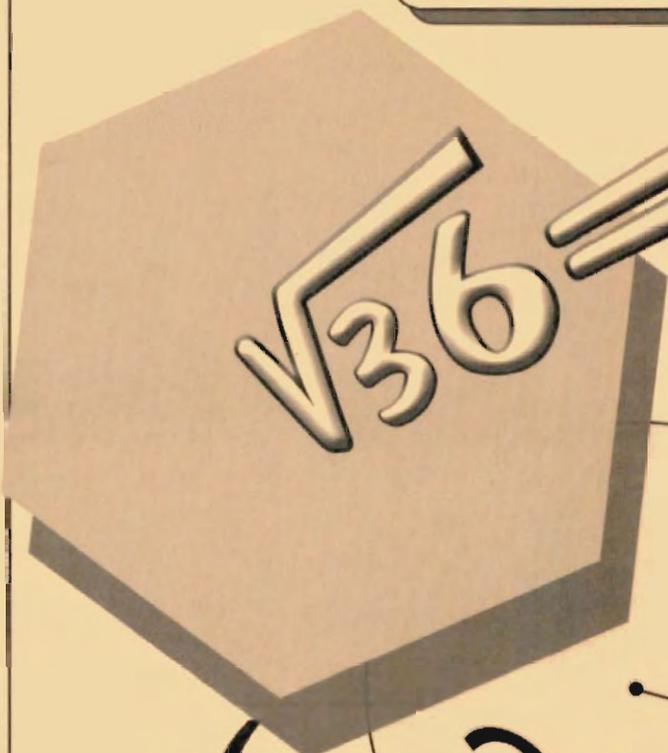


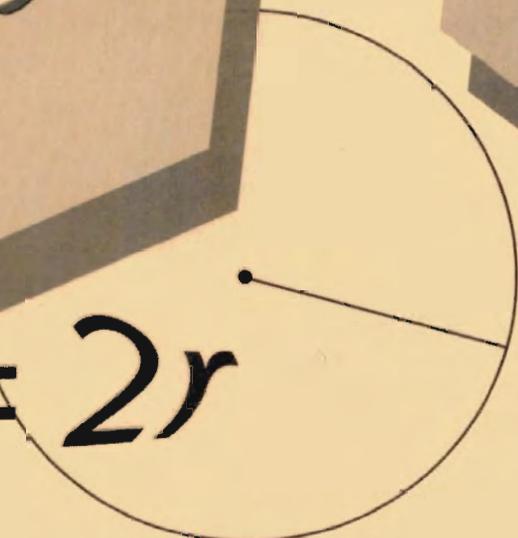
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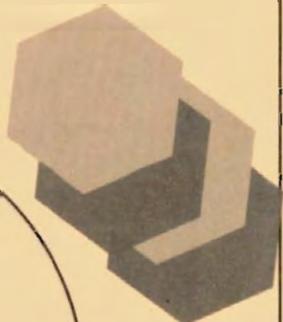
MATHEMATICS

LEVEL 4A

6


$$\sqrt{36} = 6$$


$$d = 2r$$



SECRETARIAT OF EDUCATION
NEW SUDAN

ACCELERATED LEARNING PROGRAM

MATHEMATICS

LEVEL 4A

Secretariat of Education

New Sudan

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SUDAN BASIC EDUCATION PROGRAM

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Introduction

This book was prepared according to the ALP Level Four syllabus for mathematics. The units and contents are structured in sequence, and advance from familiar to unfamiliar. The content of the book has been written with the learner in mind, who will use it to equip himself/herself with the required theoretical and practical skills to enable him/her to continue for further education or vocational training, and lead a useful life that contributes towards the educational development of the nation.

Each unit is organized in a similar format. First, there are revision exercises for learners to practice what they learned in previous lessons. The revision exercises also provide learners with the opportunity to assess which material they need additional practice with. Next, the new material is presented, with examples, and practice exercises.

UNIT 1

Whole Numbers

1.1 (a) Place Value of Numbers

Exercise 1

1. Complete the place value chart below,

	Millions	Hundred Thousands	Ten Thousands	Hundreds	Tens	Tens	Ones
Example							
7582314	7	5	8	2	3	1	4
1826148							
865341							
35896							
47149							
138							
9114							

2. What is the place value of digit 5 in the following numbers?

- a) 2,578 b) 45,789 c) 532,689
d) 12,587,961 e) 5,683,400

3. Round off the following to the nearest ten, hundred, thousand, hundred thousand and million.

- a) 20,869 b) 2,003,841 c) 789,987
d) 62,747,861 e) 130,061,348 f) 31,475,488

4. What is the place value of the digit 8 obtained after working out the multiplication 38×49 ?

5. What is the place value of the number in the square box?

- a) 386 321 b) 4 36839
c) 60 2005 d) 581016
e) 28671456 f) 10034

6. What is the place value of the largest digit in the following numbers.

- (a) 394,567 (b) 5,128,674 (c) 2,310,212
(d) 7,245,843 (e) 420,110,110 (f) 67,492

7. What is the place value of the smallest digit in the following numbers?

(a) 986,247

(b) 314,593

(c) 2,586,737

(d) 4,744,631

(e) 631,574

(f) 7,482,631

1.1 (b) Reading and writing numbers in symbols and words

Example 1

1. Write 31,585,493 in words

Solution 31,585,493

Millions are 31 = 31,000,000 or thirty one million

Thousands are 585 = 585,000 or five hundred eighty five thousand

Hundred are 4 = 400 or four hundred

Tens are 9 = 90 or ninety

Ones are 3 = 3 or three

31,585,493 = 31,000,000 + 585,000 + 400 + 90 + 3

This is written as

Thirty one million, five hundred eighty five thousand, four hundred and ninety three.

Example 2

Write the number nineteen million, six hundred and forty nine thousand, seven hundred and seventy three in symbols.

In Words	In Symbols
Nineteen million	19,000,000
Six hundred and forty nine thousands	649,000
Seven hundred and	700
Seventy	70
Three	3
	19,649,773

Nineteen million, six hundred and forty nine thousand, seven hundred and seventy three.

Exercise 2

1. Read and write the following numbers in words
 - a) 49,856
 - b) 603
 - c) 19,673
 - d) 999,003,879
 - e) 5,000,007
 - f) 10,001,000
 - g) 999,999,999
2. Write the following in symbols
 - a) Two hundred million, nine thousand and nine
 - b) Five hundred and thirty two thousand and eighty seven
 - c) Sixty million, sixty six thousand and six
 - d) Three hundred and forty four million, two hundred and two thousand
3. Write the number which comes just before each of these numbers in words.
 - (a) 3,000,000
 - (b) 88,800
 - (c) 22,205
4. Write the number which comes just after each of these numbers in words.
 - (a) 1,000,000
 - (b) 399,993
 - (c) 453,978
5. Arrange the numbers in order from the smallest to the largest
 - (a) 2,016,580, 2,006,851, 2,010,865, 2,008,175
 - (b) 875,913, 1,903,452, 904,638, 1,394,678

1.1 (c) Four Basic Operations

Addition

Example

Work out $6586 + 29 + 726 + 3571$

Begin adding from the ones

$$\begin{array}{r} 6586 \\ 29 \\ 726 \\ + 3571 \\ \hline 10912 \end{array}$$

Exercise 3 (a)

1.
$$\begin{array}{r} 65384 \\ + 2783 \\ \hline \end{array}$$
2.
$$\begin{array}{r} 738629 \\ + 3413 \\ \hline \end{array}$$
3.
$$\begin{array}{r} 113001 \\ + 68149 \\ \hline \end{array}$$

$$\begin{array}{r} 4. \quad 53496 \\ 10327 \\ + \underline{521} \end{array}$$

$$\begin{array}{r} 5. \quad 1823496 \\ 4110382 \\ + \underline{7156752} \end{array}$$

$$\begin{array}{r} 6. \quad 2745612 \\ 19321405 \\ + \underline{24610271} \end{array}$$

$$7. \quad a) \quad 700 + 348 + 400843 =$$

$$b) \quad 9764432 + 10564597$$

$$c) \quad 107256 + 23478 + 372 + 9 =$$

$$d) \quad 2567309 + 326718 + 36 =$$

8. The population of three areas is shown as follows: 47,100; 861,325; 796,483. Find the total population for the three areas.

9. Ayaga had six hundred and fifty-one Sudanese pounds, Bringi had eighty six thousand, six hundred and twenty-five pounds and Kueth had seven hundred and ten thousand, four hundred and thirty-one Sudanese pounds. How much money did they have altogether?

10. A bus traveled from Juba to Yambio, a distance of 304 km. Later the bus went for another 150km to Tambura and then back to Yambio. What distance in km did the bus cover?

Subtraction

Example

Work out

$$\begin{array}{r} 1. \quad 874201 \\ - \underline{389743} \\ \hline 484458 \end{array}$$

$$\begin{array}{r} 2. \quad 50000 \\ - \underline{38261} \\ \hline 11739 \end{array}$$

Exercise 3(b)

1. Work out the following

$$a) \quad \begin{array}{r} 45872 \\ - \underline{28614} \end{array}$$

$$b) \quad \begin{array}{r} 32006 \\ - \underline{15937} \end{array}$$

$$c) \quad \begin{array}{r} 74871 \\ - \underline{4378} \end{array}$$

$$d) \quad \begin{array}{r} 670003 \\ - \underline{582417} \end{array}$$

2. Find x if $6826 + x = 8700$
3. The sum of three numbers is 846789. If the sum of the two numbers is 582,395, what is the other number?
4. A printing press made 69,870 exercise books in three days. On the first day, it made 13,657. On the second day it made 12,890. How many did it make on the third day?
5. A lorry carried 53,689 tons of maize to be distributed to two counties. If 25,865 tons were unloaded at the first county, how many tons of maize did the second county receive?
6. A school was given 3,000 exercise books to be given to pupils. If they gave out 2,866 books, how many books were left?
7. The area of Kaku's garden is 75480m^2 . and the area of Aguek's garden is 15672m^2 . Find the difference in area between the two gardens.
8. The population of Juba is estimated to be 1,681,420 people. If 986,741 are women and children, how many men are there?

Multiplication

Example

$$\begin{array}{r}
 1387 \\
 \times 677 \\
 \hline
 9709 \\
 97090 \\
 + 832200 \\
 \hline
 938999
 \end{array}$$

Exercise 3 (c)

Find product of the following

1. 826×21

2. 648×535

3. 82633×405

4. 7496×387

5. 26351×417

6. 2581×875

$$\begin{array}{r} 7 \text{ a) } 496 \\ \times 384 \\ \hline \end{array}$$

$$\begin{array}{r} \text{b) } 689 \\ \times 345 \\ \hline \end{array}$$

$$\begin{array}{r} \text{c) } 9048 \\ \times 565 \\ \hline \end{array}$$

$$\begin{array}{r} \text{d) } 8485 \\ \times 698 \\ \hline \end{array}$$

8. 15 lorries were used to transport bags of maize meal to a school. If each lorry carried 480 bags, how many bags of maize meal were transported?
9. Rita harvested 590 bags of maize. Each bag weighed 90kg. What was the total weight of maize harvested?
10. On average, a butcher slaughters thirty cows per month. If each cow weighs three hundred and seventy nine kilograms, how many kilograms does he sell in a year?

Division
Example

$$\begin{array}{r} \text{(a)} \quad \quad \quad 3771 \text{ rem } 10 \\ 23 \overline{)86743} \\ \underline{69} \\ 177 \\ \underline{161} \\ 164 \\ \underline{161} \\ 33 \\ \underline{23} \\ 10 \end{array} = 3771 \frac{10}{23}$$

$$\begin{array}{r} \text{(b)} \quad \quad \quad 132 \text{ rem } 112 \\ 127 \overline{)16876} \\ \underline{127} \\ 417 \\ \underline{381} \\ 366 \\ \underline{254} \\ 112 \end{array} = 132 \frac{112}{127}$$

Exercise 3 (d)

Work out the following

$$1) 7560 \div 38$$

$$2) 8040 \div 28$$

$$3) 847 \div 64$$

$$4) 3019 \div 19$$

$$5) 957377 \div 497$$

$$6) 49 \overline{)13513}$$

7) $47 \overline{)84616}$

8) $58 \overline{)3988}$

9) $22 \overline{)18008}$

10) $189 \overline{)118705}$

- 11) A school in Kwajok was given 227,950 books to divide equally among 560 pupils. How many books did each pupil get?
- 12) 10,000m² of land was dug by 25 men. If the men were digging at the same rate, how many square metres did each man dig?
- 13) A man harvested 3,420 kg of millet and put it in bags. If each bag contained 90kg, how many bags of millet did he harvest?
- 14) In a maize field there are approximately 16,308 plants, planted in rows. Each row has 36 plants. How many rows are there in the field?

1.1 (d) Solving word problems involving the four basic operations.

Given $586+294-406$, do the operations as they occur i.e. $586+294-406=880-406=474$	When this example is written as $294-406+586$, 406 is greater than 294. In this case rearrange the numbers	In general, do the addition before the subtraction.
$472 \times 77 + 49$ $= 36344 + 49$ $= 36393$	$49+472 \times 77$ $= 49 + 36344$ $= 36393$	Perform the multiplication, and then the addition
$220 \times 40 + 812$ $= 8800 + 812$ $= 7988$	$960 + 40 \times 20$ $= 960 - 800$ $= 160$	Perform the multiplication, and then the subtraction
$880 \div 110 - 5$ $= 8 - 5$ $= 3$	$880 \div 40 + 400$ $= 22 + 400$ $= 422$	Perform the division, and then subtraction or addition
$141 \times 614 \div 2$ $= 141 \times 307$ $= 43287$	$614 \div 2 \times 141$ $= 307 \times 141$ $= 43287$	Perform the division first, and then the multiplication

Exercise 3 (e)

Mixed exercise with combined operations.

Work out the following

- 1) $21256 + 3047015 + 4237202$
- 2) $80000 + 400000 + 489501 + 500 + 9000$
- 3) $137 + 704 \times 16$
- 4) $17 + 121 \div 11$
- 5) $202 \times 31 + 6140$
- 6) $180 \div (3 \times 3) - 15$
- 7) $58 - 24 \div 8 + 45 \div 9 + 5$
- 8) $816 \div 12 \div 4$
- 9) $64 + 15 \div 3 \times 68 \div 4 - 6$
- 10) $17 \times 36 \div 4 \times 48 + 15$
- 11) Find the product of 3783 and 421
- 12) Bol had 355 cows. Then his three daughters got married and he was paid 307 cows as dowry. A year later his son Deng got married and Bol gave him 105 cows to pay as dowry. How many cows was Bol left with?
- 13) 5250kg of millet were equally distributed to 350 families. How many kg of millet did each family get?
- 14) Poni had £s 6750. She wanted to buy a dress which cost £s.80,000. How much more money did she need?
- 15) During an election, four candidates contested for a seat. The results of the election showed that the winner got 8603 votes more than the second candidate. The second candidate got 6408 votes more than the third candidate. The fourth candidate got 102 votes less than the third. If the third and the fourth candidates got a total of 1204 votes, how many votes did the winning candidate get?

1.1 (e) Squares and Square Roots of Perfect Squares

1.1 (e) (i) Squares

Example 1

What is 9^2 ?

9^2 (nine squared) means 9 multiplied by itself $9^2 = 9 \times 9 = 81$

Example 2

What is the square of $\frac{3}{4}$?

$$\left(\frac{3}{4}\right)^2 = \frac{3}{4} \times \frac{3}{4} = \frac{9}{16}$$

Example 3

What is the square of $1\frac{2}{3}$?

$$1\frac{2}{3} = \frac{5}{3} = \left(\frac{5}{3}\right)^2 = \frac{25}{9} = 2\frac{7}{9}$$

Exercise 4 (a)

Work out the following

1. (a) 3×3 b) 9×9 c) 11×11 d) 10×10

What is?

2. (a) 7^2 b) 12^2 c) 4^2 d) 1^2

3. a) 18^2 b) 22^2 c) 30^2 d) 41^2

4. Find the squares of the following:

- a) 15 b) 17 c) 19 d) 20

5. Work out the squares of the following fractions

- a) $\frac{3}{4}$ b) $\frac{3}{7}$ c) $\frac{1}{5}$ d) $\frac{3}{8}$ e) $\frac{3}{10}$ f) $\frac{4}{9}$

6. Find the squares of the following

a) $3\frac{1}{3}$

b) $2\frac{2}{5}$

c) $6\frac{1}{3}$

d) $1\frac{3}{8}$

e) $3\frac{1}{7}$

f) $4\frac{7}{9}$

7. The length of a square flower garden is 17 cm. Find its area.

8. Keji multiplied 69 by itself. What was her answer?

9. What is the sum of 20^2 and 30^2 ?

10. Find the next two numbers in the series 16, 25, 36, 49.....

1.1 (e) (ii) Square Root

Example 1

25 can be expressed as 5×5 or 5^2 .

5 is the number which when multiplied by itself twice will give 25. Therefore 5 is the square root of 25.

The symbol $\sqrt{\quad}$ means "the square root of"

$$\sqrt{25} = 5$$

Example 2

Find the square root of 225.

Step 1

Record 225 in its prime factors i.e.

3	225
3	75
5	25
5	5
	1

Step 2

Pair the prime factors: $3 \times 3 \times 5 \times 5$

Step 3

Pick one factor from each pair and multiply them: $3 \times 5 = 15$

$$\therefore \sqrt{225} = 15$$

Example 3

Find the square root of i) $\frac{16}{25}$ ii) $6\frac{1}{4}$

$$\text{i). } \frac{\sqrt{16}}{\sqrt{25}} = \frac{4}{5}$$

$$\text{ii). } \sqrt{6\frac{1}{4}} = \sqrt{\frac{25}{4}} = \frac{\sqrt{5}}{\sqrt{2}} = \frac{5}{2} = 2\frac{1}{2}$$

Exercise 4 (b)

Using the factorization method as in example 2, find the square root of:

1. a) 36 b) 196 c) 256 d) 324

Work out the following:

2. a) $\sqrt{36}$ b) $\sqrt{64}$ c) $\sqrt{100}$ d) $\sqrt{144}$
3. a) $\sqrt{121}$ b) $\sqrt{169}$ c) $\sqrt{1}$ d) $\sqrt{4}$
4. a) $\sqrt{\frac{9}{25}}$ b) $\sqrt{\frac{4}{9}}$ c) $\sqrt{\frac{1}{4}}$ d) $\sqrt{\frac{25}{36}}$

Find the square root of the following

5. a) $2\frac{1}{4}$ b) $1\frac{7}{9}$ c) $1\frac{9}{16}$ d) $5\frac{1}{16}$
- e) $1\frac{19}{81}$ f) $1\frac{24}{25}$ g) $1\frac{13}{36}$ h) $3\frac{13}{36}$

6. The area of a square piece of land is 1089 m^2 . Find the length of one side of the piece of land.
7. The area of the top of a square table is 7569 cm^2 . What is the length of one of the sides?
8. The perimeter of a square clearing is 14m . Find its area.
9. Find the length of the square garden whose area is $177\frac{7}{9}\text{m}^2$.
10. A square field of area $44\frac{4}{9}\text{m}^2$ was fenced and surrounded with barbed wire. The wire went around the field 9 times.
 - a) What was the length of the field?
 - b) What was the length of the wire?

1.2 Fractions

1.2 (a) Fractions and mixed numbers

Exercise 4

1. Calculate the following

a) $\frac{1}{3} + \frac{1}{6} + \frac{3}{7}$

b) $\frac{2}{3} - \frac{2}{7}$

c) $\frac{1}{2} \div \frac{1}{3}$

d) $(\frac{2}{3} \div \frac{1}{2}) + \frac{1}{4}$

e) $1\frac{3}{8} - \frac{3}{4}$

f) $\frac{1}{3}$ of $\frac{13}{15} \div \frac{3}{5}$

g) $\frac{2}{5} \times \frac{15}{16}$

h) $\frac{3}{8} \times \frac{5}{9}$

i) $\frac{7}{26}$ of $\frac{13}{21} \div \frac{3}{5}$

2. Makur's share of a piece of land is $\frac{2}{5}$. Deng's share is $\frac{1}{2}$ of the remainder. If the total area of the land is 120 ha , how much land does Deng have?
3. A school has 720 pupils. One day, 36 pupils were absent. What fraction of the school was present on that day?
4. Marial sold 60 animals to the Wau meat canning factory. This represented $\frac{1}{4}$ of the animals he intended to sell. How many more animals did he have for sale?

Addition

Example 1

$$\begin{aligned}5 + 1\frac{5}{8} + 2\frac{1}{5} &= (5 + 1 + 2) + \frac{5}{8} + \frac{1}{5} \\ &= 8 + \frac{25 + 8}{40} \\ &= 8\frac{33}{40}\end{aligned}$$

Example 2

Work out

$$4\frac{1}{3} + 3\frac{2}{5} + 5\frac{1}{15}$$

Solution

$$\begin{aligned}4\frac{1}{3} + 3\frac{2}{5} + 5\frac{1}{15} &= (4 + 3 + 5) + \frac{1}{3} + \frac{2}{5} + \frac{1}{15} \\ &= 12 + \frac{5 + 6 + 1}{15} = 12 + \frac{12}{15} = 12 + \frac{4}{5} = 12\frac{4}{5}\end{aligned}$$

Exercise 5 (b)

1. a) $2\frac{1}{3} + 1\frac{1}{2}$

b) $6\frac{1}{3} + 2\frac{1}{9}$

c) $1 + 2\frac{1}{4} + 3\frac{1}{2}$

2. a) $5\frac{1}{6} + 2\frac{1}{3}$

b) $4\frac{7}{12} + 2\frac{1}{4}$

c) $1\frac{1}{3} + 2\frac{4}{9}$

3. a) $1\frac{1}{4} + 2\frac{1}{2} + 1\frac{2}{3}$

b) $4\frac{3}{16} + 1\frac{3}{8} + 2\frac{1}{2}$

c) $4\frac{3}{5} + 3\frac{7}{15} + 1\frac{1}{3}$

4. a) $9\frac{2}{13} + 2\frac{9}{26}$

b) $27\frac{1}{3} + 16\frac{4}{9}$

c) $4\frac{5}{6} + 8\frac{3}{4}$

5. a) $42\frac{5}{8} + 14\frac{1}{4} + 3\frac{3}{16}$

b) $32\frac{1}{2} + 25\frac{7}{10} + 3\frac{2}{5}$

6. Ayen made three dresses for her daughters. The first took $7\frac{1}{2}$ m of material, the next one took $2\frac{3}{4}$ m and the last one took $1\frac{1}{4}$ m. How much material did she use altogether?
7. Gatluak set out to work in his garden. He worked for $4\frac{1}{2}$ hours in the morning and then went for lunch. In the afternoon he worked for $3\frac{1}{3}$ hours. For how long did he work on that day?
8. Two Lorries carried $7\frac{1}{2}$ tones and $6\frac{2}{3}$ tones of sand respectively to a building site. How much sand was taken to the site?
9. Bringi pushed a wheel-barrow containing three bags of sand weighing $6\frac{3}{4}$ kg, $5\frac{2}{5}$ kg and $4\frac{1}{2}$ kg. How many kg were there in the wheel-barrow?
10. A shopkeeper had $70\frac{2}{3}$ kg of sugar in his store. He added $31\frac{5}{6}$ kg more to his stock. How many kg of sugar did he have altogether?

Subtraction

Example 1

$$7\frac{1}{4} - 6\frac{1}{5} = (7 - 6) + \frac{1}{4} - \frac{1}{5} = 1 + \frac{5-4}{20} = 1 + \frac{1}{20} = 1\frac{1}{20}$$

Example 2

$$5\frac{1}{4} - 2\frac{2}{3} = (5 - 2) + \frac{1}{4} - \frac{2}{3} = 3 + \frac{3-8}{12}$$

Since we cannot subtract 8 from 3, we borrow one from the whole number and add it.

$$3 + \frac{3-8}{12} = 2 + \frac{12}{12} + \frac{3-8}{12} = 2 + \frac{15-8}{12} = 2 + \frac{7}{12} = 2\frac{7}{12}$$

Example 3

$$(i) \quad 6\frac{3}{8} - 3\frac{2}{3} = (6-3) + \frac{3}{8} - \frac{2}{3}$$

$$= 3 + \frac{9+16}{24} = 2 + \left(\frac{24+9-16}{24}\right) = 2 + \frac{17}{24} = 2\frac{17}{24}$$

$$(ii) \quad 4\frac{1}{3} - (1\frac{3}{4} - 1\frac{1}{2}) = 4\frac{1}{3} - 1\frac{3}{4} + 1\frac{1}{2} \quad (\text{the minus sign in the brackets changes into plus on removing of the brackets})$$

$$= 4\frac{1}{3} + 1\frac{1}{2} - 1\frac{3}{4}$$

$$= (4 + 1 + 1) + \frac{1}{3} + \frac{1}{2} - \frac{3}{4}$$

$$= 4 + \frac{1}{3} + \frac{1}{2} - \frac{3}{4}$$

$$= 4 + \frac{4+6-9}{12}$$

$$= 4 + \frac{1}{12}$$

$$= 4\frac{1}{12}$$

Exercise 5 (c)

$$1. a) \quad 2\frac{2}{3} - 1\frac{1}{6}$$

$$b) \quad 3\frac{5}{8} - 1\frac{1}{2}$$

$$c) \quad 12\frac{1}{5} - 3\frac{1}{7}$$

$$2. a) \quad 6\frac{2}{10} - 2\frac{2}{3}$$

$$b) \quad 15\frac{1}{4} - 7\frac{1}{3}$$

$$c) \quad 10\frac{1}{6} - 4\frac{2}{3}$$

$$3. a) \quad 17\frac{3}{4} - 9\frac{5}{12}$$

$$b) \quad 23\frac{1}{3} - 4\frac{7}{8}$$

$$c) \quad 14\frac{3}{7} - 6\frac{5}{6}$$

4. a) $23\frac{1}{8} - 18\frac{3}{4}$

b) $50 - 45\frac{3}{8}$

c) $19\frac{7}{9} - 17\frac{5}{6}$

5. a) $8 - (4\frac{1}{7} - 1\frac{2}{9})$

b) $11\frac{1}{5} - 3\frac{9}{10} - 1\frac{3}{15}$

c) $22\frac{1}{2} - 16\frac{5}{6} - 2\frac{1}{3}$

6. Nadi bought $7\frac{1}{2}$ kg of meat. She gave $3\frac{1}{4}$ kg to her mother-in-law. How many kg of meat was she left with?

7. Nyandeng collected $4\frac{3}{8}$ baskets of termites. She gave $2\frac{1}{3}$ baskets to her friend. How many baskets was she left with?

8. Rina harvested $9\frac{3}{4}$ bags of groundnuts. Of these she gave her sister $1\frac{1}{4}$ bags. How many bags of groundnuts was she left with?

Multiplication

Example 1

Work out

i) $\frac{1}{6} \times \frac{1}{5} = \frac{1}{30}$

ii) $\frac{1}{3}$ of $\frac{1}{6} = \frac{1}{3} \times \frac{1}{6} = \frac{1}{18}$

Example 2

Work out

i) $\frac{1}{2} \times 8 = \frac{8}{2} = 4$

ii) $4\frac{1}{3} \times 3\frac{2}{5} = \frac{13}{3} \times \frac{17}{5} = \frac{13 \times 17}{3 \times 5} = \frac{221}{15} = 14\frac{11}{15}$

iii) $5\frac{1}{3} \times 1\frac{1}{4} \times 1\frac{1}{2} = \frac{16}{3} \times \frac{5}{4} \times \frac{3}{2} = \frac{240}{24} = 10$

Exercise 5(c)

Work out the following

1. a) $\frac{1}{2} \times \frac{3}{4}$

b) $\frac{1}{7} \times \frac{2}{9}$

c) $\frac{3}{16} \times \frac{3}{8}$

d) $\frac{3}{7} \times \frac{5}{8}$

2. a) $2\frac{1}{2} \times 3\frac{1}{2}$

b) $3\frac{1}{4} \times 1\frac{1}{4}$

c) $4\frac{1}{2} \times 1\frac{1}{3}$

d) $\frac{3}{8} \times 4\frac{1}{3}$

3. a) $\frac{3}{4} \times 16$

b) $\frac{1}{6} \times 24$

c) $\frac{4}{5} \times 50$

d) $\frac{1}{3} \times 18$

4. a) $\frac{1}{8}$ of 80

b) $\frac{1}{4}$ of 48

c) $\frac{5}{12}$ of 108

d) $\frac{1}{15}$ of 75

5. a) $15\frac{5}{7} \times 11\frac{1}{5}$

b) $5\frac{5}{8} \times 11\frac{1}{5} \times 3\frac{1}{2}$

c) $8\frac{1}{4} \times 2\frac{6}{11} \times 1\frac{1}{7}$

6. Ujiri had 90 cows. $\frac{1}{3}$ of the cows died of anthrax. How many of them were left?

7. A school in Maridi County had 675 pupils. $\frac{1}{3}$ of the pupils did the final examination. How many pupils did the examination?

8. A tailor bought 300 metres of material. He used $\frac{2}{3}$ of it to make dresses for ladies. How much material did he use?

9. A tractor can plough $10\frac{2}{3}$ ha in one day. How many ha can he plough in $5\frac{1}{4}$ days?

10. A bag of groundnuts weights 24 kg. A farmer harvested $5\frac{5}{8}$ bags. How many kg of groundnuts did he harvest?

Division

Example 1

$$\text{i) } 8 \div \frac{1}{4} = 8 \times \frac{4}{1} = 32$$

$$\text{ii) } \frac{3}{10} \div 4 = \frac{3}{10} \times \frac{1}{4} = \frac{3}{40}$$

Example 2

Work out

$$\begin{aligned} \text{(i) } 2\frac{2}{5} \div 5\frac{1}{3} &= \frac{12}{5} \div \frac{16}{3} \\ &= \frac{12}{5} \times \frac{3}{16} = \frac{9}{20} \end{aligned}$$

$$\begin{aligned} \text{(ii) } \frac{2}{3} \div 2\frac{2}{3} &= \frac{2}{3} \div \frac{8}{3} \\ &= \frac{2}{3} \times \frac{3}{8} = \frac{1}{4} \end{aligned}$$

$$\begin{aligned} \text{(iii) } 3\frac{1}{4} \div \frac{3}{8} &= \frac{13}{4} \div \frac{3}{8} \\ &= \frac{13}{4} \times \frac{8}{3} \\ &= \frac{26}{3} = 8\frac{2}{3} \end{aligned}$$

Exercise 5(e)

Work out the following

1. a) $\frac{3}{4} \div \frac{1}{4}$

b) $\frac{2}{3} \div 4\frac{1}{2}$

c) $12\frac{1}{4} \div \frac{11}{8}$

2. a) $5\frac{3}{5} \div \frac{2}{5}$

b) $15\frac{1}{3} \div \frac{2}{3}$

c) $8\frac{4}{5} \div \frac{2}{5}$

3. a) $\frac{5}{9} \div 5\frac{5}{9}$

b) $19\frac{1}{2} \div \frac{2}{7}$

c) $5\frac{5}{6} \div \frac{5}{8}$

4. a) $5\frac{1}{3} \div 1\frac{2}{3}$

b) $7\frac{1}{2} \div 3\frac{1}{3}$

c) $2\frac{2}{7} \div 3\frac{1}{5}$

5. a) $9\frac{1}{3} \div 4\frac{2}{3}$

b) $8\frac{1}{2} \div 11\frac{1}{3}$

c) $14\frac{2}{3} \div 1\frac{1}{3}$

6. A shopkeeper had $40\frac{1}{2}$ kg of sugar. He packed them in $\frac{1}{4}$ kg packets. How many packets did he pack?
7. Nako measured a distance of 52 m using her strides. If her strides were $\frac{3}{4}$ of a metre each, how many strides did she make?
8. What is $\frac{1}{3}$ divided by $5\frac{1}{3}$?
9. Mabior had $24\frac{1}{2}$ ha of land. He divided it into equal portions of $3\frac{1}{2}$ ha. How many portions did he get?
10. The area of a rectangular flower garden $16\frac{1}{4}$ m² if its length measures $4\frac{1}{3}$ m, what is its width?

1.2 (b) Combined operations

Note: when different operations occur in the same problems perform them in the following order (BODMAS)

- B (Brackets first)
- O (of ie multiplication)
- D (Division)
- M (multiplication)
- A (Addition)
- S (subtraction)

Examples

Work out

$$i) \frac{23}{4} \times 1\frac{1}{6} \div 1\frac{3}{8} = \frac{11}{4} \times \frac{7}{6} \div \frac{11}{8}$$

Change division into multiplication;

$$\frac{11}{8} \text{ to } \frac{8}{11} - \frac{11}{4} \times \frac{7}{6} \times \frac{8}{11}$$

$$= \frac{7}{3} = 2\frac{1}{3}$$

$$\text{ii) } \frac{1}{3} \text{ of } 15 - 3 \times \frac{1}{4} \div 3$$

find $\frac{1}{3}$ of 15 then subtract 3

$$\frac{1}{4} \div 3 \text{ i.e. } \frac{1}{3} \text{ of } 15 = \frac{1}{3} \times 15 = 5$$

$$\text{and } 3 \times \frac{1}{4} \div 3 = \frac{3}{4} \times \frac{1}{3} = \frac{1}{4}$$

$$\therefore 5 - \frac{1}{4} = 4\frac{3}{4}$$

$$\text{iii) } \frac{1}{3} \text{ of } (15 - 3) \times \frac{1}{4} \div 3$$

If of is included in any calculation which also includes brackets, of should be worked out after the brackets but before any of the other operations e.g

$$\frac{1}{3} \text{ of } (15 - 3) \times \frac{1}{4} \div 3$$

Remove the brackets first, then work out rest ie

$$\frac{1}{3} \text{ of } (15 - 3) \times \frac{1}{4} \div 3 = \frac{1}{3} \text{ of } (12) \times \frac{1}{4} \div 3$$

$$\frac{1}{3} \text{ of } 12 \times \frac{1}{4} \div 3$$

$$\text{But } \frac{1}{3} \text{ of } 12 = 4$$

$$\therefore \frac{1}{3} \text{ of } 12 \times \frac{1}{4} \div 3 = 4 \times \frac{1}{4} \div 3$$

$$= 4 \times \frac{1}{4} \times \frac{1}{3}$$

$$= \frac{1}{3}$$

$$\text{iv) } \frac{7}{8} \text{ of } 2\frac{1}{4} \div \left(4\frac{3}{16} - \frac{3}{8}\right)$$

Use Bodmas

$$\therefore \frac{7}{8} \text{ of } 2\frac{1}{4} \div \left(4\frac{3}{16} - \frac{3}{8}\right) \text{ first remove the bracket}$$

$$= \frac{7}{8} \text{ of } 2\frac{1}{4} \div \left(\frac{67}{16} - \frac{6}{8}\right)$$

$$= \frac{7}{8} \text{ of } 2\frac{1}{4} \div \left(\frac{67-24}{16}\right)$$

$$= \frac{7}{8} \text{ of } 2\frac{1}{4} \div \frac{43}{16} \text{ Work out "of" second}$$

$$= \frac{7}{8} \text{ of } \frac{9}{4} \div \frac{43}{16}$$

$$= \frac{63}{32} \div \frac{43}{16} \text{ work out division lastly}$$

$$= \frac{63}{32} \times \frac{16}{43}$$

$$= \frac{63}{122}$$

Exercise 6

Work out the following:

$$1. \text{ a) } \frac{1}{4} \text{ of } \left(\frac{2}{25} \times 3\frac{3}{4}\right)$$

$$\text{b) } \frac{1}{2} \text{ of } \left(8\frac{1}{4} \div 3\frac{3}{10}\right)$$

$$2. \frac{3}{5} \div \frac{5}{6} \text{ of } 2\frac{2}{25}$$

$$3. \frac{1\frac{4}{9} \times 2\frac{1}{13}}{3\frac{1}{5}}$$

$$4. \frac{3\frac{2}{2} + 4\frac{1}{2}}{2\frac{1}{5} + 5\frac{1}{2}}$$

$$5. \frac{5\frac{7}{12} + 4\frac{2}{3}}{1\frac{1}{3} - \frac{7}{8}}$$

$$6. \frac{6\frac{1}{6} + 3\frac{1}{3}}{6\frac{3}{10} - 2\frac{1}{6} \text{ of } 2\frac{3}{5}}$$

$$7. (5\frac{1}{4} + 3\frac{1}{8} - 2\frac{5}{6}) \div 2\frac{3}{8}$$

8. A man spends $\frac{1}{5}$ of his yearly income on rent and taxes, $\frac{1}{2}$ on household expenses, $\frac{1}{10}$ on other expenses. He saves the remainder. What fraction of his income does he save?
9. One tap can fill a container in 6 minutes. Another tap can fill the same container in 3 minutes. If the tank is empty and both taps are opened at the same time, how long will it take for the tank to be completely filled?

1.2 (c) Square and Square Root of a Fraction

Squares of Fraction

Examples

$$i) \left(\frac{1}{3}\right)^2 = \frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$$

$$ii) \left(\frac{5}{14}\right)^2 = \frac{5}{14} \times \frac{5}{14} = \frac{25}{196}$$

$$iii) \text{ Find the square of } 2\frac{2}{5} = \left(\frac{12}{5}\right)^2 = \frac{12}{5} \times \frac{12}{5} = \frac{144}{25} = 5\frac{19}{25}$$

Exercise 7

1. Find the squares of the following

a) $\frac{1}{4}$

b) $\frac{2}{3}$

c) $\frac{3}{4}$

d) $\frac{5}{6}$

e) $\frac{2}{11}$

2. a) $\frac{4}{7}$

b) $\frac{7}{12}$

c) $\frac{5}{9}$

d) $\frac{12}{15}$

3. a) $1\frac{1}{4}$

b) $12\frac{1}{3}$

c) $14\frac{1}{2}$

d) $11\frac{3}{4}$

e) $5\frac{7}{8}$

4. The length of a square table cloth is $1\frac{2}{3}$ m. What is the area of the cloth?
5. What is the area of the square flower garden whose width is $7\frac{1}{2}$ m?
6. The top of a square table has a width of $2\frac{3}{4}$ m, what is its area?
7. What is the difference between the square of $2\frac{1}{3}$ and $1\frac{1}{2}$?
8. Divide the square of $\frac{7}{8}$ by the square of $\frac{3}{4}$

Square root of fractions

Examples

- i) What is the square root of $\frac{4}{9}$?

Solution

$$\sqrt{\frac{4}{9}} = \frac{\sqrt{4}}{\sqrt{9}} = \frac{2}{3}$$

- ii) what is the square root of $6\frac{1}{4}$?

Solution

$$\sqrt{6\frac{1}{4}} = \sqrt{\frac{25}{4}} = \frac{\sqrt{25}}{\sqrt{4}} = \frac{5}{2} = 2\frac{1}{2}$$

Exercise 8

1. Find the square root of each of the following fractions

a) $\frac{16}{25}$ b) $\frac{9}{16}$ c) $\frac{49}{81}$ d) $\frac{121}{144}$ e) $\frac{49}{121}$ f) $\frac{64}{169}$

2. Work out the square roots of the following fractions

a) $\frac{49}{64}$ b) $\frac{169}{225}$ c) $\frac{81}{121}$ d) $\frac{196}{225}$ e) $\frac{64}{256}$

3. Work out the following:

a) $\sqrt{\frac{9}{25}}$

b) $\sqrt{\frac{64}{81}}$

c) $\sqrt{\frac{144}{169}}$

d) $\sqrt{\frac{289}{324}}$

4. Find the square root of each of the following numbers

a) $5\frac{4}{9}$

b) $12\frac{1}{4}$

c) $3\frac{1}{16}$

d) $30\frac{1}{4}$

e) $1\frac{15}{49}$

5. Work out the following:

a) $\sqrt{1\frac{13}{36}}$

b) $\sqrt{2\frac{14}{25}}$

c) $\sqrt{1\frac{11}{25}}$

d) $\sqrt{20\frac{1}{4}}$

6. Given that the square of fraction is $\frac{25}{64}$, what is the fraction?

7. I think of a fraction and I multiply that by itself. My answer is $\frac{25}{81}$. What is the fraction?

8. A square field with an area of $44\frac{24}{9}$ m² was fenced and surrounded with barbed wire. The wire went around the field 10 times.

- What was the length of the field?
- What was the length of the wire?

1.3 Decimals

1.3 (a) Place Value

Example

	Thousand	Hundred	Ten	Ones	Decimal point	Tenths	Hundredths	Thousand	Ten thousand	Hundred thousand
0.85				0	.	8	5			
46.384			4	6	.	3	8	4		
600.7		6	0	0	.	7				
3648.0731	3	6	4	8	.	0	7	3	1	
3.94312				3	.	9	4	3	1	2
20.475			2	0	.	4	7	5		
867.3486		8	6	7	.	3	4	8	6	

Exercise 9(a)

What is the place value of each of the underlined digits?

1. a) 0.345 b) 34.047 c) 6.569 d) 467.3509
2. a) 500.4578 b) 6784.59 c) 9103567.38
3. Round off the following to the number of decimal places indicated in the brackets.
 - a) 21.7635 (3) b) 13.098(2) c) 105.053(1)
 - d) 349.00632(4) e) 29.321(1)
4. In the following figures, underline the digit which represents the place value indicated in the brackets.
 - a) 549.0356 (tenths)
 - b) 148.3479 (thousands)
 - c) 0.0853 (hundreds)
 - d) 12156.01349 (hundred thousands)
 - e) 23.15021 (ten thousands)

1.3 (c) Combine operations involving decimal, square and square roots

Addition and subtraction of decimals

Addition

Examples

a) $5.016 + 2.12 + 0.3$

$$\begin{array}{r} 5.016 \\ 2.120 \\ + 0.300 \\ \hline 7.436 \end{array}$$

Exercise 9(c)

Work out the following subtraction problems

1. (a) $60.8 - 45.3$ (b) $110.9 - 74.5$ (c) $8.53 - 3.06$

2. (a) $46.07 - 12.73$ (b) $1.03 - 0.99$ (c) $3.012 - 0.9$

3. (a) $3.706 - 2.198$ (b) $8 - 0.356$ (c) $9.6 - 3.421$

4. (a) $(6 - 0.3) - (0.05 + 1.45)$

(b) $(58.3 - 47.91) - (1.256 - 0.39)$

5. Nyandeng bought 5.75kg of sugar. She gave her neighbour 1.5kg. How much sugar was she left with?

6. Ukel gets 35.2 litres of milk per day. If he sells 17.25 litres, how much milk is he left with for the family?

Multiplication of decimals

Examples

a) $0.8 \times 9 = 7.2$

Multiply as whole numbers. Count the number of decimal places in the numbers being multiplied. After getting the product, count the total number of decimal places beginning from the right to the left.

b) 16×1.032

$$\begin{array}{r} 1.032 \\ \times 16 \\ \hline 6192 \\ \underline{1032} \\ 16.512 \end{array}$$

Here there are three decimal places

c) Find the value of $\frac{5.4 \times 0.28}{0.07 \times 0.06}$

$$\begin{aligned} &= \frac{5.4 \times 0.28 \times 10000}{0.07 \times 0.06 \times 10000} = \frac{54 \times 280}{7 \times 6} \\ &= 9 \times 40 \\ &= 360 \end{aligned}$$

Exercise 9(d)

Work the following

1. (a) 0.6×8 b) 0.295×9 c) 0.2×19 (d) 0.031×5
2. (a) 5.242×7 b) 58.34×35 c) 1.2×2 d) 97×0.045
3. a) 0.75×0.03 b) 2.75×0.05 c) 1.134×0.007

4. Find the value of the following

a) $\frac{7.2 \times 9.6 \times 2.7}{5.4 \times 1.8 \times 0.3}$ b) $\frac{4.5 \times 2.4 \times 1.8}{0.12 \times 2.7 \times 0.5}$

5. Work out the following and give your answer correctly to two decimal places

a) 0.087×25 b) 68.19×0.8 c) $\frac{0.027 \times 0.48}{0.3 \times 0.6}$ d) $\frac{0.36 \times 3.224}{7.2}$

6. Calculate the area of a room whose measurements are 15m by 17.5m.

7. A bag of potatoes weighs 29.25kg. What will be the weight of 9 such bags?

8. A wheel has a diameter of 2.1m. What distance does it cover after turning round eight times? Take $\pi = \frac{22}{7}$

9. To make a school uniform, a tailor requires 2.5m. If he made 97 such uniforms, how many metres did he use?

10. A machine packs 125.75kg of fat in 1 hour. How many kg of fat will it pack in 24 hours?

1.3 (b) Divisions of decimals

Examples

a) Work out $60 \div 1.5$
 $= 600 \div 15$

$$\begin{array}{r} 40 \\ 15 \overline{) 600} \\ \underline{60} \\ 00 \end{array}$$

$\therefore 60 \div 1.5 = 40$

b) Work out $3.609 \div 0.03$

$$= \frac{3.609}{0.03} \times \frac{100}{100}$$

$$= \frac{360.9}{3}$$

$$= \underline{120.3}$$

Since the divisor has two decimal places, we multiply both the divisor and the dividend by 100, to make the divisor a whole number.

Exercise 9(e)

Work out the following problems:

1. a) $9 \div 0.3$

b) $8 \div 0.2$

c) $24 \div 0.12$

d) $36 \div 0.9$

e) $45 \div 1.5$

f) $39 \div 1.3$

2. a) $125 \div 0.05$

b) $138 \div 2.3$

c) $60 \div 0.012$

d) $22 \div 1.1$

3. What is the value of

a) $0.6 \div 0.3$

b) $0.8 \div 0.02$

c) $0.36 \div 0.04$

d) $0.16 \div 0.004$

e) $48.012 \div 0.03$

f) $34.85 \div 0.17$

4. Work out the following and give your answer to one decimal place.

a) $0.5341 \div 80.307$

b) $21.789 \div 7.805$

5. A jerry-can contains 23.8 litres of petrol. The petrol is emptied into smaller containers of 2.38 litres each. How many 2.38 litres containers are needed?

6. A school has a tank which holds 450.75 litres of water when full. One day the pupils were allowed to drink all the water from this tank. If each child drank 0.75 of a litre, how many pupils were there in the school on that day?

7. Lupai had 16.75ha of land which he divided into 0.25ha of land for sale. How many such pieces of land did he sell?

8. A piece of land 7.25ha is to be divided into 0.125ha plots. If a house is built on each plot, how many houses can be built?

Mixed Exercise 9(f)

Find the value of each of the following:

1. (a) $10.9 + 9.34 + 13.21$
(c) $(5.356 + 2.76) + (2.82 - 0.75)$
- (b) $27.025 + 14.3 + 12.006$
(d) $21.6 + 0.25$ of 15.5
2. a) $16.49 \times 7.83 + 3.15$
c) $13.48 - 14.67 + 6.12$
- b) $19.56 \times 8.38 + 5.97 \div 7.25$
d) $23.92 - 3.456 + 11.2 + 0.08$
3. Find the value of
 - a) $\frac{(2.78 + 3.52) \times (1.5 + 0.35)}{0.7 \times 0.5}$
 - b) $\frac{(4.84 \div 4) \times (2.04 \div 0.08)}{1.5 \times 1.1}$
 - c) 0.45 of $15 \div 4.5 + 6.48$
4. Convert $\frac{7}{9}$ into decimals, and then give your answer in short form.
5. Convert $\frac{5}{7}$ into a decimal number and give your answer correct to 4 decimal places.
6. What is $\frac{5.6}{3}$ correct to three decimal place?
7. The capacity of eight containers is 96.168 litres. Find the average capacity of each of the eight containers.
8. A rectangular field measures 32.1m by 24.24m. A wire fence was put around the field three times. Find the length of the wire used.
9. The average weight of 5 sacks of sorghum is 67.25kg. What is their total weight?
10. Nyaluak sent six parcels to friends in America with the following weights: 7.4g, 24.2g, 48.6g, 32.3g 10.5g and 14.4g. Find the average weight of the parcels.

Square and Square Roots of Decimals

Examples

i) Find the square of 0.3

Solution

$$i) (0.3)^2 = 0.3 \times 0.3 \text{ or } \frac{3}{10} \times \frac{3}{10} = \frac{9}{100} = 0.09$$

$$ii) (0.25)^2 = 0.25 \times 0.25 \text{ or } \frac{25}{100} \times \frac{25}{100} = \frac{625}{10000} = 0.0625$$

$$\begin{array}{r} = 0.25 \\ \quad \underline{0.25} \\ \quad \quad 125 \\ \quad \quad \underline{050} \\ \quad \quad \quad 0.0625 \end{array}$$

Exercise 10 (a)

Find the squares of the following:

- | | | | | |
|--------|--------|--------|--------|--------|
| a) 0.6 | b) 0.8 | c) 0.7 | d) 7.2 | e) 3.6 |
|--------|--------|--------|--------|--------|
- | | | | | |
|--------|---------|---------|---------|----------|
| a) 1.9 | b) 0.09 | c) 0.04 | d) 0.02 | e) 0.006 |
|--------|---------|---------|---------|----------|
- What is

a) 2.1^2	b) 5.6^2	c) 0.4^2	d) 4.9^2	e) 6.4^2
------------	------------	------------	------------	------------
- Work out the following:

a) 0.24^2	b) 1.13^2	c) 4.35^2	d) 0.06^2	e) 9.1^2
-------------	-------------	-------------	-------------	------------
- What is the area of the square garden whose side measures 9.6 metres?
- Atima made a square bed-cover whose side was 3.5m. How many square metres of material did she use?
- Amani bought a square mat for her children to sleep on. If one side of the mat measured 2.1m, what was the size of the mat in square metres?

Square root of decimals

Examples

i) Find the square root of 0.36

$$\begin{aligned} \text{i.e. } & \sqrt{0.36} \\ &= \sqrt{\frac{36}{100}} \\ &= \frac{6}{10} \\ &= 0.6 \end{aligned}$$

First convert the decimal to a fraction, and then find the square root of the numerator and the square root of the denominator.

Divide the numerator by the denominator

$$\begin{aligned} \text{ii) } & \sqrt{1.44} \\ &= \sqrt{\frac{144}{100}} \\ &= \frac{12}{10} \\ &= 1.2 \end{aligned}$$

$$\begin{aligned} \text{iii) } & \sqrt{0.0004} \\ &= \sqrt{\frac{4}{10000}} \\ &= \frac{2}{100} \\ &= 0.02 \end{aligned}$$

Exercise 10 (b)

Find the square roots of the following

- (a) 0.04 b) 0.0049 c) 0.0064 d) 0.81
- (a) 0.0225 b) 0.0169 c) 0.0196 d) 0.0625
- (a) 1.21 b) 1.44 c) 1.69 d) 1.21
- (a) 2.89 b) 3.24 c) 6.25 d) 4.41 e) 7.84

5 Work out the following:-

- $\sqrt{3.24}$
- $\sqrt{0.0009}$
- $\sqrt{0.0256}$
- $\sqrt{2.89}$
- $\sqrt{12.25}$
- $\sqrt{7.29}$
- $\sqrt{16.81}$
- $\sqrt{10.24}$

- 6 A square room is 20.25m^2 . Find its length.
- 7 Find the size of the side of a square whose area is 30.25cm^2 .
- 9 The area of the floor of a square room is 29.16m^2 . Each side of another square room is half the length of the first room.
- (a) What is the measure of one side of the floor of the second room?
- (b) How many tiles, each 15 cm by 15 cm will be needed to cover the floor of the second room completely?
10. Deng's cattle shed is in the shape of a square. If the area of the shed is 42.25 m^2 , find the size of one side.

Recurring decimal

Examples

- i) What out $\frac{5}{9}$ as a decimal. Write your answer in a short form.

$$\begin{array}{r}
 0.555 \\
 9 \overline{) 50} \\
 \underline{45} \\
 50 \\
 \underline{45} \\
 50 \\
 \underline{45} \\
 5
 \end{array}$$

This is called a non-terminating or repeating decimal. The repeating decimal number can be written in short as the dot on top of 5 meaning 5 is repeating itself continuously or recurring.

$$\therefore \frac{5}{9} \text{ as a decimal} = 0.\dot{5}$$

ii) Express $\frac{7}{22}$

$$\begin{array}{r} 0.31818 \\ 22 \overline{)70} \\ \underline{66} \\ 40 \\ \underline{22} \\ 180 \\ \underline{176} \\ 40 \\ \underline{22} \\ 180 \end{array}$$

This is recurring decimal. The pattern 18 keeps repeating itself. This can be written in short as $0.3\overline{18}$. The dots on the top of 18 indicate that these two numbers keep on repeating themselves.

Note: Terminating numbers are those that divide completely

e.g. $\frac{1}{5} = 0.2$

Non terminating decimals are those that do not divide completely.

Exercise 10 (c)

1. Convert the following fractions into decimals and state which ones are terminating decimals. Divide up to 4 decimal places.

(a) $\frac{1}{4}$

(b) $\frac{2}{6}$

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

(d) $\frac{3}{9}$

2. Convert the following into decimals and state which ones are non-terminating decimals.

(a) $\frac{4}{5}$

(b) $\frac{1}{6}$

(c) $\frac{2}{7}$

(d) $\frac{3}{4}$

3. Convert the following fractions into decimals and state which ones are recurring decimals. Divide up to 5 decimal places.

(a) $\frac{1}{3}$

(b) $\frac{1}{22}$

(c) $\frac{4}{9}$

(d) $\frac{3}{8}$

4. Write the following recurring decimals in short form. (e.g) $0.222 = 0.\dot{2}$
 (a) 0.4444 (b) 0.04545 (c) 0.9999 (d) 0.31818
5. Given the following, correct to 5 decimal places written as
 $0.3 = 0.33333$ $0.5 = 0.55556$

Write the following correct to 5 decimal places

- (a) $0.\dot{7}$ (b) $0.\dot{2}$ (c) $0.3\dot{1}8$ (d) $4.4\dot{5}$ (e) $6.\dot{1}$ (f) $9.0\dot{4}5$

1.4 Ratio Proportion and Percentages

1.4 (a) Ratios used in comparing quantities

Examples

- i) There are 4 girls and 3 boys. Express the number of boys to the number of girls.

Solution

The number of the boys to that of the girls is three to four. The ratio is written as 3:4.

- ii) Lado's dog has five black puppies and three brown ones. Find the ratio of the black puppies to brown ones.

Solution

The ratio of the black puppies to the brown ones is 5:3

Exercise 11 (a)

- In a certain medical clinic in Juba there are 3 doctors and 5 nurses. Express the number of doctors and nurses as a ratio.
- In certain school in Tonj county there are seven male teachers and 5 female teachers. What is the ratio of the
 - male teachers to the female teachers?
 - female teachers to the male teachers?

3. The length of the classroom is 8m and the width is 7m.
Find the ratio of the:
- length to the width
 - width to the length
4. In a certain village in Awiel, there is an average of one man and three wives in every household. What is the ratio of
- wives to husbands
 - husbands to wives.
5. Bafuka harvested 9 bags of groundnuts and 11 bags of maize during the short rains in 1989. Find the ratio of:
- the number of bags of groundnuts to the bags of maize.
 - the number of bags of maize to the bags of groundnuts.

Ratios expressed in their simplest form

Example 1

Express the ratio 4:6 in its simplest form.

Solution

2	4 : 6
	2 : 3

Divide the ratios by their greatest common factor or divisor

Example 2

In a certain school, the number of the girls to the number of boys is 12:18.
Express the ratio in its simplest form.

Solution

2	12:18
3	6:9
	2:3

Divide by GCD and continue until the numbers have no common divisor.

∴ 12 : 18 in its simplest form is 2:3

Exercise 11 (b)

Express the following ratios in their simplest forms.

- a) 3:6 (b) 5:15 c) 10:15 d) 24:36 e) 36:45
f) 27:54 (g) 25:125 (h) 42:36 i) 15:75
- (a) 0.5m :200cm b) 300ml:0.6 litres (c) 0.5 litres : 600ml
- (a) 15:115:125 (b) 3:9:12
- Wayo has 84 heads of cattle. His brother Lobojo has 72. Express this relationship as a ratio in its simplest form.
- For every 24 chickens there were 120 eggs. Express this relationship as a ratio in its simplest form.

Ratio in sharing

Example 1

Shange and Robo shared 27 mangoes in the ratio of 1:2.

- What fraction represented Shange's share?
- What fraction represented Robo's share?
- How many mangoes did each boy get?

Solution

$$\text{Total share} = 1 + 2 = 3$$

$$\text{a) Shange's share} = \frac{1}{3}$$

$$\text{b) Robo's share} = \frac{2}{3}$$

$$\text{c) Shange got } \frac{1}{3} \text{ of } 27 = \frac{1}{3} \times 27 = 9 \text{ mangoes}$$

$$\text{Robo got } \frac{2}{3} \text{ of } 27 = \frac{2}{3} \times 27 = 18 \text{ mangoes}$$

Example 2

Chuol had 55 cows. He shared them between his two sons, Jok and Gatluak in the ratio of 5:6. How many cows did each son get?

Solution

For every 5 cows got, Gatluak received 6.
The total number of shares is $5 + 6 = 11$.

∴ Jok got $\frac{5}{11}$ of the total number of cows.

Gatluak got $\frac{6}{11}$ of the total.

If the total number of cows is 55

∴ (a) Jok got $\frac{5}{11}$ of 55 = $\frac{5}{11} \times 55 = 25$ cows

(b) Gatluak got $\frac{6}{11}$ of 55 = $\frac{6}{11} \times 55 = 30$ cows

Exercise (11) (c)

- Lupai had 560 cattle which he shared between his two sons Kenyi and Lado in the ratio of 2:5.
 - What fraction of the total share did Lado get?
 - What number of cattle did each son get?
- 360 tons of food were air-dropped for distribution to the people in two counties A and B in the ratio of 4:5.
 - How much food did A receive?
 - How much food did B receive?
- Share the following quantities in the indicated ratio.
 - 120 bags of groundnuts in the ratio 2:3
 - 40 tins of honey in the ratio 1:4
 - 135 bags of maize in the ratio of 3:2
 - 168 books in the ratio of 3:5
 - 98 mangoes in the ratio of 1:6

4. Lino and Zackaria shared 60 mangoes. Zachariah got 45 mangoes.
 - a) How many mangoes did Lino get?
 - b) In what ratio did they share the mangoes?
(Give your answer in the simplest form)

5. Keje harvested 18 bags of millet and groundnuts. If the ratio of the bags of millet to that of groundnuts was 4:5, how many bags of:
 - (a) millet did he harvest?
 - (b) groundnuts did he harvest?

6. Dut shared his 36ha piece of land amongst his three sons Deng, Chol and Muorwel in the ratio of 2:3:4 respectively. How many ha of land did each son get?

7. In a chicken brooding farm, the ratio of female birds to male birds was 5:2. If the farm had a total of 630 birds, how many
 - a) male birds were there?
 - b) female birds were there?

8. In Raga country there are 160 schoolteachers. If the ratio of female teachers to male teachers is 3:5, find out
 - a) the number of female teachers
 - b) the number of male teachers.

9. In a primary six class, the number of the girls to the number of the boys is a ratio of 3:4.
If the total number of children in the class is 42, how many
 - a) girls are there?
 - b) boys are there?

10. Amato mixed cement with sand in the ratio of 2:3. If he used 60 wheelbarrows of cement, how many wheel-barrows were used in the total mixture?

1.4 (b) Ratio as a percentage

Examples

- i). Express 60%: 80% in the simplest form.

Solution

Since both numbers are out of 100 we can simplify them as shown below

2	60 : 80
2	30 : 40
5	15 : 20
	3 : 4

Therefore 60%: 80% in the simplest form is 3:4.

- ii) In a science examination Pingjuok scored 90%. If he scored 50% in biology, what percentage did he score in both chemistry and physics? Write this relationship in its simplest form.

Solution

Total score = 90%

Biology = 50%

Chemistry and physics = 40%

The ratio in its simplest form is 5:4

- iii) In a certain hospital in Southern Sudan, the ratio of doctors to nurses is 3:5.
- a) What percentage of the medical personnel are:
- i) nurses ii) doctors
- b) If the total number of doctors and nurses is 32, how many nurses and doctors are there?

Solution

a) i) Percentage of doctors = $\frac{3}{8} \times 100 = \frac{75}{2} = 37.5\%$

ii) Percentage of nurses = $\frac{5}{8} \times 100 = \frac{125}{2} = 62.5$

b) i) Number of nurses = $\frac{5}{8} \times 32 = 20$

ii) Number of doctors = $\frac{3}{8} \times 32 = 12$

Exercise 11(d)

1. Simplify the following
 - a) 50%:20%
 - b) 25%:75%
 - c) 80%:60%
 - d) 45%:90%
 - e) 15% : 35%
 - f) 75%:50%
2. In a carton containing text books for primary seven, 30% are science and the rest are geography. What is the ratio of science books to geography books? Write the answer in the simplest form.
3. 40% of the pupils in a class are girls and the rest are boys. If there are 120 pupils in the class, find:
 - a) the ratio of the girls to the boys.
 - b) the number of girls in the class.
 - c) the number of boys in the class.
4. 30% of Mrs. Adwok's harvest was groundnuts and the rest was sorghum.
 - a) What percentage was sorghum?
 - b) What is the ratio of groundnuts to sorghum in its simplest form?
 - c) Mrs. Adwok's total harvest of groundnuts and sorghum was 35 bags. How many bags contained
 - i. Groundnuts?
 - ii. Sorghum?
5. 60% of the teachers in Yambio County are male, and the rest are female.
 - a) What percentage are female?
 - b) What is the ratio of male to female?
 - c) The total number of teachers in the whole Yambio county is 230. Find out how many:
 - a) Male teachers
 - b) Female teachers

Ratios can be expressed as decimals

Examples

- i) Kuc and Deng mixed aggregates and cement in the ratio of 0.3:0.4 in order to lay a classroom foundation.
 - a) Express this relationship as a ratio in its simplest form.

Solution

0.3:0.4 multiply each side 10 to remove the decimal point.

ie $(0.3 \times 10) : (0.4 \times 10) = 3:4$

b) If the total weight of the mixture above is 42kg. Find the weight of

- i) Aggregates
- ii) Cement

Solution

The fraction representing Aggregate is $\frac{3}{7}$. If the total weight is 42kg

i) Then the total weight for Aggregate $= \frac{3}{7} \times 42 = 18$ kg

ii) The fraction representing cement is $\frac{4}{7}$

The total weight of cement $= \frac{4}{7} \times 42 = 24$ kg

Exercise 11(e)

1. A farmer mixed chemicals A and B in the ratio of 0.2 : 0.3 to make a solution for spraying coffee.
 - a) Express this ratio in its simplest form.
 - b) The mixture obtained after mixing chemicals A and B amounted to 12 litres. How much of the mixture was chemical
 - i) A?
 - ii) B?
2. To prepare simsim peanut butter, Luka mixed simsim and groundnuts in the ratio 0.4:0.5. If he produced 81 g of butter,
 - i) How much simsim was in the butter?
 - ii) How many grams of groundnuts was in the butter?
3. To prepare Kisira for a family gathering, Poni used wheat and sorghum flour in the ratio of 0.3:0.6.
 - i) Express this ratio in the simplest form.
 - ii) If the total weight of the mixture was 6kg, how much:
 - a) wheat was in the mixture?
 - b) sorghum was in the mixture?
4. In some parts of Southern Sudan, dried cassava is ground together with sorghum to make flour for various meals. Zita mixed cassava and sorghum in the ratio of 0.3:0.7
 - a) Express this ratio in the simplest form.
 - b) If the total of the flour was 5kg,

- (i) How much cassava was in the flour?
 ii) How much sorghum was in the flour?

5. Simplify

- a) 0.8:0.4 b) 1.5:2.5 c) 1.2:3.6
 d) 0.9:2.7 e) 1.44:0.12 f) 1.3:0.26

Ratios as fractions as well as a whole number

Examples

- i) Express the following ratio in its simplest form $\frac{1}{3} : \frac{1}{2}$

Solution

Find the common denominator for the two fractions: $\frac{1}{3} : \frac{1}{2} = \frac{2}{6} : \frac{3}{6}$

Use the numerator ignoring the denominator. Therefore, $\frac{1}{3} : \frac{1}{2}$
 In simplest form is 2:3

- ii) Simplify the following ratio $\frac{1}{2} : 4$

Solution

Multiply both sides by 2 to make the fraction a whole number.

$$\text{i.e. } \frac{1}{2} \times 2 : 4 \times 2 = 1:8$$

Exercise 11(f)

1. Express the following ratios in their simplest form:

- a) $\frac{1}{2} : \frac{2}{5}$ b) $\frac{3}{4} : \frac{5}{8}$ c) $\frac{2}{3} : \frac{5}{6}$ d) $\frac{1}{8} : \frac{1}{4}$ e) $\frac{5}{6} : \frac{7}{8}$

2. Simplify the following ratios

- a) $\frac{3}{8} : 2$ b) $3 : \frac{4}{5}$ c) $\frac{1}{4} : 1$ d) $3 : \frac{3}{8}$ e) $\frac{2}{3} : 2$

3. In baking a cake, Sarah used $\frac{1}{2}$ teaspoonful of baking powder for every two cups of flour.
- Express this ratio in the simplest form.
 - How many teaspoons of baking powder will she need for:
 - 8 cups of flour?
 - 10 cups of flour?
4. Express $\frac{1}{3} : \frac{1}{5} : \frac{3}{10}$ in its simplest form.
5. A lorry carried 600 bags of maize, wheat and sorghum flour in the ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{6}$ respectively.
- Express the ratio in its simplest form.
 - Calculate the number of bags for each type of flour.

Increase and decrease in ratio

Examples

- i) Increase 75kg of sugar in the ratio of 3:5

Solution

The increase is $\frac{5}{3}$ of 75 = $\frac{5}{3} \times 75 = 125$ kg.

- ii) In what ratio should 500 be increased to make 800?

Solution

The number increased in the ratio 800:500
= 8:5

Therefore 500 is increased in the ratio 8:5 to make 800

- iii) Decrease 350 in the ratio of 5:7

Solution

The decrease is $\frac{5}{7}$ of 350 = $\frac{5}{7} \times 350 = 250$

- iv) A carpenter reduced the length of a piece of timber measuring 6m in the ratio 2:3. Find the new length of the timber.

Solution

Old measurement is = 6 m

Reduction is $\frac{2}{3}$ of 6 = $\frac{2}{3} \times 6 = 4$ m

Exercise 11 (g)

- Increase 60 in the ratio:
a) 6:4 b) 3:2 c) 7:5
- The production of groundnuts in Zackaria's farm increased this year in the ratio of 8:5. If the previous year's production was 15 bags, how many bags did he produce this year?
- The enrollment of a school this year increased to 700 from 500 of the previous year. Express this increment as a percentage.
- Decrease 162 kg in the ratio:
a) 2:3 b) 1:2 c) 5:6 d) 3:8
- The temperature of a certain place was recorded as 36 °c at noon. By evening the temperature fell by the ratio 3:4. What was the recording in the evening?
- Malual had 450 cows at the beginning of the year. Due to an outbreak of foot and mouth disease, some of his cows died. This was a reduction in the ratio of 5:9. How many cows was he left with?

1.4 (c) (i) Proportions

Direct proportion

Examples

- i) 4 bags of sorghum weigh 200kg. Find the weight of 7 such bags.

Solution

Weight of 4 bags of sorghum = 200 kg

$$\text{Weight of 1 bag of sorghum} = \frac{200}{4} = 50 \text{ kg}$$

$$\text{Weight of 7 bags of sorghum} = 50 \times 7 = 350 \text{ kg}$$

- ii) From 8m of cloth, you can make 4 small shirts. How many shirts can you make from 12m?

Solution

8 m make 4 shirts

1 m makes $\frac{4}{8}$ shirts

12 m make $\frac{4}{8} \times 12 = 6$ shirts

Exercise 12 (a)

1. The cost of 6 primary seven mathematic books is £2,400. How much will 9 such books cost?
2. Deng takes 5hrs to cycle a distance of 75km. How many km will he cover in 2hrs, if he maintains a constant speed?
3. A lorry uses 12 litres of diesel to cover a distance of 72 km. How much diesel will the lorry need to cover a distance of 120 km?
4. 8 primary eight mathematics books cost £3,200. How much will 3 books cost?
5. 16 loaves of bread are needed to serve 40 people. How many loaves of bread would be needed for 150 people?
6. 3 lorries can carry 240 bags of millet. How many bags of millet would 9 such lorries carry?

1.4 (c) (ii) Indirect proportion

Examples

- i) Five men can clear an area of bush in 3 days. How long will 3 men take to clear the same bush?

Solution

5 men take 3 days

1 man takes (5×3) days

3 men will take $\frac{5 \times 3}{3} = 5$ days

ii) 4 men take 5 days to weed a garden. How long will 10 men working at the same rate take?

Solution

4 men take 5 days

1 man takes (4×5) days

10 men will take $\frac{4 \times 5}{10} = 2$ days

iii) Two lorries take 16 trips to transport bags of beans from one centre to the other centre. How many more lorries would be needed to transport the bags in 4 trips?

Solution

16 trips require 2 lorries

1 trip requires (2×16) lorries

4 trips require $\frac{2 \times 16}{4} = 8$ lorries

Therefore more lorries required = $8 - 2 = 6$ lorries

Exercise 12(b)

- 4 school girls take 30 minutes to sweep the school compound. How long will 5 school girls take to sweep the same compound?
- 15 women harvest a field of maize in 3 days. How long will it take 5 women to harvest such a field of maize?
- 9 boys can dig the school garden in 4 days. How long will take:
(a) 6 boys? b) 12 boys?

4. A family of 4 takes 28 days to consume a certain amount of food. How long will a family of 7 take to consume the same amount of food?
5. A boarding school has enough food for 280 pupils for 12 weeks. If 40 pupils were sent home because of school fees, how much longer would the food last?
6. 1 tap takes 14 hours to fill a tank. How many more taps would be needed to fill the tank in 2 hours?
7. 10 men take 8 hours to arrange a hall. How many more men are needed to complete the job in 2 hours?

1.4 (d) Express fractions as decimals and percentage and vice versa

1.4 (d) (i) Conversion of fraction into percentage and vice versa.

Example

i) What is $\frac{3}{4}$ as a percentage

Solution

One whole represents 100%

$\frac{3}{4}$ of the whole represent $\frac{3}{4} \times 100\% = 75\%$

Example

ii) Convert $\frac{1}{5}$ into percentage.

Solution

$$\frac{1}{5} \times 100\% = 20\%$$

Exercise 1

Convert the following fractions into percentage.

a) $\frac{6}{10}$

b) $\frac{18}{25}$

c) $\frac{21}{40}$

d) $\frac{35}{50}$

e) $\frac{12}{25}$

Example 2

Convert 20% into a fraction

Solution

$$\frac{20}{100} = \frac{1}{5}$$

Exercise 2

Convert the following percentage into fractions

- a) 25% b) 61% c) 75% d) 02% e) 98%

1.4 (d) (ii) Conversion of decimal into percentage and vice versa

Example 3

Convert 0.82 into percentage

Solution

$$0.82 = \frac{82}{100}$$

$$\frac{82}{100} \times 100\% = 82\%$$

Exercise 3

Convert the following into percentage.

- a) 045 b) 0.11 c) 0.89 d) 0.21 e) 0.95

Example 4

Convert 55% into a decimal

Solution

$$55\% = \frac{55}{100} = 0.55$$

Exercise 4

Convert the following percentages into decimals

- a) 80% b) 33% c) 42% d) 02% e) 99%

1.4 (e) Percentages

Percentage Increase

Examples

i) Increase 150 kg by 60%

Solution

The initial weight is 150 kg = 100%

The increase is 60% of the old weight

The new weight is 100% + 60% of 150

$$= 160\% \text{ of } 150 \quad \frac{160}{100} \times 150 = 16 \times 15$$

$$= 240 \text{ kg}$$

ii) Last year Garang was 200 cm tall. This year his height has increased by 10%. Find his present height.

Solution

Garang's height last year = 200 cm = 100%

Increase in height = 10% of 200.

His new height = 100% + 10% of 200.

$$= 110\% \text{ of } 200$$

$$= \frac{110}{100} \times 200 = 220 \text{ cm}$$

iii) A lorry was loaded with bags of maize. 25% more bags were added so that the load was 625kg. What was the original weight of the bags?

Solution

Original = 100%

Increase = 25%

New weight = 100% + 25% = 125%

Therefore 125% = 625 kg

$$\therefore 100\% = \frac{625}{125} \times 100$$

$$= 500 \text{ kg}$$

Exercise 13 (a)

- Increase
 - £s240 by 30%
 - 51 by 70%
 - $\frac{3}{4}$ by 20%
 - $7\frac{1}{2}$ kg by 20%
- The price of a shirt was £s 40. If this price was later increased by 20%, find the new price of the shirt.
- Rumbek county schools received 2500 primary seven mathematics text books in 1998. The following year this number was increased by 25%. How many P7 mathematics textbooks did they receive altogether?
- The area of a school garden is 144mm^2 . If this area is increased by $12\frac{1}{2}\%$, calculate the new area of the school garden.
- Kong earns £s. 250 in a month. If his salary has been increased by 12%, how much will he earn?
- At six months, Asunta's baby weighed 15 kg. After three months the baby's weight increased by 24%. What was the weight of the baby after three months?
- What length when increased by 20% becomes 60 cm?
- After 5 years the height of a tree increased by 10%. If the new height is 8m, what was the original height? (give your answer to one decimal place)
- John works on a farm. His salary has been increased by 20% and he now earns £s6,600. What was his salary before the increase?
- In 1997 a school in Raga had 480 pupils. In 1998 there was an increase in enrollment by 30%. How many pupils are there in the school now?

Percentage decrease

Example

- Ajongo had 360 cows. During an epidemic, some animals died and the number was reduced by 25%. How many cows does Ajongo have now?

Solution

Number of cattle before epidemic = 360 = 100%

Decrease in percentage is 25%.

Therefore the number of cattle after the epidemic = (100%-25%) of 360

$$\begin{aligned}\therefore 75\% \text{ of } 360 &= \frac{75}{100} \times 360 \\ &= 270 \text{ cattle}\end{aligned}$$

ii) Decrease 500 by 30%

$$= 500 \times (100\% - 30\%)$$

$$= 500 \times \frac{70}{100}$$

$$= \underline{350}$$

iii) Lemi sold 25% of his harvest of honey. The amount left was 175 L. How much honey did he harvest?

Solution

Percentage of the amount harvested = 100%

Percentage of the amount sold = 25%

Percentage of the amount left = (100%-25%) = 75%

$$\therefore 75\% = 175 \text{ L}$$

$$\therefore 1\% = \frac{175}{75}$$

$$\therefore 100\% = \frac{175}{75} \times 100$$

$$= \frac{700}{3}$$

$$= 233\frac{1}{3} \text{ L}$$

Exercise 13 (b)

1. Decrease

(a) $\frac{1}{2}$ by 50%

(b) 600 by 40%

(c) 0.75 by 80%

(d) 35 kg by 50%

(e) $3\frac{1}{2}$ by 25%

(d) £200 by 60%

2. (a) Decrease 90 by 30%

b) decrease 3m ,50cm by 20%

(c) Decrease 75 by 12%

d) decrease 16 by 40%

3. On a certain dairy farm, 360 litres of milk are produced everyday. This production has been reduced by 15 % due to severe drought that has hit the area. How much milk does the farm produce now?
4. 20% of Akelo's harvest of groundnuts was spoiled during storage. How many bags of groundnuts was she left with if she harvested 10 bags?
5. During the first term of school, Miyada scored a total of 600 marks. At the end of the second term her total marks were reduced by 15%. How many marks did she score in the second term?
6. A farmer harvested 120 mangoes. After selling, he found out that he was left with 15% of his total harvest. How many mangoes did he sell?
7. A farmer decided to sell 30% of his cows because of drought. If he had 690 cows before the drought, how many cows was he left with after selling?
8. Last month John got sick with malaria and as a result his weight was reduced by 15%. Before he got sick, he weighed 60 kg. How much does he weigh now?

UNIT 2

Measurement

2.1 (a) Recognizing decimeter, decameter and hectometer as units of length

Length conversion

- 10 mm = 1 centimeter (cm)
- 10 cm = 1 decimeters (dm)
- 10 dm = 1 metre (m)
- 10 m = 1 decameter (Dm)
- 10 Dm = 1 hectometer (hm)
- 10 hm = 1 Kilometer (km)

2.1 (b) Solving problems involving decimeter, decameter and hectometer

a) Conversion to decameter

Examples

a) (i) 200 dm to Dm
 $100 \text{ dm} = 1 \text{ Dm}$

ii) 65 dm to Dm
 $100 \text{ dm} = 1 \text{ Dm}$

iii) 3 hm to Dm
 $1 \text{ hm} = 10 \text{ Dm}$
 $\therefore 3 \text{ hm} = (3 \times 10) \text{ Dm}$
 $= 30 \text{ Dm}$

iv) 1.5 hm to Dm
 $1 \text{ hm} = 10 \text{ Dm}$
 $1.5 \text{ hm} = (1.5 \times 10) \text{ m}$
 $= 15 \text{ Dm}$

b) Conversion to Hectometer

Example

(i) 35 Dm to hm
 $10 \text{ Dm} = 1 \text{ hm}$
 $35 \text{ Dm} = \frac{35}{10} \text{ hm}$
 $= 3.5 \text{ hm}$

(ii) 4 Dm to hm
 $10 \text{ Dm} = 1 \text{ hm}$
 $4 \text{ Dm} = \frac{4}{10} \text{ hm}$
 $= 0.4 \text{ hm}$

iii) 475 dm to hm
 $1000 \text{ dm} = 1 \text{ hm}$
 $475 \text{ dm} = \frac{475}{1000} \text{ hm}$
 $= 0.475 \text{ hm}$

iv) 13 dm to hm
 $1000 \text{ dm} = 1 \text{ hm}$
 $13 \text{ dm} = \frac{13}{1000} \text{ hm}$
 $= 0.013 \text{ hm}$

Exercise 14 (a)

- Convert the following measurements into decameters
a) 500dm b) 79 dm c) 3 dm
d) 45 hm e) 6.5 hm f) 0.9 hm
- Convert the following measurements into decimeters
a) 92 Dm b) 4Dm c) 9 hm
d) 0.3 hm e) 22.4 Dm f) 2.14 hm
- Convert the following measurements into hectometer
a) 92 dm b) 345 dm c) 2 dm
d) 650 Dm e) 4535 Dm f) 270 Dm
- Write the following measurements in centimeters
a) 36 mm b) 0.5dm c) 0.25m
d) 0.175 hm e) 1.471 km
- Convert the following measurements into mm.
a) 4.9 cm b) 1.678 dm c) 5.4 m d) 0.8463 hm
- Convert the following measurements into km.
a) 82396 mm b) 155 Dm c) 1235 cm
d) 9 hm e) 927m f) 29431 dm

Exercise 14 (b)

Work out the following:

- a) $7 \text{ dm } 4 \text{ m} + 2 \text{ m} + 5 \text{ dm}$
b) $16 \text{ Dm } 8 \text{ m } 6 \text{ dm} + 1 \text{ Dm } 8 \text{ m } 4 \text{ dm}$

2. a)

<i>hm</i>	<i>Dm</i>	<i>M</i>	<i>dm</i>
21	3	8	7
<hr/>			
+ 9	8	7	6

b)

<i>hm</i>	<i>Dm</i>	<i>dm</i>
24	7	68
<hr/>		
+ 5	9	44

c)

<i>m</i>	<i>dm</i>
35	6
<hr/>	
- 12	8

d)

<i>Dm</i>	<i>m</i>	<i>dm</i>
45	9	7
<hr/>		
- 21	8	9

Problems Involving Common Units of Length

10 mm = 1 centimeter (cm)

100 cm = 1 metre (m)

1000 cm = 1 kilometre (km)

Addition

Examples

$$\begin{array}{r} \text{i) cm mm} \\ 3 \quad 4 \\ 1 \quad 6 \\ + \underline{2 \quad 6} \\ \hline 7 \quad 9 \end{array}$$

$$\begin{array}{r} \text{ii) m cm mm} \\ 12 \quad 30 \quad 2 \\ 13 \quad 40 \quad 6 \\ 17 \quad 65 \quad 3 \\ + \underline{18 \quad 75 \quad 5} \\ \hline 62 \quad 11 \quad 5 \end{array}$$

$$\begin{array}{r} \text{iii) km m cm mm} \\ 21 \quad 650 \quad 60 \quad 7 \\ 51 \quad 870 \quad 93 \quad 5 \\ 75 \quad 456 \quad 77 \quad 3 \\ + \underline{45 \quad 784 \quad 90 \quad 9} \\ \hline 194 \quad 763 \quad 22 \quad 4 \end{array}$$

Exercise 15 a

1. Work out the following:

$$\begin{array}{r} \text{a) cm mm} \\ 35 \quad 34 \\ 16 \quad 21 \\ + \underline{18 \quad 13} \end{array}$$

$$\begin{array}{r} \text{b) m cm mm} \\ 21 \quad 48 \quad 21 \\ 15 \quad 85 \quad 38 \\ + \underline{17 \quad 75 \quad 12} \end{array}$$

$$\begin{array}{r} \text{c) km m cm mm} \\ 16 \quad 396 \quad 20 \quad 4 \\ 17 \quad 300 \quad 65 \quad 8 \\ 13 \quad 750 \quad 45 \quad 9 \\ + \underline{21 \quad 820 \quad 98 \quad 7} \end{array}$$

- A man tied clothesline between four posts in a straight line. The distances between the posts were 3m 64cm 9mm, 4m 35cm 6mm, and 2m 25cm 5mm. What was the total length of the wire used if the knot took 2m of wire?
- Nyidier went to a cow auction near her home. The auction was 3km 600m away from her home. On arriving at the auction she was advised by her friend to go to the next auction, which had better cows. It was 2km 750m away from the first auction. How far was the second auction from Nyidier's home?
- Ochan is 1 m 6cm 3mm tall and Ariet is 1 m 20cm 9mm tall. What is their total height?
- An electrician had two wires measuring 2m 58cm 6mm and 3m 49cm 5mm long. He joined these wires to make one long line. What was the total length of the joined wires?

Subtraction

Example

$$\begin{array}{r} \text{(i)} \quad \text{cm} \quad \text{mm} \\ 61 \quad 3 \\ - 52 \quad 8 \\ \hline 8 \quad 5 \end{array}$$

$$\begin{array}{r} \text{(ii)} \quad \text{m} \quad \text{cm} \quad \text{mm} \\ 28 \quad 36 \quad 6 \\ - 9 \quad 86 \quad 9 \\ \hline 18 \quad 59 \quad 7 \end{array}$$

$$\begin{array}{r} \text{(iii)} \quad \text{km} \quad \text{m} \quad \text{cm} \quad \text{mm} \\ 175 \quad 261 \quad 21 \quad 1 \\ - 49 \quad 938 \quad 78 \quad 7 \\ \hline 25 \quad 332 \quad 52 \quad 4 \end{array}$$

Exercise 15b

$$\begin{array}{r} \text{1. (a)} \quad \text{cm} \quad \text{mm} \\ 92 \quad 6 \\ - 76 \quad 9 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(b)} \quad \text{m} \quad \text{cm} \quad \text{mm} \\ 405 \quad 47 \quad 3 \\ - 308 \quad 96 \quad 8 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(c)} \quad \text{km} \quad \text{m} \quad \text{cm} \quad \text{mm} \\ 69 \quad 132 \quad 26 \quad 3 \\ - 29 \quad 875 \quad 77 \quad 9 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(d)} \quad \text{km} \quad \text{m} \quad \text{cm} \quad \text{mm} \\ 31 \quad 360 \quad 61 \quad 2 \\ - 12 \quad 898 \quad 87 \quad 7 \\ \hline \end{array}$$

- One day Asiri covered a total distance of 3 km 840 m. She covered a distance of 11km 912m running, then walked for the remaining distance. What distance did she cover by walking?
- A tailor bought 16m 50cm of material. He used 11m 95cm to make school uniforms. What was the length of the remaining piece of material?
- Ayak had a piece of sugar cane which measured 3m 13cm and 3mm. She cut a piece for Luka measuring 1m 19cm 8mm long. What was the length of the piece she was left with?
- A farmer has a string which measured 304m 39cm long. He used 239m 58cm 3mm of it to tie tomato plants. What was the length of the piece which remained?
- Utu was competing in the four hundred metres race. After covering a distance of 300m 87cm, he fell down and was unable to complete the race. What distance was he left with in order to cover the race?

Multiplication

Example

Multiply 5 km 254 m 63 cm 6 mm by 5

$$\begin{array}{r} \text{km} \quad \text{m} \quad \text{cm} \quad \text{mm} \\ 5 \quad 254 \quad 63 \quad 6 \\ \hline \times \quad 5 \\ \hline 26 \quad 273 \quad 18 \quad 0 \end{array}$$

Steps

- (i) Multiply mm column first $6 \times 5 = 30$; divide 30 by 10 and convert it to cm = 3 cm. Carry 3 to cm column and 0 in mm.
- (ii) Multiply the cm column $63 \times 5 = 315 + 3 = 318$ and divide it by 100 = 3 remainder. Write 18 under cm.
- (iii) Multiply 254 by 5 to get 1270 + 3 to give 1273m. Divide by 1000 to give 1 km and write the remainder under m ie 273. Multiply 5 by 5m to get 25 + 1 = 26 km.

Exercise 15 (c)

1. Work out the following problems:

(a)

$$\begin{array}{r} \text{m} \quad \text{cm} \quad \text{mm} \\ 30 \quad 70 \quad 8 \\ \hline \times \quad 8 \end{array}$$

(b)

$$\begin{array}{r} \text{m} \quad \text{cm} \\ 9 \quad 6 \\ \hline \times \quad 7 \end{array}$$

(c)

$$\begin{array}{r} \text{km} \quad \text{m} \quad \text{cm} \quad \text{mm} \\ 15 \quad 680 \quad 30 \quad 6 \\ \hline \times \quad 7 \end{array}$$

(d)

$$\begin{array}{r} \text{km} \quad \text{m} \quad \text{cm} \quad \text{mm} \\ 35 \quad 860 \quad 75 \quad 6 \\ \hline \times \quad 5 \end{array}$$

2. Multiply 38 cm 9 mm by 6.
3. 9 girls had material for home science measuring 8 m 15 cm 5 mm each. What was the total length of material they had?
4. A group of people constructed a bridge with logs of wood measuring 3m 15cm each. If they used 9 such logs, what was the total length of the wood used?

- 16 men walked a distance of 3km 210m each. What was the total distance covered by them?
- Okot placed two carpets measuring 5m 48 cm long, side by side. What was the total length of the two carpets?

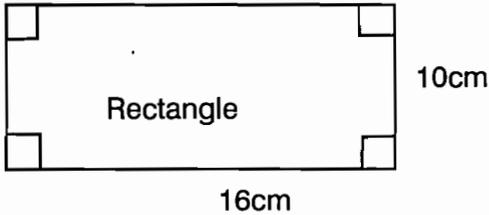
Exercise 15(d)

- Divide 43km 115m by 6
- Divide 20 km 72cm 7mm by 9
- Divide 65km 178m 49cm 8mm by 7
- Divide 46 cm 5mm by 5
- A circle whose circumference was 65m 46cm was divided into 8 equal parts. What was the length of each section?
- A road 17km 8m long had a lot of potholes. 4 men were required to work on this road. If they were given equal distances to work on, what section did each man cover?
- It took a man 2 hours to cover a distance of 125km 16m by car. If he was traveling at a constant speed, how far had he traveled in 1 hour?

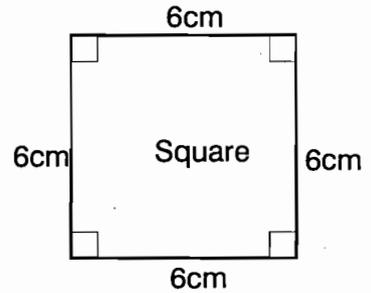
Perimeter and circumference

Perimeter is the distance around any figure. Circumference is the distance around a circle.

Examples

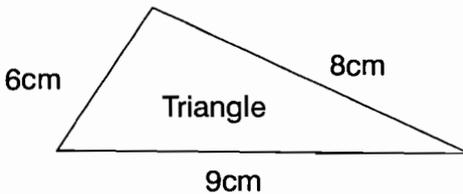


$$\begin{aligned}\text{Perimeter} &= L + W + L + W \\ &= 2(L + W) \\ &= 2(16 + 10) \\ &= 2(26) = 52 \text{ cm}\end{aligned}$$



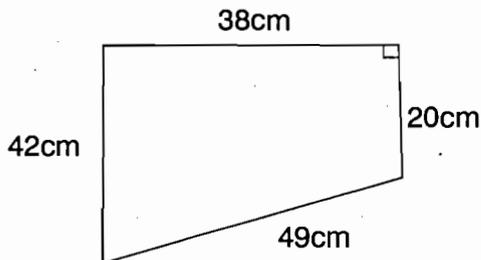
$$\begin{aligned}\text{Perimeter of a square} &= (L \times 4) \text{ cm} \\ &= (6 \times 4) \text{ cm}\end{aligned}$$

For the perimeter of a triangle, you add all sides of a triangle



Solution

$$\text{Perimeter} = 9 + 8 + 6 = 23 \text{ cm}$$

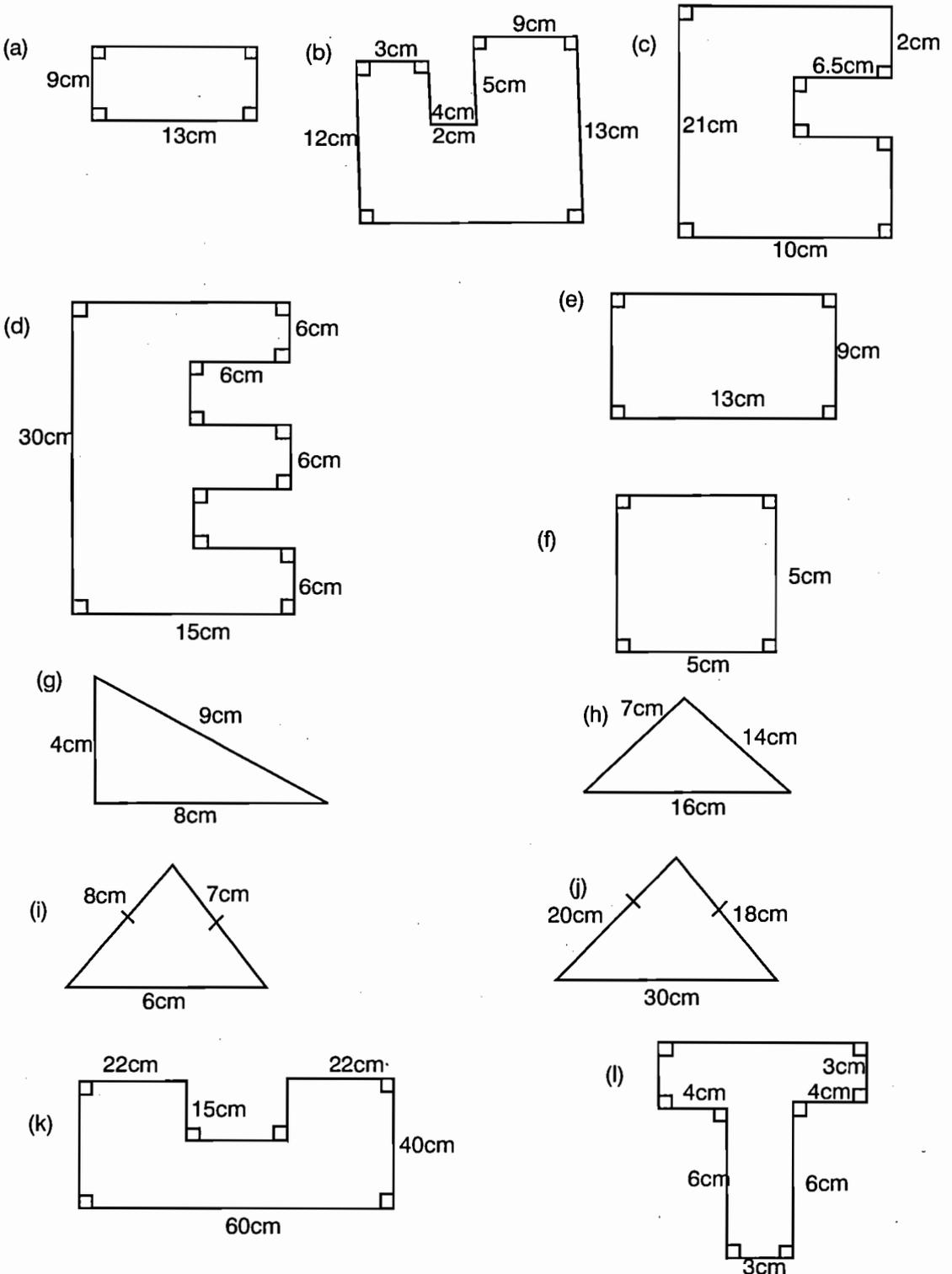


Solution

$$\text{Perimeter} = 49 + 20 + 38 + 42 = 149 \text{ cm}$$

Exercise 16

1. Work out the perimeter of the following figures



2. What is the perimeter of a square whose measurement is 18.5 cm long?
3. A rectangular garden measures 53m long by 36 m wide. What is its perimeter?
4. A school playground measures 150m by 56m long. Zindo went around the field 4 times. What distance did she cover?
5. A square flower garden was fenced with a wire which went around 4 times. If the length of the garden was 75m, what was the length of the wire used to fence the garden?
6. A farmer had a triangular plot whose measurements were 30 m by 15 m by 25m. He put 5 lines of barbed wire around it. What was the length of the wire used?
7. Calculate the length of the third side of the following triangles given the perimeter and the measurement of two sides.
 - (a) perimeter 49 cm measures of two sides are 17.25 cm and 16.5 cm
 - (b) Perimeter 150m measurements of two sides are 58 m and 62m.
 - (c) Perimeter 20.75 cm measures of the two sides are 6.02 and 8.33 cm
 - (d) Perimeter 52 measures of two sides are 25 and 15 cm
8. A farmer has a triangular plot measuring 500m by 400m by 300m. He fenced it with poles and barbed wire. If the barbed wire was placed around the plot three times, what length of wire did he use?
9. Mataba's home compound is rectangular in shape. It measures 115m by 95m. One day he went around it three times chasing a cow. What distance did he cover in all?
10. A rectangular compound measures 210 m by 132m. It is fenced with posts and barbed wire. A post is placed at each corner of the compound and the other posts are placed at an interval of 3m apart. How many posts were used altogether?

Circumference of a circle

- (a) The distance around any circular object is called its circumference.
- (b) The diameter of a circle is from one side of the circle passing through the centre of the circle to the other side of the circle.
- (c) The radius of circle is a straight line from the centre of the circle to the edge.
- (d) The diameter (D) of the circle is twice the radius r of the circle.

Therefore: $r = \frac{d}{2}$ and $d = 2r$

- (e) To develop the relationship between the circumference, diameter and radius, draw several circles of different radii. Measure the circumference and the diameter using a string and a ruler. In each case divide the circumference by the diameter. Each time you find the answer $3\frac{1}{7}$ or 3.14
- (f) $\frac{\text{Circumference}}{\text{diameter}} = 3$ or 3.14 which is given the name pi as π
- (g) Circumference = pi x diameter or 2 x pi radius hence the formula $C = \pi D$ or $2\pi r$

Example

- (i) Find the circumference of the circle whose diameter is 28 cm (take $\pi = \frac{22}{7}$)

Solution

$$\begin{aligned} C &= \pi D \\ &= \frac{22}{7} \times 28 \\ &= 88 \text{ cm} \end{aligned}$$

- (ii) Find the circumference of the circle whose radius is 35 cm (take $\pi = \frac{22}{7}$)

Solution

$$\begin{aligned} C &= 2\pi r = 2 \frac{22}{7} \times 35 \\ &= 220 \text{ cm} \end{aligned}$$

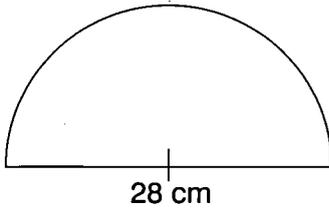
(iii) Find the radius and diameter of a circle whose circumference = 88 cm

Solution

$$C = 2\pi r$$

Therefore
$$r = \frac{C}{2\pi} = 88 \div \left(2 \times \frac{22}{7}\right)$$
$$= 88 \times \frac{7}{44}$$
$$= 14 \text{ cm}$$
Diameter = $2r = 28 \text{ cm}$

(iv) Find the perimeter of the figure below



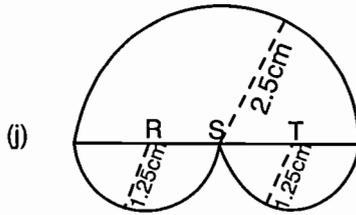
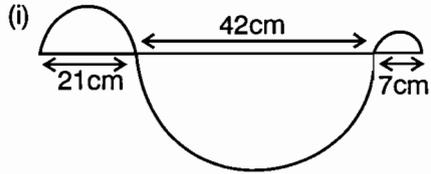
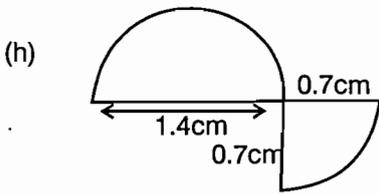
Solution

$$C = \pi D$$

$$\frac{1}{2}C = \frac{1}{2}\pi D$$

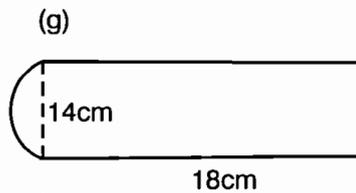
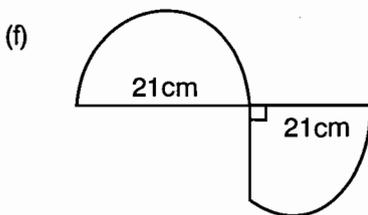
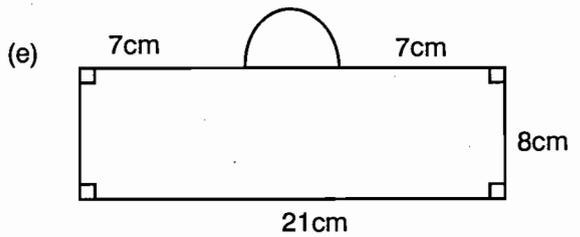
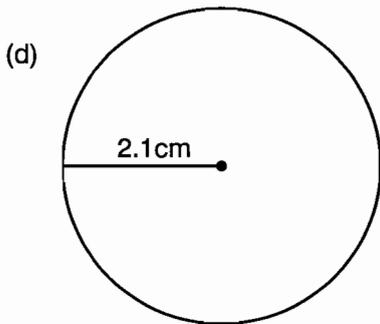
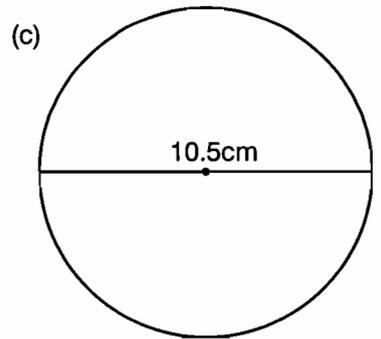
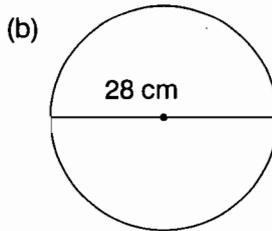
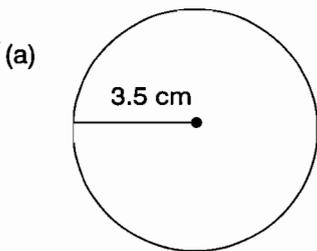
$$\frac{1}{2} \times \frac{22}{7} \times 28 = 44 \text{ cm}$$

Perimeter = $\frac{1}{2}C + d$
 $= (44 + 28) \text{ cm}$
 $= 72 \text{ cm}$

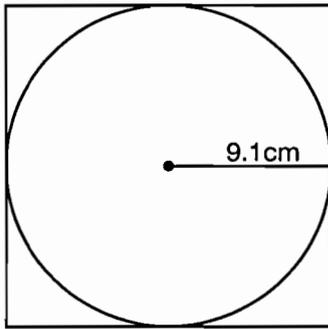


Exercise 17

1. Find the circumference of the following figures:



2. Calculate the circumference of the following circles whose radii are:
(Take $\pi = \frac{22}{7}$)
- (a) $3\frac{1}{2}$ cm (b) 28 cm (c) 35 cm (d) 14 cm (e) 14.7 cm
3. The diameter of the wheel is 63 cm. What is its circumference?
4. Calculate the perimeter of a semi-circular flower bed whose diameter is 14.5 cm. (Take $\pi = 3.14$)
5. The long hand of a clock is 7cm long. What distance does its tip cover in one hour?
6. The diameter of a circular tin is 21cm. A string was tied around it. If the knot was 4cm long, what was the total length of the string used?
7. A wheel has a diameter of 49 cm. How many revolutions does it make to cover 154m?



8. From the figure given above, find the difference between the perimeter of the square and the circumference of the circle inscribed in the square.
9. Given that the circumference of a storage tank is 6.6m, what is the measure of the radius of the tank?
10. If the diameter of a car wheel is $45\frac{1}{2}$ cm, how many meters will it cover in 200 revolutions?
11. A bicycle wheel whose radius is 30 cm covered a distance in 70 revolutions. How many km was this distance? (Take $\pi = \frac{22}{7}$)
12. A circular table has a circumference of 4.4 m. What is its radius? (Take $\pi = \frac{22}{7}$)

13. The wheel of James's lorry has a radius of 28cm. The wheel of Zackariah's car has a diameter of 42cm. How many more revolutions does the wheel of Zachariah's car make than the wheel of James's lorry to cover a distance of 770m? Give your answer to the nearest unit. (Take $\pi = \frac{22}{7}$)

2.2 (a) Area of a circle

Example

1. Find the area of the following circles:

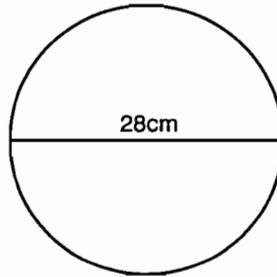
Take (Take $\pi = \frac{22}{7}$)

- (i) Diameter = 28cm

$$\text{Radius} = \frac{28}{2} = 14 \text{ cm}$$

$$\text{Area} = \pi r^2 = \frac{22}{7} \times 14 \times 14$$

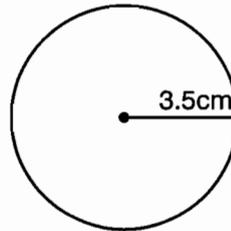
$$= 616 \text{ cm}^2$$



- (ii) Take π to be 3.14. Write your answer, rounded off to one decimal place.

$$\text{Radius} = 3.5 \text{ cm}$$

$$\begin{aligned} \therefore \text{Area} &= \pi r^2 \\ &= 3.14 \times 3.5 \times 3.5 \\ &= 38.465 \\ &= 38.5 \text{ cm}^2 \end{aligned}$$



2. Find the area of a circular pond 42 m across the centre (take $\pi = \frac{22}{7}$)

Solution

The distance across the centre represent the diameter.

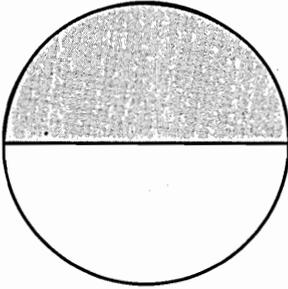
$$\therefore d = 42 \text{ m}$$

$$\therefore r = 42 \div 2 = 21 \text{ cm}$$

$$\begin{aligned} \therefore \text{area} &= \pi r^2 \\ &= \frac{22}{7} \times 21 \times 21 = 1386 \text{ cm}^2 \end{aligned}$$

3. Find the area of the shaded regions

(i)



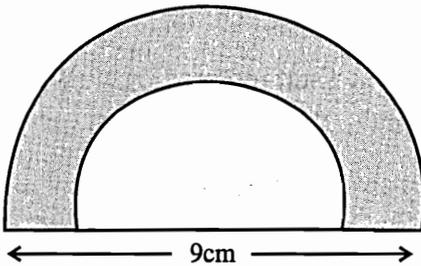
Solution

$$D = 14 \text{ cm}$$

$$r = \frac{14}{2} = 7 \text{ cm}$$

$$\begin{aligned} \text{Area of half circle} &= \frac{1}{2} \pi r^2 \\ &= \frac{1}{2} \times \frac{22}{7} \times 7 \times 7 \\ &= 77 \text{ cm}^2 \end{aligned}$$

(ii)



Solution

$$\text{Use } \pi = 3.14$$

The area of the outer half circle

$$D = 9; r = \frac{9}{2} = 4.5 \text{ cm}$$

$$\begin{aligned} \text{Area} &= \frac{\pi r^2}{2} = \frac{1}{2} \times 3.14 \times 4.5 \times 4.5 \\ &= 31.79 \text{ cm}^2 \end{aligned}$$

Area if the inner half circle

$$D = 8 \text{ cm} \therefore r = 4 \text{ cm}$$

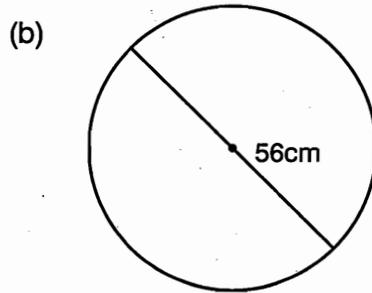
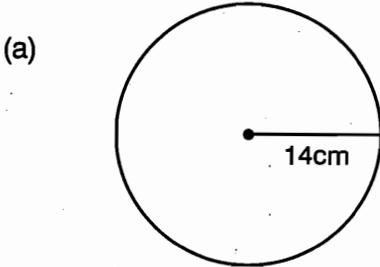
$$\begin{aligned} \text{Area} &= \frac{\pi r^2}{2} = \frac{1}{2} \times 3.14 \times 4 \times 4 \\ &= 25.12 \text{ cm}^2 \end{aligned}$$

$$\therefore \text{The area of the shaded region} = 31.79 - 25.12 = 6.67 \text{ cm}^2$$

Exercise 18

1. Find the areas of the circles whose radii are given below: (take $\pi = 3.14$). Write your answer rounded off to 2 decimal places.
- (a) 2.1 cm (b) 0.7 m (c) 9 cm

2. Calculate the areas of the following circles (take $\pi = \frac{22}{7}$).

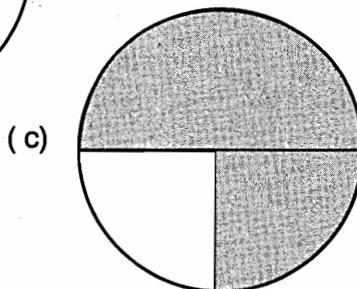
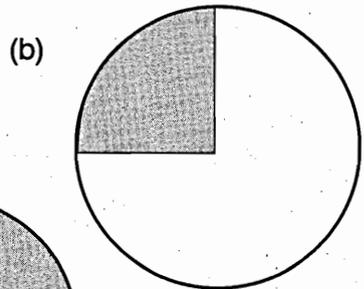
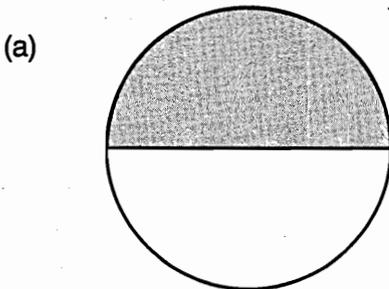


3. A circle has a radius 0.5 m. Find its surface area (take $\pi = 3.14$).

4. Find the areas of the circles whose diameters are:
- (a) 14.5 cm (b) 140 m (take $\pi = \frac{22}{7}$)

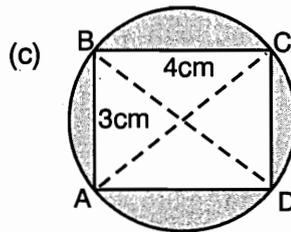
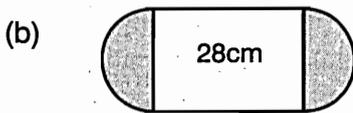
5. A circular pond has a diameter of 200 m. Find the surface area of the water in the pond.

6. Find the area of each of the shaded parts of the circles below. (Diameter = 10m)



7. What is the area of a circle whose circumference is 50.24 cm. (take $\pi = 3.14$)

8. Calculate the area of a circle whose circumference is 88 cm. (take $\pi = \frac{22}{7}$)
9. A room is 5 m long and 4 m wide. A round carpet of radius 1.4 m is in the middle of the room. What area of the floor is left uncovered? (take $\pi = \frac{22}{7}$)
10. The distance around a circular hut is 17.6m. What is the area of the floor?
11. What is the radius of a circle whose area is 154cm^2 ?
12. Find the areas of the shaded regions in the following diagrams:

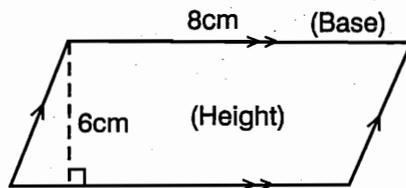


13. The area of a circular mat is 154m^2 . Find its circumference.
14. A semi-circular grass lawn has a radius of 56m.
 (a) Find the cost of planting grass on it if it costs £s 25 per square metre.
 (b) Find how many flower bushes can be planted around the lawn at 4m apart.
15. Two discs have diameters of 14cm and 28cm. Find the ratio of their areas.

2.2 (b) Area of a Parallelogram

Examples

- (i) Find the area of this parallelogram.



Solution

The area of a parallelogram = base length \times height
 $= (8 \times 6) \text{ cm}^2 = \underline{48\text{cm}^2}$

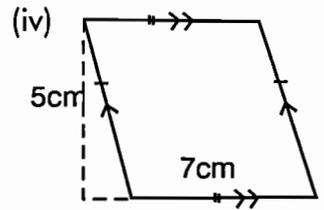
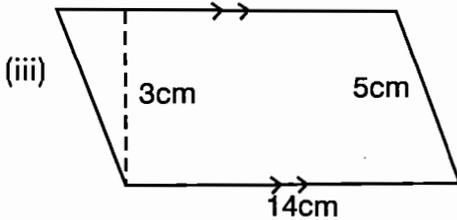
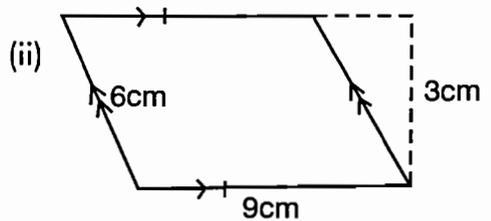
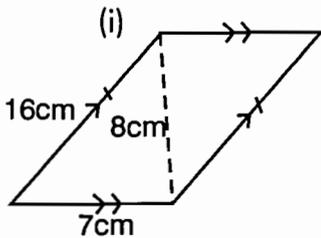
(ii) The base length of a parallelogram is 12cm. Find its perpendicular height if its area is 60cm^2 .

Solution

$$\begin{aligned} \text{Area} &= \text{base length} \times \text{height} \\ &= 12 \text{ cm} \times \text{height} = 60\text{cm}^2 \quad \therefore \text{height} = \frac{60 \text{ cm}^2}{12 \text{ cm}} \\ &= 5 \text{ cm} \end{aligned}$$

Exercise 19

1. Find the areas of the following parallelograms



2. Area of a trapezium

A trapezium is a quadrilateral (four sided figure) with only two sides parallel.

$$= \frac{1}{2}h (\text{sum of two parallels} = \frac{1}{2}h (a + b))$$

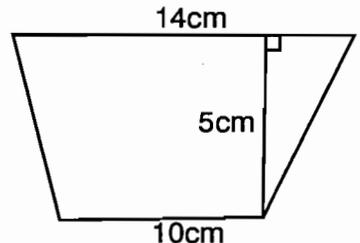
Where a and b are two parallel sides.

$$\text{Area of trapezium} = \frac{1}{2}h (a + b)$$

$$= \frac{1}{2} \times 5 (14 + 10)$$

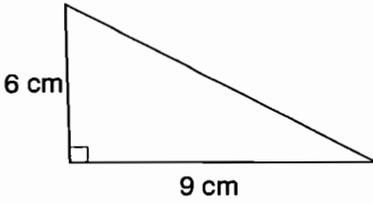
$$= \frac{1}{2} \times 5 \times 24$$

$$= 60 \text{ cm}^2$$



3. Area of a triangle

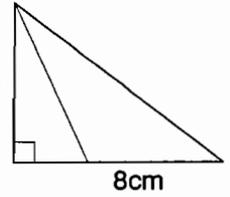
(i)



Area of a triangle = $\frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2}bh$

$$\begin{aligned} \text{Area} &= \frac{1}{2} \times 9 \times 6 \\ &= 27 \text{ cm}^2 \end{aligned}$$

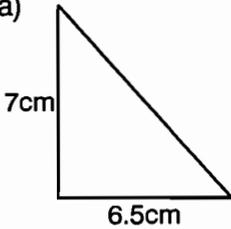
(ii) 5cm



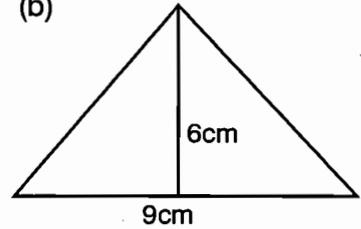
$$\begin{aligned} \text{Area} &= \frac{1}{2} \times 8 \times 5 \\ &= 20 \text{ cm}^2 \end{aligned}$$

4. Find the areas of the figures shown below

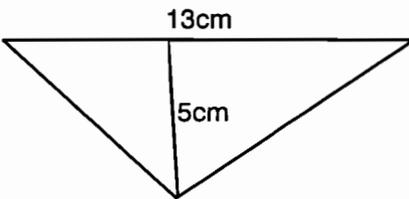
(a)



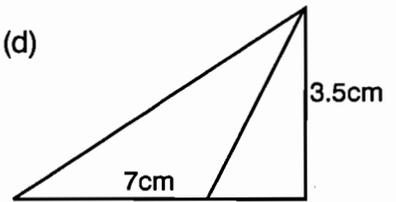
(b)



(c)

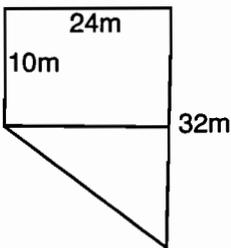


(d)

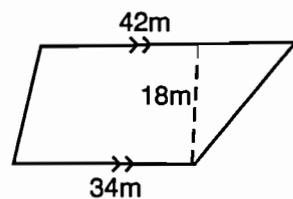


3. Find the area of the following Trapezia

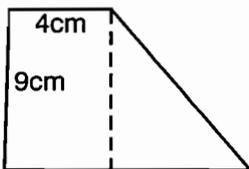
(i)



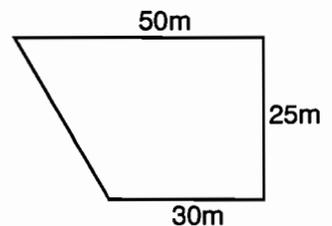
(ii)



(iii)



(iv)



6. The base length of a parallelogram is 24.5 cm. Find its area if the perpendicular height is 5cm.
7. The area of a parallelogram is 84cm^2 . Calculate its base length if the perpendicular height is 7cm.
8. The height of a parallelogram is 9cm. Calculate its area if the base length is 16.5cm.
9. The area of a triangular field is 24m^2 . Find its height if the base is 6m.
10. A triangular piece of paper has a height of 8.5cm and a base 6.2cm. Find its area.
11. Complete the table below for a triangular figure.

	Base	Height	Area
(a)	7.4 cm	5 cm	-
(b)	6.4 cm	-	48 cm^2
(c)	-	9.1 cm	72.8 cm^2
(d)	4 cm	7.8 cm	-
(e)	-	9 cm	108 cm^2

12. In a room 12m by 9m, a carpet is spread leaving a space of 30cm from the wall all around. Calculate the area of the carpet.

2.2 (b) Surface Area of Common Solids

2.2 (b) (i) Surface Area of Cuboids

A cuboid is a rectangular shape with six faces. Examples include bricks, boxes for chalk, matches and cigarettes and cartons.

Examples

(i) Find the surface area of a closed box (cuboid)

Solution

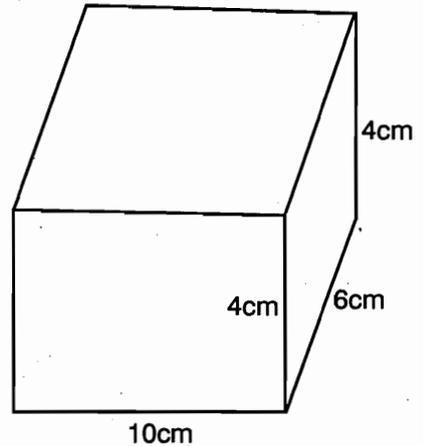
Surface area of a closed box (cuboid)

$$\text{Area of 2 sides} = (2 \times 10 \times 4) \text{ cm}^2 = 80 \text{ cm}^2$$

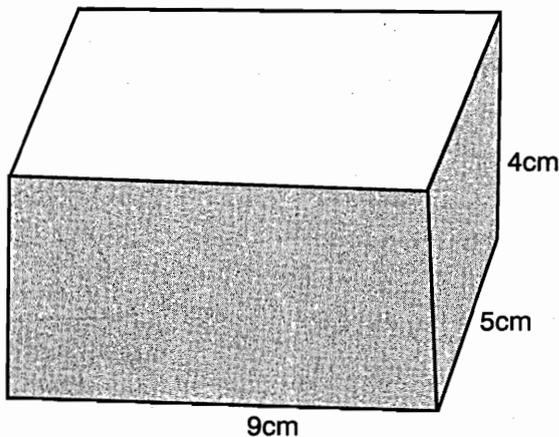
$$\text{Area of 2 sides} = (2 \times 4 \times 6) \text{ cm}^2 = 48 \text{ cm}^2$$

$$\text{Area of 2 sides} = (2 \times 10 \times 6) \text{ cm}^2 = \underline{120 \text{ cm}^2}$$

$$\text{Total surface area of a cuboid} = \underline{248 \text{ cm}^2}$$



(ii)



Solution

$$\text{Area of 2 sides} = (2 \times 9 \times 4) \text{ cm}^2 = 72 \text{ cm}^2$$

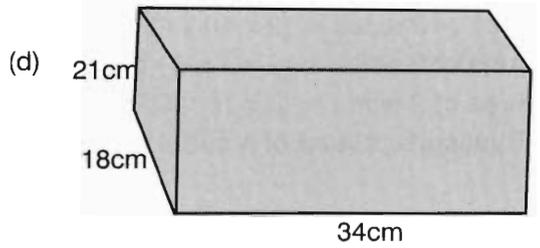
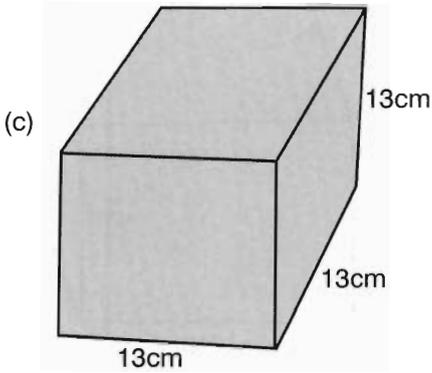
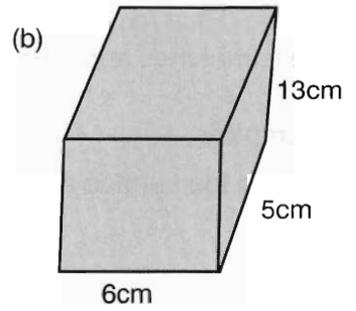
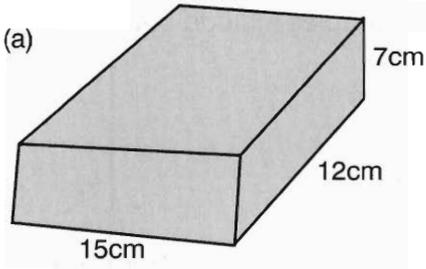
$$\text{Area of 2 sides} = (2 \times 4 \times 5) \text{ cm}^2 = 40 \text{ cm}^2$$

$$\text{Area of 1 sides} = (1 \times 9 \times 5) \text{ cm}^2 = \underline{120 \text{ cm}^2}$$

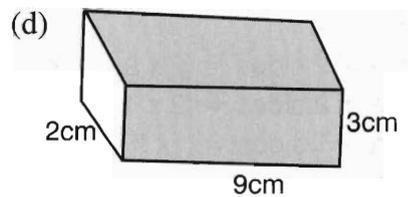
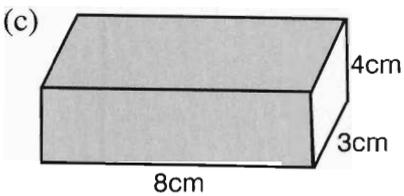
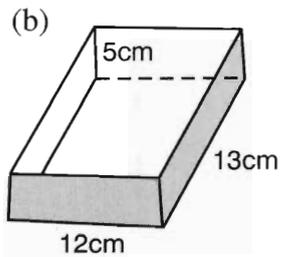
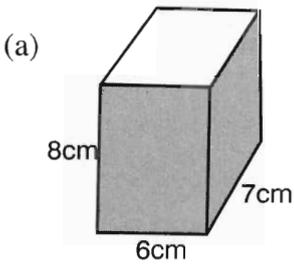
$$\text{Total surface area of a cuboid} = \underline{157 \text{ cm}^2}$$

Exercise 20

1. Find the surface area of the following closed boxes



2. Find the surface area of the following open boxes



3. A match box measures 4cm long, 3cm wide and 2cm high. Find the surface area of the cuboid.
4. A cuboid with an open top measures 5cm long, 4m wide and 3m high. Find the surface area of the box.
5. A box open at the top measures 12cm long, 7cm wide and 5cm high. Find the surface area of the box.
6. Find the surface area of a closed cube measuring 8cm long.
7. A wooden box for storing medicine has the following measurements 3cm by 2cm by 1.5cm. Find the surface area if it is closed.
8. An open rectangular water tank measures 9m long by 6.5m wide and 4.2m high. What is the total surface area of the tank?
9. A bar of soap measures 40cm long, 5cm wide and 6cm high. What is the total surface area?
10. A geometrical set box measures 17cm long, 7cm wide and 2cm high. Find its surface area when closed.

Area of walls, ceilings and floors

Example

A room with a ceiling measures 7m long by 5m wide by 4m high. It has a door measuring 2m by 1m and 2 windows measuring 1m by 1m.

- (a) Find the surface area of the room including the walls, floor, ceiling, windows and the door.
- (b) Find the surface area of the walls excluding the windows and the door.

Solution

$$\begin{aligned}
 \text{(a) Area of 2 opposite walls} &= (2 \times 7 \times 4) \text{ m}^2 &&= 56 \text{ m}^2 \\
 \text{Area of 2 opposite walls} &= (2 \times 5 \times 4) \text{ m}^2 &&= 40 \text{ m}^2 \\
 \text{Area of ceiling and the floor} &= (2 \times 5 \times 4) \text{ m}^2 &&= \underline{70 \text{ m}^2} \\
 &&& \underline{166 \text{ m}^2}
 \end{aligned}$$

- (b) Area of the walls = $(56 + 40) \text{ m}^2 = 96 \text{ m}^2$
 Area of the windows = $(2 \times 1) \text{ m}^2 = 2 \text{ m}^2$
 Area of the door = $(2 \times 1) \text{ m}^2 = \underline{2\text{m}^2}$

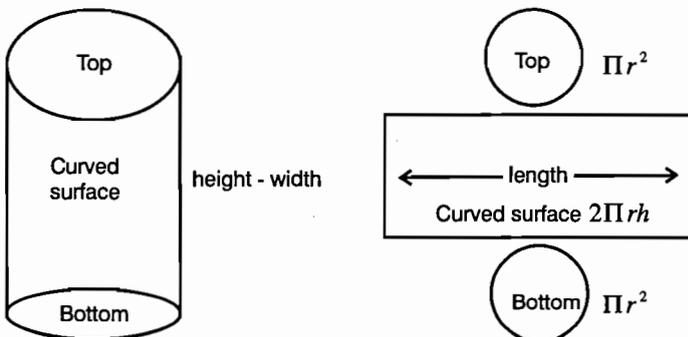
Total area of walls excluding windows and doors = $(96-4) \text{ m}^2 = \underline{92\text{m}^2}$

Exercise 21

1. A hall measures 10m long, 8m wide and 4m high. It has two doors each measuring 2.3m high and 1.2m wide and 4 windows each measuring 1.5m wide by 1.2m high. It has no ceiling.
 - (a) Find the total surface area of the walls including the windows, the doors and the floor.
 - (b) Find the total surface area of the wall including windows and doors.
 - (c) Find the total surface area of the walls excluding windows and doors.
2. A room measures 6m long 5m wide and 4m high. It has a door measuring 2.5m high and 1.3m wide and 2 wooden windows 1.4m wide and 1.3m high each. If the walls were painted white and the door and the windows light blue, find
 - (a) The total area painted white.
 - (b) The total area painted light blue.

2.2 (b) (ii) Surface area of cylinders

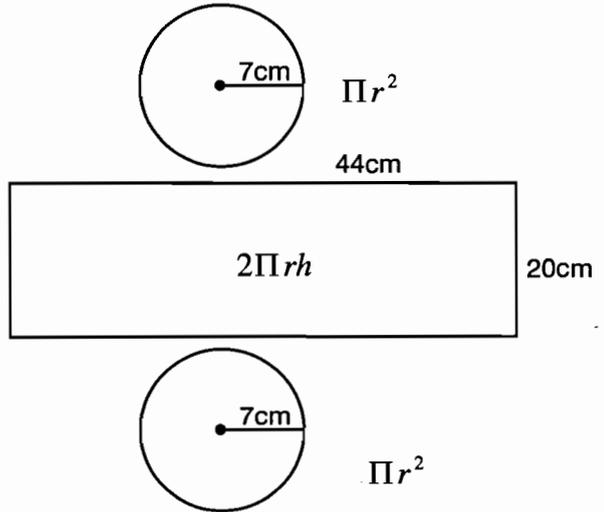
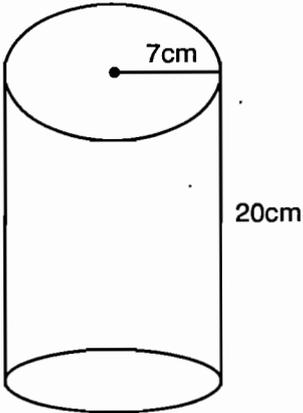
A cylinder is a shape with a long straight body and flat circular ends. If a cylinder is cut and opened out, there would be two circular pieces and a rectangular piece from the curved surface. The circumference of the cylinder becomes the length of the rectangle. The height of the cylinder becomes the width of the rectangle.
 Curve surface area = height x circumference = width x length of a rectangle.



Here width = height = 20 cm

Length = circumference

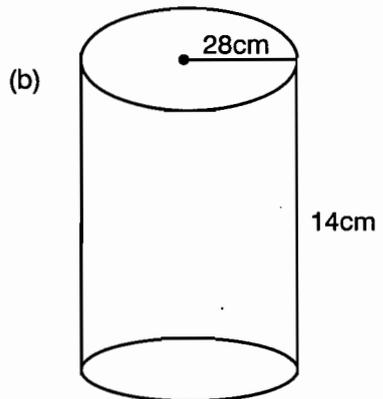
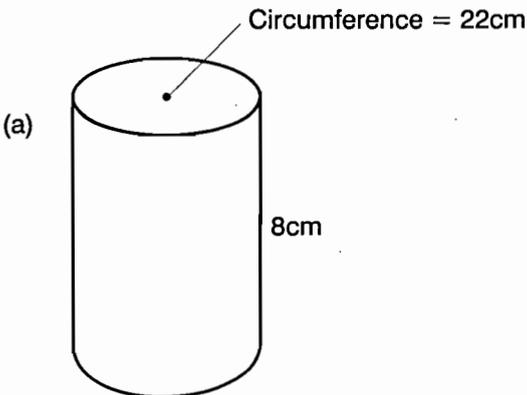
$$= 2\pi r = 2 \times \frac{22}{7} \times 7 = 44 \text{ cm}$$

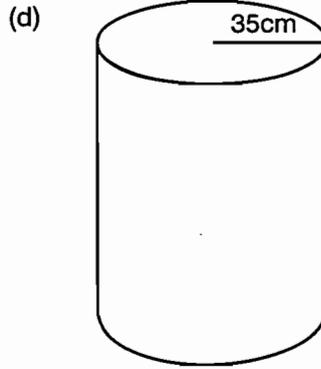
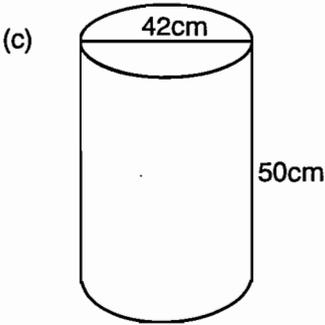


\therefore Surface area of a cylinder =
area of the two circular parts + the area of the curved surface
 $= 2\pi r^2 + 2\pi rh$
 $= 2 \times \frac{22}{7} \times 7 \times 7 + 2 \times \frac{22}{7} \times 7 \times 20$
 $= 308 \text{ cm}^2 + 880 \text{ cm}^2$
 $= 1188 \text{ cm}^2$

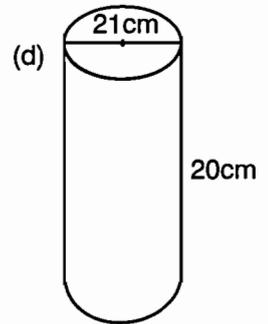
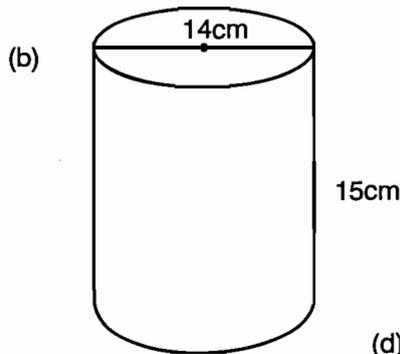
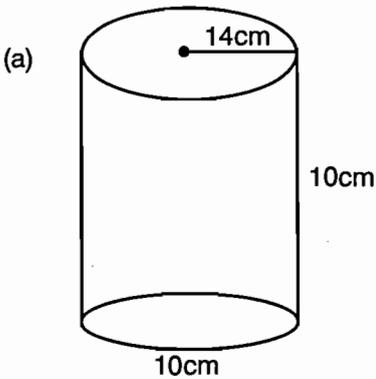
Exercise 22

1. Calculate the surface area of the following cylinders





2. Find the curved surface area of the following cylinders



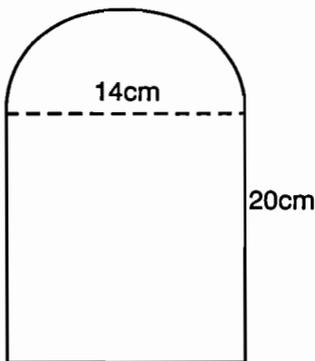
- The height of a cylindrical tank is 15m. Find its surface area if its diameter is 7m.
- The radius of a water pipe is 3.5cm. Calculate its surface area if it is 20m long. The pipe is assumed to be open.
- The diameter of a tin of cocoa is 6.4cm. Find the surface area of the tin if it has a height of 9cm. (Take $\pi = 3.14$) (round off your answer to one decimal place).
- The diameter of paint tin is 21cm. The height of the tin is 15cm. What is the surface area of the tin?

7. A coffee tin measures 7cm in diameter and 10cm in height. The curved surface of the tin has a paper cover all the way around. What is the area of the paper cover?
8. Find surface area of a cylinder open at both ends with the following measurements (take $\pi = \frac{22}{7}$)
- (a) Height 2.3cm, radius 3.5cm.
 (b) Height 1.5 cm, radius 4.2cm.
9. Find the surface area of the following cylinders open at one end, (take $\pi = \frac{22}{7}$)
- (a) Height 25cm, radius 7 cm.
 (b) Height 8cm, radius 2.1 cm.
10. Udiki built a cylindrical concrete water tank 2.5m high and 2.1m in diameter. On top of the tank he left a circular opening 14 cm in diameter to let in water. On the curved surface, he also left two circular openings each with a diameter of 3.5cm, one to serve as an overflow opening and the other for a tap. What was the surface area of the rest of the tank? (give your answer to 3 decimal places).

2.2 (f) Area of combined shapes

Example

Find the area of the shape below



First area of the semicircle = $\frac{1}{2}\pi r^2$

where $r = 7$ cm

$$\therefore \text{Area} = \frac{1}{2} \times \frac{22}{7} \times 7 \times 7$$

$$= 77 \text{ cm}^2$$

Second area of a rectangle = $L \times b$

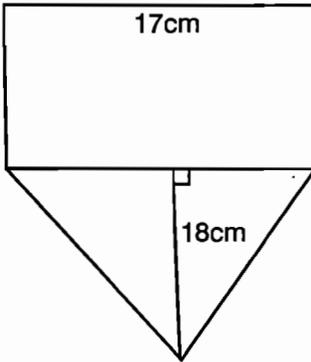
$$= 14 \times 20 = 280 \text{ cm}^2$$

$$\therefore \text{Total area of the shape} = 280 + 77 \\ = 357 \text{ cm}^2$$

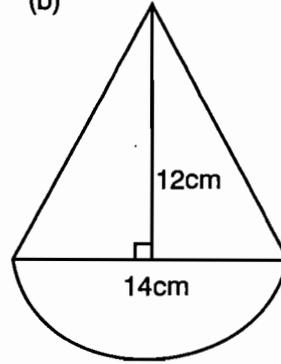
Exercise 23

1. Find the areas of the following combined shapes.

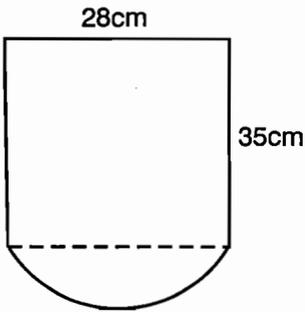
(a)



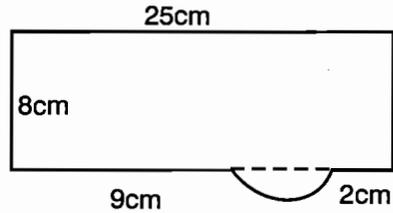
(b)



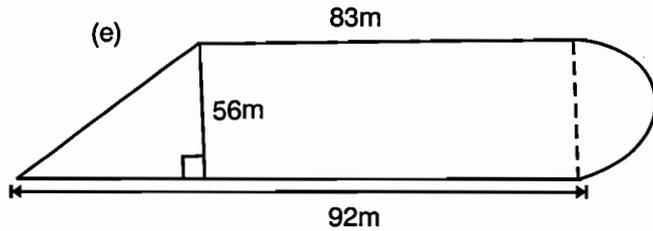
(c)



(d)



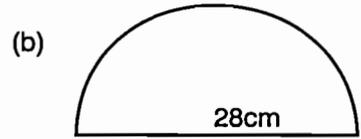
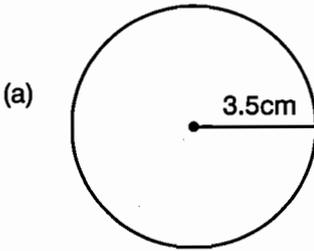
(e)



2. A rectangular pond has a semi-circular end on both sides. Find the total area of the pond if it has a length of 25 m and a diameter of 14m.
3. A circular mat is fitted in a square room such that the ends of the mat touches the four walls. If the room is 7m long, find
- The area of the mat.
 - The area not covered by the mat.

Mixed Exercise 23

1. Find the area of the following diagrams:



2. The area of a circle is 154 cm^2 . Find

- (a) Its diameter
- (b) Its radius

3. The diameter of a circular pond is 42m. Find the surface area of the pond.

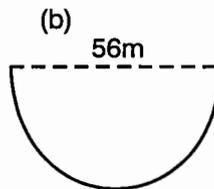
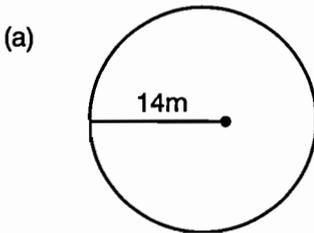
4. The circumference of circular flower garden is 132m. Find its (i) diameter (ii) radius.

5. The area of a round table is 616 cm^2 . Find the

- (a) Radius of the table.
- (b) Diameter of the table.

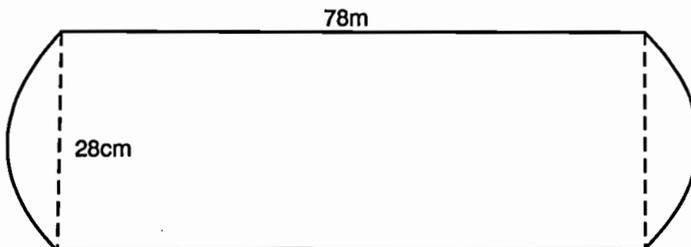
6. (a) Find the perimeter of the following figure.

(b) Find the area of the figure.



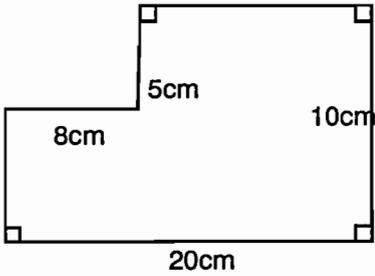
7. Find (a) The area

(b) The perimeter of the given figures

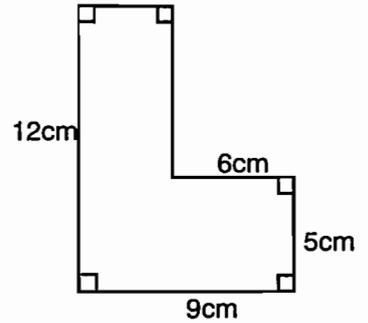


8. Find (a) Area
(b) Perimeter of the following shapes.

(a)

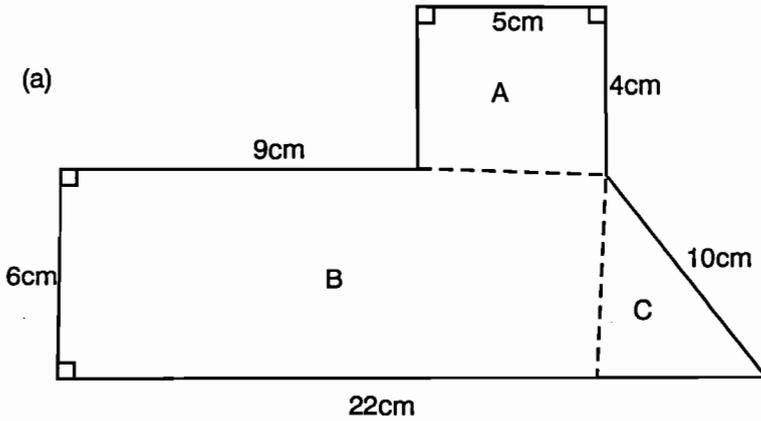


(b)

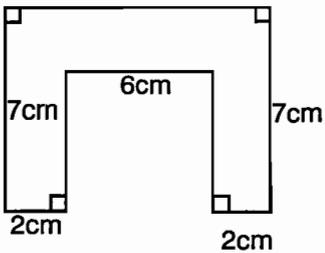


9. Find the area of the following figures

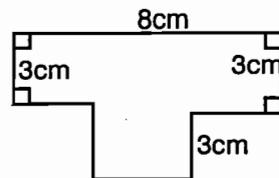
(a)



(b)



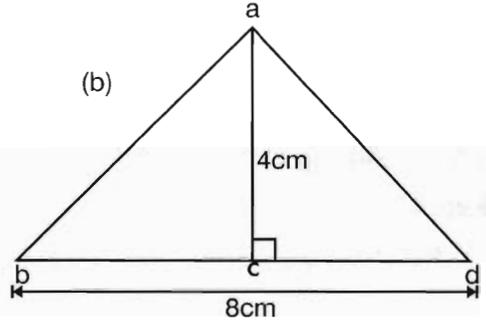
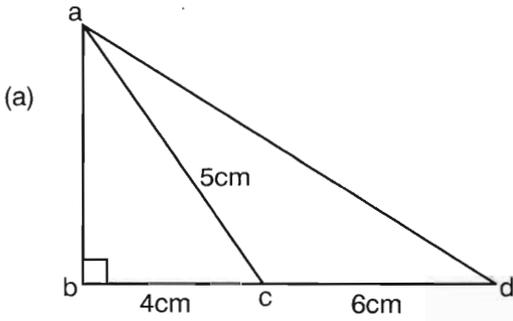
(c)



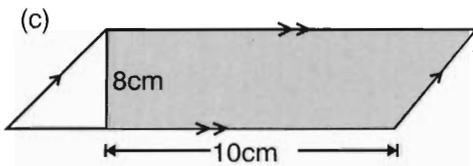
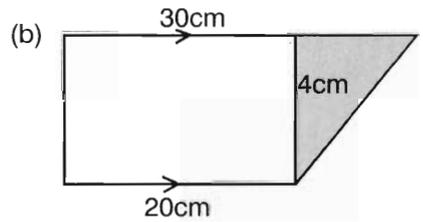
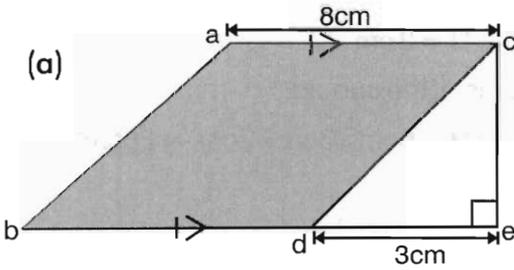
Problems involving area of Triangle Quadrilaterals, Trapezium and Parallelogram

Exercises

1. Find the area of the figures below:



3. Find the area of the shaded parts



2.3 Volume and Capacity

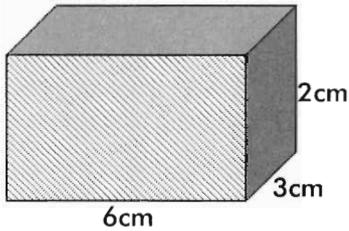
The volume of an object is the space that it occupies. Volume is usually measured in cubic units.

Remember $1000\text{cm}^3 = 1000 \text{ ml} = 1 \text{ litre}$
 $100\text{cm}^3 = 1 \text{ deciliter}$

2.3 (a) Finding volume of cuboids, cylinders and cubes

Examples

(i) Find the volume of the cuboid below



Volume of a cuboid = length x width x height
 $= L \times W \times H$

Here $L = 6\text{cm}$

$W = 3\text{cm}$

$H = 2\text{cm}$

Volume of the cuboid =

$$L \times W \times H = 6\text{cm} \times 3\text{cm} \times 2\text{cm} = \underline{36\text{cm}^3}$$

(ii) The volume of a cuboid is 210 cm^3 . If its length is 7cm and width is 5cm , what is its height?

Solution

$$L \times W \times H$$

$$= 210 \text{ cm}^3$$

$$\therefore 7 \times 5 \times H = 210$$

$$\therefore H = \frac{210}{35}$$

$$\therefore H = \underline{6\text{cm}}$$

(iii) The volume of a cuboid is 960cm^3 . If its height is 8cm , what is its base area?

Solution

Base area \times height = volume

$$\text{Base area} = \frac{\text{volume}}{\text{height}}$$

$$= \frac{960\text{ cm}^3}{8\text{ cm}}$$

$$= 120\text{ cm}^2$$

Volume of Cylinders

Example

Find the volume of a cylinder

Volume of a cylinder = base area \times height

$$= \pi r^2 \times h = \pi r^2 h$$

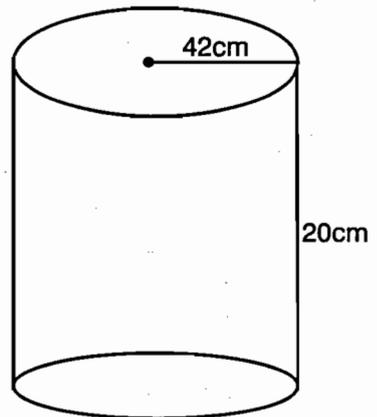
Here $r = 42\text{cm}$ height = 20

\therefore Volume = base area \times height

$$= \pi r^2 \times \text{height}$$

$$= \frac{22}{7} \times 42 \times 42 \times 20 = 132 \times 840$$

$$= \underline{110880\text{cm}^3}$$



Exercise 24

1. A grain store has circular base of radius 2.8m . If it is $4\frac{1}{2}\text{ m}$ high. What is its volume?
2. Find the volume of cylindrical water tank whose base has a diameter of 3.5m and a height of 8m .
(take $\pi = 3.14$)

3. A cylindrical piece of wood has a base radius of 5.6 cm. Find its height if it has a volume of 492.8cm^3 .
4. A wooden lid used to cover a water well is 5cm thick. If its volume is 27730cm^3 , find its base area. (Take $\pi = \frac{22}{7}$)
5. A container with a volume of 224m^3 was filled with water, and then emptied into another container measuring 8m long by 7m wide. What was the depth of the water in the second container?
6. A rectangular water tank has a volume of $72,000,000\text{cm}^3$. What is the height of the tank if it measures 6m long and 4m wide?
($1,000,000\text{cm}^3 = 1\text{m}^3$) (Give your answer in metres)
7. What is the volume of a container which has a capacity of 2.25 litres?
8. Change
 - (a) (i) 800cm^3 into litres (ii) 1640cm^3 into litres
 - (b) (i) 3.4 litres into cm^3 (ii) 1.8 litre into cm^3
9. A cylindrical drum has a diameter of 2.1 m and a height of 9m. What is its volume?
10. A cylindrical oil tank has a diameter 3.5m and a height of 14m. Find its volume (correct to 2 decimal places).
11. A tank contains 2125 litres of water. The water is poured from the tank into a container whose base is the shape of a square of side 250cm.
 - (a) What is the area in cm^2 , of base of the container?
 - (b) How high does the water rise in the container?

Exercise 25

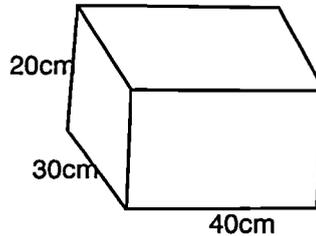
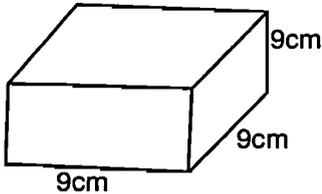
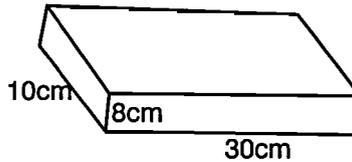
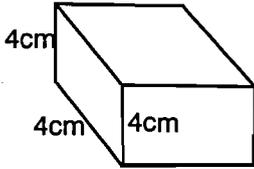
1. (a) 1 litre is equivalent to cm^3
 (b) 1 deciliter is equivalent to cm^3
 (c) 5 litres are equivalent to cm^3
 (d) 8 deciliters are equivalent to cm^3
 (e) 0.9 litres are equivalent to cm^3
 (f) 1.5 deciliters are equivalent to..... cm^3
2. What is the volume of the following in cm^3 ?
 (A) 25.8 litres of oil
 (b) 3.5 litres of milk

- (c) 0.5 dl of lemon juice
 - (d) 650 litres of water
3. Give the number of deciliters equivalent to
- (a) 4500 cm³
 - (b) 150 cm³
 - (c) 98 cm³
 - (d) 5 cm³
 - (e) 45 cm³
 - (f) 225 cm³
4. Find the number of litres equivalent to
- (a) 3075 cm³
 - (b) 1565 cm³
 - (c) 1235 cm³
 - (d) 250 cm³
 - (e) 5 cm³
5. A container measures 150cm by 300cm by 100cm. How many litres of water does it hold when $\frac{3}{4}$ full?
6. A rectangular container with a square base of side 90cm and a height of 60cm is filled with oil. How many litres of oil are there?
7. A container with volume of 10,000 cm³ was filled with milk. The milk was packed in 2dl packets. How many packets were filled with milk?
8. In a school of 800 pupils, each pupil drank 200ml of milk every day.
- (a) How many litres of milk did they drink in one week?
 - (b) How many deciliters of milk did each child drink per week?
9. Okot owns 30 cows. Each cow produces an average of 7.5 litres of milk a day.
- (a) How many litres of milk does Okot get each day?
 - (b) How many litres of milk did the cows produce in the month of August?
10. Badi bought 30 bottles of water. If each bottle contained 750 ml of water, how many litres of water did Badi buy?

2.3 (b) Solving problems involving volumes of cuboid, cubes and cylinders

Exercise 26

1. Find the volume of the cubes and cuboids below:



2. A tin contains 50 litres of honey. If this honey is poured into 300ml containers, how many containers will be filled?
3. A box is packed with 100 containers of fruit juice. If each container has a capacity of 10 dl, find the total capacity in litres.
4. A can of medicine holds 50dl. If these were distributed equally to 100 patients, how many ml of medicine did each patient get?
5. A family used 9.5 litres of paraffin in the month of March.
(a) How many dl did they use per day?
(b) How many ml did they use per day?
6. A container is 6m long, 4.5m wide and 3.5m high. What is its volume?
7. A rectangular water tank measures 2.5m long, 1.5m wide and 0.9m high. What is its volume?
8. The height of a metal box is 24cm and its volume 1728cm^3 . What is its base area?
9. A wooden box has a volume of 3.375cm^3 and a base area of 3.75cm^2 . Find its height.

10. A box measures 50cm by 30cm by 20 cm; how many packets measuring 10cm by 5cm by 4cm can be packed into the box?
11. A box has a volume of 504cm^3 . Its length is 20cm and its width is 14cm. What is its thickness?
12. Copy and complete the table below

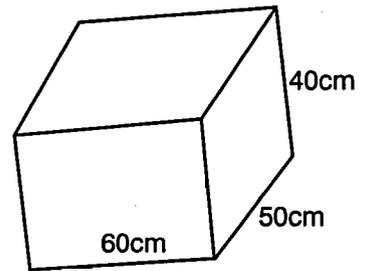
	Base area	Height	Volume
(a)	108cm^2		756cm^3
(b)		10cm	291.5cm^3
(c)	126cm^2		1000cm^3
(d)		3cm	33.75cm^3
(e)	32cm^2		240cm^3

2.3 (d) Solving problems involving units of capacity

Volume

Example

- (i) (a) Find the volume of the container below.
- (b) Find its capacity in litres



Solution

$$\begin{aligned}
 \text{(a) Volume} &= L \times W \times H \\
 &= (60 \times 50 \times 40)\text{cm}^3 \\
 &= \underline{120,000\text{cm}^3}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) } 1000\text{cm}^3 &= 1\text{ litre} \\
 \therefore 120,000\text{cm}^3 &= \frac{120,000}{1000}\text{ litres} \\
 &= \underline{120}\text{ litres}
 \end{aligned}$$

- (ii) A rectangular oil tin has a capacity of 6.4 litres when full. Its base measures 40cm long by 20cm wide. Find its height.

Solution

Capacity of the tin = 6.4 litres

1 litre = 1000 cm³

$$\therefore 6.4 \text{ litres} = (6.4 \times 1000) \text{ cm}^3 = 6400 \text{ cm}^3$$

Volume of the tin = 6400 cm³

Volume = L x W x H

$$\therefore (40 \times 20 \times h) = 6400 \text{ cm}^3$$

$$\therefore h = \frac{6400}{800}$$

8cm

2.4 Weight

Conversion: grams into kg and vice versa

$$1000\text{g} = 1\text{kg}$$

Examples:

- (i) Convert into grams

(a) $\frac{3}{4}$ kg

(b) $1\frac{2}{5}$ kg

Solution

(a) 1 kg = 1000 g

$$\therefore \text{kg} = \left(\frac{3}{4} \times 1000\right)\text{g} = 750\text{g}$$

(b) 1 kg = 1000 g

$$1\frac{2}{5}\text{kg} = \left(\frac{7}{5} \times 1000\right)\text{g} = 1400\text{g}$$

(ii) Convert into kg

(a) 6000g

(b) 350g

Solution

(a) $1000\text{g} = 1\text{kg}$

$$\therefore 6000\text{g} = \left(\frac{6000}{1000}\right)\text{kg} = 6\text{kg}$$

(b) $1000\text{g} = 1\text{kg}$

$$\therefore 350\text{g} = \left(\frac{350}{1000}\right)\text{kg} = 0.35\text{kg}$$

Conversion: kg into tons and vice versa

$$1000\text{kg} = 1\text{ton}$$

Examples

(i) Convert the following into kg

(a) 0.350 ton

(b) $4\frac{1}{2}$ tons

Solution

(a) $1\text{ton} = 1000\text{kg}$

$$\therefore 0.350\text{ton} = (0.350 \times 1000)\text{kg} \\ = 350\text{kg}$$

(b) $1\text{ton} = 1000\text{kg}$

$$\therefore 4\frac{1}{2}\text{tons} = \left(\frac{9}{2} \times 1000\right)\text{kg}$$

$$= 4500\text{kg}$$

(ii) Convert the following into tons

(a) 8400 kg

(b) 6570 kg

Solution

(a) 1000 kg = 1 ton

$$8400 \text{ kg} = \left(\frac{8400}{1000} \right) \text{ tons}$$

$$= 8.4 \text{ tons}$$

(b) 1000kg = 1 ton

$$6570 \text{ kg} = \left(\frac{6570}{1000} \right) \text{ ton}$$

$$= 6.570 \text{ tons}$$

Exercise 28

1. Convert the following into grams:

(a) $1\frac{1}{4}$ kg

(b) $\frac{3}{4}$ kg

(c) 5.6kg

(d) 0.8 kg

(e) 0.00006 tons

(f) 0.3314 tons

2. Convert the following into kg:

(a) 600 g

(b) 2500 g

(c) $1\frac{1}{2}$ g

(d) 0.637 ton

(e) 75 tons

3. Convert the following into tons

(a) 8715 kg

(b) 6,000,000 kg

(c) 750 kg

(d) 2869 kg

4. A tin weighs 29.60 kg when full of water. If it weighs 4.78kg when it is empty, what is the weight of the tin?
5. A book weighs 0.6kg. What is the weight of the book in grams?
6. A tin containing cooking oil weighs 850g. Express this weight in grams.
7. A bag of maize weighs 90kg. Express this weight in tons.
8. The weight of the lorry is $4\frac{1}{5}$ tons. What is this weight in kg?
9. A truck was carrying eighteen bags of maize, each weighing 100kg. Express the weight of the bags in tons.
10. A basket weighs 250g. It was filled with groundnuts using a container of 200g. If the container was emptied 15 times,
 - (a) What was the weight of the groundnuts in kg?
 - (b) What was the total weight of the basket and the groundnuts in kg?

2.3 (c) Operations involving units of capacity

Examples

Find the value of the following:

(a)

litre	dl
8	9
5	6
+ 7	8
22	3

(b)

litres	dl
35	2
-19	9
15	3

(c)

litre	dl
9	7
x 19	
184	3

(d)

	6 litre 9 dl
7) 48 litre 3 dl
	42
	6
	6x10 = 60 dl
	63

6 litre 9 dl

Exercise 29

1. Work out the following

$$\begin{array}{r} \text{(a) litre} \quad \text{dl} \\ 9 \quad 7 \\ 6 \quad 6 \\ + 4 \quad 9 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(b) litre} \quad \text{dl} \\ 8 \quad 7 \\ \times \quad 18 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(c) litre} \quad \text{dl} \\ 18 \quad 1 \\ -10 \quad 8 \\ \hline \end{array}$$

$$\text{(d) } 9 \overline{)5 \text{ litre } 3 \text{ dl}}$$

2. A rectangular water tank with a square base of side 600cm has a height 200cm.
 - (a) What is the volume of the tank in m^3 ?
 - (b) What is the capacity of the tank in litres?
 - (c) If 1856 litres of water was used from the tank, how much water was left?
3. A farmer emptied 20 containers each holding 480 litres of water into a tank.
 - (a) How much water was this in m^3 ?
 - (b) If the tank has a depth of 2.4m, what is the base area of the tank?
4. A family uses 300ml of paraffin per day for lighting. How many litres of paraffin do they use in 30 days?
5. An organization gave 240 litres of orange juice to a school in Maridi. If each child took 2dl of orange juice, how many children drank the juice?
6. Ukanda had a large container full of honey. He emptied the honey into 12 bottles with a capacity of 750ml each. What was the volume of the large container in litres?

Mixed Exercise 27

1. Work out

$$\begin{array}{r}
 \text{(a) litre} \quad \text{dl} \\
 6 \quad 2 \\
 8 \quad 9 \\
 + \underline{5} \quad 7 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{(b) litre} \quad \text{dl} \\
 9 \quad 6 \\
 \times \quad 5 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{(c) litre} \quad \text{dl} \\
 20 \quad 7 \\
 - \underline{9} \quad 9 \\
 \hline
 \end{array}$$

$$\text{(d) } 7 \overline{) 6 \text{ litre } 3 \text{ dl}}$$

2. Copy and complete the table below

cm ³	ml	dl	litre	m ³
9000	9000	90	9	0.009
6000				
	40000			
		5000		
			900	
				8



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