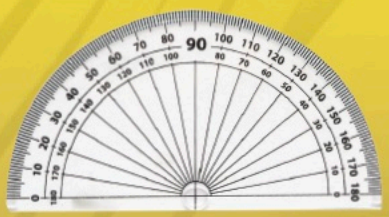
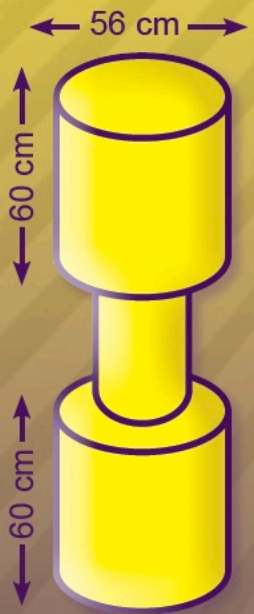
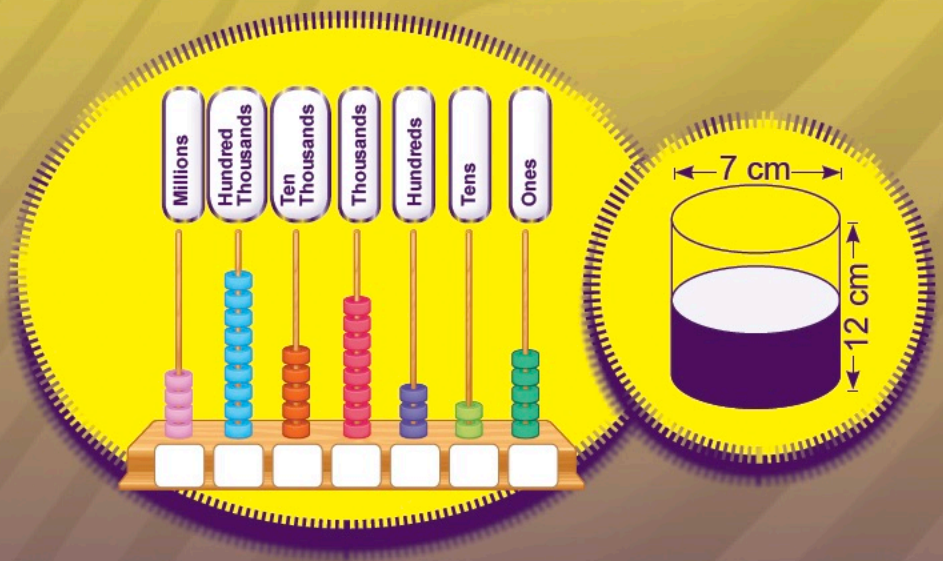
Mathematics

Standard Six

Pupil's Book







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Mathematics

Standard Six

Pupil's Book



THE UNITED REPUBLIC OF TANZANIA
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SCIENCE AND TECHNOLOGY

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Dr. Lyabwene M. Mtahabwa
Commissioner for Education

Tanzania Institute of Education

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Introduction

This is the fourth book in a series of five textbooks on Mathematics for primary schools. The book is prepared according to the 2016 Mathematics Syllabus for Primary Schools issued by the Ministry of Education, Science and Technology. This book consists of 14 chapters which are Whole numbers, Operations on whole numbers, Factors and multiples, Percentages, Decimals, Approximation of numbers and Integers. Other chapters include Time, Metric units, Business arithmetic, Algebra, Geometry, Coordinate geometry and Statistics. The book contain activities, illustrations and exercises which enhance learning. You are encouraged to do all activities and all exercises. This will enable you to develop intended competencies.

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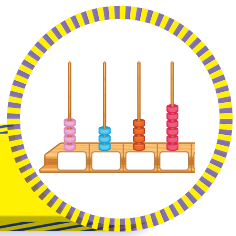
Chapter One

Whole numbers



Introduction

In Standard Five, you learnt about counting, reading, writing, recognising total values of digits, and expanding numbers not exceeding one million. In this chapter, you will learn about counting, reading, writing, recognising values of digits and expanding numbers not exceeding ten million. The knowledge and skills gained will help you in solving daily life problems such as measurement of quantities, business, and money.

Exercise 1:Revision

1. Write the following numbers in words:

(a) 217 300
(b) 195 734
(c) 800 137
(d) 970 441
(e) 879 326
(f) 532 110
(g) 352 706
(h) 990 000

2. Write the following numbers in numerals:

(a) Nine hundred ninety-nine thousand nine hundred and eighty-eight
(b) Ninety-nine thousand seven hundred and sixty-five
(c) Forty-five thousand eight hundred and seventy-nine
(d) Three hundred twenty-one thousand two hundred and forty
(e) Six hundred seventy-four thousand eight hundred and eighty-five
(f) Seventy-eight thousand six hundred and fourty-six
(g) Two hundred thousand nine hundred and thirty-five

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3. Write the place value of 7 in each of the following numbers:

(a) 846 274
(b) 673 901
(c) 536 147
(d) 198 766
(e) 789 589

4. Write in numerals the numbers which correspond to the following place values:

(a) Seven ten thousands, three thousands, five hundreds, two tens and eight ones
(b) Nine hundred thousands, three ten thousands, zero thousands, five hundreds, seven tens and two ones
(c) Two ten thousands, eight thousands, zero hundreds, five tens and three ones
(d) Five ten thousands, nine thousands, seven hundreds, zero tens and one ones
(e) Three hundred thousands, six ten thousands, eight thousands, four hundreds, nine tens and zero ones

5. Write the following numbers in expanded form:

(a) 285 109
(b) 893 120
(c) 986 374
(d) 531 682
(e) 712 836

6. If each of the digits 8, 9, 2, 5, 6 and 1 is used once, write in numerals the number corresponding to the following:

(a) The largest number formed by the given digits
(b) The smallest number formed by the given digits

7. Use the numbers 325 168, 871 394 and 786 320 to answer the following questions:

(a) Which number has 6 in the tens place?
(b) Which number has 2 in the tens place?
(c) Which number has 1 in the hundreds place?
(d) Which number has 7 in the ten thousands place?
(e) Which number has 3 in the hundred thousands place?

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8. Study the following number patterns and fill in the blanks:
   (a) 987 109, 987 110,....., ..., ...
   (b) ....., ..., ..., 999 700, 999 800, 999 900
   (c) 999 940, 999 950, 999 960, ..., ..., ...
   (d) ....., ..., ..., 700 000, 800 000, 900 000
   (e) ....., ..., ..., 950 000, 960 000, 970 000, 980 000

9. Write in numerals a number pattern from four hundred forty thousand to six hundred thousand by adding forty thousand successively.

10. Write the following numbers in short form:
   (a) 900 000 + 50 000 + 3 000 + 800 + 70 + 2
   (b) 80 000 + 9 000 + 700 + 50 + 6
   (c) 700 000 + 0 + 9 000 + 600 + 30 + 5
   (d) 600 000 + 20 000 + 0 + 200 + 10 + 7
   (e) 500 000 + 30 000 + 8 000 + 600 + 50 + 0

Counting by grouping

It is much easier to count large number of objects by putting them in groups depending on your choice of the group size. For example, it is easy to count one million objects by arranging the objects in groups of hundred thousands or ten thousands. Likewise, you may use groups of thousands, hundreds or tens. Also, ten million objects can be counted by using groups of millions or one hundred thousands. You may also use groups of ten thousands, thousands or hundreds.

Counting objects not exceeding ten million (10 000 000)

Counting money in groups of banknotes of ten thousand shillings

1. Ten banknotes of ten thousand shillings each form one hundred thousand shillings (100 000).



Figure 1: Ten banknotes of ten thousand shillings

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Figure 2: One bundle of ten banknotes of ten thousand shillings each making a total of 100 000 shillings

2. Ten bundles of one hundred thousand shillings each (or 100 banknotes of ten thousand shillings) form one bundle with a total of one million shillings (1 000 000).



Figure 3: Ten bundles of one hundred thousand shillings making a total of one million shillings (1 000 000)

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Figure 4: One bundle of one hundred banknotes of ten thousand shillings each making a total of one million shillings (1 000 000)

3. Ten bundles of one million shillings each (or 1 000 banknotes of ten thousand shillings) form a bundle of ten million shillings (10 000 000).



Figure 5: Ten bundles of one million shillings each making a total of ten million shillings

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Figure 6: One bundle of one thousand banknotes of ten thousand shillings each making a total of ten million shillings (10 000 000)

In numerals, ten million is written as 10 000 000. The number 1 000 000 is formed by seven digits while 10 000 000 is formed by eight digits.

Activity 1: Counting objects in groups of hundred thousands by using number cards

Study the following number cards and answer the questions that follow:



Figure 7: Number cards with a value of one hundred thousand each

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1. Count any five number cards then write down their total value in words and in numerals.
2. Count any seven number cards then write down their total value in words and in numerals.
3. Count any nine number cards then write down their total value in words and in numerals.
4. Count all number cards then write down their total value in words and in numerals.

Activity 2 : Counting objects in groups of millions using number cards

Study the following number cards and answer the questions that follow:

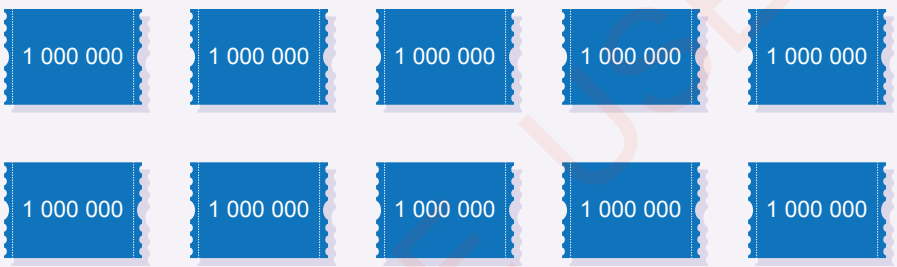

Figure 8: Number cards with a value of one million each

1. What is the value of each number card?
2. Count two cards. What is the sum of the two numbers on the cards?
3. Count three cards. What is the sum of the three numbers on the cards?
4. Count four cards. What is the sum of the four numbers on the cards?
5. Count five cards. What is the sum of the five numbers on the cards?
6. Count six cards. What is the sum of the six numbers on the cards?
7. Count seven cards. What is the sum of the seven numbers on the cards?
8. Count eight cards. What is the sum of the eight numbers on the cards?
9. Count nine cards. What is the sum of the nine numbers on the cards?
10. Count all the cards. What is the sum of all the numbers on the cards?

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Activity 3: Counting objects by grouping

A businessman packed soap bars in containers, boxes, and bundles of different sizes. Some containers were packed with one million soap bars, one hundred thousand bars, ten thousand bars and one thousand bars. Also, he packed boxes with one hundred bars, ten bars, nine bars and one bar. Figures 9 to 16 show the number of soap bars packed by the businessman in containers, boxes, and bundles.

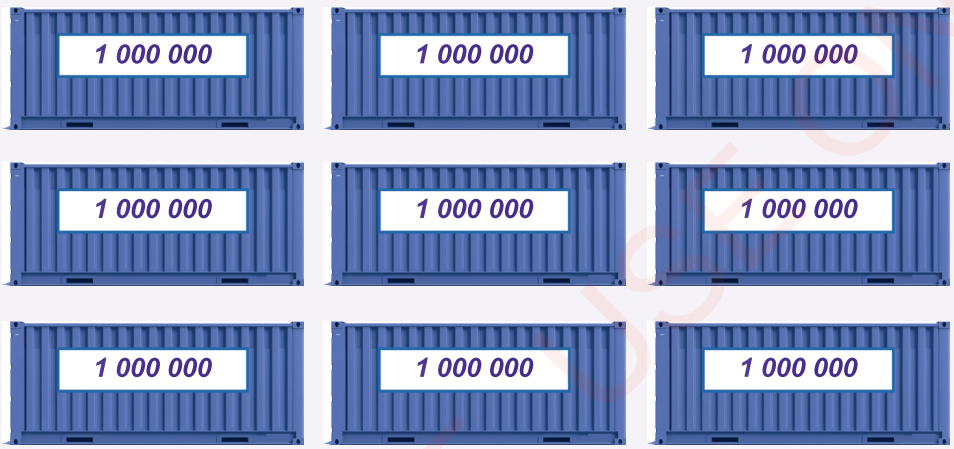

Figure 9: Containers having one million soap bars each

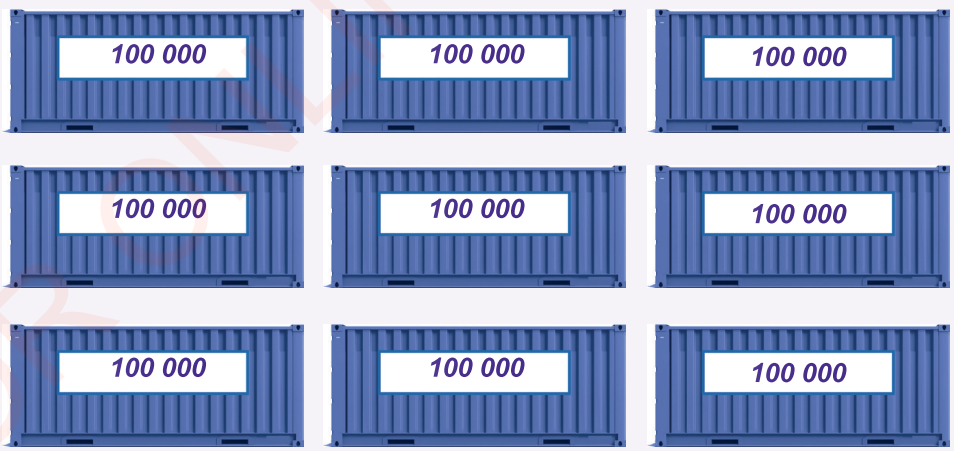

Figure 10: Containers having one hundred thousand soap bars each

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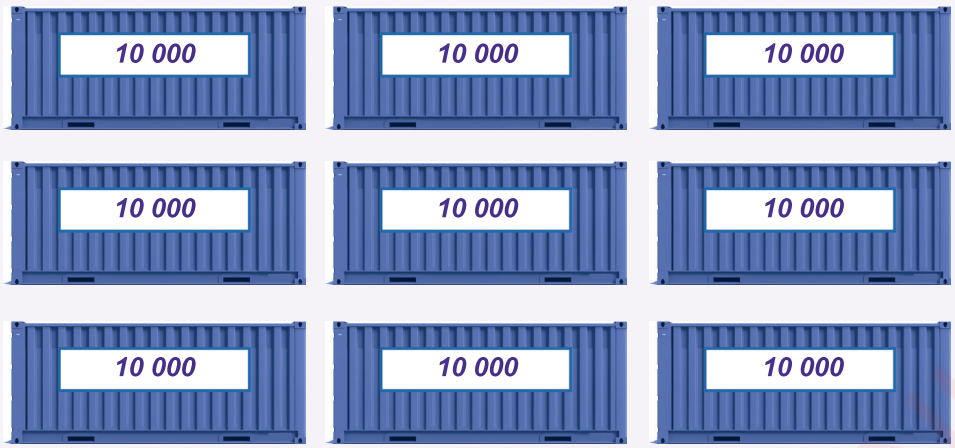

Figure 11: Containers having ten thousand soap bars each

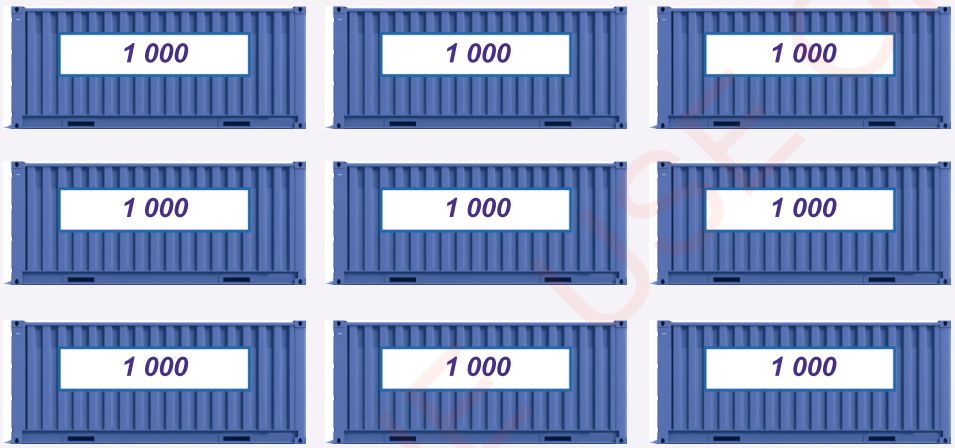

Figure 12: Containers having one thousand soap bars each



Figure 13: Boxes having one hundred soap bars each

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Figure 14: Boxes having ten soap bars each

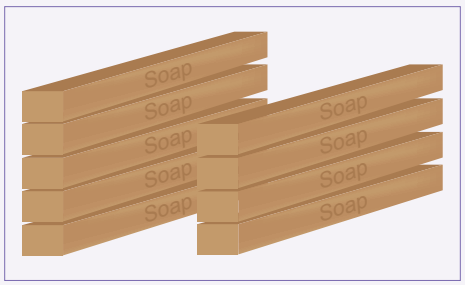

Figure 15: A group of nine soap bars

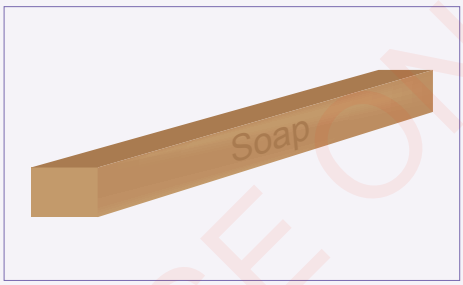

Figure 16: One soap bar

Steps:

1. Count all the containers in Figure 9, then find the total number of soap bars in those containers.
2. Count all the containers in Figure 10, then find the total number of soap bars in those containers.
3. Count all the containers in Figure 11, then find the total number of soap bars in those containers.
4. Count all the containers in Figure 12, then find the total number of soap bars in those containers.
5. Count all the boxes in Figure 13, then find the total number of soap bars in those boxes.
6. Count all boxes in Figure 14, then find the total number of soap bars in those boxes.
7. Count all the soap bars in Figure 15.
8. Find the total number of all soap bars from steps 1 to 7.
9. Add one soap bar (Figure 16) to the total number of bars obtained in step 8. What is the total number of soap bars do you get?

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Exercise 2

Answer the following questions:

1. A certain factory packed execise books in different containers for distribution in different places as shown in Figure 17. Count in groups of one million the total number of exercise books in the containers given in items (a) to (i).

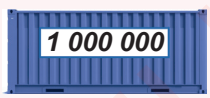
(a) 

(b) 

(c) 

(d) 

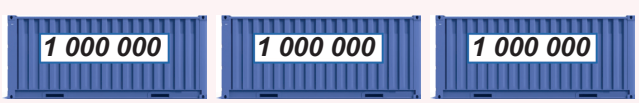
(e) 



(f) 



(g) 



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(h)





(i)







Figure 17: Containers with one million exercise books each

2. How many hundred thousands will you count from three million to four million and five hundred thousand?

3. How many five hundred thousands will you count from one million to four million?

4. How many millions will you count from three million to nine million?

5. If you have eight million, how many two millions will you count?

6. How many three millions will you count from one million to ten million?

7. How many five hundred thousands will you count from three million to eight million?

8. Study the following abacus and write in the boxes the digits of the number represented:

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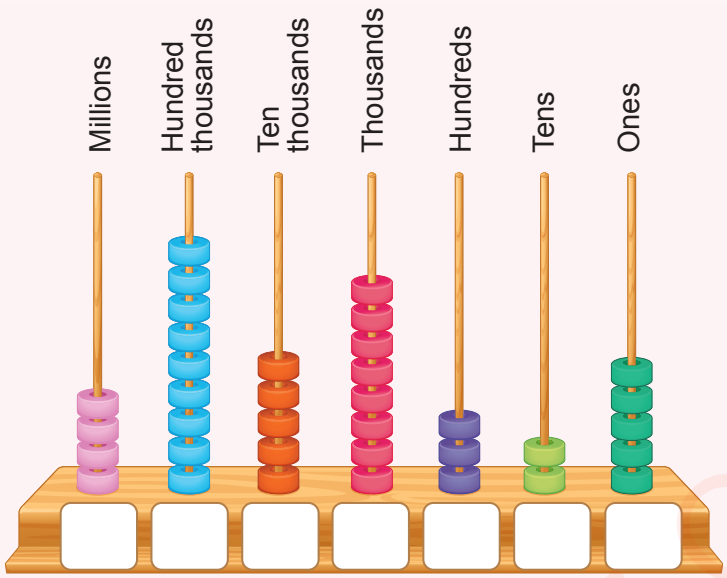

Total value of a digit in numbers not exceeeding 10 000 000

The number 1 000 000 is formed by seven digits. Any whole number between one million and ten million has seven digits as well. Ten million or 10 000 000 in numerals is formed by eight digits. In this section, you will learn to identify the total value of a digit in a number not exceeding 10 000 000 by considering the corresponding place values.

The position of each digit determines the total value of that digit in the number. It should also be noted that the total value of a digit in the number increases from right to left of the number. We start with ones, followed by tens, hundreds, thousands, ten thousands and so on.

Activity 4 : Using number cards to determine the total value of a digit in the number

Instructions

1. Eight pupils should stand in a straight line infront of the class facing other pupils.
2. One pupil should hold a number card labelled 1, and each of the remaining 7 pupils to hold cards labelled 0.

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3. The pupils holding cards labelled 0 should align to the left of the pupil holding the card labelled 1.
4. The pupil with a card labelled 1 should show up his/her card and say, “I am number 1, I stand in the position of ones, therefore my value is one (1)”.
5. The pupil holding card labelled 1 should exchange position with the first pupil in his/her left. Then say that “I am number 1, I stand in the position of tens, therefore my value is ten (10)”.
6. The pupil holding card labelled 1 should continue to exchange positions until he/she reaches the last pupil and get a total value of ten million.

Example 1

Arrange the digits in 10 000 000 in their corresponding place values.

Solution

The number, 10 000 000 has eight digits. Thus, it has eight place values. The place values of the digits in 10 000 000 are as follows:

Place value of a digit							
Ten millions	Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
1	0	0	0	0	0	0	0

Therefore,

1 is in ten millions
0 is in millions
0 is in hundred thousands
0 is in ten thousands
0 is in thousands
0 is in hundreds
0 is in tens
0 is in ones

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Example 2

Write 9 876 543 by using:
(a) Place value of each digit
(b) Total value of each digit

Solution

Number	Digits	(a) Place value of a digit	(b) Total value of the digit
9876543	9	Millions	9 000 000
	8	Hundred thousands	800 000
	7	Ten thousands	70 000
	6	Thousands	6 000
	5	Hundreds	500
	4	Tens	40
	3	Ones	3

Example 3

Write the following numbers in expanded form:
(a) 9 876 543
(b) 3 821 834

Solution

Remember that a number is written in expanded form by adding the total values of its digits. Therefore,

(a) 9 876 543 = 9 000 000 + 800 000 + 70 000 + 6 000 + 500 + 40 + 3
(b) 3 821 834 = 3 000 000 + 800 000 + 20 000 + 1 000 + 800 + 30 + 4

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Exercise 3

1. Fill the blank spaces in the following table:

Number	Place values of digits							
	Ten millions	Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
821 834				2		8		4
903 475			9		3	4	7	5
1 368 210		1		6	8		1	
4 105 275		4		0		2		5
8 796 534			7		6		3	
2 536 907		2		3			0	7
6 731 425		6	7		1	4	2	
5 200 512				0		5	1	2
9 999 999			9			9	9	
10 000 000		0		0		0		0

2. Write the following numbers in expanded form:

(a) 903 475 =
(b) 1 368 210 =
(c) 4 105 275 =
(d) 8 796 534 =
(e) 2 536 907 =
(f) 6 731 425 =
(g) 5 200 512 =
(h) 9 999 999 =
(i) 1 618 400 =
(j) 6 058 101 =

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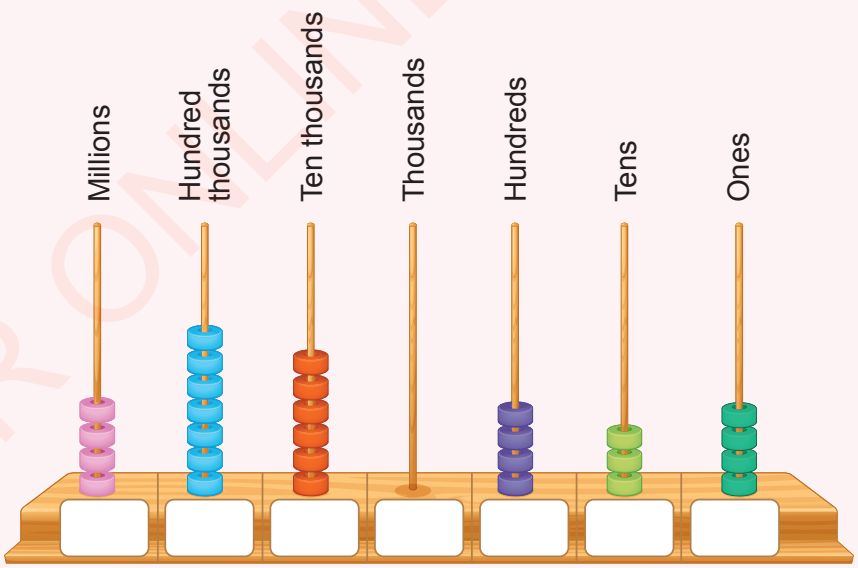
3. Write the place value of the underlined digit in each of the following numbers:

(a) 2̲91 434
(b) 873 5̲01
(c) 9̲ 218 226
(d) 1 654 31̲4
(e) 5 49̲6 475
(f) 7 54̲9 002
(g) 6 2̲49 356
(h) 3 81̲6 941
(i) 9 999 99̲9
(j) 1̲0 000 000

4. Write the total value of the underlined digit in each of the following numbers:

(a) 2̲91 434
(b) 873 5̲01
(c) 9̲ 218 226
(d) 1 654 31̲4
(e) 5 49̲6 475
(f) 7 54̲9 002
(g) 6 2̲49 356
(h) 3 81̲6 941
(i) 9 999 99̲9
(j) 1̲0 000 000

5. Write in the boxes provided the digits of the number represented by the following abacus:



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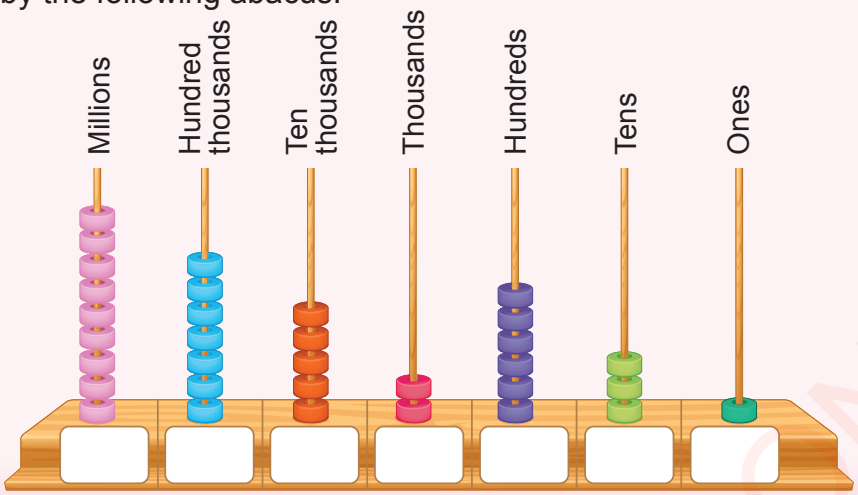
6. Write in the boxes provided the digits of the number represented by the following abacus.



Reading and writing numbers up to ten million (10 000 000)

Reading whole numbers depends on the number of digits and the total value of the digits in the corresponding number. Start to identify the ones, tens, hundreds, thousands, ten thousands, hundred thousands and so on. Thereafter, read the number from left to right by considering the total value of the corresponding digit. That is, reading a number begins with a digit of the highest place value. For example, you can read a number from ten millions, millions, hundred thousands, ten thousands, thousands, hundreds, tens and ones. Remember that, pronouncing a number written in numerals is the same as reading that number.

Example 1

Read the following numbers:

1. 1 000 001

1 000 001
- Ones
- Tens
- Hundreds
- Thousands
- Ten thousands
- Hundred thousands
- Millions

Therefore, 1 000 001 is read as one million and one.

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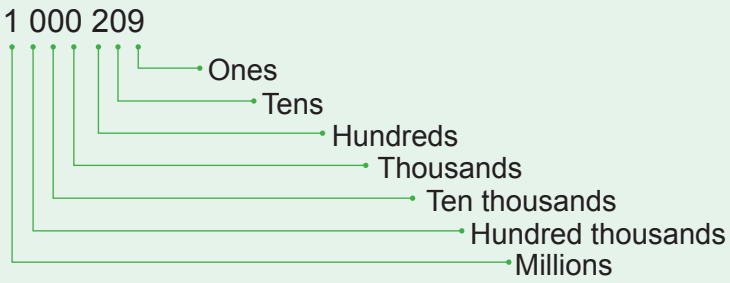
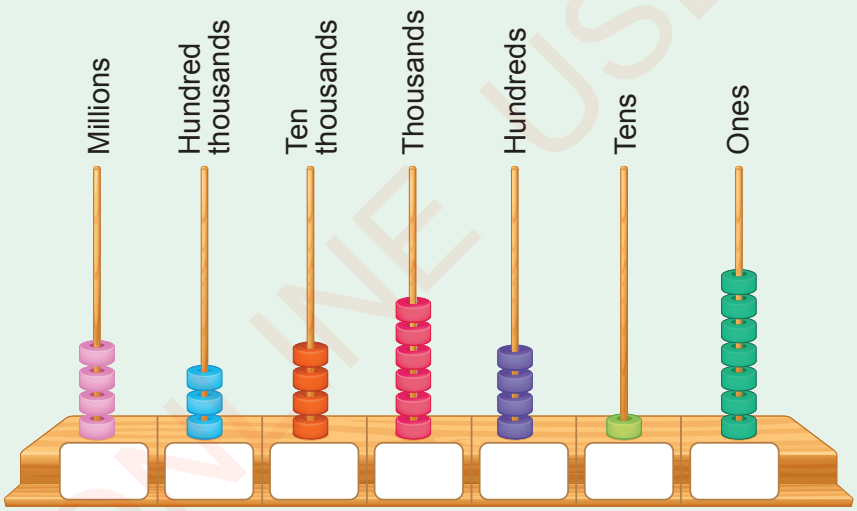
2. 1 000 209



Therefore, 1 000 209 is read as one million two hundred and nine.

Example 2

Read the number represented by the following abacus:



The number represented by the abacus is 4 346 417 and it is read as four million three hundred forty-six thousand four hundred and seventeen.

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Example 3

Read the numbers in the following table:

	Number	Number in words
1.	1 000 010	One million and ten
2.	2 103 000	Two million one hundred and three thousand
3.	7 850 720	Seven million eight hundred fifty thousand seven hundred and twenty
4.	5 990 990	Five million nine hundred ninety thousand nine hundred and ninety
5.	3 400 106	Three million four hundred thousand one hundred and six
6.	10 000 000	Ten million
7.	4 090 400	Four million ninety thousand and four hundred
8.	8 000 003	Eight million and three
9.	9 609 015	Nine million six hundred and nine thousand and fifteen
10.	6 300 000	Six million three hundred thousand

Exercise 4

1. Read the following numbers:
   - (a) 999 999, 1 000 000, 1 000 001, 1 000 002, 1 000 003, 1 000 004, 1 000 005, 1 000 006, 1 000 007, 1 000 008, 1 000 009, 1 000 010
   - (b) 1 000 005, 1 000 010, 1 000 015, 1 000 020, 1 000 025, 1 000 030, 1 000 035, 1 000 040, 1 000 045, 1 000 050
   - (c) 1 000 010, 1 000 020, 1 000 030, 1 000 040, 1 000 050, 1 000 060, 1 000 070, 1 000 080, 1 000 090, 1 000 100
   - (d) 1 000 100, 1 000 200, 1 000 300, 1 000 400, 1 000 500, 1 000 600, 1 000 700, 1 000 800, 1 000 900, 1 001 000

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(e) 1 001 000, 1 002 000, 1 003 000, 1 004 000, 1 005 000, 1 006 000, 1 007 000, 1 008 000, 1 009 000, 1 010 000

(f) 1 010 000, 1 020 000, 1 030 000, 1 040 000, 1 050 000, 1 060 000, 1 070 000, 1 080 000, 1 090 000, 1 100 000

(g) 1 100 000, 1 200 000, 1 300 000, 1 400 000, 1 500 000, 1 600 000, 1 700 000, 1 800 000, 1 900 000, 2 000 000

(h) 1 000 000, 2 000 000, 3 000 000, 4 000 000, 5 000 000, 6 000 000, 7 000 000, 8 000 000, 9 000 000, 10 000 000

(i) 9 100 000, 9 200 000, 9 300 000, 9 400 000, 9 500 000, 9 600 000, 9 700 000, 9 800 000, 9 900 000, 10 000 000

2. Read the numbers in the following table and write them in words:

	Number in numerals	Number in words
(a)	3 843 564	
(b)	2 402 400	
(c)	6 666 666	
(d)	8 457 810	
(e)	2 000 000	
(f)	9 728 372	
(g)	3 642 000	
(h)	10 000 000	
(i)	9 990 099	
(j)	4 728 225	
(k)	7 342 623	
(l)	1 221 343	
(m)	4 400 001	
(n)	1 006 007	
(o)	1 051 420	
(p)	1 000 000	
(q)	5 058 999	
(r)	9 999 999	
(s)	7 050 050	
(t)	5 189 365	

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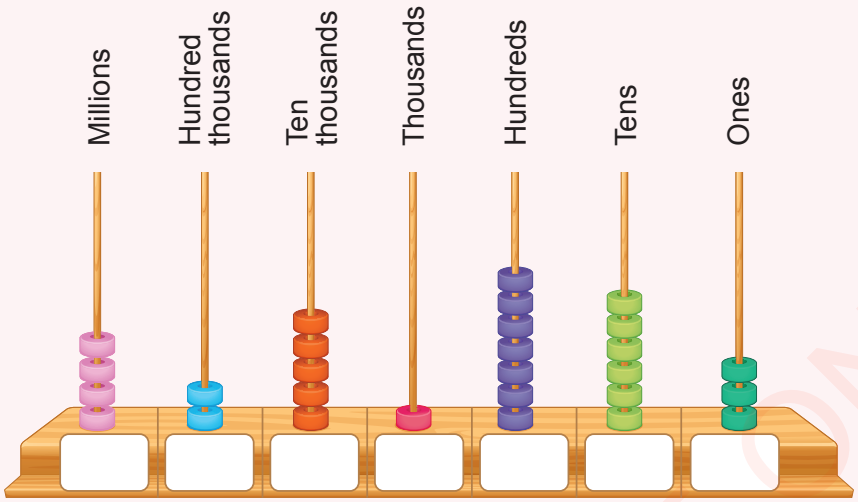
3. Count the beads in the following abacus and answer the questions that follow:



(a) Fill in the boxes with the digits represented by the abacus
(b) Read the number represented by the abacus

Writing numbers up to ten million (10 000 000) in numerals and in words

Whole numbers can be written in numerals or in words. The number in numerals shows all the digits contained in the given number.

Example

Write the following numbers in words and indicate the place value of each digit:
(a) 1 435 978
(b) 5 783 156
(c) 2 073 856

(a) 1 435 978

Solution

1 is in millions
4 is in hundred thousands
3 is in ten thousands

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5 is in thousands
9 is in hundreds
7 is in tens
8 is in ones

Therefore, 1 435 978 in words is:
One million four hundred thirty-five thousand nine hundred and seventy-eight.

(b) 5 783 156

Solution
5 is in millions
7 is in hundred thousands
8 is in ten thousands
3 is in thousands
1 is in hundreds
5 is in tens
6 is in ones

Therefore, 5 783 156 in words is:
Five million seven hundred eighty-three thousand one hundred and fifty-six.

(c) 2 073 856

Solution
2 is in millions
0 is in hundred thousands
7 is in ten thousands
3 is in thousands
8 is in hundreds
5 is in tens
6 is in ones

Therefore, 2 073 856 in words is:
Two million seventy-three thousand eight hundred and fifty-six.

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Exercise 5

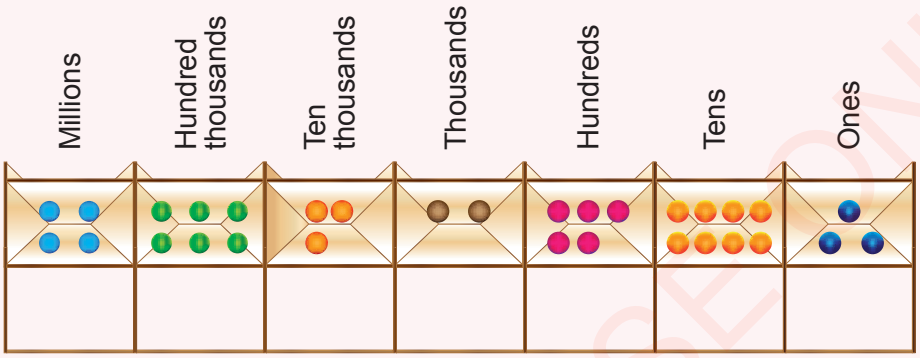
Answer the following questions:

1. Count the counters in the following number tray and then write:

(a) The digits in the blank spaces provided

(b) The numeral represented by the number of counters obtained in part (a)

(c) The number in part (b) in words



2. Write the following numbers in words:

(a) 9 342 057
(b) 1 256 080
(c) 3 437 000
(d) 5 870 074
(e) 10 000 000
(f) 2 000 003
(g) 8 752 467
(h) 4 009 752
(i) 6 178 293
(j) 7 062 015

3. Write the following numbers in numerals:

(a) Five hundred seventy-nine thousand six hundred and four
(b) Nine hundred ninety-three thousand eight hundred and ten
(c) Four million two hundred thousand
(d) Seven hundred thirty-six thousand and two
(e) One million nine hundred eighty thousand three hundred and ninety-five
(f) Nine million one hundred thousand one hundred and one
(g) Three million five hundred eighty-nine thousand nine hundred and seventy-six
(h) Seven million and nineteen
(i) Five million nine hundred and two thousand and seven
(j) One million nine thousand

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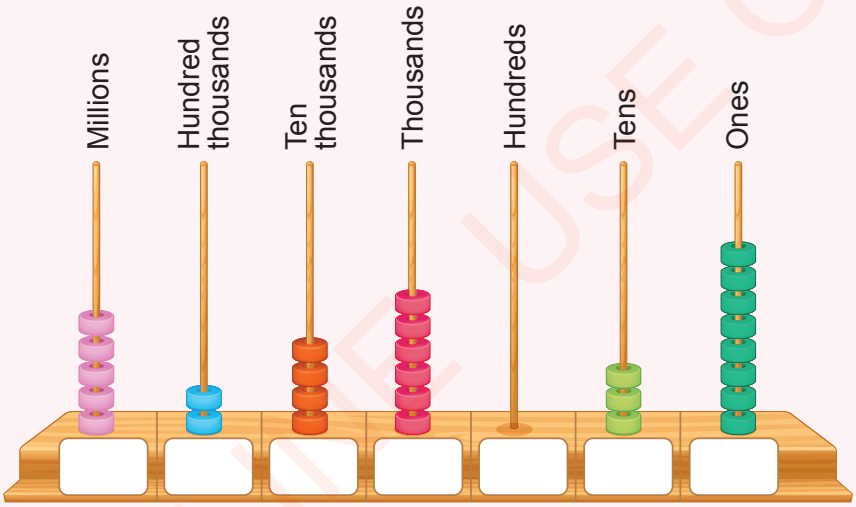
4. Write the place value of 6 in each of the following numbers:

(a) 645 218
(b) 546 128
(c) 5 460 281
(d) 6 381 483
(e) 8 321 610
(f) 1 930 265
(g) 7 034 536
(h) 6 123 900

5. Write the total value of 6 in each of the following numbers:

(a) 645 218
(b) 546 128
(c) 5 460 281
(d) 6 381 483
(e) 8 321 610
(f) 1 930 265
(g) 7 034 536
(h) 6 123 900

6. Study the following abacus and answer the questions that follow:



(a) Write the digits forming the number represented by the abacus in the boxes provided
(b) Write the resulting number in numerals
(c) Write the resulting number in words

7. Write the following numbers in expanded form. Part (a) is an example:

(a) 5 321 106 = 5 000 000 + 300 000 + 20 000 + 1 000 + 100 + 0 + 6
(b) 7 486 120 =
(c) 1 074 508 =
(d) 4 051 900 =
(e) 2 109 239 =
(f) 8 150 728 =
(g) 3 056 180 =
(h) 9 800 069 =
(i) 5 630 913 =
(j) 6 999 999 =
(k) 1 000 569 =

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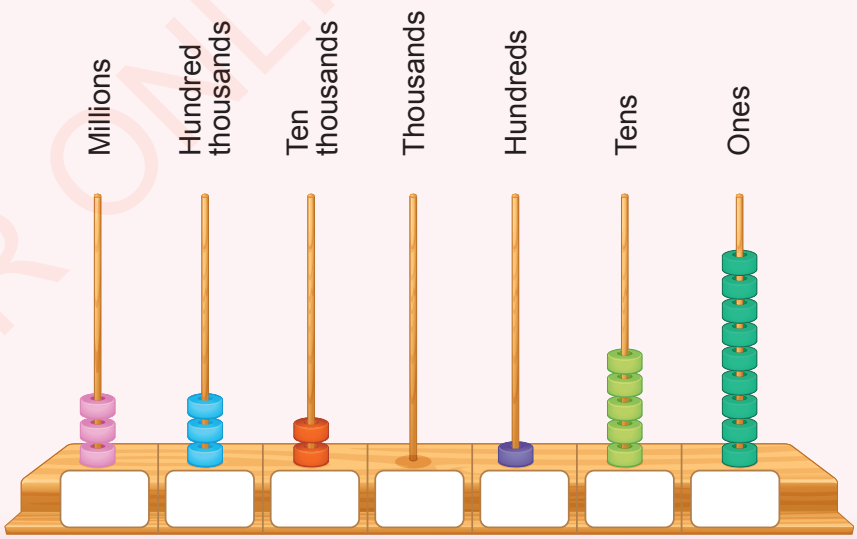
Revision exercise

1. Write the next three numbers by adding one hundred thousand successively in the following patterns:
   - **(a)** 3 673 800, _____, _____, _____
   - **(b)** 5 318 166, _____, _____, _____
   - **(c)** 7 105 200, _____, _____, _____
   - **(d)** 8 245 000, _____, _____, _____
   - **(e)** 1 003 890, _____, _____, _____

2. Write the next three numbers by subtracting five hundred thousand successively in the following patterns:
   - **(a)** 3 500 000, _____, _____, _____
   - **(b)** 4 219 585, _____, _____, _____
   - **(c)** 3 862 000, _____, _____, _____
   - **(d)** 7 165 140, _____, _____,_____
   - **(e)** 5 703 000, _____,_____, _____

3. Write the numbers between 3 800 000 and 4 010 000 by adding thirty thousand successively.

4. Study the following abacus and write the digits of the number it represents:
   - **(a)** In numerals
   - **(b)** In words



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5. Fill in the blank spaces with the numbers obtained by subtracting one hundred successively from the following numbers:

(a) 9 153 235, _____, _____, _____
(b) 7 000 000, _____, _____, _____
(c) 3 995 768, _____, _____, _____
(d) 5 813 831, _____, _____, _____
(e) 2 183 216, _____, _____, _____

6. The population of a certain city is 5 000 000 people. If the population increases by 100 000 each year, what will be the population after five years?

7. Study the following table and fill in the blank spaces:

Number	Place value of a digit in the number							
	Ten Millions	Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
834 821								
475 903								
2 101 368								
7 425 105								
9 687 345								

8. Write the following numbers in expanded form:

(a) 8 475 930 =
(b) 6 138 102 =
(c) 1 054 257 =
(d) 7 968 543 =
(e) 5 362 079 =
(f) 6 637 142 =
(g) 2 152 200 =
(h) 8 899 898 =
(i) 7 400 618 =
(j) 9 010 581 =

9. Write the total value of the underlined digit in the following numbers:

(a) 3 142 914
(b) 2 738 510
(c) 2 262 189
(d) 2 496 563
(e) 8 163 419
(f) 6 541 341
(g) 4 755 964
(h) 5 497 020
(i) 9 779 990
(j) 3 454 876

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10. Write the place value of the underlined digit in the following numbers:

(a) 6 923 04<u>1</u>
(b) 7951 8<u>3</u>0
(c) 8 2<u>6</u>9 218
(d) <u>6</u> 501 314
(e) 7 5<u>5</u>4 946
(f) 9 <u>7</u>04 000
(g) 3 506 04<u>0</u>
(h) 5 <u>0</u>00 002
(i) 1 900 <u>1</u>11
(j) 2 568 <u>0</u>00

11. Write the following numbers in words:

(a) 3 429 075
(b) 4 208 560
(c) 6 400 370
(d) 7 780 045
(e) 5 111 111
(f) 2 010 002
(g) 7 582 674
(h) 8 090 725
(i) 9 861 290
(j) 1 062 010

12. Write the following numbers in numerals:

(a) One million two hundred thousand and fourteen
(b) Three million eight hundred thousand
(c) Five million and one
(d) Six million six hundred thousand and sixty-six
(e) Two million ten thousand and two
(f) Seven million one hundred thousand one hundred and three
(g) Eight million five hundred eighty-seven thousand nine hundred and eighty-six
(h) Seven million five hundred thousand and nineteen
(i) Six million nine hundred and two thousand and seventeen
(j) Five million six hundred thousand

13. Write the place value of 4 in each of the following numbers:

(a) 1 218 640
(b) 3 456 278
(c) 6 504 218
(d) 3 684 189
(e) 4 613 210
(f) 5 430 256
(g) 9 703 436
(h) 8 123 904
(i) 3 568 840
(j) 1 432 000

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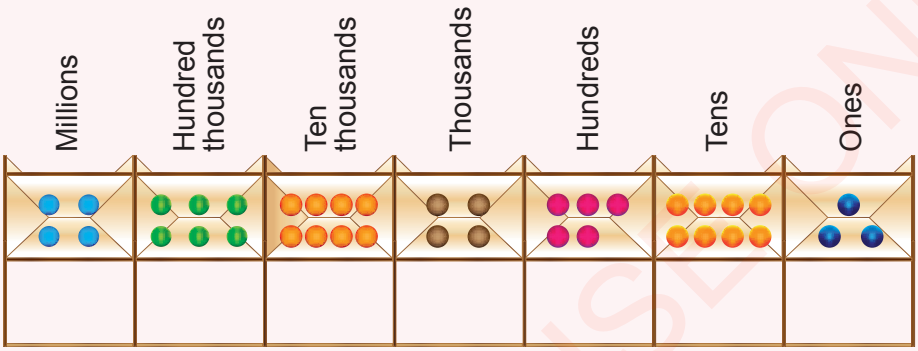
14. Write the total value of 3 in each of the following numbers:

(a) 3 456 218
(b) 4 365 100
(c) 5 063 001
(d) 7 831 481
(e) 8 610 321
(f) 7 923 065
(g) 7 005 436
(h) 6 312 922
(i) 4 113 111
(j) 9 746 713

15. Count the counters in the following number tray then answer the questions that follow:



(a) Write the digit represented by the counters in each place value.
(b) Write the number represented by the number tray in numerals.
(c) Write the number represented by the number tray in words.

Summary

1. It is much easier to use bundles of hundred thousands and millions when counting objects from one million up to ten million. Bundles of tens, hundreds and thousands can also be used.
2. In order to read a whole number easily, you have to identify the place value of each digit in the number. Start reading a number from the left (digit with the largest place value) and continue to the right.
3. When writing a number in expanded form, start with the digit with the highest total value and continue to the digit with the lowest total value.

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Chapter Two

Operations on whole numbers

Introduction

In Standard Five, you learnt about operations on numbers up to one million (1 000 000). You learnt addition, subtraction, multiplication and division of numbers whose sum and product do not exceed one million. In this chapter, you will continue to learn operations on numbers up to ten million (10 000 000). You will learn about addition, subtraction, multiplication and division of numbers whose sum and product do not exceed ten million. You will also solve word problems involving operations on numbers in real life situations. The knowledge and skills gained will help you to use numbers in buying and selling goods, mastering money transactions, and generating statistical data to address related challenges facing the society.

Exercise 1: Revision

1. 902 653 + 81 152 =
2. 73 789 + 12 364 + 387 =
3. 92 000 + 1 379 + 263 =
4. 236 108 + 618 293 =
5. 183 256 + 347 684 =
6. 982 650 – 81 152 =
7. 782 683 – 216 957 =
8. 589 106 – 124 000 =
9. 626 231 – 58 744 =
10. 809 162 – 235 897=
11. 722 × 12 =
12. 289 × 163 =
13. 2 605 × 267 =
14. 849 × 125 =
15. 1 739 × 509 =
16. 35 505 ÷ 45 =
17. 23 436 ÷ 126 =
18. 430 815 ÷ 231 =
19. 368 820 ÷ 108 =
20. 1 000 000 ÷ 50 =

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21.
$$\begin{array}{r} 342696 \\ 4186 \\ +\quad 5674 \\ \hline \\ \hline \end{array}$$

22.
$$\begin{array}{r} 425314 \\ +\,354360 \\ \hline \\ \hline \end{array}$$

23.
$$\begin{array}{r} 693179 \\ 29686 \\ +\quad 5754 \\ \hline \\ \hline \end{array}$$

24.
$$\begin{array}{r} 523412 \\ +\,364350 \\ \hline \\ \hline \end{array}$$

25.
$$\begin{array}{r} 748934 \\ +\,164559 \\ \hline \\ \hline \end{array}$$

26.
$$\begin{array}{r} 425212 \\ -\,187463 \\ \hline \\ \hline \end{array}$$

27.
$$\begin{array}{r} 703156 \\ -\,594729 \\ \hline \\ \hline \end{array}$$

28.
$$\begin{array}{r} 956405 \\ -\,387768 \\ \hline \\ \hline \end{array}$$

29.
$$\begin{array}{r} 5100002 \\ +\,167483 \\ \hline \\ \hline \end{array}$$

30.
$$\begin{array}{r} 589035 \\ -\,19459 \\ \hline \\ \hline \end{array}$$

31.
$$\begin{array}{r} 935 \\ \times\,459 \\ \hline \\ \hline \end{array}$$

32.
$$\begin{array}{r} 705 \\ \times\,863 \\ \hline \\ \hline \end{array}$$

33.
$$\begin{array}{r} 1805 \\ \times\quad 247 \\ \hline \\ \hline \end{array}$$

34.
$$\begin{array}{r} 1910 \\ \times\quad 68 \\ \hline \\ \hline \end{array}$$

35.
$$\begin{array}{r} 837 \\ \times\,837 \\ \hline \\ \hline \end{array}$$

36. $17\overline{)\,28\,611}$

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37. $17\overline{)13\,872}$

38. $230\overline{)187\,680}$

39. $142\overline{)123\,398}$

40. $23\overline{)29\,003}$

41. Kulwa, Doto, Tatu and Juma went to the shop to buy clothes for the holiday. Kulwa spent 42 945 shillings, Doto spent 39 900 shillings, Tatu spent 36 260 shillings and Juma spent 39 450 shillings. How much money did they spend altogether?

42. A factory manufactured 563 630 metres of cloth. If 237 789 metres of the same cloth were sold, how many metres of the cloth remained?

43. During the farmer's day celebration, 26 789 farmers displayed food crops and 8 375 farmers displayed commercial crops. What was the total number of farmers who displayed crops during the celebration?

44. A certain village had 32 686 cattle, 3 789 sheep and 7 897 goats. Find the total number of livestock in the village.

45. A farmer sold some of her crops as follows: 60 570 kg of potatoes, 23 402 kg of groundnuts and 525 710 kg of maize. How many kilograms of crops did the farmer sell altogether?

46. A certain bussinesswoman offered 286 590 exercise books to pupils from two villages affected by floods. If she gave 182 778 exercise books to the first village, how many exercise books remained for the second village?

47. Yusufu's shop has 174 pairs of khanga. If the cost of one pair is 7 500 shillings, how much money will be collected after selling all the pairs?

48. Eighteen regions in Tanzania mainland shared equally 268 020 bags of maize seeds. How many bags did each region receive?

49. Eliza buys 3 litres of milk everyday for her restaurant. If each litre of milk costs 1 800 shillings, how much money does she pay for milk in a month consisting of 30 days?

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50. Twelve regions received 420 000 story books to be shared equally. How many story books did each region receive?

Addition of numbers

Recall that, in order to add two or more numbers you have to consider the place value of each digit in the given number. First, add the ones, followed by the tens, hundreds, thousands, ten thousands and so on. Also, remember that you can add the numbers horizontally or vertically by regrouping or without regrouping.

Addition of whole numbers horizontally or vertically without regrouping

Example 1

1 463 069 + 7 532 810 =

Solution

Use the following steps to add the given numbers horizontally:

Steps:

1. Add ones: 9 + 0 = 9. Write 9 in the ones place.

1 463 069 + 7 532 810 = _ _ _ _ _ _ 9

2. Add tens: 6 + 1 = 7. Write 7 in the tens place.

1 463 069 + 7 532 810 = _ _ _ _ _ 7 9

3. Add hundreds: 0 + 8 = 8. Write 8 in the hundreds place.

1 463 069 + 7 532 810 = _ _ _ _ 8 7 9

4. Add thousands: 3 + 2 = 5. Write 5 in the thousands place.

1 463 069 + 7 532 810 = _ _ _ 5 8 7 9

5. Add ten thousands: 6 + 3 = 9. Write 9 in the ten thousands place.

1 463 069 + 7 532 810 = _ _ 9 5 8 7 9

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6. Add hundred thousands:
4 + 5 = 9. Write 9 in the hundred thousands place.

1 463 069 + 7 532 810 = _ 9 9 5 8 7 9

7. Add millions:
1 + 7 = 8. Write 8 in the millions place.

1 463 069 + 7 532 810 = 8 9 9 5 8 7 9

Therefore,1 463 069 + 7 532 810 = 8 995 879.

Example 2



```
    7 5 9 4 6 8 2
+   2 3 0 5 2 1 5
-----------------
-----------------
```

Solution

Align numbers vertically corresponding to the place value of each digit as follows:

	Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
	7	5	9	4	6	8	2
+	2	3	0	5	2	1	5
	9	8	9	9	8	9	7

Therefore, 7 594 682 + 2 305 215 = 9 899 897.

Activity 1: Finding the purchasing price of a plot

1. Prepare number cards to represent different values of money as follows: 10 000, 100 000, 500 000, 1 000 000, 1 500 000, 2 000 000, and 5 000 000.
2. Four pupils should stand in front of the class. Let one of the four pupils take the role of a seller and another pupil take the role of a customer. The remaining two pupils will take the role of witnesses.

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3. The customer and the seller should agree with each other on the price of a square plot of length 30 m.
4. The seller and the customer need to agree with each other on the selling price in the absence of witnesses. The customer should arrange number cards to represent the bundle of money equivalent to the agreed amount.
5. Every witness should count loudly the bundle of number cards to get the agreed price.
6. If the witnesses are satisfied, all the number cards should be given to the seller for counting and verification.
7. Finally, the seller, customer and witnesses should sign the prepared sales agreement.

Exercise 2



Answer the following questions:

1. 6 924 613 + 2 062 170 =
2. 3 703 542 + 4 054 213 + 121 234 =
3. 8 131 205 + 1 715 372 + 52 221 =
4. 1 342 175 + 5 352 612 =
5. 6 500 000 + 3 267 031 =
6. 7 261 555 + 1 321 321 =
7. 5 420 210 + 1 232 135 + 2 347 654 =
8. 1 176 215 + 3 813 752 =
9. 9 186 101 + 813 898 =
10. 2 800 241 + 7 189 328 =

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11.
$$\begin{array}{r} 4\,2\,1\,0\,7\,4 \\ +\,4\,6\,2\,8\,2\,3 \\ \hline \\ \hline \end{array}$$

12.
$$\begin{array}{r} 6\,7\,3\,4\,1\,8 \\ 2\,1\,5\,1\,2\,0 \\ +\quad 1\,1\,3\,5\,1 \\ \hline \\ \hline \end{array}$$

13.
$$\begin{array}{r} 1\,6\,3\,1\,2\,3 \\ +\,7\,2\,5\,7\,6\,5 \\ \hline \\ \hline \end{array}$$

14.
$$\begin{array}{r} 3\,0\,2\,3\,1\,2 \\ +\,4\,5\,7\,5\,8\,4 \\ \hline \\ \hline \end{array}$$

15.
$$\begin{array}{r} 5\,2\,9\,2\,1\,3 \\ +\,4\,6\,0\,5\,7\,5 \\ \hline \\ \hline \end{array}$$

16.
$$\begin{array}{r} 6\,2\,3\,1\,4\,5\,1 \\ 1\,3\,1\,0\,1\,1\,2 \\ +\,2\,3\,1\,6\,3\,2\,4 \\ \hline \\ \hline \end{array}$$

17.
$$\begin{array}{r} 3\,7\,2\,2\,4\,6\,1 \\ 1\,1\,0\,1\,2\,3 \\ +\quad 1\,5\,3\,2\,1\,4 \\ \hline \\ \hline \end{array}$$

18.
$$\begin{array}{r} 1\,3\,2\,7\,1\,0\,1 \\ 3\,1\,0\,1\,0\,2\,5 \\ +\,2\,1\,4\,1\,6\,3\,2 \\ \hline \\ \hline \end{array}$$

19.
$$\begin{array}{r} 3\,2\,3\,1\,4\,5\,3 \\ 4\,1\,1\,0\,1\,2\,2 \\ +\,1\,1\,1\,8\,2\,1\,1 \\ \hline \\ \hline \end{array}$$

20.
$$\begin{array}{r} 3\,0\,8\,2\,1\,5\,2 \\ +\,6\,7\,1\,4\,7\,2\,6 \\ \hline \\ \hline \end{array}$$

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Adding whole numbers horizontally and vertically by regrouping

Example 1



2 549 384 + 6 986 768 =

Solution

Use the following steps for horizontal addition:

Steps:

1. Add ones: 4 + 8 = 12. Write 2 in the ones place. Regroup 10 ones into 1 tens and add it to the tens place.	2 549 384 + 6 986 768 = _ _ _ _ _ _ _ 2
2. Add tens: 1 + 8 + 6 = 15. Write 5 in the tens place. Regroup 10 tens into 1 hundreds and add it to the hundreds place.	2 549 384 + 6 986 768 = _ _ _ _ _ _ 5 2
3. Add hundreds: 1 + 3 + 7 = 11. Write 1 in the hundreds place. Regroup 10 hundreds into 1 thousands and add it to the thousands place.	2 549 384 + 6 986 768 = _ _ _ _ 1 5 2
4. Add thousands: 1 + 9 + 6 = 16. Write 6 in the thousands place. Regroup 10 thousands into 1 ten thousands and add it to the ten thousands place.	2 549 384 + 6 986 768 = _ _ _ 6 1 5 2
5. Add ten thousands: 1 + 4 + 8 = 13. Write 3 in the ten thousands place. Regroup 10 ten thousands into 1 hundred thousands and add it to the hundred thousands place.	2 549 384 + 6 986 768 = _ _ 3 6 1 5 2

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6. Add hundred thousands:
1 + 5 + 9 = 15. Write 5 in the hundred thousands place. Regroup 10 hundred thousands into 1 millions and add it to the millions place.

2 549 384 + 6 986 768 = _ 5 3 6 1 5 2

7. Add millions: 1 + 2 + 6 = 9. Write 9 in the millions place.

2 549 384 + 6 986 768 = 9 5 3 6 1 5 2

Therefore, 2 549 384 + 6 986 768 = 9 536 152.

Example 2



$$\begin{array}{r} 2\ 3\ 7\ 9\ 3\ 8\ 4 \\ +\ 6\ 9\ 8\ 6\ 7\ 5\ 8 \\ \hline \\ \hline \end{array}$$

Solution

Align the given numbers vertically according to the place value of each digit as follows:

Steps:

1. Add ones: 4 + 8 = 12. Write 2 in the ones place. Regroup 10 ones into 1 tens and add it to the tens place.
2. Add tens: 1 + 8 + 5 = 14. Write 4 in the tens place. Regroup 10 tens into 1 hundreds and add it to the hundreds place.
3. Add hundreds: 1 + 3 + 7 = 11. Write 1 in the hundreds place. Regroup 10 hundreds into 1 thousands and add it to the thousands place.
4. Add thousands: 1 + 9 + 6 = 16. Write 6 in the thousands place. Regroup 10 thousands into 1 ten thousands and add it to the ten thousands place.
5. Add ten thousands: 1 + 7 + 8 = 16. Write 6 in the ten thousands place. Regroup 10 ten thousands into 1 hundred thousands and add it to the hundred thousands place.
6. Add hundred thousands: 1 + 3 + 9 = 13. Write 3 in the hundred thousands place. Regroup 10 hundred thousands into 1 millions and add it to the millions place.

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7. Add millions: 1 + 2 + 6 = 9. Write 9 in the millions place.

Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
1	1	1	1	1	1	
	13	16	16	11	14	12
2	3	7	9	3	8	4
+ 6	9	8	6	7	5	8
9	3	6	6	1	4	2

Therefore,

$$\begin{array}{r} 2\ 3\ 7\ 9\ 3\ 8\ 4 \\ +\ 6\ 9\ 8\ 6\ 7\ 5\ 8 \\ \hline 9\ 3\ 6\ 6\ 1\ 4\ 2 \\ \hline \end{array}$$

Exercise 3

Answer the following questions:

1. 1 265 539 + 2 423 469 =
2. 3 703 142 + 4 054 543 + 1 141 252 =
3. 2 501 321 + 1 715 378 + 1 252 221 =
4. 1 678 177 + 5 352 687 =
5. 1 500 000 + 1 999 999 =
6. 1 245 239 + 185 891 =
7. 3 420 219 + 1 632 135 =
8. 7 976 286 + 3 613 298 =
9. 1 786 101 + 3 613 298 =
10. 4 687 692 + 3 189 328 =
11. $\begin{array}{r} 4\ 4\ 8\ 6\ 3\ 4\ 7 \\ 1\ 7\ 8\ 9\ 7\ 9\ 3 \\ +\ 2\ 3\ 7\ 4\ 3\ 8\ 6 \\ \hline \\ \hline \end{array}$
12. $\begin{array}{r} 2\ 6\ 7\ 2\ 7\ 1\ 9 \\ +\ 3\ 2\ 5\ 5\ 8\ 6\ 6 \\ \hline \\ \hline \end{array}$

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13.
$$\begin{array}{r} 6\,3\,1\,2\,5\,3 \\ 1\,7\,2\,5\,7\,6\,5 \\ +\quad 9\,0\,9\,3\,7\,4 \\ \hline \\ \hline \end{array}$$

14.
$$\begin{array}{r} 1\,5\,2\,7\,2\,0\,3 \\ 4\,0\,1\,5\,7\,5 \\ +\quad 8\,8\,5\,6\,4\,9 \\ \hline \\ \hline \end{array}$$

15.
$$\begin{array}{r} 2\,3\,0\,2\,3\,8\,2 \\ 4\,5\,7\,5\,8\,4\,6 \\ +\,1\,7\,9\,6\,7\,0\,8 \\ \hline \\ \hline \end{array}$$

16.
$$\begin{array}{r} 9\,3\,6\,4\,7\,9 \\ +\,1\,3\,4\,7\,3\,5\,4 \\ \hline \\ \hline \end{array}$$

17.
$$\begin{array}{r} 1\,7\,2\,2\,4\,6\,6 \\ 5\,8\,9\,7\,1\,8 \\ +\,2\,0\,5\,3\,2\,1\,4 \\ \hline \\ \hline \end{array}$$

18.
$$\begin{array}{r} 1\,6\,5\,1\,7\,0\,1 \\ +\quad 5\,4\,1\,6\,3\,2 \\ \hline \\ \hline \end{array}$$

19.
$$\begin{array}{r} 1\,2\,3\,1\,7\,4\,3 \\ 1\,1\,8\,6\,1\,9\,2 \\ +\,5\,6\,1\,2\,1\,3\,5 \\ \hline \\ \hline \end{array}$$

20.
$$\begin{array}{r} 3\,0\,8\,2\,1\,5\,2 \\ +\,1\,0\,2\,5\,9\,7\,4 \\ \hline \\ \hline \end{array}$$

Word problems involving addition of whole numbers

Example 1

Paula's earnings in three consecutive months were 3 003 600 shillings, 3 634 000 shillings and 3 350 350 shillings. What was the total amount of Paula's earnings in three months?

Solution

Month	Earnings (shillings)
1st month	3 003 600
2nd month	3 634 000
3rd month	+ 3 350 350
Total	9 987 950

Therefore, Paula's total earning was 9 987 950 shillings.

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Example 2

In 2018, the women community market group in Arusha city earned a profit of 4 678 145 shillings from selling beans, 2 521 675 shillings from green grams and 2 798 989 shillings from cowpeas. What profit did the group earn after selling those crops?

Solution

Type of crop		Profit earned (shillings)
		1 111 21
Beans		4 678 145
Green grams		2 521 675
Cowpeas	+	2 798 989
Total		9 998 809

Therefore, the group earned a total profit of 9 998 809 shillings

Exercise 4

Answer the following questions:

1. The mass of fish caught by certain fishermen were 2 562 350 kg in the first month, 1 225 000 kg in the second month and 3 110 200 kg in the third month. Find the total number of kilograms of fish caught in the three months.

2. The villagers made 3 893 072 bricks in the first month and 3 000 023 bricks in the second month. Find the total number of bricks made in the two months.

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3. The village government used 3 403 100 shillings to renovate buildings of two primary schools, 1 171 300 shillings to renovate roads, 1 302 160 shillings to renovate their dispensary and 1 011 200 shillings to renovate water pipes. Find the total amount of money used in the renovation.

4. A factory manufactured 1 140 010 bars of soap in 2016. In 2017, it manufactured 910 150 bars of soap, and 1 325 250 bars of soap were manufactured in 2018. How many bars of soap were manufactured in the three years?

5. The Ports Authority exported 4 360 100 tons of timber in January and 3 138 920 tons in February. How many tons of timber were exported in the two months?

6. Chande has grain stores in Iringa, Kilimanjaro and Dar es Salaam regions. He stored 1 461 213 bags of maize in Iringa, 2 600 007 bags of maize in Kilimanjaro and 3 200 300 bags of maize in Dar es Salaam. How many bags of maize did he store in the three regions?

7. A cooperative union sold 1 630 220 bags of wheat, 2 123 513 bags of millet and 5 215 246 bags of maize. How many bags of grains did the union sell altogether?

8. Five schools in a certain ward launched a brick production project. The first school produced 1 000 115 bricks, the second school produced 2 000 031 bricks, the third school produced 863 512 bricks, the fourth school produced 1 024 100 bricks and the fifth school produced 2 110 040 bricks. How many bricks did the schools produce altogether?

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9. There are 5 256 423 exercise books in the store. If 2 491 708 more exercise books are received, how many exercise books will be in the store?

10. A person is selling two plots of land at 3 350 000 shillings and 4 000 000 shillings respectively. What amount of money will the person earn from the sales of the two plots?

11. Poultry farmers sold 2 965 493 eggs during the first phase, 3 197 289 eggs during the second phase, and 3 658 394 eggs during the third phase. What was the total number of eggs the farmers sold in the three phases?

12. One region launched a tree planting campaign for three consecutive years as follows: 3 912 567 trees were planted in the first year, 2 483 432 trees in the second year and 2 247 168 trees in the third year. How many trees were planted in the three years?

13. The meat processing industry sold 267 893 kilograms of meat in 2016. It also sold 2 296 269 kilograms of meat in 2017 and 1 321 989 kilograms of meat in 2018. How many kilograms of processed meat were sold by the industry?

14. A certain group of farmers opened a cooperative industry for processing tomatoes. In 2015, the industry earned 2 467 670 shillings from sales of processed tomatoes, and 4 950 890 shillings in 2016. How much money did the cooperative industry earn in the two years?

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15. The Mshikamano youth group from Makwema village produced 2 617 890 bricks in November and 1 499 479 bricks in December. How many bricks did the youth group produce in the two months?

16. Two health centres in a certain district received maintenance funds from the government. The first centre received 2 496 000 shillings and the second centre received 2 367 100 shillings. What is the total amount of money the two centres received?

17. A businessman sold two auto spare parts as follows: The first spare part was sold at 195 857 shillings and the second spare part was sold at 959 348 shillings. How much money did he collect from the sales of the two spare parts?

18. A farmer decided to buy electronic devices from the sales of her crops. She bought a television set at 2 565 000 shillings, a laptop at 1 550 000 shillings, a radio at 967 800 shillings and a mobile phone at 315 000 shillings. How much money did she spend to buy the devices?

19. A company paid the monthly office expenditure as follows: Electricity 3 781 800 shillings, water consumption 3 189 569 shillings and fuel 2 340 274 shillings. How much money did the company pay for the office expenditure?

20. A beverage company sold 360 900 bottles of cold drinks in the first year and 1 620 000 bottles in the second year. How many bottles of cold drinks were sold in the two years?

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Subtraction of numbers up to 10 000 000 without regrouping and by regrouping

When subtracting numbers, remember to consider the place value of each digit in the number. Start by subtracting ones, followed by tens, hundreds, thousands up to the highest place value of the given numbers. Also, you can subtract the numbers when arranged horizontally or vertically by regrouping or without regrouping.

Subtracting numbers horizontally and vertically without regrouping

Example 1

9 878 784 – 4 768 670 =

Solution

Use the following steps to subtract the given numbers horizontally:

Steps:

1. Subtract ones: 4 – 0 = 4. Write 4 in the ones place.	9 878 784 – 4 768 670 = _ _ _ _ _ _ 4
2. Subtract tens: 8 – 7 = 1. Write 1 in the tens place.	9 878 784 – 4 768 670 = _ _ _ _ _ 1 4
3. Subtract hundreds: 7 – 6 = 1. Write 1 in the hundreds place.	9 878 784 – 4 768 670 = _ _ _ _ 1 1 4
4. Subtract thousands: 8 – 8 = 0. Write 0 in the thousands place.	9 878 784 – 4 768 670 = _ _ _ 0 1 1 4
5. Subtract ten thousands: 7 – 6 = 1. Write 1 in the ten thousands place.	9 878 784 – 4 768 670 = _ 1 0 1 1 4
6. Subtract hundred thousands: 8 – 7 = 1. Write 1 in the hundred thousands place.	9 878 784 – 4 768 670 = 1 1 0 1 1 4

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7. Subtract millions: 9 – 4 = 5.
Write 5 in the millions place.

9 878 784 – 4 768 670 = 5 1 1 0 1 1 4

Therefore, 9 878 784 – 4 768 670 = 5 110 114.

Example 2



5 7 6 5 8 6 0
– 3 4 5 3 7 6 0

Solution

To subtract numbers vertically without regrouping, follow the same steps as for horizontal subtraction. That is,

5 7 6 5 8 6 0
– 3 4 5 3 7 6 0
2 3 1 2 1 0 0

Therefore, the answer is 2 312 100.

Activity 2: Using number cards to subtract whole numbers

Steps:

Form groups of three pupils each, prepare cards numbered from 0 to 9, a card with a minus sign and two long cards of equal sizes which serves as an equal sign ("="). Thereafter, use the following procedures:

1. Use the number cards to form a number with millions value; for example, 9 776 543.
2. Form another smaller number than the previous; for example, 8 251 230.

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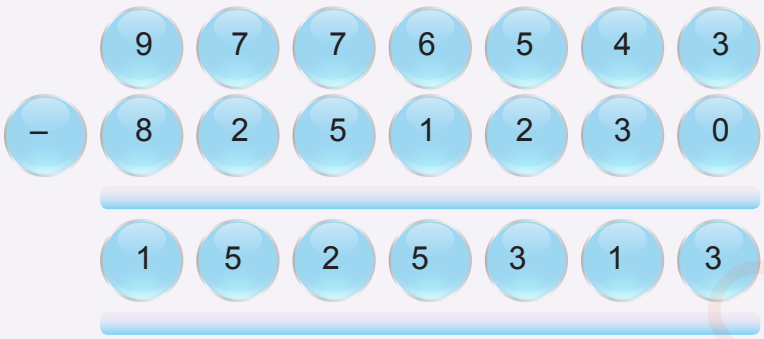
3. Align the numbers vertically in order to subtract. Make sure that the numbers can be subtracted without regrouping.
4. Use the number cards to form a number that represents your answer.
5. Observe the arrangement of cards in the following example:



Exercise 5

Answer the following questions:

1. 9 983 579 – 6 962 158 =
2. 1 557 882 – 456 432 =
3. 4 198 667 – 61 365 =
4. 1 187 865 – 182 660 =
5. 8 7 3 9 0 0 0
   – 5 3 6 0 0 0
6. 5 8 4 2 3 3 8
   – 3 1 2 0 1 7
7. 9 0 4 4 2 5 2
   – 6 0 3 2 0 4 1
8. 8 9 5 7 7 4 8
   + 7 7 0 6 6 2 6

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9.
$$\begin{array}{r} 7\,7\,6\,0\,4\,7\,4 \\ -\,4\,4\,5\,0\,4\,6\,2 \\ \hline \\ \hline \end{array}$$

10.
$$\begin{array}{r} 3\,2\,4\,7\,6\,3\,8 \\ -\,1\,1\,2\,5\,6\,0\,1 \\ \hline \\ \hline \end{array}$$

11.
$$\begin{array}{r} 6\,4\,9\,7\,5\,9\,9 \\ -\,2\,3\,4\,1\,4\,3\,1 \\ \hline \\ \hline \end{array}$$

12.
$$\begin{array}{r} 3\,3\,8\,8\,5\,4\,6 \\ -\,\,\,2\,1\,7\,2\,1\,2 \\ \hline \\ \hline \end{array}$$

13.
$$\begin{array}{r} 4\,4\,8\,6\,1\,8\,3 \\ -\,3\,2\,4\,2\,1\,6\,2 \\ \hline \\ \hline \end{array}$$

14.
$$\begin{array}{r} 6\,5\,4\,4\,3\,9\,6 \\ -\,4\,3\,2\,2\,1\,7\,5 \\ \hline \\ \hline \end{array}$$

15.
$$\begin{array}{r} 9\,0\,4\,4\,2\,5\,2 \\ -\,6\,0\,3\,2\,0\,4\,1 \\ \hline \\ \hline \end{array}$$

16.
$$\begin{array}{r} 2\,6\,1\,3\,5\,8\,8 \\ -\,1\,0\,1\,1\,0\,2\,8 \\ \hline \\ \hline \end{array}$$

17.
$$\begin{array}{r} 7\,9\,1\,0\,1\,0\,0 \\ -\,\,\,6\,0\,0\,0\,0\,0 \\ \hline \\ \hline \end{array}$$

18.
$$\begin{array}{r} 7\,9\,7\,7\,7\,3\,6 \\ -\,\,\,3\,4\,1\,5\,0\,2 \\ \hline \\ \hline \end{array}$$

19.
$$\begin{array}{r} 5\,9\,0\,7\,6\,8\,7 \\ -\,4\,2\,0\,5\,1\,3\,2 \\ \hline \\ \hline \end{array}$$

20.
$$\begin{array}{r} 8\,6\,1\,3\,7\,4\,5 \\ -\,3\,5\,1\,1\,1\,3\,3 \\ \hline \\ \hline \end{array}$$

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Subtracting whole numbers horizontally and vertically by regrouping

Example 1

7 452 140 – 5 731 671 =

Solution	Answer
1. Subtract ones: 0 – 1. It is not sufficient. Take 1 group of tens from 4 tens, and regroup it to get 10 ones. Add ones. 10 + 0 =10. Now, subtract ones; 10 – 1 = 9. Write 9 in the ones place. Remember, 1 tens was regrouped into 10 ones. Thus, 3 tens remained in the tens place.	7 452 140 – 5 731671 = _ _ _ _ _ _ 9
2. Subtract tens: 3 – 7: It is not sufficient. Take 1 group of hundreds from 1 hundreds and regroup it to get 10 tens. Add tens; 10 + 3 = 13. Now, subtract tens; 13 – 7 = 6. Write 6 in the tens place. Remember 1 hundreds was regrouped into 10 tens. Thus, 0 hundreds remained in the hundreds place.	7 452 140 – 5 731671 = _ _ _ _ 6 9
3. Subtract hundreds: 0 – 6: It is not sufficient. Take 1 group of thousands from 2 thousands and regroup it to get 10 hundreds. Add hundreds; 10 + 0 = 10. Now, subtract hundreds; 10 – 6 = 4. Write 4 in the hundreds place.	7 452 140 – 5 731671 = _ _ _ 4 6 9

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Remember 1 thousands was regrouped into hundreds. Thus, 1 thousands remained in the thousands place.	
4. Subtract thousands: 1 – 1 = 0. Write 0 in the thousands place.	7 452 140 – 5 731 671 = _ _ 0 4 6 9
5. Subtract ten thousands: 5 – 3 = 2. Write 2 in the ten thousands place.	7 452 140 – 5 731 671 = _ 2 0 4 6 9
6. Subtract hundred thousands: 4 – 7. It is not sufficient. Take 1 millions from 7 millions and regroup it into 10 hundred thousands. Add hundred thousands; 10 + 4 = 14. Now, subtract hundred thousands; 14 – 7 = 7. Write 7 in the hundred thousands place. Remember, 6 millions remained after taking 1 millions from 7 millions.	7 452 140 – 5 731 671 = _ 7 2 0 4 6 9
7. Subtract millions: 6 – 5 = 1. Write 1 in the millions place.	7 452 140 – 5 731 671 = 1 7 2 0 4 6 9

Therefore, 7 452 140 – 5 731 671 = 1 720 469.

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Example 2

$$\begin{array}{r} 5\ 0\ 4\ 2\ 1\ 5\ 0 \\ -\ 1\ 1\ 0\ 4\ 0\ 6\ 1 \\ \hline \\ \hline \end{array}$$

Solution

	Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
	4	10	3	12	0	14	10
	~~5~~	~~0~~	~~4~~	~~2~~	~~1~~	~~5~~	~~0~~
–	1	1	0	4	0	6	1
	3	9	3	8	0	8	9

Therefore, the answer is 3 938 089

Exercise 6

Answer the following questions:

1. 6 140 040 – 281 153 =

2. 2 159 318 – 457 429 =

3. 6 196 021 – 457 306 =

4. 1 142 640 – 746 922 =

5. $\begin{array}{r} 8\ 1\ 4\ 0\ 8\ 1\ 0 \\ -\ \ 4\ 9\ 1\ 0\ 5\ 3 \\ \hline \\ \hline \end{array}$

6. $\begin{array}{r} 5\ 9\ 1\ 2\ 2\ 1\ 8 \\ -\ 1\ 4\ 0\ 0\ 9\ 2\ 7 \\ \hline \\ \hline \end{array}$

7. $\begin{array}{r} 7\ 1\ 3\ 7\ 3\ 1\ 0 \\ -\ 3\ 0\ 2\ 9\ 3\ 4\ 0 \\ \hline \\ \hline \end{array}$

8. $\begin{array}{r} 7\ 6\ 0\ 3\ 5\ 4\ 5 \\ -\ \ 7\ 1\ 1\ 4\ 2\ 2 \\ \hline \\ \hline \end{array}$

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9.
$$\begin{array}{r} 6\,4\,6\,0\,9\,1\,3 \\ -\,5\,9\,8\,1\,5\,1\,4 \\ \hline \end{array}$$

10.
$$\begin{array}{r} 2\,0\,0\,2\,7\,2\,0 \\ -\,1\,1\,2\,6\,3\,0\,1 \\ \hline \end{array}$$

11.
$$\begin{array}{r} 7\,3\,2\,0\,5\,4\,0 \\ -\,6\,4\,2\,1\,1\,8\,2 \\ \hline \end{array}$$

12.
$$\begin{array}{r} 3\,1\,0\,1\,2\,0\,7 \\ -\quad 1\,9\,5\,2\,6\,2 \\ \hline \end{array}$$

13.
$$\begin{array}{r} 9\,0\,5\,1\,8\,3\,0 \\ -\quad 1\,2\,0\,9\,4\,0 \\ \hline \end{array}$$

14.
$$\begin{array}{r} 9\,1\,3\,1\,1\,4\,0 \\ -\,3\,0\,7\,3\,6\,9\,0 \\ \hline \end{array}$$

15.
$$\begin{array}{r} 2\,0\,2\,3\,3\,0\,0 \\ -\,1\,0\,7\,6\,9\,1\,8 \\ \hline \end{array}$$

16.
$$\begin{array}{r} 9\,8\,0\,0\,9\,5\,0 \\ -\quad 4\,1\,1\,0\,3\,0 \\ \hline \end{array}$$

17.
$$\begin{array}{r} 6\,1\,5\,0\,1\,1\,0 \\ -\,5\,1\,6\,0\,2\,0\,9 \\ \hline \end{array}$$

18.
$$\begin{array}{r} 2\,8\,4\,7\,0\,6\,3 \\ -\,1\,8\,3\,9\,8\,8\,2 \\ \hline \end{array}$$

19.
$$\begin{array}{r} 9\,0\,1\,3\,4\,0\,7 \\ -\,6\,2\,2\,5\,5\,8\,0 \\ \hline \end{array}$$

20.
$$\begin{array}{r} 9\,6\,9\,3\,1\,4\,3 \\ -\,5\,8\,4\,6\,6\,5\,0 \\ \hline \end{array}$$

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Word problems involving subtraction of whole numbers

Example 1

The government grain reserve contains 1 993 720 bags of maize. If 980 610 bags of maize are supplied to the families facing food shortage, how many bags of maize will remain in the reserve?

Solution

Total number of bags in the reserve = 1 993 720
Number of bags given to the families = 980 610

In this example, you can subtract vertically or horizontally to get the number of bags remaining in the reserve. However, subtracting vertically is preferred. That is,

$$\begin{array}{rr} & 1\,993\,720 \\ - & 980\,610 \\ \hline & 1\,013\,110 \end{array}$$

Therefore, 1 013 110 bags of maize remained in the reserve.

Example 2

The total number of cattle and goats in a certain district is 2 139 500. If the number of cattle is 1 104 563, what is the number of goats in the district?

Solution

Total number of cattle and goats in the district = 2 139 500
The number of cattle = 1 104 563
Subtract the numbers of cattle from the total number of cattle and goats to get the number of goats.

$$\begin{array}{rr} & 2\,139\,500 \\ - & 1\,104\,563 \\ \hline & 1\,034\,937 \end{array}$$

Therefore, the number of goats in the district is 1 034 937.

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Exercise 7

Answer the following questions:

1. The villagers harvested 2 600 000 kilograms of cotton. If 2 100 000 kilograms of cotton harvested were clean, how many kilograms of cotton were not clean?

2. The poultry farmer had 200 000 chickens. If 2 760 chickens died from a certain disease, how many chickens remained?

3. A primary school earned 1 646 000 shillings. If 991 000 shillings were used for buying stationery, how much money remained?

4. A certain village harvested 2 240 000 oranges in one month. If 1 290 000 oranges were sold, how many oranges remained?

5. Four residential plots were sold at 9 500 000 shillings. If three plots were sold at 6 860 000 shillings, what was the cost of the fourth plot?

6. A textile industry supplied 1 400 000 pairs of shorts to primary school pupils in five regions. If 693 420 pairs of shorts were supplied to two regions, how many pairs of shorts were supplied to the three remaining regions?

7. Mwendo village has 2 678 518 livestock. If 561 714 livestock are goats, what is the total number of the other livestock?

8. During an environmental conservation campaign, the villagers planted 1 417 316 trees. If 429 538 were fruits bearing trees, what was the number of non-fruit bearing trees?

9. A food crop business company collected 3 521 110 kilograms of maize. If 1 708 099 kilograms were sold, how many kilograms remained?

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10. A school made 1 800 000 bricks for building classrooms. If 904 235 bricks were used, how many bricks remained?

11. In an open market, 175 332 goats were sold from April to June and 187 460 goats were sold from July to November. What is the difference between the number of goats sold in the two periods?

12. A factory made 193 708 pairs of Khanga and 172 646 pairs of Vitenge. Find the difference between the number of pairs of Khanga and Vitenge.

13. A population in a certain region is 1 450 000. If the number of women is 803 000, how many men are there in that region?

14. In 2019, a customer planned to buy a motor vehicle at a cost of 10 000 000 shillings. If an advance payment of 4 550 000 shillings was made, how much money remained to complete the payment?

15. A businessman got 8 950 000 shillings in one month from the sales of minerals. If the cost of running this business in that month was 1 163 200 shillings, how much profit did he get?

16. According to the population statistics from different regions, the region with highest population has 2 131 920 people. The region with lowest population has 971 000 people. What is the difference in population between the two regions?

17. A businesswoman budgeted 9 000 000 shillings for buying clothes. If she got a discount and used only 7 902 000 shillings, how much money did she remain with?

18. Mtani received a bank loan of 3 700 000 shillings with a loan payment agreement of 960 000 shillings per month. What is the amount of debt remaining after paying the first month?

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19. A dealer in building materials budgeted 7 810 000 shillings for hardware materials. If 5 400 000 shillings was used to buy bags of cement, how much money remained?

20. There were 1 403 000 electrical materials imported from outside the country. If 573 000 imported electrical materials were defective, how many materials were not defective?

Multiplying whole numbers to get a product not exceeding 10 000 000

Remember that, you have learnt to multiply numbers to get a product not exceeding one million. Also, you learnt to multiply numbers with more than one digit by arranging them vertically according to their place values. In this section, you will be able to multiply numbers to get a product that does not exceed 10 000 000.

Example 1

$1293 \times 259 =$

Solution

Use the following steps to multiply the given numbers:

Steps:

1. Align the numbers vertically to correspond to the place value of each digit. That is, ones to be aligned together, similarly for tens, hundreds, thousands, ten thousands and so on, up to the highest place value of the given number.
2. You can multiply the number by starting with the lowest place value (ones) of the multiplier towards the left side. You can also start with the highest place value of the multiplier towards the right side .
3. In this example, the multiplier is 259. Start with the lowest place value in the multiplier, which is 9 (ones).

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	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
			1	2	9	3
		×		2	5	9
		1	1	6	3	7
		6	4	6	5	
+	2	5	8	6		
	3	3	4	8	8	7

Therefore, 1 293 × 259 = 334 887.

Example 2

8 703 × 962 =

In this example, start with a digit of the highest value in the multiplier; that is 9 which is in hundreds.

	Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
				8	7	0	3
			×		9	6	2
	7	8	3	2	7		
		5	2	2	1	8	
+			1	7	4	0	6
	8	3	7	2	2	8	6

Therefore, 8 703 × 962 = 8 372 286.

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Exercise 8

Answer the following questions:

1. $873 \times 613 =$

2. $6\,365 \times 821 =$

3. $1469 \times 235 =$

4. $9\,215 \times 341 =$

5. $637 \times 4\,181 =$

6. 3713×960

7. 8141×517

8. 2190×954

9. 5300×432

10. 1069×7315

11. 3604×1882

12. 4284×739

13. 8386×692

14. $792 \times 6\,563 =$

15. $2\,240 \times 4\,301 =$

16. $3\,781 \times 810 =$

17. $7\,631 \times 942 =$

18. $1912 \times 4\,172 =$

19. $713 \times 3\,064 =$

20. $373 \times 9\,183 =$

21. $6\,170 \times 512 =$

22. $1\,624 \times 5\,467 =$

23. $5\,412 \times 1\,732 =$

24. $1\,931 \times 309 =$

25. $4\,201 \times 550 =$

Word problems on multiplication of whole numbers

Example 1

Each college student receives a subsistence allowance of 7 500 shillings per day. Find the total amount of money given per day to 1 200 students.

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Solution

Number of all students = 1 200

Amount of money given to each student per day = 7 500 shillings

Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
			1	2	0	0
		×	7	5	0	0
			0	0	0	0
		0	0	0	0	
	6	0	0	0		
8	4	0	0			
9	0	0	0	0	0	0

Therefore, the students are given a total of 9 000 000 shillings per day.

Example 2

A house was constructed using 9 000 bricks. How many bricks will be used to construct 137 houses of the same size?

Solution

Total number of bricks for one house = 9 000

Number of houses to be constructed = 137

Multiply the two numbers to get the answer. That is,

Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones
			9	0	0	0
			×	1	3	7
		6	3	0	0	0
	2	7	0	0	0	
+	9	0	0	0		
1	2	3	3	0	0	0

Therefore, 137 houses will require 1 233 000 bricks.

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Exercise 9

Answer the following questions:

1. There are 174 pairs of Khanga in the shop. If the price of each pair of Khanga is 75 000 shillings, how much money will be collected from the sales of all pairs of Khanga?

2. A car travels 75 649 metres per hour. How many metres will it travel in 15 hours?

3. Each of 786 Kisiwani village farmers harvested 260 kilograms of cashew nuts. How many kilograms of cashew nuts were harvested by all the farmers?

4. A certain hotel uses 1 425 litres of water everyday. How many litres will be used by the hotel in 365 days?

5. In 2017, the cost of an air flight ticket from Dar es Salaam to Mwanza was sold at 113 000 shillings. How much money was collected from 55 passengers who took the flight?

6. Juma deposits a profit of 380 000 shillings every month from his business. How much money will he deposit in two years?

7. A residential plot costs 300 000 shillings. What is the cost of four plots of the same price?

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8. The villagers from a certain village agreed to contribute 5 300 shillings each for a water project. If 1 650 villagers contributed, what was the total amount of their contribution?

9. A businessman bought 2 735 watermelons. If each watermelon costs 2 500 shillings, how much money did he spend to buy the watermelons?

10. A certain civil engineering company has 312 day workers. Every worker is paid 9 500 shillings per day. How much money does the company pay everyday?

11. A businesswoman earns a profit of 300 000 shillings everyday. What profit will she earn in 31 days?

12. Esta buys 2 litres of milk everyday. If one litre costs 240 shillings, how much money will Esta spend on buying milk in a year consisting of 365 days?

13. A bus carries 60 passengers for a single journey. If a bus ticket costs 45 000 shillings, how much money will be collected in a single journey?

14. A matchbox contains an average of 85 sticks. How many sticks will be in 14 250 similar matchboxes?

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15. Josephine is a poultry farmer who sells 60 chickens at 12 000 shillings every month. How much money does she collect from chickens' sales in one year?

16. A certain airport in Africa serves 400 000 passengers monthly. How many passengers will be served in five months if the number of passengers remain constant?

17. A neighbour saved 14 250 shillings every month for 3 years and 8 months to be able to buy a television set. What is the cost of the television set?

18. Nota primary school uses 63 540 litres of water every month. How many litres of water will the school use in a year if the consumption of water per month is constant?

19. A cashew nuts farmer harvests 730 kilograms per year. How many kilograms will be harvested by 5 050 such farmers in one year?

20. A telecommunication company has 8 030 registered clients. If every client buys airtime at 550 shillings a day, how much money will the company collect in one day from its clients?

Dividing whole numbers not exceeding 10 000 000

Steps for dividing whole numbers are the same as those learnt in Standard Five. Long division is easier when dividing large numbers.

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Example 1

$3\,850\,500 \div 150 =$

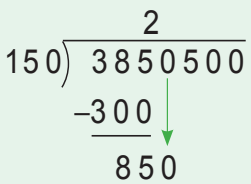
Steps:

1. Divide 38 by 150:
   38 is not sufficient for this division.
   Therefore, take 385 and
   divide it by 150.

   Find a number which when
   multiplied by 150 gives 385
   or a whole number closer to 385.

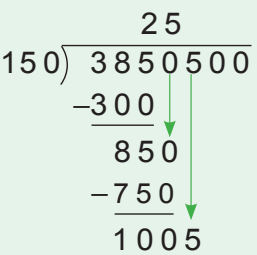
   Multiply 2 by 150 to get 300.
   This is the required whole number.
   (When you multiply it by 3 you get 450
   which is greater than 385)

   Write 2 above the ten thousands
   position in the answer, then write
   300 below 385. Subtract to get 85.
   Drop down 0 to get 850.



2. Divide 850 by 150.

   Find a number which when
   multiplied by 150 gives
   850 or a whole number closer to
   850. The number is 5,
   that is $150 \times 5 = 750$. Write 5 in
   the place of the answer at the
   thousands place to the right of 2.
   Write 750 below 850 and subtract
   to get 100. Drop down 5 to get 1 005.



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3. Divide 1 005 by 150.

Find a number which when multiplied by 150 gives 1 005 or a whole number closer to 1 005. This number is 6, that is $6 \times 150 = 900$.

Write 6 above hundreds in the place of the answer and 900 below 1 005, then subtract. You remain with 105. Drop 0 in order to get 1 050.

```
      256
150 ) 3850500
    –300
      850
    –750
     1005
    – 900
     1050
```

4. Divide 1 050 by 150.

Find a number which when multiplied by 150 gives 1 050 or a whole number closer to 1 005. This number is 7, whereby $7 \times 150 = 1\,050$. Write 7 above tens in the position of the answer and write 1 050 below 1 050, then subtract to get 0. Drop down 0 in order to get 0.

```
      2567
150 ) 3850500
    –300
      850
    –750
     1005
    –900
     1050
    –1050
       00
```

5. Divide 0 by 150.

Find a number when multiplied by 150 you will get 0. This number is 0. Write 0 above the ones place in the position of the answer, and write 0 below 0. Subtract to get 0.

Therefore, 3 850 500 ÷ 150 = 25 670.

```
      25670
150 ) 3850500
    –300
      850
    –750
     1005
    – 900
     1050
    –1050
       00
      – 0
        0
```


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Example 2

$2\,502\,382 \div 28\,763 =$

Solution

$$
\begin{array}{r}
\quad\quad\quad 87 \\
28763\overline{)\,2502382} \\
-230104\downarrow \\
\hline
\quad 201342 \\
-\;201341 \\
\hline
\quad\quad\quad 1
\end{array}
$$

Therefore, 2 502 382 ÷ 28 763 = 87 remainder 1.

Exercise 10

Answer the following questions:

1. $78\overline{)23\,400}$
2. $140\overline{)63\,000}$
3. $10\,000\,000 \div 100 =$
4. $35\,421 \div 150 =$
5. $4\,276\,800 \div 1\,584 =$
6. $2\,046\,805 \div 2\,380 =$
7. $694\,500 \div 1\,852 =$
8. $6\,410\,625 \div 51\,285 =$
9. $472\,708 \div 2\,013 =$
10. $8\,383\,375 \div 9\,581 =$
11. $1\,433\,385 \div 161 =$
12. $5\,434\,878 \div 246 =$
13. $66\,306 \div 11\,051 =$
14. $130\,704 \div 18\,172 =$
15. $520\,192 \div 32\,512 =$
16. $6\,184\,608 \div 44\,816 =$
17. $142\,030 \div 14\,203 =$
18. $642\,078 \div 71\,342 =$
19. $3\,748\,374 \div 420 =$
20. $3\,527\,228 \div 51\,871 =$

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Word problems involving division of whole numbers

Example 1

Every month a region needs an average of 2 234 400 litres of clean water for 420 households. How many litres of clean water does each household use in one month?

Solution

Total number of litres of clean water = 2 234 400
Number of households = 420
Divide to get the required answer.

```
          5320
420 ) 2234400
     -2100
      1344
     -1260
       840
     -  840
          00
        -  0
           0
```

Therefore, every household uses 5 320 litres of clean water every month.

Example 2

In the construction of classrooms, a total of 1 162 050 shillings was spent for buying cement bags. If one bag of cement costs 14 000 shillings, how many bags were bought, and how much money remained?

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Solution

Total amount of money is 1 162 050 shillings.
Cost of one bag of cement is 14 000 shillings.

$$
\begin{array}{r}
83 \\
14000\overline{)\,1162050} \\
-112000\downarrow \\
\hline
42050 \\
-42000 \\
\hline
50
\end{array}
$$

Therefore, 83 bags of cement were bought, and 50 shillings remained.

Exercise 11

Answer the following questions:

1. A businessman bought 200 baskets of the same type at 960 000 shillings. How much money did each basket cost?

2. The volume of water tank is 1 200 litres. How many buckets of water of 20 litres each will be used to fill it?

3. If the cost of renovating a 25 kilometres road is 10 000 000 shillings, what is the average cost of renovating 1 kilometre of the road?

4. If 67 435 crates of soda are to be carried by 90 lorries of the same capacity, how many crates will remain uncarried?

5. A lorry transported equally 1 379 bags of cement in 7 trips. How many bags of cement were transported in each trip?

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6. A farmer collected 819 900 shillings after selling 300 watermelons. How much money does each watermelon cost?

7. A total of 864 tons of sand were transported by 6 lorries each with the capacity of 18 tons. How many trips will each lorry make?

8. A lorry uses 1 litre of diesel to travel 8 kilometres. If it travels 21 632 kilometres, how many litres of diesel will be used?

9. Halima's subsistence allowance is 1 451 000 shillings for 20 days. What is the average amount of money Halima gets everyday?

10. The district council bought 117 286 bricks for 45 primary schools. If the bricks were equally shared, how many bricks did each school get? How many bricks remained?

11. If one crate contains 35 cans, how many crates are required to pack 7 280 cans?

12. A primary school received 455 000 eggs. If 1 200 pupils shared the eggs equally, how many eggs did each pupil get? How many eggs remained?

13. A villager harvested 334 000 kilograms of beans. If all beans were packed in containers of 12 500 kilograms each, how many kilograms of beans were not packed?

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14. A primary school used 63 540 litres of water in June. If the school used the same amount of litres everyday, how many litres of water were used in each day?

15. A carpentry factory made 1 827 sieves. If the sieves were sold at 584 640 shillings, what is the average cost of one sieve?

16. A group of 8 businesswomen recorded a joint profit of 8 500 000 shillings. If the profit was equally shared, how much money did each businesswoman get?

17. A cooperative union supplied 6 432 186 empty bags to 42 512 farmers. If the bags were equally shared, how many bags did each farmer get? How many bags remained?

18. There were 4 560 000 textbooks shared equally to 350 schools. How many books did each school get? How many books remained?

19. A company supplied 450 000 iron sheets to 1 500 families. If the iron sheets were equally shared, how many did each family receive? How many iron sheets remained?

20. A city water authority supplied 1 480 000 litres of water to 2 500 households. If each household received the same amount of water, how many litres did each household get?

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Revision exercise

Answer the following questions:

1. 6 364 274 + 2 023 110=

2. 3 916 327 + 1 370 616 =

3. 5 342 + 6 085 916 =

4.
$$\begin{array}{r} 3\,082\,152 \\ +\ 6\,714\,726 \\ \hline \\ \hline \end{array}$$

5.
$$\begin{array}{r} 3\,121\,392 \\ +\ 5\,809\,020 \\ \hline \\ \hline \end{array}$$

6. 4 415 399 – 311 180 =

7. 7 705 152 – 2 006 163 =

8. 1 714 × 863 =

9. 8 206 × 739 =

10. 113 265 ÷ 135 =

11. 4 001 172 ÷ 532 =

12. 7 705 183 ÷ 616 =

13. 1 774 509 ÷ 148 =

14. The profit earned by a food crops businessman in three years was as follows: In 2017, he earned a profit of 3 544 300 shillings, in 2018 he earned a profit of 2 710 950 shillings and in 2019 he earned a profit of 2 156 370 shillings. How much profit did he earn in the three years?

15. A district has a population of 1 701 200 people. If the district has 800 000 women, how many men are there in the district?

16. Two countries have an estimated area of 1 820 664 square kilometres. If the area of one country is 947 303 square kilometres, what is the area of the other country?

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17. A neighbour owed his friend 8 540 700 shillings. If he paid 4 560 000 shillings, how much debt remained?

18. The cooperative union collected some milk from 195 farmers. If each farmer provided 7 450 litres every month, how many litres of milk did the cooperative union collect every month?

19. The government supplied 1 623 600 kilograms of subsidized fertilizer to 12 300 families. If the families shared the fertilizers equally, how many kilograms did each family get?

20. A primary school spent 3 289 000 shillings to buy bags of cement. If 253 bags of cement were bought, what was the cost of one bag of cement?

Summary

1. When adding and subtracting numbers, use vertical or horizontal method.
2. Add numbers by considering the place value of each digit in the given numbers. That is, add ones, tens, hundreds, thousands, ten thousands and so on up to the highest place value. Do the same when subtracting numbers.
3. It is easy to multiply numbers with more than one digit when arranged vertically. You can multiply the numbers by starting with the digit of the lowest place value to the digit of the highest place value or starting with the digit of the highest place value to the digit of the lowest place value of the multiplier.
4. When dividing numbers, start dividing from left by finding a number which is equal or greater than the divisor.

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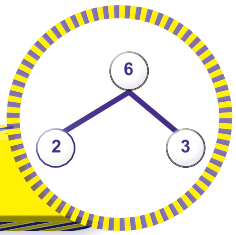
Chapter Three

Factors and multiples



Introduction

In standard Five, you learnt about even numbers, odd numbers and prime numbers. Also, you learnt about factors and multiples of numbers and how to use them in finding the Greatest Common Factor (GCF) and Lowest Common Multiple (LCM) of two whole numbers. In this chapter, you will learn about finding GCF and LCM of three whole numbers. The knowledge and skills gained will enable you to solve various problems in real life situations such as distributing things in ratios and interpreting medical prescription on how to use drugs.

Exercise 1: Revision

Answer the following questions:

1. Write all the factors of 42.
2. Write all the factors of 45.
3. Write all the factors of 60.
4. Find all common factors of 48 and 60.
5. Find the Lowest Common Multiple of 20 and 70.
6. Write the multiples of 6 between 30 and 120.
7. Write the multiples of 8 between 10 and 100.
8. Write all even numbers between 26 and 60 which are multiples of 5.

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9. Write all odd numbers between 20 and 80 which are multiples of 7.

10. List all the multiples of 6 which are less than 40.

11. List all the multiples of 7 between 20 and 110.

12. Find the common prime factors of 84 and 90.

13. List all the multiples of 9 between 21 and 145.

14. List all the common multiples of 5, 7 and 15 between 10 and 120.

15. Find the GCF of 36 and 54.

16. Find the LCM of 24 and 64.

17. Find the GCF of 30 and 42 by using prime factors.

18. Find the GCF of 90 and 210 by using prime factors.

19. Find the LCM of 150 and 250 by using prime factors.

20. Find the LCM of 90 and 162 by using prime factors.

Greatest Common Factor (GCF)

A factor is a number which divides another number without leaving a remainder. Every number is a factor of itself. The greatest common factor of two or more numbers is the largest common factor of the given numbers.

The Greatest Common Factor (GCF) of three whole numbers

The Greatest Common Factor of three numbers is the largest common factor among the common factors of three given numbers.

There are several methods of finding the GCF of numbers. One of the methods is to use the factors of the given numbers. The other method is to use all prime factors of the given numbers.

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Example 1

Find the Greatest Common Factor of 6, 12 and 20.

Solution

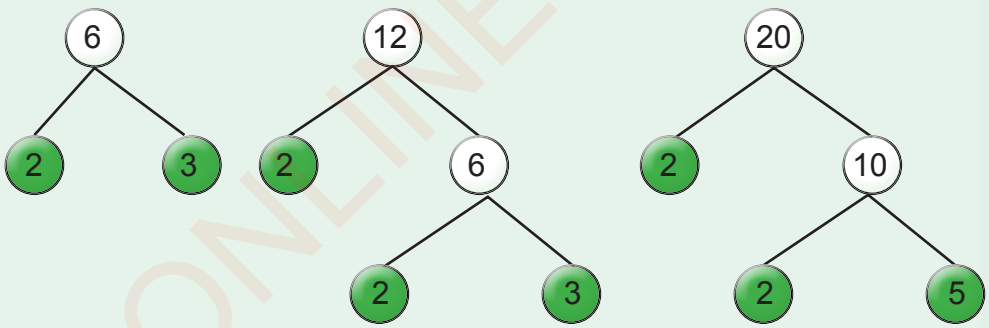
By listing all factors of the given numbers

List all factors of 6, 12 and 20 as follows:
Factors of 6 are 1, 2, 3 and 6.
Factors of 12 are 1, 2, 3, 4, 6 and 12.
Factors of 20 are 1, 2, 4, 5, 10 and 20.
Common factors are 1 and 2.
The Greatest Common Factor is 2.

Therefore, the GCF of 6, 12 and 20 is 2.

Alternative solution

By using prime factors of given numbers
Find all prime factors of 6, 12 and 20.
The prime factors of 6, 12 and 20 can be found by using tree diagrams as follows:



Thus, 2 is the greatest factor which appears in all the three numbers.

Therefore, the GCF of 6, 12 and 20 is 2.

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Example 2

Find the GCF of 12, 18 and 15.

Solution

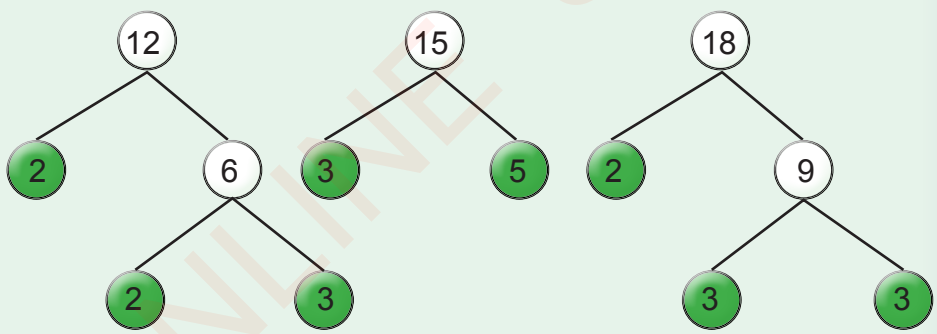
By listing all factors of the given numbers

List all factors of 12, 18 and 15.
Factors of 12 are 1, 2, 3, 4, 6 and 12.
Factors of 15 are 1, 3, 5 and 15.
Factors of 18 are 1, 2, 3, 6, 9 and 18.
Common factors are 1 and 3.
The greatest common factor is 3

Therefore, the GCF of 12, 18 and 15 is 3.

Alternative solution

By using the method of prime factors
It is easy to use tree diagrams to find the prime factors of 12, 18 and 15 as follows:



Thus, the prime factors of 12, 18 and 15 are:

$12 = 2 \times 2 \times 3$
$15 = 3 \times 5$
$18 = 2 \times 3 \times 3$

Thus, 3 is the greatest factor appearing in all the three numbers.

Therefore, the GCF of 12, 18 and 15 is 3.

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Example 3

Find the GCF of 3, 4 and 7.

Solution

List down all factors of 3, 4 and 7.
Factors of 3 are 1 and 3
Factors of 4 are 1, 2 and 4
Factors of 7 are 1 and 7
The only common factor of the given numbers is 1.

Therefore, the GCF of 3, 4 and 7 is 1.

Activity 1: Finding GCF of three numbers by using number cards

Find GCF of 24, 48 and 60.

Steps:

1. Prepare three bundles of number cards labelled 1 to 100.
2. Fix on the board the cards labelled 24, 48 and 60.
3. Select the cards whose numbers are factors of 24 and arrange them around the card labelled 24.
4. Do the same for the cards labelled 48 and 60.
5. Observe the cards surrounding the cards with number 24, 48 and 60, then remove all number cards with the same numbers
6. Arrange the removed cards in a line.
7. The largest number among the numbers you have arranged is the GCF of 24, 48 and 60.

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Exercise 2

Find the GCF of the numbers in questions 1 to 10 by listing all their factors.

1. 6, 12 and 24
2. 12, 24 and 36
3. 18, 28 and 48
4. 28, 48 and 36
5. 15, 21 and 36
6. 67, 133 and 147
7. 18, 72 and 27
8. 34, 51 and 68
9. 13, 15 and 17
10. 35, 60 and 65

Find the GCF of the following numbers by prime factors:

11. 63, 60 and 99
12. 66, 88 and 112
13. 18, 36 and 27
14. 36, 48 and 56
15. 24, 36 and 48
16. 15, 50 and 25
17. 24, 36 and 72
18. 32, 56 and 98
19. 16, 40 and 56
20. 35, 25 and 55

The Lowest Common Multiple (LCM)

A multiple is a number which can be divided by another number without leaving a remainder. Multiplication is the opposite of division. Therefore, a multiple is a product obtained after multiplying two or more numbers. The LCM is the least number which can be divided by two or more numbers without leaving a remainder.

The Lowest Common Multiple (LCM) of three numbers

The Lowest Common Multiple (LCM) of three numbers is the least number which can be divided by the three given numbers. There are several methods of finding the LCM of numbers as shown in the following examples:

Example 1

Find the LCM of 2, 4 and 6.

Solution

By listing all multiples of the given numbers

List all multiples of 2, 4 and 6.

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Multiples of 2 are 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, …
Multiples of 4 are 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, …
Multiples of 6 are 6, 12, 18, 24, 30, 36, 42, 48, …
Common multiples of 2, 4 and 6 are 12, 24, 36, … The multiples of given three numbers are infinite.

Therefore, the LCM of 2, 4 and 6 is 12.

Example 2



Find the LCM of 2, 4 and 12.

Solution

Finding the LCM by prime factors method

2	2	4	12
2	1	2	6
3	1	1	3
	1	1	1

The Lowest Common Multiple is a product of 2, 2 and 3.
Thus, LCM = $2 \times 2 \times 3 = 12$
Therefore, LCM of 2, 4 and 12 is 12.

Activity 2: Finding LCM of three numbers by using number cards

Find the LCM of 2, 3 and 4.

Steps:

1. Draw the following table in your exercise book:

Number	Multiples											

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2. Starting from the top, use the three blank spaces of the first column to fill in the numbers 2, 3 and 4.
3. Fill the first blank row by the multiples of 2, the second row by the multiples of 3 and the third row by the multiples of 4. Differentiate the numbers 2, 3 and 4 by colours.
4. Fill each row with the multiples of the given numbers in ascending order starting from the smallest.
5. Use different colours to circle all common multiples appearing in the three rows.
6. Write the common number among the multiples of the three numbers.
7. The least common number is the LCM of 2, 3 and 4.

Exercise 3

Find the LCM of the numbers in questions 1 to 10 by listing their multiples:

1. 5, 4 and 8
2. 4, 6 and 8
3. 6, 8 and 10
4. 25, 30 and 40
5. 18, 24 and 30
6. 46, 23 and 69
7. 20, 48 and 56
8. 84, 78 and 72
9. 35, 45 and 50
10. 22, 44 and 66

Use the method of prime factors to find the LCM of the numbers in questions 11 to 20.

11. 16, 32 and 42
12. 24, 28 and 34
13. 72, 56 and 48
14. 58, 68 and 78
15. 13, 39 and 52
16. 21, 54 and 77
17. 18, 27 and 39
18. 52, 26 and 81
19. 50, 150 and 75
20. 48, 20 and 58

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Revision exercise

Find the GCF and LCM of numbers in questions 1 to 20.

1. 15, 25 and 35
2. 12, 36 and 17
3. 15, 36 and 45
4. 20, 48 and 56
5. 10, 20 and 30
6. 9, 12 and 18
7. 27, 15 and 45
8. 12, 24 and 36
9. 18, 27 and 36
10. 14, 21 and 28
11. 32, 48 and 64
12. 32, 40 and 60
13. 38, 56 and 70
14. 15, 36 and 42
15. 56, 92 and 96
16. 24, 30 and 42
17. 14, 21 and 35
18. 24, 36 and 48
19. 12, 20 and 24
20. 25, 35 and 45

21. What is the least number which can be divided by 18, 36 and 27 without leaving a remainder?

22. Find the largest number which divides 150, 750 and 10 000 without leaving a remainder.

23. Two drums are sounding after every 5 and 6 minutes respectively. If they started sounding together, how long will they sound together for the second time?

24. The academic committee at Mtakuja primary school convenes a meeting after every two weeks, discipline committee convenes after every three weeks and environmental committee convenes after every four weeks. If the committees convened their first

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meetings at the same time, how long will it take for the three committes to convene their meetings at the same time again?

25. Three students went to the river to fetch water. The first student went after every 10 minutes, the second went after every 15 minutes and the third went after every 20 minutes. If they started fetching water and left the river at the same time, how long will they take to meet again at the river?

26. Find all common multiples of 3, 4 and 6 which are less than 40.

27. Find all common multiples of 5, 15 and 10 which are less than 100.

28. Find all common factors of 16, 12 and 18.

29. Find all common factors of 63, 45 and 99 which are greater than 1.

30. Find all common factors of 36, 48 and 72 which are multiples of 3.

Summary

1. A factor is a number which divides another number without leaving a remainder.
2. The Greatest Common Factor (GCF) is the largest common factor from the list of common factors of the given numbers.
3. The Greatest Common Factor of an even number, odd number and a prime number is 1. Also, the GCF of an even number and odd number is 1.
4. A multiple is the number which is divisible by another number without leaving a remainder.
5. The Lowest Common Multiple (LCM) of three numbers is the least number which is divisible by the three given numbers.
6. Division is the opposite of multiplication. Therefore, a multiple is a product of two or more numbers.

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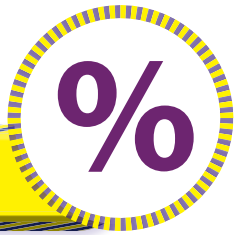
Chapter Four

Percentages



Introduction

In this chapter, you will learn about the concept of percentages, converting percentages into fractions, fractions into percentages, percentages into decimals and decimals into percentages. The knowledge and skills gained will enable you to interprete and present information in everyday life such as presenting examination scores, knowing profit and loss in business, expressing quality of things and comparing different measures of various statistical data.

The concept of percentages

Percentage is a number expressed as parts of 100. For example, 20 percent means 20 parts of a whole object divided into 100 equal parts which in short form is written as $\frac{20}{100}$. Percentage is denoted by a symbol % which is written on the right side of a number. For instance, 10 percent is written as 10%, which means 10 parts of 100 equal parts of a whole thing as shown in Figure 1.

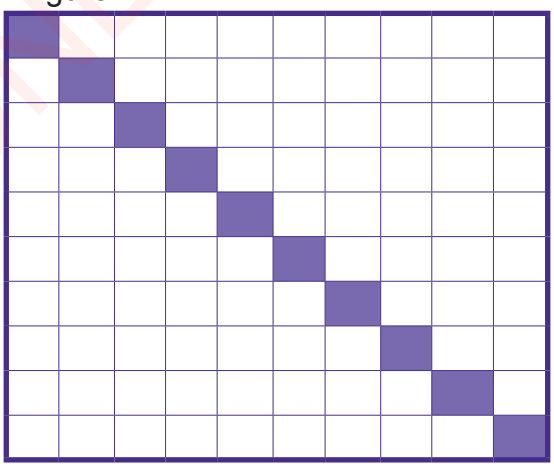


Figure 1: A diagram of 100 squares with 10 parts shaded

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In Figure 1, there are 100 equal squares. Among them, 10 squares are shaded while the remaining 90 squares are unshaded. The shaded squares represent $\frac{10}{100}$ of all the squares, which is equivalent to ten percent (10%). The unshaded squares represent $\frac{90}{100}$ which is the same as ninety percent (90%). The top number of a fraction is known as the numerator while the bottom number is called the denominator. For example, in $\frac{10}{100}$, 10 is the numerator and 100 is the denominator. In order to express a number in percentage, convert the given fraction such that the denominator becomes 100, and then write the numerator followed by the % symbol.

Example

Figure 2 consists of 25 rectangles of which 10 rectangles are shaded while 15 rectangles are unshaded.

(a) What is the percentage of the shaded rectangles?

(b) If there are 80 rectangles of which 40 rectangles are shaded, what is the percentage of the shaded part?

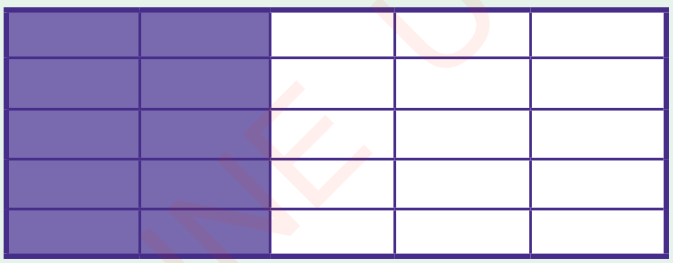

Figure 2: A diagram of 25 rectangles with 10 shaded parts

Solution

(a) There are 10 shaded rectangles out of 25, which in fraction is $\frac{10}{25}$.

In order to obtain the percentage of the shaded rectangles, convert the fraction such that the denominator becomes 100. To do this, multiply both the numerator and the denominator by 4. Thus, the numerator becomes 40 and the denominator becomes 100. The procedure is summarized as follows:

$$\frac{10}{25} = \frac{10 \times 4}{25 \times 4} = \frac{40}{100} = 40\%.$$

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Altenatively, multiply the fraction $\frac{10}{25}$ by 100 percent as follows:

$\frac{10}{25} \times 100\% = 40\%$

Therefore, the shaded rectangles is forty percent and it is written as 40%.

(b) Similarly, if there are 80 rectangles of which 40 of the rectangles are shaded, this is the same as 50 percent. That is, find a number which when multiplied by the denominator, which is 80, gives 100. This number is 1.25. Multiply both the numerator and the denominator by 1.25 as follows:

$\frac{40}{80} = \frac{40 \times 1.25}{80 \times 1.25} = \frac{50}{100} = 50\%$; Alternatively, it can be simply done by taking $\frac{40}{80} \times 100\% = 50\%$.

Therefore, the shaded rectangles is 50 percent, that is 50%.

Activity 1: Representing the number of pupils in the class by percentages

Form groups of not more than five pupils. Use steps 1 to 7 to perform the activity.

Steps:

1. Count the number of girls in the class.
2. Count the number of boys in the class.
3. Find the total number of pupils in the class.
4. Find the fraction of the number of girls in the class.
5. Find the fraction of the number of boys in the class.
6. What is the percentage of girls in the class?
7. What is the percentage of boys in the class?

After completing all seven steps, each group should present its answers to the class.

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Converting fractions into percentages

A fraction is considered to be a percentage if its denominator is 100. In Figure 3, there are 100 squares. The fraction of 25 purple squares is $\frac{25}{100}$ which is equivalent to 25 percent (25%). There are 75 uncoloured squares which give a fraction of $\frac{75}{100}$ equivalent to 75 percent (75%).

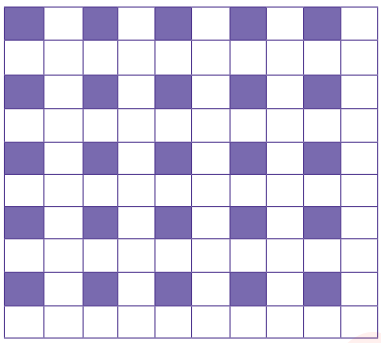

Figure 3: A diagram of 100 squares

The following table shows the relationship between percentage and fraction:

Percentage	5%	10%	25%	29%	50%	75%	90%	100%
Fraction	$\frac{5}{100}$	$\frac{10}{100}$	$\frac{25}{100}$	$\frac{29}{100}$	$\frac{50}{100}$	$\frac{75}{100}$	$\frac{90}{100}$	$\frac{100}{100}$
	$\frac{1}{20}$	$\frac{1}{10}$	$\frac{1}{4}$	$\frac{29}{100}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{9}{10}$	$\frac{1}{1}=1$

A fraction with a denominator of 100 can be simplified further if both the numerator and the denominator have a Greatest Common Factor (GCF) greater than 1. For example, 75% which is $\frac{75}{100}$ can be simplified to get $\frac{3}{4}$ because the numerator and the denominator have GCF of 25. To simplify a fraction, divide the numerator and the denominator by their GCF. For example, the greatest common factor of 75 and 100 is 25. Thus, $\frac{75}{100}=\frac{75\div25}{100\div25}=\frac{3}{4}$. The twenty-nine percent (29%) which is $\frac{29}{100}$ cannot be simplified further because the numerator and the denominator have GCF of 1.

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Example 1

Convert the following fractions into percentages:

(a) $\frac{2}{5}$

(b) $\frac{7}{25}$

Solution

(a) Find a number which when multiplied by the denominator gives 100. The number is 20. Multiply both the numerator and the denominator by 20. The resulting numerator will be the percentage. That is;

$$\frac{2}{5} = \frac{2\times20}{5\times20} = \frac{40}{100} = 40\%$$

Alternatively, multiply $\frac{2}{5}$ by 100% as follows:

$$\frac{2}{5}\times100\% = \frac{40}{100} = 40\%$$

Therefore, $\frac{2}{5}$ is equal to forty percent, that is 40%.

(b) Find a number which when multiplied by the denominator will give 100. That number is 4. Multiply both the numerator and the denominator by 4. The new numerator becomes the percentage. That is,

$$\frac{7}{25} = \frac{7\times4}{25\times4} = \frac{28}{100} = 28\%$$

Alternatively, multiply $\frac{7}{25}$ by 100%

Therefore, $\frac{7}{25}$ is equal to twenty-eight percent, that is 28%.

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Example 2

Convert the following fractions into percentage:

(i) $\frac{320}{400}$ (ii) $\frac{500}{200}$

Solution

(i) Find a number which when multiplied by 400 gives 100. The number is $\frac{1}{4}$. Multiply both the numerator and the denominator by $\frac{1}{4}$.

$\frac{320}{400} = \frac{320 \times \frac{1}{4}}{400 \times \frac{1}{4}} = \frac{80}{100} = 80\%$. Or, $\frac{320}{400} \times 100\% = \frac{320}{4}\% = 80\%$

Therefore, $\frac{320}{400}$ is equal to eighty percent, that is 80%.

(ii) $\frac{500}{200} = \frac{500 \times \frac{1}{2}}{200 \times \frac{1}{2}} = \frac{250}{100} = 250\%$. Or, $\frac{500}{200} \times 100\% = \frac{500}{2}\% = 250\%$.

Therefore, $\frac{500}{200}$ is equal to two hundred and fifty percent, that is 250%.

Example 3

Convert $\frac{2}{3}$ into percentage.

Solution

Find a number which when multiplied by 3 the result will be 100. That number is $\frac{100}{3}$. Multiply both the numerator and the denominator by $\frac{100}{3}$ as follows:

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$$\frac{2}{3} = \frac{2 \times \frac{100}{3}}{3 \times \frac{100}{3}}$$

$$= \frac{2 \times \frac{100}{3}}{100}$$

$$= \frac{\frac{200}{3}}{100} = \frac{66\frac{2}{3}}{100} = 66\frac{2}{3}\%$$

Alternatively, multiply $\frac{2}{3}$ by 100%;

$$\frac{2}{3} \times 100\% = \frac{200}{3}\% = 66\frac{2}{3}\%$$

Therefore $\frac{2}{3}$ is equal to $66\frac{2}{3}\%$.

Example 4

Convert $\frac{17}{20}$ into percentage.

Solution

Multiply $\frac{17}{20}$ by 100%

$$\frac{17}{20} \times 100\% = 17 \times \frac{100\%}{20}$$

$$= 17 \times 5\%$$

$$= 85\%$$

Therefore, $\frac{17}{20}$ is equal to 85%.

Example 5

Convert $\frac{190}{50}$ into percentage.

Solution

Multiply $\frac{190}{50}$ by 100%

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$\frac{190}{50} \times 100\% = 190 \times \frac{100\%}{50} = 190 \times 2\% = 380\%$

Therefore, $\frac{190}{50}$ is equal to 380%.

Activity 2: Converting fractions into percentages

During a preparation for standard seven graduation ceremony, the Head Teacher provided standard six pupils with a piece of cloth to make clothes for a dancing performance. The piece of cloth was shared by the standard six streams A, B, C and D as follows:

Stream A received $\frac{1}{4}$ of the whole cloth and stream B got $\frac{1}{4}$ of the whole cloth. Stream C received $\frac{1}{5}$ of the whole cloth. Stream D received the remaining piece after all other streams have taken their portions. Form groups of not more than five pupils and discuss the questions that follow. Write your solutions in your exercise book. Finally, present your work to the rest of the class.

1. What percentage of the piece of cloth was given to stream D?
2. What percentage of the piece of cloth was given to stream C?

If $\frac{4}{9}$ of the piece of cloth given to stream D was given to boys, what percentage of the whole piece of cloth was received by girls in stream D?

Exercise 1

Convert the following fractions in questions 1 to 5 into percentages:

1. $\frac{1}{4}$
2. $\frac{9}{20}$
3. $\frac{23}{50}$
4. $\frac{39}{100}$
5. $\frac{29}{5}$

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6. Eliza spends $\frac{7}{20}$ of her money for rent, while Neema spends 30% of her money for rent. What amount of money in percentage does Eliza pay more than Neema?

7. Find the difference between 55% and $\frac{1}{5}$, give your answer in percentage.

8. In a certain company, 2 out of 200 cups manufactured are defective. What percentage of the manufactured cups are defective?

9. Add 27% to $\frac{1}{4}$, write your answer in percentage.

10. Eric spent quarter of his money to buy building materials. He also spent half of the remaining money for rent. He deposited the remaining amount into his bank account. What percentage of his money was deposited in the bank?

Converting percentage into fraction

Example 1

Convert 35% into fraction.

Solution

Write 35 as a numerator and 100 as a denominator as follows:

$$\frac{35}{100}$$

Simplify the fraction by dividing both the numerator and denominator by 5.

$$\frac{35}{100} = \frac{35 \div 5}{100 \div 5} = \frac{7}{20}$$

Therefore, 35% is equal to $\frac{7}{20}$.

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Example 2

Convert 125% into fraction.

Solution

Write 125 as a numerator and 100 as a denominator as follows:

$\frac{125}{100}$

Divide both the numerator and the denominator by 25 so as to simplify the fraction.

$$\frac{125 \div 25}{100 \div 25} = \frac{5}{4} = 1\frac{1}{4}$$

Therefore, 125% is equal to $1\frac{1}{4}$.

Exercise 2

Convert the percentages in questions 1 to 15 into fractions.

1. 36%
2. 45%
3. 95%
4. 5%
5. 100%
6. 270%
7. 900%
8. 1 600%
9. 15 000%
10. $\frac{4}{5}\%$
11. $\frac{8}{15}\%$
12. $18\frac{2}{5}\%$
13. $220\frac{5}{8}\%$
14. $1500\frac{2}{3}\%$
15. $24\frac{16}{25}\%$

16. Janeti and Christina made a profit in their fruits business. Janeti received $\frac{3}{5}$ of the profit while Christina received 40%. Who received a larger amount of the profit and by what percentage?

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17. Find the difference between $\frac{16}{25}$ and 36%. Write your answer in fraction.

18. Musa spent $\frac{1}{10}$ of his money to buy pens, $\frac{8}{25}$ to buy exercise books, and 22% to buy books. What fraction of the money remained?

19. Out of 40 pupils in standard six, 35 pupils attended class on a certain day. What fraction of pupils did not attend class on that day?

20. Half of the school farm is planted maize, a quarter is planted beans and ten percent is planted cassava. The remaining part of the farm is planted sweet potatoes. What fraction of the school farm is planted sweet potatoes?

Converting percentages into decimals

In order to convert a percentage into decimal, first convert it into a fraction with 100 as the denominator. Then, divide the numerator by its denominator to obtain the required decimal.

Example 1

Convert 32% into decimal.

Solution

Convert 32% into fraction. That is $32\% = \frac{32}{100}$.

Divide 32 by 100 to obtain the required decimal.

$$
\begin{array}{r}
0.32 \\
100\overline{)\,320} \\
-300 \\
\hline
200 \\
-200 \\
\hline
0
\end{array}
$$

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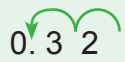
Alternatively, if the denominator is 100, write the numerator of the given fraction and count two digits of the numerator from right. Then, put a decimal point followed by zero if there is no any digit in the left of the decimal point as follows:



Therefore, $32\% = \frac{32}{100} = 0.32$.

Example 2

Convert 360% into decimal.

Solution

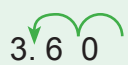
Convert the given percentage into fraction. That is $360\% = \frac{360}{100}$

Divide 360 by 100 to obtain the required decimal.

$$
\begin{array}{r}
3.6 \\
100\overline{)\,360} \\
-300 \\
\hline
600 \\
-600 \\
\hline
0
\end{array}
$$

Therefore, 360% = 3.6

Alternatively, since the denominator is 100, write the numerator and count two digits from right. Then put a decimal point as follows:



Therefore, $360\% = \frac{360}{100} = 3.6$.

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Exercise 3

Convert the following percentages into decimals:

1. 37%
2. 8%
3. 75%
4. $\frac{4}{5}\%$
5. $11\frac{2}{5}\%$
6. $\frac{24}{4}\%$
7. 512%
8. $640\frac{3}{4}\%$
9. 101%
10. 1 234%

Converting decimals into percentages

In converting decimals into percentages, first convert the decimal into fraction. Thereafter, multiply the resulting fraction by 100%.

Example 1

Convert 0.6 into percentage.

Solution

Convert the given decimal into a fraction with 100 as a denominator.
First, write the decimal number into fraction as follows:

$$0.6 = \frac{6}{10}$$

Multiply both the numerator and the denominator of $\frac{6}{10}$ by 10 to get 100 in the denominator.

$$\frac{6}{10} = \frac{6\times10}{10\times10} = \frac{60}{100} = 60\%$$

Alternatively, multiply $\frac{6}{10}$ by 100% as follows:

$$\frac{6}{10}\times100\% = \frac{600\%}{10} = 60\%$$

Or,

$$0.6 = \frac{0.6}{1} = \frac{0.6\times100}{1\times100} = \frac{60}{100} = 60\%$$

Therefore, 0.6 is equal to 60%.

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Example 2

Convert 0.56 into percentage.

Solution

Convert the given decimal into a fraction with a denominator of 100 as follows :

$$0.56 = \frac{56}{100}$$

Multiply $\frac{56}{100}$ by 100% as follows:

$$\frac{56}{100} \times 100\% = \frac{5\ 600\%}{100} = 56\%$$

Alternatively,

$$0.56 = \frac{0.56}{1} = \frac{0.56 \times 100}{1 \times 100} = \frac{56}{100} = 56\%$$

Therefore, 0.56 is equal to 56%.

Example 3

Convert 1.45 into percentage.

Solution

Write the decimal into a fraction with 100 as a denominator as follows:

$$1.45 = 1\frac{45}{100} = \frac{145}{100}$$

Multiply $\frac{145}{100}$ by 100% as follows:

$$\frac{145}{100} \times 100\% = \frac{14\ 500\%}{100} = 145\%$$

Alternatively,

$$1.45 = \frac{1.45}{1} = \frac{1.45 \times 100}{1 \times 100} = \frac{145}{100} = 145\%$$

Therefore, 1.45 is equal to 145%.

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Exercise 4

Convert the following decimals into percentages:

1. 0.21
2. 0.05
3. 0.97
4. 2.25
5. 1.05
6. 7.75
7. 15.03
8. 125.29
9. 320.77
10. 2 500.6

Word problems involving percentages

Example 1

A certain class has a total of 40 pupils. If the class has 16 girls;
(a) What is the fraction of boys in the class?
(b) What is the percentage of boys in the class?

Solution

(a) Total number of students = 40
Number of girls = 16
Number of boys = 40 – 16 = 24

Fraction of boys in the class is given by: $\frac{24}{40} = \frac{6}{10} = \frac{3}{5}$

Therefore, the fraction of boys in the class is $\frac{3}{5}$ of all the students in the class.

(b) The percentage of boys in the class is given by:

$$\frac{3}{5} = \frac{3 \times 20}{5 \times 20} = \frac{60}{100}$$

Therefore, the percentage of boys in the class is sixty percent (60%).

Example 2

A standard six classroom has a total of 50 chairs. If 15 chairs are painted;
(a) What percentage of the chairs are not painted?
(b) What fraction of the chairs are not painted?

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Solution

(a) Total number of chairs = 50

Number of painted chairs = 15

Number of unpainted chairs = 50 – 15 = 35

The percentage of unpainted chairs is given by :

$$\frac{35}{50} \times 100\% = \frac{7}{10} \times 100\% = 70\%$$

Therefore, the percentage of unpainted chairs is equal to seventy percent (70%).

(b) The fraction of unpainted chairs is $\frac{35}{50}$ which is equal to $\frac{7}{10}$ in the simplest form. Therefore, the fraction of unpainted chairs is $\frac{7}{10}$.

Example 3

Beti's montly salary is 800 000 shillings. She spends 240 000 shillings for food every month.

(a) What fraction of the salary does Beti spend for food?

(b) What is the amount in percentage she spends for food?

Solution

(a) Beti's salary is sh 800 000

Amount she spends for food is 240 000 shillings which can be expressed in fraction as follows:

$$\frac{240\,000}{800\,000} = \frac{240\,000 \div 10\,000}{800\,000 \div 10\,000} = \frac{24}{80}$$

$$\frac{24}{80} = \frac{24 \div 8}{80 \div 8} = \frac{3}{10}$$

Therefore, the fraction she spends for food is $\frac{3}{10}$ of her salary.

(b) The amount in percentage she spends for food is $\frac{3}{10} \times 100\% = 30\%$

Therefore, the amount in percentage she spends for food is 30% of her salary.

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Exercise 5

Answer the following questions:

1. Classrooms are opened for 42 hours every week. What is the percentage of hours in a week are the classrooms opened?

2. A certain class has a total of 50 pupils. If 9 of the pupils are leaders, what percentage of the pupils are leaders?

3. A certain teacher uses three pieces of chalk everyday to write on a chalkboard. If one box of chalk has a total of 100 pieces of chalk, what percentage of the pieces of chalk are used by the teacher in five days?

4. A tank of 200 litres was filled with water by 24 pupils. If each pupil used a galon of 5 litres and poured water only once, what percentage of the tank was filled?

5. A teacher had 399 exercise books for his 60 standard six pupils. If each pupil was required to be given 7 exercise books, what percentage of pupils did not get the exercise books?

6. In doing school cleanliness, the distribution of various cleanliness duties was as follows: 20 percent of the pupils swept school sorroundings, $\frac{2}{5}$ mopped classrooms and $\frac{3}{10}$ of the pupils slashed grass. The remaining pupils were leaders and sick pupils. If the school had a total of 600 pupils;
   - (a) What percentage of the pupils were involved in cleanliness duties?
   - (b) What fraction of the pupils was not involved in cleanliness duties?
   - (c) What is the total percentage of pupils who were slashing grass and sweeping the school sorroundings?
   - (d) How many pupils did not do cleanliness?
   - (e) If $\frac{3}{50}$ of the pupils are leaders, how many pupils were sick on that day?

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7. Suppose in standard four, our class had a total of 80 pupils. If 55 pupils were girls;
   (a) What percent represented the total number of girls?
   (b) What percent represented the total number of boys?

Revision exercise



Answer the following questions:

1. Convert $\frac{121}{20}$ into percentage.
2. Convert $15\frac{2}{5}$ into percentage.
3. Convert 1.25 into percentage.
4. Convert $22\frac{1}{2}$ into decimal.
5. Find the difference between 35% and 0.25. Write your answer in fraction.
6. Subtract 0.15 from 60%. Give your answer in percentage.
7. Subtract 0.27 from 80%. Give your answer in decimal.
8. Subtract 5% from $\frac{17}{20}$. Give your answer in decimal.
9. Find the difference between $\frac{13}{25}$ and 2%. Give your answer in fraction.
10. Add $\frac{3}{4}$ to 0.2. Write your answer in percentage.
11. Add 45% to $\frac{4}{5}$. Give your answer in decimal.
12. Add 50% to $\frac{4}{50}$. Give your answer in percentage.
13. Fred's salary was raised by 20% and an income tax of $\frac{1}{20}$ was deducted from the increment. What amount of money in decimals was raised after income tax deduction?

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14. Hadija spent $\frac{1}{3}$ of her money for treatment. She spent $\frac{3}{4}$ of the remaining amount to pay school fees. What percentage of her money remained?

15. Twenty percent of my grandmother's farm is planted fruits. The 50 percent of the remaining farm is planted other varieties of crops.
(a) What percentage of the farm remains unplanted?
(b) What fraction of the farm is planted with varieties of crops?

16. A teacher distributed $\frac{4}{5}$ of books from the store to his three classes; standard five, six and seven. Standard five received 0.25 of all the books. Standard six received $\frac{1}{3}$ of the remaining books. What percentage of the books were received by standard seven pupils?

17. A father distributed his money among his three children; Maria, Janeth and Baraka as follows: Maria received 0.4 of all the money, Janeth received 0.5 of the remaining amount of money. What percentage of the money was given to Baraka?

18. A salary of a certain employee was raised by $\frac{1}{5}$ of her previous salary. An income tax of 20% is deducted from her new salary. If her previous salary was sh 200 000, what is the fraction of income tax in her new salary?

19. Ali spent 15% of his time in doing cleanliness, 10% for physical exercises and 20% of the remaining time in studying. If he spent the remaining time for travelling, what is this travelling time in decimals?

20. The distance from Aisha's home to school is 0.6 km and the distance from school to the market is 0.2 km. If Aisha walked from home to the market via the school, what distance in percentage did she walk from home to the market?

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Summary



1. In order to convert a number into percentage, first write that number into fraction and then convert its denominator to 100. The resulting numerator is the percentage.
2. In converting a percentage into fraction, write the percentage as a fraction with 100 as the denominator. Then, simplify the answer by dividing both the numerator and denominator by their GCF.
3. In converting fraction into percentage, multiply the fraction by 100%.
4. In order to convert a percentage into decimal, first convert the percentage into fraction and then divide the numerator by the denominator.

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Chapter Five

Decimals

Introduction

In Standard Five, you learnt about addition, subtraction, and multiplication of decimals with not more than two decimal places. In this chapter, you will learn about reading and writing decimals with not more than three decimal places. You will also learn about converting decimals into fractions, fractions into decimals, adding, subtracting, multiplying and dividing decimals with not more than three decimal places. The knowledge and skills gained will enable you to perform various daily life activities such as measuring mass, length, volume and capacity more accurately.

Exercise 1: Revision

Answer the following questions:

1. 0.1 + 0.2 =
2. 0.2 + 0.8 =
3. 0.92 – 0.6 =
4. 10.03 – 6.42 =
5. 50.3 + 40.45 + 50.08 =
6. 101.12 + 200.23 – 300.34 =
7. 1 111.14 + 2 222.26 + 3 333.38 + 4 444.49 =
8. 45 678.5 – 23 456.3 – 12 345.2 =

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9. $0.56 \times 25 =$

10. $200.34 \times 32 =$

11. $2.5 + 4.62 + 6 + 4.58 =$

12. Aneth used 0.6 of a day to work and 0.2 of the day to rest. She used the remaining time for sports. What time in decimal did she use for sports?

Write the following decimals in numerals:

13. Zero point two seven

14. Fifteen point nine three

15. One hundred and five point eight four

16. Three thousand and two point zero nine

Write the following decimals in words:

17. 76 543.21

18. 9 876.54

19. 567.89

20. 15.75

Reading and writing decimals with three decimal places

Decimals are read from left to right. Digits on the right side of the decimal point are read one after another.

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Example 1

Read the following decimals:

(a) 12.006 (b) 0.847 (c) 338.229 (d) 45670.921

Answer

	Decimals	How to read decimals
(a)	12.006	Twelve point zero zero six.
(b)	0.847	Zero point eight four seven.
(c)	338.229	Three hundred and thirty-eight point two two nine.
(d)	45 670.921	Forty-five thousand six hundred and seventy point nine two one.

Example 2

Write the following decimals in words:

	Decimals	Decimals in words.
(a)	0.461	Zero point four six one
(b)	18.208	Eighteen point two zero eight
(c)	109.319	One hundred and nine point three one nine
(d)	2 003.111	Two thousand and three point one one one

Example 3

Write the following decimals in numerals:
(a) Zero point two three five
(b) Thirty-eight point four eight seven
(c) Eight hundred and fifty-one point nine two four
(d) Seventeen thousand and two point one eight six

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	Decimals	Decimals in numerals
(a)	Zero point two three five	0.235
(b)	Thirty-eight point four eight seven	38.487
(c)	Eight hunderd and fifty-one point nine two four	851.924
(d)	Seventeen thousand and two point one eight six	17 002.186

Exercise 2

Write the following decimals in words:

1. 5.001
2. 0.074
3. 10.123
4. 20.456
5. 30.789
6. 9.629
7. 11.904
8. 7.951
9. 101.101
10. 203.405

Write the following decimals in numerals:

11. Zero point zero seven.
12. Zero point zero six nine.
13. One point one nine two.
14. Seventy-five point seven zero two.
15. Two hundred point zero nine four.

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16. Fifty-four point one five three.

17. Twenty-three point four zero six.

18. Six point seven five one.

19. Ninety point eight two five.

20. Five hundred and seventy-nine point seven three nine.

Adding decimals with three decimal places

The common method of adding decimal numbers is by aligning them vertically.

Start by arranging the digits of the numbers according to their place values.

Thereafter, add the digits from right to the left of the decimal number.

Example 1

(a) $150.135 + 95.004 =$ (b) $50.252 + 35.798 =$

Solution

(a) $150.135 + 95.004 =$

Steps	
1. Arrange the numbers vertically according to their place values.	150.135 + 95.004 _____ _____
2. Add digits from right towards the left of a decimal number.	150.135 + 95.004 _____ 245.139

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Solution

(b) $50.252 + 35.798 =$

$$\begin{array}{r} 50.252 \\ +\ 35.798 \\ \hline 86.050 \end{array}$$

Therefore, the answer is 86.050.

Example 2

(a) $0.456 + 270.975 =$ (b) $1.045 + 1\,250.608 =$

Solution

(a)

$$\begin{array}{r} 0.456 \\ +\ 270.975 \\ \hline 271.431 \end{array}$$

Therefore, the answer is 271.431.

(b)

$$\begin{array}{r} 1.045 \\ +\ 1\,250.608 \\ \hline 1\,251.653 \end{array}$$

Therefore, the answer is 1 251.653.

Exercise 3

Answer the following questions:

1. $0.005 + 1.026 + 10.567 =$
2. $0.575 + 12.987 + 20.645 =$
3. $25.123 + 50.234 + 75.765 =$

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4. 44.555 + 77.888 + 99.333=

5. 100.002 + 20.022 + 5.531=

6. 500.003 + 400.024 + 350.601 =

7. 1 122.343 + 4 000.005 =

8. 4 455.123 + 100.578 + 33.787 =

9. 12 345.678 + 98 765.432 + 5 643.134 =

10. 575 000.305 + 2 450 975.678 + 5 678 345.123 =

11. 7.391 + 31.279 + 802.152 =

12. 1 078.367 + 32 036.941 + 536 821.029 =

13. 687 243.014 + 301 457.309 + 897 201.401 =

14. 6.021 + 51.973 + 723.104 + 4 729.006 + 71 085.901=

15. 57 319.603 + 4 923.371 + 913.587 =

16. 391 048.003 + 780 813.617 =

17. 202 020.202 + 101 010.101 + 303 030.303 =

18. 974 564.101 + 664 477.248 + 2 456 673.445 =

19. 400 333.303 + 3 222 444.242 + 5 303 455.212 =

20. 19.031 + 317.794 + 3 471.089 + 50 592.738 =

Subtracting decimals with three decimal places

A common method of subtracting decimals is to align them vertically. Start by arranging the digits of the decimals according to their place values.

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Thereafter, subtract the digits from right to left in their corresponding place values.

Example 1

40.175 – 20.023 =

Solution

40.175 – 20.023 =

Steps:	
1. Arrange the decimals vertically according to the place values of their digits.	40.175 – 20.023 _____ _____
2. Subtract the digits from right to left of the given decimals.	40.175 – 20.023 _____ 20.152
Therefore, 40.175 – 20.023 = 20.152.	

Example 2

50.025 – 25.997 =

Solution

Steps:	
1. Arrange the decimals vertically according to place values of their digits.	50.025 – 25.997 _____ _____
2. Subtract the digits from right to the left of the given decimals.	50.025 – 25.997 _____ 24.028
Therefore, 50.025 – 25.997 = 24.028.	

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Exercise 4

Answer the following questions:

1. 11.008 – 0.005 =
2. 265.343 – 36.089 =
3. 76.468 – 56.342 =
4. 95.501 – 88.561 =
5. 106.321 – 62.393 =
6. 800.426 – 345.907 =
7. 444.006 – 0.986 =
8. 2 471.014 – 392.108 =
9. 0.228 – 0.045 =
10. 45.085 – 2.424 =
11. 25 987.234 – 45.888 =
12. 102.064 – 41.596 =
13. 33.161 – 0.922 =
14. 312.007 – 98.069 =
15. 56 345.246 – 267.888 =
16. 798.734 – 546.505 =
17. 59 061.084 – 25 463.129 =
18. 18 396.328 – 9 183.726 =
19. 37 381.092 – 4 017.108 =
20. 49 106.907 – 3 089.201 =

Multiplication of decimals

When multiplying decimals, follow the same procedure used when multiplying whole numbers. Count the required number of decimal places from the right of the product obtained. The number of decimal places in the answer is obtained by counting the total number of decimal places from the multiplied decimals.

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Multiplying decimals with two decimal places by decimals with one decimal place

Example 1

(a) $4.52 \times 1.3 =$ (b) $100.55 \times 0.2 =$

Solution

(a) $4.52 \times 1.3 =$

The number 4.52 has two decimal places and 1.3 has one decimal place. This gives a total of three decimal places.

Multiply these numbers as whole numbers without considering their decimal places. That is, multiply 452 by 13 then count three decimal places from right to left of the answer as follows:

$$\begin{array}{r} 452 \\ \times\ 13 \\ \hline 452 \\ +1356 \\ \hline 5876 \end{array}$$

After counting three decimal places, the answer is 5.876

Therefore, $4.52 \times 1.3 = 5.876$.

(b) $100.55 \times 0.2 =$

Solution

Multipy 10 055 by 2, then indicate three decimal places as follows:

$$\begin{array}{r} 10055 \\ \times\ \ 2 \\ \hline 20110 \end{array}$$

That is, $10055 \times 2 = 20110$

After counting three decimal places, the answer is 20.110

Therefore, $100.55 \times 0.2 = 20.110$.

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Exercise 5

Answer the following questions:

1. 0.11 × 1.1 =
2. 0.05 × 3.5 =
3. 10.25 × 4.1 =
4. 55.22 × 3.4 =
5. 66.63 × 4.7 =
6. 345.11 × 0.2 =
7. 4 321.02 × 0.8 =
8. 22 345.24 × 0.4 =
9. 10 100.12 × 0.5 =
10. 33 333.36 × 0.9 =
11. 213.21 × 5.5 =
12. 196.22 × 7.1 =
13. 423.12 × 2.0 =
14. 711.30 × 1.3 =
15. 32.45 × 2.3 =
16. 94.72 × 4.2 =
17. 18.62 × 2.2 =
18. 111.11 × 9.3 =
19. 26.23 × 1.1 =
20. 56.26 × 3.1 =

Multiplying decimals with three decimal places by whole numbers

Example 2

(a) 327.425 × 7 = (b) 27.321 × 33 =

Solution

(a) 327.425 × 7 =

Multiply 327 435 by 7, then indicate three decimal places by counting digits of the answer from right.

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$$\begin{array}{rrrrrrr} & 3 & 2 & 7 & 4 & 3 & 5 \\ \times & & & & & & 7 \\ \hline & 2 & 2 & 9 & 2 & 0 & 4 & 5 \end{array}$$

327 435 × 7 =2 292 045

After indicating three decimal places, the answer is 2 292.045
Therefore, 327.435 × 7 = 2 292.045.

Solution

(b) 27.321 × 33 =

Multiply 27321 by 33 then indicate three decimal places by counting digits of the answer from right.

$$\begin{array}{rrrrrr} & 2 & 7 & 3 & 2 & 1 \\ \times & & & & 3 & 3 \\ \hline & 8 & 1 & 9 & 6 & 3 \\ + & 8 & 1 & 9 & 6 & 3 \\ \hline & 9 & 0 & 1 & 5 & 9 & 3 \end{array}$$

27 321 × 33 = 901 593

After counting three decimal places, the answer is 901.593.
Therefore, 27.321 × 33 = 901.593.

Exercise 6

Answer the following questions:

1. 50.101 × 5 =
2. 1 010.014 × 7 =
3. 560.222 × 16 =
4. 90.32 × 222 =
5. 78.545 × 6 =
6. 1 000.001 × 9 =
7. 20.075 × 20 =
8. 250.404 × 15 =
9. 415.999 × 24 =
10. 300.059 × 37 =

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11. 90.120 × 8 =

12. 8.763 × 4 =

13. 100.670 × 5 =

14. 33.724 × 9 =

15. 421.162 × 2 =

16. 72.435 × 7 =

17. 2 000.227 × 4 =

18. 360.116 × 7 =

19. 219.001 × 3 =

20. 32.982 × 7 =

Division of decimals

Dividing decimals by whole numbers

Example 1

0.35 ÷ 7 =

Solution

Write the two numbers as a fraction with the numerator and the denominator.

That is, $\frac{0.35}{7}$

Multiply the numerator and the denominator by 100 to remove the decimal places.

$$\frac{0.35\times100}{7\times100} = \frac{35}{700}$$

Divide 35 by 700 to get 0.05.

Therefore, 0.35 ÷ 7 = 0.050.

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Example 2

$96.75 \div 9 =$

Solution

$$96.75 \div 9 = \frac{96.75}{9}$$

Multiply the numerator and the denominator by 100 to remove the decimal places. That is,

$$\frac{96.75}{9} = \frac{96.75 \times 100}{9 \times 100}$$
$$= \frac{9675}{900}$$
$$= 10.75$$

Therefore, $96.75 \div 9 = 10.75$.

Exercise 3

$45.5 \div 5 =$

Solution

$$45.5 \div 5 = \frac{45.5}{5}$$

Multiply the numerator and the denominator by 10 to remove the decimal places.

$$\frac{45.5}{5} = \frac{45.5 \times 10}{5 \times 10}$$
$$= \frac{455}{50}$$
$$= 9.1$$

Therefore, $45.5 \div 5 = 9.1$.

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Dividing whole numbers by decimals

Example 1

$24 \div 0.2 =$

Solution

Write the two numbers as a fraction with the numerator and the denominator. That is,

$$\frac{24}{0.2}$$

Multiply the numerator and the denominator by 10 to remove the decimal places:

$$\frac{24 \times 10}{0.2 \times 10} = \frac{240}{2}$$

Divide 240 by 2 to get 120.
Therefore, $24 \div 0.2 = 120$.

Example 2

$65 \div 0.05 =$

Solution

$$65 \div 0.05 = \frac{65}{0.05}$$

Multiply the numerator and the denominator by 100 to remove the decimal places. That is,

$$\frac{65 \times 100}{0.05 \times 100}$$
$$= \frac{6500}{5}$$
$$= 1300$$

Therefore, $65 \div 0.05 = 1\,300$.

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Example 3

$125 \div 0.001 =$

Solution

$125 \div 0.001 = \frac{125}{0.001}$, numerator is 125 and the denominator is 0.001.

Multiply the numerator and the denominator by 1000 to remove the decimal places. Next, divide the resulting numbers as whole numbers.

$$\frac{125}{0.001} = \frac{125 \times 1000}{0.001 \times 1000} = \frac{125\,000}{1} = 125\,000$$

Therefore, 125÷0.001=125 000.

Alternative solution

Convert the decimal into fraction, then divide the whole number by the fraction.

As a fraction, $0.001 = \frac{1}{1000}$

$$125 \div 0.001 = 125 \div \frac{1}{1000} = 125 \times \frac{1000}{1} = 125\,000$$

Therefore, 125 ÷ 0.001=125 000.

Exercise 7

Answer the following questions:

1. 5 ÷ 0.2 =
2. 31 ÷ 15.5 =
3. 12 ÷ 0.24 =
4. 9 ÷ 0.003 =
5. 40 ÷ 8.00 =
6. 364 ÷ 0.2 =

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7. 456 ÷ 0.6 =

8. 789 ÷ 0.05 =

9. 1 250 ÷ 0.4 =

10. 450 ÷ 1.25 =

11. 5 ÷ 0.125 =

12. 77 ÷ 0.022=

13. 969 ÷ 0.323 =

14. 17 ÷ 2.125 =

15. 616 ÷ 0.014 =

16. 848 ÷ 0.212 =

17. 3 850 ÷ 0.154 =

18. 121 ÷ 0.011 =

19. 441 ÷ 0.021 =

20. 200 ÷ 3.125 =

Dividing decimals by decimals

Example 1

$5.550 \div 0.111 =$

Solution

Write the decimals as a fraction with the numerator and the denominator as follows:

$$\frac{5.550}{0.111}$$

Multiply both numerator and denominator by 1 000 to remove the decimal places.

$$\frac{5.550 \times 1\,000}{0.111 \times 1\,000} = \frac{5\,550}{111}$$

Divide 5 550 by 111 to get 50.

Therefore, 5.550 ÷ 0.111 = 50.

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Example 2

$52.32 \div 0.05 =$

Solution

$$52.32 \div 0.05 = \frac{52.32}{0.05}$$

Multiply both the numerator and the denominator by 100 to remove the decimal places.

$$\frac{52.32}{0.05} = \frac{52.32 \times 100}{0.05 \times 100}$$

$$= \frac{5232}{5}$$

Divide 5 232 by 5 to get 1 046.4.
Therefore, 51.32 ÷ 0.05 = 1 046.4.

Exercise 8

Answer the following questions:

1. 7.15 ÷ 0.013 =
2. 3.8 ÷ 0.076 =
3. 4.08 ÷ 0.2 =
4. 0.213 ÷ 0.012 =
5. 9.19 ÷ 0.919 =
6. 2.147 ÷ 0.1 =
7. 6.5 ÷ 0.05 =
8. 1.55 ÷ 0.310 =
9. 12.5 ÷ 0.25 =
10. 19.12 ÷ 0.2 =
11. 6.25 ÷ 0.025 =
12. 1.9 ÷ 0.095 =
13. 0.25 ÷ 0.125 =
14. 0.375 ÷ 0.015 =
15. 0.909 ÷ 3.03 =
16. 2.248 ÷ 11.24 =
17. 5.6 ÷ 0.007 =
18. 1.7 ÷ 0.136 =
19. 11.5 ÷ 0.092=
20. 99.99 ÷ 0.303 =

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Word problems involving decimals

Example 1

My mother cooked 0.5 kilogram of rice on the first day. She cooked 0.25 kilogram of rice on the second day. How many kilogram of rice did my mother cook in the two days?

Solution

Number of kilograms of rice cooked on first day = 0.5 kilogram
Number of kilograms of rice cooked on second day = 0.25 kilogram
Number of kilograms of rice cooked in two days = 0.5 + 0.25 = 0.75
Therefore, in two days my mother cooked 0.75 kilogram of rice.

Example 2

Baraka cultivated 0.6 of a farm and Neema cultivated 0.1 of the same farm. Find the difference between the sizes of the farm cultivated by Baraka and Neema.

Solution

Baraka cultivated 0.6 of the farm,
Neema cultivated 0.1 of the farm

Difference = 0.6 – 0.1 = 0.5.
Therefore, the difference between the sizes of farm cultivated by Baraka and Neema is 0.5.

Example 3

Bakari sells 155.25 litres of water daily. How many litres of water will he sell in 20 days?

Solution

Bakari sells 155.55 litres of water everyday.
In 20 days he will sell 155.25 × 20 = 3 105 litres
Therefore, Bakari will sell 3 105 litres of water in 20 days.

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Example 4

A rope of length forty-three point nine four metres was divided into fifty-two equal pieces. How long was each piece in metres?

Solution

Length of the rope = 43.94 metres
Number of equal pieces of the rope = 52.
The length of each piece of the rope is obtained as follows:
Divide 43.94 metres by 52 to get the length of each piece.

$$43.94 \div 52 = \frac{43.94}{52} = \frac{43.94 \times 100}{52 \times 100} = \frac{4394}{5200} = 0.845$$

Therefore, each piece of a rope had a length of zero point eight four five metres, that is 0.845 metres.

Exercise 9

Answer the following questions:

1. Rashidi weighs 70.5 kilograms and John weighs 68.15 kilograms. Find the sum of their mass in kilograms.

2. A certain farmer has two diary cows. One cow produces 20.25 litres of milk per day and the other cow produces 12.5 litres of milk per day. How many litres of milk does the farmer get per day?

3. A child weighed 15.75 kilograms in April. If the child lost 2.5 kilograms in May of the same year, find the mass of the child at the end of May.

4. Asha sold 851.5 kilograms of maize and 925.25 kilograms of beans. Find the difference in mass of the maize and beans sold.

5. The speed of a plane is 7 324.73 kilometres per hour. How many kilometres will the plane travel in 7 hours?

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6. Bernad's cow produces 18.5 litres of milk per day. If he has 22 such cows, how many litres of milk will he get in a week?

7. A train wagon carries 16.8 tons. If the train has 13 wagons of the same capacity, how many tons will it carry?

8. The area of a rectangle is 57.5 square centimetres. If its length is 12.5 centimetres, find its width.

9. The total scores of 25 pupils in Mathematics examination is 1 412.5. Find their average score.

10. A standard six class has 50 pupils. A teacher gave these pupils a rope that measures 8.5 metres. If the pupils shared the rope equally, how long in centimetres did each pupil get?

Converting decimals into fractions

Remember that place values of decimals decrease by tenth towards the right of the decimal point. Thus, if the decimal has one decimal place, its fraction will have a denominator of 10. If the decimal has two decimal places, its fraction will have a denominator of 100, and if the decimal has three decimal places, its fraction will have a denominator of 1 000. The numerator will be a whole number after converting the decimal into fraction with a denominator of 10, 100 or 1 000.

Example 1

Convert each of the following decimals into fractions:
(a) 0.2
(b) 0.32

Solution

(a) 0.2
Write the decimal as a fraction. That is, $\frac{0.2}{1}$.

Multiply both the numerator and the denominator by 10 to remove the decimal place.

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$$\frac{0.2 \times 10}{1 \times 10} = \frac{2}{10}$$

$$= \frac{1}{5}$$

Therefore, 0.2 in fraction is $\frac{1}{5}$.

Solution

(b) 0.32

Write the decimal as fraction. That is, $\frac{0.32}{1}$.

Multiply both the numerator and the denominator by 100 to remove the decimal places.

$$\frac{0.32}{1} = \frac{0.32 \times 100}{1 \times 100}$$

$$= \frac{32}{100}$$

Simplify $\frac{32}{100}$ to get $\frac{8}{25}$.

Therefore, 0.32 in fraction is $\frac{8}{25}$.

Example 2

Convert the following decimals into fractions:

(a) 0.125

(b) 10.06

Solution

(a) 0.125

Write 0.125 as a fraction. That is, $\frac{0.125}{1}$.

Multiply the numerator and the denominator by 1 000. That is,

$$\frac{0.125}{1} = \frac{0.125 \times 1000}{1 \times 1000}$$

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$= \frac{125}{1000}$

Simplify to get a simple fraction.

Therefore, 0.125 in fraction is $\frac{1}{8}$.

Solution

(b) 10.06

Write 10.06 as a fraction. That is, $\frac{10.06}{1}$

Multiply both the numerator and the denominator by 100 to remove the decimal places.

$\frac{10.06}{1} = \frac{10.06 \times 100}{1 \times 100}$

$= \frac{1006}{100} = \frac{503}{50}$

In mixed number, $\frac{503}{50}$ is equal to $10\frac{3}{50}$.

Therefore, 10.06 in fraction is $10\frac{3}{50}$.

Exercise 10

Convert the following decimals into fractions:

1. 0.18
2. 0.154
3. 0.05
4. 0.015
5. 9.564
6. 16.25
7. 50.75
8. 25.125
9. 55.32
10. 96.24
11. 0.375
12. 0.175
13. 40.375
14. 220.08
15. 1 000.625

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Converting fractions into decimals

When converting fractions into decimals, use long division method to divide the numerator by the denominator.

Example 1

Convert $\frac{7}{200}$ into decimal.

Solution

This is a simple fraction. Use long division method to divide the numerator (7) by the denominator (200) as follows:

$$
\begin{array}{r}
0.035 \\
200\overline{)\ 700} \\
-\ 600 \\
\hline
1000 \\
-1000 \\
\hline
0
\end{array}
$$

Therefore, $\frac{7}{200} = 0.035$.

Example 2

Convert $15\frac{3}{4}$ into decimal.

Solution

$15\frac{3}{4}$ is a mixed number of which 15 is a whole number and $\frac{3}{4}$ is a fraction. Convert the simple fraction $\frac{3}{4}$ into decimal by dividing the numerator which is 3 by the denominator which is 4 as follows:

$$
\begin{array}{r}
0.75 \\
4\overline{)\ 30} \\
-\ 28 \\
\hline
20 \\
-\ 20 \\
\hline
0
\end{array}
$$

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That is, $\frac{3}{4} = 0.75$

Add 0.75 to the whole number. That is 15 + 0.75 = 15.75.

Thus, $15\frac{3}{4} = 15.75$.

Alternative solution

Convert the mixed number into fraction, that is $15\frac{3}{4} = \frac{63}{4}$

Use long division method to divide the numerator, which is 63 by denominator which is 4 as follows:

$$
\begin{array}{r}
15.75 \\
4\overline{)\,63} \\
-\,4 \\
\hline
23 \\
-\,20 \\
\hline
30 \\
-28 \\
\hline
20 \\
-20 \\
\hline
0
\end{array}
$$

Therefore, $15\frac{3}{4} = 15.75$.

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Exercise 11

Convert the following fractions into decimals:

1. $\frac{3}{8}$
2. $\frac{3}{4}$
3. $7\frac{1}{8}$
4. $\frac{51}{100}$
5. $\frac{39}{40}$
6. $\frac{13}{50}$
7. $105\frac{3}{4}$
8. $230\frac{1}{20}$
9. $1\ 567\frac{29}{50}$
10. $23\ 954\frac{7}{250}$

Revision exercise

Answer the following questions:

1. Write the following decimals in words:
   - **(a)** 37.22
   - **(b)** 108.45
   - **(c)** 0.378
   - **(d)** 1 230.125
   - **(e)** 15 670.7

2. Write the following decimals in numerals:
   - **(a)** Four hundred and fifty point seven seven nine.
   - **(b)** Fifty-four thousand two hundred point one two five.
   - **(c)** One hundred twenty thousand and seven point seven four nine.
   - **(d)** Twenty-one point seven nine five.

3. **(a)** 52.248 + 152.112 =
   - **(b)** 4 571.12 + 354.156 =
   - **(c)** 68 476.559 + 100 524.3 =
   - **(d)** 647 215.679 + 224 626.221 =

4. **(a)** 1.334 – 0.113 =
   - **(b)** 4 768.102 – 2 476.998 =
   - **(c)** 346.224 – 247.44 =
   - **(d)** 49 762.7 – 31 486.119 =

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5. **(a)** $0.26 \times 12 =$

(b) $157.23 \times 25 =$

(c) $729.126 \times 33 =$

(d) $0.115 \times 1026 =$

6. **(a)** $8 \div 0.5 =$

(b) $147.6 \div 4 =$

(c) $8\,345.91 + 153.7 =$

(d) $123.99 \div 0.03 =$

7. Convert the following decimals into fractions:

(a) 0.125 **(b)** 15.01 **(c)** 560.225 **(d)** 17.675

8. Convert the following fractions into decimals:

(a) $\frac{35}{56}$ **(b)** $460\frac{49}{50}$ **(c)** $215\frac{39}{40}$ **(d)** $\frac{132}{165}$

9. Three businessmen bought sugar as follows; 9.5 tons, 14.75 tons and 23.015 tons. Find the total amount of sugar bought in tons.

10. A representative of farmers distributed agricultural inputs to 42 farmers. Each farmer received one bag of inputs weighing 12.5 kilograms. How many kilograms did the representative distribute to the farmers?

11. The lengths of two pieces of sugarcane are 84.55 centimetres and 54.7 centimetres respectively. Find the difference of their lengths in centimetres.

12. The age of a child is 0.25 of the father's age. If the age of the father is 40 years, find the age of the child.

13. The area of a rectangle is 1 502.55 square centimetres. If the width of the rectangle is 26.5 centimetres, find its length.

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14. How many 0.975 are there in 156?

15. A crate contains 12 bottles with a mass of 1.5 grams each. What is the total mass of the bottles?

Summary

1. The values of decimal places decrease by one tenth towards the right. Decimals are read from left to right. Digits to the left of a decimal point are read as whole numbers, while digits to the right of a decimal point are read one after the other.
2. When adding or subtracting decimal numbers, align them according to their place values.
3. When multiplying decimals, multiply them as whole numbers without considering the decimal points. Thereafter, place a decimal point after counting the decimal places from right to left of the answer. Number of decimal places of the answer is the sum of decimal places of the multiplied decimals.
4. When dividing a decimal by a whole number, write the decimal as a fraction with the numerator and the denominator. Remove the decimal points, then divide by using long division method.
5. When dividing decimals by decimals, convert all decimals into whole numbers.
6. When converting fractions into decimals, divide the numerator by the denominator by using the long division method.

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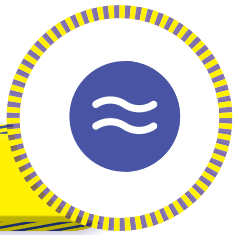
Chapter Six

Approximation of numbers



Introduction

Approximation is the process of estimating a quantity of something such as money or distance. Approximation involves expressing a number into a higher value or lower value which is close to the exact value. The symbol for approximation is '≈'. In this chapter you will learn about approximating whole numbers as well as decimals. The knowledge and skills gained will help you in presenting approximated information regarding real life situations. For example, the number of domestic animals in a certain region is approximately 30 000 which means, the number can be slightly below or above 30 000.

Approximating whole numbers

Low and high approximation of whole numbers

The place value of a digit in the number is used in writing low or high approximation of the number. Low approximation of a number is done by adding 0 to the digit being approximated, while high approximation is obtained by adding 1 to the digit being approximated.

When approximating a number, consider the place value of the digit at the right of the digit to be approximated.

Procedures for approximating whole numbers

1. If a digit to the right of the digit to be approximated is less than 5 (that is either 0, 1, 2, 3 or 4), add 0 to the digit being approximated and all digits which are on the right of the approximated digit will be replaced by 0.

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2. If a digit on the right of a digit to be approximated is 5 or greater than 5 (that is 5, 6, 7, 8 or 9), add 1 to the digit being approximated and all digits on the right of the approximated digit will be replaced by 0.

Example 1

Approximate 3 459 210 to the nearest hundreds.

Solution

(a) The hundreds digit to be used in approximating the given number is 2.
(b) The digit on the right of 2 is 1, which is less than 5. According to procedure 1, add 0.
(c) Add 0 to the digit being approximated: 2 + 0 = 2.
(d) Write 2 in the position of hundreds, and all digits on its right (that is tens and ones) will be replaced by 0.

Therefore, the approximation of 3 459 210 to the nearest hundreds is 3 459 200. This is a low approximation, that is 3 459 210 ≈ 3 459 200.

Example 2

Approximate 2 323 478 to the nearest tens.

Solution

(a) The tens digit to be used in approximating the given number is 7.
(b) The digit which is on the right of 7 is 8 which is greater than 5. According to procedure 2, add 1.
(c) Add 1 to the digit being approximated: 7 + 1 = 8.
(d) Write 8 in the position of tens and all the digits on the right of 7 (ones) will be replaced by 0, that is 2 323 480.

Therefore, 2 323 478 ≈ 2 323 480 to the nearest tens. This is a high approximation.

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Example 3

Approximate 6 723 874 to the nearest thousands.

Solution

(a) The thousands digit to be used in approximating the given number is 3.
(b) The digit on the right of 3 is 8 which is greater than 5. According to procedure 2, add 1.
(c) Add 1 to the digit being approximated: 3 + 1 = 4.
(d) Write 4 in the position of thousands, and all the digits on the right of 3 (hundreds, tens and ones) will be replaced by 0, that is 6 724 000.

Therefore, the approximation of 6 723 874 to the nearest thousands is 6 724 000. That is, 6 723 874 ≈ 6 724 000. This is a high approximation.

Activity 1

Approximate the following numbers to the nearest hundreds, then arrange them in the ascending order:
2 203, 3 071, 3 844, 1 231, 1 021, 9 431, 9 001, 1 203.

Example 4

Approximate 9 256 102 to the nearest hundred thousands.

Solution

(a) The hundred thousands digit to be used in approximating the given number is 2.
(b) The digit which is on the right of 2 is 5.
(c) The digit to be approximated is 2. According to procedure 2, add 1.
(d) Add 1 to the digit being approximated: 2 + 1 = 3.
(e) Write 3 in the position of the hundred thousands, and all digits on the right of 2 will be replaced by 0, that is 9 300 000.

Therefore, approximation of 9 256 102 to the nearest hundred thousands is 9 300 000.

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Example 5

Approximate 8 759 601 to the nearest hundred thousands.

Solution

(a) The hundred thousands digit to be used in approximating the given number is 7.
(b) The digit to the right of 7 is 5.
(c) The digit to be approximated is 7. According to procedure 2, add 1.
(d) Add 1 to the digit being approximated: 7 + 1 = 8.
(e) Write 8 in the position of hundred thousands and all the digits on the right of 7 (ten thousands, thousands, hundreds, tens and ones) will be replaced by 0, that is 8 800 000.

Therefore, the approximation of 8 759 601 to the nearest hundred thousands is 8 800 000, that is 8 759 601 ≈ 8 800 000. This is a high approximation.

Activity 2

Approximate the following numbers to the nearest thousands:
847 520, 468 532, 264 521, 159 524, 100 500, 789 567, 900 500, 234 561.

Exercise 1

Answer the following questions:

1. Approximate the following numbers to the nearest tens:
   (a) 1 386
   (b) 2 457
   (c) 3 414
   (d) 5 243
   (e) 7 835

2. Approximate the following numbers to the nearest hundreds:
   (a) 14 395
   (b) 41 057
   (c) 53 214
   (d) 72 143
   (e) 32 782

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3. Approximate the following numbers to the nearest thousands:

(a) 248 375
(b) 331 730
(c) 407 214
(d) 535 443
(e) 207 530

4. Approximate the following numbers to the nearest ten thousands:

(a) 1 931 095
(b) 2 004 957
(c) 3 230 418
(d) 4 006 243
(e) 7 325 418

5. Approximate the following numbers to the nearest hundred thousands:

(a) 5 031 095
(b) 6 145 987
(c) 7 290 001
(d) 8 101 524
(e) 3 654 972

6. Approximate the following numbers to the nearest hundreds:

(a) 1 254 854
(b) 2 466 356
(c) 3 000 754
(d) 4 839 058
(e) 6 473 456

7. Approximate the following numbers to the nearest thousands:

(a) 5 422 531
(b) 6 093 573
(c) 7 270 592
(d) 8 764 557
(e) 2 057 573

8. Approximate the following numbers to the nearest ten thousands:

(a) 4 375 788
(b) 5 755 535
(c) 5 456 747
(d) 6 751 436
(e) 4 895 501

9. Approximate the following numbers to the nearest hundred thousands:

(a) 4 752 071
(b) 5 354 630
(c) 6 052 314
(d) 7 452 043
(e) 5 254 927

10. Approximate the following numbers to the nearest ten thousands:

(a) 3 119 005
(b) 7 720 149
(c) 8 329 041
(d) 9 007 243
(e) 2 895 406

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Approximation of decimals

Decimal places are read towards the right after a decimal point. Approximation of decimals is done according to the given number of decimal places.

Procedures for approximating decimals

There are two procedures to be considered when approximating decimals.

1. If the digit to the right of the digit to be approximated is less than 5, add 0 to the digit being approximated. That is, leave the digit unchanged. Then, all the digits on the right of the approximated digit will be replaced by 0, which are usually not written.

Example 1

Approximate 9.0347 to two decimal places.

Solution

(a) The digit to be used in approximating the given number to two decimal places is 3.
(b) The digit which is on the right of 3 is 4 which is less than 5. According to procedure 1, add 0.
(c) Add 0 to the digit being approximated: 3 + 0 = 3.
(d) Write 3 in the second decimal place and all digits on the right of 3 will be replaced by 0, which are usually not written.

Therefore, the approximation of 9.0347 to two decimal places is 9.03, that is $9.0347 \approx 9.03$.

Example 2

Approximate 10.2571 to three decimal places.

Solution

(a) The digit to be used in approximating the given number to three decimal places is 7.
(b) The digit which is on the right of 7 is 1 which is less than 5. By considering procedure 1, add 0.
(c) Add 0 to the digit being approximated: 7 + 0 = 7.

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(d) Write 7 to the third decimal place, and all digits on the right of 7 will be replaced by 0, which is not written, that is 10.257.

Therefore, the approximation of 10.2571 to three decimal places is 10.257, that is 10.2571 ≈ 10.257.

2. If the digit on the right of the digit to be approximated is 5 or greater than 5, add 1 to the digit being approximated. All other digits on the right of the approximated digit will be replaced by 0, which is not written.

Example 3

Approximate 0.4763 to one decimal place.

Solution

(a) The digit to be used in approximating the given number to one decimal place is 4.
(b) The digit which is on the right of 4 is 7 which is greater than 5; by considering procedure 2, add 1.
(c) Add 1 to the digit being approximated: 4 + 1 = 5.
(d) Write 5 in the first decimal place, and all the digits on the right of 4 will be replaced by 0, which is usually not written.

Therefore, the approximation of 0.4763 to one decimal place is 0.5, that is 0.4763 ≈ 0.5.

Example 4

Approximate 3.0685 to two decimal places.

Solution

The approximation of 3.0685 to two decimal places is 3.07.
Therefore, 3.0685 ≈ 3.07.

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Activity 3

Approximate the following numbers to three decimal places:
12.4564, 258.16822, 0.4529, 0.11527.

Example 5



Approximate 0.0453 to two decimal places.

Solution

(a) The digit to be used for approximating this number to two decimal places is 4.
(b) The next digit to the right of 4 is 5.
(c) The digit to be approximated is 4. By considering procedure 2, add 1.
(d) Add 1 to the digit to be approximated: 4 + 1 = 5.
(e) Write 5 to the second decimal place, and all the digits on the right of 4 will be replaced by 0, which is not written, that is 0.05.

Therefore, the approximation of 0.0453 to two decimal places is 0.05, that is 0.0453 ≈ 0.05.

Example 6



Approximate 2.1065 to three decimal places.

Solution

By using procedure 2;
The approximation of 2.1065 to three decimal places is 2.107.

Therefore, 2.1065 ≈ 2.107.

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Example 7

Approximate 5.07523 to two decimal places.

Solution

(a) The digit to be used for approximating this number to two decimal places is 7.
(b) The next digit to the right of 7 is 5.
(c) The digit to be approximated is 7. According to procedure 2, add 1.
(d) Add 1 to the digit being approximated 7 + 1 = 8.
(e) Write 8 in the second decimal place, and all the digits on the right of 7 will be replaced by 0, which is not written.

Therefore, the approximation of 5.07523 to two decimal places is 5.08, that is 5.07523 ≈ 5.08.

Example 8

Approximate 21.10952 to three decimal places.

Solution

By using procedure 2 of approximating decimals; 21.10952 is approximated to 21.110 to three decimal places.

Therefore, 21.10952 ≈ 21.110.

Example 9

Approximate 14.7055 to three decimal places.

Solution

The approximation of 14.7055 to three decimals places is 14.706.

Therefore, 14.7055 ≈ 14.706.

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Activity 4

Approximate the following numbers to two decimal places:
0.0854, 3.87501, 126.4254, 54.3352.

Exercise 2

Answer the following questions:

1. Approximate the following numbers to 2 decimal places:
   (a) 0.1263 (c) 0.0584
   (b) 0.0271 (d) 0.5293

2. Approximate the following numbers to 2 decimal places:
   (a) 0.0743 (c) 5.3214
   (b) 2.4105 (d) 7.2133

3. Approximate the following numbers to 3 decimal places:
   (a) 2.08370 (c) 5.00740
   (b) 3.10019 (d) 14.0728

4. Approximate the following numbers to 3 decimal places:
   (a) 0.01045 (c) 3.23041
   (b) 2.00435 (d) 4.00524

5. Approximate the following numbers to 2 decimal places:
   (a) 0.0256 (c) 7.2651
   (b) 6.1459 (d) 8.1052

6. Approximate the following numbers to 2 decimal places:
   (a) 0.0754 (c) 2.4556
   (b) 1.2354 (d) 4.8950

7. Approximate the following numbers to 3 decimal places:
   (a) 5.422931 (c) 7.000592
   (b) 6.093573 (d) 20.76455

8. Approximate the following numbers to 3 decimal places:
   (a) 0.101372 (c) 5.456747
   (b) 0.005715 (d) 11.10096

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Revision exercise

Answer the following questions:

1. Approximate the following numbers to the nearest tens:
   (a) 1 283 (c) 3 641
   (b) 2 543 (d) 4 735

2. Approximate the following numbers to the nearest hundreds:
   (a) 31 495 (c) 51 432
   (b) 41 057 (d) 62 134

3. Approximate the following numbers to the nearest thousands:
   (a) 270 458 (c) 540 214
   (b) 431 073 (d) 635 240

4. Approximate the following numbers to the nearest ten thousands:
   (a) 3 119 095 (c) 5 182 304
   (b) 4 920 037 (d) 7 024 053

5. Approximate the following numbers to the nearest hundred thousands:
   (a) 3 105 095 (c) 7 230 001
   (b) 5 961 487 (d) 8 521 014

6. Approximate the following numbers to the nearest hundreds:
   (a) 1 254 900 (c) 5 043 107
   (b) 2 456 356 (d) 8 430 591

7. Approximate the following numbers to the nearest thousands:
   (a) 2 574 230 (c) 7 110 592
   (b) 6 193 573 (d) 8 476 157

8. Approximate the following numbers to the nearest ten thousands:
   (a) 1 005 788 (c) 4 567 470
   (b) 2 019 534 (d) 6 143 675

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9. Approximate the following numbers to the nearest hundred thousands:

(a) 2 074 751 **(c)** 6 502 153

(b) 3 545 630 **(d)** 7 035 642

10. Approximate the following numbers to the nearest ten thousands:

(a) 5 097 931 **(c)** 7 230 519

(b) 6 034 958 **(d)** 8 900 543

11. Approximate the following numbers to 2 decimal places:

(a) 0.0174 **(c)** 0.1362

(b) 0.0485 **(d)** 0.3239

12. Approximate the following numbers to 2 decimal places:

(a) 0.0637 **(c)** 6.0019

(b) 3.0541 **(d)** 8.6321

13. Approximate the following numbers to 3 decimal places:

(a) 2.07083 **(c)** 6.71001

(b) 3.10192 **(d)** 20.0287

14. Approximate the following numbers to 3 decimal places:

(a) 0.01045 **(c)** 2.20431

(b) 1.49005 **(d)** 5.00322

15. Approximate the following numbers to 2 decimal places:

(a) 0.0562 **(c)** 7.5126

(b) 4.1139 **(d)** 9.1002

16. Approximate the following numbers to 2 decimal places:

(a) 0.0475 **(c)** 2.4152

(b) 1.3524 **(d)** 3.7954

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17. Approximate the following numbers to 3 decimal places:

(a) 5.422931 **(c)** 8.010592

(b) 7.930537 **(d)** 9.076455

18. Approximate the following numbers to 3 decimal places:

(a) 0.015705 **(c)** 4.456751

(b) 0.105372 **(d)** 7.105963

19. The construction of a fence at Kwamkono Primary School used 1 748 bags of cement. Approximate this number of bags to the:

(a) Nearest tens

(b) Nearest hundreds

(c) Nearest thousands

20. A land surveyor surveyed 70.2575 hectares of land for road expansion. Approximate this quantity of land to:

(a) One decimal place

(b) Two decimal places

(c) Three decimal places

Summary

1. The place value of a digit is used to find low or high approximation of a given number.
2. Low approximation of a number is found by adding 0 to the digit being approximated.
3. High approximation of a number is found by adding 1 to the digit being approximated.
4. The approximation of a decimal number is done on the digits after a decimal point towards the right.

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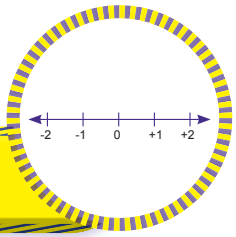
Chapter Seven

Integers



Introduction

In Standard Five, you learnt about various types of numbers which include even, odd and prime numbers. In this chapter you will learn about other types of numbers called integers. You will learn about addition, subtraction, multiplication and division of integers. The knowledge and skills gained on integers will help you to analyse various information on daily life activities such as the increase or decrease of some quantities. For example, the increase or decrease of temperature above or below the freezing point can be represented by integers.

Concept of integers

Integers are formed by positive whole numbers, opposites of positive whole numbers and zero. These numbers are adjoined by dots or small pieces of lines which are equally spaced on a number line. Starting from zero to the right of the number line, the integers increase by one and from zero to the left of the number line they decrease by one.

Integers have different applications in real life such as showing the temperature of an object above or below the freezing point. For example, the temperature of 38°C below the freezing point is written as –38°C. If the temperature is above the freezing point, then it is written as 38°C. The height of 75 metres above the sea level is written as 75 metres, and the depth of 75 metres below sea level is written as –75 metres.

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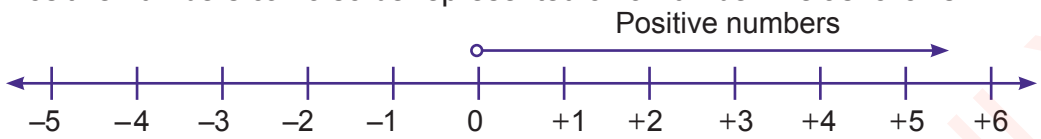
Positive numbers

Positive numbers are all numbers greater than zero on the number line. The following are examples of positive numbers.

$+1,\ +1.3, +2,\ +3\frac{1}{2}, +4.5, +5, +6\frac{2}{5}$ or $1,\ 1.3,\ 2,\ 3\frac{1}{2},\ 4.5,\ 5,\ 6\frac{2}{5}$

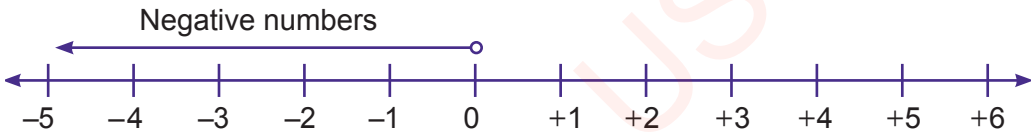
Positive numbers can also be represented on a number line as follows:



Negative numbers

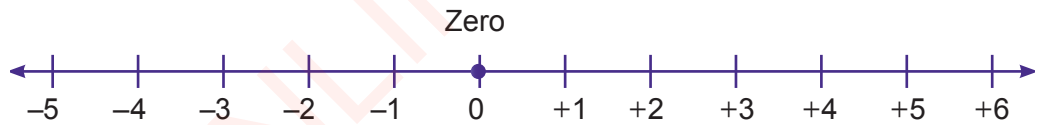
Negative numbers are all numbers less than zero on the number line.

For example; $-1,\ -1.5, -2\frac{1}{2},\ -3.2,\ -3\frac{1}{2}, -4, -5.5, -6$ are negative numbers. Negative numbers can also be represented on a number line as follows:



Zero

Zero is not a positive or negative number. It is a number separating the positive and negative numbers on the number line.



Positive integers

Positive integers are all whole numbers starting from +1 to the right direction on the number line. These numbers are obtained by adding 1 in order to get the next number. Also, they are written by placing a plus sign (+) to the left of the number or without the plus sign. For example, in the following number line, $+1, +2, +3, +4$ or $1, 2, 3, 4$ are positive integers.



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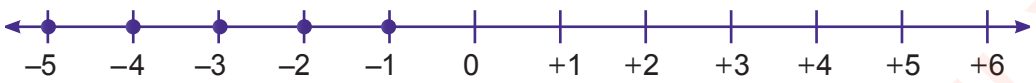
Negative integers

Negative integers are all whole numbers starting from –1 to the left direction on the number line. These numbers are obtained by subtracting 1 to get the next number. They are written by placing a minus sign (–) to the left of the number. For example, in the following number line, –1, –2, –3, –4, –5, are negative integers.



Example 1

Write the opposite of each of the following integers:

(a) +2 (b) –5 (c) –9 (d) 13

Answers

(a) The opposite of + 2 is –2
(b) The opposite of – 5 is 5
(c) The opposite of – 9 is 9
(d) The opposite of 13 is –13

Example 2

What is the opposite of the following numbers?

(a) –12 (b) –46

Answers

(a) The opposite of –12 is 12
(b) The opposite of – 46 is 46

Number line of integers

A number line of integers is a straight line containing equally spaced short lines or dots. All the whole numbers on the right direction from zero are called positive integers, while all the opposites of positive whole

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numbers on the left direction from zero are called negative integers. Study figures (a) and (b) which show different ways of drawing number lines of integers:

(a) Number line of integers divided by short pieces of lines which are equally spaced.



(b) Number line of integers divided by small dots which are equally spaced.



The following are the steps for drawing a number line:

1. Use a ruler and a pencil to draw a horizontal straight line, then insert equally spaced pieces of vertical lines.



2. Write zero as a starting point which separates positive and negative integers. Thereafter, write the integers on the right and left of zero.



The negative integer can be indicated by placing a minus sign at the middle of the number. The numbers in the positive side can be written without the plus sign as shown in the following number line:



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Activity

Steps:

1. Draw a number line on the ground, then divide it into equally spaced short lines by using your foot steps. Write 0 at the centre of the number line and 1 to 5 to the right and left sides of zero.
2. Put the negative and positive signs to indicate the negative and positive numbers.
3. Starting from zero, move four steps to the right. Which number have you arrived at? Write the opposite of that number.
4. Move back to zero and then move four steps to the left. Which number have you arrived at? Write the opposite of that number.

Example 1

Indicate the numbers 1,–2 and –5 on the number line by using the dot (●).

Solution:



Exercise 1

Answer the following questions:

1. Use the concept of integers to write the following temperature readings:
   - (a) 12° C above freezing point
   - (b) 33° C below freezing point
   - (c) 14° C above freezing point
   - (d) 42° C below freezing point
   - (e) 0° C

2. Write the opposite of the following numbers:
   - (a) –1
   - (b) –2
   - (c) +3
   - (d) 4
   - (e) 3
   - (f) +11
   - (g) +12
   - (h) –15

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3. Write the two missing numbers in each of the following sequences:

(a) 0, + 2, + 4, _____, _____
(b) –8, – 7, – 6, _____, _____
(c) –9, –7, – 5, _____, _____
(d) –10, _____, _____, –4 , –2
(e) –1, 0, 1, 2,_____, _____
(f) _____, _____ –3, –2, –1

4. Draw a number line and indicate each of the following numbers on the number line by using the symbol x:

(a) –4, – 3, – 2, 0, + 2
(b) –7, – 5, – 1, 0, + 3
(c) 0, + 3, + 4, + 7, + 9
(d) –5, – 3, – 2, 0, + 1, + 6

Operations on integers

Addition of integers

When a positive integer is added to another positive integer, the answer is a positive integer. If a positive integer is added to a negative integer which is smaller in magnitude than that of a positive integer, the answer is positive. Likewise, if a positive integer is added to a negative integer which is larger in magnitude than that of a positive integer, the answer is negative.

Example 1

+3 + (–2) =

Solution

Write three positive signs to show a profit of three items. Also, write two negative (minus) signs below the positive signs to show a debt of two items of the same type.

+	+	+
–	–	

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Pay the debt by using the two profit items.

$\not{+}$ $\not{+}$ $+$

$\not{+}$ $\not{+}$

A profit of one item will remain after paying the debt.

Therefore, $+3 + (-2) = +1$.

Example 2

$-5 + (-4) =$

Solution

Write five negative (minus) signs to show a debt of five items. Also, write four negative signs below to show another debt of four items of the same type.

−	−	−	−	−
−	−	−	−	

The total debt will be 9 items.

Therefore, $-5 + (-4) = -9$

Example 3

$+7 + (+7) =$

Solution

Write seven positive signs to show a profit of seven items. Also, write seven positive signs below to show another profit of seven items of the same type.

+	+	+	+	+	+	+
+	+	+	+	+	+	+

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The total profit will be 14 items.

Therefore, $+7 + (+7) = +14$.

Example 4

$+4 + (-7) =$

Solution

Write four positive signs to show a profit of four items. Also, write seven negative signs below to show a debt of seven items of the same type.

+	+	+	+			
−	−	−	−	−	−	−

Pay the debt by using the four profit items.

≠	≠	≠	≠			
≠	≠	≠	≠	−	−	−

The remaining debt will be 3 items.

Therefore, $+4 + (-7) = -3$.

Example 5

$-12 + (+12) =$

≠	≠	≠	≠	≠	≠	≠	≠	≠	≠	≠	≠
≠	≠	≠	≠	≠	≠	≠	≠	≠	≠	≠	≠

Therefore, $-12 + (+12) = 0$.

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Exercise 2

Answer the following questions:

1. $-6 + (-8) =$
2. $(+13) + (-10) =$
3. $-18 + (+8) =$
4. $+(25) + (-21) =$
5. $(-42) + (+51) =$
6. $(+13) + (+13) =$
7. $+22 + (-27) =$
8. $+67 + (-67) =$
9. $(-50) + (+60) =$
10. $(+94) + (-100) =$
11. $-102 + (-88) =$
12. $+200 + (-135) =$
13. $(-176) + (-300) =$
14. $(-55) + (-55) =$
15. $(-150) + (-166) =$
16. $(+234) + (+136) =$
17. $-102 + (+222) =$
18. $-280 + (-280) =$
19. $-575 + (+300) =$
20. $+610 + (-700) =$

Addition of integers using a number line

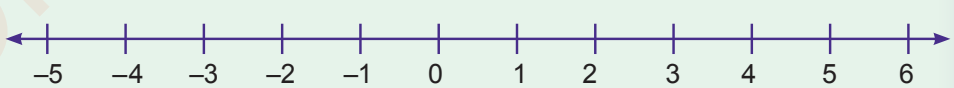
Example 1

$+3 + (+4) =$

Steps:

Use the following steps to add the given numbers:

1. Draw a number line and then indicate the negative integers, positive integers and zero. Make sure you have indicated enough integers for you to locate the answer.



2. Starting from 0, use an arrow to show 3 steps to the right (positive side). You will reach at +3.

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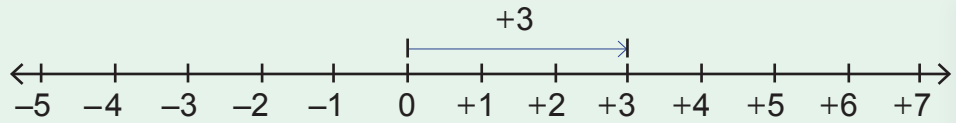
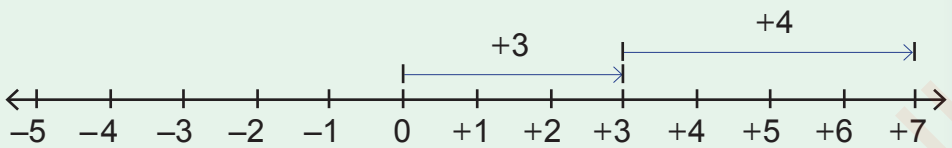
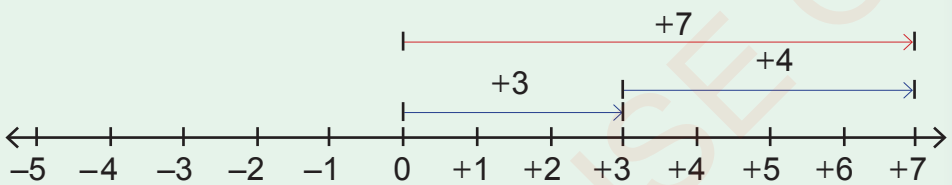


3. Starting from +3, use another arrow to show 4 steps to the right (positive side). You will reach at +7.



4. Count the steps from zero to the right of zero to get a total of 7 steps as shown in the following number line:



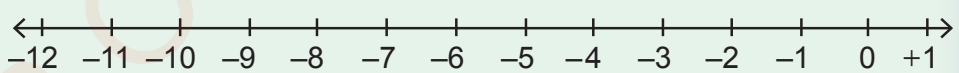
Therefore, $+3 + (+4) = +7$.

Example 2

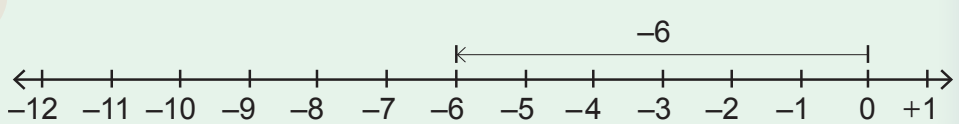
$-6 + (-5) =$

Steps:

1. Draw a number line and then indicate the negative integers, positive integers and zero on it. Make sure you have indicated enough integers for you to locate the answer.



2. Starting from 0, use an arrow to show 6 steps to the left (negative side). You will reach at – 6.



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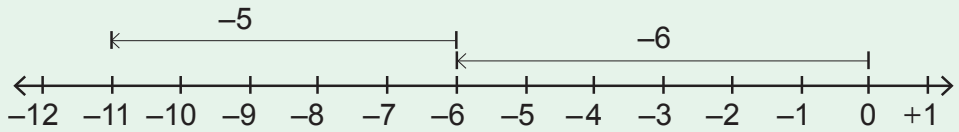
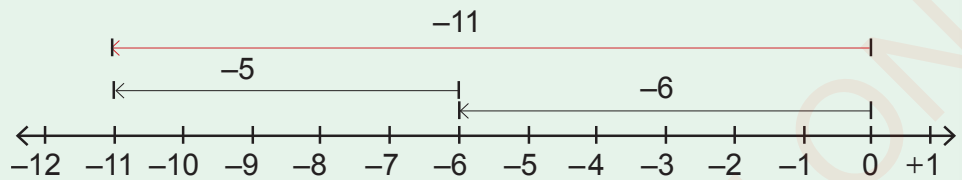
3. Starting at –6, use another arrow to show 5 steps to the left (negative side). You will reach at –11.



4. Count steps from zero towards the left to get a total of 11 steps as shown in the following number line:



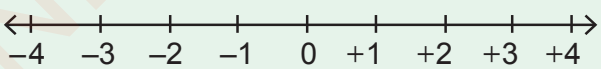
Therefore, – 6 + (– 5) = – 11.

Example 3

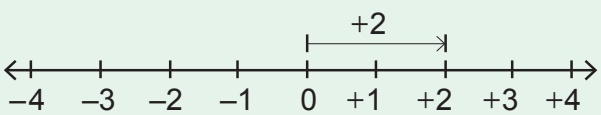
+2 + (–5) =

Steps:

1. Draw a number line and then indicate the negative integers, positive integers and zero on it. Make sure you have indicated enough integers for you to locate the answer.



2. Starting from 0, use an arrow to show 2 steps to the right (positive side). You will reach at +2.



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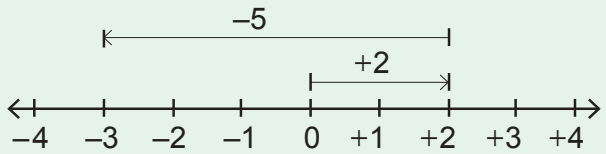
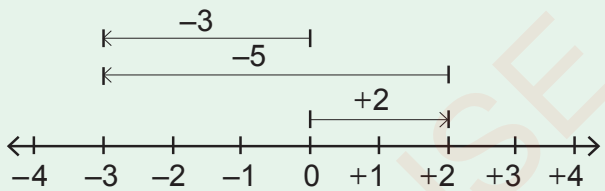
3. Starting at +2, use another arrow to show 5 steps to the left (negative side). You will reach at –3 as shown in the following number line:



4. Count steps from zero (0) to the end of the second arrow on the negative direction, you will reach at –3. This means, there are 3 steps to the left as shown in the following number line:



Therefore, $+2 + (-5) = -3$.

Exercise 3

Use a number line to answer the following questions:

1. $-7 + (+6) =$
2. $-6 + (-6) =$
3. $+10 + (-8) =$
4. $+8 + (-8) =$
5. $-2 + (-9) =$
6. $+4 + (-12) =$
7. $-9 + (+11) =$
8. $-8 + (-2) =$
9. $-5 + (+8) =$
10. $-6 + (+11) =$

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Answer the following questions without using a number line:

11. –2 + (+1) =

12. +8 + (+3) =

13. +12 + (–7) =

14. +10 + (–10) =

15. –15 + (– 11) =

16. –1 + (+5) =

17. +14 + (–21) =

18. – 27 + (+21) =

19. +32 + (–17) =

20. +12 + (–25) =

21. –11 + (+14) =

22. +44 + (+22) =

23. –73 + (+88) =

24. –65 + (+55) =

25. –36 + (– 43) =

26. +124 + (–100) =

27. –90 + (–21) =

28. –300 + (+222) =

29. +225 + (+50) =

30. +115 + (–220) =

31. –566 + (–319) =

32. –469 + (+800) =

33. +200 + (+1405) =

34. +123 + (–900) =

35. +850 + (–254) =

Subtraction of integers

The idea of opposite is used in the subtraction of integers. The opposite of subtraction is addition and the opposite of addition is subtraction. The opposite of negative is positive and the opposite of positive is negative. Therefore, in subtracting integers, you need to change the operation from subtraction to addition.

When the operation is changed from subtraction to addition, the next sign after the operation must change. If it is negative, then it will be positive, and if it is positive, then it will be negative.

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Example 1

$+14 - (+13) =$

Solution

Suppose you have a profit of 14 items, but you also have a debt of 13 items of the same type. After paying the debt you will remain with a profit of 1 item.

Therefore, $+14 - (+13) = +14 + (-13) = +1$

Example 2

$+6 - (+9) =$

Solution

Positive 6 minus positive 9 (remember that, positive numbers can be written together with a plus sign or without the sign).

Therefore, $6 - 9 = +6 + (-9) = -3$

Example 3

$-26 - (+20) =$

Solution

$-26 - (+20) = -26 + (-20) = -46$

Subtraction of integers using a number line

Example 1

$+6 + (-9) =$

Steps:

1. Draw a number line and then indicate the negative integers, positive integers and zero on it. Make sure you have indicated enough integers for you to locate the answer.

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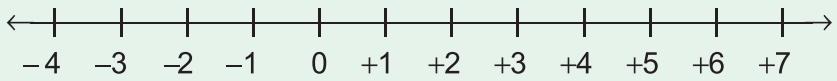
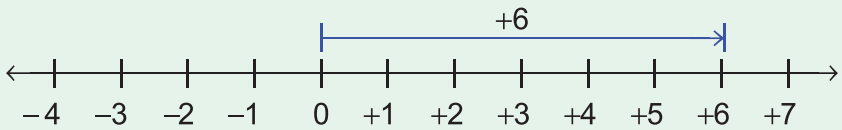
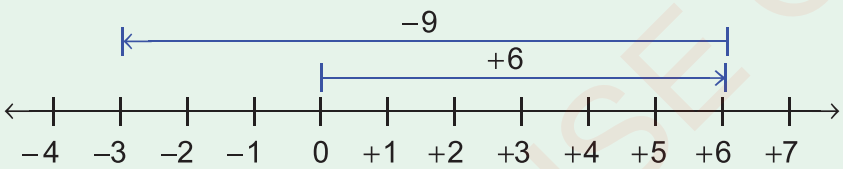


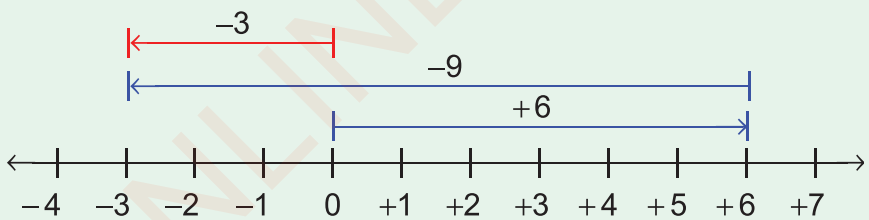
2. Starting at 0, use an arrow to show 6 steps to the right direction (positive side). You will arrive at +6.



3. Starting at +6 use another arrow to show 9 steps to the left direction (negative side). You will arrive at –3.



4. Count from zero (0) to the end of the second arrow to get 3 steps on the left direction (negative side) as shown in the following number line:



Therefore, +6 + (–9) = +6 – 9 = –3.

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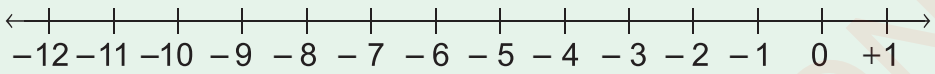
Example 2

$-11 - (-4) =$

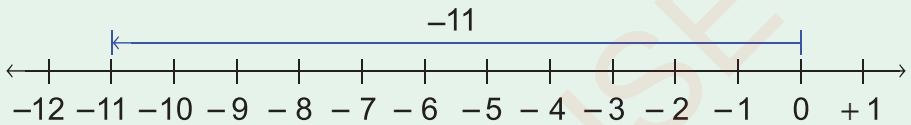
Steps:

Since, $-11 - (-4) = -11 + 4 =$

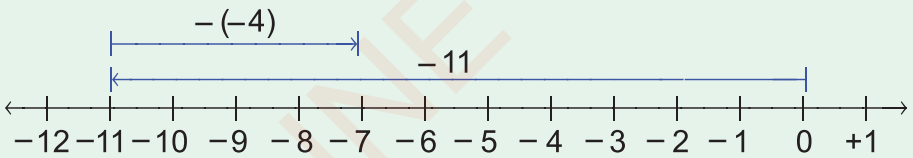
1. Draw a number line and then indicate the negative integers, positive integers and zero on it. Make sure you have indicated enough integers for you to locate the answer.



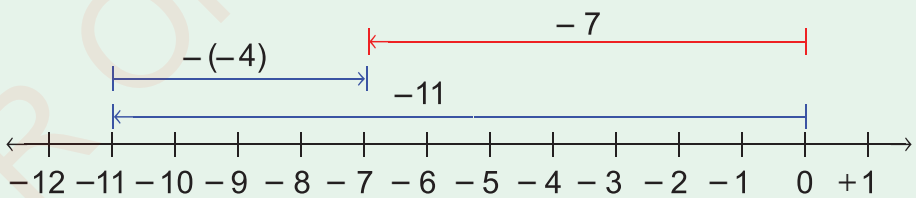
2. Starting at 0, use an arrow to show 11 steps to the left direction (negative side). You will arrive at –11.



3. Starting at –11, use another arrow to show 4 steps to the right direction (positive side). You will arrive at –7.



4. Count steps from zero (0) to the end of the second line to get 7 steps on the left direction as shown in the following number line:



Therefore, $-11 - (-4) = -11 + 4 = -7$.

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Exercise 4

Answer the following questions by using a number line:

1. $-8-(+2)=$
2. $-6+(-6)=$
3. $-3-(-10)=$
4. $-10-(-12)=$

Answer the following questions:

5. $+10-(+24)=$
6. $-14-(+16)=$
7. $64-(-9)=$
8. $+45-(+45)=$
9. $-73-(+70)=$
10. $+99-(+99)=$
11. $156-(-97)=$
12. $-890-(+535)=$
13. $333-(-230)=$
14. $+48-(+70)=$
15. $-86-(-112)=$
16. $+400-(+300)=$
17. $2\,700-(+1\,000)=$
18. $+6\,535-(-9\,400)=$
19. $+450-(-225)=$
20. $412-(+560)=$

Multiplication of integers

When a positive number is multiplied by another positive number, the product is also a positive number.

Example 1

(a) $(+3)\times(+4)=$

Solution

There are four (4) groups of (+3) each as shown in the following number line:

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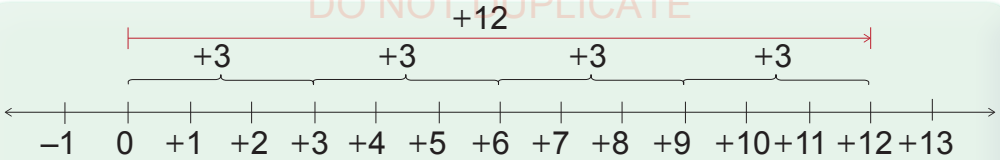
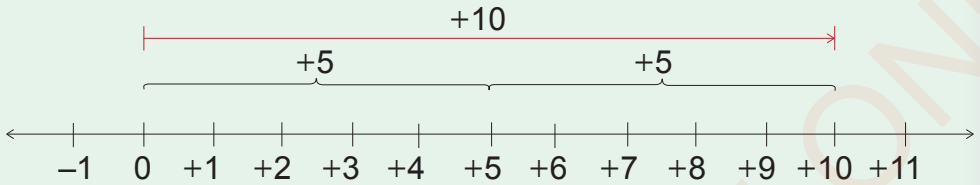


Therefore, $(+3)\times(+4) = +3\times 4 = +12$.

(b) $+5\times(+2) =$

Solution

There are two (2) groups of five (+5) each as shown in the following number line:



Therefore, $+5\times(+2) = +10$.

(c) $+16\times(+10) = +160$
(d) $+54\times(+45) = +2\,430$

When a negative number is multiplied by another negative number, the product is a positive number.

Example 2

(a) $-2 \times (-4) = +8$
(b) $-18 \times (-12) = +216$
(c) $-70 \times (-55) = +3\,850$

When a positive number is multiplied by a negative number or a negative number is multiplied by a positive number, the product is a negative number.

Example 3

(a) $-3 \times (+3) =$

Solution

There are three groups of –3 each as shown in the following number line:

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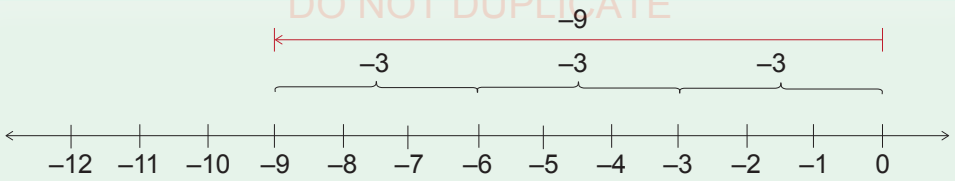
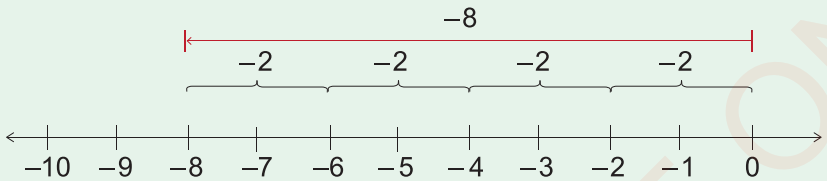


Therefore, $-3 \times (+3) = -9$.

(b) $-2 \times (4) =$

Solution

In this case, there are four groups of –2 each as shown in the following number line:



Therefore, $-2 \times (+4) = -2 \times 4 = -8$.

(c) $-11 \times (+5) = -55$

(d) $205 \times -30 = -6\,150$

Exercise 5

Answer the following questions:

1. $-7 \times (-8) =$
2. $+29 \times (-3) =$
3. $+38 \times (-10) =$
4. $+9 \times (+79) =$
5. $-124 \times (+13) =$
6. $26 \times -33 =$
7. $47 \times (-112) =$
8. $-144 \times (+271) =$
9. $+65 \times (-43) =$
10. $-560 \times (-43) =$
11. $-203 \times (+101) =$
12. $+96 \times (-26) =$
13. $+76 \times (+43) =$
14. $100 \times (+48) =$
15. $-441 \times (-18) =$
16. $+51 \times (-27) =$
17. $+97 \times (+22) =$
18. $-54 \times (-65) =$
19. $+16 \times (+19) =$
20. $163 \times (+193) =$

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Division of integers

When a positive number is divided by another positive number, the result is a positive number.

Example 1

(a) $+84 \div (+7) = +12$
(b) $+112 \div (+4) = +28$
(c) $+345 \div (+23) = +15$

When a negative number is divided by another negative number, the result is a positive number.

Example 2

(a) $-72 \div (-6) = +12$
(b) $-208 \div (-16) = (+13)$
(c) $-3100 \div (-124) = +25$

If a positive number is divided by a negative number or a negative number is divided by a positive number, the result is a negative number.

Example 3

(a) $+99 \div (-11) = -9$
(b) $-323 \div (+17) = -19$
(c) $4\,042 \div (-94) = -43$

Exercise 6

Answer the following questions:

1. $+64 \div (+4) =$
2. $+378 \div (-21) =$
3. $+476 \div (-14) =$
4. $-840 \div (-105) =$
5. $-2\,210 \div (+85) =$
6. $-1\,470 \div (+98) =$
7. $+6\,300 \div (+42) =$
8. $+91\,200 \div (-200) =$
9. $-27\,660 \div (+60) =$
10. $+726 \div (-33) =$

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11. +816 ÷(–16) =

12. – 3 890 ÷ (–10)=

13. + 3 230 ÷ (–85)=

14. + 5 625 ÷ (+75)=

15. – 36 294 ÷ (+789)=

16. –28 134 ÷ (–54) =

17. +16 544 ÷ (+88) =

18. –19 557 ÷ (+159) =

19. +4 332 ÷ (–76) =

20. – 3 549 ÷ (–13)=

Revision exercise

Answer the following questions:

1. –69 – (–48) =

2. +41 + (–12) =

3. +85 – (+76) =

4. +123 + (–121) =

5. – 409 + (–221) =

6. –1 025 – (–686) =

7. +561 – (–202) =

8. –320 × (+10) =

9. +90 × (–62)=

10. –67 × (+34) =

11. +600 ÷ (–20) =

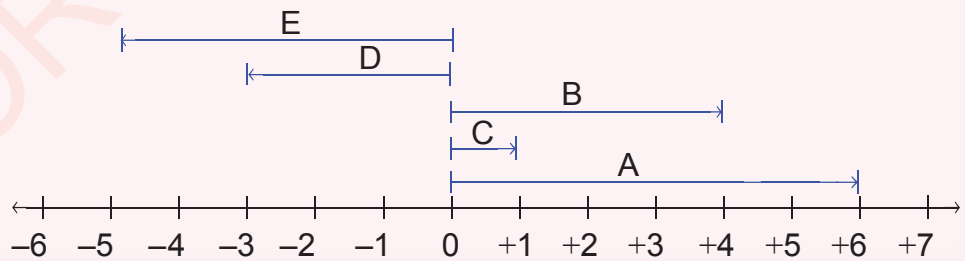
12. –890 ÷ (–50) =

13. +3 200 ÷ (–80) =

14. Write the opposite of the answer obtained from +165 – (+78).

15. Use a number line to show all steps in calculating the value of –10 +(+12).

Use the following figure to answer questions 16 to 19:



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Example:

Write three equivalent mathematical statements to represent arrow C.
Some statements from line C are:

(i) $-1 + (+2) = +1$

(ii) $-1 - (-2) = +1$

(iii) The opposite of –1 is +1

16. Construct 3 mathematical statements to represent arrow A.

17. Construct 3 mathematical statements to represent arrow B.

18. How much shoud be added to +3 to get –3 represented by arrow D?

19. How much should be subtracted from +5 to get –5 represented by arrow E?

20. Calculate –720 — (+480) and write the opposite of the answer.

Summary

1. Integers are formed by positive integers, negative integers and zero.
2. Positive integers are the integers which are greater than 0.
3. Negative integers are the integers which are less than 0.
4. Zero is neither a positive nor a negative integer.
5. The opposite of a positive integer is a negative integer and the opposite of a negative integer is a positive integer.
6. Integers can be represented on a number line.

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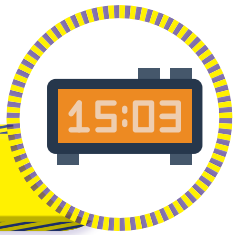
Chapter Eight

Time



Introduction

In Standard Five, you learnt about preparing a calendar, converting, multiplying and dividing units of time. In this chapter, you will learn about reading and writing time in 12 hours and 24 hours formats. Also, you will learn about converting time from 12 hours format to 24 hours format and converting time from 24 hours format to 12 hours format. You will also learn to solve word problems involving time. The knowledge and skills gained will improve your punctuality in different activities such as following school timetable, transport schedules and completing many other daily routines by observing time.

Exercise 1: Revision

Answer the following questions:

1.

hours	minutes
3	10
+ 5	20

2.

hours	minutes
3	33
+ 1	38

3.

hours	minutes
3	10
+ 5	20

4.

hours	minutes
5	52
– 4	30

5.

hours	minutes
3	37
– 1	34

6.

hours	minutes
7	20
– 1	30

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7.

hours	minutes
3	15
×	3

8.

hours	minutes
8	15
×	5

9.

hours	minutes
4	42
×	6

10.

	days	hours
15	40	15

11.

	years	months
14	28	56

12. Write the names of the months with 30 days.

13. Write in words the date of the first Tuesday of July in this year.

14. Juma is a teacher at Mtakuja Primary School. He started his holiday on 23rd September, 2018 and returned to work on 20th October, 2018. How many days did Juma spend in the holiday?

15. How many weeks and days are there in the following days?

(a) 36
(b) 42
(c) 56
(d) 65

16. Convert the following into days:

(a) 13 weeks
(b) 24 weeks and 6 days
(c) 36 weeks and 1 day
(d) 80 weeks and 5 days

17. Convert 340 minutes into hours.

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18. How many minutes are there in two hours?

19. Convert 36 hours into days.

20. How many hours are there in 10 days?

21. How many minutes are there in 30 days?

22. Aisha works 8 hours everyday. If she will work for 25 days, how many hours will she have worked?

23. Maria is supposed to report at work at 7:30 am. If she arrived at 8:20 am, how many minutes was she late?

24. The age of Eliza is 14 years and 6 months and the age of Amani is 19 years and 3 months. Find the sum of their ages.

Reading time in 12 hours and 24 hours clock formats

In East Africa, a day is divided into day time and night time. Day time is counted starting from 7:00 am and continues up to 6:59 pm. Night time starts from 7:00 pm and continues up to 6:59 am.

The day time has 12 hours and night time has 12 hours. Also, day time is divided into the following time: morning, afternoon and everning. The night time is divided into night, midnight and late night.

Internationally, a day is divided into 24 hours. A new day starts at 12:00 midnight and ends at 11:59 pm. Due to these time formats, time is generally read and written in two formats, which are 12 hours and 24 hours formats.

Reading time in 12 hours format

The 12 hours format can be read and written in Kiswahili and in English (am and pm). In Tanzania, there are various ways of reading time. One of these ways is reading time in English.

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Writing time in 12 hours fomat

One day has a total of 24 hours and starts at 12:00 midnight. After every 24 hours, a new day starts. In writing time in 12 hours format, one day is divided into two parts, each part has 12 hours. The first part of the day is divided into night, late night, early morning, and morning as follows:

12:01 am	-	Night	7:00 am	-	Morning
1:00 am	-	Night	8:00 am	-	Morning
2:00 am	-	Late night	9:00 am	-	Morning
3:00 am	-	Late night	10:00 am	-	Morning
4:00 am	-	Late night	11:00 am	-	Morning
5:00 am	-	Early Morning			
6:00 am	-	Morning			

The second part of the day starts at 12:00 noon and continues up to 11:59 pm. Therefore, from noon up to the end of the day, there are 12 hours divided into afternoon, evening and night as follows:

12:00	-	Noon	6:00 pm	-	Evening
12:01 pm	-	Afternoon	7:00 pm	-	Night
1:00 pm	-	Afternoon	8:00 pm	-	Night
2:00 pm	-	Afternoon	9:00 pm	-	Night
3:00 pm	-	Late Afternoon	10:00 pm	-	Night
4:00 pm	-	Evening	11:00 pm	-	Night
5:00 pm	-	Evening	12:00	-	Midnight

Exercise 2

Answer the following questions:

1. How many hours are there from 7:00 pm to the end of the day?
2. At what time does noon start?
3. Mention the time when it is midnight.

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4. How many hours are there between 12:01 pm and 6:00 am?

5. How many hours are there from 5:00 am to noon?

6. Ado started a journey at 6:30 am. He travelled by a car from one village and arrived at the other village at 2:45 pm. How many hours did he use to travel?

7. Neema left home at 7:18 am to town. She arrived in town at 8:05 am. How much time did she travel from home to town?

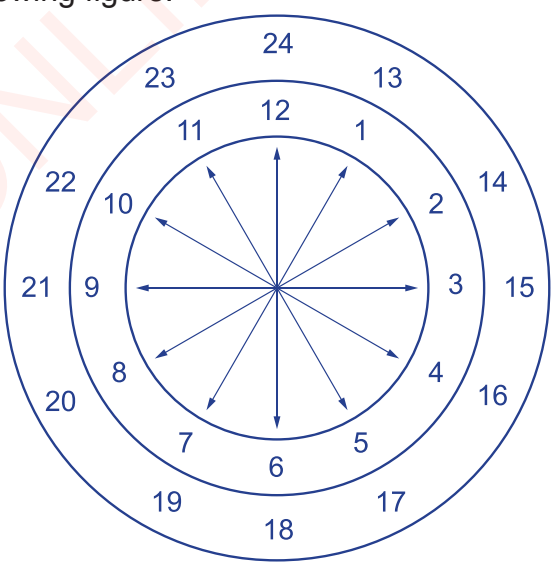
8. Belinda slept at 9:00 pm and woke up at 5:30 am. How many hours did she sleep?

9. How many minutes are there in four hours and thirty minutes?

10. How many hours are there in three weeks?

Reading time in 24 hours format

The 24 hours format is the international time format which is commonly used in reading and writing time. People from countries that differ in time zones may easily communicate to each other about time by using the 24 hours format. Companies such as broadcasting, railways, airlines, postal and telecommunication companies use the 24 hours format. There is a difference of 12 hours between 12 hours format and 24 hours format as shown in the following figure:



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The given figure shows that 24 hours are not read on clock face. We know that a day time has 12 hours and a night time has 12 hours. In the 24 hours format, a day starts at 12:00 midnight. Time in 24 hours format is written using four digits. The first two digits from left represent the hours and the remaining two digits represent minutes as shown in the following table:

12 hours format	24 hours format
12:00 midnight	0000
12:01 am	0001
01:00 am	0100
02:00 am	0200
03:00 am	0300
04:00 am	0400
05:00 am	0500
06:00 am	0600
07:00 am	0700
08:00 am	0800
09:00 am	0900
10:00 am	1000
11:00 am	1100
12:00 noon	1200
12:01 pm	1201
1:00 pm	1300
2:00 pm	1400
3:00 pm	1500
4:00 pm	1600
5:00 pm	1700
6:00 pm	1800
7:00 pm	1900
8:00 pm	2000
9:00 pm	2100
10:00 pm	2200
11:00 pm	2300
12:00 midnight	0000

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Activity: Reading and writing time in 12 hours and 24 hours formats

Read the following time in 12 hours and 24 hours formats.

12 hours format	24 hours format
12:00 midnight	0000
1:00 pm	0100
2:00 pm	0200
3:00 pm	0300
Continue up to	……
6 am	0600
7:00 am	0700
8:00 am	0800
9:00 am	0900
Continue up to	……
12:00 noon	1200
1:00 pm	1300
2:00 pm	1400
3:00 pm	1500
Continue up to	……
6:00 pm	1800
7:00 pm	1900
8:00 pm	2000
9:00 pm	2100
Continue up to	……
12:00 midnight	0000

Converting time from 12 hours format into 24 hours format

Example 1

Convert 9:47 am into 24 hours format.

Solution

Count from 0000 midnight up to 9:47 am to get 0947 morning in 24 hours format.

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9:47 am is written as 0947.

Therefore, 9:47 am in 12 hours is the same as 0947 in 24 hours format.

Example 2



Write 2:00 am in 24 hours format.

Solution

Start counting hours from 0000 up to 2:00 am to get 0200 in 24 hours format. Therefore, 2:00 am in 12 hours format is the same as 0200 in 24 hours format.

Example 3



Write 1:00 pm in 24 hours format.

Solution

Count hours from 0000 up to 1:00 pm to get 1300 in 24 hours format.

Therefore, 1:00 pm in 12 hours format is the same as 1300 in 24 hours format.

Exercise 3



Write the following time in 24 hours format:

1. 9:00 am
2. 6:01pm
3. 11:00 am
4. 12:50 pm
5. 7:55 am
6. 1:00 pm
7. 3:45 pm
8. 4:00 pm
9. 8:00 am
10. 11:45 pm

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Converting time from 24 hours to 12 hours format

Example 1

Convert 0400 into 12 hours format.

Solution

0400 = 4:00 am.
Therefore, 0400 is the same as 4:00 am.

Example 2

Convert 1700 into 12 hours format.

Solution

Count 17 hours from 0000 up to 1700 to get 5:00 pm in 12 hours format.
Therefore, 1700 is the same as 5:00 pm.

Example 3

Convert 2200 into 12 hours format.

Solution

Count 22 hours from 0000 up to 2200 to get 10:00 pm in 12 hours format.
Therefore, 2200 is the same as 10:00 pm.

Exercise 4

Convert the following time into 12 hours format:

1. 0012
2. 1650
3. 2010
4. 1015
5. 1918
6. 2222

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7. 0000

8. 1201

9. 1100

10. 1710

11. 1015

12. 1918

Word problems involving Time

Example 1

An aeroplane arrived at 2105. What is the arrival time in 12 hours format?

Solution

Referring to the 12 hours format in the chart provided, 2105 is the same as 9:05 pm.
Therefore, the aeroplane arrived at 9:05 pm in 12 hours format.

Example 2

If it is 2:00 pm, what is this time in 24 hours format?

Solution

2:00 pm is the same as 1400 by referring to the chart of the 24 hours format.

Therefore, 2:00 pm is the same as 1400 in 24 hours format.

Exercise 5

Answer the following questions:

1. Juma worked for 8 hours from 8:00 am. At what time in 24 hours format did he finish working?

2. What is 4:45 am in 24 hours format?

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3. Convert 1945 into 12 hours format.

4. How many hours are there from 1800 to 2400?

5. Convert 2300 into 12 hours format.

6. Sheba told Bura that his watch was showing 8:15 am. What is this time in 24 hours format?

7. A farmer started cultivating his farm at 1700. Write this time in 12 hours format.

8. A netball match started at 1520. Convert this time into 12 hours format.

9. A certain doctor worked for 11 hours. If she started working at 7:30 am, at what time in 24 hours format did she finish working?

10. Tourists arrived at the Kilimanjaro International Airport at 1625. Write this time in 12 hours format.

Revision exercise

Write the time in questions 1 to 9 in 12 hours format:

1. 0256
2. 425
3. 0712
4. 1711
5. 1930
6. 2127
7. 1513
8. 2324
9. 0815

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Write the time in questions 10 to 17 in 24 hours format:

10. 2:34 am

11. 1:05 pm

12. 5:55 am

13. 3:15 pm

14. 8:10 am

15. 11:30 am

16. 3:51 pm

17. 4:00 pm

18. Asha started to feel headache on Friday at 1808. Write this time in 12 hours format.

19. A clock shows 8:25 pm. What is this time in 24 hours format?

20. If it is 11:00 am, what is this time in 24 hours format?

21. The first half of a football match started at 1630. Write this time in 12 hours format.

22. A traffic police arrived at her working station at 5:45 am. What was her arrival time in 24 hours format?

Summary

1. We can read and write time in two formats which are 12 hours and 24 hours formats
2. A day starts at 12:00 midninght and ends at 11:59 pm
3. The time in 24 hours format is written in the form of four digits. The first two digits from left represent hours and the remaining two digits to the right represent minutes.
4. Time in 12 hours format is written in the form of three or four digits. The digits on the left of a colon (:) represent hours and the two digits to the right of the colon represent minutes.

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Chapter Nine

Metric units



Introduction

In Standard Five, you learnt about conversion, addition and subtraction of metric units of length, mass and volume. In this chapter, you will learn about multiplication, division and solving word problems of metric units of length, mass and volume. The knowledge and skills gained will help you to perform various measurement activities in daily life situations such as tailoring, carpentry, construction of buildings and business.

Activity 1: Showing the relationship between metric units of length, mass and volume

Remember, you learnt the relationship of metric units of length, mass and volume.

(a) In a group of 3 pupils, refer to a chart showing the relationship between metric units.

(b) Some of the groups should prepare a chart showing the relationship between metric units of length. Other groups should prepare a chart showing the relationship between metric units of mass. Also, some groups should prepare a chart showing the relationship between metric units of volume.

(c) Present your findings to the rest of the class for more discussion and improvement.

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Exercise 1: Revision

Answer the following questions:

1.

km	m	cm
15	450	80
+ 28	673	95

2.

kg	g
3	800
– 2	940

3.

ton	kg	g
24	612	500
+ 20	561	527

4.

hm	dam	cm
56	2	45
– 21	8	40

5. How many centimetres are in 3.5 metres?

6. Convert 2.15 kilometres into metres.

7. How many decametres are in 5 670 metres?

8. Convert 858 millimetres into centimetres and millimetres.

9. How many centimetres are in 45 decimetres?

10. Convert 23 cm into decimetres.

11. How many kilometres are in 178 decametres?

12. How many metres are in 1 876 centimetres?

13. A horse drinks an average of 10 litres of water every week. How many litres of water will the horse drink in 24 weeks?

14. How many m, dm, cm, and mm are in 14 589 millimetres?

15. A piece of wood whose length is 85 cm was cut from a piece of wood of 1 m long. What was the length of the remaining piece of wood?

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16. A motor vehicle uses 4 litres of petrol to travel a distance of 30 km. How many litres will be used by the same vehicle to travel a distance of 900 km?

17. An athlete jumped 1.8 m in high jump competition. How many decimetres did he jump?

18. If Aisha stands on the box, her height together with the height of the box is 137.5 cm. If the height of the box is 12.6 cm, find the height of Aisha.

19. Nelu measured his shadow as follows: At 8.00 am the shadow was 193 cm and 5 mm, at 12.00 noon the shadow was 175 cm and 7 mm. How long did the shadow decrease?

20. Shuhuda was given a piece of sugarcane of length 25.3 cm. Johari was given a piece of sugarcane of length 3.6 dm. Among the two, who was given a longer piece of sugarcane than the other and by how long?

21. A lorry carried 15 tons of rice. What is this mass in kilograms?

22. A pole is 4.15 m long. How long is it in mm?

23. How many metres are in 3.64 hectometres?

Multiplying metric units

Length

In order to multiply the metric units of length, it is important to know the relationship between the metric units of length. Use the chart of metric units of length to remind yourself the relationship between metric units of length from millimetres to kilometres.

Example 1

Multiply 3 km 604 m 54 cm by 4.

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Steps:

1. Arrange the units vertically with the smallest unit on the right and the largest unit on the left

	km	m	cm
	3	604	54
×			4

2. Multiply from right to left or from the smallest to the largest unit.
3. Multiply by considering the relationship between units of length, for example: 1 km = 1 000 m, and 1 m = 100 cm.
4. Multiply 54 cm by 4 to get 216 cm. Remember 1 m = 100 cm, therefore 216 cm equals to 2 m and 16 cm.
5. Write 16 cm in the centimetres column.
6. Multiply 604 m by 4 to get 2 416 m. Add the 2 m that remained in step 4 to 2 416 m. That is, 2 416 m + 2 m = 2418 m.
7. Remember 1 km = 1 000 m, therefore 2 418 m equals to 2 km and 418 m.
8. Write 418 m in the metres column.
9. Multiply 3 km by 4 to get 12 km, then add the 2 km that remained in step 7 to 12 km. That is, 12 km +2 km =14 km.
10. Write 14 km in the kilometres column.

	km	m	cm
	3	604	54
×			4
	14	418	16

Therefore, the answer is 14 km 418 m 16 cm.

Mass

Mass can be measured in tons, kilograms (kg), grams (g), milligrams (mg) and other metric units of mass. Use the chart of the metric units of mass to remind yourself the relationship between metric units of mass from milligrams to tons.

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Multiplying units of mass

Example 2

Multiply 3 tons 964 kg 300 g by 5.

Steps:

1. Arrange units vertically with the smallest unit on the right and the largest unit on the left.

ton	kg	g
3	964	300
×		5

2. Multiply from the smallest to the largest unit, that is from right to left.
3. Consider the relationship between units of mass; 1 kg =1 000 g and 1 ton = 1 000 kg.
4. Start by multiplying the smallest unit. Multiply 300 g by 5 to get 1 500 g. Remember, 1 kg = 1 000 g. Thus, 1 500 g equals to 1 kg and 500 g. Write 500 g in the grams column.
5. Multiply 964 kg by 5 to get 4 820 kg, then add 1 kg remained in step 4 to get 4 821 kg. Remember, 1 ton = 1 000 kg. Therefore, 4 821 kg equals to 4 tons and 821 kg.
6. Write 821 kg in the kilograms column.
7. Multiply 3 tons by 5 to get 15 tons, add 4 tons you got in step 5; 15 tons + 4 tons = 19 tons.
8. Write 19 tons in the tons column.

ton	kg	g
3	964	300
×		5
19	821	500

Therefore, the answer is 19 tons 821 kg 500 g.

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Volume

Metric units of volume are used to measure liquids and gases. Units of volume are like litres (l) and millilitres (ml). Use the chart of metric units of volume to remind yourself the relationship between metric units of volume from millilitres to litres.

Multiplication of metric units of volume

Example 3

Multiply 23 l 200 ml by 7.

Solution

	l	ml
	23	200
×		7

Steps:

1. Arrange units vertically from the smallest to the largest starting from right to left.
2. Consider the relationship between units of volume; 1litre = 1 000 ml.
3. Multiply 200 ml by 7 to get 1 400 ml. Remember 1litre = 1 000 ml. Therefore, 1 400 millilitres equal to 1litre and 400 millilitres.
4. Write 400 ml in the millilitres column.
5. Multiply 23 litres by 7 to get 161 litres. Add 1 litre that remained in step 3 to 161 litres. That is, 161 litres + 1 litre = 162 litres.
6. Write 162 litres in the litres column.

	l	ml
	23	200
×		7
	162	400

Therefore, the answer is 162 litres 400 millilitres.

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Activity 2: Measuring lengths of various things

1. In groups, use a ruler (in centimetres) to measure the length of your desk surface and the teacher's table surface. Convert the length you have measured to other three units of length.
2. Use a tape measure to measure the length of your classroom. Record the measured length in metres. Convert this length to other three different units of length. What will be the total length of 15 such classrooms?

Activity 3: Measuring masses of various things

Use a beam balance to measure various objects like flour, beans, stones, and sand. Record their mass in kilograms. Convert these masses to other three different units of mass.

Activity 4: Measuring the volume by using bottles

In groups, collect three bottles whose capacities are 500 millilitres, 1 000 millilitres and 1 500 millilitres.

1. Use 500 millilitres bottle to fill in 1 000 millilitres bottle.
2. How many 500 millilitre bottles will be used to fill in a 1 000 millilitres bottle?
3. Repeat the first and the second steps to fill in a 1 500 ml bottle.
4. If you have 10 bottles with 1.5 litres and 500 millilitres capacities, what is their total volume? Give your answer in litres and millilitres.

Exercise 2

Answer the following questions:

1.

	km	dam	dm
	49	876	83
×			2

2.

	m	cm	mm
	15	68	8
×			4

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3.

	dm	cm	mm
	6	7	9
×			6

4.

	km	dam	dm
	6	95	60
×			8

5.

	dm	cm	mm
	6	7	9
×			6

6.

	m	cm	mm
	13	20	9
×			4

7.

	kg	g
	6	40
×		25

8.

	kg	dag	g
	6	62	5
×			4

9.

	ton	kg	mg
	13	45	300
×			2

10

	ton	kg	dag
	20	245	50
×			10

11.

	dag	dg	mg
	16	40	45
×			6

12.

	ton	kg	dag
	20	245	10
×			5

13.

	l	ml
	23	100
×		6

14.

	l	ml
	4	500
×		8

15.

	l	ml
	54	100
×		10

16.

	l	ml
	23	5
×		90

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17.

	l	ml	dm
	3	500	8
×		7	4

18.

	ton	kg	g
	10	0	500
×			4

19.

	ton	kg	g
	5	0	250
×			8

20.

	m	cm	mm
	36	468	72
×			6

Dividing metric units

Steps for dividing metric units are not different from those of multiplication. The important thing to remember is the relationship between the metric units. The only difference is that when dividing metric units, we start from the largest to the smallest unit.

Example 1

Divide 3 m 84 cm 5 mm by 5.

Steps:

1. Arrange units of length in columns, then insert the division symbol.

	m	cm	mm
5)	3	84	5

2. Divide by considering the relationship of the units of length for example: 1 m = 100 cm, 1 cm = 10 mm.
3. Divide 3 m by 5. It is not sufficient to get a whole number. Thus, write 0 in the metres column.
4. Remember 1 m = 100 cm; therefore, convert 3 m into cm by multiplying 3 by 100 to get 300 cm.
5. Add 300 cm to 84 cm to get 384 cm.
6. Divide 384 cm by 5 to get 76 cm and the remainder 4 cm.

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7. Write 76 cm in the centimetres column.
8. Remember 1 cm = 10 mm thus, convert 4 cm that remained in step 6 into mm by multiplying 4 cm by 10 to get 40 mm.
9. Add 40 mm and 5 mm to get 45 mm.
10. Divide 45 mm by 5 to get 9 mm.
11. Write 9 mm in the millimetres column.

Therefore, the answer is 0 m 76 cm 9 mm or 76 cm and 9 mm.

Example 2

Divide 48 kg 564 g by 6.

	kg	g
6	48	564

Steps:

1. Consider the relationships between metric units of mass. Example; 1 kg = 1000 g.
2. Divide 48 kg by 6. The answer is 8 kg.
3. Write 8 kg in the kilograms column.
4. Divide 564 g by 6. The answer is 94g.
5. Write 94 g in the grams column.

Therefore, the answer is 8 kg 94 g.

Example 3

Divide 4 litres 640 millilitres by 8.

Steps:

1. Arrange units of volume in columns:

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	l	ml
8	4	640

2. Divide by considering the relationship between metric units of volume; 1litre = 1 000 millilitres.
3. Divide 4 litres by 8. It is not sufficient to divide 4 litres by 8. Therefore, write 0 in the litres column.
4. Convert 4 litres into millilitres.
5. Remember 1 litre = 1 000 millilitres, therefore 4 litres equal to 4 000 millilitres.
6. Add 4 000 ml to 640 ml to get 4 640 ml.
7. Divide 4 640 ml by 8 to get 580 ml.
8. Write 580 ml in the millilitres column.

Therefore, the answer is 580 ml.

Exercise 3

Answer the following questions:

1.

	m	cm	mm
6	6	56	40

2.

	m	dm	cm
9	3	65	22

3.

	km	hm	dam
20	5	200	20

4.

	km	dam	m
8	18	45	200

5.

	km	hm	dam
11	6	4	9

6.

	dm	cm	mm
6	6	10	3

7.

	ton	kg	g
2	8	20	128

8.

	kg	g
9	7	200

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9. $3\overline{)}$ ton 6, kg 4, g 20

10. $2\overline{)}$ ton 15, kg 245, g 26

11. $9\overline{)}$ ton 28, kg 245

12. $17\overline{)}$ kg 34, g 850

13. $21\overline{)}$ ton 2, kg 100, g 63

14. $50\overline{)}$ kg 120, g 800

15. $14\overline{)}$ l 30, ml 520

16. $25\overline{)}$ l 101, ml 250

17. $6\overline{)}$ l 720, ml 198

18. $12\overline{)}$ l 24, ml 600

19. $24\overline{)}$ m 96, cm 76, mm 8

20. $19\overline{)}$ km 30, hm 520, dam 9, m 9

Word problems involving metric units

Example 1

A carpenter made a table of length 3 m, 30 cm and 5 mm. What is the length of 12 tables of the same type in metres, centimetres and millimetres?

Steps:

1. Arrange the metric units in columns

	m	cm	mm
	3	30	5
×			12

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2. Start to multiply the column of 5 mm by 12 to get 60 mm. Remember, 1 cm = 10 mm. Thus, 60 mm equal to 6 cm.
3. Write 0 in the mm column.
4. Multiply the centimetres column:
5. Add 360 cm to 6 cm which was obtained from the mm column. The total is 366 cm. Remember 1 m = 100 cm. Thus, 366 cm is equal to 3 m and 66 cm.
6. Write 66 cm in the cm column.
7. Multiply the metres column: 3 m × 12 = 36 m and then add 3 m obtained from the cm column to get 39 m.
8. Write 39 in the metres column.

Therefore, 12 tables will have a total length of 39 m and 66 cm.

Example 2

5 000 litres and 240 millilitres of oil are to be stored in 8 barrels of the same capacity. How many litres of oil will each barrel hold?

Solution

To know the capacity of each barrel, divide the given volume by the number of barrels.

Arrange units of volume in columns, then follow the steps of dividing the units of volume.

$$\begin{array}{r|ll} & l & ml \\ 8 & 5000 & 240 \end{array} = \begin{array}{ll} l & ml \\ 625 & 30 \end{array}$$

Therefore, each barrel will hold 625 litres and 30 millilitres.

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Example 3

A goat gave birth to three kids at once. Each kid weighed an average of 3 kilograms and 250 grams. What was the total mass of all the kids?

Solution

Arrange the units of mass in columns then follow steps on multiplication of metric units.

	kg	g
	3	250
×		3
	9	750

Therefore, all kids weighed 9 kg and 750 g.

Exercise 4

Answer the following questions:

1. A road in one region measures 257 kilometres and 625 metres. Another road measures 5 times the previous. What is the length of the later road?

2. The bus travelled from one region to another with an average speed of 75 kilometres per hour. What distance will the bus travel in 14 hours ?

3. A can of oil weighs 16 kg and 130 g. What is the mass of a crate with 22 such cans if the mass of the empty crate is ignored?

4. A goat weighs 20 kg and 15 g. What is the total mass in kilograms and grams of 16 goats of the same mass?

5. The heights of eight pupils were measured and each pupil had 1.86 m. What was the total height of all the pupils?

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6. Nine books of the same type have the same width. Find the total width of those books in cm and mm, if the width of each book is 3 cm and 8 mm.

7. A carpenter made 15 tables of the same length. The length of one table is 1 m 8 dm 6 cm and 4 mm. Find the total length of the tables in m, dm, cm and mm.

8. The leathers of 45 cattle had the same mass. Find the total mass of all the leathers in kg and g if each leather weighed 10 kg and 24 g.

9. In a group of 60 people, each person used 25 litres and 750 millilitres of water. How many litres were used by all the people?

10. A total of 25 pieces of paper were arranged on top of the other to make a total thickness of 13 cm and 6 mm. What was the thickness of each piece of paper in cm and mm?

11. A mass of 125 kilograms of rice was bought by 8 people. If the rice was divided equally to all the people, how much rice in kg and g did each of the person get?

12. A piece of cloth whose length is 30 m and 60 cm was divided into 6 equal pieces. What was the length of each peace?

13. The length of a book shelf is 2 m and 5 cm. If 15 books of the same thickness were filled in that shelf, what is the thickness of each book in m, dm and cm?

14. The total height of 235 children is 282 m. If all children have the same height, what is the height of each child in m and dm?

15. The total width of 24 houses of the same width is 1 644 m. What is the width of each house in m and cm?

16. A total of 24 450 litres of milk were equally shared among 150 villagers. How many litres of milk was received by each villager?

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17. A total of 85 995 kilograms of meat were equally shared among 105 schools. How many kilograms did each school get?

18. Two hundred bags of groundnuts weigh 16 000 kg. Find the mass of each bag if all the bags have the same mass.

19. A total of 520 tons of millet were carried by 76 lorries. If each lorry carried the same mass, how many tons of millet were carried by each lorry?

20. In a certain city, there are 35 residents who are supposed to share equally 250 litres and 765 millilitres of water. How many litres of water will each resident get?

Revision exercise

Answer the following questions:

1.

m	cm
25	20
×	3

2.

km	cm	mm
6	12	50
×		4

3.

dm	mm
21	38
×	4

4.

hm	m
13	50
×	3

5.

kg	dag	g
3	16	42
×		9

6.

dag	g
51	7
×	8

7.

kg	g
11	428
×	26

8.

kg	dag	g
1	62	5
×		4

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9.

	l	ml
	6	12
×		8

10.

	l	ml
	8	14
×		17

11.

	m	cm	mm
4	8	14	26

12.

	dm	cm
9	48	51

13.

	hm	dam	cm
2	7	8	52

14.

	km	m
20	10	120

15.

	ton	kg	g
3	4	29	123

16.

	kg	g
23	7	475

17.

	kg	dag
5	46	4

18.

	ton	kg	g
2	15	245	26

19.

	l	ml
3	33	540

20.

	l	ml
50	240	800

21.

	l	ml
14	9	184

22.

	l	ml
7	12	110

23. A brick has length 12 centimetres and 30 millimetres. What is the total length of 50 bricks of the same kind?

24. A bunch of onions weighs 1 kilogram and 500 grams. What will be the mass in kg and g of 30 bunches of onions of the same type?

25. A water supplying company sells the average of 5 500 litres and 760 millilitres of water per day. How many litres of water will this company sell in a month consisting of 30 days?

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26. A container with goods weighs 29 tons and 700 kilograms without its mass. If the container carries 45 items of the same kind, what is the mass of each item?

27. A farm has length 225 m and 90 cm and width 50 m. If the farm is to be shared equally among 5 people, what length in metres of the portion will each person get?

28. A milk processing company supplied 2 500 litres and 500 millilitres of milk to 250 villagers during the milk drinking campaign. If the milk was supplied equally among the villagers, how much milk did each villager receive?

29. A total of 60 000 kilograms of beans were equally shared among 25 secondary schools. How many kilograms of beans were received by each school?

Summary

1. In order to multiply or divide metric units, it is important to know the relationship among the units.
   Example, 1 km = 1000 m, 1 kg = 1000 g and 1 litre = 1000 millilitres.
2. When multiplying or dividing metric units, the simplest way is to arrange the units in columns then multiply or divide by the given number.
3. When multiplying metric units, start multiplying from the smallest to the largest unit.
4. When dividing metric units, start dividing from the largest to the smallest unit.

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Chapter Ten

Business arithmetic



Introduction

The knowledge of business arithmetic is important in daily life. Financial institutions and individuals require this knowledge in managing revenues and expenditures as well as predicting profits or losses that may arise in business and other related daily activities. In this chapter, you will learn about solving word problems on profit and loss in business, and prepare invoices of quantities. The knowledge and skills gained will help you in managing business activities effectively and create awareness of profit and loss in business.

Profit and loss

Profit is an excess amount of money obtained after selling goods. Profit is obtained if the selling price is greater than the buying price. Thus, to obtain the profit we use the following formula:

$$\text{Profit} = \text{Selling price} - \text{Buying price}$$

Loss is the opposite of profit. Loss is obtained when selling price is less than buying price. Therefore, loss is the difference between buying price and selling price. That is;

$$\text{Loss} = \text{Buying price} - \text{Selling price}$$

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Word problems on profit and loss

Example 1

An orange was bought at 150 shillings and sold at 200 shillings.
(a) What was the profit generated?
(b) What was the percentage profit?

Solution

(a) Profit is the difference between selling price and buying price.
Selling price = sh 200
Buying price = sh 150
Profit = sh 200 – sh 150 = sh 50.
Therefore, the generated profit was sh 50.

(b) Percentage profit is obtained by expressing the profit as a fraction of buying price.

$$\frac{50}{150} = \frac{1}{3}$$

Multiply a fraction by 100% to obtain the percentage profit. That is,

$$\frac{1}{3} \times 100\% = 33.3\%$$

Therefore, the profit was 33.3%.

Example 2

Juma bought a pair of shoes at 25 000 shillings and sold it at 16 000 shillings.
(a) What loss did Juma get?
(b) What was the percentage of the loss?

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Solution

(a) Loss is the difference between buying price and selling price.

Loss = Buying price – Selling price

Selling price = sh 16 000;

Buying price = sh 25 000;

Loss = sh 25 000 – sh 16 000 = sh 9 000.

Therefore, Juma got a loss of 9 000 shillings.

(b) Percentage loss is obtained by expressing the loss as a fraction of buying price.

$$\frac{9\,000}{25\,000} = \frac{9}{25}$$

Multiply the fraction representing the loss by 100%. That is,

$$\frac{9}{25} \times 100\% = 36\%$$

Therefore, the loss was 36%.

Example 3

The carpenter made a door at a cost of 250 000 shillings and sold it at a profit of 10%.

(a) What profit did the carpenter get?

(b) How much money did the carpenter get in total?

Solution

(a) Cost of making a door = sh 250 000.

To obtain the profit, calculate 10% of sh 250 000 as follows:

$$10\% = \frac{10}{100}$$

Multiply the percentage profit by the cost of making a door. That is,

$$\frac{10}{100} \times 250\,000 = 25\,000$$

Therefore, the carpenter got a profit of 25 000 shillings.

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(b) The total amount of money that the carpenter got, is the sum of money for making the door and the profit made:
sh 250 000 + sh 25 000 = sh 275 000
Therefore, the carpenter got a total of 275 000 shillings.

Example 4



Amani bought 40 goats at sh 3 200 000 and sold them at the open market at a loss of 18%.
(a) What loss did Amani get in shillings?
(b) How much money did he get from the sales?

Solution

(a) To obtain the loss, calculate 18% of 3 200 000 shillings as follows:

$$18\% = \frac{18}{100}$$

Multiply the percentage loss by the cost of buying the goats. That is,

$$\frac{18}{100} \times 3\,200\,000 = 576\,000$$

Therefore, Amani got a loss of 576 000 shillings.

(b) The amount of money that Amani got is the difference between buying price and the loss. That is,

sh 3 200 000 – sh 576 000 = sh 2 624 000
Therefore, the amount of money Amani got after the sale was 2 624 000 shillings.

Exercise 1



Answer the following questions:

1. A gas cooker was bought at 180 000 shillings and sold at 225 000 shillings.
   (a) What was the selling profit?
   (b) What was the percentage of the profit?

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2. If Halima would have sold her cupboard for 1 200 000 shillings, there would be a loss of 240 000 shillings. Find the value of her cupboard.

3. Find the selling price of a book if the buying price was:
   (a) 15 000 shillings and sold at a profit of 5%
   (b) 9 000 shillings and sold at a loss of 10%
   (c) 2 400 shillings and sold at a profit of 25%
   (d) 12 000 shillings and sold at a loss of 10%
   (e) 4 000 shillings and sold at a profit of 5%

4. Find the buying price of commodities if the selling price was:
   (a) 16 000 shillings and was sold at a loss of 20%
   (b) 84 000 shillings and was sold at a profit of 5%
   (c) 5 700 000 shillings and was sold at a loss of 5%
   (d) 1 140 000 shillings and was sold at a loss of 5%
   (e) 6 900 000 shillings and was sold at a profit of 15%

5. John bought twenty chickens at 100 000 shillings and fifteen ducks at 126 500 shillings. He sold chickens at a profit of 25% and ducks at a profit of 15%. Calculate the total profit obtained.

6. Asia bought two hundred holiday cards at 3 000 shillings each. She sold the cards at 3 600 shillings each
   (a) Find the profit from the sales of all the cards
   (b) What was the percentage of the profit?

7. Mshamu bought one hundred pawpaws from a farmer at 750 shillings each. He sold each pawpaw at 1 000 shillings. If all pawpaws were sold, what profit did Mshamu get?

8. Doto was charged to pay 12% of his business capital as a penalty for failure to provide sales receipts to customers. If his capital was 8 800 000 shillings, what was the amount payed as penalty?

9. Mwajuma bought an air ticket to Mwanza at a price of 180 000 shillings. If 14% of the air ticket price was paid as penalty for postponing her flight, how much penalty did she pay?

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10. A businessman bought some commodities and allocated profit for each commodity as follows:

(i) One bag of beans; buying price 240 000 shillings and a profit of 20%

(ii) One bag of rice; buying price 165 200 shillings and a profit of 18%

(iii) One bag of maize; buying price 77 000 shillings and a profit of 10%

(iv) One bag of cowpeas; buying price 89 600 shillings and a profit of 12%

How much profit will he get after selling all commodities?

Invoice

An invoice is a list of items bought or sold with their prices or unit costs. Invoices are used to keep records of requirements, expenditures, sales and profits in a certain period of time. The symbol @ which denotes "for each" is used when writing invoices. The symbol is usually placed between the quantity of an item and its unit price which means "price for each item". Therefore, the cost of the item is obtained by multiplying the quantity of items by the unit price.

Example 1

On 3.12.2018, Aneth was given sh 23 000 by her mother to buy school requirements as follows:
2 pairs of socks @ sh 1 200, 10 small exercise books @ sh 600, 15 pens @ sh 250, 5 pencils @ sh 100 and 4 erasers @ sh 150.

Prepare an invoice of quantities and find her balance after expenditures.

Solution

Aneth's invoice on 3.12. 2018 was as follows:

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Items	Cost (sh)
2 pairs of socks @ sh 1 200	2 400
10 small exercise books @ sh 600	6 000
15 pens @ sh 250	3 750
5 pencils @ sh 100	500
4 Erasers @ sh 150	600
Total	**13 250**

Aneth spent a total of 13 250 shillings.
The amount left after expenditure is:
sh 23 000 – sh 13 250 = sh 9 750

Therefore, her balance was 9 750 shillings.

Example 2

After receiving a salary of 134 000 shillings on 26.04. 2019, Tumaini bought the following items:
6 kg of sugar @ sh 2 400
3 litres of cooking oil @ sh 1 200
10 kg of maize flour @ sh 900
7 kg of rice @ sh 1 600
Tumaini deposited the remaining amount in his bank account. Prepare Tumaini's invoice, and then find the amount deposited in the bank account.

Solution

Tumaini's invoice on 26.04. 2019 was as follows:

Items	Cost (sh)
6 kg of sugar @ sh 2 400	14 400
3 litres of cooking oil @ sh 1 200	3 600
10 kg of maize flour@ sh 900	9 000
7 kg of rice @ sh 1 600	11 200
Total	**38 200**

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Tumaini spent a total of 38 200 shillings
Amount received = sh 134 000
Expenditures = sh 38 200
Amount deposited in the bank = amount received – expenditures
= sh 134 000 – sh 38 200 = sh 95 800

Therefore, the amount deposited in the bank account is sh 95 800.

Exercise 2

Answer the following questions:

1. Rose was given 23 000 shillings on 18.03.2018. She bought 2 litres of milk @ sh 1 500, 2 kilograms of beans @ sh 2 500, and 2 trays of eggs @ sh 7 500. Write an invoice of these items.

2. Atupele received a salary of 129 569 shillings on 23.04. 2019 and bought the following items: 3 pairs of trousers @ sh 15 000, 3 shirts @ sh 12 400, 1 belt @ sh 7 000, and 2 bedsheets @ sh 3 000. Write an invoice of these items.

3. Subira bought the following items on 04.09.2018: 2 pairs of khanga @ sh 7 500, 1 pair of shoes @ sh 14 000, 3 pairs of socks @ sh 1 500, 3 tins of shoe polish @ sh 2 000 and 2 airtime vouchers @ sh 1 000. If she had 100 000 shillings, what will be her balance?

4. On 20.05.2019, Joyce received 20 000 shillings from her sister for purchasing the following items:
   2 shoe brushes @ sh 400
   3 pieces of soap bar @ sh 250
   3 airtime vouchers @ sh 500
   10 bottles of soda @ sh 500
   5 kilograms of maize flour @ sh 1 000
   (a) Write an invoice of these items
   (b) Find the amount of money remained

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5. Hamisi had 25 000 shillings on 01.11.2018. He used some amount to buy the following items: Four cans of tomatoes at sh 600 each, 3 pairs of slipers for sh 1 300 each, 10 kilograms of wheat flour for sh 1 200 per kilogram, 5 kilograms of cowpeas for sh 600 per kilogram and 2 kilograms of groundnuts at sh 800 per kilogram.
(a) Prepare an invoice of these items
(b) Find the amount of money Hamisi remained with

6. On 14.07.2018 the treasurer of a wedding committee collected 8 000 000 shillings for Juma's wedding ceremony. The budget for the ceremony was as follows:
Drinks for 200 people @ sh 8 000,
Food for 200 people @ sh 10 000,
Reception hall sh 1 500 000,
3 cars for transport @ sh 150 000.
(a) Write an invoice of these items
(b) Find the amount of money remained after the ceremony

7. On 20.05.2018 Mwajuma bought the following items:
5 kilograms of sugar @ sh 2 500, 10 litres of cooking oil @ sh 3 500, 20 kilograms of rice @ sh 2 000 and 6 packets of salt @ sh 500.
(a) Write an invoice of these items
(b) If Mwajuma had one hundred thousand shillings, how much money was she left with?

8. Write an invoice of the following purchases done by the Head teacher of Kaloleni primary school on 07.01.2018:
25 seedlings of flowers @ sh 700, 12 big exercise books @ sh 3 000, 12 rulers @ sh 250, 2 thermos flasks @ sh 18 000 and 3 office curtains @sh 8 000. How much money was paid for the purchases?

9. On 12.05.2019 the sales of a fruits vender were as follows:
55 oranges @ sh 200, 10 watermelons @ sh 3 000, 22 pawpaws @ sh 1 500, ripe bananas at sh 3 000, 70 avocados @ sh 500 and 31 pineapples @ sh 1 000. How much money was collected by the fruits vender?

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10. On 14.05.2019 a mother had 25 000 shillings. She used some of her money to buy the following items: 3 bunches of green vegetables @ sh 500, 2 kilograms of meat @ sh 7 500, $\frac{1}{2}$ litre of cooking oil @ sh 3 500 and $3\frac{1}{2}$ kilograms of maize flour @ sh 600.

(a) Write an invoice of these items

(b) How much money did she remain with?

Revision exercise

Answer the following questions:

1. Find the selling price of certain commodities if the buying price was:

(a) 75 000 shillings and sold at a proft of 15%

(b) 36 000 shillings and sold at a profit of 20%

(c) 2 400 000 shillings and sold at a profit of 24%

2. Find the buying price of a commodity if the selling price was:

(a) 32 000 shillings and sold at a loss of 20%

(b) 840 000 shillings and sold at a profit of 12%

(c) 2 100 000 shillings and sold at a loss of 25%

3. Tumaini purchased a car at sh 7 250 000 and sold it at sh 9 820 000.

(a) How much profit did he get?

(b) What was the percentage of the profit?

4. Anna was given 30 000 shillings on 17.04.2019. She bought 4 litres of milk @ sh 2 000, 3 kilograms of beans @ sh 2 200 and 2 kilograms of rice @ sh 1 900. Write an invoice of these items.

5. Issa received a salary of 450 000 shillings on 25.05.2019 and bought the following items: 3 shirts @ sh 20 000, 2 pairs of trousers @ sh 32 400, 1 hat @ sh 4 500 and 1 belt @ sh 3 000. Write an invoice of these items.

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6. On 09.01.2018, Thomas bought the following items: 1 pair of shoes @ sh 14 000, 3 pairs of khanga @ sh 12 000, 3 pairs of socks @ sh 1 500, 2 tins of shoe polish @ sh 2 000 and 2 airtime vouchers @ sh 1 000. If he had 90 000 shillings, how much money did he remain with?

7. On 14.05.2018 Kabibi was given 20 000 shillings by her sister to buy the following requirements:
2 medicated soaps @ sh 800,
3 washing soaps @ sh 250,
3 airtime vouchers @ sh 1 000,
1 tube of toothpaste @ sh 1 500.
(a) Write an invoice of these items
(b) Find the remaining amount of money

8. On 22.12.2018 Mwajuma bought the following items: 5 kilograms of flour @ sh 1 200, 5 litres of cooking oil @ sh 1 500, 10 kilograms of sugar @ sh 2 000 and 3 packets of salt @ sh 500.
(a) Write an invoice of these items
(b) If Mwajuma had sh 50 000, how much money did she remain with?

9. The Head teacher of Mtakuja Primary school did the following purchases on 02. 09. 2018: 20 garden seedlings @ sh 2 000, 12 counter books @ sh 2 000, 12 rulers @ sh 500, 2 thermos flasks @ sh 12 000 and 3 office curtains @ sh 8 000. How much did he pay in total?

10. On 02.01.2010, the fruits vender sold a variety of fruits as follows:50 mangoes @ sh 500, 10 water melons @ sh 2 000, 20 pineapples @ sh 1 000, 3 bunches of bananas @ sh 15 000, 70 avocados @ sh 800 and 30 oranges @ sh 200. How much money did the vender get?

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11. Mzee Bakari had 50 000 shillings on 06.07.2019 and bought the following items: 3 bunches of vegetables @ sh 500, 2 kilograms of meat @ sh 5 000, $1\frac{1}{2}$ litres of cooking oil @ sh 2 500 and $3\frac{1}{2}$ kilograms of wheat flour @ sh 1 500. Write an invoice of these items, hence find the remaining amount of money.

Summary

1. Profit is an excess amount of money obtained after selling goods.
2. Profit is the difference between the selling price and the buying price.
3. Loss is the opposite of profit.
4. An invoice is a list of items sold or bought and their prices.
5. The symbol @ is used when writing invoices to represent the words “for each”.

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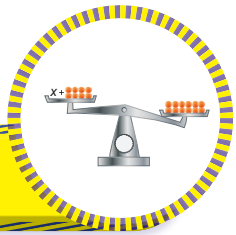
Chapter Eleven

Algebra



Introduction

In Standard Five, you learnt about algebraic expressions and how to use mathematical operations to simplify them. In this chapter, you will learn about the meaning of simple equations, solving simple equations and word problems involving simple equations. The knowledge and skills gained will enable you to translate word problems into mathematical statements. For example, finding the age of a person which is related to the age of another person.

Exercise 1: Revision

Write the variables in each of the following terms:

1. 5p
2. 3mn
3. pk
4. n

Write the coefficient in each of the following terms:

5. 2pq
6. m
7. 4ab
8. pk

Answer the following questions:

9. 6n + n + 2n =
10. 4k + 8k =
11. 2p + 4a + p + 2a =
12. 4m + 3n + 4m + 3n =
13. 2m – m =
14. 6k – k – 3k =

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15. $16x - x - 14x =$

16. $7mk - 4mk - mk =$

17. $8a + 6a - a =$

18. $7m - m - 2m =$

19. $8t - t - 8t =$

20. $16ap + 4q - 6pa - 3q =$

21. $m \times m =$

22. $3a \times a =$

23. $t \times k \times r =$

24. $y \times w \times 2y \times 3w =$

25. $6b \div 2 =$

26. $15a \div 5a =$

27. $12nm^2 \div 12m =$

28. $8y^2 w^2 + 4yw^2 =$

If $a = 1$, $b = -2$, $x = 3$ and $y = 2$, find the value of the following expressions:

29. $2a + 6b =$

30. $a + x =$

31. $3y - 2x + b =$

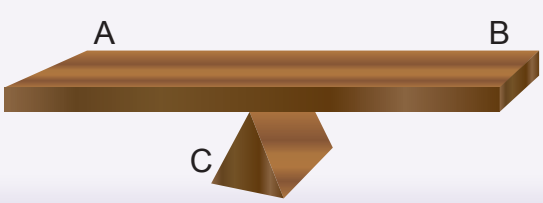
32. $-x - 3b + 7a =$

Simple equations

The word "equation" is derived from the verb "equal". An equation is like a beam balance whereby two sides must be balanced. Therefore, an equation is a mathematical statement which shows that the two expressions separated by an equality sign are equal.

Activity

Use a piece of wood or timber to make the following instrument, then use it to perform the balancing game.



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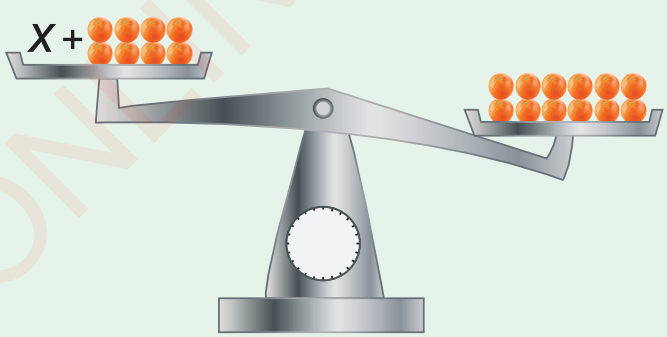
Steps:

1. The letters A and B represent the positions for putting two weighing blocks, one on A and the other on B.
2. The object labelled C is placed between A and B as shown in the figure.
3. The object C represents the symbol "=", it means that the two sides A and B need to be equal.
4. If the two sides, A and B in the figure are not balanced, that is one side is heavier than the other, then the figure will not represent a simple equation.
5. In order to make a simple equation, the two sides A and B must be balanced.
6. You can also use bags of sand instead of weighing blocks to perform the experiment.

Example 1

Letter x represents the number of oranges required to make the two sides of the beam balance equal. How many oranges are represented by x?



For the two sides of the beam balance to be equal, four oranges are required on the left side. Therefore, all one variable linear algebraic equations are called simple equations.

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How to identify simple equations

Simple equations have one variable whose exponent is one (1).

Example 2

Study the following equations and identify simple equations:

(a) $3x + 5 = 16$
(b) $2xy - 7 = 2x + 3$
(c) $x^2 - 16 = 0$
(d) $4(y + 5) = 3(y - 1)$

Answer

Equations (a) and (d) are simple equations because each has one variable and its highest exponent is one.
Equation (b) is not a simple equation because the first term on the left side, 2xy has two variables x and y.
Equation (c) is not a simple equation because the highest exponent of *x* is 2

Exercise 2

Which of the following are simple equations?

1. $x - 3 = 3$
2. $a^2 - 1 = 1$
3. $9(y + 5) = 4(y - 1)$
4. $x - 37 = 2x - 3$
5. $3x^2y - 1 = 16$
6. $y + 5 = 0$
7. $2c - 7c = 2a + 3$
8. $k - 16 = 3k - 3$
9. $4 = 3(y - 1)$
10. $w + 5 = 3(w - 1)$

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Solving simple equations

Consider the following when solving simple equations:

1. Collect terms with variables to the left side of the equation and numbers to the right side. Note that, when collecting terms with variables or numbers to the other side of equal sign, the operation sign changes. If the operation is addition (+), it changes to subtraction (–) and subtraction (–) changes to addition (+).
2. Adding or subtracting same numbers in both sides of the equation does not affect the equation.
3. Multiplying or dividing by the same numbers in both sides of the equation does not affect the equation.

Addition in simple equations

Example 1

Find the value of p in the following equation: $p + 2 = 3$.

Solution

To make p remain alone in the left hand side of the equation, collect $+2$ to the other side of the equation. It changes to –2.

That is, $p = 3 - 2$

$p = 1$

Therefore, the value of $p = 1$.

Alternatively, from $p + 2 = 3$

Subtract 2 from both sides:

$p + 2 - 2 = 3 - 2$

$p = 1$

Therefore, the value of $p = 1$.

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Example 2

Find the value of x in the following equation: $x + 8 = 4$.

Solution

$x + 8 = 4$.

To make x remain alone in the left handside of the equation, subtract 8 from both sides of the equation:

$$x + 8 - 8 = 4 - 8$$
$$x + 0 = -4$$
$$x = -4$$

Therefore, the value of $x = -4$.

Example 3

Find the value of k in the following equation: $-23 + k = 32$.

Solution

$-23 + k = 32$

Add 23 in both sides of the equation:

$$-23 + 23 + k = 32 + 23$$
$$0 + k = 55$$
$$k = 55$$

Therefore, the value of $k = 55$.

Example 4

Find the value of y if $y + 12 + 2y = 69$.

Solution

Combine the like terms.

$y + 2y + 12 = 69$

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$3y + 12 = 69$

Subtract 12 from both sides of the equation:

$3y + 12 - 12 = 69 - 12$

$3y + 0 = 57$

$3y = 57$

Divide both sides of the equation by the coefficient of *y*. That is, divide both sides of the equation by 3.

$$\frac{3y}{3} = \frac{57}{3}$$

$$y = 19$$

Therefore, the value of y = 19.

Exercise 3

Find the value of each variable in the following equations:

1. $t + 8 = 2$
2. $a + 17 = 13$
3. $9 = 4 + n$
4. $-1 = y + 3$
5. $-x + 12 = 2$
6. $m + 8 = -9$
7. $n + 2n + 11 = 4$
8. $a + 8 + 3a = 4$
9. $60y + 40 + 59y = 170$
10. $-21 = 6p + 8p + 7$
11. $0.2x + 22 = 8.8$
12. $5.5n + 55 + 10.5n = 311$
13. $6.25t + 0.05 = 6.3$
14. $\frac{4}{5}w + \frac{1}{5} = \frac{21}{5}$
15. $\frac{6}{7} + \frac{1}{3}c = \frac{1}{3}$
16. $\frac{9}{s} + \frac{2}{5} = \frac{7}{4}$
17. $\frac{x}{3} + \frac{1}{5} + \frac{4x}{3} = \frac{16}{5}$
18. $775\,000 = 55\,000r + 225\,000$
19. $400\,000m + 800\,000 = 1200\,000$
20. $\frac{250\,000}{5}p + \frac{100\,000}{7} = \frac{450\,000}{7}$

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Subtraction in Simple equations

Example 1

Find the value of k in the equation $k - 5 = 7$.

Solution

To make k remain alone in the left hand side of the equation, add 5 on both sides

$k - 5 + 5 = 7 + 5$

$k + 0 = 12$

$k = 12$

Therefore, the value of $k = 12$.

Example 2

Find the value of v in the equation $-14 = v - 19$.

Solution

Since it is a simple equation, re-write it as:

$v - 19 = -14$

To make v remain alone in the left hand side, add 19 in both sides of the equation. That is,

$v - 19 + 19 = -14 + 19$

$v = 5$

Therefore, the value of $v = 5$.

Example 3

Find the value of R if $R - 0.5 = 9$.

Solution

To make R remain alone in the left hand side, add 0.5 in both sides of the equation.

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That is, $R - 0.5 + 0.5 = 9 + 0.5$

$R + 0 = 9.5$

$R = 9.5$

Therefore, the value of $R = 9.5$.

Example 4

Find the value of w in the following equation:
$7w - 18 - w = 72$

Solution

Collect the like terms and subtract.

$7w - w - 18 = 72$

$6w - 18 = 72$

Add 18 in both sides of the equation.

$6w - 18 + 18 = 72 + 18$

Thus,

$6w + 0 = 90$

$6w = 90$

Divide both sides of the equation by the coefficient of w. That is, divide both sides of the equation by 6.

$$\frac{6w}{6} = \frac{90}{6}$$

$w = 15$

Therefore, the value of $w = 15$.

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Exercise 4

Find the value of the variable in each of the following equations:

1. $c - 7 = 2$
2. $f - 14 = -12$
3. $-w - 3 = 12$
4. $-1 = y - 3$
5. $-x - 48 = 2$
6. $q - 0.3 = 0.2$
7. $n - 40 = 20$
8. $10 = 7a - 21 - 6a$
9. $14y - 5 - 13y = 30$
10. $a - \frac{1}{2} = 13$
11. $0.4x - 4.4 = 17.6$
12. $16.5p - 165 - 31.5p = 1\,335$
13. $0.5a - 1 = 6.50$
14. $\frac{8}{5}x - \frac{2}{5} = \frac{46}{5}$
15. $\frac{9}{7} - \frac{5}{3}z = \frac{4}{3}$
16. $\frac{9}{c} - \frac{2}{5} = \frac{1}{2}$
17. $\frac{19}{5} = \frac{-a}{3} - \frac{1}{5} - \frac{2a}{3}$
18. $775 = 25k - 225$
19. $400\,000m - 800\,000 = 120\,000$

Multiplication in simple equations

The opposite of multiplication is division. Therefore, in solving equations which involve multiplication, you can also apply division.

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Example 1

Find the value of x if $7 \times x = 49$.

Solution

The equation $7 \times x = 49$ can be written as $7x = 49$.
Make x remain alone in the left hand side by dividing both sides of the equation by 7.

$$\frac{7x}{7} = \frac{49}{7}$$
$$x = 7$$

Therefore, the value of x = 7.

Example 2

Find the value of n if $-3 \times n - 5 = 61$.

Solution

The equation $-3 \times n - 5 = 61$ can be written as $-3n - 5 = 61$
Add 5 in both sides of the equation.

$$-3n - 5 + 5 = 61 + 5$$
$$-3n + 0 = 66$$
$$-3n = 66$$

Divide by – 3 on both sides of the equation.

$$\frac{-3n}{-3} = \frac{66}{-3}$$
$$n = -22$$

Therefore, the value of n = –22.

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Example 3

Find the value of k if $\frac{3}{4}k \times \frac{1}{3} = 24$.

Solution

Multiply terms on the left hand side of the equal sign (=). That is, numerator × numerator and denominator × denominator.

$$\frac{3}{4}k \times \frac{1}{3} = \frac{3}{12}k$$

Thus, $\frac{3}{12}k = 24$

In order to convert the fraction into whole number, multiply both sides by 12. That is,

$$12 \times \frac{3}{12}k = 24 \times 12$$

$$3k = 288$$

To make x remain alone in the left hand side, divide both sides of the equation by 3.

$$\frac{3k}{3} = \frac{288}{3}$$

$$k = 96$$

Therefore, the value of k = 96.

Exercise 5

Find the value of the variable in each of the following equations:

1. $x \times 4 = 36$
2. $7 = -3y$
3. $4w \times 20 = 8$
4. $-3 = 81k$
5. $6v \times \frac{1}{5} = \frac{12}{5}$
6. $\frac{1}{2}r \times \frac{8}{6} = \frac{9}{4}$
7. $1\frac{3}{7} = \frac{20}{7v}$
8. $0.3p \times 0.1 = 0.01$
9. $0.5t \times 0.25 = 500$
10. $1\,000 = n \times 0.5$

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11. $\frac{-2}{3p} \times \frac{2}{3} = \frac{4}{9}$

12. $\frac{45}{2t} = \frac{20}{9}$

13. $300\,000y \times \frac{2}{3} = 900\,000$

14. $\frac{2}{3z} \times 4\,500\,000 = 900\,000$

15. $\frac{k}{3} \times 2\,400\,000 = 7200\,000$

Division in simple equations

The opposite of division is multiplication. Therefore, when solving simple equations which involve division you have to multiply both sides of the equation by the denominator.

Example 1

Find the value of x if $x \div 2 = 4$.

Solution 1

$x \div 2 = 4$

Re-write the equation in fraction to get the numerator and denominator:

$\frac{x}{2} = 4$

Multiply both sides of the equation by 2 (the denominator). That is,

$2 \times \frac{x}{2} = 4 \times 2$

$x = 8$

Therefore, the value of $x = 8$.

Example 2

Find the value of m if, $-2 \div m = 7$.

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Solution

$-2 \div m = 7$ can be written as $\frac{-2}{m} = 7$

Also, $\frac{-2}{m} = 7$ can be written in the form $-\frac{2}{m} = 7$

Multiply both sides of the equation by m (the denominator). That is,

$$m \times -\frac{2}{m} = 7 \times m$$
$$-2 = 7m$$

Divide both sides of the equation by 7 to make m remain alone in one side of the equation.

$$-\frac{2}{7} = \frac{7m}{7}$$
$$-\frac{2}{7} = m$$

Therefore, the value of $m = -\frac{2}{7}$.

Exercise 6

Find the value of the variable in each of the following equations:

1. $x \div 4 = 5$
2. $3 = -y + 1$
3. $4w \div 20 = 8$
4. $k \div 3 = 81$
5. $625 \div \frac{t}{5} = 125$
6. $\frac{1}{2}r \div \frac{2}{8} = \frac{1}{4}$
7. $\frac{3}{4} = \frac{1}{5}v \div \frac{2}{5}$
8. $0.3x \div 0.1 = 4$
9. $2.5t \div 1.25 = 500$
10. $\frac{-2}{3p} \div \frac{2}{3} = 1$

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Solving simple equations with variable on both sides

Example 1

Find the value of x if $7x - 6 = x + 18$.

Solution

$7x - 6 = x + 18$

Collect terms with variable on one side and numbers on the other side.

$7x - x = 18 + 6$

Combine terms with variable and those without variable to get

$6x = 24$

Divide both sides of the equation by 6. That is,

$$\frac{6x}{6} = \frac{24}{6}$$

$$x = 4$$

Therefore, the value of $x = 4$.

Example 2

Find the value of b if $3b - 4 = b + 8$

Solution

Collect the terms with variable on one side and numbers on the other side.

From $3b - 4 = b + 8$

$3b - b = 8 + 4$

$2b = 12$

Divide both sides by 2 to make b remain alone in one side of the equation.

$$\frac{2b}{2} = \frac{12}{2}$$

$b = 6$

Therefore, the value of $b = 6$.

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Exercise 7

Find the value of the variable in each of the following equations:

1. $3x + 5 = 29 - 5x$
2. $3y + 1 = -y + 7$
3. $w + 3 = 2(2w - 3)$
4. $7(k - 1) = -k + 9$
5. $22r + 4 = 52 + 14r$
6. $7c + 2 = 5c + 18$
7. $\frac{1}{2}y = y - 20$
8. $20r - 7 = 22r + 23 + 3r$
9. $\frac{3(t-1)}{2} = 2t + 1$
10. $\frac{1}{2}r - 1 = \frac{1}{4}r + 2$
11. $\frac{3}{4}(v - 1) = \frac{1}{5}v \div \frac{2}{5}$
12. $0.3x \div 0.1 = 0.4x - 0.9$
13. $2.5t - 1.25 = 0.5t + 2.75$
14. $\frac{-2}{3p-1} = \frac{1}{3+p}$

Word problems on simple equations

Example 1

Ali bought a bus ticket for 450 shillings to travel to school and remained with 1 750 shillings. How much money did he have?

Solution

Let y be the total amount of money Ali had before buying a ticket.

Therefore, the equation will be: $y - 450 = 1\,750$

Add 450 on both sides of the equation.

$y - 450 + 450 = 1\,750 + 450$

$y + 0 = 2\,200$

$y = 2\,200$

Therefore, Ali had 2 200 shillings.

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Example 2

Rehema is 5 years older than Kemi. If the sum of their ages is 25 years, find their ages.

Solution

Form a simple equation by choosing any variable.
Let x be the age of Kemi.
Note that Rehema is 5 years older than Kemi. Thus, add 5 to Kemi's age to get Rehema's age.

That is, Rehema's age $= x + 5$

So the simple equation is, $(x + 5) + x = 25$.
Collect the terms with variable and add them.

$x + x + 5 = 25$

$2x + 5 = 25$

Subtract 5 from both sides of the equation.

$2x + 5 - 5 = 25 - 5$

$2x + 0 = 20$

$2x = 20$

Divide both sides by 2 to get the value of x.

$$\frac{2x}{2} = \frac{20}{2}$$

$x = 10$

Therefore, Kemi's age is 10 years

Rehema's age = 10 + 5 = 15 years.

Example 3

The age of Furaha is $\frac{1}{2}$ of the age of her aunt. If the sum of their ages is 54 years, find their ages.

Solution

Let x be the age of Furaha's aunt.
The age of Furaha = $\frac{1}{2}x$

But the sum of their ages is 54 years.

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Thus, the simple equation is given by:

$$x + \frac{1}{2}x = 54$$

$$\frac{2x + x}{2} = 54$$

$$\frac{3x}{2} = 54$$

Multiply both sides of the equation by 2 to get:

$$\frac{3x}{2} \times 2 = 54 \times 2$$

$$3x = 108$$

Divide by 3 on both sides

$$\frac{3x}{3} = \frac{108}{3}$$

$$x = 36$$

Thus, the age of Furaha's aunt is 36 years. The age of Furaha is given by:

$$\frac{1}{2}x = \frac{1}{2} \times 36 = 18$$

Therefore, the age of Furaha is 18 years.

Exercise 8

Answer the following questions:

1. Joseph bought a pen at 200 shillings and remained with 2 300 shillings. How much money did he have before buying the pen?
2. Amina sold 800 trees from her farm and 324 trees remained in the farm. How many trees were there in the farm?
3. Think of a number and subtract $\frac{1}{8}$ from it. If the answer is 41, what is the number?

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4. Think of a number, multiply it by 3 and add 5 to the product. If the answer is 20, what is the number?

5. Think of a number, multiply it by 8, and add 15 to the product. If the answer is 22, what is the number?

6. A school has 249 girls. If the number of girls is $\frac{3}{4}$ of all the pupils, how many pupils are at the school?

7. The area of a rectangle is 30 m^2. If its width is p metres and its length is 8 metres, find the width of the rectangle.

8. The height of a triangle is k cm . If its area is 30 cm^2 and its base is 6 cm, what is the value of k?

9. The number of pupils who attended school is 0.8 of all the pupils. If 720 pupils attended to school, what is the total number of pupils at the school?

10. The price of a chicken is 8 000 shillings. How many chickens will be sold to get 72 000 shillings?

11. If 5n + 15 children ate 350 oranges, find the value of n if every child ate one orange.

Revision exercise

Which of the following are simple equations?

1. $5x - 3 = -8 - x$

2. $a^2 - 2 = 6 - b$

3. $-9 \times 5y = 8 (y - 3)$

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Find the value of the variable in each of the following equations

4. $y + 2y + 5y = \frac{1}{2}$

5. $c + 10 + 9c = 20$

6. $-42 = 12s - 16s - 14$

7. $0.3x + 0.1 = 0.12$

8. $\frac{4}{5}y = 4 - \frac{1}{5}y$

9. $3q - 0.9 = 0.6$

10. $5x - 200 = 100$

11. $10 - 6b = 7b - 29$

12. $0.9x - 0.1 = 0.8$

13. $\frac{3}{4}c - \frac{2}{4}c = \frac{1}{16} - \frac{1}{8}c$

14. $-5 + 14y - 13y + 30 = 0$

15. $5a - \frac{9}{2} = 65 - \frac{a}{2}$

16. $0.01m \times 0.3 = 0.001$

17. $0.5f \times 0.25 = 0.0625$

18. $\frac{-2}{3} = \frac{4}{2y}$

19. $3x \div 7 = 6$

20. $\frac{3}{4} \div j = 1\frac{1}{2}$

21. Think of a number, multiply it by $\frac{3}{4}$ and subtract 6 from the product. If the answer is 66, what is the number?

22. Think of a number, divide it by 7 and add 6 to the result. If the answer is 3 times the number, find the value of this number.

23. Zakaria is 3 years older than Abedi. If the sum of their ages is 37, find the age of Zakaria?

24. Juma is 5 years older than Anna. If the sum of their ages is twenty-five years, find their ages.

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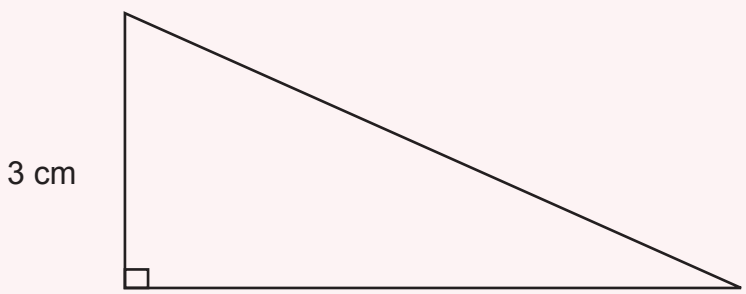
25. The area of the following triangle is 36 cm^2. Find the length of its base.



26. If the area of the following rectangle is 105 cm^2, find the value of its length.



Summary

1. A simple equation is an arrangement of algebraic terms which require the left side and the right side to be equal.
2. A simple equation has one variable whose exponent is 1.
3. When collecting like terms to the other side of an equal sign, the operation sign changes.
4. Adding or subtracting the same number on both sides of the simple equation does not change the meaning of the equation.
5. Multiplying or dividing the same number on both sides of the simple equation does not change the meaning of the equation.

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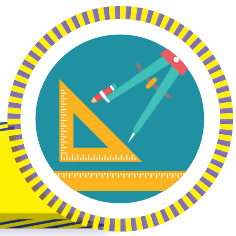
Chapter Twelve

Geometry



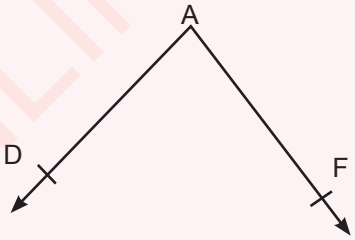
Introduction

In Standard Five, you learnt about types of angles, drawing and estimating angles, drawing symetrical lines, identifying types and properties of triangles, finding areas of rectangles, squares and triangles and solving word problems. In this chapter, you will identify parallel lines, perpendicular lines and four sided figures. You will also draw and calculate angles of plane figures and calculate the perimeters and areas of plane figures. The knowledge and skills gained will enable you to prepare and design different shapes of real objects such as sketches of house plans and other buildings.

Exercise 1: Revision

Answer the following questions:

1. Write the name of the angle in the following figure:



2. Write all angles in the following figure:



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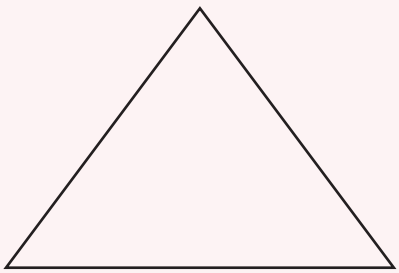
3. Study the following figure and answer questions that follow:



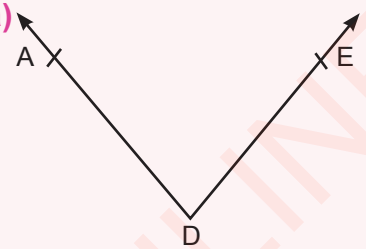
(a) Write the name of the figure.
(b) Write the number of sides of the figure.

4. How many angles are there in a square?

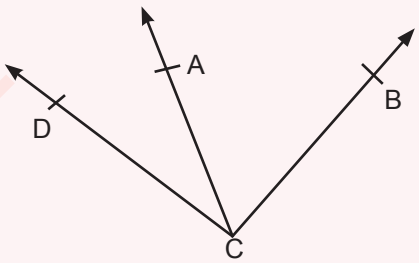
5. How many angles are there in a rectangle?

6. Write the number of angles in each of the following figures:

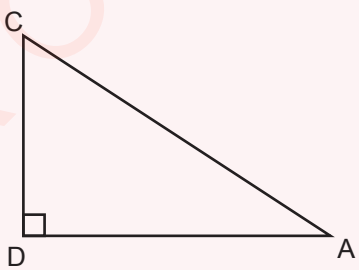
(a)



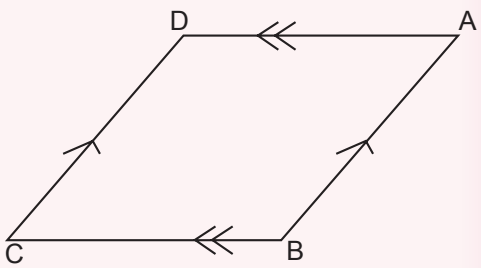
(b)



(c)



(d)



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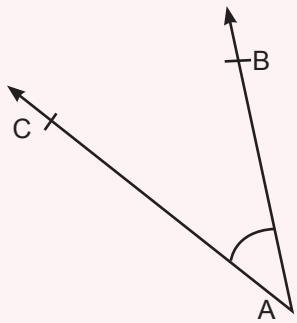
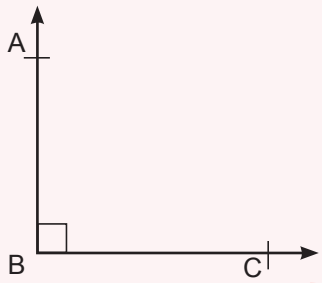
Study the following angles, then answer questions 7 – 11.

(a)



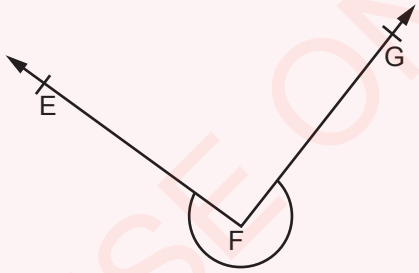
(b)



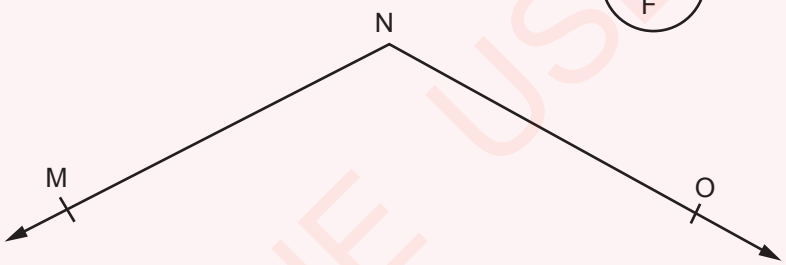
(c)



(d)



(e)



7. Which angle is an obtuse?

8. Which angle is a reflex?

9. Which angle is a right angle?

10. Which angle is less than $E\hat{F}G$ and larger than $M\hat{N}O$?

11. Which angle is larger, $M\hat{N}O$ or $A\hat{B}C$?

Draw the angles in questions 12 – 16:

12. $A\hat{B}C$ measures 60 degrees.

13. $M\hat{N}O$ measures 120 degrees.

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14. $K\hat{L}M$ measures 210 degrees.

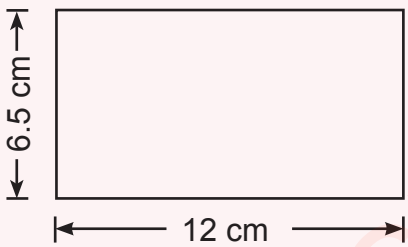
15. $G\hat{E}F$ measures 330 degrees.

16. $P\hat{Q}R$ measures 75 degrees.

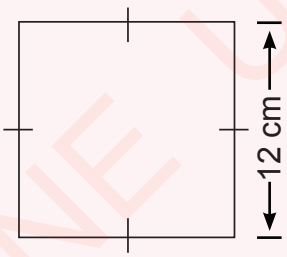
17. Find the area of a triangle with height 15 cm and base 20 cm.

Find the area of each figure in questions 18 and 19.

18.



19.



20. A square garden has length 5.6 m. Find its area.

21. A top of the rectangular table has length 3 m and width 2.5 m. Find its surface area.

22. A triangular farm has an area 675 m^2. If its base is 135 m, find its height.

23. A floor of a square room has an area 81 m^2. Find the length of one side of the room.

24. The area of a triangle is 625 m^2. If its height is 25 m, find the length of its base.

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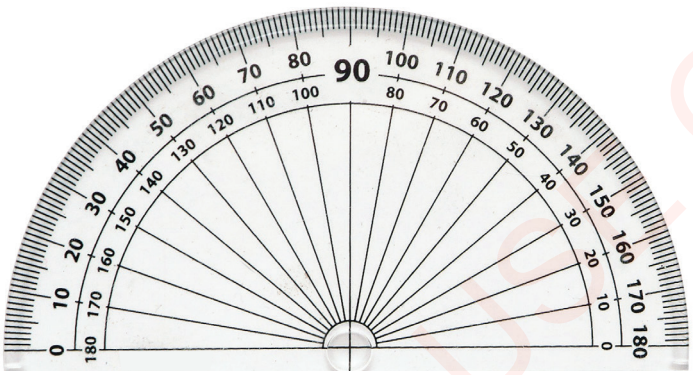
25. The area of a rectangle is 400 cm^2. If its length is 25 cm, find its width.

Measuring angles

An angle is the amount of space between two intersecting lines. Angles are measured by using a protractor. The protractor takes measurements in degrees which start from 0 to 180 degrees, that is from 0° to 180°.

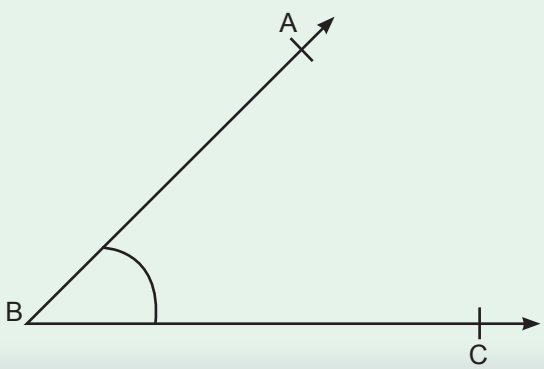


The protractor has inner and outer scales. An angle can be measured from any side of the protractor. A decision to use either the inner or the outer scale depends on the position of the reference line. The angles are measured from 0° to 180° on the scale where the reference line points.

Example 1

Measure the angle in the following figure:

Solution



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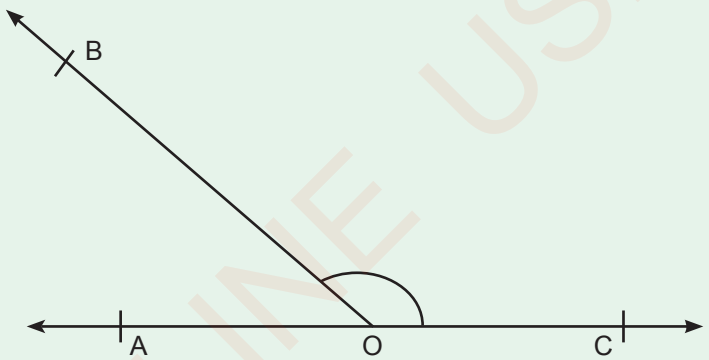
(a) Put the protractor on the figure so that the line from 0° to 180° of the protractor lies on $\overline{BC}$.
(b) Make sure that the angle formed by line from 0° to 180° and the vertical line of the protractor lies exactly on $A\hat{B}C$.
(c) The line $\overline{AB}$ will show the required degree measure of the angle.
(d) Read and record the degree which concides with $\overline{AB}$ on the inner scale of a protractor.
(e) The degree on the scale where $\overline{AB}$ extends is the size of the angle.
(f) Therefore, angle ABC is 45°.

Example 2

Measure $B\hat{O}C$ in the following figure:



Solution

(a) Put the protractor on the figure in such a way that line from 0° to 180° lies on $\overline{AC}$. Make sure that the vertical line and horizontal line from 0° to 180°of the protractor meet at point O, that is, the point where $\overline{OC}$ and $\overline{OB}$ meet.
(b) Read the degree which is on $B\hat{O}C$ from the inner scale of the protractor. The number on the scale where $\overline{OB}$ extends is the size of $B\hat{O}C$.
(c) Therefore, $B\hat{O}C$ is 140°.

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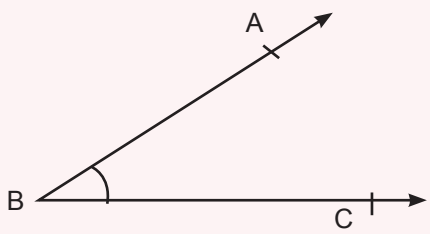
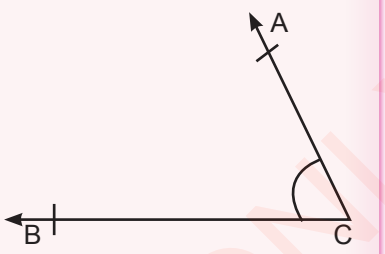
Exercise 2

Measure and write the size of the following angles by using a protractor:

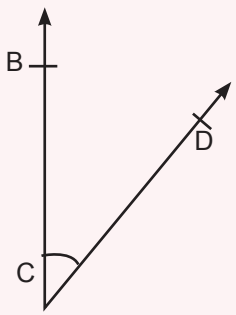
1.



2.



3.



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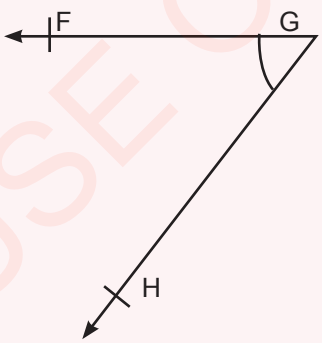

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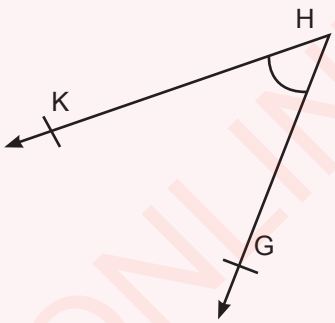

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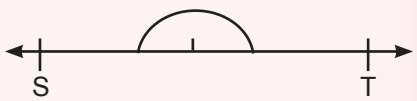

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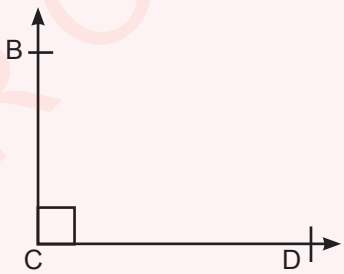
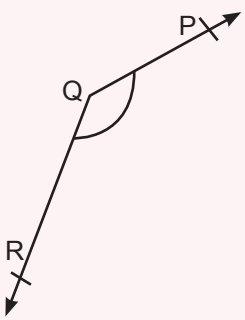


8.



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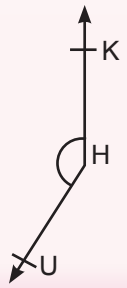
9.



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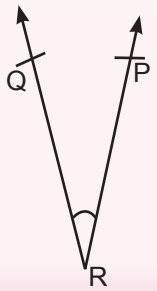


Drawing angles by using a protractor

An angle can be drawn by using a protractor. The procedure for drawing angles is not different from the procedure for measuring angles.

Example 1

Draw an angle that measures 30 degrees.

Solution

(a) Draw a line segment $\overline{OP}$.

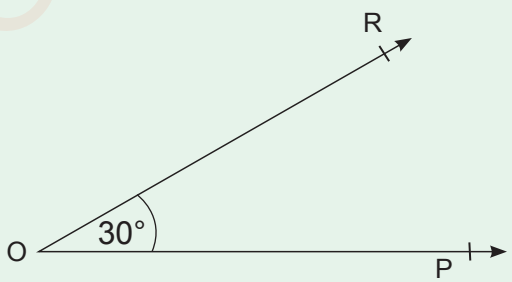
(b) Put a point on the line segment where you would like the angle to appear and call it O.

(c) Align the protractor in such a way that the perpendicular lines of the protractor meet at point O. Also, make sure the horizontal line of the protractor lies on $\overline{OP}$.

(d) Use the inner scale of the protractor to read 30 degrees from $\overline{OP}$ starting from zero degree.

(e) Put a point on 30 degrees and join it with point O on $\overline{OP}$.

(f) The angle $P\hat{O}R$ obtained is 30 degrees as shown in the following figure:



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Example 2

Draw $A\hat{O}B = 45°$; $\overline{OA} = 8$ cm and $\overline{OB} = 7$ cm.

Solution

(a) Draw a straight line

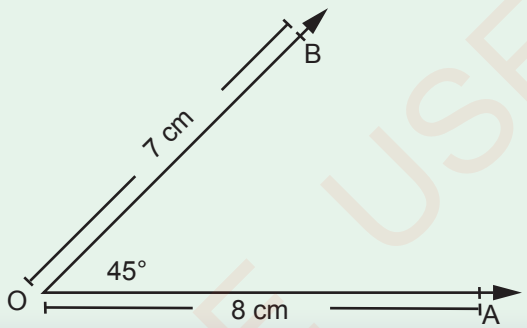
(b) Put point O on the line where you would like the angle to appear. Measure 8 cm from O in order to get $\overline{OA}$.

(c) Put the protractor on the figure so that the line from 0° to 180° is on $\overline{OA}$. The perpendicular lines of the protractor must meet at O.

(d) Measure 45 degrees and indicate it by a point.

(e) Measure a line segment of length 7 cm to connect the 45 degrees marked point with the point O.

(f) The resulting angle is as shown in the following figure:



Exercise 3

Use a ruler and a protractor to draw the following angles:

1. $Y\hat{A}C = 30°$; $\overline{AY} = 3$ cm and $\overline{AC} = 4$ cm.
2. $P\hat{Q}R = 43°$; $\overline{OR} = 8$ cm and $\overline{OP} = 7$ cm.
3. $B\hat{C}D = 67°$; $\overline{CD} = 5$ cm and $\overline{CB} = 3.8$ cm.
4. $M\hat{N}R = 85°$; $\overline{NR} = 6.4$ cm and $\overline{NM} = 9$ cm.
5. $D\hat{E}F = 70°$; $\overline{EF} = 6.3$ cm and $\overline{ED} = 8.6$ cm.

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6. $R\hat{S}T = 45°$; $\overline{SR}$ = 4 cm and $\overline{ST}$ = 6 cm.

7. $J\hat{K}L = 55°$; $\overline{KL}$ = 13 cm and $\overline{KJ}$ = 9 cm.

8. Draw a right angle $M\hat{N}O$; $\overline{NM}$ = 4.8 cm and $\overline{NO}$ = 6.6 cm.

9. Draw $A\hat{B}C = 45°$; $\overline{AB}$ = 7 cm and $\overline{BC}$ = 4 cm.

10. Draw $O\hat{Z}Y = 138°$; $\overline{ZY}$ = 6 cm and $\overline{ZO}$ = 7 cm.

Parallel and perpendicular lines

Activity 1: Recognising parallel and perpendicular lines by using walls of a classroom

When you study the rectangular walls of a classroom, you will find out that there are walls that meet at a certain angle and other walls are opposite to each other. Form groups of not more than three pupils and perform the following tasks:

(a) Use a set square to measure angles of a rectangular classroom. What is the size of each angle you have measured?

(b) Use a tape measure to measure the perpendicular distance between the opposite walls.

(c) Measure the perpendicular distances between the opposite walls at different points and record your answers. Are the distances the same?

(d) Use a protractor to draw an angle of the same size as the angle you have measured.

(e) Use the results obtained on the opposite walls of the classroom to draw lines with similar properties.

The walls which meet at an angle you obtained are known as perpendicular walls. The opposite walls separated by the same distance are called parallel walls. By referring to the lines you have drawn, what do you understand about parallel and perpendicular lines?

Certainly, you have learnt that perpendicular lines are lines which meet at a right angle. Parallel lines are lines which do not intersect at any point.

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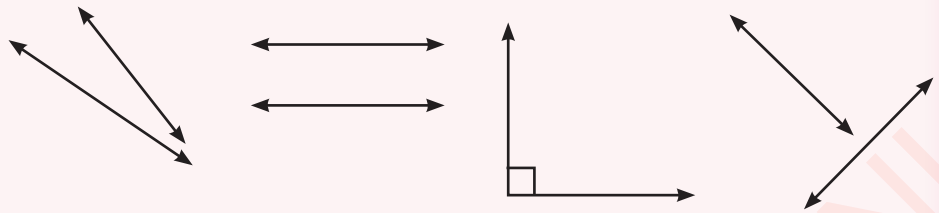
Exercise 4

Answer the following questions:

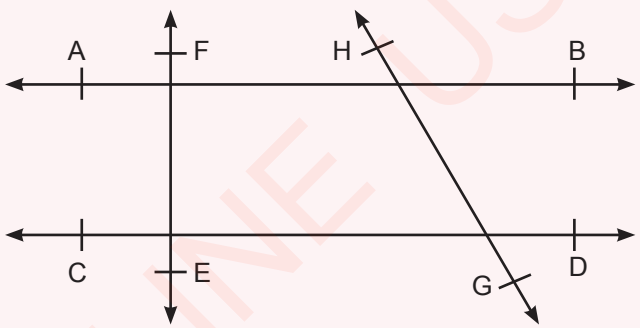
1. Which of the following pairs of lines are perpendicular?



(a) (b) (c) (d)

2. In question 1, which pairs of lines are parallel?

3. Mention the pairs of parallel and perpendicular lines in the following figure:



4. Mention real life examples related to perpendicular lines.

5. Mention real objects from your sorroundings with the properties of parallel lines.

Angles in plane figures

Plane figures are closed flat figures in a plane with length and width. Plane figures have no thickness. Since plane figures are closed, they have specific sum of degrees of their interior angles. Examples of plane figures are triangles, circles, and quadrilaterals. In this section, you will learn to calculate angles in plane figures.

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Activity 2: Identifying the sum of angles in a triangle

In groups of not more than three pupils, follow the given instructions to identify the sum of angles in triangles and quadrilaterals.

(a) Draw four triangles of different sizes.
(b) Use a protractor to measure the angles of each triangle.
(c) For each triangle, write the size of its angles.
(d) Find the sum of all angles in each triangle, then write the sum besides the respective triangle.
(e) Study the answers you have obtained from each triangle.
(f) What have you noticed? What conclusion can you make about the sum of angles in a triangle?
(g) Follow steps (a)-(f) by using quadrilaterals of different sizes.

Activity 3: Identifying the sum of angles in a circle

In groups of not more than three pupils, perform the following tasks:

(a) Draw three circles of different sizes.
(b) Starting from the centre of the circle, divide each circle into four parts of different sizes.
(c) Use a protractor to measure the angle formed in each part of the circle and record its degrees.
(d) Find the sum of angles of all parts in each circle and record it.
(e) What is the sum of angles in each circle? What can you conclude about the sum of angles of a circle?

Activity 4: Identifying the sum of angles on a straight line

In groups of not more than three pupils, draw a straight line $\overline{AB}$.

(a) Locate point O at the centre of $\overline{AB}$.
(b) Draw two line segments, $\overline{OC}$ and $\overline{OD}$ to get angles of different sizes. If you have followed the instructions properly, the resulting figure will be similar to the following figure:

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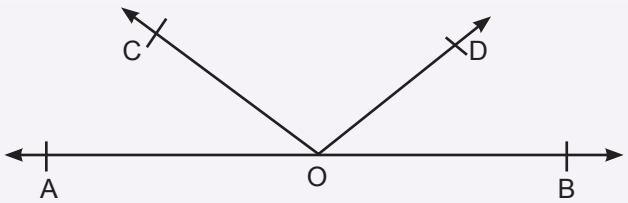


(c) Measure all angles in the line $\overline{AB}$ and find their sum.

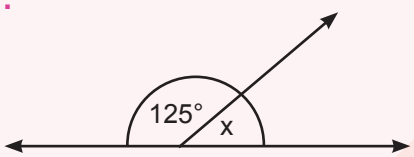
(d) Draw other two straight lines and increase the number of angles on them. Measure all angles in the lines and find the sum in each line.

(e) What is the sum of angles of each straight line? What can you conclude about the sum of angles on a straight line?

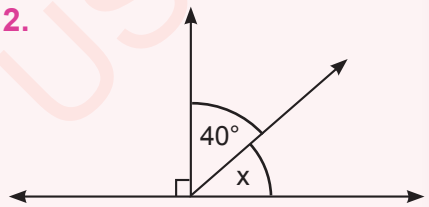
Exercise 5

Find the values of angles labeled by letters in the following figures:

1.



2.



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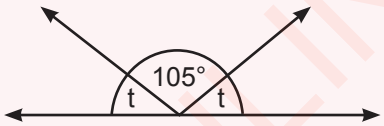

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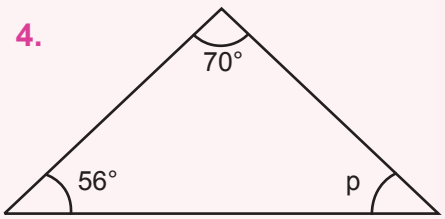
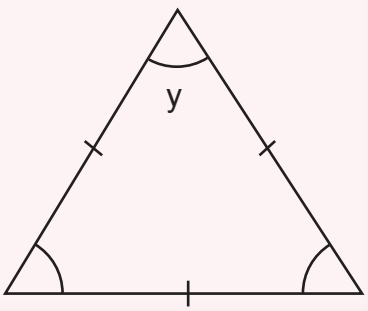


5.



6.



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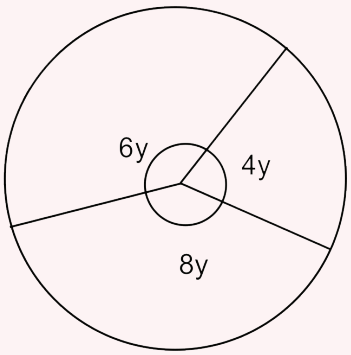
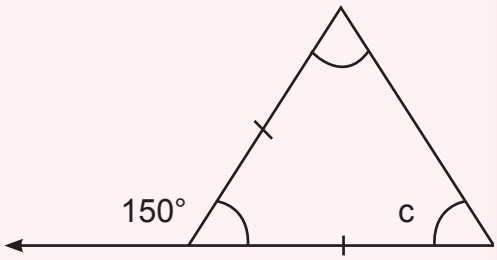
7.



8.



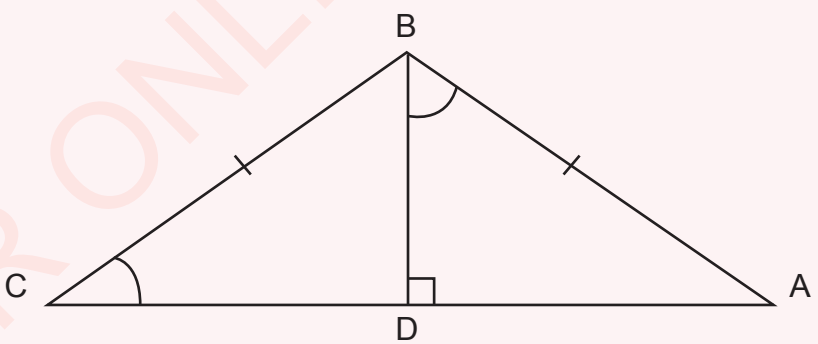
9. A straight line is divided into two angles which measure x and 8x. Find the value of x.

10. The angles of a quadrilateral are 89°, 5y, 71° and 20°. Find the value of y.

11. One angle of an isosceles triangle is 130 degrees. Find the value of each of the remaining two angles.

12. In a triangle BNK, $B\hat{N}K = 70°$, $N\hat{B}K = 40°$. Find the value of $N\hat{K}B$.

13. If $D\hat{B}A = 30°$, find the value of $B\hat{C}A$ and $A\hat{B}C$ in the following figure:



14. The sum of two angles in a quadrilateral is 245°. Find the sum of the remaining angles.

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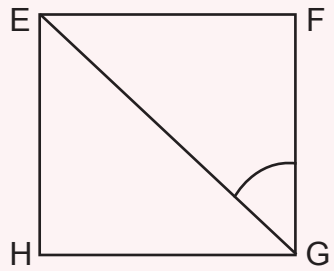
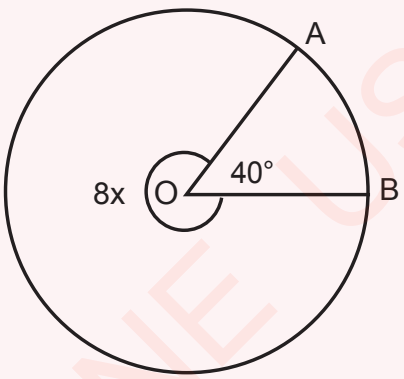
15. Figure EFGH is a square. Find the value of $E\hat{G}F$.



16. $L\hat{R}S$ is a straight angle. It is equally divided into three angles. Find the value of each angle.

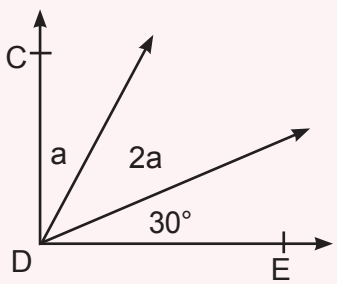
17. If $\overline{OA}$ is the radius of the circle, find the value of x in the following figure.



18. How many right angles are there in a straight angle?

19. The sum of two angles in a quadrilateral is 2m. The other two angles are 70° and 80°. Find the value of m.

20. If $C\hat{D}E$ is a right angle, find the value of *a* in the following figure:



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Perimeters of plane figures

Remember that you have learnt to find the perimeters and areas of triangles, squares and rectangles. In this section, you will learn to find the perimeters of parallelograms and trapeziums.

Properties of parallelograms and trapeziums

Parallelograms and trapeziums are plane figures with four angles. These figures share several properties although they differ in some other properties.

Activity 5: Recognising the properties of parallelogram and trapezium

In groups of not more than three pupils, perform the following tasks:

(a) Draw any parallelogram in your exercise book.
(b) By using a ruler, measure the length of each side of the parallelogram and record the answers in your exercise book. Or, write the lengths you have obtained on the respective sides of the parallelogram.
(c) Use a protractor to measure the size of each angle and record the results.
(d) Measure different perpendicular distances between the opposite sides and record the results.
(e) Draw any trapezium in your exercise book and repeat steps (b) to (d).
(f) In each figure, study carefully the lengths of the sides, size of angles and the sum of the interior angles.
(g) Summarise your findings by writing the properties of the parallelogram and the trapezium you have identified.
(h) Mention common objects from your sorroundings which have shapes of parallelogram and trapezium.

In the Activity 5, you have identified some of the properties of the parallelogram and trapezium. The properties of a parallelogram include the following:

(a) Opposite sides are parallel.
(b) Opposite angles are equal.
(c) The sum of two adjacent angles is 180 degrees.

Also, you have identified some properties of the trapezium which include the following:

(a) One pair of opposite sides is parallel.
(b) The sum of two pairs of adjacent angles is 180 degrees.

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Perimeter of a parallelogram and trapezium

The perimeter of a figure is the length of the outline of the figure. It is obtained by adding the lengths of all the sides of a given figure.

Activity 6: Finding the perimeter of a parallelogram and trapezium

In groups of not more than three pupils, perform the following tasks:

(a) Use a ruler to measure the length of each side of the parallelogram and trapezium given by your teacher.

(b) Write each of the length on its respective side.

(c) Add the lengths of all the sides of the parallelogram and trapezium separately. Write down your answers.

(d) Open at one point of the parallelogram and trapezium to make the shapes straight.

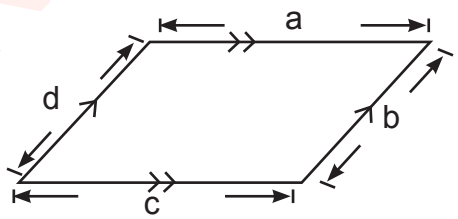
(e) Use a ruler to measure the length of each stretched shape and compare the answers with those obtained in (c).

(f) Basing on this activity, how can you define a perimeter and how can it be found?

(g) Write the formula for finding the perimeter of a parallelogram and trapezium.

The parallelogram

The perimeter of a parallelogram is obtained by adding the lengths of all its sides. Study the following parallelogram with sides a, b, c and d:



Perimeter of a parallelogram = a + b + c + d.

Since the opposite sides of a parallelogram are equal, sides a and c are equal and sides b and d are also equal. That is, a = c and b = d.

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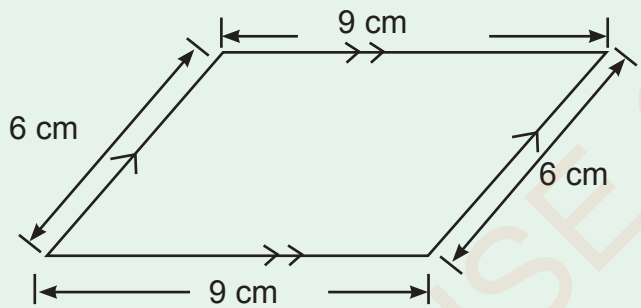
Thus, the formula for finding perimeter of the parallelogram can be written as follows:

Perimeter of a parallelogram = a + a + b + b
= 2a + 2b
= 2 (a + b)

Therefore, the perimeter of a parallelogram = 2 (a + b).

Example 1

Find the perimeter of the following parallelogram:



Solution

Given a = 9 cm, b = 6 cm, c = 9 cm and d = 6 cm

Perimeter of a parallelogram = a + b + c + d
= 9 cm + 6 cm + 9 cm + 6 cm
= 30 cm

Therefore, the perimeter of the parallelogram is 30 cm.

Also, you can find the perimeter of a parallelogram by using the formula.

Perimeter of a parallelogram = 2(a+b)

= 2 (9 cm + 6 cm)
= 2 × 15 cm
= 30 cm

Therefore, the perimeter of a parallelogram is 30 cm.

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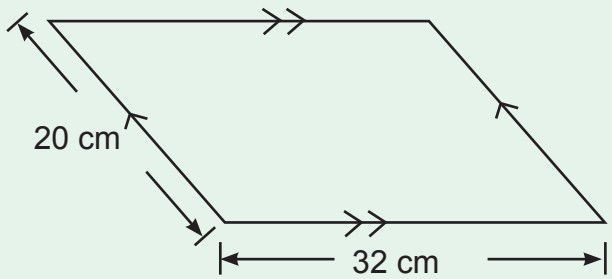
Example 2

Find the perimeter of the following parallelogram:



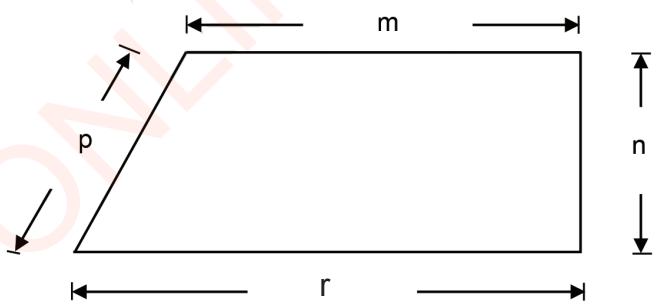
Solution

Perimeter of a parallelogram = 2(a+b)
= 2 (20 cm + 32 cm)
= 2 × 52 cm
= 104 cm

Therefore, the perimeter of the parallelogram is 104 cm.

The trapezium

The perimeter of a trapezium is obtained by adding lengths of all the sides of the trapezium. Study the following trapezium:



The perimeter of a trapezium = m + n + r + p

Since perimeter is a length, it can be measured in centimetres, metres or any other unit of length depending on the dimensions of the given figure.

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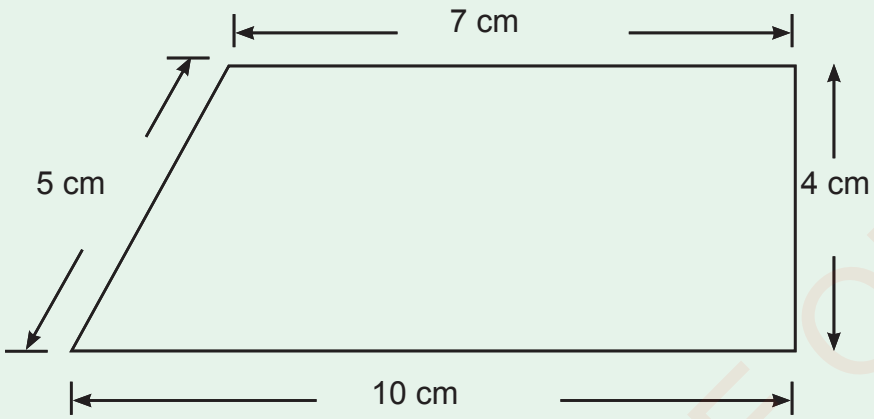
Example

Find the perimeter of the following figure:



The lengths of the sides of the trapezium are 7 cm, 4 cm, 10 cm and 5 cm. Therefore,

Perimeter of a trapezium = 7 cm + 4 cm + 10 cm + 5 cm

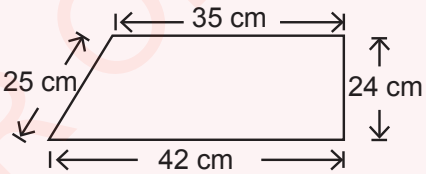
= 26 cm

Therefore, the perimeter of the trapezium is 26 cm.

Exercise 6

For each of the questions 1 – 3, find the perimeter of the given figures.

1.



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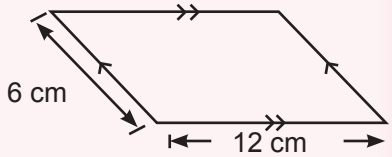

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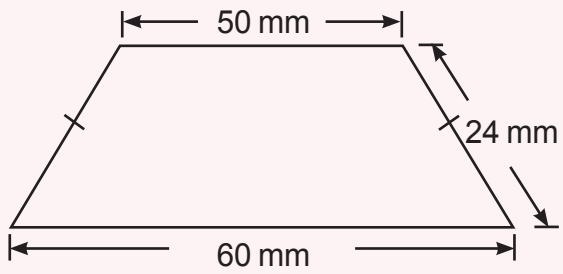
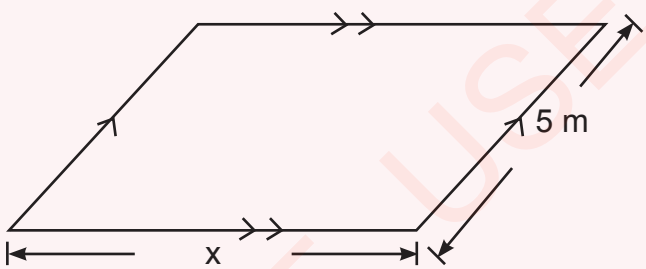
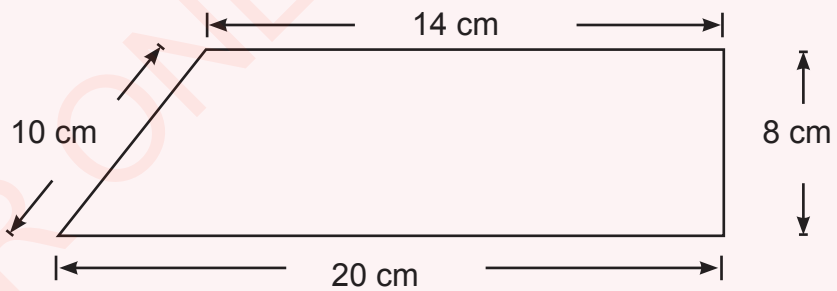
3.



4. Given the following figure, find the value of x if its periemeter is 36 m:



5. Find the perimeter of the following figure:



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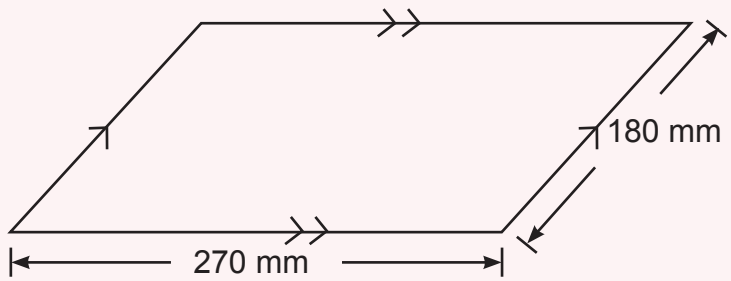
6. Find the perimeter of the following figure:



7. Two sides of a parallelogram have lengths 35 cm and 25 cm. Find its perimeter.

8. The parallel sides of a trapezium have lengths 30 cm and 60 cm. If the lengths of the other sides are 14 cm and 15 cm, find its perimeter.

9. The perimeter of a parallelogram is 20 m. If one of its sides has length 4 m, what is the length of the other side?

10. The perimeter of a trapezium is 48 dam. If three sides of the trapezium have lengths 10 dam, 12 dam and 6 dam, find the length of the other side.

Circumference of a circle

In the previous section, you learnt on how to find the perimeter of a parallelogram and a trapezium. In this section, you will learn to find the circumference of a circle. Let us start with the main parts of the circle.

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Parts of a circle

Study the following circle and identify its common parts:

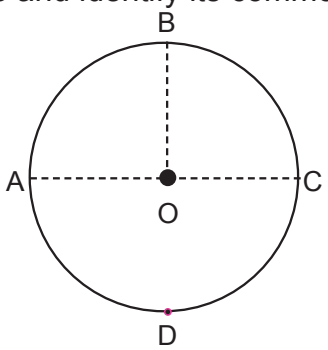

Figure ABCDA is known as a circle. Point O is the centre of the circle. The line $\overline{AC}$ is the diameter of the circle and $\overline{OB}$ is its radius. Also, $\overline{OA}$ and $\overline{OC}$ are the radii. Therefore, the diameter is twice the radius. However, the centre, diameter and the radius are all imaginary parts of the circle. In reality, these parts do not exist.

Activity 7: Measuring circumference of a base of a cylindrical tin

Steps:

1. Prepare a cylindrical tin, thread and a ruler.
2. Round the thread once around the tin as shown in Figure 1.

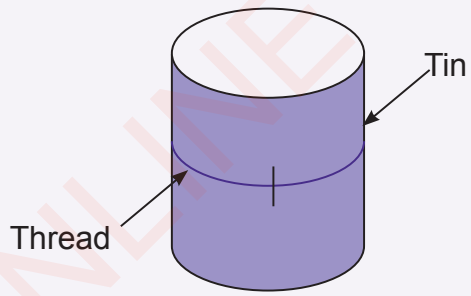

Figure 1: A thread rounded once on a cylindrical tin

3. Mark the point where the thread meet the initial point. Use a ruler to measure the length of the thread around the tin.
4. The length you have obtained is the circumference of the base of the tin.

The circumference of a circlular object can also be obtained by using a ruler. Study the following steps and measure again the circumference of the cylindrical tin by using a ruler.

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Steps:

1. Put a mark on the surface of the circular object.
2. Align the mark on the circular object with the 0 mark on the ruler.
3. Roll the circular object on the ruler until you reach again to the mark on the surface of the tin.
4. Read the length on a ruler at the point of the mark after rolling.
5. Is the length obtained the same as that measured by using a thread?

Activity 8: Recognising the relationship between the circumference of a circle and its diameter

1. In groups of not more than three pupils, find the circumference and diameters of each of the following objects by using the methods you learnt in Activity 7:
   (a) 200 shillings coin
   (b) Base of the bottle.
   (c) Circular plate.
   (d) Circular base of a tea cup.
2. Present your answers in two decimal places in the following table:

Object	Circumference (cm)	Diameter (cm)	Circumference ÷ diameter
Base of a bottle			
Base of a circular plate			
Base of a cup			
200 shillings coin			

3. Study the answers you have obtained after dividing the circumference by its diameter in each of the objects. What have you observed?

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4. Write the relationship between the circumference, diameter and the number you have obtained.
5. If the diameter of a base of a bottle is 7 cm, find the circumference of the base of the bottle by using the relationship you obtained in step 4.

If you measured properly, the results obtained after dividing the circumference by the diameter is approximately 3.142857. This number is known as "Pi" denoted by the symbol π. Thus, the value of Pi is 3.14 in two decimal places. Also, as a fraction, $\pi = \frac{22}{7}$. The diameter of a circle is denoted by letter d and its radius is denoted by the letter r. Therefore,

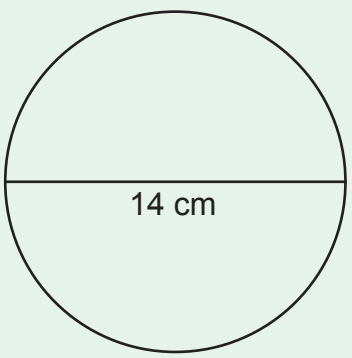
$$\frac{\text{Circumference of a circle}}{\text{diameter (d)}} = 3.14 = \pi \text{ or } \frac{\text{Circumference of a circle}}{\text{diameter (d)}} = \frac{22}{7} = \pi$$

Therefore, circumference of a circle = πd or circumference of a circle = $2\pi r$.

Example 1

Find the circumference of a circle with a diameter 14 cm. Use $\pi = \frac{22}{7}$.

Solution



The circumference of the circle = πd

$= \frac{22}{7} \times 14$ cm

$= 44$ cm

Therefore, the circumference of the circle is 44 cm.

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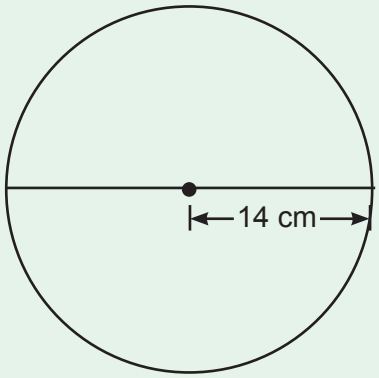
Example 2

Find the circumference of a circle of radius 14 cm. Use $\pi = \frac{22}{7}$.

Solution



Circumference of a circle = $2\pi r$

$$= 2 \times \frac{22}{7} \times 14 \text{ cm}$$

$$= 88 \text{ cm}$$

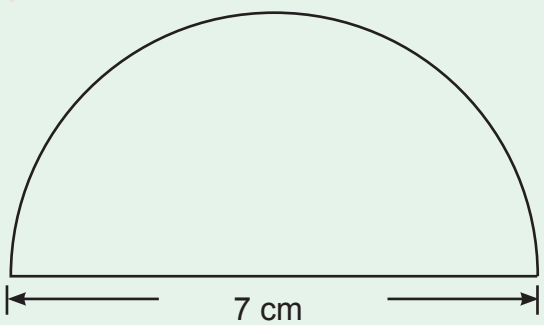
Therefore, the circumference of the circle is 88 cm.

Example 3

Find the circumference of a semi-circular figure with a diameter 7 cm.

Use $\pi = \frac{22}{7}$.

Solution



Find the circumference of a circle and divide it by two, then add its diameter.

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Circumference of a semi-circular figure is $\frac{\pi d}{2} + d$

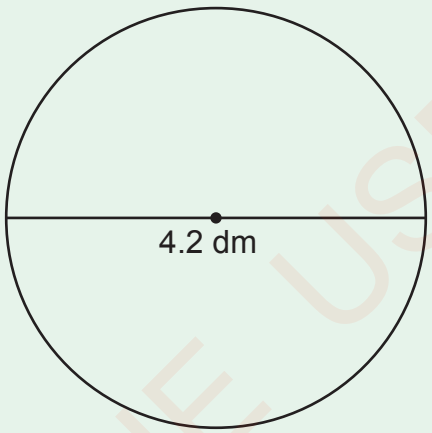
$$= \frac{22}{7} \times \frac{7}{2} \text{ cm} + 7 \text{ cm}$$
$$= 18 \text{ cm}$$

Therefore, the circumference of the semi-circular figure is 18 cm.

Example 4

Find the circumference of a circle with a diameter 4.2 dm.

Use $\pi = \frac{22}{7}$.



Solution

Circumference of the circle = πd

$$= \frac{22}{7} \times 4.2 \text{ dm}$$
$$= 13.2 \text{ dm}$$

Therefore, circumference of the circle is 13.2 dm.

Example 5

Find the diameter of a circle whose circumference is 110 cm.

Solution

Circumference of a circle = πd

Divide both sides by π to make d the subject.

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Thus,

$$d = \frac{\text{circumference}}{\pi}$$

$$= 110\text{ cm} \times \frac{7}{22}$$

$$= 35\text{ cm}$$

Therefore, the diameter of the circle is 35 cm.

Exercise 7

Answer the following questions. Use $\pi = \frac{22}{7}$ unless stated otherwise:

1. Find the circumference of circles with the following diameters:
   (a) 98 cm **(b)** 56 cm **(c)** 9.1 dm **(d)** 7 dm

2. Find the diameters of circles with the following circumferences:
   (a) 44 m **(b)** 132 m **(c)** 220 mm

3. Find the radii of the circles with the following circumferences:
   (a) 968 dm **(b)** 616 dm

4. Find the three-quarter of the circumference of a circle whose radius is 35 cm.

5. Find the circumference of three-quarter of a circular figure whose radius is 35 cm.

6. Find the circumferences of circles with the following measurements:
   (a) Diameter 80.5 cm **(b)** Radius 210 mm

7. The circumference of a floor of a round building is 968 cm. The length of each brick used in building the floor is 22 cm. How many bricks were used?

8. The diameter of a tyre is 63 cm. If the tyre rotates to cover a distance of 63.36 metres, how many rotations will the tyre make?

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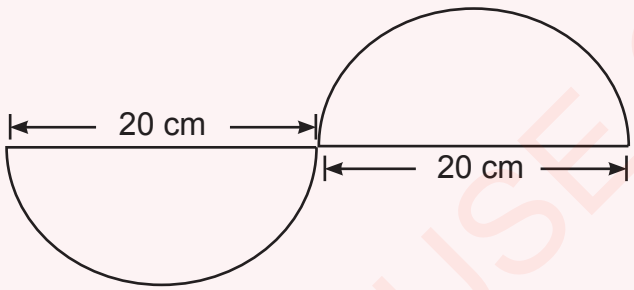
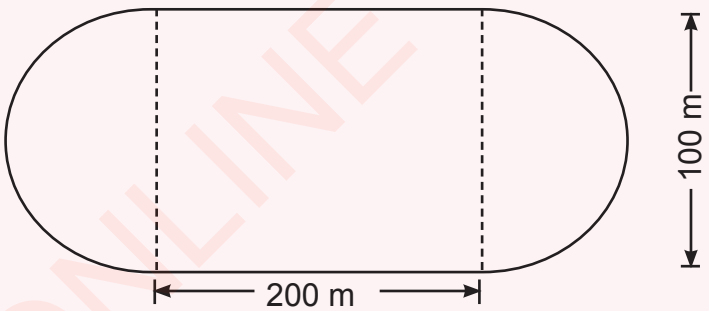
9. Akilimali has a square shaped house of length 12 m. Musa has a circular house of diameter 12 m. Which of the two houses has a larger perimeter? What is the differences in their perimeters?

10. Mr Baraka constructed a well of diameter 35 m. During the early stages of its construction, there were pillars placed 2.2 m apart to strengthen the well. How many pillars were used in the construction of the well?

11. Find the circumference of the following figure. Use $\pi = 3.14$.



12. Find the perimeter of the following playing ground. Use $\pi = 3.14$.



13. Find the circumferences of the semi-circular figures with the following diameters:
(a) 21 m **(b)** 84 cm

14. Find the circumference of quarter of a circle with radius 49 cm.

15. The circumference of a circular base of a bowl is 110 mm. Find its diameter.

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Areas of plane figures

In the previous sections, you learnt to find the perimeter of a parallelogram, trapezium and circumference of a circle. In this section, you will learn to find areas of these figures.

Area of a parallelogram

Parallelograms are among the plane figures. You can recall that, some of the properties of parallelograms are: opposite sides and opposite angles are equal. But, what is the formula for calculating areas of parallelograms?

Activity 9: Recognising the formula for culculating the area of a parallelogram

In groups of three pupils, peform the following tasks:

(a) Use a manila paper to prepare a parallelogram of average size

(b) Measure the length of the parallelogram and write it on one side of the parallelogram.

(c) By using a pair of scissors or a razor blade, cut out part of the parallelogram which has a shape of a triangle as shown in the following figure. Cut the triangle at an angle of 90 degrees by following the height of the parallelogram.



Cut by following the height of the parallelogram

(d) Measure the height of the parallelogram and write the answer beside the height.

(e) Shift the triangular shape to the opposite side of the parallelogram. Make sure the triangular cut fits exactly as shown in following figure. What is the name of the resulting figure?

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(f) Which formula can you use to find the area of the resulting figure?
(g) Use the formula you have obtained to calculate the area of the parallelogram.

The resulting figure in the activity is a rectangle. Remember that, the area of a rectangle is calculated by multiplying its length by width. Therefore, the area of the parallelogram is the same as the area of the rectangle formed. Thus,

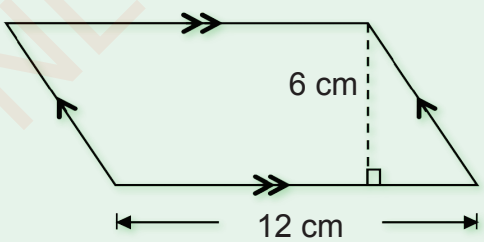
Area of parallelogram = length $\times$ width.

Remember that, the parallelogram has no width, but it has height. The formula for the area of the parallelogram is therefore given by:

Area of parallelogram = length $\times$ height.

Example 1

Find the area of the following parallelogram:



Solution

Area of parallelogram = length $\times$ height
= 12 cm $\times$ 6 cm
= 72 cm^2

Therefore, the area of the parallelogram is 72 cm^2.

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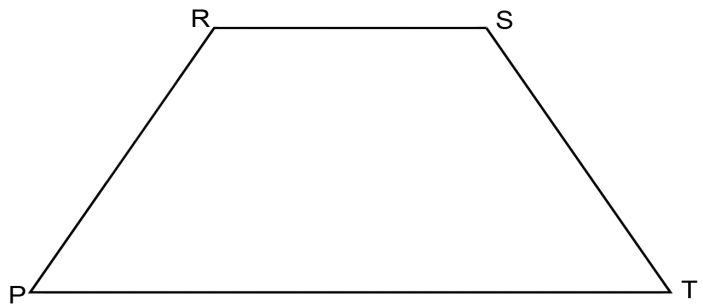
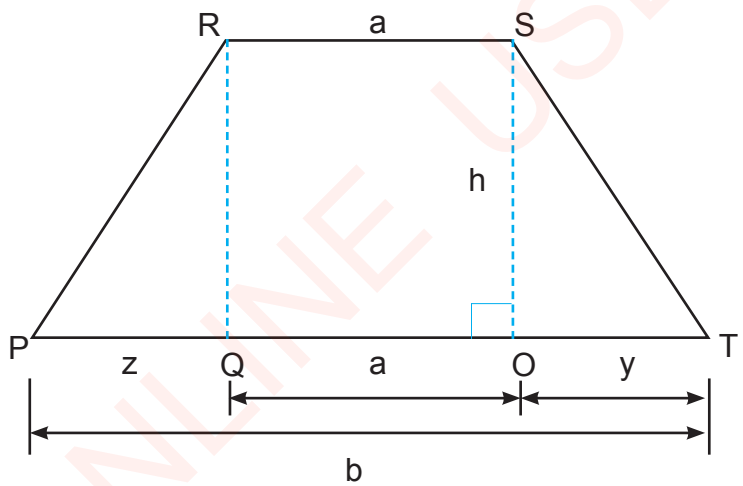
Area of a trapezium

Study carefully the trapezium PRST.



Divide the trapezium PRST into two triangles PQR and TOS, and a rectangle RQOS. Use dotted lines for $\overline{SO}$ and $\overline{RQ}$ which is the height of triangles PQR and TOS. Also, $\overline{SO}$ or $\overline{RQ}$ is the length of rectangle QROS as shown in the following figure:



The length of $\overline{SO}$ and $\overline{RQ}$ is h, $\overline{RS}$ and $\overline{QO}$ is a, $\overline{PQ}$ is z, $\overline{OT}$ is y, and $\overline{PT}$ is b.

The area of trapezium = Area of a triangle PQR + Area of a triangle TOS + Area of a rectangle QRSO.

But, area of a triangle $= \frac{1}{2} \times$ base $\times$ height.

Area of a rectangle = length $\times$ width.

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The height of the triangle PQR is h and its base is z. The height of triangle TOS is h and its base is y. The length of the rectangle QRSO is h and its width is a. Therefore,

$$\text{Area of triangle QPR} = \frac{1}{2} \times z \times h = \frac{zh}{2}$$

$$\text{Area of triangle TOS} = \frac{1}{2} \times y \times h = \frac{yh}{2}$$

$$\text{Area of rectangle QRSO} = h \times a = ah$$

Area of a trapezium = Area of triangle PQR + Area of triangle TOS + Area of a rectangle QRSO.

Thus,

$$\text{Area of trapezium} = \frac{zh}{2} + \frac{yh}{2} + ah$$
$$= h\left(\frac{z}{2} + \frac{y}{2} + a\right)$$
$$= \frac{h}{2}(z + y + 2a)$$
$$= \frac{h}{2}(z + y + a + a)$$

But $z + y + a = b$

Thus,

$$\text{Area of a trapezium} = \frac{h}{2}(b + a)$$
$$= \frac{h}{2}(a + b)$$
$$= \frac{1}{2}h(a + b)$$

Therefore, the area of trapezium $= \frac{1}{2} \times h \times (a + b)$, where h is height, a and b are the lengths of the two parallel sides of the trapezium.

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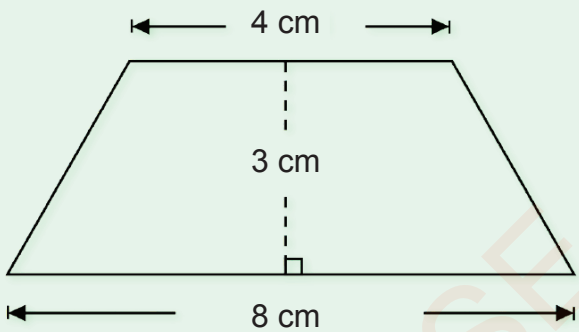
Therefore, area of a trapezium is calculated by taking the average of the two parallel sides of the trapezium multiplied by its height.

Example

Find the area of the following trapezium:



Solution

The lengths of two opposite parallel sides of a trapezium are 8 cm and 4 cm. Its height is 3 cm. That is a = 4 cm, b = 8 cm and h = 3 cm. Thus;

$$\text{Area of a trapezium} = \frac{1}{2} \times h \times (a + b)$$

$$= \frac{1}{2} \times 3\ \text{cm} \times (4\ \text{cm} + 8\ \text{cm})$$

$$= 18\ \text{cm}^2$$

Therefore, the area of the trapezium is 18 cm^2.

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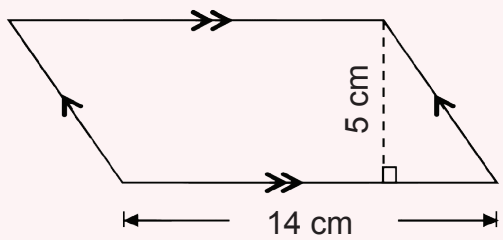
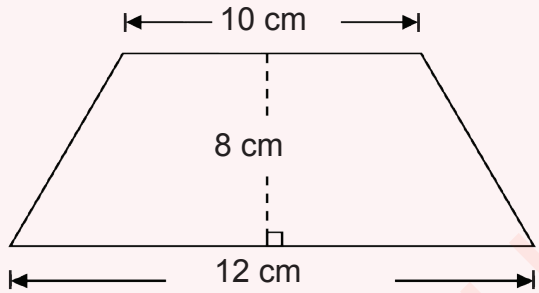
Exercise 8

Find the area of each of the figures in questions 1 – 5.

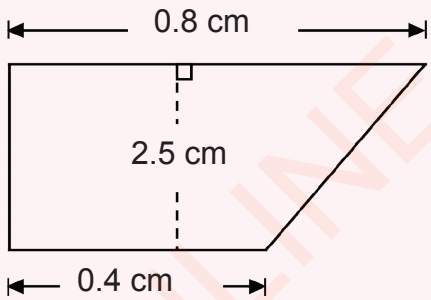
1.



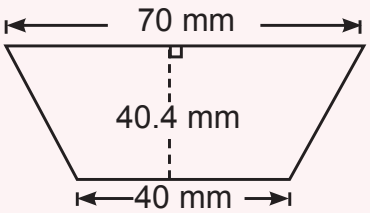
2.



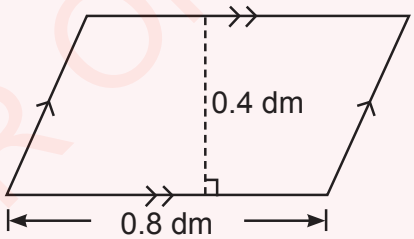
3.



4.



5.



6. A parallelogram shaped farm has length 30 m and height 15 m. Find the area of the farm.

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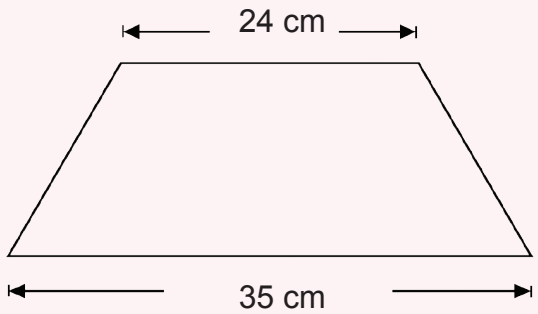
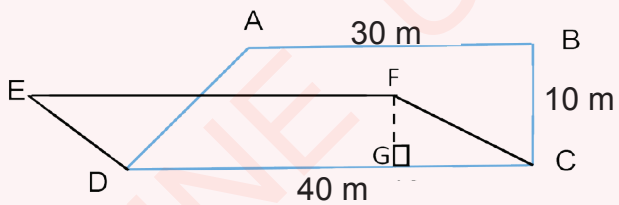
7. The opposite sides of a trapezium have lengths 0.6 m and y. If its area is 0.28 m^2 and height 0.4 m, find the value of y.

8. Find the area of the following figure if its height is 18 cm:

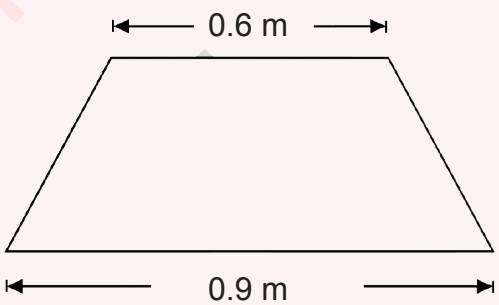


9. The area of a parallelogram is 84 dm^2 and its height is 7 dm. Find its length.

10. Find the area of the following figure if ABCD is a trapezium and CDEF is a parallelogram whose height $\overline{FG}$ is 5 m.



11. Calculate the area of the following figure if its height is 0.5 m:



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12. Find the area of a trapezium with height 28 cm and a pair of parallel sides having lengths 30 cm and 42 cm.

13. My neighbour has a carpet with a shape of a parallelogram. She wants to paint it. The carpet has length 6 m and height 4 m. If the cost of painting one square metre of the carpet is 350 shillings, how much money would she pay for painting the whole carpet?

14. The area of a trapezium is 140 mm^2. Its height is 5 mm and one of its parallel sides has length 20 mm. Find the length of the other parallel side.

15. The area of a parallelogram is 128 cm^2. If its height is 8 cm, find the length of one side of the parallelogram.

Area of a circle

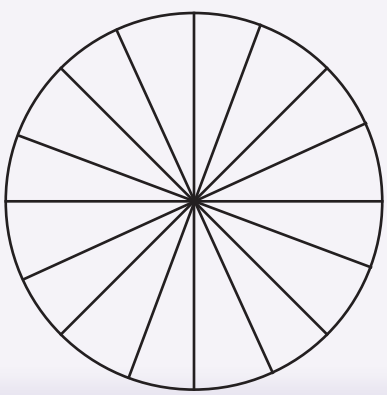
You have already learnt to find the area of a trapezium and parallelogram. Also, you have learnt to find the area of a triangle, rectangle and square. How can the area of the circle be obtained?

Activity 10: Recognising the area of a circle

In your groups, make sure you have a manila paper or other piece of paper, a razor blade or a pair of scissors, a pen or pencil and a pair of compasses.

(a) Use the pair of compasses to draw a circle on a manila paper.

(b) Cut the circular plane shape out of the manila card. Divide it into 16 equal parts as shown the following figure:



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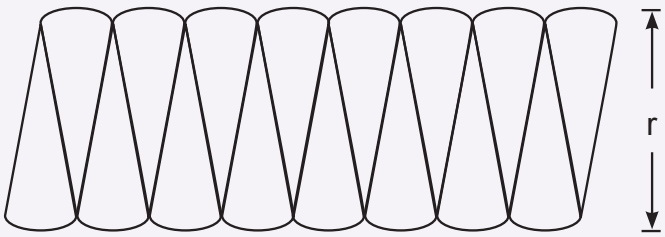
(c) Measure the diameter and use it to calculate the circumference of the circle.

(d) Cut carefully all the parts by using a pair of scissors (or razor blade) and then arrange the parts to form a rectangular shape as shown in the following figure:



(e) Measure the length and width of the rectangular shape and record answers in your exercise book.

(f) Divide the circumference of the circle you calculated by 2 and then compare your answer with the length of the rectangle. What have you observed?

(g) Divide the diameter by 2 to get the radius. Compare the radius you have obtained with the width of the rectangle. What have you observed?

(h) Find the area of the rectangular shape by using the length and width you have obtained.

You might have observed that the length of the rectangle you constructed is half the circumference of the circle. Therefore,

$$\text{Length of the rectangular shape} = \frac{\text{Circumference of the circle}}{2} = \frac{2\pi r}{2} = \pi r$$

Also, the width of the rectangular shape is the same as the radius of the circle. Therefore, the area of a circle can be obtained by calculating the area of the rectangle constructed. This is possible because the length and width of the rectangle constructed are known.

Therefore,

$$\text{The area of a circle} = \text{Area of rectangular shape}$$
$$= \text{length} \times \text{width}$$
$$= \pi r \times r$$
$$= \pi r^2$$

Therefore, the area of a circle is πr^2 where r is the radius of the circle.

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Now, use this formula to calculate the area of the circle. Thereafter, compare the answer with the area of the rectangular shape you have constructed. Use $\pi = 3.14$. The answers are expected to be approximately the same.

Since, diameter (d) = 2 × radius (r)

$$= 2r$$

$$d = 2r$$

$$r = \frac{d}{2}$$

Thus, area of a circle $= \frac{\pi d^2}{4}$

Therefore, area of a circle $= \frac{\pi d^2}{4} = \pi r^2$ where r is the radius and d is the diameter of the circle.

Example 1

Find the area of a circle with radius 14 mm.

Solution

Area of a circle $= \pi r^2$

$$= \frac{22}{7} \times 14\text{ mm} \times 14\text{ mm}$$

$$= 616\text{ mm}^2$$

Therefore, the area of the circle is 616 mm^2.

Example 2

Find the area of a circle with diameter 21 dm.

Solution

Area of a circle $= \pi \frac{d^2}{4}$

$$= \frac{22}{7} \times \frac{21\text{ dm} \times 21\text{ dm}}{4}$$

$$= 346.5\text{ dm}^2$$

Therefore, the area of the circle is 346.5 dm^2.

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Example 3

Find the diameter of a circle whose area is $616\ m^2$.

Solution

$$\text{Area of a circle} = \pi \frac{d^2}{4}$$

$$d^2 = \frac{\text{Area of a circle} \times 4}{\pi}$$

$$= \frac{616\ m^2 \times 4 \times 7}{22}$$

$$d^2 = 784\ m^2$$

$$d = \sqrt{784\ m^2} = 28\ m$$

Therefore, the diameter of the circle is 28 m.

Exercise 9

Answer the following questions:

1. Find the areas of circles with the following radii:
   (a) 80 mm **(b)** 2 dm **(c)** 3.5 cm **(d)** 2.5 m **(e)** 22 dm

2. Find the areas of circles with the following diameters. Use $\pi = 3.14$.
   (a) 8 m **(b)** 6 cm **(c)** 2 dm **(d)** 3.5 cm **(e)** 3 cm

3. Find the area of a circular shaped fish pond having a diameter of 98 m.

4. A circular pot has a top of diameter 10 cm and a base of diameter 6 cm. Find the difference of their areas.

5. Find the area of a circle with radius 8 cm. Use $\pi = 3.14$.

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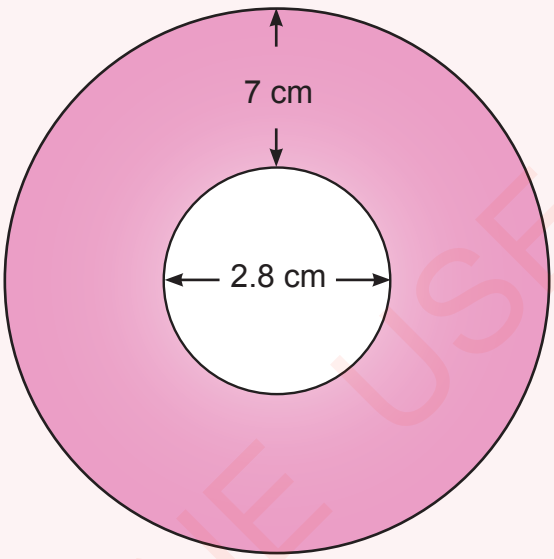
6. A top of a bucket has radius 16 cm. Find the area of the top of the bucket. Use $\pi = 3.14$.

7. Which of the area is larger between a square of length 10 cm and a circle of radius 10 cm? By how much?

8. In the following figure, find the area of a shaded region. Use $\pi = 3.14$.



9. If the circumference of a circle is 88 dm, find its area.

10. A villager built a circular house of diameter 28 m. The mason constructed the flow at a cost of 5 000 shillings per square metre. How much money did the villager pay to the mason? Use $\pi = \frac{22}{7}$.

Areas of three-dimensional figures

Three-dimensional figures are solid figures which have three dimensions namely; length, width and height. Examples of these figures are rectangular prisms, cubes and cylinders. In this section, you will learn to find areas and volumes of three dimensional figures.

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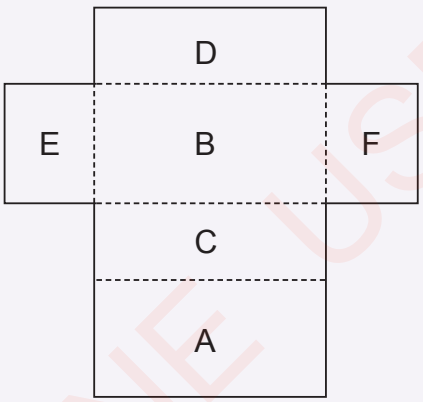
Surface areas of three-dimensional figures

Three-dimensional figures are formed by plane surfaces. Rectangular prisms, cubes and cylinders are examples of three-dimensional figures. You have learnt plane figures and how to find their areas. In this section, you will learn to find the surface areas of three-dimensional figures.

Activity 11: Finding the area of a rectangular prism

Steps:

1. Take a rectangular box of any size and open it by cutting along its edges.
2. The opened rectangular box will look like the following figure:



3. There are six rectangles obtained after opening the box.
4. Measure the length of each side of the rectangles and write the results on their respective sides.
5. In order to get the surface area of the rectangular box, add the areas of rectangles A, B, C, D, E and F.
6. Use letters of the alphabet to label every side of the rectangles.
7. Since all the figures are rectangles, find the area of each rectangle by multiplying length by width. Find the surface area of the original rectangular box by adding the areas of A, B, C, D, E and F. Simplify your answer as much as possible.
8. The resulting answer gives the formula for finding the area of a rectangular prism.
9. By using the formula obtained in step 8 and the lengths measured in step 4, find the surface area of the box.

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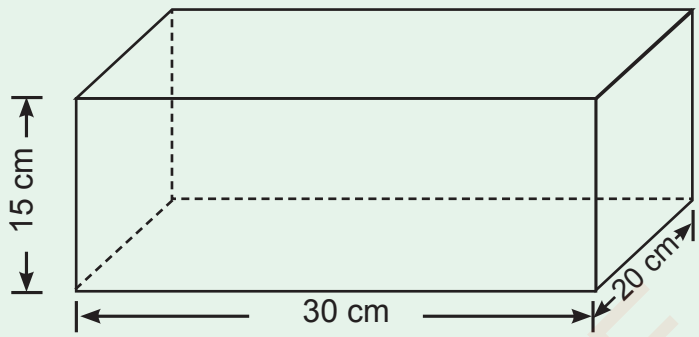
Example 1

Find the surface area of the following rectangular prism:



Solution

There are 6 faces in the rectangular prism. Thus, the surface area of the rectangular prism is given by:

$$\text{Surface area} = (\text{length} \times \text{width}) \times 2 + (\text{length} \times \text{height}) \times 2 + (\text{width} \times \text{height}) \times 2$$

$$= (30\text{ cm} \times 15\text{ cm}) \times 2 + (30\text{ cm} \times 20\text{ cm}) \times 2 + (15\text{ cm} \times 20\text{ cm}) \times 2$$

$$= 450\text{ cm}^2 \times 2 + 600\text{ cm}^2 \times 2 + 300\text{ cm}^2 \times 2$$

$$= 900\text{ cm}^2 + 1\,200\text{ cm}^2 + 600\text{ cm}^2$$

$$= 2\,700\text{ cm}^2$$

Therefore, the surface area of the rectangular prism is 2 700 cm^2

In order to get the surface area of a cube, follow the same steps used to find the surface area of the rectangular prism.

Example 2

Find the surface area of a cube of length 30 cm.

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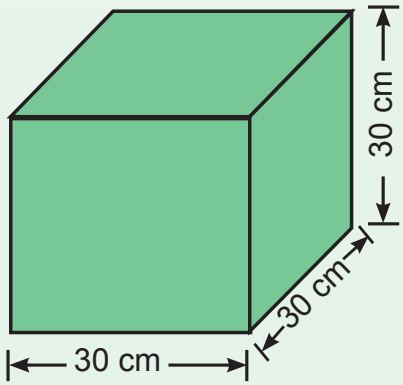


Solution

Since all the six sides of the cube are equal, the surface area of the cube is obtained by using the formula:

The surface area of a cube = length × length × 6

= 30 cm × 30 cm × 6

= 5 400 cm^2

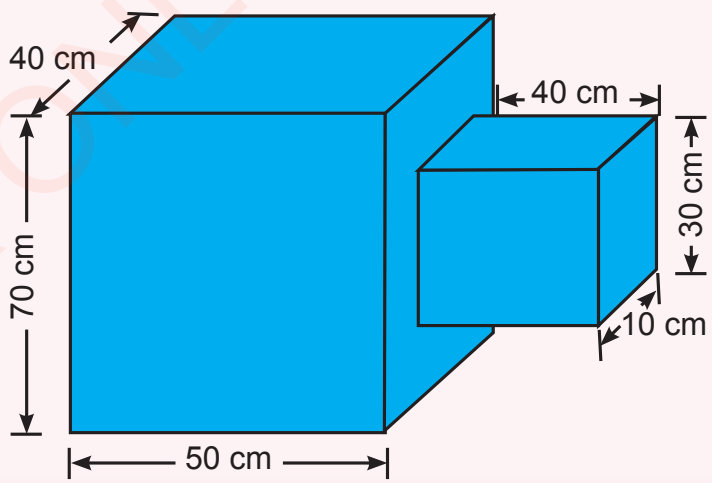
Therefore, the surface area of the cube is 5 400 cm^2.

Exercise 10

Answer the following questions:

1. A cube has a length of 20 cm. Find its surface area.

2. Find the surface area of the following figure:



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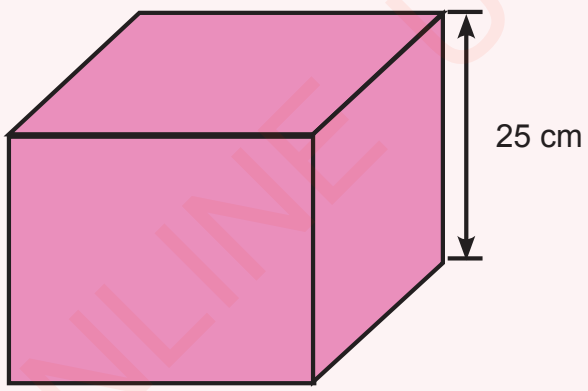
3. A closed box has length 80 cm, width 40 cm and height 40 cm. The box is cut through its length to form two boxes of equal size. Find the surface area of one of the boxes obtained.

4. Find the surface area of the rectangular prism in question 3 before it was divided.

5. A rectangular prism piece of metal has length 8 cm, width 5 cm and height 15 cm. It is joined to another piece of metal of length 90 cm, width 60 cm and height 40 cm. Find the surface area of the resulting figure if the smallest faces of the two metals are joined.

6. Find the surface area of a soap bar with dimensions 30 cm, 5 cm and 3 cm.

7. The following cube has length 25 cm. Find its surface area.



8. A rectangular box has length 40.25 cm, width 20 cm and height 30.5 cm. Find its surface area.

9. Find the area of a ractangular prism of length 25 cm, width 10 cm and height 15 cm.

10. Find the surface area of the following piece of metal if the dimensions of the hole are 50 cm, 30 cm and height 80 cm.

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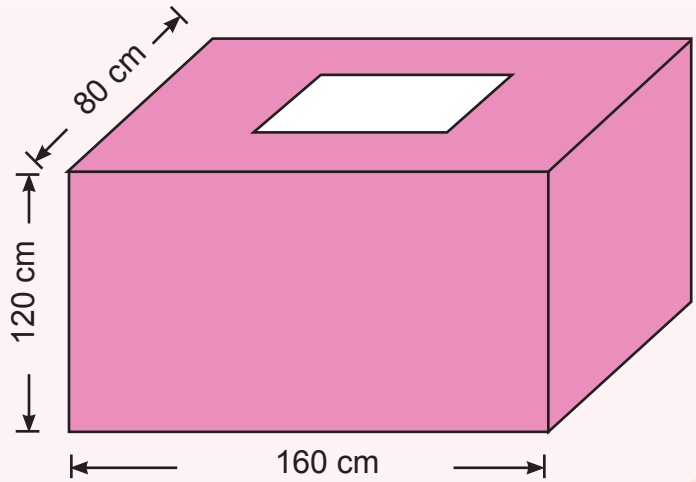
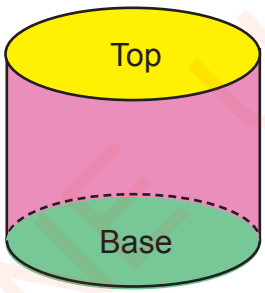


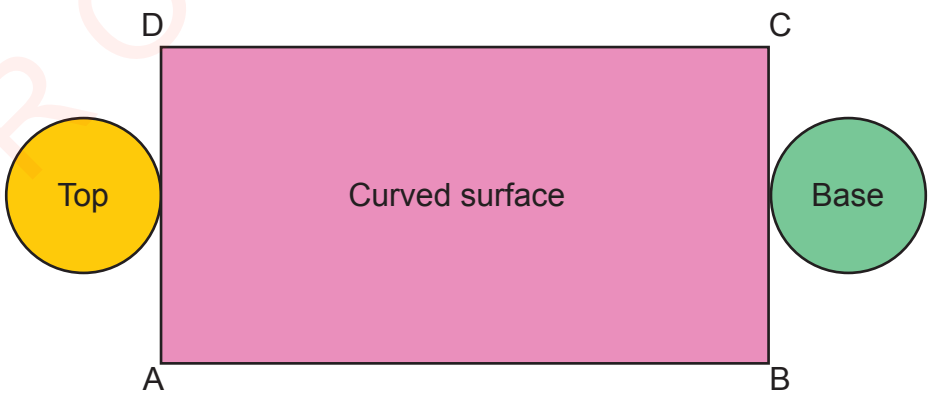
Surface area of a cylinder

Any cylindrical object has the form of the following figure:



The parts of the figure are the top, base and curved surface. The top and base have the same diameter.

When a cylinder is opened along its height, the resulting surfaces are shown in the following figure:



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When a cylinder is cut along its height, it results into three shapes which are the two circles and a rectangle. In order to obtain the surface area of a cylinder, add areas of the circles and the area of the rectangle. The formula for finding the surface area of a cylinder is obtained as follows:
The circumference of a circle is the same as the width of the rectangle obtained after opening the cylinder.

Surface area of a cylinder = Circumference of a circle $\times$ height + area of a circle $\times$ 2

$$= \pi dh + 2\pi \frac{d^2}{4}$$

Using the radius of the cylinder, the formula is given by

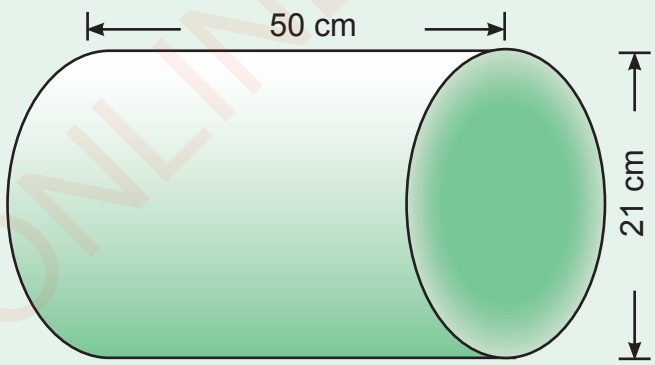
Surface area of a cylinder $= 2\pi rh + 2\pi r^2$

$$= 2\pi r(r + h)$$

Therefore, the surface area of a cylinder = $2\pi r(r+h)$.

Example 1

Find the surface area of the following cylinder:



Solution

By using the formula involving a diameter

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Surface area of a cylinder $= \pi dh + 2\pi\frac{d^2}{4}$

$= \frac{22}{7} \times 21\,\text{cm} \times 50\,\text{cm} + 2 \times \frac{22}{7} \times \frac{21\,\text{cm} \times 21\,\text{cm}}{4}$

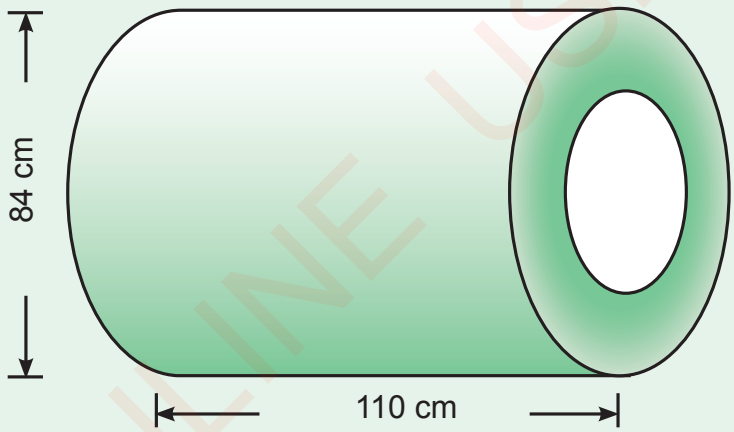
$= 3\,300\,\text{cm}^2 + 693\,\text{cm}^2$

$= 3\,993\,\text{cm}^2$

Therefore, the surface area of a cylinder is 3 993 cm^2.

Example 2

A closed empty bucket is cut at its top as shown in the following figure. Find the surface area of the bucket if its height is 110 cm, diameter 84 cm and the diameter of the hole on the top is 28 cm.



Solution

Surface area of a bucket = surface area of a whole figure – area of the hole

$= \frac{22}{7} \times 84\,\text{cm} \times 110\,\text{cm} + 2 \times \frac{22}{7} \times \frac{84\,\text{cm} \times 84\,\text{cm}}{4} - \frac{22}{7} \times \frac{28\,\text{cm} \times 28\,\text{cm}}{4}$

$= 29\,040\,\text{cm}^2 + 11\,088\,\text{cm}^2 - 616\,\text{cm}^2$

$= 39\,512\,\text{cm}^2$

Therefore, the surface area of the bucket is 39 512 cm^2.

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Activity 12: Determining the surface area of a bucket

Obtain a 20 litres and 10 litres buckets. Measure the internal height and the diameter of each bucket. Find the surface area of each bucket when:

(i) The buckets are closed.

(ii) The buckets are open.

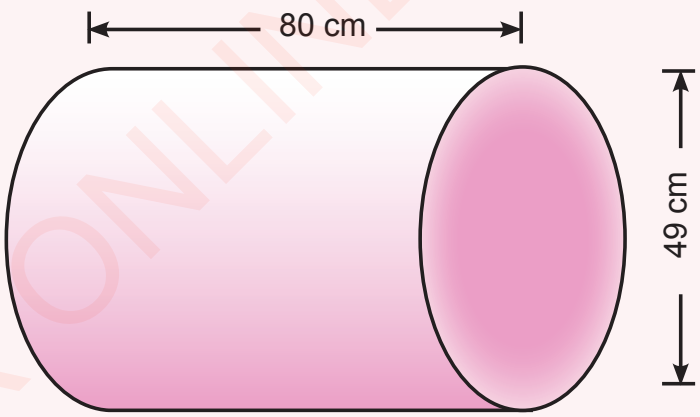
Exercise 11

Answer the following questions:

1. Find the surface area of a cylinder closed on both sides with diameter 42 cm and height 45 cm.

2. A cylindrical pipe is open on both sides. If its height is 500 cm and diameter is 10 cm, find its surface area. Use $\pi = 3.14$.

3. Find the surface area of the following cylinder if it is closed on both sides:



4. A water tank has a diameter 105 cm and height 240 cm. Find the surface area of the tank if it is open on one side.

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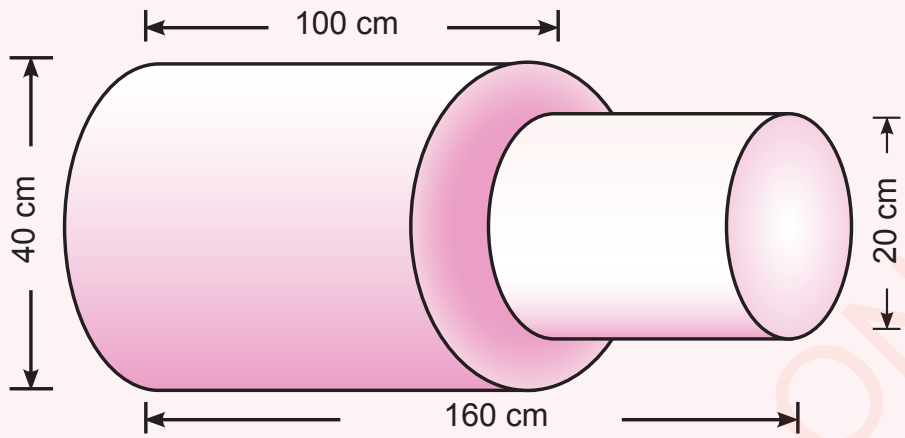
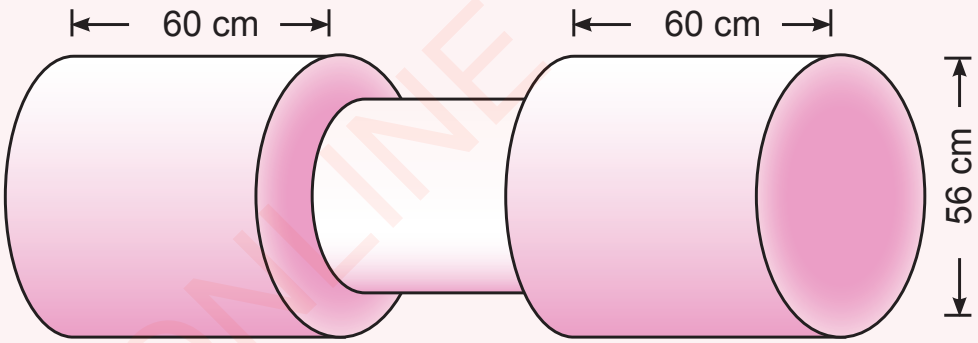
5. Given the following figure, find its surface area. Use $\pi = 3.14$.



6. The following figure has length 145 cm and the diameter of the small figure is 28 cm:



(a) Find the surface area of the figure if it is closed on both sides.

(b) Find the surface area of the figure if it is open on both sides.

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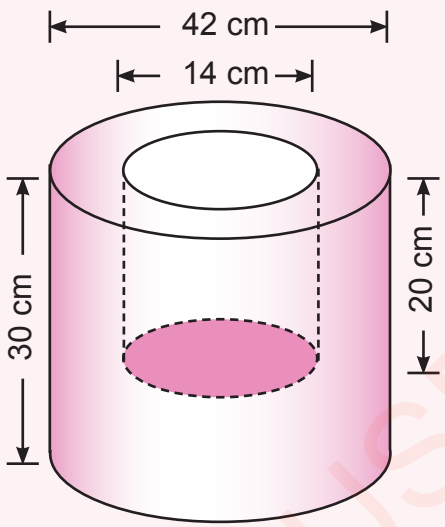
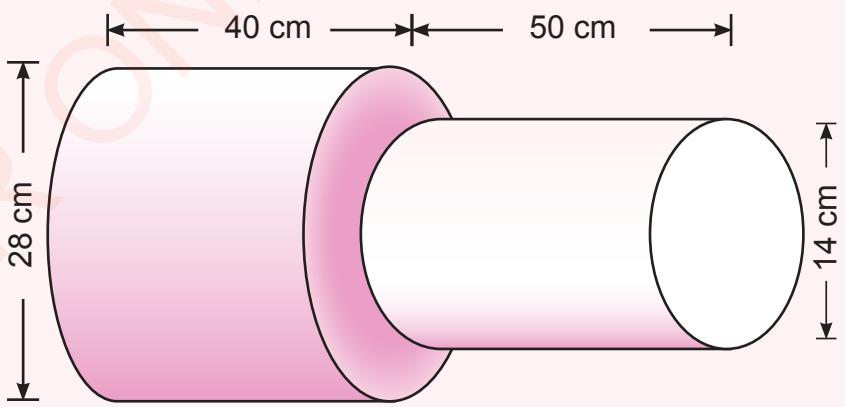
7. The following figure is a log with a hole of diameter 14 cm and height 20 cm. Find its surface area.



8. A cylinder has a diameter 35 cm and height 100 cm. Find its surface area.

9. The following figure has a base diameter 28 cm and an open top of diameter 14 cm. Find its surface area.



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10. Find the surface area of the figure in question 9 if its base is removed and the top is closed.

Volumes of three-dimensional figures

The volume of a three-dimensional figure is obtained by multiplying its base area by height. A rectangular prism has a length, width and height. A cube has a length which is the same as its width and height. A cylinder has a base and height. Generally in finding the volume of a three-dimensional figure, multiply the base area by height.

Volumes of rectangular prisms and cubes

Rectangular prisms

In finding the volume of a rectangular prism, multiply its base area by height. Also, you can multiply length by width by height.

Example 1

Find the volume of a rectangular prism of length 20 cm, width 10 cm and height 15 cm.

Solution

Volume of rectangular prism = length × width × height
= 20 cm × 10 cm × 15 cm

Thus, the volume of the rectangular prism is 3 000 cm^3.

Cubes

A cube is similar to a rectangular prism. The only difference is that a cube has all its sides equal. That is length, width and height are all equal. In finding the volume of a cube shown in the following figure, multiply length by length by length:

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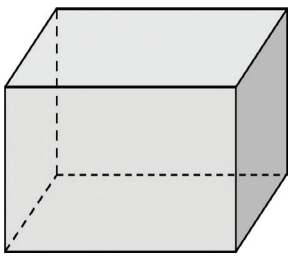

Volume of a cube = length × length × length

Example 2

Find the volume of a cube of length 20 cm.

Solution

Since the sides of a cube are equal, the volume of a cube is obtained by multiplying the length by length by length. That is,

$$\text{Volume of a cube} = \text{length} \times \text{length} \times \text{length}$$

$$= 20\ \text{cm} \times 20\ \text{cm} \times 20\ \text{cm}$$

$$= 8\,000\ \text{cm}^3$$

Therefore, the volume of the cube is 8 000 cm^3.

Activity 13: Finding volumes of objects

Measure the length, width and height of the following objects and then find their volumes:

(i) A box of chalk

(ii) Classroom

Exercise 12

Answer the following questions:

1. A rectangular prism has length 40 cm, width 25 cm and height which is equal to its width. Find its volume.

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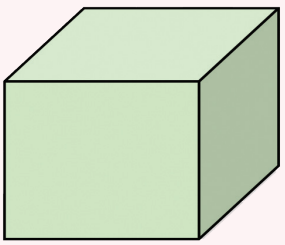
2. Find the volume of a matchbox of length 5 cm, width 3 cm and height 1 cm.

3. A water tank has an inner length 4 m, width 3 m and height 5 m. Find its volume.

4. The following cube has length 32 cm. Find its volume.



5. The volume of a cube is 1 728 cm^3. Find the length of one side of the cube.

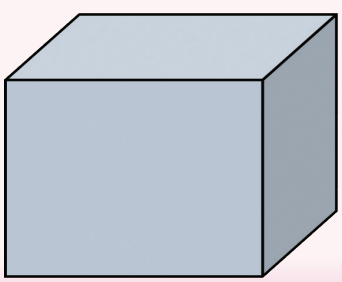
6. A water tank has length 6 m, width 2 m and height 4 m. Inside the tank, there is a metal cube of length 20 cm. Find the inside volume of the tank.

7. Find the volume of a rectangular prism of length 15 cm, width 10 cm and height 20 cm.

8. The length of a cube is 25 cm. Find its volume.

9. The volume of a cube is 64 000 cm^3. Find the length of one of its sides.

10. The following cube has length 50 cm. Find its volume.



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Volume of a cylinder

The volume of a cylinder is obtained by multiplying its base area by height. The base area of a cylinder is circular and it is obtained by using the following formula:

$$\text{Area of circle} = \pi \times \frac{\text{diameter} \times \text{diameter}}{4}$$

$$= \pi \frac{d^2}{4}$$

$$= \pi r^2$$

Thus, Volume of a cylinder = Area of a circle $\times$ height

$$= \pi \times \frac{d^2}{4} h$$

$$= \pi r^2 h$$

Therefore, the volume of cylinder = $\pi r^2 h$.

Example 1

Find the volume of a cylinder with diameter 28 cm and height 50 cm.

Solution

$$\text{Volume of a cylinder} = \pi \frac{d^2}{4} h$$

$$= \frac{22}{7} \times \frac{28\text{ cm} \times 28\text{ cm}}{4} \times 50\text{ cm}$$

$$= 30\,800\text{ cm}^3$$

Therefore, the volume of the cylinder is 30 800 cm^3.

Alternatively, using the radius;

The volume of the cylinder = $\pi r^2 h$

$$= \frac{22}{7} \times 14\text{ cm} \times 14\text{ cm} \times 50\text{ cm}$$

$$= 30\,800\text{ cm}^3$$

Therefore, the volume of the cylinder is 30 800 cm^3.

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Example 2

The volume of a cylinder is 41 580 cm^3. If its height is 30 cm, find its radius.

Solution

Volume of a cylinder = $\pi r^2 h$

$$41\,580\ cm^3 = \frac{22}{7} \times r^2 \times 30\ cm$$

Multiply by 7 both sides of the equation:

$$7 \times 41\,580\ cm^3 = \frac{22}{7} \times r^2 \times 30\ cm \times 7$$

$$291\,060\ cm^3 = 660\ cm \times r^2$$

Divide both sides by 660.

$$\frac{291\,060\ cm^3}{660\ cm} = \frac{660\ cm \times r^2}{660\ cm}$$

$$r^2 = 441\ cm^2$$

Find the square root on both sides:

$$\sqrt{r^2} = \sqrt{441\,cm^2}$$
$$r = 21\,cm$$

Therefore, the radius of the cylinder is 21 cm.

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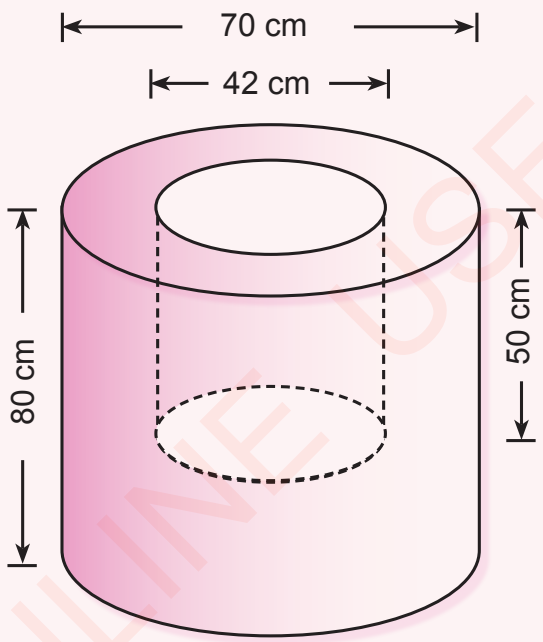
Exercise 13

Answer the following questions. Use $\pi = \frac{22}{7}$ unless stated otherwise.

1. A cylinder has a height 10 metres and radius 3.5 metres. Find its volume.

2. Find the volume of the following cylinder:



3. A part of the cylinder of length 100 cm and diameter 56 cm was cut to obtain a cylinder of height 40 cm and diameter 21cm. Find the volume of the remaining part of the cylinder.

4. A cylindrical metal of diameter 7 cm and height 30 cm was cut from a piece of metal as shown in the following figure. Find the volume of the remained piece of metal.

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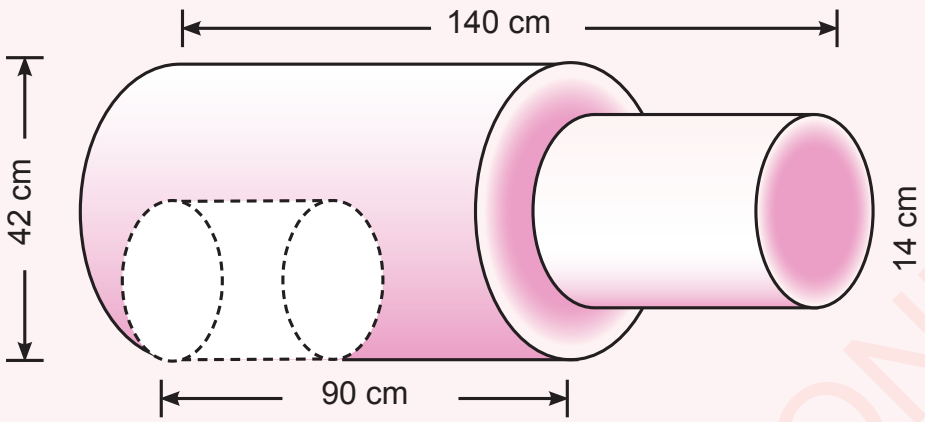

5. The volume of a cylinder is 188 650 cm^3. If its height is 100 cm, find its diameter.

6. If a well has height 2 m and radius 1m, find:
(a) The volume of the well.
(b) What is this volume in cubic centimetres? Use $\pi = 3.14$.

7. Find the volume of a cylinder with diameter 20 cm and height 30 cm. Use $\pi = 3.14$.

8. A water tank with height 180 cm and diameter 84 cm has three-quarter of its volume filled with water. Find the volume of the water in the tank.

9. The base area of a cylinder is 224 cm^2. Find the volume of the cylinder if its height is 50 cm.

10. Convert 1 cubic metre into cubic centimetres.

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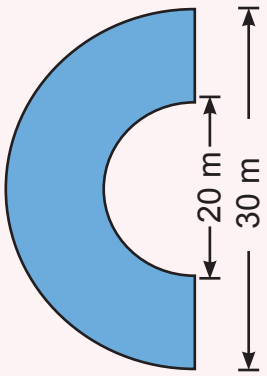
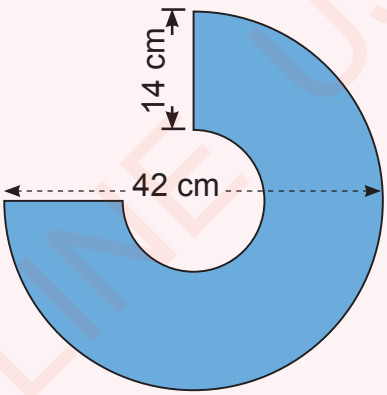
Revision exercise

Answer the following questions:

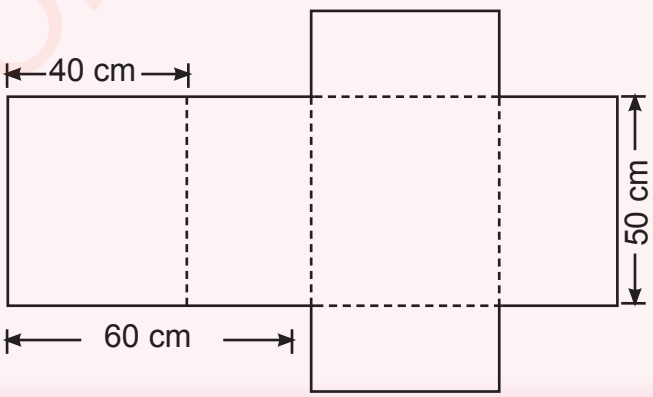
1. Consider the following figure:
   (a) Find its circumference.
   (b) Find its area



2. Find the area of the shaded region in the following figure:



3. The following figure shows the surfaces of a rectangular box.



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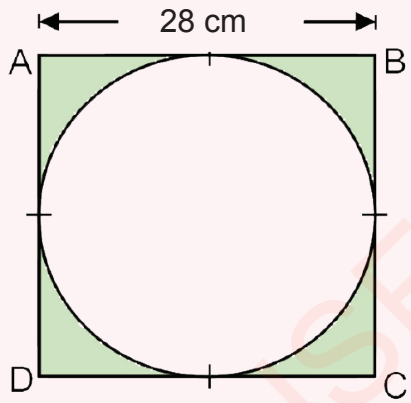
Assemble all the surfaces and then find:

(a) Its surface area

(b) Its volume

4. Find the perimeter of the figure in question 3.

5. Find the area of the shaded region if ABCD is a square of length 28 cm.



6. The area of a parallelogram is 120 cm^2. If the length of the parallelogram is 15 cm, find its height.

7. The area of a trapezium is 171 dam^2. One of its parallel sides has length 16 dam and height 9 dam. What is the length of the other parallel side?

8. John's plot has length 64 m and width 36 m. Abdallah's square plot has the same area as John's plot. Find the length of Abdallah's plot.

9. The circumference of a quarter-circular figure is 50 cm. Find its area.

10. The surface area of a cube is 1 536 cm^2. Find its volume.

11. The following piece of metal has a hollow of diameter 28 cm and height 40 cm. Find the surface area of the piece of metal.

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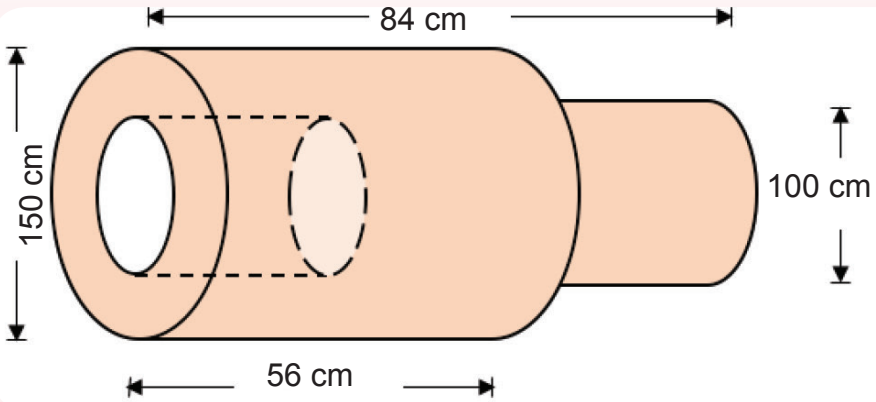


12. A goat can graze in a circular area whose circumference is 88 cm. Find the grazing area.

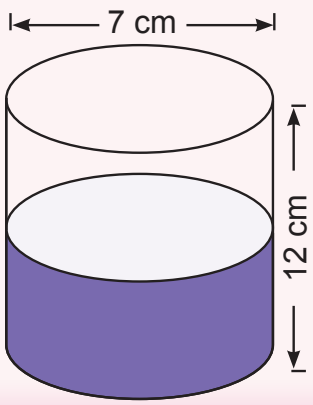
13. A piece of timber has length 100 cm, width 50 cm and height 50 cm. The timber is divided into two equal pieces. Find the volume of one of the pieces of the timber.

14. Find the volume of a bucket of water with a diameter 21 cm and height 40 cm.

15. A rectangular prism has length 90 cm, width 50 cm and height 40 cm. Find its volume.

16. A square box has length 25 cm. Find the total length of its edges.

17. Aneth is using a glass of diameter 7 cm and height 12 cm to drink a soda. She has drunk half of the soda as shown in the following figure. Find the surface area of the glass:



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18. Find the volume of a cube of length 80 cm.

19. A tank of water has length 5 metres, width 4 metres and height 3 metres. The tank is open through a top of diameter 1 metre. In order to prevent rust, the tank is painted both of its inside and outside surfaces. Find the surface area of the painted tank.

20. In question 19, if half a litre of a tin of paint is used in painting one square metre of a surface:

(a) How many litres of paint are needed to paint the tank?

(b) If one litre of paint is sold at 3 000 shillings, what amount of money will be used in painting the whole tank?

Summary

1. The size of an angle is measured by a protractor which measure angles from 0° to 180°.
2. Perpendicular lines are the lines which meet at 90°. Parallel lines are the lines separated by a constant distance as they extend.
3. The sum of the angles in a triangle is 180°, the sum of interior angles in quadrilaterals is 360° and for a straight line is 180°.
4. The value of π is $\frac{22}{7}$ which is also written as 3.14 in two decimal places.
5. Three-dimensional figures are formed by plane figures. That is, the faces of three dimensional figures are plane figures.
6. The volume of a three-dimensional figure is obtained by multiplying the base area by height.

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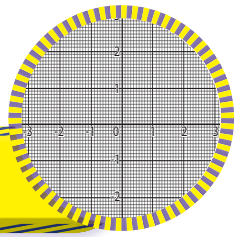
Chapter Thirteen

Coordinate geometry



Introduction

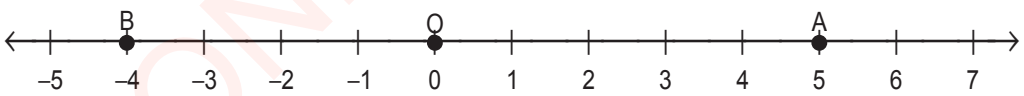
Coordinates of a point are ordered pairs of numbers that show position of the point on a plane. In this chapter, you will learn about reading and writing coordinates of points. You will also learn about drawing plane figures by using the coordinates of points. The knowledge and skills gained will help you in locating or indicating places correctly. For example, you will be able to indicate plot boundaries and interpret properly traffic information on roads, flights and marine.

Point on a line

Point A is indicated on the following line.



It is not possible to locate exactly the position of point A. This is because you need a reference or the starting point. The starting point is called the origin. Together with the origin, you need to know the distance from the origin and the direction from the origin. Therefore, in order to locate the point A, use the given number line and follow the explanation that follows:



(a) By using a number line, identify the origin (starting point) and call it point O
(b) The point A is on the right of point O
(c) Count the number of steps from point O to point A, you will get 5 steps

If the point is on the left of the origin O, use the same procedure to locate it, starting from O towards the left. For example, the point B is four steps to the left of origin O.

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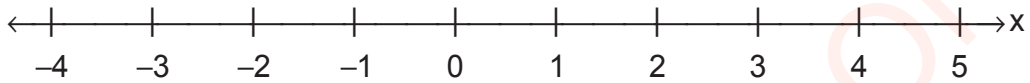
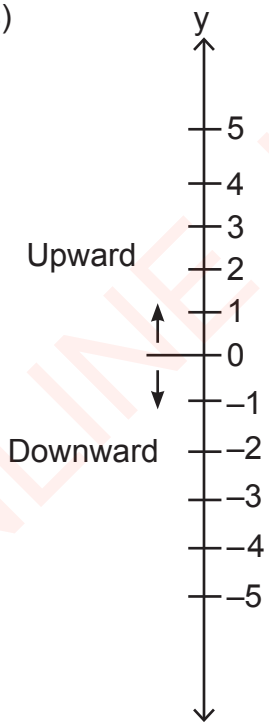
Concept of coordinates of a point

In coordinate geometry, the position of a point on a plane is well defined by an ordered pair of numbers. Coordinate points are read from two perpendicular lines that show the horizontal and vertical axes. The horizontal line is called x-axis and the vertical line is called y-axis. The ordered pair of numbers is read from the two perpendicular lines, the first number represents the value of x from the x-axis and the second represents the value of y from the y-axis. This pair of numbers is written inside the brackets starting with x-coordinate followed by the y-coordinate.

Horizontal axis (x-axis)



Vertical axis (y-axis)



The horizontal and vertical axes intersect at the origin O(0, 0), and divide the plane into four quadrants as shown in the following graph:

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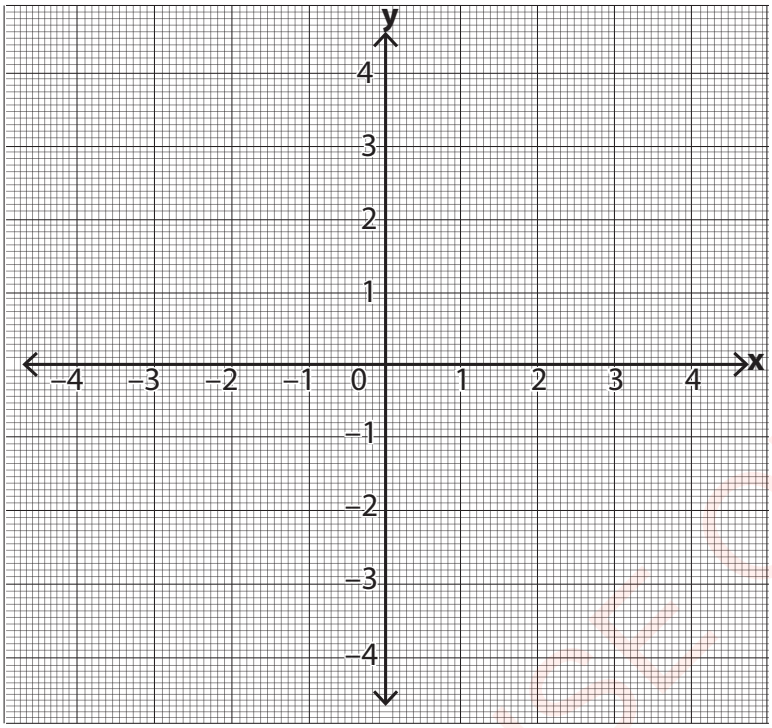

All the numbers on the right of 0 along the horizontal axis are positive and those on the left are negative. Also, all the numbers from 0 upwards along the vertical axis are positive and those from 0 downwards are negative.

Reading and writing coordinates of points

Coordinates of points enable you to draw a graph of horizontal and vertical axes with grid lines. When reading and writing coordinate points, the following steps need to be considered:

1. All the numbers are read starting from the point O(0, 0).
2. The first number to be read represents the horizontal axis (x-axis) and the second number represents the vertical axis (y-axis).
3. Coordinate points in a plane are indicated by two numbers, the first number is from the x-axis and the second number is from the y-axis.
4. These numbers are written inside brackets and separated by a comma. For example, (x, y) is read as “x comma y”.
5. Coordinates of a point are obtained by reading the ordered pair of numbers on the point of intersection of the two perpendicular lines representing x and y-axes.

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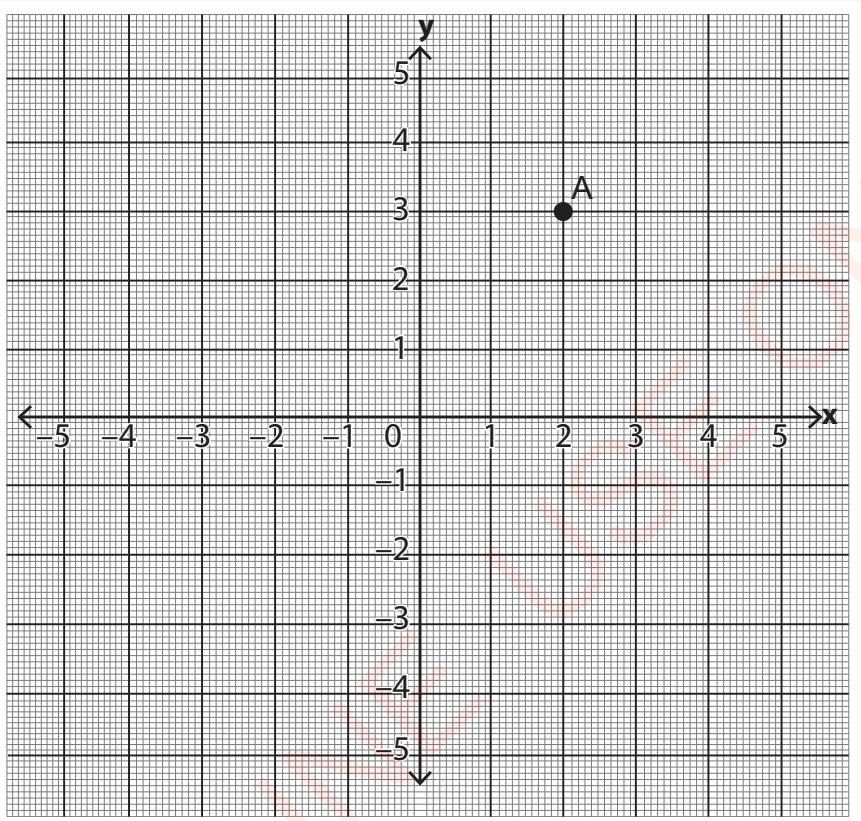
Activity

Study the following graph and use the given instructions to answer the questions that follow:



(a) Draw a line perpendicular to the x-axis from point A
(b) Draw a line perpendicular to the y-axis from point A
(c) Write the coordinates of point A

Example 1

Use the following graph to read and write the coordinates of the points A, B, C, D and E:

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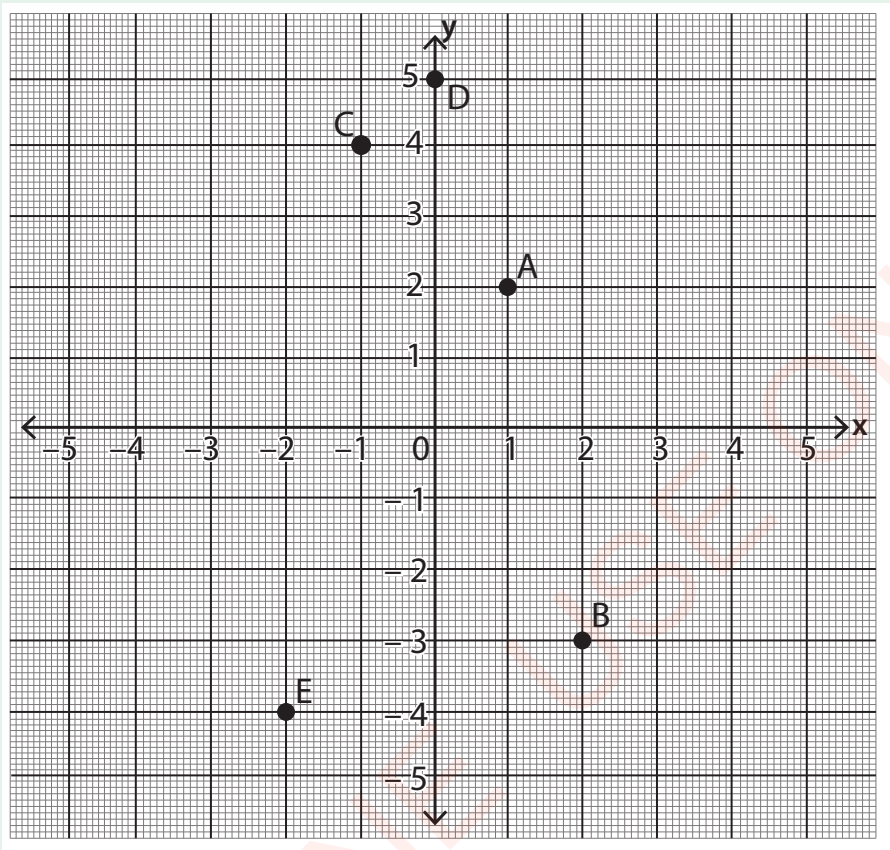

Solution

The coordinates of the given points in the graph are A (1, 2); B (2, –3); C (–1, 4); D (0, 5) and E (–2, – 4).

Example 2

Draw a graph of x and y-axes and then indicate the coordinates of the following points:

A(3, –5); B(– 4, 5); C(5, 2.5); D(–5.5, – 4) and E(–3, 1.5).

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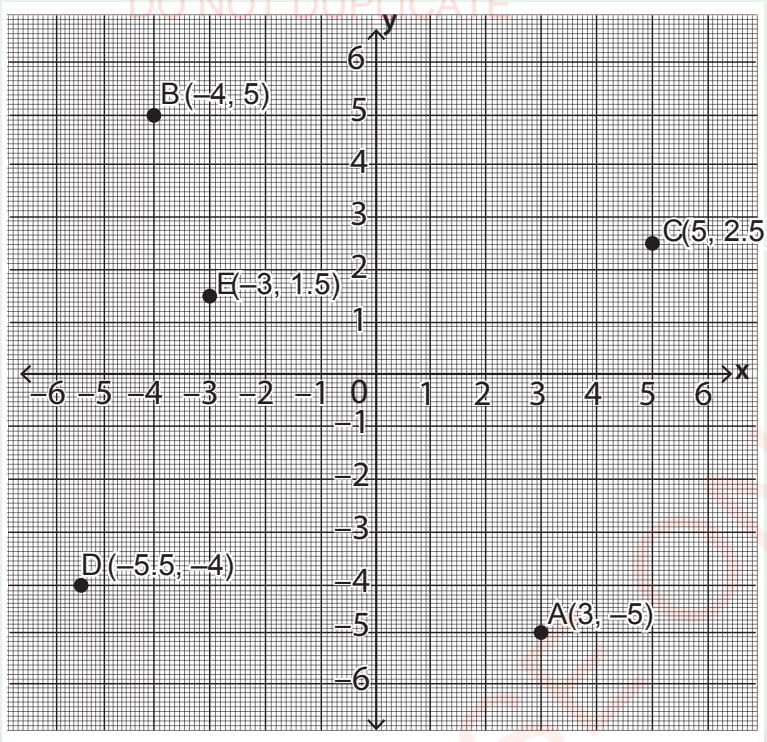
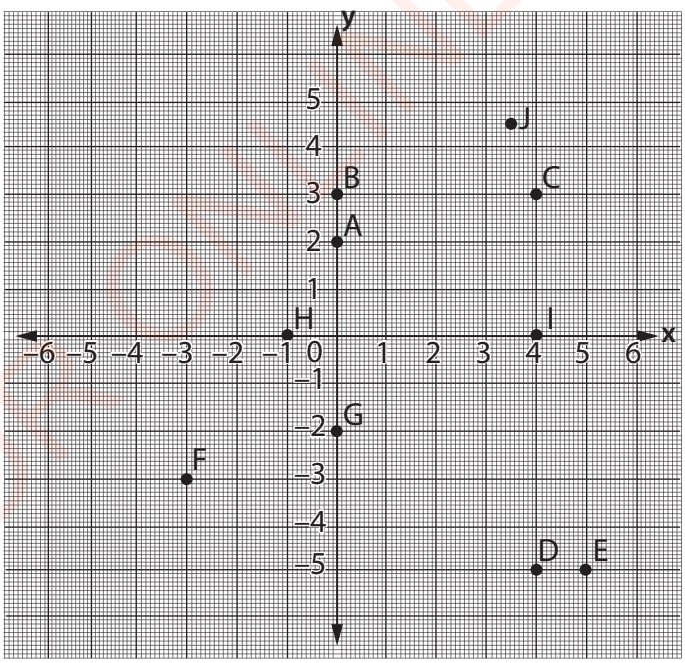
Solution



Exercise 1

Study the following graph and write the coordinates of the indicated points.



1. Point A
2. Point B
3. Point C
4. Point D
5. Point E
6. Point F
7. Point G
8. Point H
9. Point I
10. Point J

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Draw the horizontal and vertical axes and locate the following coordinate points:

11. A (–2, 3)

12. B (4, –4)

13. C (–5, 2)

14. D (– 4, – 4)

15. E (3, 0)

16. F (0, –1)

17. G (–1.5, 3.5)

18. H (–4.5, –1.5)

19. J$(-1, \frac{5}{2})$

20. K (3.5, 2)

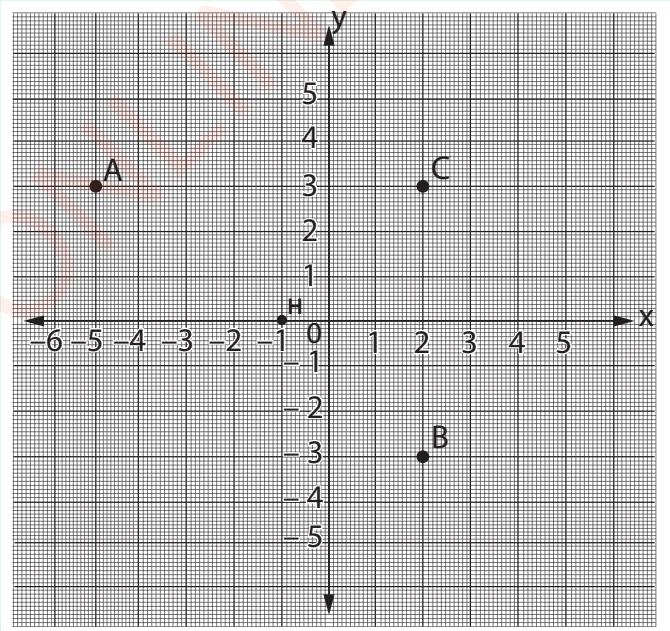
Drawing plane figures using coordinates of points

By using a ruler, you can join the pairs of coordinate points which are sequentially aligned to get different types of plane figures. Therefore, the vertices of the resulting plane figures are the coordinate points used to form the figures.

Example 1

Draw a plane figure which is formed by joining the points: A (–5, 3); B (2,–3) and C (2, 3). What is the name of the figure?

1. Draw a graph on x and y-axes and indicate all the given coordinate points as shown in the following figure:



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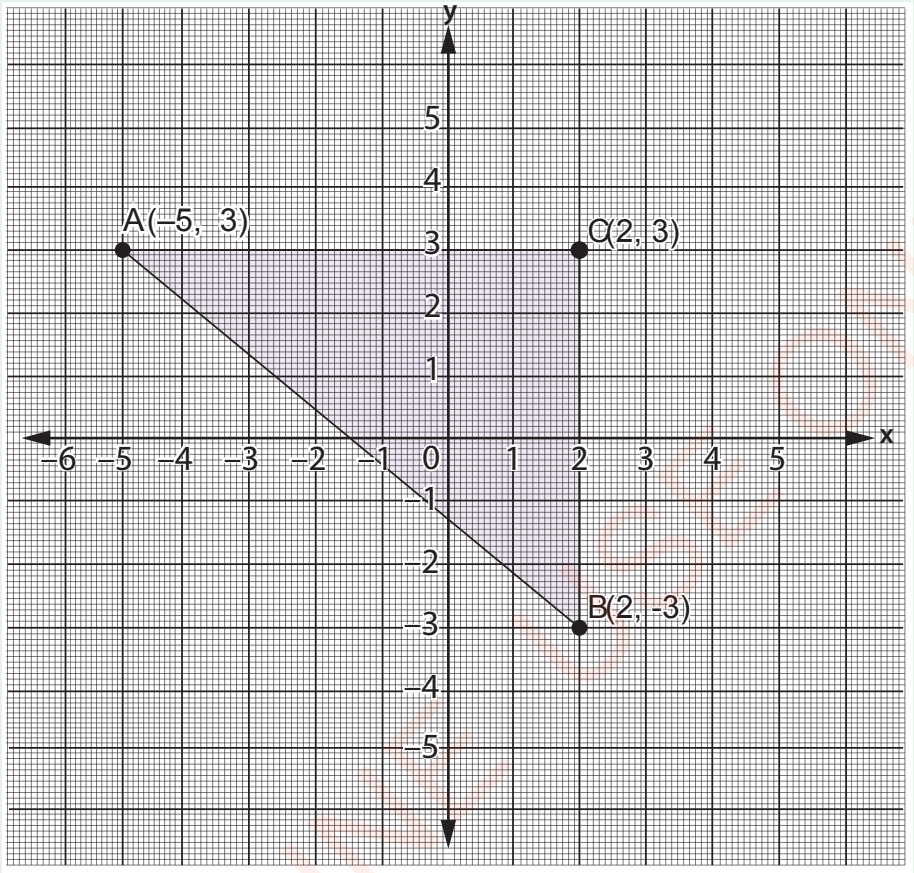
2. By using a ruler, join the coordinate points in the order of A B C A to get a plane figure.



Therefore, the resulting plane figure is a triangle.
Note that, steps 1 and 2 are done directly on a graph.

Example 2

Draw a plane figure by joining the points A (–2, 3); B (1, 3); C (1, –2) and D(–2, –2) in the order A B C D A.

Solution

Draw the x and y-axes and indicate all the given coordinate points.
Use a ruler to join the points in the order A B C D A.

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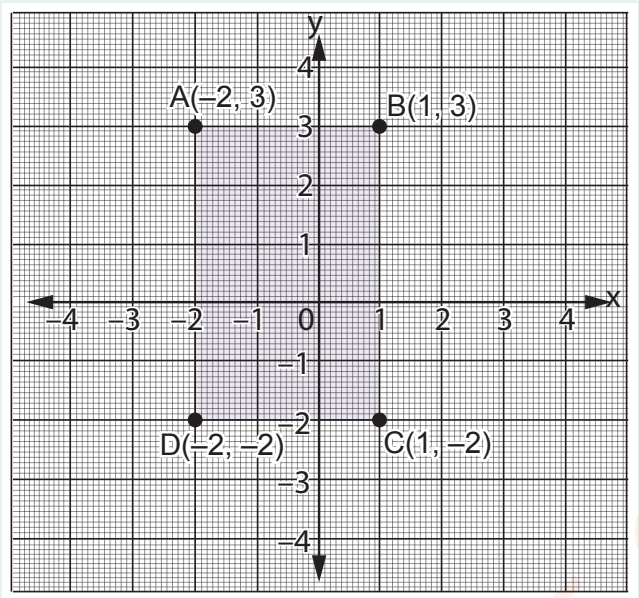
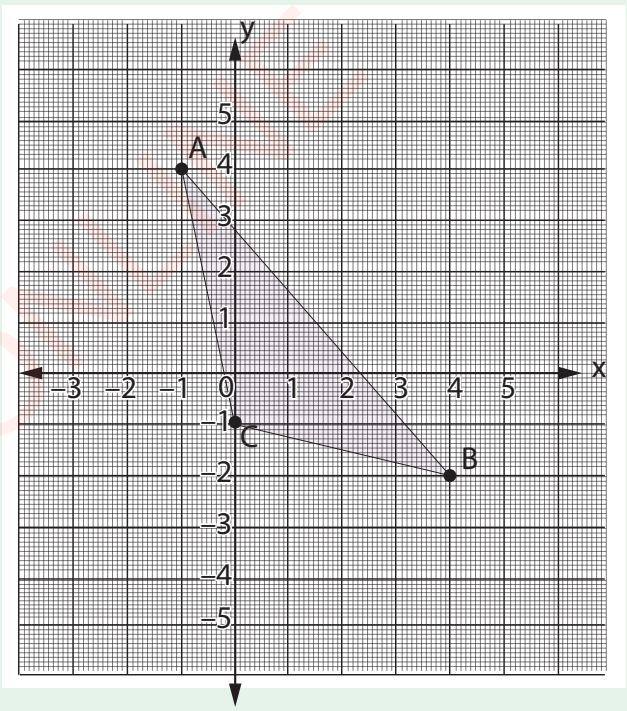


Example 3

Write the coordinates of the points A, B and C of the triangle shown in the following graph:



Therefore, the coordinate points are A (–1, 4), B (4, –2) and C (0, –1).

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Exercise 2

For question 1 – 6 , use a graph paper, ruler and pencil to draw lines represented by the given coordinate points:

1. A (3,–2) and B (2,–5)
2. C (0, 0) and D (–3,– 4)
3. E (–2, 4) and F (5,–2)
4. G (–3,–3) and H (–1,–3)
5. P (0, 3) and Q (3, 0)
6. W (– 4, –1) and X (4, –5)

For question 7 – 13, use a graph paper to draw the plane figures formed by joining the vertices in the given order:

7. A (3, –1); B (– 4, –1) and C (0, 1), in the order A B C A. What is the name of the resulting figure?

8. P (3, 3); Q (–2, 0) and R (–2, –1), in the order P Q R P. What is the name of the resulting figure?

9. J (4, 1); K (7, 1) and L (4, 3), in the order J K L J. What is the name of the resulting figure?

10. A (3, –1); B (5, –1); C (5, –3) and D (3, –3), in the order A B C D A. What is the name of the resulting figure?

11. W (–3, 4); X (2, 4); Y (2, 6) and Z (–3, 6), in the order W, X, Y, Z, W. What is the name of the resulting figure?

12. J (– 4, 0); K (– 4, – 4); L (–8, – 4) and M (–8, 0), in the order J K L M J. What is the name of the resulting figure?

13. C (1, –7); D (5, –7); E (7, –5) and F (3, –5), in the order C D E F C. What is the name of the resulting figure?

In questions 14-16, write the coordinates of the points forming the given plane figures:

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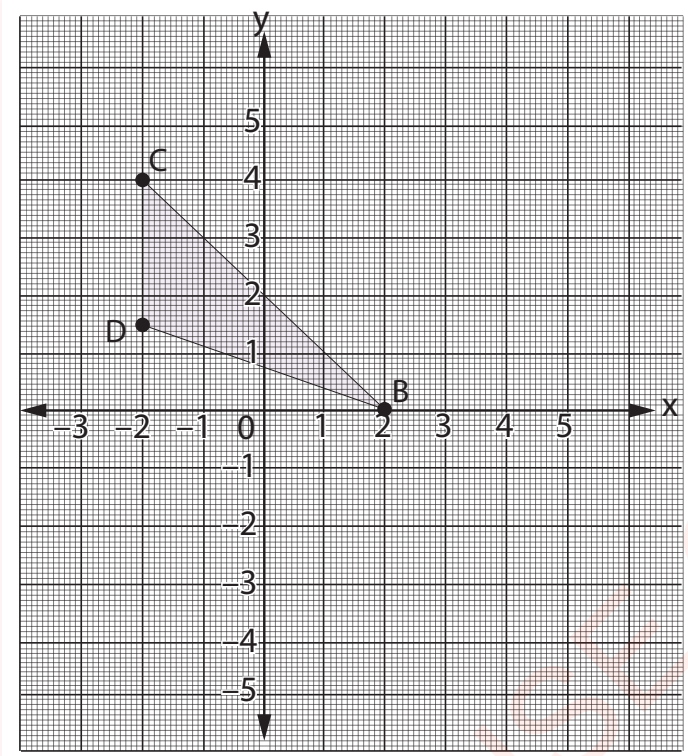
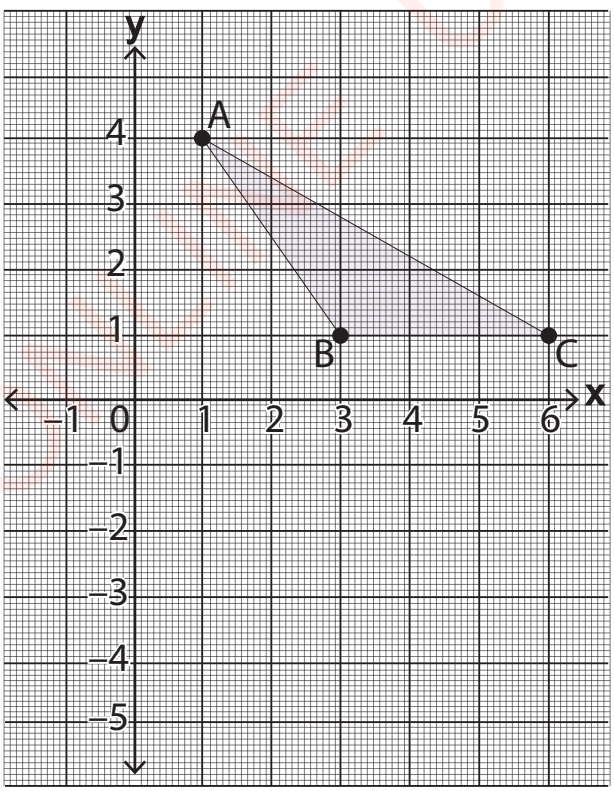
14.



15.



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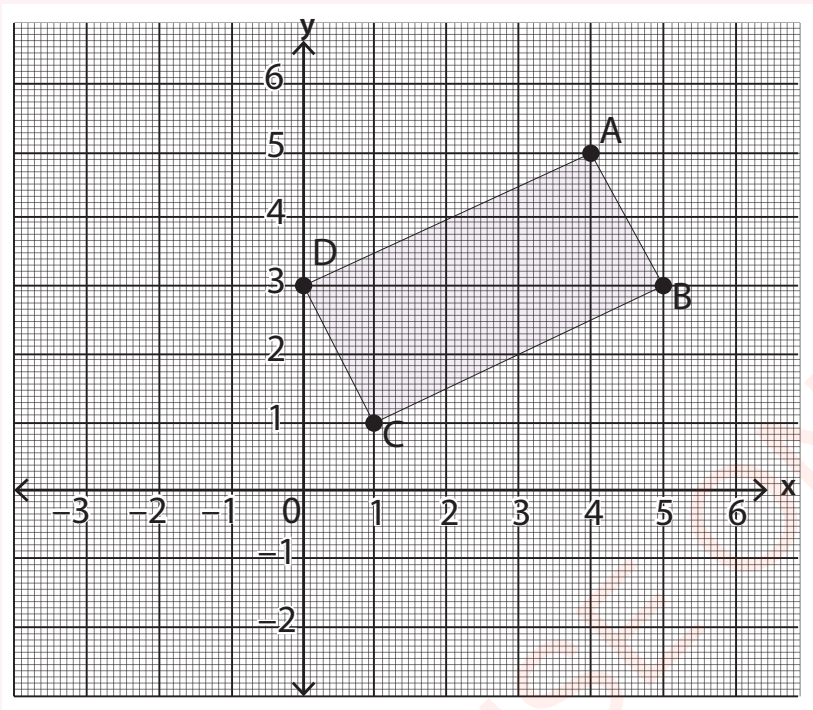
16.



Revision exercise

Answer the following questions:

1. What is a coordinate point?

2. How many lines are required in order to read the coordinates of a point on a plane?

3. How many quadrants are in the plane surface for reading coordinates of points?

4. Coordinates of points are read starting with the ..... axis, followed by the ..... axis.

Read the coordinates of points indicated in the following graph:

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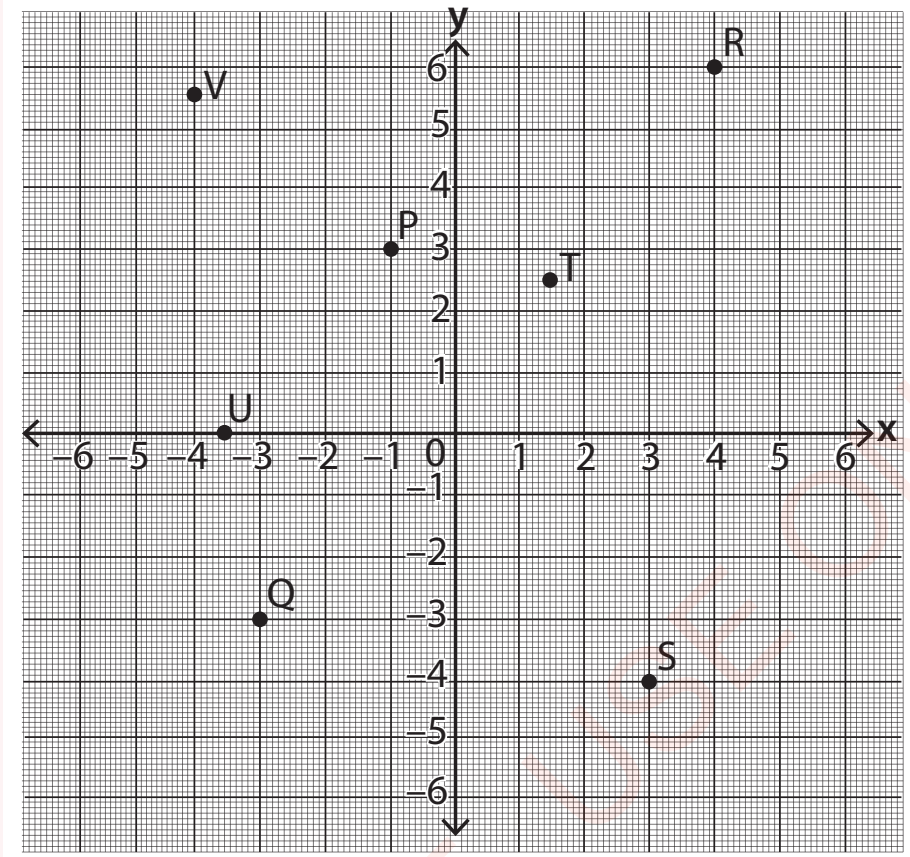

Use the given graph to write the coordinates of the following points:

5. Point P

6. Point Q

7. Point R

8. Point S

9. Point T

10. Point U

11. Point V

For question 12 – 16, draw a graph to indicate the coordinates of the given points.

12. A(–1, – 3)

13. B(2,– 1)

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14. C(0.5, –1.5)

15. D$(-2, \frac{3}{2})$

16. E$(2\frac{1}{2}, -4)$

Use a graph paper to draw the plane figures formed by the following vertices in the given order:

17. A (–1, 3); B (–1, – 4) and C (1, 0) in the order A B C A. What is the name of the resulting figure?

18. P (3, 3); Q (0, –2) and R (–1, –2) in the order PQRP. What is the name of the resulting figure?

19. J (1, 4); K (1, 7) and L (3, 4), in the order J K L J. What is the name of the resulting figure?

20. A (– 4, –3); B (–2, –1); C (–2, 1); and D (– 4, 3), in the order A B C D A. What is the name of the resulting figure?

Summary



1. To locate the position of a point, you need to know the origin point O(0,0).
2. The coordinates of a point is an ordered pair of numbers which show the position of an object on a plane.
3. Coordinates of points are indicated using two perpendicular lines on a plane.
4. Coordinates of points on a plane are located by pairs of two numbers, the first number represents the x-coordinate and the second represents the y-coordinate.
5. You can form different plane figures by joining the coordinate points in a specified order.
6. Coordinates of points form the vertices of the plane figures.

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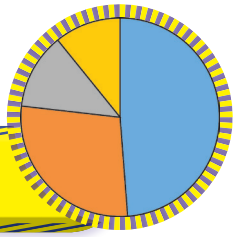
Chapter Fourteen

Statistics



Introduction

In Stardard Five, you learnt about reading and interpreting histograms as well as finding average. In this chapter you will learn about drawing, reading, interpreting pie charts and solve word problems. The knowledge and skills gained will help you in collecting and interpreting different statistical information such as number of people, harvests, health matters, educational matters and industrial productions.

Exercise 1: Revision

Answer the following questions:

1. Zomboko bought some crates of tomatoes from the market as follows: On Monday 10 crates, on Tuesday 6 crates, and on Wednesday 8 crates. What is the average number of crates bought per day?
2. The attendance of standard six pupils in five days of a week was as follows:

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Attendance	40	42	38	39	42

Find the average attendance of the pupils per day.

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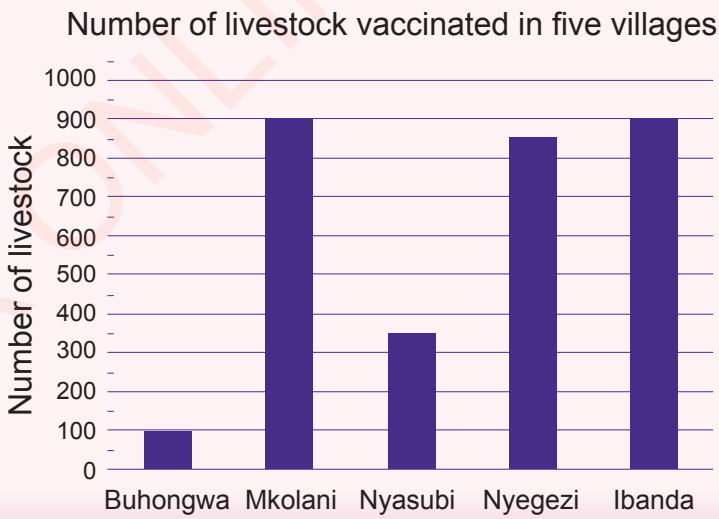
3. A lorry carried maize bags of the following mass in different days: 1 100 kg, 1 000 kg, 1 880 kg, 1 800 kg, 1 700 kg, 1 610 kg and 1 200 kg. What is the average mass of maize bags carried per day?

4. Use the following table which shows the mass and heights of children to answer the questions that follow:

Name	Mass	Height
Aisha	14 kg	120 cm
Deo	15 kg	128 cm
Jerome	17 kg	125 cm
Bakari	15 kg	122 cm
Salma	19 kg	116 cm

(a) Find the average mass of the children in kilograms.
(b) Find the average height of the children in metres.
(c) How many children weigh above the average?
(d) How many children have height above the average?

5. The following graph shows the number of livestock vaccinated in five villages of Buhongwa, Mkolani, Nyasubi, Nyegezi and Ibanda. Use the graph to answer the questions that follow:



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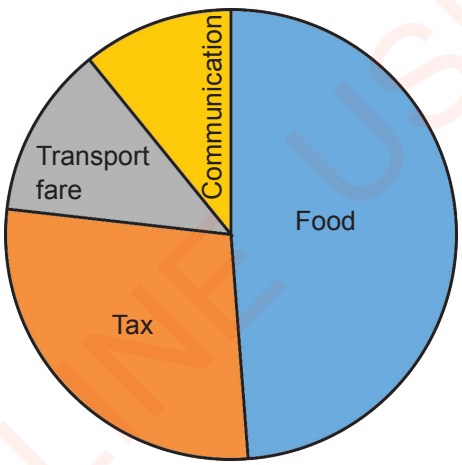
(a) Which village vaccinated the highest number of livestock and by how many?
(b) Which villages vaccinated the same number of livestock?
(c) Find the difference in the number of livestock vaccinated in Buhongwa and Ibanda.
(d) Find the total number of livestock vaccinated in all five villages.

Reading and interpreting pie charts

We can read and draw pie charts in order to obtain the required information. When reading and drawing pie charts, relate the number of items with the total degrees of a circle. For example, study the following pie chart which represent the expenditure of Farida's monthly salary:

Expenditure of Farida's monthly salary



The graph shows that a large fraction of Farida's salary is used for food. The rest is used for tax, transport fare and communication.

In pie charts, angles represent the number of objects. The largest number of objects are represented by the largest angle and the smallest number of objects are represented by the smallest angle.

Note that, the decimal solution for questions involving people, animals or things are approximated to a whole number.

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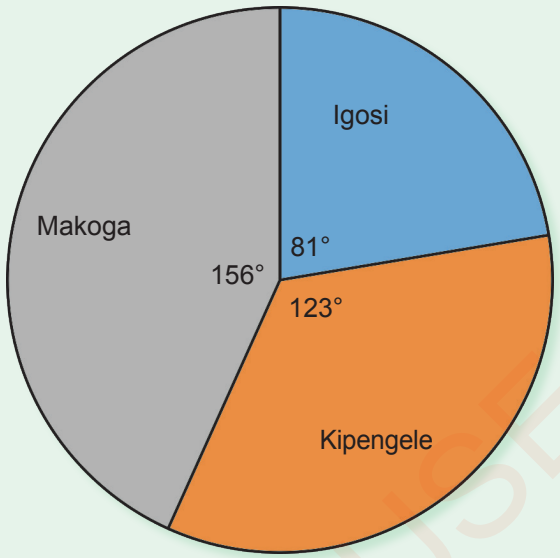
Example 1

The following pie chart shows the distribution of households in some villages in Njombe district for the year 2005:



If the total number of households in Kipengele, Makoga and Igosi villages is 24 000, answer the following questions:

(a) Which village has the largest number of households?

(b) Which village has the smallest number of households?

(c) What fraction represent the households in Kipengele village?

Solution

(a) The village with the largest number of households is the one represented by the largest angle. Therefore, Makoga village has the largest number of households.

(b) The village with the smallest number of households is the one represented by the smallest angle. Therefore, Igosi has the smallest number of households.

(c) The fraction representing the number of households in Kipengele village is $\frac{123}{360}$ or $\frac{41}{120}$ of all households.

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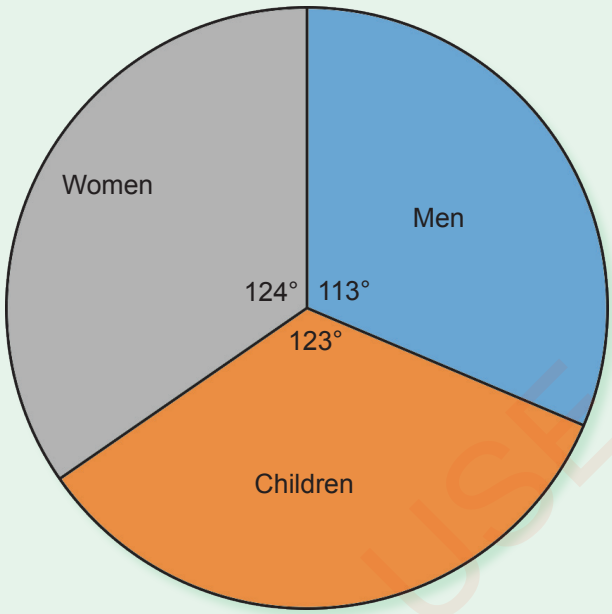
Example 2

The following pie chart shows the proportion of people in Mbeya town in the year 2007.



If Mbeya town had 900 000 people in that year, answer the following questions:

(a) How many children were there?
(b) How many men were there?
(c) How many women were there?
(d) Which category of people had the largest number of people?
(e) What fraction of all the people were men?

Solution

The number of people for each group is found by using the size of the representative angle in the pie chart.

Therefore,

$$\text{Number of people} = \frac{\text{Size of the angle}}{\text{Sum of angles in a circle}} \times \text{total number of people}$$

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(a) Number of children $= \frac{123°}{360°} \times 900\,000 = 307\,500$

Therefore, the number of children is 307 500.

(b) Number of men $= \frac{113°}{360°} \times 900\,000 = 282\,500$

Therefore, the number of men is 282 500.

(c) Number of women $= \frac{124°}{360°} \times 900\,000 = 310\,000$

Therefore, the number of women is 310 000.

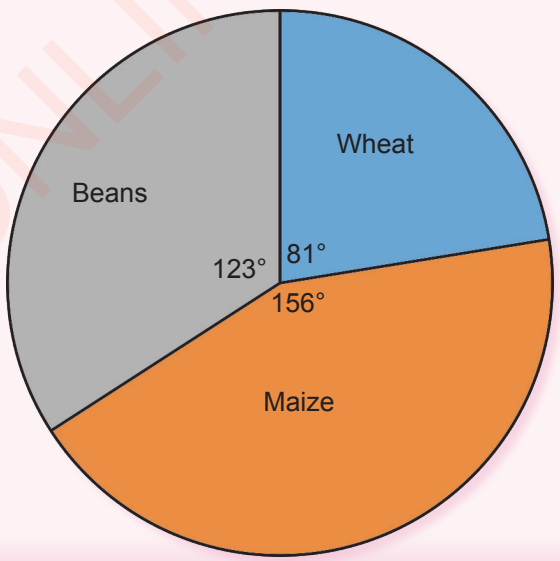
(d) Women were more than men and children.

(e) Men were $\frac{113}{360}$ of all the people.

Exercise 2

Answer the following questions:

1. The angles in the following pie chart represent the number of bags of different crops sold at Tandale market in a certain month:



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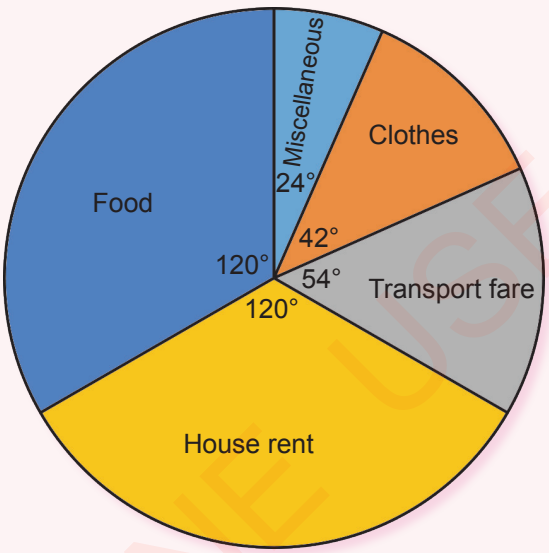
If 48 000 bags of beans, maize and wheat were sold in that month, answer the following questions:

(a) How many bags of beans were sold?
(b) How many bags of maize were sold?
(c) Which crop was mostly sold in that month?
(d) The sales of wheat represent what fraction of all the crops?

2. Halifa received 720 000 shillings after tax deduction on his monthly salary. The monthly expenditure of his salary is as shown in the following pie chart.



How much money does Halifa spend on:

(a) Food?
(b) House rent?
(c) Transport fare?
(d) Clothes?
(e) Miscellaneous?

3. The following pie chart shows the distribution of 6 000 standard seven leavers from one of the Tanzanian districts selected to join secondary schools for the period of 2013 to 2015.

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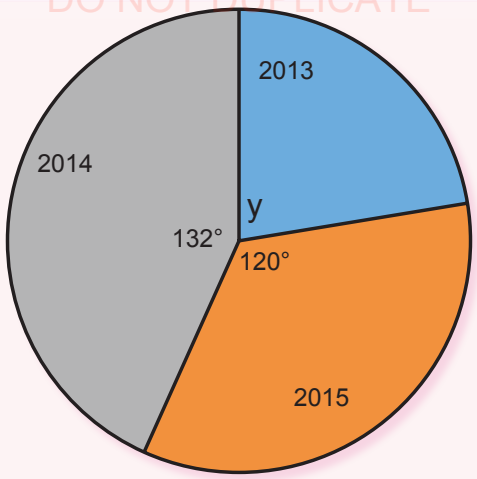

(a) Find the size of angle y
(b) Find the number of students selected in 2013
(c) Which year had the largest number of students selected to join secondary schools?
(d) Find the difference in the number of students selected in 2014 and 2015

Drawing pie charts

Information can also be interpreted by drawing a pie chart using a protractor. The following are steps to follow when drawing a pie chart:

1. Find the total number of all items involved.
2. Convert the amount of each item into degrees of the circle.
3. Make sure the sum of degrees in all items is equal to 360°.
4. Draw a circle and then use a protractor to measure angles representing the items.

Example 1

The following is the number of livestock in one of the streets in Kinzudi: 1 260 chickens, 300 goats and 600 cattle: Present this data in a pie chart.

Solution

Total number of livestock;
1 260 + 300 + 600 = 2 160.

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Convert the number of each type of livestock into degrees;

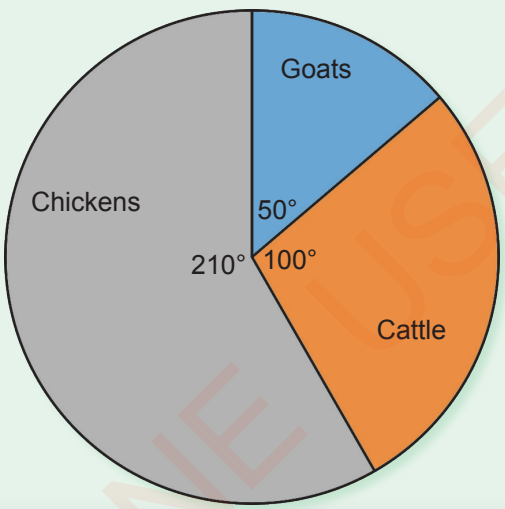
Degrees for chickens: $\frac{1260}{2160} \times 360° = 210°$

Degrees for goats: $\frac{300}{2160} \times 360° = 50°$ and,

Degrees for cattle: $\frac{600}{2160} \times 360° = 100°$

Verify the sum of degrees; $210° + 50° + 100° = 360°$

A pie chart showing the distribution of livestock in degrees is as follows:



Example 2

The maize harvests from a certain school were as follows:

Year of harvest	2006	2007	2008	2009
Harvests in terms of number of bags	60	80	20	40

Present this information in a pie chart.

Solution

Total number of bags; $60 + 80 + 20 + 40 = 200$

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Convert the number of bags for each year into degrees.

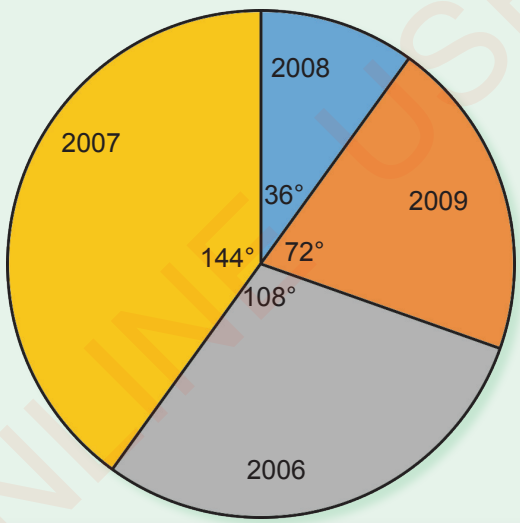
Degrees for year 2006 are $\frac{60}{200} \times 360° = 108°$.

Degrees for year 2007 are $\frac{80}{200} \times 360° = 144°$.

Degrees for year 2008 are $\frac{20}{200} \times 360° = 36°$.

Degrees for year 2009 are $\frac{40}{200} \times 360° = 72°$.

Verify the sum of degrees: 108° + 144° + 36° + 72° = 360°
The pie chart showing the maize harvests for the years 2006, 2007, 2008, and 2009 is as follows:



Example 3

In 2018, Joyce cultivated groundnuts, maize and beans crops in her farm. The following was her harvests in percentages:

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Crop	Harvest (%)
Groundnuts	15
Maize	65
Beans	20

Present this information in a pie chart.

Solution

Total percentages of crops;
15% + 65%+ 20% = 100%
Convert the percentages of each crop into degrees.

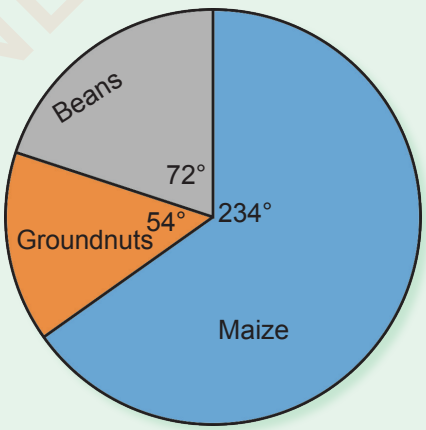
Degrees for groundnuts are $\frac{15}{100} \times 360° = 54°$.

Degrees for maize are $\frac{65}{100} \times 360° = 234°$.

Degrees for beans are $\frac{20}{100} \times 360° = 72°$.

Verify the sum of the degrees: $54° + 234° + 72° = 360°$

The pie chart showing the harvests from Joyce's farm in 2018 is as follows:



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Exercise 3

Answer the following questions:

1. In a certain class, there are ten pupils aged 15 years, fifteen pupils aged 17 years and twenty pupils aged 18 years. Present this information in the pie chart.

2. A certain village sold oranges in tons as follows: 30 tons were sold in 2012, 40 tons in 2013 and 50 tons in 2014. Present this information in the pie chart.

3. Present the following information in a pie chart:

Crop	**Tons**
Groundnuts	5 000
Sunflower	8 000
Maize	7 000

4. There are 800 people in Guni village. If 200 are children and 600 are adults, present this information in a pie chart.

5. A certain primary school has 300 pupils. Among them, 120 are girls and 180 are boys. Draw a pie chart to present this information.

6. The report of four primary schools on renovation costs for the financial year 2016/2017 was as shown in the following table:

School	Expenditure (sh)
Ndono	1 200 000
Mnazi mmoja	1 150 000
Mlangali	1 130 000
Mwenge	1 120 000

Present this information in a pie chart.

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7. The following table shows the amount of money used for renovation of primary schools in three villages in the year 2016/2017:

School	Expenditure (sh)
Iyele	1 500 000
Oye	2 400 000
Milambi	1 100 000

Present this information in a pie chart.

8. A train fare from Dar es salaam to Mwanza was as follows: First class 79 400 shillings, second class 62 500 shillings, and third class 48 600 shillings. Use this information to draw a pie chart.

9. The following was a village report on the number of livestock for the year 2017:

Type of livestock	Number
Chickens	23 900
Goats	62 500
Cattle	45 100
Rabbits	12 010
Sheep	8 490

Answer the following questions:

(a) Present this information by using a pie chart
(b) Which livestock is represented by the smallest angle?
(c) Which livestock is represented by the largest angle?
(d) What fraction of all the livestock represent the number of sheep?

10. A certain cashew nuts cooperative union spent its earnings as follows: 40% for paying farmers debts, 25% for payment of agricultural inputs and pesticides, 15% for house rent, 10% for salaries and 10% as savings. Draw a pie chart to represent the expenditures of the cooperative union.

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11. A certain family keeps three types of chickens namely local chickens, broilers and layers. All chickens are fed with one type of food. The amount of food to feed each type of chickens in one day is as shown in the following table:

Type of chicken	Amount of food in kilograms
Local chickens	10
Broilers	20
Layers	30

Answer the following questions:

(a) Use a pie chart to present this information

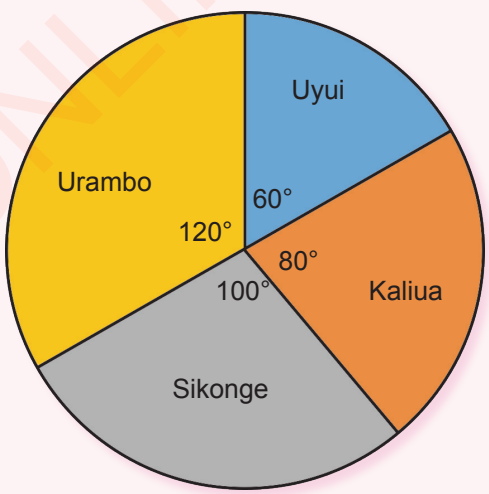
(b) What degrees represent the amount of food for broiler chickens?

(c) Find the difference in degrees between the amount of food for local chickens and layers

Revision exercise

Answer the following questions:

1. A certain company bought 2 160 000 kilograms of tobacco from tobacco farmers in Tabora region. The tobacco which was bought from Kaliua, Urambo, Uyui and Sikonge district councils is presented in the following pie chart:



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Use a pie chart to answer the following questions:

(a) What was the amount of tobacco sold by each district council?

(b) Which district council had the highest sales?

(c) What fraction of all sales represent the sales of Uyui district council?

(d) Find the sum of the sales from Urambo and Sikonge district councils

2. Msaranga ward has 4 pre-primary schools, 10 primary schools and 3 secondary schools. Use a pie chart to present this information.

3. Mr. Mkono spends his monthly salary as shown in the following table:

Expenditure	Amount (%)
Food	30
Tax	15
Fare	15
Communication	10
Balance	20
Miscellaneous	10

Draw a pie chart to present this information.

Summary

The following are the steps for drawing a pie chart:

1. Add the quantities of all given items to obtain its sum.
2. Convert the quantity of each item into degrees in a circle.
3. Make sure the sum of all angles is 360 degrees.
4. Use a protractor to draw the size of all angles in the pie chart that represent the given items.

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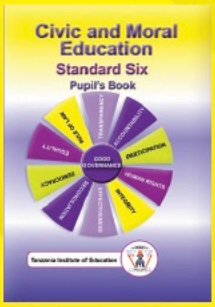

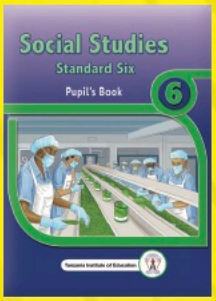

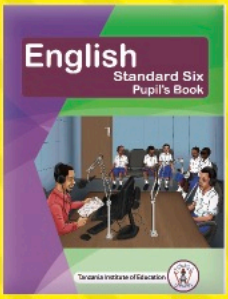

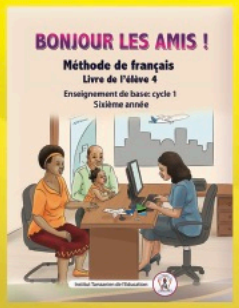

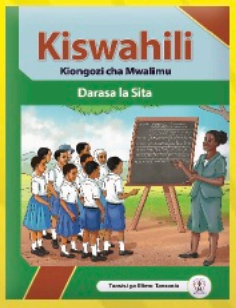

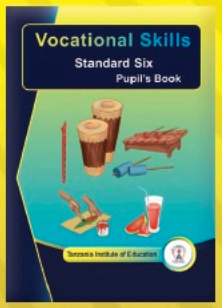

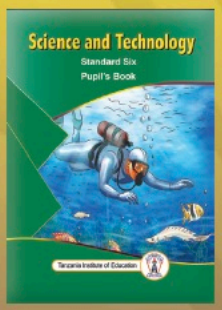

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