Introduction

A fraction is a number showing part of a whole. A number written as a quotient i.e. as one number divided by another. In the fraction $\frac{7}{9}$, seven is the numerator and nine is the denominator. When both the numerator and denominator are integers, the fraction is known as a simple, common or vulgar fraction.

A fraction whose numerator is less than the denominator is called a proper fraction.
e.g. $\frac{1}{3}, \frac{2}{9}, \frac{5}{8}, \frac{3}{13}$ etc.
A fraction whose numerator is greater than the denominator is called an improper fraction.
e.g. $\frac{7}{2}, \frac{10}{9}, \frac{15}{4}, \frac{8}{3}$ etc.
Fractions which have both whole numbers and fractions are called mixed numbers.
e.g. $3\frac{2}{3}, 7\frac{1}{15}, 1\frac{3}{8}, 12\frac{1}{2}$ etc.

Take note of the following;

→ *We name fractions according to the parts in the whole.*

→ *To change from an improper fraction to a mixed number, divide the numerator by the denominator.*

→ *To change from a mixed numbers to an improper fraction, multiply the denominator by the whole number, add the numerator and write the result over the denominator.*

→ *To find the equivalent fractions, we multiply the denominator and the numerator by the same number.*

Exercise 5:1

1. Write the following in words.

   a) $\frac{1}{2}$ d) $\frac{3}{4}$ g) $\frac{6}{7}$ j) $\frac{6}{11}$

   b) $\frac{1}{4}$ e) $\frac{5}{8}$ h) $\frac{3}{5}$ k) $\frac{7}{8}$

   c) $\frac{1}{8}$ f) $\frac{1}{9}$ i) $\frac{2}{9}$ l) $\frac{3}{2}$

2. Draw and shade the following:

   a) Four fifths   c) Three eighths   e) Three quarters

   b) Ten twelfths   d) Two thirds   f) A half

3. Change the following to mixed numbers.

   a) $\frac{5}{2}$ c) $\frac{13}{4}$ e) $\frac{30}{7}$ g) $\frac{25}{11}$

   b) $\frac{9}{4}$ d) $\frac{15}{8}$ f) $\frac{84}{5}$ h) $\frac{35}{9}$

4. Change the following to improper fractions.

a) $1\frac{1}{2}$

b) $5\frac{1}{4}$

c) $7\frac{1}{8}$

d) $2\frac{3}{4}$

e) $1\frac{5}{8}$

f) $3\frac{1}{9}$

g) $2\frac{6}{7}$

h) $4\frac{3}{5}$

i) $2\frac{2}{9}$

j) $2\frac{6}{11}$

k) $7\frac{7}{8}$

l) $13\frac{7}{11}$

5. Find the next two equivalent fractions to;

a) $\frac{3}{7}$

b) $\frac{7}{8}$

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

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

e) $\frac{3}{8}$

f) $\frac{8}{9}$

g) $\frac{4}{7}$

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

i) $\frac{7}{17}$

j) $\frac{6}{13}$

k) $\frac{7}{23}$

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

Finding the missing numerator or denominator

To find the missing number, we compare numerators or denominators (by dividing) of the given fractions to find the common number to use in multiplication.

Example 1

Find the missing number: $\frac{3}{4} = \frac{\square}{20}$

$20 \div 4 = 5$

$\frac{3 \times 5}{4 \times 5} = \frac{15}{20}$

Therefore, $\frac{3}{4} = \frac{\boxed{15}}{20}$

Example 2

Find the missing number: $\frac{6}{7} = \frac{24}{\square}$

$24 \div 6 = 4$

$\frac{6 \times 4}{7 \times 4} = \frac{24}{28}$

Therefore, $\frac{6}{7} = \frac{24}{\boxed{28}}$

Example 3

How many twelfths are in two thirds?

$\frac{2}{3} = \frac{\square}{12}$

$12 \div 3 = 4$

$\frac{2 \times 4}{3 \times 4} = \frac{8}{12}$

$\frac{2}{3} = \frac{8}{12}$

__8 twelfths__

Example 4

Find the missing number: $\frac{3}{\square} = \frac{21}{35}$

$21 \div 3 = 7$

$\frac{21 \div 7}{35 \div 7} = \frac{3}{5}$

Therefore, $\frac{3}{\boxed{5}} = \frac{21}{35}$

Exercise 5:2

1. Find the missing numbers.

a) $\frac{3}{5} = \frac{9}{\square}$

b) $\frac{2}{7} = \frac{\square}{21}$

c) $\frac{5}{8} = \frac{\square}{24}$

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

e) $\frac{11}{13} = \frac{132}{\square}$

f) $\frac{5}{\square} = \frac{35}{63}$

2. How many sixths are equal to one half?

3. How many eighths are equal to $\frac{3}{4}$?

4. Calculate the number of eighteenths that are equal to $\frac{5}{6}$?

5. How many fifteenths are equal to two thirds?

Comparing fractions with the same denominator

* The sign >,< always points to the smaller number

* We consider the numerators when comparing fractions with the same
   denominators.

Example 1

Compare the following fractions using < or >

$\frac{5}{9}$ —— $\frac{2}{9}$

5 is greater than 2

$\frac{5}{9} > \frac{2}{9}$

Example 2

Compare the following fractions using <, >

$\frac{3}{10}$ —— $\frac{9}{10}$

3 is less than 9

$\frac{3}{10} < \frac{9}{10}$

Exercise 5:3

Use < or > to complete the statements below;

a) $\frac{5}{9}$ —— $\frac{4}{9}$ c) $\frac{8}{15}$ —— $\frac{11}{15}$ e) $\frac{5}{10}$ —— $\frac{3}{10}$ g) $\frac{3}{29}$ —— $\frac{1}{29}$

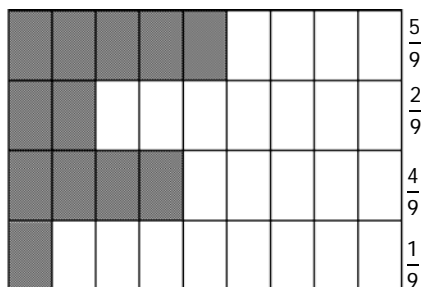b) $\frac{6}{11}$ —— $\frac{9}{11}$ d) $\frac{3}{8}$ —— $\frac{5}{8}$ f) $\frac{17}{20}$ —— $\frac{9}{20}$ h) $\frac{17}{8}$ —— $\frac{13}{8}$

Ordering fractions with the same denominator

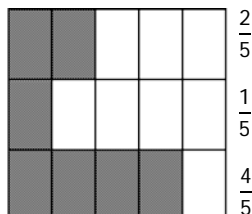*Diagrams used while comparing fractions must be equal.*

Example 1

Arrange $\frac{5}{9}, \frac{2}{9}, \frac{4}{9}$ and $\frac{1}{9}$ starting with the smallest

$\frac{5}{9}$

$\frac{2}{9}$

$\frac{4}{9}$

$\frac{1}{9}$

$\frac{1}{9}, \frac{2}{9}, \frac{4}{9}, \frac{5}{9}$

Example 2

Order $\frac{2}{5}, \frac{1}{5}$ and $\frac{4}{5}$ from biggest

$\frac{2}{5}$

$\frac{1}{5}$

$\frac{4}{5}$

$\frac{4}{5}, \frac{2}{5}, \frac{1}{5}$

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Exercise 5:4

1. Arrange the following fractions from the smallest:

   a) $\frac{1}{7}, \frac{6}{7}, \frac{4}{7}$ and $\frac{5}{7}$

   b) $\frac{6}{9}, \frac{5}{9}, \frac{1}{9}$ and $\frac{7}{9}$

   c) $\frac{11}{13}, \frac{3}{13}$ and $\frac{10}{13}$

   d) $\frac{7}{8}, \frac{6}{8}, \frac{3}{8}$ and $\frac{4}{8}$

2. A pupil scored in $\frac{17}{20}$ Mathematics and $\frac{15}{20}$ in Science. In which subject did the pupil perform the better?

3. Arrange these fractions from the largest:

   a) $\frac{7}{10}, \frac{9}{10}, \frac{3}{10}$ and $\frac{5}{10}$

   b) $\frac{3}{4}, \frac{4}{4}, \frac{1}{4}$ and $\frac{5}{4}$

   c) $\frac{2}{13}, \frac{8}{13}, \frac{7}{13}$ and $\frac{1}{13}$

   d) $\frac{8}{11}, \frac{5}{11}, \frac{9}{11}$ and $\frac{10}{11}$

Addition of fractions of the same denominators

To add fractions of the same denominator, we add only the numerators

Example 1	Example 2	Example 3
Work out: $\frac{1}{8} + \frac{5}{8}$	Simplify: $\frac{1}{15} + \frac{4}{15} + \frac{7}{15}$	Find the sum of $\frac{6}{13}$ and $\frac{7}{13}$
$\frac{1}{8} + \frac{5}{8} = \frac{1+5}{8}$ $= \frac{6}{8}$	$\frac{1}{15} + \frac{4}{15} + \frac{7}{15} = \frac{1+4+7}{15}$ $= \frac{12}{15}$ $= \frac{4}{5}$	$\frac{6}{13} + \frac{7}{13} = \frac{6+7}{13}$ $= \frac{13}{13}$ $= 1$

Exercise 5:5

1. Work out the following:

   a) $\frac{3}{7} + \frac{2}{7}$

   b) $\frac{2}{9} + \frac{4}{9}$

   c) $\frac{13}{17} + \frac{4}{17}$

   d) $\frac{7}{8} + \frac{5}{8} + \frac{6}{8}$

   e) $\frac{8}{11} + \frac{9}{11} + \frac{5}{11}$

   f) $\frac{1}{8} + \frac{3}{8} + \frac{5}{8}$

2. Zakayo ate $\frac{2}{9}$ of a pineapple, Bobi ate $\frac{5}{9}$ of the pineapple. What fraction did both children eat?

3. Henry ate $\frac{3}{7}$ of the fish for lunch and $\frac{1}{7}$ of the same fish for supper. What fraction of the fish did Henry eat altogether?

4. Kasoma read $\frac{3}{10}$ of a book on Monday and $\frac{4}{10}$ of the same book on Tuesday. What fraction of the book did he read altogether?

5. Kulamba walked $\frac{3}{10}$ of his journey and ran $\frac{4}{10}$ of the journey. What fraction of the journey did he cover?

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6. A woman used $\frac{5}{8}$ of the sugar in the morning, $\frac{1}{8}$ in the afternoon and $\frac{1}{8}$ of the same sugar in the evening. What fraction of the sugar did she use?

7. Ogalal sold $\frac{1}{5}$ of his land to Samaidu and $\frac{2}{5}$ of the same land to Ayo. What fraction of the land did he sell altogether?

8. A girl spent $\frac{4}{9}$ of her pocket money on books, $\frac{2}{9}$ on pens and $\frac{1}{9}$ on pencils. What fraction of the pocket money did the girl spend altogether?

9. A boy did $\frac{3}{6}$ of his holiday package in the first week, $\frac{1}{6}$ in the second week and $\frac{1}{6}$ in the third week. What fraction of the holiday package did the boy do in the three weeks?

10. A man spends $\frac{5}{18}$ of his salary on food, $\frac{1}{18}$ on rent, $\frac{6}{18}$ on fees, $\frac{1}{18}$ on medical and $\frac{3}{18}$ on transport. What fraction of the salary does he spend altogether?

11. Find the sum of $\frac{7}{8}, \frac{9}{8}, \frac{5}{8}$ and $\frac{3}{8}$

Comparing fractions with different denominators.

Group activity:
Find the LCM of;
a) 4 and 3   b) 6 and 12   c) 9 and 6   d) 10 and 15

To compare fractions of different denominators, first find the LCD
The LCD is the lowest common denominator.

Example 1	Example 2
Compare the following fractions using < or >	Compare the following fractions using <, >
$\frac{3}{4} \underline{\quad} \frac{2}{3}$	$\frac{5}{12} \underline{\quad} \frac{4}{9}$
$M_4 = \{4, 8, 12, 16, 20 \ldots\}$	$M_{12} = \{12, 24, 36, 48, 60, 72, 84 \ldots\}$
$M_3 = \{3, 6, 9, 12, 15, 18, \ldots\}$	$M_9 = \{9, 18, 27, 36, 45 \ldots]$
LCD = 12	LCD = 36
$\frac{3}{4}$ x 12 $\quad\bigg\vert\quad \frac{2}{3}$ x 12	$\frac{5}{12}$ x 36 $\quad\bigg\vert\quad \frac{4}{9}$ x 36
3 x 3 $\quad\bigg\vert\quad$ 2 x 4	5 x 3 $\quad\bigg\vert\quad$ 4 x 4
9 $\quad\bigg\vert\quad$ 8	15 $\quad\bigg\vert\quad$ 16
So, $\frac{3}{4} > \frac{2}{3}$	So, $\frac{5}{12} < \frac{4}{9}$

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Exercise 5:6

Use <, > or = to complete the statements below;

a) $\frac{1}{2}$ —— $\frac{1}{3}$ c) $\frac{2}{3}$ —— $\frac{3}{5}$ e) $\frac{6}{8}$ —— $\frac{5}{6}$ g) $\frac{5}{18}$ —— $\frac{2}{9}$

b) $\frac{2}{5}$ —— $\frac{1}{2}$ d) $\frac{4}{9}$ —— $\frac{2}{3}$ f) $\frac{7}{10}$ —— $\frac{4}{5}$ h) $\frac{5}{3}$ —— $\frac{3}{2}$

Ordering fractions with different denominators

Group activity

1. Arrange the following in ascending order
    a) 23, 5, 78, 12, 9 and 8   b) 8, 10, 9, 2, 7, and 4   c) 234, 845, 523, 243
2. Write starting with the largest (descending / decreasing order)
    a) 425, 748, 243, 646, 1001   b) 78, 90, 75, 79, 54, 106   c) 723, 894, 342, 564

To order fractions of different denominators, first find the LCD
The LCD is the lowest common denominator.

Example 1

Arrange $\frac{5}{6}, \frac{2}{3}$ and $\frac{3}{4}$ starting with the smallest.

M_6 = {6, 12, 18, 24 …}
M_3 = {3, 6, 9, 12, 15 …}
M_4 = {4, 8, 12 …}
LCD = 12

$\frac{5}{6}$ x 12 | $\frac{2}{3}$ x 12 | $\frac{3}{4}$ x 12
5 x 2 | 2 x 4 | 3 x 3
10 | 8 | 9

8, 9, 10
$\frac{2}{3}, \frac{3}{4}, \frac{5}{6}$

Example 2

Write $\frac{1}{2}, \frac{2}{5}, \frac{5}{6}$ and $\frac{1}{3}$ in descending order.

2	2	5	6	3
3	1	5	3	3
5	1	5	1	1
1	1	1	1	

$LCD = 2 \times 3 \times 5$
$LCD = 30$

$\frac{1}{2}$ x 30 | $\frac{2}{5}$ x 30 | $\frac{5}{6}$ x 30 | $\frac{1}{3}$ x 30
1 x 15 | 2 x 6 | 5 x 5 | 1 x 10
15 | 12 | 25 | 10

25, 15, 12, 10
$\frac{5}{6}, \frac{1}{2}, \frac{2}{5}, \frac{1}{3}$

Exercise 5:7

1. Arrange the following fractions in ascending order (from the smallest to the largest)

a) $\frac{1}{2}, \frac{2}{3}, \frac{5}{6}$ c) $\frac{2}{3}, \frac{4}{9}, \frac{5}{6}$ e) $\frac{3}{8}, \frac{1}{5}, \frac{3}{10}$ g) $\frac{2}{3}, \frac{3}{5}, \frac{5}{6}, \frac{3}{10}$

b) $\frac{3}{4}, \frac{2}{3}, \frac{5}{12}$ d) $\frac{3}{5}, \frac{1}{3}, \frac{4}{5}$ f) $\frac{6}{7}, \frac{1}{4}, \frac{3}{14}$ h) $\frac{3}{4}, \frac{3}{8}, \frac{5}{6}, \frac{2}{3}$

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2. Arrange the following fractions in descending order.

a) $\frac{5}{7}, \frac{1}{2}, \frac{9}{14}$

b) $\frac{8}{9}, \frac{2}{3}, \frac{1}{2}$

c) $\frac{4}{5}, \frac{3}{8}, \frac{7}{20}$

d) $\frac{2}{5}, \frac{1}{3}, \frac{3}{10}$

e) $\frac{7}{9}, \frac{11}{18}, \frac{5}{6}$

f) $\frac{7}{12}, \frac{3}{4}, \frac{13}{18}$

g) $\frac{4}{5}, \frac{1}{6}, \frac{4}{15}, \frac{7}{10}$

h) $\frac{3}{4}, \frac{5}{24}, \frac{7}{18}, \frac{9}{16}$

3. Circle the fraction which is greater in the pairs below:

a) $\frac{10}{12}, \frac{11}{15}$

b) $\frac{7}{8}, \frac{9}{10}$

c) $\frac{3}{4}, \frac{2}{3}$

d) $\frac{1}{2}, \frac{3}{5}$

4. Business partners Lucy, Kamua and Nduta shared their profit as follows: Lucy got $\frac{1}{4}$, Kamau got $\frac{1}{3}$ and Nduta got $\frac{5}{12}$. Who received the greatest share?

5. Mr. Ssemwogere wrote the following in his will.

The eldest son to receive $\frac{3}{10}$ of his estate. The youngest son to receive $\frac{1}{4}$ of his estate. The daughter to receive $\frac{2}{5}$ of his estate. Who was to receive the smallest share?

6. A pupil scored $\frac{14}{15}$ and $\frac{18}{20}$ in the first term and second term science test respectively. In which test did the pupil perform better?

7. Kagulu covered $\frac{5}{7}$ km on Monday and $\frac{3}{5}$ km on Tuesday. On which day did he cover the longer distance?

Addition of fractions with different denominators

First find the LCD, then multiply each of the given fractions by the LCD

Example 1	Example 2
Simplify: $\frac{1}{2} + \frac{1}{3}$	Work out: : $\frac{1}{18} + \frac{4}{9} + \frac{1}{6}$

Example 1

Simplify: $\frac{1}{2} + \frac{1}{3}$

$M_2 = \{2, 4, \mathbf{6}, 8, 10 \ldots\}$

$M_3 = \{3, \mathbf{6}, 9 \ldots\}$

LCD is 6

$\frac{1}{2} + \frac{1}{3} = \dfrac{(\frac{1}{2} \times 6) + (\frac{1}{3} \times 6)}{6}$

$= \dfrac{3 + 2}{6}$

$= \dfrac{5}{6}$

Example 2

Work out: : $\frac{1}{18} + \frac{4}{9} + \frac{1}{6}$

$M_{18} = \{\mathbf{18}, 36, 54 \ldots\}$

$M_9 = \{9, \mathbf{18}, 27 \ldots\}$

$M_6 = \{6, 12, \mathbf{18} \ldots\}$

LCD is 18

$\frac{1}{18} + \frac{4}{9} + \frac{1}{6}$

$\dfrac{(\frac{1}{18} \times 18) + (\frac{4}{9} \times 18) + (\frac{1}{6} \times 18)}{18}$

$\dfrac{1 + 8 + 3}{18}$

$\frac{12}{18}$ or $\frac{2}{3}$

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Exercise 5:8

Work out the following

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

b) $\frac{1}{5} + \frac{1}{10}$

c) $\frac{1}{2} + \frac{1}{5}$

d) $\frac{1}{2} + \frac{2}{3}$

e) $\frac{2}{3} + \frac{3}{4}$

f) $\frac{3}{5} + \frac{1}{6}$

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

h) $\frac{1}{4} + \frac{3}{8} + \frac{1}{6}$

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

Solving word problems involving addition of fractions

Example 1

Muto gave out $\frac{1}{2}$ of his mangoes to his friends and $\frac{1}{4}$ of the same mangoes to his sister. What is the fraction of mangoes did he give out altogether?

2	2	4
2	1	2
	1	1

$LCD = 2 \times 2$

$LCD = 4$

$\frac{1}{2} + \frac{1}{4}$

$\frac{2+1}{4}$

$\frac{3}{4}$

Example 2

A man spends $\frac{1}{3}$ of his salary on food, $\frac{1}{9}$ on clothing, $\frac{1}{6}$ on medical and $\frac{1}{18}$ on house rent. What fraction of his salary does he spend altogether?

2	3	9	6	18
3	3	9	3	9
3	1	3	1	3
	1	1	1	1

$LCD = 2 \times 2 \times 3$

$LCD = 18$

$\frac{1}{3} + \frac{1}{9} + \frac{1}{6} + \frac{1}{18}$

$\frac{6+2+3+1}{18}$

$\frac{12}{18}$ or $\frac{2}{3}$

Example 3

Two taps A and B are connected to a water tank. In one minute, tap A fills $\frac{1}{8}$ of the tank and tap B fills $\frac{1}{6}$ of the same tank. If both taps are opened at the same time, what fraction do both taps fill in one minute?

2	6	8
2	3	4
2	3	2
3	3	1
	1	1

$LCD = 2 \times 2 \times 2 \times 3$

$LCD = 24$

$\frac{1}{8} + \frac{1}{6}$

$\frac{3+4}{24}$

$\frac{7}{24}$

Example 4

Find the sum of $\frac{3}{4}$ and $\frac{2}{3}$

2	4	3
2	2	3
3	1	3
	1	1

$LCD = 2 \times 2 \times 3$

$LCD = 12$

$\frac{3}{4} + \frac{2}{3}$

$\frac{9+8}{12}$

$\frac{17}{12}$

$1\frac{1}{2}$

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Exercise 5:8

1. A trader sold $\frac{1}{3}$ of the bag of rice on Monday, $\frac{1}{2}$ of the same bag of rice on Tuesday. Find the total fraction she sold in the two days.

2. Find the sum of $\frac{1}{3}$ and $\frac{3}{4}$

3 A farmer dug $\frac{1}{3}$ of his garden in the morning and $\frac{1}{4}$ in the evening. What fraction of the land was dug altogether?.

4. A girl ate $\frac{1}{2}$ of her cake on the first day and $\frac{1}{3}$ of the same cake on the second day. What fraction of the cake did the girl eat in the two days?

5. Samson read $\frac{2}{3}$ of the novel in February and $\frac{1}{4}$ in March. What fraction of the novel did he read?

6. The farmer used $\frac{1}{3}$ of his land for growing crops and $\frac{2}{5}$ of the same land for rearing animals. What fraction of the land was used altogether?

7. In a village, $\frac{1}{6}$ of the population are men and $\frac{1}{2}$ are women. Find the total fraction for adults.

8. Flavia spends $\frac{1}{8}$ of his salary on rent, $\frac{1}{6}$ on food and $\frac{1}{4}$ on transport. What fraction of the salary does Flavia spend altogether?

9. In a school, $\frac{1}{3}$ of the pupils are Catholics, $\frac{1}{4}$ are Muslims and $\frac{1}{6}$ are Anglicans. Find their total fraction.

10. A third of the books in the school library are science books, $\frac{1}{4}$ are mathematics books and $\frac{1}{6}$ are English books. Find their total fraction.

11. Two taps F and K are connected to a water tank. In one hour, tap F fills $\frac{1}{6}$ of the tank and tap K fills $\frac{1}{4}$ of the same tank. If both taps are opened at the same time, what fraction do both taps fill in one hour?

12. Kulima digs a plot of land in 9 days. Munafu digs the same plot of land in 12 days. If they work together at the same rate, what fraction will they dig in one day?

13. Three taps A, B and C are connected to a water tank. Given that A fills the tank in 12 hours, B in 6 hours and C in 9 hours.
All taps are opened at the same time, what fraction will they fill in one hour?

14. Amoti can sweep the classroom in 4 minutes, Kerekere can sweep the same classroom in 6 minutes while Mariachi can sweep it in 8 minutes. If all the boys work together at the same rate, what fraction will they sweep in one minute?

15. Which fraction is $\frac{1}{4}$ more than $\frac{2}{5}$?

16. Find the sum of $\frac{7}{9}$ and $\frac{5}{12}$

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Addition of mixed numbers

* First convert the mixed numbers into improper fractions.
* Find the Lowest Common Denominator (LCD)
* Multiply each of the given fractions by the LCD.

Example 1

Work out: $2\frac{1}{3} + 4\frac{1}{2}$

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

$\frac{(3\times2) + 1}{3} + \frac{(2\times4) + 1}{2}$

$\frac{7}{3} + \frac{9}{2}$

$\frac{14 + 27}{6}$

$\frac{41}{6}$

$6\frac{5}{6}$

2	2	3
3	1	3
	1	1

$LCD = 2 \times 3$
$LCD = 6$

Example 2

Simplify: $6\frac{2}{3} + 4\frac{3}{4}$

$6\frac{2}{3} + 4\frac{3}{4}$

$\frac{(3\times6) + 2}{3} + \frac{(4\times4) + 3}{4}$

$\frac{20}{3} + \frac{19}{4}$

$\frac{80 + 57}{12}$

$\frac{137}{12}$

$11\frac{5}{12}$

2	3	4
2	3	2
3	3	1
	1	1

$LCD = 2 \times 2 \times 3$
$LCD = 12$

Exercise 5:9

Work out the following

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

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

c) $2\frac{1}{6} + 4\frac{1}{3}$

d) $1\frac{1}{3} + 1\frac{1}{2}$

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

f) $7\frac{1}{3} + 1\frac{1}{2}$

g) $2\frac{1}{5} + 1\frac{1}{2}$

h) $4\frac{1}{8} + 2\frac{1}{2}$

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

j) $5 + 1\frac{1}{2} + 2\frac{1}{6}$

k) $3\frac{11}{12} + 1\frac{3}{4} + 2\frac{1}{3}$

l) $3\frac{1}{8} + 2\frac{4}{5}$

Word problems involving addition of mixed fractions

Example

Mpaata ate $4\frac{1}{3}$ oranges and Nabirye ate $2\frac{1}{4}$ oranges. Work out the total number of oranges they ate.

$4\frac{1}{3} + 2\frac{1}{4} = \frac{(3\times4) + 1}{3} + \frac{(4\times2) + 1}{4}$

$= \frac{13}{3} + \frac{9}{4}$

$= \frac{52 + 27}{12}$

$= \frac{79}{12}$

$= 6\frac{7}{12}$ oranges

2	3	4
2	3	2
3	3	1
	1	1

$LCD = 2 \times 2 \times 3$
$LCD = 12$

By Sseggayi Benjamin Kasuka

Exercise 5:10

1. Mukisa spent $1\frac{1}{2}$ hours revising English and $2\frac{1}{3}$ hours revising Mathematics. Find the total time he spent while revising.

2. Candidates spent $2\frac{1}{2}$ hours answering a mathematics test and $2\frac{1}{4}$ hours answering a science test. Find the total time spent.

3. Find the sum of $4\frac{1}{3}$ and $1\frac{1}{4}$

4. Increase $2\frac{3}{4}$ by $1\frac{1}{3}$

5. Lutabi ate $4\frac{1}{2}$ mangoes. Mawanda ate $2\frac{1}{5}$ mangoes. Work out the total number of mangoes the two boys ate.

6. A tailor bought $4\frac{1}{3}$ metres of a cloth and more $2\frac{1}{4}$ metres. Find the length of the cloth the tailor bought altogether.

7. My father bought $3\frac{3}{4}$ dozens of books for my sister and $1\frac{1}{6}$ dozens for my brother. How many dozens of books did my father buy altogether?

8. Two boxes weigh $1\frac{1}{2}$kg and $2\frac{1}{3}$kg respectively. Find their total weight.

9. UNRA constructed a road to the length of $4\frac{1}{3}$km last year, the length of the road has been increased by $3\frac{4}{4}$ kilometres. Find in kilometres, the current length of the road.

10. Add $3\frac{4}{5}$ to $2\frac{1}{4}$

Subtraction of fractions of the same denominators

Example 1

Work out: $1 - \frac{2}{9}$

$1 - \frac{2}{9}$

$\frac{9}{9} - \frac{2}{9}$

$\frac{9 - 2}{9}$

$\frac{7}{9}$

Example 2

Take away $\frac{8}{13}$ from $\frac{12}{13}$

$\frac{12}{13} - \frac{8}{13}$

$\frac{12 - 8}{13}$

$\frac{4}{13}$

Exercise 5:11

Work out the following:

a) $\frac{3}{5} - \frac{1}{5}$

b) $1 - \frac{8}{15}$

c) $\frac{17}{19} - \frac{8}{19} - \frac{3}{19}$

d) $1 - \frac{3}{13} - \frac{8}{13}$

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

f) $7 - \frac{12}{13} - \frac{8}{13}$

By Sseggayi Benjamin Kasuka

Subtracting fractions of different denominators

First find the Lowest Common Denominator then multiply each of the given fractions by the LCD

Example 1

Work out: $\frac{5}{6} - \frac{1}{4}$

$\frac{5}{6} - \frac{1}{4}$

$\frac{10 - 3}{12}$ LCD = 12

$\frac{7}{12}$

Example 2

Simplify: $2\frac{1}{2} - 1\frac{1}{4}$

$2\frac{1}{2} - 1\frac{1}{4}$

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

$\frac{5}{2} - \frac{5}{4}$

$\frac{10 - 5}{4}$ LCD = 4

$\frac{5}{4}$

$1\frac{1}{4}$

Exercise 5:12

Work out the following:

a) $\frac{3}{7} - \frac{1}{4}$

b) $\frac{9}{10} - \frac{2}{5}$

c) $\frac{4}{5} - \frac{1}{10}$

d) $\frac{4}{9} - \frac{1}{3}$

e) $\frac{5}{6} - \frac{3}{4}$

f) $1\frac{1}{6} - \frac{1}{4}$

g) $\frac{3}{4} - \frac{2}{3}$

h) $2\frac{1}{3} - 1\frac{3}{4}$

i) $2\frac{3}{4} - 1\frac{1}{3}$

j) $2\frac{1}{5} - 1\frac{1}{4}$

k) $2\frac{1}{2} - 1\frac{1}{6}$

l) $3\frac{1}{6} - 1\frac{1}{4} - \frac{1}{9}$

Word problems involving subtraction of fractions

Example 1

A boy had $\frac{5}{6}$ of a cake, he ate $\frac{1}{2}$.
What fraction of the cake remained?

$\frac{5}{6} - \frac{1}{2}$

$\frac{5 - 3}{6}$ LCD = 6

$\frac{2}{6}$ or $\frac{1}{3}$

Example 2

Mondry had $3\frac{1}{2}$ jack fruits, he gave out $2\frac{1}{4}$ jack fruits. How many jack fruits remained?

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

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

$\frac{7}{2} - \frac{9}{4}$

$\frac{14 - 9}{4}$ LCD = 4

$\frac{5}{4}$

$1\frac{1}{4}$ jack fruits

By Sseggayi Benjamin Kasuka

Exercise 5:13

1. A tank was $\frac{1}{3}$ full of water on Monday. We used $\frac{1}{4}$ on Tuesday. What fraction was left?

2. Subtract $\frac{1}{2}$ from $\frac{2}{3}$

3. A jerry can was $\frac{7}{10}$ full of oil, Kayiwa poured $\frac{1}{5}$. What fraction of oil remained in the jerry can?

4. Namata had $\frac{3}{4}$ litres of milk. She gave out $\frac{1}{2}$ litres. How much milk did she remain with?

5. A man received $\frac{2}{3}$ of his salary. He spent $\frac{1}{9}$. What fraction of the salary remained?

6. A water tank was $\frac{1}{3}$ full of water, when it rained, the tank became $\frac{1}{2}$ full. By what fraction did the amount of water in the tank increase?

7. Two taps X and Y are connected to a water tank. X takes 4 hours to fill the tank while Y takes 6 hours to empty the tank. Find the fraction of water in the tank in one hour.

8. Lule had $3\frac{1}{2}$ litres of water. He gave out $2\frac{1}{4}$ litres. How many litres of water remained?

9. What must be added to $4\frac{1}{2}$ to become $5\frac{1}{3}$?

10. Musoke had $2\frac{3}{4}$ cakes and ate $1\frac{1}{2}$ cakes. How many cakes remained?

11. At a school, pupils use $4\frac{1}{2}$ bags of beans while workers use $2\frac{1}{3}$. How many more bags of beans do pupils use?

12. Suzan studies for $5\frac{1}{2}$ hours daily. She devotes $2\frac{2}{3}$ hours of her study time for mathematics and science. How much time does she devote for other subjects?

Problems involving addition and subtraction of fractions

Example 1

Work out: $\frac{1}{2} + \frac{1}{3} - \frac{1}{4}$

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

$\frac{6 + 4 - 3}{12}$ *LCD = 12*

$\frac{10 - 3}{12}$

$\frac{7}{12}$

Example 2

Simplify: $\frac{7}{12} - \frac{1}{4} + \frac{1}{5}$

$\frac{7}{12} - \frac{1}{4} + \frac{1}{5}$

$\frac{7}{12} + \frac{1}{5} - \frac{1}{4}$

$\frac{35 + 12 - 15}{60}$ *LCD = 60*

$\frac{47 - 15}{60}$

$\frac{32}{60}$ or $\frac{8}{15}$

Example 3

Work out: $3\frac{7}{10} - \frac{7}{15} + 1\frac{5}{6}$

Approach a

$\frac{37}{10} - \frac{7}{15} + \frac{11}{6}$

$\frac{37}{10} + \frac{11}{6} - \frac{7}{15}$

$\frac{111 + 55 - 14}{30}$

$\frac{166 - 14}{30}$

$\frac{152}{30}$ or $5\frac{1}{15}$

Approach b

$3\frac{7}{10} - \frac{7}{15} + 1\frac{5}{6}$

$3\frac{7}{10} + 1\frac{5}{6} - \frac{7}{15}$

$3 + 1 + \frac{7}{10} + \frac{5}{6} - \frac{7}{15}$

$4 + \frac{21 + 25 - 14}{30}$ *LCD = 60*

$4 + \frac{46 - 14}{30}$

$4 + \frac{32}{30}$

$4 + \frac{16}{15} = 4 + 1\frac{1}{15} = 5\frac{1}{15}$

By Sseggayi Benjamin Kasuka

Exercise 5:14

1. Work out:

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

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

e) $\frac{7}{12} - \frac{1}{4} + \frac{1}{5}$

g) $2\frac{1}{3} + 1\frac{1}{4} - 1\frac{2}{5}$

b) $\frac{3}{5} + \frac{1}{10} - \frac{1}{5}$

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

f) $\frac{5}{12} - \frac{1}{2} + \frac{1}{4}$

h) $5\frac{1}{3} + 2\frac{1}{4} - 3\frac{1}{2}$

2. Subtract $2\frac{2}{3}$ from the sum of $1\frac{1}{4}$ and $3\frac{1}{6}$

3. Decrease the sum of $2\frac{1}{3}$ and $1\frac{1}{4}$ by $3\frac{1}{2}$

4. Simplify:

a) $2\frac{1}{2} + 2\frac{1}{4} - 1\frac{1}{8}$

c) $1\frac{1}{6} - 1\frac{1}{4} + 1\frac{2}{5}$

e) $1\frac{1}{4} - \frac{1}{3} - 1\frac{1}{2}$

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

d) $\frac{5}{6} - 1\frac{1}{2} + 2\frac{2}{3}$

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

Finding the remaining fraction of the whole

Example 1

A tank was full of water, $\frac{3}{7}$ of the water was used. What fraction of water remained?

$$\frac{7}{7} - \frac{3}{7} = \frac{7-3}{7}$$
$$= \frac{4}{7}$$

Example 2

In a class, $\frac{4}{9}$ of the pupils are above 12 years. Find the fraction of pupils who are not above 12 years.

$$\frac{9}{9} - \frac{4}{9} = \frac{9-4}{9}$$
$$= \frac{5}{9}$$

Example 3

Umon spent $\frac{1}{3}$ of his salary on rent, $\frac{1}{4}$ on food and saved the rest.

a) Find the total fraction spent on rent and food.

$$\frac{1}{3} + \frac{1}{4} = \frac{4+3}{12}$$
$$= \frac{7}{12}$$

b) What fraction of the salary does he save?

$$\frac{12}{12} - \frac{7}{12} = \frac{12-7}{12}$$
$$= \frac{5}{12}$$

Example 4

Amon did $\frac{3}{8}$ of his holiday package in the first week, $\frac{1}{3}$ in the second week and dodged the remaining work. What fraction of the holiday package did he dodge?

1st week + 2nd week

$$\frac{3}{8} + \frac{1}{3} = \frac{9+8}{24} = \frac{17}{24}$$

Dodged

$$\frac{24}{24} - \frac{17}{24} = \frac{24-17}{24} = \frac{7}{24}$$

Example 5

My mother gave $\frac{1}{3}$ of the jack fruit to Mary, $\frac{1}{6}$ to Akram, $\frac{5}{24}$ to Bonny, $\frac{1}{4}$ of the same jack fruit to Bashir and the rest to Sylvia. What fraction of the jack fruit did Sylvia get?

Mary + Akram + Bonny + Bashir	Fraction for Sylvia's share
$\frac{1}{3} + \frac{1}{6} + \frac{5}{24} + \frac{1}{4}$	$\frac{24}{24} - \frac{23}{24} = \frac{24 - 23}{24}$
$\frac{8 + 4 + 5 + 6}{24}$	$= \frac{1}{24}$
$\frac{23}{24}$	

Exercise 5:15

1. Work out: $1 - \frac{7}{15}$

2. The fraction of boys in a class is $\frac{1}{6}$. Find the fraction of girls.

3. The probability that Mark will pass the test is $\frac{5}{7}$. What is the probability that Mark will fail the test?

4. The probability that a car picked at random from the park is made in Japan is $\frac{4}{9}$. Find the probability that a car picked at random from the park is not made in Japan.

5. A woman spends $\frac{1}{3}$ of her salary on treatment, $\frac{1}{6}$ on transport and saves the rest.
   (a) Find the total fraction spent on treatment and transport.
   (b) What fraction is saved?

6. A quarter of the pupils in the school are Catholics, $\frac{1}{6}$ are Muslims and the rest are Anglicans.
   (a) Find the total fraction for Catholics and Muslims.
   (b) Find the fraction for Anglicans.

7. Given that $\frac{1}{12}$ of the population was vaccinated in February, $\frac{1}{4}$ in March, $\frac{1}{3}$ in April and the rest after May. Find the fraction of the population which was vaccinated;
   a) before May.   b) after May

8. Amos, Bernice and Hallan shared some money. Amos got $\frac{2}{9}$ of it, Hallan got $\frac{1}{4}$ and the rest of the money was given to Bernice. Find the fraction for Bernice's share.

9. Deo's car broke when he had covered $\frac{3}{8}$ of his journey. What fraction of the journey was left?

10. A water tank was full of water. Three quarters of the water was used in the morning, $\frac{1}{5}$ was used in the afternoon. Find the fraction of water that remained in the tank.

11. A pen was full of ink. Jonnie used $\frac{1}{3}$ of the ink to write homework and $\frac{2}{5}$ to write classwork. What is the fraction of ink that remained in the pen?

12. A tank was $\frac{1}{3}$ full of water. When it rained, the fraction of water in the tank increased by $\frac{1}{4}$. What fraction of the tank was left empty?

13. Schools shared textbooks as follows; Meeru P/S got $\frac{1}{18}$ of the books, Kiti P/S got $\frac{1}{6}$. Nsuwa P/S got $\frac{1}{3}$. Eyalama P/S got $\frac{1}{9}$ and the rest of the books were given to Nyetu P/S. Express as a fraction, the number of books Nyetu P/S got.

14. Tap R fills the tank in 6 hours and tap P fills the same tank in 10 hours. Both taps were opened at the same time, find fraction left to fill the tank after one hour.

15. The sum of the values in the table below is the same vertically, horizontally and diagonally. Find the missing values.

——	——	$\frac{3}{8}$
——	$\frac{1}{3}$	$\frac{5}{12}$
——	——	$\frac{5}{24}$

MULTIPLICATION OF FRACTIONS
Multiplying a whole number by a fraction

Let us consider $6 \times \frac{1}{2}$

Approach 1

$6 \times \frac{1}{2} = \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2}$

$= \frac{1 + 1 + 1 + 1 + 1 + 1}{2}$

$= \frac{6}{2}$

$= 3$

Approach 2

$6 \times \frac{1}{2} = \frac{6}{1} \times \frac{1}{2}$

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

$= 3$

Approach 3

$\frac{Product\ of\ the\ numerators}{Product\ of\ the\ denominators}$

$6 \times \frac{1}{2} = \frac{6}{1} \times \frac{1}{2}$

$= \frac{6 \times 1}{1 \times 2}$

$= \frac{6}{2}$

$= 3$

To multiply a fraction by a whole number, we simply multiply the numerator by the whole number and then simplify the resulting fraction if necessary.

Exercise 5:16

1. Work out the following:

(a) $16 \times \frac{3}{4}$ (c) $12 \times \frac{3}{11}$ (e) $6 \times \frac{1}{3}$

(b) $10 \times \frac{3}{5}$ (d) $7 \times \frac{3}{4}$ (f) $24 \times \frac{2}{9}$

2. Kule buys $\frac{1}{2}$ litres of milk every day. How much milk does he buy a week?

3. Musitafah uses $\frac{3}{4}$ kg of sugar every week. Find in kilograms the amount of sugar Musitafah uses in 12 weeks?

4. A tap is connected to a water tank. It draws $\frac{3}{4}$ litres of water per minute. Find in litres the amount of water the tap draws in 12 minutes.

5. Musomi reads $\frac{1}{3}$ of a page in a minute. How many pages will he read in 15 minutes?

6. A class uses $\frac{3}{4}$ of a box of chalk a day. A box contains 100 pieces of chalk.
   a) How many boxes of chalk will the same class use in 20 days?
   b) How many pieces of chalk will be used by the end of the 20 days?

7. Mpafu answers $\frac{5}{6}$ questions in a minute. How many questions will he answer in 24 minutes?

8. Mguu walked $\frac{2}{3}$ kilometres in an hour. How far will he go in 9 hours?

9. Mukyusa collects $\frac{4}{5}$ trays of eggs every day. He sells the eggs to traders at sh. 350 an egg.
   a) How many trays of eggs will he have in 10 days?
   b) Given that a tray holds 30 eggs, how much money will he earn in the 10 days?

10. The cost of a kilogram of meat in Bukomansimbi town is sh. 12,000. Luberenga buys $\frac{3}{4}$ kg of meat every day.
   a) Find in kilograms, the mass of meat he buys in 8 weeks.
   b) How much money does he spend on meat in the 8 weeks?

10. Two taps F and E were connected to a water tank which contained 412 litres of water. Tap F pours water into the tank at a rate of $\frac{4}{5}$ litres per minute and tap E draws water from the tank at a rate of $\frac{8}{9}$ litres per minute. The two taps were left open for $1\frac{1}{2}$ hours.
   a) Find in litres, the amount of water in the tank after that period.
   b) If the remaining water in the tank was sold using 20 litre jerry cans at sh. 300 each, how much money was collected altogether?

This is very important

*When working with fractions, the word "of" means **multiplication**.*

Example 1

What is $\frac{1}{3}$ of 27 cows?

$\frac{1}{3}$ of 27 cows

$\frac{1}{3}$ x 27 cows

9 cows

Example 2

In a class of 120 pupils, $\frac{3}{4}$ of them are girls. Find the number of girls in the class

$\frac{3}{4}$ of 120

$\frac{3}{4}$ x 120

3x30

90 girls

Exercise 5:17

1. What is $\frac{2}{9}$ of 81 goats?

2. A man's salary is sh 600,000. He spends $\frac{2}{3}$ of it. How much money does he spend?

3. A man had 100 cows, he gave away $\frac{2}{5}$ of them to his wife. How many cows did he give to his wife?

4. A tank contained 4800 litres of water. $\frac{3}{4}$ of that water was sold.
   a) How much water was sold?
   b) Find in litres, the amount of water that remained in the tank.

5. Three quarters of Frank's salary is equal to Hamidu's salary. Hamidu's salary is sh. 420,000. Find Frank's salary.

6. Ssuuna Ben wanted to travel from Masaka to Kampala which is 120 kilometres away. His vehicle broke when he had covered just $\frac{1}{3}$ of his journey. What distance had he covered?

7. A tap fills an empty 600 litre tank in 5 hours. If the tap is opened, How much water will be in the tank
   a) after one hour?
   b) after four hours?

8. In a school of 720 pupils, $\frac{3}{8}$ of them are boys and the rest are girls.
   a) Find the number of boys
   b) How many more girls than boys are in the school?

9. In the car park, there are 216 cars. The probability of picking at random a car made in Japan is $\frac{2}{3}$. Find the number of cars made in Japan in the car park.
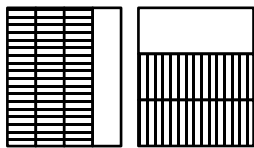
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Multiplying a fraction by a fraction

To multiply fractions, multiply the numerators to get the numerator of the answer and multiply the denominators to get the denominator of the answer.
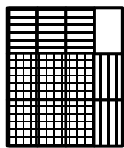

Example 1

Work out: $\frac{3}{4} \times \frac{2}{3}$

Using diagrams

$\frac{3}{4}$ $\frac{2}{3}$ $\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$ or $\frac{1}{2}$

double shaded parts

total parts

Approach 1

$\frac{3}{4} \times \frac{2}{3}$

$\frac{\overset{1}{3}}{\underset{2}{4}} \times \frac{\overset{1}{2}}{\underset{1}{3}}$

$\frac{1}{2}$

Approach 2

product of the numerators
product of the denominators

$\frac{3}{4} \times \frac{2}{3}$

$\frac{3 \times 2}{4 \times 3}$

$\frac{6}{12}$ or $\frac{1}{2}$

Example 2

Simplify: $2\frac{1}{4} \times 1\frac{1}{5}$

To improper fractions

$\frac{9}{4} \times \frac{6}{5}$

Reduce diagonally

$\frac{9}{\underset{2}{4}} \times \frac{\overset{3}{6}}{5}$

Product of the numerators
Product of the denominators

$\frac{9 \times 3}{2 \times 5}$

$\frac{27}{10}$

To a mixed number

$2\frac{7}{10}$

Exercise 5:18

1. Work out:

a) $\frac{4}{5} \times \frac{1}{3}$ c) $\frac{1}{4} \times \frac{1}{3}$ e) $\frac{1}{2} \times \frac{2}{5} \times \frac{3}{4}$

b) $\frac{1}{3} \times \frac{3}{8}$ d) $\frac{7}{8} \times \frac{1}{14}$ f) $\frac{3}{4} \times \frac{2}{3} \times \frac{3}{8}$

2. Simplify:

a) $1\frac{2}{3} \times 5\frac{1}{4}$ c) $3\frac{4}{7} \times 4\frac{2}{3}$ e) $3\frac{3}{4} \times 1\frac{1}{9}$ g) $1\frac{1}{3}$ of $5\frac{1}{4}$

b) $2\frac{3}{5} \times 1\frac{1}{4}$ d) $12\frac{2}{3} \times 1\frac{2}{19}$ f) $2\frac{1}{2} \times \frac{4}{15}$ h) $6\frac{3}{4}$ of $4\frac{1}{9}$

3. Work out:

a) $\frac{2}{7} \times 1\frac{2}{5} \times 1\frac{1}{4}$ b) $\frac{3}{4} \times 4\frac{2}{3} \times \frac{4}{7}$ c) $2\frac{2}{5} \times 1\frac{1}{6} \times 2\frac{2}{7}$ d) $1\frac{1}{3} \times 1\frac{2}{7} \times 1\frac{1}{4}$

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Squares of fractions

Example 1

Find the square of $\frac{4}{5}$

$$\left(\frac{4}{5}\right)^2 = \frac{4}{5} \times \frac{4}{5}$$

$$= \frac{4 \times 4}{5 \times 5}$$

$$= \frac{16}{25}$$

Example 2

Work out: $(2\frac{4}{7})^2$

$$(2\frac{4}{7})^2 = 2\frac{4}{7} \times 2\frac{4}{7}$$

$$= \frac{18}{7} \times \frac{18}{7}$$

$$= \frac{18 \times 18}{7 \times 7}$$

$$= \frac{324}{49} \text{ or } 6\frac{30}{49}$$

Example 3

Find $\frac{3}{4}$ of $(1\frac{7}{9})^2$

$$\frac{3}{4} \text{ of } (1\frac{7}{9})^2$$

$$\frac{3}{4} \times 1\frac{7}{9} \times 1\frac{7}{9}$$

$$\frac{3}{4} \times \frac{16}{9} \times \frac{16}{9}$$

$$\frac{1 \times 4 \times 16}{1 \times 3 \times 9}$$

$$\frac{64}{27} = 2\frac{10}{27}$$

Exercise 5:19

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

a) $\frac{2}{3}$ c) $\frac{3}{4}$ e) $\frac{4}{13}$ g) $1\frac{2}{5}$ i) $1\frac{1}{6}$
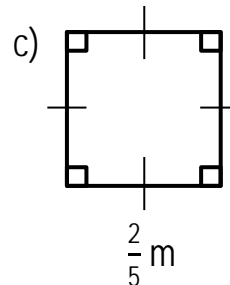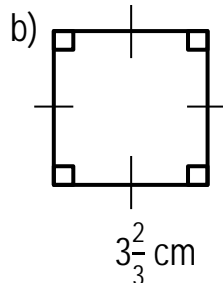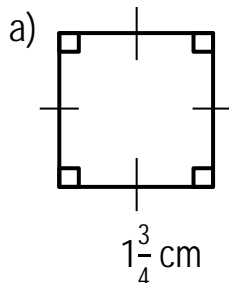
b) $\frac{1}{9}$ d) $\frac{2}{7}$ f) $\frac{11}{15}$ h) $2\frac{1}{4}$ j) $4\frac{1}{3}$

2. Find the area of each of the following;

a)

b)

c)

$1\frac{3}{4}$ cm $3\frac{2}{3}$ cm $\frac{2}{5}$ m

3. Work out:

a) $(\frac{4}{7})^2$ c) $(\frac{1}{3})^2$ e) $(1\frac{3}{5})^2$ g) $\frac{9}{32} \times (5\frac{1}{3})^2$

b) $(\frac{3}{4})^2$ d) $(\frac{8}{9})^2$ f) $(3\frac{1}{2})^2$ h) $(1\frac{7}{9})^2 \times 1\frac{3}{5}$

Square roots of fractions

Example

Work out the square root of $1\frac{14}{25}$

$$\sqrt{1\frac{14}{25}} = \sqrt{\frac{49}{25}}$$

$$= \sqrt{\frac{(7 \times 7)}{(5 \times 5)}}$$

$$= \frac{7}{5} \text{ or } 1\frac{2}{5}$$

7	49
7	7
	1

5	25
5	5
	1

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Exercise 5:20

1. Work out the square root of;

a) $\frac{4}{9}$ c) $\frac{36}{121}$ e) $1\frac{7}{9}$ g) $1\frac{11}{25}$ i) $1\frac{32}{49}$

b) $\frac{9}{25}$ d) $\frac{1}{16}$ f) $2\frac{1}{4}$ h) $5\frac{4}{9}$ j) $1\frac{9}{16}$

2. The area of a square is $6\frac{1}{4}$ cm². Find the length of each side of the square.

3. A road was constructed along one side of a square garden. The area of the square garden is $\frac{100}{169}$ km². Calculate the length of the road.

Word problems involving multiplication of fractions by fractions / whole numbers

Example 1

A pen was $\frac{3}{4}$ full of ink. $\frac{1}{2}$ of the ink was used. What fraction of the ink was used?

$\frac{3}{4}$ of $\frac{1}{2}$ = $\frac{3}{4}$ x $\frac{1}{2}$

= $\frac{3}{8}$

Example 2

In a school of 720 pupils, the fraction of boys is $\frac{4}{9}$. Given that $\frac{3}{4}$ of the boys are day scholars.

(a) Find the fraction of boys who are day scholars

$\frac{3}{4}$ of $\frac{4}{9}$

$\frac{3}{4}$ x $\frac{4}{9}$

$\frac{1}{3}$

b) Find the number of boys who are day scholars.

$\frac{1}{3}$ of 720

$\frac{1}{3}$ x 720

240 boys

Exercise 5:21

1. What is $\frac{9}{20}$ of $\frac{5}{21}$?

2. In a class of 48 pupils, $\frac{3}{8}$ of them are boys and $\frac{2}{3}$ of the boys eat meat.
   a) Find the fraction of boys who eat meat.
   b) How many boys are in the class?
   c) Calculate the number of boys who eat meat.

3. A tank was $\frac{5}{6}$ full of water. $\frac{2}{9}$ of the water in the tank was drawn. What fraction of water was drawn?

4. In a class, $\frac{1}{4}$ of the pupils are absent. If $\frac{2}{3}$ of the pupils who are absent are boys. Find the fraction of boys who are absent.

5. A bucket was $\frac{3}{4}$ full of milk. $\frac{1}{6}$ of the milk in the bucket was sold. Find the fraction of milk sold.

6. A school library had 1200 textbooks. $\frac{2}{3}$ of them were stolen. $\frac{1}{4}$ of the stolen textbooks were for mathematics. How many mathematics textbooks were stolen?

7. A pen was $\frac{5}{9}$ full of ink. $\frac{3}{10}$ of the ink was used. What fraction of the ink was used?

8. Allen had $\frac{4}{7}$ of the sugar cane. She ate $\frac{21}{32}$ of it. What fraction of the sugar cane did Allen eat?

9. Ssemere had $\frac{4}{5}$ of a cake. He ate $\frac{5}{6}$ of it. What fraction of the cake did he eat?

10. A tank full of water lasts a school 72 days. How long will $\frac{2}{3}$ of water in the same tank last the school?

11. Amuriati earns sh. 412000 per month and $\frac{3}{4}$ of Amuriati's salary is equal to Besigye's salary. How much does Byesigye earn per month?

12. A mixed farm has a total area of 216 hectares. $\frac{1}{2}$ of the land is used for growing crops. Find in hectares, the size of land used for growing crops.

13. In a class, the probability of selecting a girl at random to be a class captain is $\frac{3}{5}$. There are 150 pupils in the class. Find the number of girls.

14. In a school of 1080 pupils, $\frac{5}{9}$ of them are girls and $\frac{2}{5}$ of the girls are in upper primary classes.
    a) Find the fraction of girls in upper primary classes.
    b) Find the number of girls in the school.
    c) How many boys are in the school altogether?

15. In a school of 900 pupils, $\frac{7}{9}$ of them are girls and $\frac{3}{14}$ of the girls are above 10 years. Find the number of girls who are above 10 years.

16. Nsomtwa, Janzi and Munyera shared 24 kilograms of meat such that Nsontwa gets $\frac{1}{3}$ of it, Janzi got $\frac{1}{2}$ and Munyera got $\frac{1}{6}$. How many kilograms of meat did each get?

17. In a class of 72 pupils, two thirds of them are girls and three quarters of the girls are boarders. If 20 boys are boarders, find the total number of boarders in the school.

Increasing and decreasing quantities using the given fraction

Example 1

1. Increase sh 12,000 by $\frac{1}{2}$ of it.

Approach a

$\frac{1}{2}$ of sh 12,000

$\frac{1}{2}$ x sh 12,000

sh 6,000

Add $\frac{1}{2}$ of sh 12000 to sh 12000

$\begin{array}{r} \text{sh } 12,000 \\ + \text{ sh } 6,000 \\ \hline \text{sh } 18,000 \end{array}$

Approach b

$(\frac{2}{2} + \frac{1}{2})$ of sh 12,000

$(\frac{2+1}{2})$ of sh 12,000

$\frac{3}{2}$ x sh 12,000

3 x sh 6,000

sh 18,000

Add $\frac{1}{2}$ to the whole and multiply the result by sh 12000

Example 2

Akena started with 348 fish in a bond.

After 8 months, the number of fish had

increased by $\frac{2}{3}$ of the original number.

Find the new number of fish in the pond now.

$(\frac{3}{3} + \frac{2}{3})$ of 348

$(\frac{3+2}{3})$ of 348

$\frac{5}{3}$ x 348

5 x 116

580 fish

Example 3

Decrease 240 by $\frac{3}{8}$ of it.

$(\frac{8}{8} - \frac{3}{8})$ of 240

$(\frac{8-3}{8})$ of 240

$\frac{5}{8}$ x 240

5 x 30

150

Example 4

The price of a radio was reduced by a third of the marked price. The marked price of the radio was sh 42,000.Find the new price of the radio.

Approach a

$\frac{1}{3}$ of sh 42,000

$\frac{1}{3}$ x sh 42,000

sh 14,000

sh 42,000 - sh 14000 = sh 28,000

Approach b

$(\frac{3}{3} - \frac{1}{3})$ of sh 42,000 = $(\frac{3-1}{3})$ of sh 42,000

$= \frac{2}{3}$ x sh 42,000

$= $ sh 28,000

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Exercise 5:22

1. Increase sh 36000 by $\frac{1}{5}$ of it.

2. Increase 5400g of rice by $\frac{1}{3}$ of it.

3. Muto's monthly salary was sh 600,000. It was increased by $\frac{2}{3}$ of it. What was Muto's salary after the increment?

4. In 2007, the population of Uganda was 27 million. In 2021 the population increased by $\frac{5}{9}$ of it. Calculate the population of Uganda 2021.

5. The price of the bread was sh 3,000. The price has increased by half of it. Find the new price of the bread.

6. The taxi fare from Kampala to Masaka was sh 12,000. It has been increased by $\frac{3}{8}$ of it. Find the new taxi fare.

7. Decrease 4800 by $\frac{1}{4}$ of it.

8. Reduce sh 7500 by $\frac{2}{5}$ of it.

9. A certain school had 600 pupils last year. The number of pupils has reduced by $\frac{1}{12}$ of the original number.
   a) How many pupils left the school?
   b) Find the current number of pupils in the school.

10. A water tank of capacity 2400 litres was full of water. When some water was sold, $\frac{3}{8}$ of it remained.
    a) Find in litres, the amount of water that remained in the tank.
    b) How much water was sold?

11. Ssegirinya's car fuel tank had 20 litres of fuel. When he travelled to Magere, $\frac{2}{5}$ of the fuel in the tank was used. Find in litres the amount of fuel that;
    a) was used.   b) remained.

12. A man's salary was decreased by $\frac{2}{3}$ of the original salary. The man's salary was sh 360,000. Find his final salary.

13. Three quarters of the 600 animals died in the drought. How many animals survived?

14. A business woman bought a dress at sh. 35000. She later sold it at a loss which was $\frac{2}{7}$ of the buying price.
    a) Find the loss, the business woman made.
    b) How much did the business woman sell the dress?

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Reciprocals (Multiplicative inverse)

Any number apart from zero, when multiplied by its reciprocal, the result is always 1

Example 1

Work out the reciprocal of 4

Let the reciprocal be y

$4 \times y = 1$

$4y = 1$

$\dfrac{4y}{4} = \dfrac{1}{4}$

$y = \dfrac{1}{4}$

So, the reciprocal of 4 is $\dfrac{1}{4}$

Example 2

Find the reciprocal of $2\frac{1}{3}$

Let the reciprocal be m

$2\frac{1}{3} \times m = 1$

$\dfrac{7}{3} \times m = 1$

$\dfrac{7m}{3} = 1$

$3 \times \dfrac{7m}{3} = 1 \times 3$

$\dfrac{7m}{7} = \dfrac{3}{7}$

$m = \dfrac{3}{7}$

So, the reciprocal of $2\frac{1}{3}$ is $\dfrac{7}{3}$

Exercise 5:23

1. Fill in the missing values.

a) $\dfrac{3}{7} \times \boxed{} = 1$

b) $\dfrac{6}{13} \times \boxed{} = 1$

c) $\boxed{} \times \dfrac{4}{3} = 1$

2. Work out the reciprocal of each of the following:

a) $\dfrac{3}{7}$ c) $\dfrac{1}{6}$ e) $\dfrac{3}{8}$ g) $\dfrac{4}{7}$ i) $3\frac{1}{5}$ k) $5\frac{1}{4}$ m) 8

b) $\dfrac{7}{8}$ d) $\dfrac{1}{4}$ f) $\dfrac{8}{9}$ h) $\dfrac{2}{5}$ j) $4\frac{2}{3}$ l) $2\frac{2}{5}$ n) 5
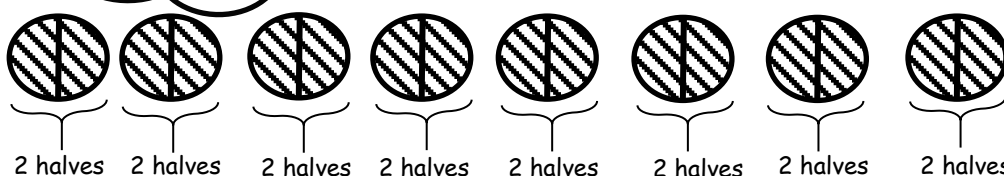
Dividing whole numbers by fractions

Let us consider $8 \div \dfrac{1}{2}$

We are finding the number of halves in 8 wholes

2 halves   2 halves   2 halves   2 halves   2 halves   2 halves   2 halves   2 halves

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From the diagram on the previous page (141), we come up with;

8 groups of 2 halves

8 x 2 halves

16 halves

So, $8 \div \frac{1}{2} = 16$

Example 2

How many packets of $\frac{1}{8}$kg can be obtained from 5kg?

$5\text{kg} \div \frac{1}{8}\text{kg}$

$\frac{5\text{kg}}{1} \div \frac{1\text{kg}}{8}$

$\frac{5\text{kg}}{1} \times \frac{8}{1\text{kg}}$

40 packets

Example 3

Bottles of $\frac{3}{4}$ litres were used to fill a nine litre bucket with water. Find the number of full $\frac{3}{4}$ litre bottles that were used.

$9 \div \frac{3}{4}$

$\frac{9}{1} \div \frac{3}{4}$

$\frac{9}{1} \times \frac{4}{3}$

12 bottles

Exercise 5:24

1. Workout:

a) $9 \div \frac{3}{5}$ c) $12 \div \frac{1}{4}$ e) $7 \div \frac{1}{5}$

b) $10 \div \frac{1}{2}$ d) $24 \div \frac{2}{3}$ f) $14 \div \frac{7}{8}$

2. A shopkeeper packed 16 kg of sugar into half kilogram sachets. How many sachets did the shopkeeper make?

3. Paul poured 12 litres of honey into third litre containers. How many containers did he get?

4. How many three quarter litre bottles can be obtained from 21 litres?

5. How many cubes of $\frac{1}{4}$cm³ volume are contained in a cube of 5cm³ volume?

6. Pingu has a wire of length 6 metres. He cuts this wire into pieces of $1\frac{1}{2}$ metres each. How many pieces did he get?
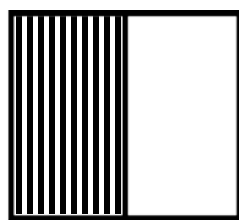
7. Okia bought 6 kilograms of washing powder in packets each weighing $\frac{3}{4}$ kilograms. Find the number of packets of washing powder Okia bought.

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8. The total mass of tins of honey in a box is 8kg. The mass of each tin is $\frac{1}{4}$kg. The cost of the box of tins of honey is sh 64000.
   a) Find the number of tins of honey in the box
   b) Find the cost of each tin of honey.

9. A shopkeeper uses a container of capacity $\frac{2}{5}$ litres to sell cooking oil. On a certain day, the shopkeeper sold 14 litres of cooking oil at sh. 5000 per litre.
   a) How many such containers were sold?
   b) At what price did the shopkeeper sell each container of cocking oil?

10. A cake of mass 4 kilograms was shared by some pupils such that each gets $\frac{2}{3}$kg. How many pupils shared the cake?

Dividing fractions by whole numbers

Let us consider $\frac{1}{2} \div 4$ using diagrams
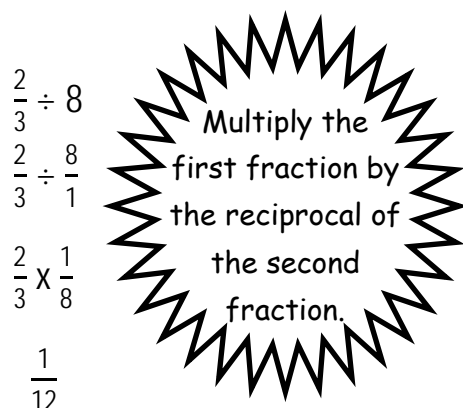

$\frac{1}{2}$

$\frac{1}{2} \div 4$

$\frac{1}{8}$

Double shaded
Single shaded

Example 2

Simplify: $\frac{2}{3} \div 8$

$\frac{2}{3} \div 8$

$\frac{2}{3} \div \frac{8}{1}$

$\frac{2}{3} \times \frac{1}{8}$

$\frac{1}{12}$

Multiply the first fraction by the reciprocal of the second fraction.

Example 3

A teacher shared $\frac{1}{2}$ jack fruit equally amongst 5 children. What fraction did each child get?

$\frac{1}{2} \div 5$

$\frac{1}{2} \div \frac{5}{1}$

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

$\frac{1}{10}$

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Exercise 5:25

1. Work out:

a) $\frac{3}{4} \div 9$ c) $\frac{2}{5} \div 10$ e) $\frac{8}{15} \div 4$

b) $\frac{1}{2} \div 8$ d) $\frac{3}{7} \div 6$ f) $\frac{2}{3} \div 3$

2. Share $\frac{1}{4}$ of a jack fruit among 2 boys. What fraction does each get?
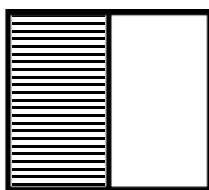
3. Two thirds of a sugarcane was shared among 2 girls. What fraction of the sugarcane did each girl get?

4. A saucepan was $\frac{3}{4}$ full of porridge. The porridge was shared equally among 18 pupils, What fraction of the porridge did each pupil take?

5. Our father bought $1\frac{3}{4}$ dozens of books. The books were shared equally amongst my three brothers. What fraction of the dozens of books did each of my brothers get?
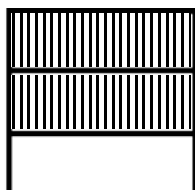
Dividing a fraction by a fraction

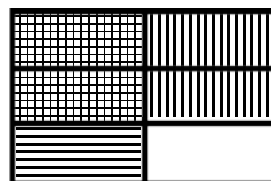Let us consider $\frac{1}{2} \div \frac{2}{3}$ using diagrams

$\frac{1}{2}$
Shaded horizontally

$\frac{2}{3}$
Shaded vertically

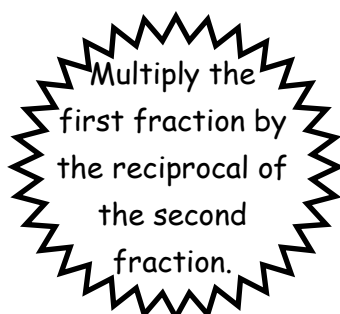$\frac{3}{4}$
Shaded horizontally

Shaded vertically

Example 2

How many $\frac{1}{8}$ litre cups of water can be obtained from $\frac{1}{2}$ litres of water?

$\frac{1}{2} \div \frac{1}{8}$

$\frac{1}{2} \times \frac{8}{1}$

4 cups

Multiply the first fraction by the reciprocal of the second fraction.

Example 3

Simplify: $1\frac{1}{2} \div 1\frac{4}{5} \div 3\frac{1}{3}$

$1\frac{1}{2} \div 1\frac{4}{5} \div 3\frac{1}{3}$

$\frac{3}{2} \div \frac{9}{5} \div \frac{10}{3}$

$\frac{3}{2} \times \frac{5}{9} \times \frac{3}{10}$

$\frac{1}{4}$

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Exercise 5:26

1. Work out:

a) $\dfrac{1}{2} \div \dfrac{3}{4}$

b) $\dfrac{2}{3} \div \dfrac{1}{12}$

c) $\dfrac{7}{8} \div \dfrac{1}{2}$

d) $\dfrac{1}{3} \div \dfrac{2}{3}$

e) $\dfrac{14}{15} \div \dfrac{2}{5}$

f) $1\dfrac{1}{5} \div \dfrac{5}{6}$

2. How many $\dfrac{1}{8}$kg packets of sugar that can be made from $\dfrac{3}{4}$kg of sugar?

3. Divide $\dfrac{1}{9}$ by $\dfrac{1}{6}$

4. Dorrah had $\dfrac{3}{4}$ of a cake. She shared the cake among her children such that each child gets $\dfrac{3}{8}$. How many children shared the cake?

5. Simplify: $\dfrac{2}{5} \div 1\dfrac{2}{3} \div \dfrac{9}{10}$

6. The product of two numbers is $\dfrac{4}{7}$. One of them is $\dfrac{8}{27}$. Find the other number.

7. How many pieces of wire $1\dfrac{1}{7}$ metres can be cut from a wire of length $5\dfrac{5}{7}$ metres?

8. How many $2\dfrac{1}{3}$ litre tins are contained in $9\dfrac{1}{3}$ litres of water?

Mixed operations on fractions

B → *Brackets*

O → *Orders*

D → *Division*

M → *Multiplication*

A → *Addition*

S → *Subtraction*

Example 1

Work out: $16 \div \dfrac{2}{3}$ of $\dfrac{3}{4}$

$16 \div \dfrac{2}{3}$ of $\dfrac{3}{4}$

$16 \times \dfrac{3}{2} \times \dfrac{3}{4}$

$2 \times 3 \times 3$

18

Example 2

Simplify: $\dfrac{1}{2} - \dfrac{2}{5}$ of $\dfrac{5}{6} + \dfrac{1}{4}$

$\dfrac{1}{2} - \dfrac{2}{5}$ of $\dfrac{5}{6} + \dfrac{1}{4}$

$\dfrac{1}{2} - \dfrac{2}{5} \times \dfrac{5}{6} + \dfrac{1}{4}$

$\dfrac{1}{2} - \dfrac{1}{3} + \dfrac{1}{4}$

$\dfrac{1}{2} + \dfrac{1}{4} - \dfrac{1}{3}$

$\dfrac{6 + 3 - 4}{12}$

$\dfrac{9 - 4}{12}$

$\dfrac{5}{12}$

2	2	3	4
2	1	3	2
3	1	3	1
	1	1	1

$LCD = 2 \times 2 \times 3$

$LCD = 12$

Example 3

Work out: $\dfrac{2}{3} \times \dfrac{3}{4} - \dfrac{1}{3} + \dfrac{1}{5} \div \dfrac{2}{5}$

First divide

$\dfrac{2}{3} \times \dfrac{3}{4} - \dfrac{1}{3} + \dfrac{1}{5} \div \dfrac{2}{5}$

$\dfrac{2}{3} \times \dfrac{3}{4} - \dfrac{1}{3} + \left(\dfrac{1}{5} \times \dfrac{5}{2}\right)$

Then multiply

$\dfrac{2}{3} \times \dfrac{3}{4} - \dfrac{1}{3} + \dfrac{1}{2}$

$\left(\dfrac{2}{3} \times \dfrac{3}{4}\right) - \dfrac{1}{3} + \dfrac{1}{2}$

$\dfrac{1}{2} - \dfrac{1}{3} + \dfrac{1}{2}$

$\dfrac{1}{2} + \dfrac{1}{2} - \dfrac{1}{3}$

$\dfrac{3 + 3 - 2}{6}$

$\dfrac{6 - 2}{6}$

$\dfrac{4 \div 2}{6 \div 2}$

$\dfrac{2}{3}$

2	2	3
3	1	3
	1	1

$LCD = 2 \times 3$

$LCD = 6$

By Sseggayi Benjamin Kasuka

Example 4

Work out: $1\frac{1}{3} \times \frac{3}{5} + \frac{1}{4} \div 1\frac{1}{2} - \frac{3}{4}$

$1\frac{1}{3} \times \frac{3}{5} + \frac{1}{4} \div 1\frac{1}{2} - \frac{3}{4}$

Change $1\frac{1}{2}$ to an improper fraction

$\frac{4}{3} \times \frac{3}{5} + \frac{1}{4} \div \frac{3}{2} - \frac{3}{4}$

Divide

$\frac{4}{3} \times \frac{3}{5} + (\frac{1}{4} \times \frac{2}{3}) - \frac{3}{4}$

$\frac{4}{3} \times \frac{3}{5} + \frac{1}{6} - \frac{3}{4}$

Multiply

$(\frac{4}{3} \times \frac{3}{5}) + \frac{1}{6} - \frac{3}{4}$

$\frac{4}{5} + \frac{1}{6} - \frac{3}{4}$

$\frac{48 + 10 - 45}{60}$

$\frac{13}{60}$

2	5	6	4
2	5	3	2
3	5	3	1
5	5	1	1
	1	1	1

LCD = 2×2×3×5

LCD = 60

Example 5

Simplify: $\frac{4}{5} \times \frac{3}{7} \div \frac{9}{14} + 2\frac{7}{15}$

$\frac{4}{5} \times \frac{3}{7} \div \frac{9}{14} + 2\frac{7}{15}$

Divide

$\frac{4}{5} \times \frac{3}{7} \div \frac{9}{14} + \frac{37}{15}$

$\frac{4}{5} \times \frac{3}{7} \times \frac{14}{9} + \frac{37}{15}$

Multiply

$(\frac{4}{5} \times \frac{2}{3}) + \frac{37}{15}$

$\frac{8}{15} + \frac{37}{15}$

Add

$\frac{8 + 37}{15}$

$\frac{45}{15}$

3

Exercise 5:27

1. Simplify:

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

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

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

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

e) $\frac{1}{3} \times \frac{1}{2} \div \frac{1}{2} \times \frac{1}{5}$

f) $\frac{1}{3} \times \frac{1}{2} + \frac{1}{4} \times \frac{1}{5}$

g) $\frac{1}{2} - \frac{2}{5}$ of $\frac{1}{2} + \frac{1}{4}$

h) $\frac{3}{5} + \frac{1}{3} \div \frac{2}{3}$

i) $\frac{3}{5} \div \frac{1}{3}$ of 2

j) $(\frac{5}{6} - \frac{3}{4}) \div 1\frac{1}{2}$

k) $\frac{2}{5} \times \frac{3}{4} \div \frac{3}{4}$

l) $1\frac{1}{2} \times \frac{2}{3} + \frac{1}{4} \div \frac{3}{4}$

2. Work out:

a) $\frac{1}{2} \times \frac{1}{3} \times \frac{1}{4} - \frac{1}{5}$

b) $\frac{1}{3} \times (\frac{3}{7} + \frac{9}{14}) \times \frac{1}{5}$

c) $\frac{5}{6} \div (\frac{3}{4} \times \frac{1}{2})$

d) $\frac{1}{3} \times \frac{1}{3}$ of (8 - 6) + $\frac{1}{4}$

e) $1\frac{2}{3} \times \frac{4}{5} \div 1\frac{1}{4} - \frac{1}{4}$

f) $\frac{1}{5} \div \frac{2}{3} - \frac{1}{6} \times \frac{3}{4}$ of $(\frac{1}{2} + \frac{1}{3})$

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

h) $2\frac{1}{2} \div (\frac{1}{2} + \frac{1}{3}) - \frac{1}{2} \times 5\frac{1}{3}$ of $\frac{3}{4}$

i) $8 \div \frac{2}{3}$ of $\frac{3}{4}$

j) $9 \div \frac{3}{4}$ of $\frac{4}{9}$

k) $\frac{2}{3}$ of 18 $\div \frac{3}{4}$

l) $24 \div (\frac{1}{2} + \frac{1}{6})$ of $2\frac{1}{4}$

By Sseggayi Benjamin Kasuka

Word problems involving mixed operations

Example 1

In a school of 720 pupils, $\frac{3}{5}$ of them are girls and the rest are boys. $\frac{2}{3}$ of the boys are day scholars and $\frac{1}{6}$ of the girls are boarders.

(a) Find the number of boys.

Approach 1	Approach 2	Approach 3
Number of girls $\frac{3}{5}$ of 720 $\frac{3}{5}$ x 720 432 girls Number of boys 720 – 432 = 288 boys	$(\frac{5}{5} - \frac{3}{5})$ of 720 $(\frac{5-3}{5})$ of 720 $\frac{2}{5}$ x 720 288 boys	Fraction for boys $\frac{5}{5} - \frac{3}{5} = \frac{2}{5}$ Number of boys $\frac{2}{5}$ of 720 $\frac{2}{5}$ x 720 288 boys

(b) Find the total number of day scholars in the school.

Number of boys who are day scholars.
$\frac{2}{3}$ of 288
$\frac{2}{3}$ x 288
192 boys

Number of girls who are boarders
$\frac{1}{6}$ of 432

$\frac{1}{6}$ x 432
72 girls

Number of girls who are day scholars.
432 – 72 = 360girls

Number of pupils who are day scholars.
192 + 360 = 552 pupils

What is asked?
- The number of pupils who are day scholars
How to answer?
- Find the number of boys who are day scholars, then the number of girls who are day scholars, add to get the total number of pupils who are day scholars

- To find the number of boys who are day scholars, multiply $\frac{2}{3}$ by the number of boys

- To find the number of girls who are day scholars, we need to first calculate the number of girls who are borders.

Example 2

A sum of sh 920,000 was shared by Jane, Betty and Cate. Jane got one fifth and Betty got one eighth of the sum. How much money did cate get?

Approach 1

Jane's share

$\frac{1}{5}$ of sh 920000

$\frac{1}{5}$ x sh 920000

sh 184000

Betty's share

$\frac{1}{8}$ of sh 920000

$\frac{1}{8}$ x sh 920000

sh 115000

Jane's share + Betty's share

sh 184000 + sh 115000

sh 299000

Cate's share

sh 920000 – sh 299000
sh 621000

Approach 2

Jane's share + Betty's share in terms of a fraction

$\frac{1}{5} + \frac{1}{8}$

$\frac{8+5}{40}$

$\frac{13}{40}$

Cate's share in terms of a fraction

$\frac{40}{40} - \frac{13}{40} = \frac{27}{40}$

Cate's share

$\frac{27}{40}$ of sh 920,000

$\frac{27}{40}$ x sh $\overset{23\,000}{\cancel{920,000}}$
$\underset{1}{}$

27 x sh 23,000
sh 621000

Example 3

A tank of capacity 12000 litres was $\frac{3}{4}$ full of water. When some water was used, $\frac{5}{6}$ of it remained. How much water was used?

Amount of water in the tank before
$\frac{3}{4}$ x 12000 litres
9000 litres

Amount of water remained
$\frac{5}{6}$ x 9000 litres
7500 litres

Amount of water used
9 0 0 0 litres - 7 5 0 0 litres
= 1 5 0 0 litres

Approach 2

Fraction remained
$\frac{5}{6}$ of $\frac{3}{4} = \frac{5}{6}$ x $\frac{3}{4}$
$= \frac{5}{8}$

Fraction used
$\frac{3}{4} - \frac{5}{8} = \frac{6-5}{8}$
$= \frac{1}{8}$

Amount of water used
$\frac{1}{8}$ x 12000 litres
= 1500 litres

148

Example 4

An electric pole was 84 metres long. One third of it was in mud, $\frac{3}{7}$ of the remainder in water and the rest above water. Find the length of the electric pole above water.

Approach 1

Length in mud

$\frac{1}{3}$ of 84

$\frac{1}{3}$ x 84

28 metres

Remaining length

84 – 28 = 56 metres

Length in water

$\frac{3}{7}$ of 56

$\frac{3}{7}$ x 56

24 metres

Length above water

56 – 24 = 32 metres

Approach 2

Length in mud

$\frac{1}{3}$ x 84 = 28 metres

Remaining length

84 – 28 = 56 metres

Length in water

$\frac{3}{7}$ x 56 = 24 metres

Length in mud + water

28 + 24 = 52 metres

Length above water

84 – 52 = 32 metres

Approach 3

Mud → $\frac{1}{3}$

Remainder

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

Fraction in Water

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

Fraction in Mud + Water

$\frac{1}{3} + \frac{2}{7} = \frac{7+6}{21} = \frac{13}{21}$

Fraction above water

$\frac{21}{21} - \frac{13}{21} = \frac{8}{21}$

Length above water

$\frac{8}{21}$ x 84 = 32 metres

Exercise 5:28

1. Chebet, Cheboiyo and Chemai contributed sh 150000 to start a joint business. Chebet contributed $\frac{3}{10}$ and Chemboiyo contributed $\frac{5}{10}$ of the amount. How much money did Chemai contribute?

2. In a class, there are 63 pupils. Of these, $\frac{4}{9}$ of them are boys and $\frac{3}{5}$ of the girls are above 11 years. Find the number of girls below 11 years of age.

3. Olade, Onyango and Oulanya shared a 240gram cake. Olade ate $\frac{2}{5}$ of the cake, Onyango ate $\frac{1}{3}$ of the cake and the remaining part of the cake was eaten by Oulanya. Find the weight of the cake Oulanya ate.

4. Kulima had 28 hectares of land. He used $\frac{1}{4}$ of it to plant potatoes, $\frac{4}{7}$ of the remaining part for tomatoes and the remaining part of the land was not cultivated. Find in hectares, the area of the land which was not cultivated.

5. A man's monthly salary is sh 216000. He spends $\frac{1}{3}$ of it on rent, $\frac{3}{4}$ of the remainder on food and saves the rest. How much money does he save in 3 months?

6. A school library had 1512 textbooks. During the lockdown, $\frac{1}{4}$ of the textbooks were destroyed by rats. $\frac{16}{21}$ of the remaining textbooks were for mathematics and the rest were for science. How many science books remained in the school library?

7. In a class of 45 pupils, $\frac{2}{3}$ of the pupils are girls and $\frac{4}{5}$ of the boys eat meat. How many boys eat meat in the class?

8. A tank of capacity 9600 litres was $\frac{3}{4}$ full of water. Some water was sold and $\frac{1}{6}$ of it remained. Find in litres, the amount of water that was sold.

9. A certain district registered 7200 candidates for PLE 2023. $\frac{1}{4}$ of them were boys. $\frac{1}{3}$ of them were girls below 14 years and $\frac{5}{9}$ of the boys were above 14 years
   (a) How many girls sat for PLE?
   (b) Find the total number of pupils below 14 years who sat for PLE that year.

10. In a school of 720 pupils, $\frac{1}{4}$ of them are girls. $\frac{2}{3}$ of the boys are in lower primary classes and $\frac{3}{5}$ of the girls are in upper primary classes. Find the total number of pupils in upper primary classes.

11. Engoro had sh 360,000 on his account, he withdrew $\frac{5}{9}$ of it. He used $\frac{1}{4}$ of the amount he withdrew for paying electricity bills and $\frac{1}{2}$ of the remaining amount for paying school fees. How much money did Engoro spend on school fees?

12. In a class of 75 pupils, $\frac{4}{5}$ of the girls are day scholars and $\frac{1}{3}$ of the boys are day scholars. The fraction of girls in the class is $\frac{3}{5}$.
    (a) How many boys are day scholars?
    (b) Find the number of girls who are boarders.

13. In a group of 120 head teachers, $\frac{1}{6}$ of them are females and $\frac{1}{4}$ of the male head teachers are not married. Given that $\frac{3}{4}$ of the female head teachers are married, how many head teachers are married in that group?

14. Rose and Annet shared sh 480000 such that Rose gets $\frac{1}{3}$ of it. Annet gave $\frac{1}{4}$ of her share to Florence. How much money did Annet remain with?

15. In a village of 3000 people, $\frac{3}{5}$ of the population are females, $\frac{5}{6}$ of the males are boys and $\frac{3}{4}$ of the females are girls. Find the total number of children in that village.

16. Mrs Atieno spends $\frac{2}{5}$ of her daily earnings on groceries, $\frac{1}{3}$ on milk, $\frac{5}{8}$ of the remainder on transport and saves the rest. If she earns sh 60000 every day, how much money does she save?
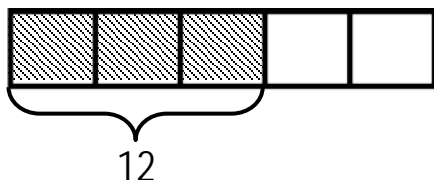
17. There are 700 people in a certain village. $\frac{3}{5}$ are children and the rest are adults. $\frac{2}{3}$ of the children are females and $\frac{9}{14}$ of the adults are males. Find the total number of males in the village.

18. In a school, there are 640 pupils, $\frac{2}{5}$ of them are girls. $\frac{5}{8}$ of the girls and $\frac{2}{3}$ of the boys passed the examination. How many pupils passed the examination?

19. A sack of posho that can feed 6 members of the family for 24 days was $\frac{3}{4}$ full. $\frac{2}{3}$ of the posho in the sack was consumed. For how long will the remaining posho feed the family?

20. Nakulima harvested 108 pumpkins on Monday. She sold $\frac{2}{9}$ of them on Tuesday, $\frac{1}{3}$ on Wednesday and $\frac{5}{8}$ of the remainder on Thursday. She sold the remaining pumpkins on Friday at sh. 90,000. How much money did Nakulima sell each pumpkin on Friday?

Finding original number / total amount when the fraction equivalent to the given quantity is given

Example 1

If $\frac{3}{5}$ of a number is 12, find that number.

Using diagrams

12 ÷ 3 = 4
4 x 5 = 20
The number is 20

See this explanation

The shaded 3 parts are equivalent to 12. So, each part stands for (12 ÷ 3 = 4)

We are finding the whole (5 parts)
So, 5 parts are equivalent to (5x4=20)
Therefore, the number is 20.

Using equivalent fractions: $\frac{3}{5} = \frac{12}{\square}$

$\frac{3}{5} = \frac{6}{10}, \frac{9}{15}, \frac{12}{20} \cdots$

Since $\frac{3}{5} = \frac{12}{20}$, the number is 20

Approach 1

Let the number be y
$\frac{3}{5}$ x y = 12
$\frac{3y}{5}$ = 12
5x $\frac{3y}{5}$ = 12x5
$\frac{3y}{3} = \frac{12 \times 5}{3}$
y = 20
The number is 20

Approach 2

3parts represent 12
1part represents (12÷3)
1part represents 4
5parts represent (5x4)
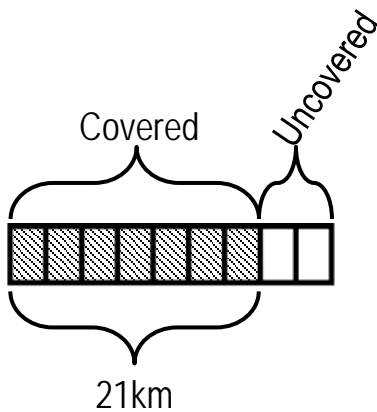5parts represent 20
The number is 20

By Sseggayi Benjamin Kasuka

Example 2

Monic's car broke when she had covered 21km and this was $\frac{7}{9}$ of her journey. How long was her journey?

Covered

Uncovered

21km

Approach 1

7parts represent 21km

1part represents (21km÷7)

1part represents 3km

9parts represent (3km x 9)

9parts represent 27km

Her journey was 27km

Approach 2

Let the number be y

$\frac{7}{9}$ x y = 21km

$\frac{7y}{9}$ = 21km

$9 \times \frac{7y}{9}$ = 21km x 9
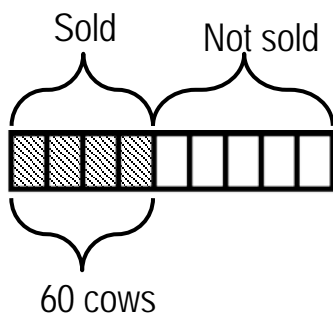
$\frac{7y}{7} = \frac{21km \times 9}{7}$

y = 27km

Her journey was 27km

Example 3

James sold 60 cows and this was $\frac{4}{9}$ of the total number of animals.

(a) Find the total number of animals James had at first.

Sold   Not sold

60 cows

Approach 1

4parts represent 60 animals

1part represents (60 ÷ 4) animals

1part represents 15 animals

9parts represent (9 x 15) animals

9parts represent 135 animals

He had 135 animals

Approach 2

Let the number be p

$\frac{4}{9}$ x p = 60

$\frac{4p}{9}$ = 60km

$9 \times \frac{4p}{9}$ = 60km x 9

$\frac{4p}{4} = \frac{60km \times 9}{4}$

p = 135

He had 135 animals

b) How many animals remained?

```
   135
 − 60
   75 animals
```

He remained with 75 animals

Exercise 5:29

1. If $\frac{2}{5}$ of a number is 24, what is that number?

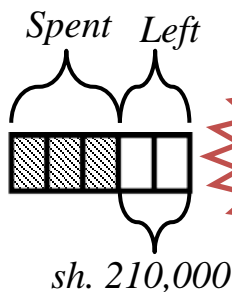2. Given that $\frac{3}{7}$ of a number is 15. Find that number

3. Ayebare spent sh 40000 on transport and this was $\frac{2}{9}$ of her monthly salary. Find her monthly salary.

4. Nduta pays sh 42000 for rent. This is $\frac{3}{7}$ of Kamau's salary. Find Kamau's salary.

6. Two thirds of the price of a smart phone is sh 80000. Find the cost of the smart phone.

7. A fifth of a number is 40. Find $\frac{3}{5}$ of the number.

8. $\frac{3}{4}$ of the water in a tank is used by a family in 24 days. How long will $\frac{2}{3}$ of water in the tank be used by the same family?

9. The fraction of boys in a class is $\frac{5}{7}$. The class has 35 boys.
   (a) Find the total number of pupils in the class.
   (b) Calculate the number of girls in the class.

10. Ssemusu's age is $\frac{4}{9}$ of Edinah's age. Ssemusu is 12 years old
    (a) How old is Edinah?
    (b) Find their total age.

11. Amini's car tyre got a puncture after covering 12km and this was $\frac{3}{8}$ of his journey. What distance was not covered?

12. There are 200 boys at Kuyita P/S. This makes $\frac{4}{11}$ of the total number of pupils in the school. Find the number of girls in the school.

13. The fraction of girls in a school is $\frac{3}{5}$. Two thirds of the girls are day scholars and
    $\frac{2}{5}$ of the boys are boarders. The school has 120 girls who are day scholars.
    (a) Find the number of girls in the school.
    (b) Calculate the number of boys who are boarders.

14. Three quarters of Rajab's salary is equal to $\frac{2}{3}$ of Akram's salary. Find Akram's salary if Rajab's salary is sh 480,000.

15. In Kibaati Primary school, there are 600 girls. $\frac{2}{5}$ of the boys are in upper primary
    classes and $\frac{3}{4}$ of the girls are in lower primary classes. The fraction of girls in the school
    is $\frac{2}{5}$.
    a) Find the total number of pupils in the school.
    b) Find the total number of pupils in upper primary classes.

16. A water tank had 7200 litres of water and this was $\frac{3}{4}$ of its capacity when full. When
    some water was sold using 20 litre jerry cans at sh.250, $\frac{2}{9}$ of it remained.
    a) How much water does the tank hold when completely full?
    b) Find in litres, the new amount of water needed to fill the tank.
    c) Calculate the amount of money that was collected altogether.

Word problems involving finding the fraction equivalent to the given quantity

Example 1

If $\frac{3}{5}$ of Tommy's salary is spent on food, sh. 210,000 remains. Find Tommy's salary.

Spent *Left*

Amount in each part
sh 210,000 ÷ 2 = sh 105,000
Tommy's salary
sh 105,000 x 5 = sh 525,000

sh. 210,000

Approach 1

Solution I

Fraction that remains

$$\frac{5}{5} - \frac{3}{5} = \frac{2}{5}$$

Tommy's salary
   2parts represent sh. 210,000
    1part represents $\frac{sh.\ 210,000}{2}$

   1part represents sh. 105,000
   5parts represent sh. 105,000 x 5
   5parts represent sh. 525,000
Tommy's salary was sh. 525,000

Approach 2

Fraction that remains

$$\frac{5}{5} - \frac{3}{5} = \frac{2}{5}$$

Tommy's salary
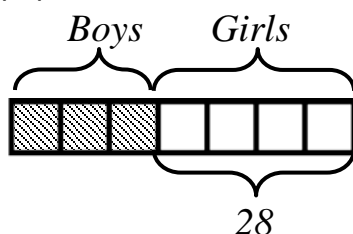 Let Tommy's salary be y

$$\frac{2}{5} \times y = sh.\ 210,000$$

$$\frac{5}{2} \times \frac{2y}{5} = sh.\ 210,000 \times \frac{5}{2}$$

$$y = sh.\ 525,000$$

Tommy's salary was sh. 525,000

Example 2

In a class, the fraction of boys is $\frac{3}{7}$. There are 28 girls in the class. Find total number of pupils in the class.

Boys *Girls*

28

Fraction for girls

$$\frac{7}{7} - \frac{3}{7}$$

$$\frac{7-3}{7}$$

$$\frac{4}{7}$$

Let the total number of pupils be d

$$\frac{4}{7}\ of\ d = 28$$

$$\frac{4}{7} \times d = 28$$

$$\frac{4d}{7} = 28$$

$$7 \times \frac{4d}{7} = 28 \times 7$$

$$\frac{4d}{4} = \frac{28 \times 7}{4}$$

$$d = 49\ pupils$$

Approach 2

4 parts represent rep 28
1 part represents 28 ÷ 4
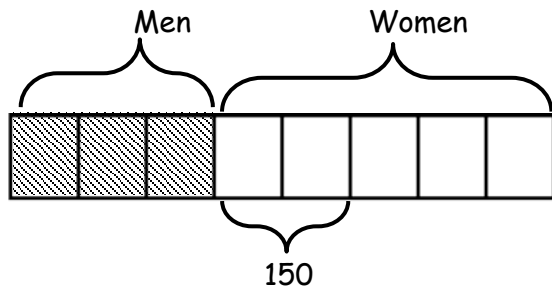1 part represents 7
7 parts represent 7 × 7
7 parts represent 49 pupils
The class has 49 pupils

Example 3

The fraction of men in a village is $\frac{3}{8}$. There are 150 more women than men in that village. Find the total number of people in the village.

Men   Women

150

Since men take 3 parts, women will take 5 parts. Therefore, women take 2 parts more than men

So,
$150 \div 2 = 75$
$75 \times 8 = 600$ people

Solution

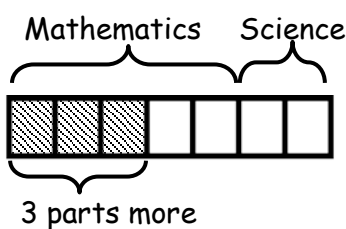| Fraction of women	Difference in parts	Total number of people
$\frac{8}{8} - \frac{3}{8}$ $\frac{8-3}{8}$ $\frac{7}{8}$ $\frac{5}{8}$	$\frac{5}{8} - \frac{3}{8}$ $\frac{5-3}{8}$ $\frac{2}{8} = \frac{1}{4}$	1part represents 150 4parts represent 150 x 4 4parts represent 600 people *The village has 600 people.*

Example 4

The fraction of mathematics books in the school library is $\frac{3}{7}$ more than the fraction of science books. There are 250 mathematics books in the school library.

a) Find the fraction of science books in the school library.

Mathematics   Science

3 parts more

Fraction of science books is $\frac{2}{7}$

Look at this also
Let the fraction of science books be h
then math books be h + $\frac{3}{7}$

Value of h

$h + h + \frac{3}{7} = 1$ | $2h + \frac{3}{7} - \frac{3}{7} = \frac{7}{7} - \frac{3}{7}$ | $\frac{14h}{14} = \frac{4}{14}$

$2h + \frac{3}{7} = 1$ | $7 \times 2h = \frac{4}{7} \times 7$ | $h = \frac{2}{7}$

b) Find the total number of books in the school library.

5 parts represent 250 books
1 part represents (250 ÷ 5) books
1 part represents 50 books
7 parts represent (7 x 50) books
7 parts represent 350 books
There are 350 books in the library.

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Example 5

The difference between $\frac{3}{4}$ and $\frac{2}{3}$ of a number is 6. Find that number.

Difference

$$\frac{3}{4} - \frac{2}{3}$$

$$\frac{9 - 8}{12}$$

$$\frac{1}{12}$$

1part represents 6

12parts represent 12 x 6

12parts represent 72

The number is 72

Exercise 5:30

1. If $\frac{1}{3}$ of my salary is spent on school fees, I save sh 480000. What is my salary?

2. After $\frac{4}{5}$ walking of her journey, Zanya still had 8 kilometres to go. How long was the journey?

3. If $\frac{3}{5}$ of a piece of land contains rice and the remaining 60 hectares are covered with potatoes.
   a) What is the total area of the land in hectares?
   b) How many hectares are covered by rice?

4. After spending $\frac{3}{7}$ of his income, Steven was left with sh 240,000.
   a) How much is his income?
   b) How much money did he spend?

5. After covering $\frac{1}{5}$ of his journey, Nalika still had 60km to go. How long was his journey?

6. In a certain school, the fraction of boys is $\frac{1}{3}$. The school has 640 girls.
   a) Find the total number of pupils in the school.
   b) Calculate the number of boys.

7. A sixth of the pupils in a class are absent and 60 pupils are present.
   a) Find the total number of pupils in the class.
   b) How many pupils are absent?

8. There are 240 more boarders than day scholars in a school. The fraction of day scholars in the school is $\frac{3}{10}$. Calculate the total number of pupils in the school.

9. Vicky spends sh 48000 more on rent than food. If she spend $\frac{3}{8}$ of her salary on food,
   a) Find her salary.
   b) How much money does she spend on rent?

10. A farmer sold 24 goats and this was $\frac{1}{7}$ less than the fraction of goats that remained
    a) Find the original number of goats the farmer had.
    b) How many goats remained?

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11. The difference between $\frac{3}{14}$ and $\frac{3}{4}$ of a number is 45. Find the number.

12. The difference between $\frac{2}{3}$ and $\frac{1}{4}$ of a number is 30. Find $\frac{5}{6}$ of the same number

13. The fraction of black pens in the box is $\frac{1}{5}$ more than the fraction of red pens. The box contains 12 red pens.
    a) Find the number of pens in the box.
    b) How many black pens are in the box?

14. In a class, $\frac{1}{6}$ of the pupils like cassava, $\frac{1}{4}$ like posho and the rest like rice. The number of pupils who like rice is 24 more than the number of pupils who like posho.
    a) Find the fraction of pupils who like rice.
    b) How many like cassava?

15. In a school, the fraction of boys is $\frac{3}{8}$ and $\frac{2}{3}$ of the boys are in lower primary classes. $\frac{7}{10}$ of the girls are in lower primary classes. There are 90 more girls than boys in lower primary classes.
    a) Find the fraction of girls in the school.
    b) Work out the fraction of boys in lower primary classes.
    c) Calculate the total number of pupils in the school.
    d) Find the number of girls in the school.
    e) How many boys are in lower primary classes?

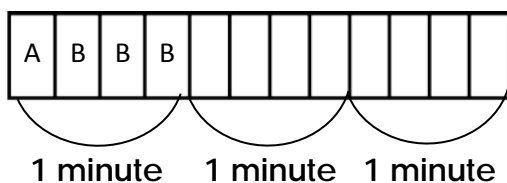## Application of fractions (Part One)

Example 1

Two taps A and B are connected to a water tank. Tap A takes 12 minutes to fill the tank and tap B takes 4 minutes to fill the same tank. Both taps are opened at the same time. How long will the two taps take to fill the tank?

Using diagrams

In 1 minute, A fills $\frac{1}{12}$ and B fills $\frac{1}{4}$

$\frac{1}{12}$ x 12 = 1 part   (LCD = 12)

$\frac{1}{4}$ x 12 = 3 parts

1 minute   1 minute   1 minute

1+1+1 = 3 minutes
They will take 3 minutes

Approach a

Fraction in the tank in 1 minute

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

$\frac{1+3}{12}$

$\frac{4}{12}$ or $\frac{1}{3}$

Time taken

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

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

3 minutes

Approach b

$\frac{\text{Product}}{\text{Sum}}$

$\frac{12 \times 4}{12 + 4}$

$\frac{48}{16}$

3 minutes

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Example 2

Taps F and D are connected to a water tank. F fills that tank in 6 hours and D takes 8 hours to draw water from the tank. The tank is $\frac{1}{4}$ full of water. The two taps are opened at the same time. How long will it take the tank to become full?

Approach a

$$\frac{\text{Product}}{\text{Difference}}$$

$$\frac{6 \times 8}{8 - 6}$$

$$\frac{48}{2}$$

24 hours

Empty space

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

Time taken

$$\frac{3}{4} \times 24 = 18 \text{ hours}$$

It will take 18 hours

Approach b

Fraction of water in the tank in one hour

$$\frac{1}{6} - \frac{1}{8}$$

$$\frac{4 - 3}{24}$$

$$\frac{1}{24}$$

Empty space

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

Time taken

$$\frac{3}{4} \div \frac{1}{24} = \frac{3}{4} \times \frac{24}{1} = 18$$

It will take 18 hours

Exercise 5:31

1. Joseph sweeps a compound in 24 minutes. Annet sweeps the same compound in 8 minutes. If both work at the same rate
   a) What fraction of the compound will they sweep in one minute?
   b) How long will they take to sweep the compound?
2. Tap C and tap D are connected to a water tank. Tap C can fill the tank in 6 minutes and tap D can fill the tank in 3 minutes. Both taps are opened at the same time. How long will it take for the tank to become full?
3. Tap W takes 9 minutes to fill the tank. Tap X takes 12 minutes to fill the same tank while tap Y takes 18 minutes to fill the tank. All the three taps are left open. How long will it take the tank to get full?
4. Tap Q takes 3 hours to fill the tank while tap E takes 4 hours to empty the tank. The two taps are opened at the same time. How long will it take to fill the tank?
5. A pipe and a tap are connected to a tank. A pipe takes 12 minutes to fill the tank and the tap takes 24 minutes to draw water from the tank. The pipe and the tap are opened at the same time, how long did it take the tank to become full?

6. A tap can fill a jerry can in 4 minutes. The jerry can has two holes on its bottom. The holes draw water from the jerry can in 24 and 12 minutes respectively. If the tap is opened, how long will it take the jerry can to become full?

7. Taps M and N are connected to a water tank. Tap M takes 8 minutes to fill the tank and N takes 24 minutes to draw water from the tank. One day, the tank was $\frac{1}{3}$ full of water, both taps were opened at the same time. How long did it take the tank to become completely full?

8. Munafu takes 18 days to do a piece of work. Kirimanyi takes 9 days to do the same piece of work. If both boys work together at the same rate, how long will they take to do the same piece of work?

9. Ssemere eats a full plate of food in 8 minutes while Joan eats the same plate of food in 24 minutes. If the two children eat the same plate of food at the same rate;
   a) What fraction of food will they eat in one minute?
   b) How long will they take to finish it?

10. A tank of capacity 9600 litres was $\frac{1}{5}$ full of water. The tank has two taps F and E connected to it. Tap F fills the tank in 5 hours and tap E draws water from the tank in 6 hours. Both taps were opened at the same time. Find in litres, the amount of water in the tank after 7 hours.

11. Tap A fills the tank in 6 hours and tap B fills the same tank in t hours. When both taps were opened at the same time, it took only 2 hours for the tank to become full. Find the value of t.

Application of fractions (Part 2)

Example 1

A woman spends $\frac{1}{2}$ of her salary on food, $\frac{1}{9}$ on clothing, $\frac{1}{18}$ on medical and banks the rest which is sh. 70000

a) What fraction of the salary does she bank?

$$\frac{1}{2} + \frac{1}{9} + \frac{1}{18} = \frac{9+2+1}{18}$$

$$= \frac{12}{18}$$

Banking

$$\frac{18}{18} - \frac{12}{18}$$

$$\frac{6}{18}$$

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

b) How much does she earn as salary?

Let her salary be d

$\frac{1}{3}$ of d = sh 70000

$\frac{1}{3}$ x d = sh 70000

$\frac{d}{3}$ = sh 70000

$3 \times \frac{d}{3}$ = sh 70000 x 3

d = sh 210000

Her salary is sh 210000

Example 2

At Queen's way P/S, $\frac{1}{4}$ of the pupils in P.7 like science, $\frac{2}{3}$ of the remainder like mathematics and 35 pupils like English.

a) Find the fraction of pupils who like mathematics.

Remainder

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

Mathematics

$$\frac{2}{3} \text{ of } \frac{3}{4}$$

$$\frac{2}{3} \times \frac{3}{4}$$

$$\frac{1}{2}$$

b) Find the total number of pupils in P.7

Fraction of pupils who like English

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

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

Total number of pupils

1 part represents 35

4 parts represent 4 x 35

4 parts represent 140 pupils

The class has 140 pupils

Example 3

On a farm, $\frac{1}{3}$ of the animals are cattle, $\frac{1}{4}$ are goats, $\frac{2}{5}$ of the remainder are sheep and the rest are rabbits. The number of rabbits on the farm is 150

a) Find the fraction of rabbits

Cattle + Goats

$$\frac{1}{3} + \frac{1}{4} = \frac{4 + 3}{12}$$

$$= \frac{7}{12}$$

Remainder

$$\frac{12}{12} - \frac{7}{12} = \frac{5}{12}$$

Sheep

$$\frac{2}{5} \times \frac{5}{12} = \frac{1}{6}$$

Rabbits

$$\frac{5}{12} - \frac{1}{6} = \frac{5 - 2}{12}$$

$$= \frac{3}{12}$$

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

b) Find the number of sheep on the farm.

Total number of animals on the farm.

1 part represents 150

4 parts represent 4 x 150

4 parts represent 600 animals

Number of sheep

$$\frac{1}{6} \times 600 = 100 \text{ sheep}$$

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Example 4

Joseph, Cate, Rajab and Kenin shared some money such that Joseph gets sh. 27000

and this was $\frac{3}{8}$ of the total amount of money shared. Cate got $\frac{1}{6}$ of the total share, Rajab got

$\frac{3}{4}$ of the remainder and Kevin got the rest.

a) Find the total amount of money the four children shared.

Approach 1
3 part represent sh 27000
1 part represents $\frac{\text{sh } 27000}{3}$
1 part represents sh 9000
8 parts represent sh 9000
$$\quad\quad\quad\quad \underline{\times \quad 8}$$
$$\quad\quad\quad\quad \text{sh } 72000$$

Approach 2
Let the total share be h
$\frac{3}{8}$ of h = sh 27000
$\frac{3}{8}$ x h = sh 27000
$\frac{3h}{8}$ = sh 27000
8 x $\frac{3h}{8}$ = sh 27000 x 8
$\frac{3h}{3}$ = $\frac{\text{sh } 270000 \times 8}{3}$
h = sh 72000
They shared sh 72000

b) Find Kevin's share.

Cate's share
$\frac{1}{6}$ x sh 72000 = sh 12000

Joseph's share + Cate's share
$\quad$ sh 27000
$\underline{+ \text{ sh } 12000}$
$\quad$ sh 39000

Remainder
$\quad$ sh 72000
$\underline{- \text{ sh } 39000}$
$\quad$ sh 33000

Rajab's share
$\frac{3}{4}$ x sh 33000 = sh 24750

Kevin's share
$\quad$ sh 33000
$\underline{- \text{ sh } 24750}$
$\quad$ sh 8250

Exercise 5:32

1. Ronald ate $\frac{2}{5}$ of the cake and John ate $\frac{1}{3}$ of the same cake. The remaining part of the cake was eaten by Modesta.
   a) What fraction of the cake did Modesta eat?
   b) Given that Modesta ate 80 grams. Find in grams, the total mass of the cake shared.

2. Privato, Steven and Atanansio shared some money. Privato got $\frac{1}{3}$ of the share, Steven got $\frac{2}{9}$ and Atanansio got sh 20000.
   a) What fraction of the total share did Atanansio get?
   b) How much money did they share altogether?

3. In a certain school, $\frac{2}{9}$ of the pupils are in lower primary classes, $\frac{1}{4}$ in middle primary and 380 pupils in upper primary classes. How many pupils are in the whole school?

4. The table below shows how Mr Mutaaya spends his monthly salary. Use it to answer questions that follow.

Food	Rent	Transport	Fees
$\frac{1}{6}$	$\frac{5}{24}$	$\frac{1}{3}$	sh. 63000

   a) Find Mr. Mutaaya's total monthly salary.
   b) How much more does he spend on transport than on rent?

5. Tr. Birasa wrote $\frac{1}{3}$ of the English test book in 2015, $\frac{1}{4}$ in 2016, $\frac{1}{6}$ in 2017 and 60 pages in 2018. How many pages are in the text book he wrote?

6. Benjamin had a sack full of rice. He sold $\frac{2}{5}$ of the rice on Monday, $\frac{2}{3}$ of the remainder on Tuesday and 10kg on Wednesday.
   a) What fraction of rice did he sell on Tuesday?
   b) What fraction was sold on Wednesday?
   c) Find in kilograms, the mass of rice sold altogether.

7. $\frac{1}{3}$ of the pole was painted black, $\frac{2}{5}$ of the remainder was painted green and 30m painted blue. Find the length of the pole.

8. Vivian spent $\frac{1}{2}$ of her salary on food. $\frac{1}{2}$ of the remaining amount on rent and saved sh. 120000. Find Vivian's salary.

9. Bridget did $\frac{1}{2}$ of her holiday package in the first week, $\frac{1}{4}$ of the remainder in the second week and dodged 12 questions. How many questions were in the holiday package?

10. In a class, $\frac{1}{6}$ of the pupils like English, $\frac{1}{3}$ like Mathematics, $\frac{3}{7}$ of the remaining pupils like Social studies and the rest like Science.
    a) Find the fraction of pupils who like science.
    b) If 24 pupils like science, find the total number of pupils in the class.

11. At a birthday party, $\frac{1}{4}$ of the guests were served with Pepsi, $\frac{1}{6}$ with coca cola, $\frac{6}{7}$ of the remainder were served with Novida and 6 guests were served with Munanaasi.
    a) Find the fraction of guests who were served with Munanaasi.
    b) How many guests attended the party?

12. The number of pupils in Kibonzi P/S decreased by $\frac{1}{5}$ of the original number of pupils before the lockdown. $\frac{1}{4}$ of the current number reported in the first week, $\frac{2}{3}$ of the remainder in the second week and 120 pupils in the third week. How many pupils were in that school before the lockdown?
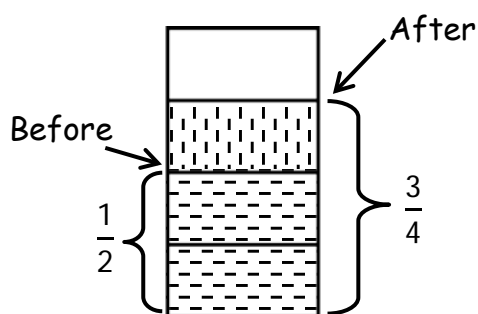
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13. Amina spent $\frac{1}{3}$ of her salary on food, $\frac{2}{5}$ on school fees, $\frac{3}{4}$ of the remainder on rent and saved the rest. If she saved sh. 15000, how much did she pay for rent?

14. A farmer used 18 hectares for cassava growing and this was $\frac{1}{4}$ of the total area of the land. $\frac{1}{6}$ was used for growing potatoes, $\frac{5}{7}$ of the remaining area for growing beans and the rest for rearing animals. Find the area of land that was used for rearing animals.

15. A woman spent sh 24000 on food and this was $\frac{1}{6}$ of her monthly salary. She spent $\frac{2}{3}$ of what was left on rent and banked the rest. How much money did the woman bank?

16. The fraction of girls is $\frac{5}{9}$ more than the fraction of boys. $\frac{1}{4}$ of the boys like science, $\frac{1}{3}$ of the boys like English, $\frac{4}{5}$ of the remaining boys like mathematics. $\frac{5}{6}$ of the girls like mathematics. There are 60 more girls than boys in the class. Find the total number of pupils who like mathematics?

17. Ndwanyi spent $\frac{1}{3}$ of his salary on food, $\frac{2}{5}$ on school fees, $\frac{3}{4}$ of the remainder on rent and saved the rest. If he saved sh. 150,000, how much did he spend on rent?

18. At St Gabriel's Bethlehem Primary school, $\frac{1}{4}$ of the pupils live at Kituntu, $\frac{1}{6}$ live at Lyabuguma, $\frac{4}{7}$ of the remaining pupils live at Bethlehem and the rest of the pupils live at Luseese. The school has 60 more pupils who live at Bethlehem than Luseese. Find the number of pupils who live at Lyabuguma.

Application of fractions (Part 3)

Example 1

A tank was $\frac{1}{2}$ full of water. When 90 litres were added, the tank became $\frac{3}{4}$ full.

a) What fraction of water was added?

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

b) Find in litres the amount of water the tank holds when $\frac{5}{9}$ full.

Capacity of the tank
1 part represents 90 litres
4 parts represent (4x90) litres
4 parts represent 360 litres

When $\frac{5}{9}$ full
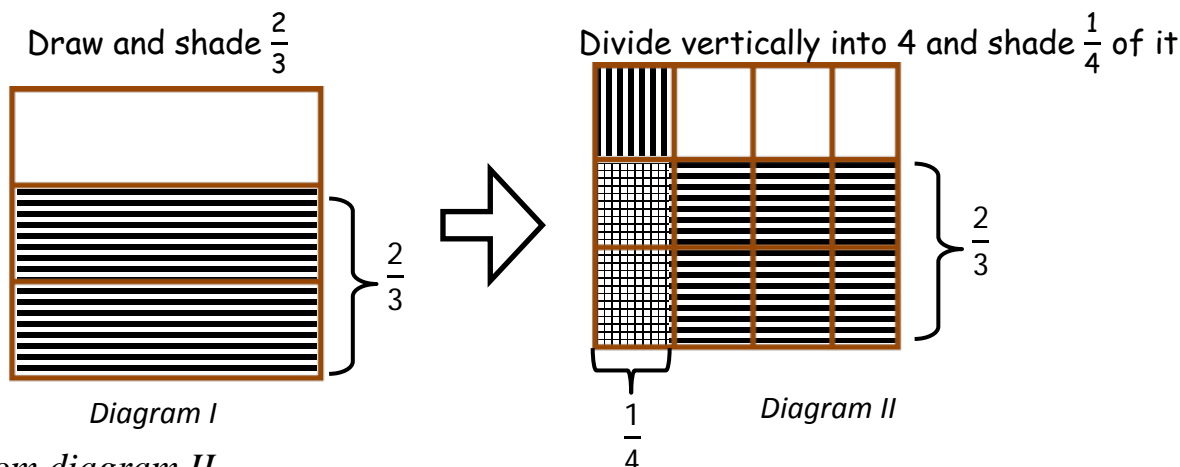
$\frac{5}{9}$ x 360 litres

5 x 40 litres

200 litres

Example 2

A tank was $\frac{2}{3}$ full of water. When $\frac{1}{4}$ of the water in the tank was drawn, 1200 litres remained. Find the capacity of the tank.

Draw and shade $\frac{2}{3}$ Divide vertically into 4 and shade $\frac{1}{4}$ of it

Diagram I   Diagram II

From diagram II

- The double shaded parts represent the fraction of water drawn (2 out of 12) or $\frac{2}{12}$

- The single shaded (of the two thirds) represent the fraction of water that remained in the tank (6 out of 12) or $\frac{6}{12}$. The 6 parts hold 1200 litres of water altogether. This means that each part hold 200 litres because (1200 ÷ 6 = 200) and the 12 parts hold 2400 litres.

Therefore; the capacity of the tank is 2400 litres.

See this approach

Fraction drawn

$\frac{1}{4}$ of $\frac{2}{3}$ = $\frac{1}{4}$ x $\frac{2}{3}$

$\qquad = \frac{1}{6}$

Fraction remained

$\frac{2}{3} - \frac{1}{6} = \frac{4 - 1}{6}$

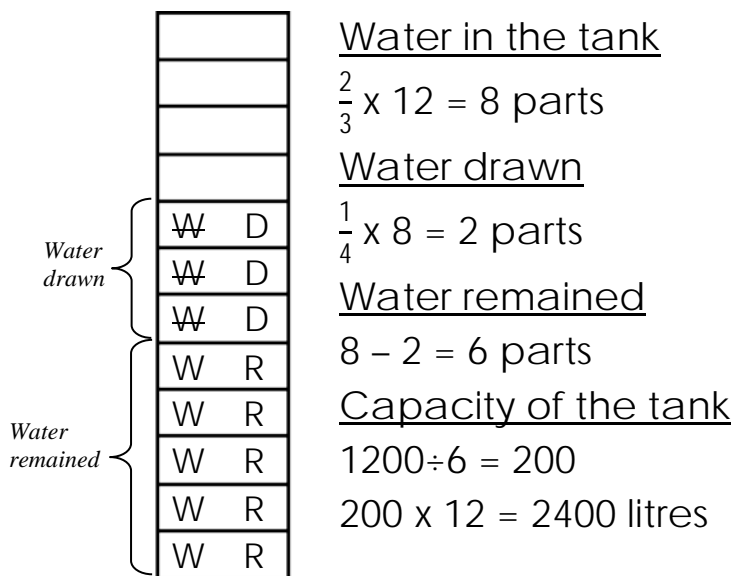$\qquad = \frac{3}{6}$

$\qquad = \frac{1}{2}$

Capacity of the tank
1 part represents 1200 litres
2 parts represent 1200 litres
$\qquad\qquad$ x 2
$\qquad$ 2400 litres

More diagrams

Common denominator = 12

Water in the tank
$\frac{2}{3}$ x 12 = 8 parts

Water drawn
$\frac{1}{4}$ x 8 = 2 parts

Water remained
8 – 2 = 6 parts

Capacity of the tank
1200÷6 = 200
200 x 12 = 2400 litres

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Example 3

A tank was $\frac{2}{3}$ full of water. When some water equivalent to $\frac{1}{4}$ of the water in the tank was added, 300 litres were needed to fill the tank. Find in litres, the capacity of the tank.

Fraction added	New fraction	Fraction needed	Capacity of the tank
$\frac{1}{4}$ of $\frac{2}{3}$	$\frac{2}{3} + \frac{1}{6}$	$\frac{6}{6} - \frac{5}{6}$	1 part rep 300 litres
$\frac{1}{4}$ x $\frac{2}{3}$	$\frac{4+1}{6}$	$\frac{6-5}{6}$	6 parts rep 300 litres
$\frac{1}{6}$	$\frac{5}{6}$	$\frac{1}{6}$	$\frac{\text{x } 6}{18\ 00 \text{ litres}}$

Example 4

In a school, $\frac{2}{5}$ of the boys are in lower primary classes and $\frac{3}{4}$ of the girls are in upper primary classes. The total number of pupils in upper primary classes is 420. The fraction of girls in the school is $\frac{2}{3}$. Find the total number of pupils in the school.

Fraction of girls in upper primary

$\frac{3}{4}$ of $\frac{2}{3}$

$\frac{3}{4}$ x $\frac{2}{3}$

$\frac{1}{2}$

Fraction of boys

$\frac{3}{3} - \frac{2}{3}$

$\frac{3-2}{3}$

$\frac{1}{3}$

Fraction of boys in upper primary

$(\frac{5}{5} - \frac{2}{5})$ of $\frac{1}{3}$

$\frac{3}{5}$ x $\frac{1}{3}$

$\frac{1}{5}$

Fraction of pupils in upper primary

$\frac{1}{5} + \frac{1}{2}$

$\frac{2+5}{10}$

$\frac{7}{10}$

Total number of pupils

7 parts represent 420 pupils

1 part represents (420 ÷ 7) pupils

1 part represents 60 pupils

10 parts represent (10 x 60) pupils

10 parts represent 600 pupils

Exercise 5:33

1. A bucket was $\frac{3}{4}$ full of water. When 3 litres were used, it became $\frac{1}{2}$ full. What is the capacity of the bucket?

2. Jackie had $\frac{4}{5}$ of a cake. She ate 100grams. The fraction of the cake remained with was $\frac{2}{3}$. Find in grams the total mass of the cake

3. When $\frac{3}{4}$ of a number is reduced by half of it, the result is 6. Find $\frac{5}{6}$ of that number.

4. Binojo got $\frac{2}{3}$ of his father's land. He gave $\frac{1}{3}$ of what he was given to his son and used the remaining 16 hectares for crop growing.
   a) What fraction of land did Binojo give to his son?
   b) Find the total area of land Binojo's father had.

5. A tank was $\frac{3}{4}$ full of water. When 300 litres were sold, $\frac{1}{6}$ of it remained. Find in litres, the amount of water the tank can hold when completely full.

6. A pen was $\frac{3}{4}$ full of ink. When $\frac{2}{3}$ of the ink was used, the remaining ink wrote 40 pages. How many pages would the pen write when full of ink?

7. Ainembabazi covered half of her journey. She covered $\frac{3}{4}$ of it by bus and 24km by taxi.
   a) How long was her journey?
   b) What distance was not covered?

8. In a school, the fraction of boys is $\frac{2}{3}$. Three quarters of the girls and $\frac{1}{2}$ of the boys eat meat. Given that 210 pupils in the school eat meat. Find the total number of pupils in the school.

9. At a party, $\frac{3}{5}$ of the guests were females and the rest were males. $\frac{5}{9}$ of the female guests were girls and $\frac{5}{12}$ of the male guests were boys. The party was attended by 80 children.
   a) Find the fraction of children who attended the party.
   b) How many men attended the party?

10. In a school, $\frac{3}{7}$ of the pupils are boarders. $\frac{5}{12}$ of the day scholars do not speak Kiswahili while $\frac{14}{15}$ of the boarders speak Kiswahili. The number of pupils who speak Kiswahili in the school is 154. Find the number of pupils who do not speak Kiswahili.

11. $\frac{2}{3}$ of Akim's salary is equal to $\frac{3}{4}$ of Amuke's salary. If Akim's salary is sh. 480000, find Amuke's salary.

12. On a farm, there were bulls and cows. The fraction of cows was $\frac{3}{5}$. When some bulls were slaughtered, the fraction of bulls became $\frac{1}{3}$. There were 60 cows on the farm. How many bulls were slaughtered?

13. Chaplin left town X for town Y. His car fuel tank was $\frac{5}{8}$ full of diesel. By the time he got to town Y, the fuel tank was $\frac{1}{6}$ full and he still needed 14 litres of diesel to get back to town X through the same route. How much diesel does his car fuel tank hold when $\frac{3}{4}$ full?

14. When 40 pupils in the class are present, $\frac{1}{3}$ of the pupils are absent. Find the number of pupils present when $\frac{2}{5}$ of the pupils are absent.

DECIMAL FRACTIONS

A decimal fraction is a fraction whose denominator is a power of ten and is therefore expressed using a decimal point. For example: 0.79 is a decimal equivalent to $\frac{79}{100}$. The dot called a decimal point is used to separate whole numbers from fraction parts.

Place values of decimals
A place value is the position name of a digit in a number.

Study the table below

Whole number			Fraction part		
	Ones		tenths ($\frac{1}{10}$ or 0.1)	hundredths ($\frac{1}{100}$ or 0.01)	thousandths ($\frac{1}{1000}$ or 0.001)
	0	.	5	8	9

From the table above, the place value of;
(i) 5 is tenths
(ii) 8 is hundredths
(iii) 9 is thousandths

You should also remember that;
(i) 0.5 is read as "*zero point five*" and it means five tenths ($\frac{5}{10}$)

(ii) 0.08 is read as "*zero point zero eight*" and it means eight hundredths ($\frac{8}{100}$)

(iii) 0.009 is read as "*zero point zero zero nine*" and it means nine thousandths ($\frac{9}{1000}$)

Example 1
State the place value of each digit in 3.848

O		t	h	th
3	.	8	4	6

→ thousandths
→ hundredths
→ tenths
→ Ones

The place value of 3 is ones   *The place value of 4 is hundredths*
The place value of 8 is tenths   *The place value of 6 is thousandths*

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Example 2

What is the place value of 6 in 4.3695?

O		t	h	th	tth
4	.	3	6	9	5

The place value of 6 is hundredths

Example 3

Write the place value of the underlined digit in 84.967

T	O		t	h	th
8	4	.	9	6	7

The place value of 9 is tenths

How to write decimals in words without using the word "point"

➢ Read the number to the left of the decimal point and write it in word form.

➢ Replace the decimal point with "and"

➢ Read the number to the right of the decimal point and write it in word form.

➢ Count the number of digits to the right of the decimal point and add the appropriate place value in the end of the number in step three.

➢ Combine all the words.

e.g. 84.967 can be read as *Eighty four and nine hundred sixty seven thousandths*

Exercise 1:1

1. Write the following in words.
   - a) 1.3
   - b) 3.48
   - c) 8.009
   - d) 0.567
   - e) 43.259
   - f) 23.004
   - g) 15.6
   - h) 1246.94
   - i) 201.25
   - j) 4.125
   - k) 23.207
   - l) 1995.287

2. Without using the word "point", write the following in words.
   - a) 0.7
   - b) 0.08
   - c) 0.029
   - d) 0.567
   - e) 1.259
   - f) 5.004
   - g) 6.05
   - h) 3.904
   - i) 6.125
   - j) 23.05
   - k) 154.6
   - l) 195.207

3. What is the place value of each digit in the following numbers;
   - a) 2.7
   - b) 0.78
   - c) 8.29
   - d) 4.57
   - e) 0.258
   - f) 5.014
   - g) 12.5
   - h) 123.94
   - i) 7.105
   - j) 27.05
   - k) 154.64
   - l) 1095.237

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4. What is the place value of 6 in each of the following;
    a) 0.64   c) 1.06   e) 5.9864
    b) 1.126   d) 14.6   f) 32.462

5. Underline the digit in hundredths place in each of the following;
    a) 0.23   d) 0.708   g) 7.123
    b) 0.124   e) 0.4572   h) 23.524
    c) 0.541   f) 0.693   i) 156.123

6. Write the following in figures.
    a) Zero point zero four.
    b) Six point zero two three.
    c) Seven point two five.
    d) Fourteen point zero two.
    e) One hundred fifty six point eight.
    f) Nine hundred three point zero one.
    g) Two point zero six nine seven.
    h) Seven tenths.
    i) Twelve thousandths.
    j) Two and six tenths.
    k) Six and two hundredths.
    l) Twelve and six tenths.
    m) Twenty three and four hundredths.
    n) Five hundred nine and two tenths.
    o) Two and two hundred one thousandths.
    p) Sixteen and thirteen thousandths.
    q) Four and eleven thousandths.
    r) Ninety and twenty three hundredths.
    s) One hundred sixteen and three tenths.
    t) Seven and twelve hundred thousandths.
    u) Four and four ten thousandths.
    v) Thirteen and thirteen thousandths.

Values of digits in decimal fractions

The value of a digit is the product of a digit and its place value.

$$Value = digit \times place\ value$$

Example 1

Find the value of each digit in 7.98.

O		t	h
7	.	9	8

$8 \times \dfrac{1}{100} = 0.08$

$9 \times \dfrac{1}{10} = 0.9$

$7 \times 1 = 7$

The value of 7 is 7

The value of 9 is 0.9

The value of 8 is 0.08

Example 2

Find the sum of the value of 2 and the value of 8 in 423. 86

H	T	O		t	h
4	2	3	.	8	6

$8 \times \dfrac{1}{10} = 0.8$

$2 \times 10 = 20$

Sum

$$\begin{array}{r} 20.0 \\ +\ 0.8 \\ \hline 20.8 \\ \hline \end{array}$$

Exercise 1:2

1. Find the value of each digit in the numbers below;

   a) 0.4   e) 0.259   i) 6.127
   b) 1.08   f) 5.014   j) 3.165
   c) 3.529   g) 9.25   k) 194.8
   d) 4.567   h) 7.974   l) 165.287

2. Find the value of 8 and 9 in 84.395.
3. Circle the digit whose value is 0.03 in 33.3333.
4. Work out the value of the underlined digit in 3.5<u>6</u>2.
5. Find the value of the digit in the tenths place in 54.76.
6. Given the number: 32.567;
   a) Write the given number in words.
   b) Find the value of 7 in the above number.
   c) Work out the sum of the value of 3 and the value of 5 in the given number.

7. Find the value of the digit in the hundredths place in 2.0435
8. Given the number: 543.908
   a) Write the given number in words.
   b) State the place value of 3 in the above number.
   c) Work out the sum of the value of 5 and the value of 8 in the given number.

9. Given the number: "Twelve and seven hundred sixty four ten thousandths.
   a) Write the given number in figures.
   b) State the place value of 2 in the above number.
   c) Work out the sum of the value of 7 and the value of 4 in the given number.
   d) Find the difference between the value of 1 and 6 in the given number above.
   e) Write the place value of each digit in the given number above.

10. Given the number: Six point zero two seven.
    a) Write the given number in figures
    b) State the place value of 2 in the number.
    c) Find the value of 7 in the number.

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Expanding decimal fractions

Examples

Expand 3.405

i) using place values

O		t	h	th
3	.	4	0	5

$(3 \times 1) + (4 \times \frac{1}{10}) + (5 \times \frac{1}{1000})$

ii) using values

O		t	h	th
2	.	4	5	6

$(2 \times 1) + (4 \times \frac{1}{10}) + (5 \times \frac{1}{100}) + (6 \times \frac{1}{1000})$

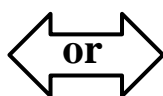$(2 \times 1) + (4 \times 0.1) + (5 \times 0.01) + (6 \times 0.01)$

$2 + 0.4 + 0.05 + 0.006$

iii) using exponents/powers/indices

O		t	h	th
3	.	4	0	5

$(3 \times 1) + (4 \times \frac{1}{10}) + (5 \times \frac{1}{100})$

$(3 \times 10^0) + (4 \times 10^{-1}) + (5 \times 10^{-2})$

or

Place value	O		t	h	th
Power of 10	10^0		10^{-1}	10^{-2}	10^{-3}
Digit	3	.	4	0	5

$3.405 = (3 \times 10^0) + (4 \times 10^{-1}) + (5 \times 10^{-2})$

Exercise 1:3

1. Expand the following using place values.
   a) 0.23   d) 4.75   g) 7.103
   b) 0.12   e) 3.457   h) 53.924
   c) 0.541   f) 12.69   i) 456.123

2. Expand using values.
   a) 0.37   d) 5.72   g) 5.173
   b) 5.4   e) 9.407   h) 3.948
   c) 0.501   f) 2.693   i) 956.187

3. Expand using powers of ten.
   a) 3.7   d) 6.72   g) 9.73
   b) 0.45   e) 8.417   h) 2.098
   c) 2.51   f) 0.693   i) 907.284

4. Expand 45.608 using exponents.

5. Given the number: Four and seventeen thousandths
   a) Write the given number in figures.
   b) Expand the given number using exponents.

Finding the expanded numbers

Example 1

What number has been expanded to give $(2 \times 10) + (3 \times \frac{1}{10}) + (5 \times \frac{1}{100})$

$(2 \times 10) + (3 \times \frac{1}{10}) + (5 \times \frac{1}{100})$
$(2 \times 10) + (3 \times 0.1) + (5 \times 0.01)$
$20 + 0.3 + 0.05$

```
  20.00
   0.30
+  0.05
  20.35
```

Example 2

Find the number whose expanded form is $0.8 + 0.04 + 0.0009$

```
   0.8000
   0.0400
+  0.0009
   0.8409
```

Example 3

Find the number that has been expanded to give; $(6 \times 10^{-1}) + (4 \times 10^{-2}) + (8 \times 10^{-4})$

$(6 \times 10^{-1}) + (4 \times 10^{-2}) + (8 \times 10^{-4})$
$(6 \times \frac{1}{10}) + (4 \times \frac{1}{100}) + (8 \times \frac{1}{10000})$
$(6 \times 0.1) + (4 \times 0.01) + (8 \times 0.0001)$
$0.6 + 0.04 + 0.0008$

```
   0.6000
   0.0400
+  0.0008
   0.6408
```

Exercise 1:4

1. Express each of the following as a single numeral.
   a) 0.03 + 0.005
   b) 20 + 0.04 + 0.007
   c) 3 + 0.9 + 0.008
   d) 6 + 0.7 + 0. 09
   e) 30 + 7 + 0.02 + 0.009
   f) 500 + 6 + 0.4
   g) 10 + 0.5 + 0.006
   h) 0.6 + 0.09 + 0.0008
   i) 3 + 0.08 + 0.007 + 0.0003
   j) 30 + 2 + 0.7 + 0.04 + 0.006
   k) 500 + 40 + 0.5 + 0.002
   l) 2000 + 30 + 8 + 0.6 + 0.008
   m) 80 + 9 + 0.6 + 0.005 + 0.0007 + 0.00002
   n) 70 + 2 + 0.6 + 0.04 + 0.0005

2. Find the numbers expanded below.

a) $(3 \times \frac{1}{10}) + (5 \times \frac{1}{1000})$

b) $(9 \times 1) + (4 \times \frac{1}{100}) + (2 \times \frac{1}{1000})$

c) $(4 \times 1) + (6 \times \frac{1}{10}) + (7 \times \frac{1}{100}) + (2 \times \frac{1}{10000}) + (5 \times \frac{1}{100000})$

d) $(3 \times 10) + (2 \times 1) + (4 \times \frac{1}{10}) + (9 \times \frac{1}{100}) + (1 \times \frac{1}{1000}) + (8 \times \frac{1}{10000})$

e) $(7 \times 100) + (6 \times 1) + (2 \times \frac{1}{100}) + (5 \times \frac{1}{1000}) + (2 \times \frac{1}{10000}) + (3 \times \frac{1}{100000})$

3. Simplify: $90 + 6 \times \frac{1}{1000}$

4. What is the expanded number below?

a) $(2 \times 10^0) + (3 \times 10^{-2})$

b) $(9 \times 10^{-1}) + (6 \times 10^{-2})$

c) $(3 \times 10^2) + (4 \times 10^{-3})$

d) $(7 \times 10^1) + (4 \times 10^0) + (2 \times 10^{-2})$

e) $(4 \times 10^1) + (8 \times 10^0) + (9 \times 10^{-2}) + (7 \times 10^{-3})$

f) $(8 \times 10^3) + (7 \times 10^0) + (4 \times 10^{-1}) + (5 \times 10^{-2}) + (9 \times 10^{-4})$

g) $(2 \times 10^2) + (6 \times 10^1) + (3 \times 10^0) + (9 \times 10^{-1}) + (2 \times 10^{-2})$

Rounding off decimals

Example 1

Round off 2.63 to the nearest tenth.

```
          RPV
   O      t  ¦  h
   2  .   6  ¦  3
+  0  .   0  ¦
_____
   2  .   6  ¦
```

2.63 ≈ 2.6

Example 2

Round off 63.495 to the nearest hundredth.

```
                RPV
   T   O      t   h  ¦  th
   6   3  .   4   9  ¦  5
+      0  .   0   1  ¦
_____
   6   3  .   5   0  ¦
```

63.495 ≈ 63.50

Exercise 1:5

1. Round off the following to the nearest tenth.

a) 3.53

b) 4.825

c) 25.64

d) 3.456

e) 32.482

f) 6.7829

g) 45.993

h) 8.654

i) 3.6785

By Sseggayi Benjamin Kasuka

2. Round off;
   a) 48.32 to the nearest whole number
   b) 6.349 to the nearest hundredth.
   c) 49.849 to the nearest tenth.
   d) 99.45692 to the nearest ten thousandth.

3. Round off 32.5678 to the nearest tenth.

Changing common fractions into decimals

Example 1

Express $\frac{3}{4}$ as a decimal.

$$\begin{array}{r} 0.7\,5 \\ 4\,\overline{)3.0\,0} \end{array}$$

$0 \times 4 = \underline{-0} \downarrow$
$3\,0$
$7 \times 4 = \underline{-2\,8} \downarrow$
$2\,0$
$5 \times 4 = \underline{-2\,0}$
$0\,0$

Steps
- *Divide (÷)*
- *Multiply (÷)*
- *Subtract (-)*
- *Bring down (↓)*

$\frac{3}{4} = 0.7\,5$

Example 2

Convert $\frac{7}{8}$ into a decimal

$$\begin{array}{r} 0.8\,7\,5 \\ 8\,\overline{)7.0\,0\,0} \end{array}$$

$0 \times 8 = \underline{-0} \downarrow$
$7\,0$
$8 \times 8 = \underline{-6\,4} \downarrow$
$6\,0$
$7 \times 8 = \underline{-5\,6} \downarrow$
$4\,0$
$5 \times 8 = \underline{-4\,0}$
$0\,0$

$\frac{7}{8} = 0.875$

Exercise 1:6

1. Express the following as decimals.
   a) $\frac{1}{4}$
   b) $\frac{2}{5}$
   c) $\frac{4}{5}$
   d) $\frac{5}{8}$
   e) $\frac{1}{5}$
   f) $\frac{3}{8}$
   g) $\frac{3}{4}$
   h) $\frac{1}{8}$
   i) $\frac{1}{2}$
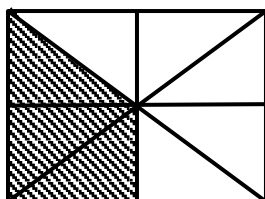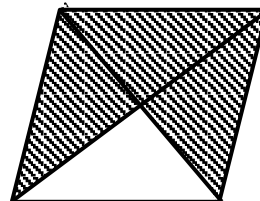   j) $\frac{3}{16}$
   k) $\frac{5}{32}$
   l) $\frac{13}{16}$

2. Express the shaded part as a decimal fraction.
   a)
   b)

Converting decimals into common fractions

Example 1

Convert 0.6 into a common fraction.

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

$$0.6 = \frac{6 \div 2}{10 \div 2}$$

$$0.6 = \frac{3}{5}$$

Example 2

Convert 0.375 into a common fraction.

$$0.375 = \frac{375}{1000}$$

$$0.375 = \frac{375 \div 25}{1000 \div 25}$$

$$0.375 = \frac{15 \div 5}{40 \div 5}$$

$$0.375 = \frac{3}{8}$$

Exercise 1:7

1. Express the following as a simplified common fraction.

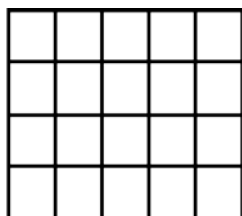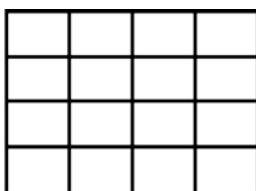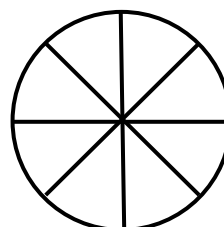|			
a) 0.2	e) 0.25	i) 0.375	
b) 0.5	f) 0.125	j) 1.25	
c) 0.3	g) 0.75	k) 0.1875	
d) 0.05	h) 0.225	l) 0.875	

2. In the figures below, shade;

    a) 0.7   b) 0.75   c) 0.375

Recurring decimals

Note: A recurring decimal, also known as a repeating decimal, is a number containing an infinitely repeating digit – or series of digits – occurring after the decimal point. For example 0.3333 recurring, or 1.2454545 recurring.

The recurring digit or digits are typically identified by a dot placed above them, like 0.3 with a dot above the 3, or 1.245 with dots above both the 4 and 5. Where there is a long series of repeating digits, dots appear above the first and last digits of the recurring sequence. For example, for 0.185185 recurring, you would see dots above both the 3 and the 5 or three dots as shown below; 0.3̇, 1.24̇5̇, 0.1̇85̇ or 0.333…, 1.24545…, 0.185185…

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Writing common fractions as recurring decimals

Example 1

Write $\frac{2}{3}$ as a recurring decimal.

```
              0.6 6 6 …
          3) 2.0 0 0
  0x3 =   -0
            2 0
  6x3 =  -1 8
            2 0
  6x3 =    -1 8
             2 0
  6x3 =      -1 8
               2
```

$\frac{2}{3}$ = 0.666…

Example 2

Express $\frac{4}{15}$ as a recurring decimal

```
                0.2 6 6 …
            15) 4.0 0 0
  0x15 =    -0
              4 0
  2x15 =   -3 0
            1 0 0
  6x15 =     -9 0
            1 0 0
  6x15 =       -9 0
               1 0
```

$\frac{4}{15}$ = 0.266…

Exercise 1:8

1. Express the following as recurring decimals;

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

   b) $\frac{1}{9}$

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

   d) $\frac{4}{9}$

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

   f) $\frac{4}{11}$
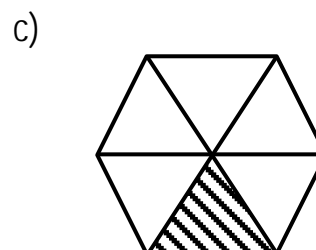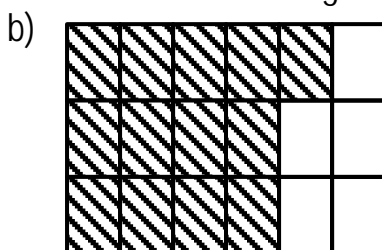
   g) $\frac{8}{15}$

   h) $\frac{7}{15}$

   i) $\frac{7}{30}$

   j) $\frac{5}{11}$

   k) $\frac{10}{99}$

   l) $\frac{11}{90}$

2. Express the un shaded fractions as recurring decimals

   a)   b)   c)

3. Express as a recurring decimal, the difference between $\frac{5}{6}$ and $\frac{2}{3}$

4. Convert the sum of $\frac{3}{4}$ and $\frac{5}{36}$ into a recurring decimal.

5. Write the square root of $\frac{49}{225}$ as a recurring decimal.

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Changing recurring decimals to common fractions

Example 1

Express 0.333... as a simplified common fraction

Let the fraction be y

$y = 0.333...$ (i)

$10 \times y = 10 \times 0.333...$

$10y = 3.333...$ (ii)

(ii) − (i)

$10y = 3.333...$

$- y = 0.333...$

$9y = 3.000$

$\dfrac{9y}{9} = \dfrac{3}{9}$

$y = \dfrac{1}{3}$

$\therefore 0.333... = \dfrac{1}{3}$

Approach 2

$0.\overline{3}3\,3...$

$\dfrac{3 - 0}{10 - 1}$

$\dfrac{3}{9}$

$\dfrac{1}{3}$

$\therefore 0.333... = \dfrac{1}{3}$

Example 2

Change 0.4242... to a simplified common fraction.

Let the fraction be h

$h = 0.4242...$ (i)

$100 \times h = 100 \times 0.4242...$

$100h = 42.4242...$ (ii)

(ii) − (i)

$100h = 42.4242...$

$- h = 0.4242...$

$99h = 42.0000$

$\dfrac{99h}{99} = \dfrac{42}{99}$

$h = \dfrac{14}{33}$

$\therefore 0.4242... = \dfrac{14}{33}$

Approach 2

$0.\overline{42}4\,2...$

$\dfrac{42 - 0}{100 - 1}$

$\dfrac{42}{99}$

$\dfrac{14}{33}$

$0.4242... = \dfrac{14}{99}$

Example 3

Express 0.233... as a simplified common fraction.

Let the fraction be p

$p = 0.233...$ (i)

$10 \times p = 10 \times 0.233...$

$10p = 2.333...$ (ii)

(ii) − (i)

$10p = 2.333...$

$- p = 0.233...$

$9p = 2.100$

$\dfrac{9p}{1} = \dfrac{21}{10}$

$10 \times \dfrac{9p}{1} = \dfrac{21}{10} \times 10$

$\dfrac{90p}{90} = \dfrac{21}{90}$

$p = \dfrac{7}{30}$

$\therefore 0.2333... = \dfrac{7}{30}$

Approach 2

Let the fraction be m

$m = 0.233...$ (i)

$10 \times m = 10 \times 0.233...$

$10m = 2.333...$ (ii)

$10 \times 10m = 10 \times 2.333...$

$100m = 23.333...$ (iii)

(iii) − (ii)

$100m = 23.333...$

$- 10m = 2.333...$

$90m = 21.000$

$\dfrac{90m}{90} = \dfrac{21}{90}$

$m = \dfrac{7}{30}$

$\therefore 0.2333... = \dfrac{7}{30}$

Approach 3

$0.2\overline{3}3...$

$\dfrac{23 - 2}{100 - 10}$

$\dfrac{21}{90}$

$\dfrac{7}{30}$

$0.233... = \dfrac{7}{30}$

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Exercise 1:9

1. Express 0.11… as a common fraction.
2. Express each of the following into a common fraction.

   a) 0.22…   e) 1.666   i) 0.999 …
   b) 0.444…   f) 2.333 …   j) 8.3̇
   c) 0.666…   g) 1.7̇   k) 1.4̇4̇
   d) 0.555…   h) 3.6̇   l) 13.6̇

3. Convert each of the following into a simplified common fraction

   a) 0.121212…   e) 0.7272…   i) 0.6̇3̇
   b) 0.2424…   f) 0.1515…   j) 0.8484…
   c) 0.4242…   g) 0.2121…   k) 1.0606…
   d) 0.5454…   h) 0.3636 …   l) 6.9696…

4. Express the following as rational numbers.

   a) 0.144…   d) 0.211…   g) 0.1̇23̇
   b) 0.2666…   e) 0.466…   h) 0.216216…
   c) 0.433…   f) 0.96̄   i) 0.18383…

Comparing and ordering decimal fractions
Change each of the given decimals into common fraction
Multiply each of the given fraction by the LCD

Exercise 1:10

1. Use <, > or = to complete the statements below.

   (i) 0.2 _____ 0.3   (iii) 0.03 _____ 0.12   (v) 0.6 _____ 0.04
   (ii) 0.5 _____ 0.7   (iv) 0.125 _____ 0.2   (vi) 1.35 _____ 1.243

2. Arrange 0.02, 0.08, 0.04 and 0.5 starting with the smallest.

3. Arrange the following in decreasing order

   a) 0.05, 0.2, 0.73, 0.9   d)   3.2, 0.125, 1.2, 0.5
   b) 1.2, 4.7, 0.53, 0.4   e)   0.8, 1.2, 0.06, 2.0
   c) 0.8, 0.01, 0.7, 0.3   f)   0.3, 0.9, 0.4, 0.7

4. Arrange 0.15, 0.102, 1.1, 0.079 and 0.9 in ascending order.

5. Matayo bought 3.8kg of sugar and 3.75kg of rice. Which item did he buy most?

6. Circle the decimal equivalent to 0.9

   0.99   0.09   0.90   9.0

7. Joan and Moses were running on a track. Joan took 21.8 minutes and Moses took 20.85 minutes. Who completed quickly?

OPERATIONS ON DECIMALS
Addition and subtraction of decimals

Example 1	Example 2	Example 3
Work out: 6.25 + 7	Take away 0.178 from 2.56	Work out: 2.4 – 5.62 + 4

Example 1

Work out: 6.25 + 7

$$\begin{array}{r} 6.25 \\ +\ 7.00 \\ \hline 13.25 \end{array}$$

Example 2

Take away 0.178 from 2.56

$$\begin{array}{r} 2.560 \\ -\ 0.178 \\ \hline 2.382 \end{array}$$

Example 3

Work out: 2.4 – 5.62 + 4

2.4 – 5.62 + 4
2.4 + 4 – 5.62

$$\begin{array}{r} 2.4 \\ +\ 4.0 \\ \hline 6.4 \end{array} \qquad \begin{array}{r} 6.40 \\ -\ 5.62 \\ \hline 0.78 \end{array}$$

Exercise 1:11

1. Work out the following:
   a) 3.48 + 1.6
   b) 9.324 + 0.489
   c) 0.03 + 0.12
   d) 0.569 + 3
   e) 0.56 + 9.56
   f) 0.784 + 1.234
   g) 3.123 + 2.43
   h) 23.23 + 5.378
   i) 643.978 + 34.567
   j) 12.738 + 8.88
   k) 36.75 + 6.7
   l) 4.9 + 426.5

2. Work out the following:
   a) 3.5 – 2.1
   b) 5.6 – 0.9
   c) 4.675 – 2.138
   d) 7.87 – 2.9
   e) 6.7 – 0.03
   f) 23.87 – 1.564
   g) 8.76 – 6.3425
   h) 12.6 – 0.07
   i) 4 – 1.125
   j) 8 – 0.8
   k) 15.7 – 6.972
   l) 3 – 1.26548

3. Work out:
   a) 2.3 + 4.2 – 1.4
   b) 4.5 + 1.5 – 2.6
   c) 5.7 + 3.4 – 6.9
   d) 4.8 + 8.6 – 9.7
   e) 4 + 1.2 – 3.4
   f) 3.4 + 2 – 1.9
   g) 7 + 1.5 – 3.542
   h) 1.78 + 5.6584 – 4.97
   i) 2.65 – 3.5 + 5.432
   j) 3 – 1.235 + 1.5
   k) 2.34 – 3.453 + 5.8
   l) 2.5463 – 5.9 + 6.324

Word problems involving addition and subtraction of decimals

Exercise 1:12

1. A tank had 348.35 litres of water. 56.47 litres were added. How much water was in the tank after?
2. Work out the sum of 0.53 and 7.86
3. Mike prepared 4.38 litres of juice on Saturday and 3.892 litres of juice on Sunday. How many litres of juice did Mike prepare in the four days?
4. Nsabohurira got 16.72 litres of milk from her cow in the morning and 9.348 litres of milk in the evening. How much milk did she get that day?
5. A bull weighs 256.245kg and a cow weighs 154.87kg. Find their total weight.
6. Town X is 5.62km away from town Y. Town Z is 4.9km from town Y. How far is town Z from town X?

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7. A cylindrical tin contained 3.08 litres of cooking oil. Cate used 2.156 litres of cooking oil. Find in litres, the amount of cooking oil that remained in the tin.

8. A nurse draws 1.456ml of AstraZeneca vaccine from a tin containing 5ml of the vaccine. Find in millilitres, the amount of vaccine that remained in the tin.

9. A fuel tank had 8642.6 litres of petrol. 45.978 litres were sold. How many litres of petrol remained?

10. A 10 litre jerry can contains 3.456 litres of water. Find in litres, the amount of water needed to fill the tank.

Multiplication of decimals

Example 1

Work out: 4.8 x 0.21

$$\frac{48}{10} \times \frac{21}{100}$$

$$\frac{48 \times 21}{10 \times 100}$$

$$\frac{1008}{1000}$$

1.008

Example 2

Work out: 3.5 x 7

$$\begin{array}{r} 3.5 \\ \times\ 7 \\ \hline 24.5 \end{array}$$

Or

$$\frac{35}{10} \times \frac{7}{1}$$

$$\frac{35 \times 7}{10}$$

$$\frac{245}{10}$$

24.5

Example 3

Multiply: 4.25 x 5.7

$$\begin{array}{r} 4.25 \\ \times\ 5.7 \\ \hline 2975 \\ +2125\ \ \\ \hline 24.225 \end{array}$$

Count 3 decimal places and locate the decimal point

Exercise 1:13
Work out the following

a) 0.2 x 0.4
b) 1.5 x 1.6
c) 1.2 x 0.15
d) 2.3 x 4.35
e) 0.72 x 0.2

e) 2.4 x 0.54
f) 0.8 x 0.9
g) 4.5 x 0.016
h) 32.5 x 12.6
i) 124.34 x 0.75

j) 3.45 x 0.543
k) 0.754 x 0.045
l) 0.9 x 0.007
m) 123.54 x 0.506
n) 4.025 x 12.225

Word problems involving multiplication of decimals

Example 1

Henry buys 0.75 litres of milk daily. How much milk does he buy in a week?

0.75 x 7

$$\frac{75}{100} \times \frac{7}{1}$$

$$\frac{75 \times 7}{100 \times 1}$$

$$\frac{525}{100} = 5.25 \text{ litres}$$

Example 2

A boy had 0.4 of a cake. He ate 0.75 of it What fraction of the cake did he eat?

$$0.4 \times 0.75 = \frac{4}{10} \times \frac{75}{100}$$

$$= \frac{4 \times 75}{10 \times 100}$$

$$= \frac{300}{1000}$$

$$= \frac{3}{10} \text{ or } 0.3$$

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Exercise 1:14

1. Find 0.5 of 0.24.
2. A pickup carries 1452.75kg of coffee per trip. Find in kilograms the mass of coffee the pickup will carry in 4 trips.
3. Katamba covers 3.25 kilometres in one hour. How far will he go in 8 hours moving at the same speed?
4. A container holds 14.225 litres of milk. How much milk will 15 similar containers hold?
5. The average weight of 4 children is 34.5kg. Find their total weight.
6. A dozen of books costs sh. 9800. How much money will Otim pay for 2.25 dozens of similar books?
7. A tank contained 2400 litres of water. 0.4 of the water in the tank was sold.
   a) Find in litres, the amount of water sold.
   b) Calculate the amount of litres that remained in the tank.
8. In a class of 120 pupils, 0.75 of them are girls and the rest are boys.
   a) Find the number of girls in the class.
   b) If 0.4 of the boys are day scholars, find the number of boys who are boarders.
9. Gaga had 0.2 of a bread. He gave 0.8 of it to his sister. What was he left with?

Squares and square roots of decimals

Example 1	Example 2	Example 3
Find the square of 0.36	Find the square of 1.5	Find the square root of 1.96

Example 1

$(0.36)^2$

0.36×0.36

$\frac{36}{100} \times \frac{36}{100}$

$\frac{36 \times 36}{100 \times 100}$

$\frac{1296}{10000}$

0.1296

Example 2

$(1.5)^2$

1.5×1.5

$\quad 1.5$

$\times\ \underline{1.5}$

$\quad 7\,5$

$+\ \underline{1\,5}$

$\quad \underline{2.2\,5}$

Example 3

$\sqrt{1.96}$

$\sqrt{\frac{196}{100}}$

$\sqrt{\frac{2 \times 2 \times 7 \times 7}{2 \times 2 \times 5 \times 5}}$

$\frac{2 \times 7}{2 \times 5}$

$\frac{14}{10}$

1.4

2	196
2	98
7	49
7	7
	1

2	100
2	50
5	25
5	5
	1

Exercise 1:15

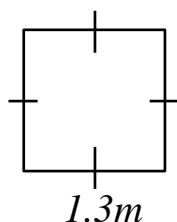1. Find the square of each of the following:

a)	0.6	d)	0.006	g)	19.5
b)	1.2	e)	5.6	h)	25.25
c)	0.24	f)	9.12	i)	153.08

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2. Calculate the area of each of the squares below;

a)

1.3m

b)

2.6cm

c)

0.085km

3. Find the square root of each of the following;

a) 0.09	d) 1.69	g) 1.69
b) 0.16	e) 0.81	h) 6.25
c) 1.44	f) 2.25	i) 39.69

4. Find the length of each side of a square whose area is;

a) $0.49m^2$	c) $0.25dm^2$	e) $1.21cm^2$
b) $0.09m^2$	d) $0.64m^2$	f) $7.29cm^2$

5. The area of a square flower garden is $4.41m^2$. Work out the total distance around it.

Division of decimals

Example 1

Work out: $9.8 \div 0.07$

$9.8 \div 0.07$

$\dfrac{98}{10} \div \dfrac{7}{100}$

$\dfrac{98}{10} \times \dfrac{100}{7}$

14×10

140

Example 2

Simplify: $0.561 \div 11$

$0.561 \div 11$

$\dfrac{561}{1000} \div \dfrac{11}{1}$

$\dfrac{\overset{51}{\cancel{561}}}{1000} \times \dfrac{1}{\underset{1}{\cancel{11}}}$

$\dfrac{51}{1000}$

0.051

Example 3

Work out: $75 \div 1.5$

$75 \div 1.5$

$\dfrac{75}{1} \div \dfrac{15}{10}$

$\dfrac{\overset{5}{\cancel{75}}}{1} \times \dfrac{10}{\underset{1}{\cancel{15}}}$

$\dfrac{5 \times 10}{1 \times 1}$

50

Exercise 1:16

Work out:

a) $0.3 \div 0.6$	g) $9.8 \div 0.7$	m) $111 \div 0.3$
b) $0.2 \div 0.04$	h) $4.2 \div 0.14$	n) $810 \div 0.6$
c) $6.75 \div 1.5$	i) $6.5 \div 1.3$	o) $192 \div 1.6$
d) $2.8 \div 2$	j) $0.169 \div 1.3$	p) $2.4 \div 12$
e) $6.12 \div 0.6$	k) $4.8 \div 0.012$	q) $6.4 \div 16$
f) $6.25 \div 0.25$	l) $3.8 \div 0.08$	r) $70.11 \div 19$

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Word problems involving division of decimals

Example 1

A shopkeeper packed 16kg of sugar into 0.5kg sachets. How many sachets did the shopkeeper make?

$16kg \div 0.5kg$

$\frac{16}{1} \div \frac{5}{10}$

$\frac{16}{1} \times \frac{\cancel{10}^{2}}{\cancel{5}_{1}}$

$\frac{16 \times 2}{1 \times 1}$

32 sachets

Example 2

A bread of mass 1.08 kg was shared by 9 boys. Find in kg the mass of bread each boy got.

$1.08kg \div 9$

$\frac{108}{100} \div \frac{9}{1}$

$\frac{108}{100} \times \frac{1}{9}$

$\frac{12 \times 1}{100 \times 1}$

0.12kg

Exercise 1:17

1. A shopkeeper uses a container of capacity 0.385 litres to sell cooking oil. On a certain day, the shopkeeper sold 15.4 litres of cooking oil. How many such containers were sold?
2. The total mass of tins of honey in a box is 20kg. The mass of each tin is 0.125kg. Find the number of tins of honey in the box.
3. Mawaya has a wire of length 12 metres. He cuts this wire into pieces of 1.5 metres each. How many pieces does he get?
4. My mother has 8.75kg of salt to be packed in sachets of 0.25kg each. How many sachets of salt will she make?
5. How many 0.85 litre bottles can fill a 25.5 litre bucket with water?
6. Primary seven pupils shared a 1.35kg cake equally and each got 0.045kg. How many pupils shared the cake?
7. The product of two numbers is 0.32. If one of them is 1.6, find the other number.
8. How many 2.45 litre tins are contained in 39.2 litres of cooking oil?
9. Mutunzi bought 4.05 metres of cloth to make table cloths of 1.35 metres each. How many table cloths did he make?
10. Divide 1.62 by 0.06 then by 0.54
11. Kiplimo ran for a total of 59.5km in practice. He ran an average of 4.25km per day.
    a) For how many weeks did he practice?
    b) If he started on a Friday, what day of the week did he end his practice?
12. Apiding had 50 kilogrammes of sugar. When she sold some of the sugar she had in full sachets of 0.75 kilograms at sh 2800 per sachet, 31.25 kg of the sugar remained.
    a) How many full sachets of sugar were sold?
    b) Calculate the total amount of money Apiding got from the sugar she sold.

By Sseggayi Benjamin Kasuka

Mixed operations on decimals

Example 1

Work out: $\dfrac{0.6 \times 0.8}{0.24}$

$(0.6 \times 0.8) \div 0.24$

$\left(\dfrac{6}{10} \times \dfrac{8}{10}\right) \div \dfrac{24}{100}$

$\dfrac{6}{10} \times \dfrac{8}{10} \times \dfrac{100}{24}$

$\dfrac{\cancel{6}^{2}}{\cancel{10}} \times \dfrac{\cancel{8}^{1}}{\cancel{10}} \times \dfrac{\cancel{100}}{\cancel{24}_{3}}_{1}$

2×1

2

Example 2

Simplify: $\dfrac{5.6 \times 0.24}{0.7 \times 0.6}$

$(5.6 \times 0.24) \div (0.7 \times 0.6)$

$\left(\dfrac{56}{10} \times \dfrac{24}{100}\right) \div \left(\dfrac{7}{10} \times \dfrac{6}{10}\right)$

$\dfrac{56}{10} \times \dfrac{24}{100} \times \dfrac{10}{7} \times \dfrac{10}{6}$

$\dfrac{32}{10}$

3.2

Example 3

Work out: $\dfrac{3.9 + 3.6}{0.06 \times 0.5}$

$\begin{array}{r} 3.9 \\ +3.6 \\ \hline 7.5 \end{array}$ | $\dfrac{7.5}{0.06 \times 0.5}$

$\dfrac{75}{10} \div \left(\dfrac{6}{100} \times \dfrac{5}{10}\right)$

$\dfrac{75}{10} \times \dfrac{100}{6} \times \dfrac{10}{5}$

5×50

250

Example 4

Simplify: $\dfrac{24.05 - 3.89}{14.4 \div 15}$

$\begin{array}{r} 24.05 \\ -3.89 \\ \hline 20.16 \end{array}$ | $\dfrac{20.16}{14.4 \div 15}$

$\dfrac{2016}{100} \div \left(\dfrac{144}{10} \div \dfrac{15}{10}\right)$

$\dfrac{2016}{100} \div \left(\dfrac{144}{10} \times \dfrac{10}{15}\right)$

$\dfrac{2016}{100} \times \dfrac{10}{144} \times \dfrac{15}{10}$

$\dfrac{210}{100}$

2.1

Example 5

Work out: $(0.63 \div 0.25) + (0.12 \div 0.25)$

$(0.63 \div 0.25) + (0.12 \div 0.25)$

$(0.63 + 0.12) \div 0.25$

$\begin{array}{r} 0.63 \\ +0.12 \\ \hline 0.75 \end{array}$

$0.75 \div 0.25$

$\dfrac{75}{10} \div \dfrac{25}{100}$

$\dfrac{75}{100} \times \dfrac{100}{25}$

3

Exercise 1:18

1. Find the value of the unknowns;

a) $0.5 \times h = 1.7$

b) $\dfrac{k}{1.5} = 0.4$

c) $\dfrac{0.4 \times m}{0.6} = 0.5$

d) $\dfrac{x}{0.05 \times 2.4} = 1.5$

2. Work out

a) $\dfrac{0.4 \times 0.2}{0.8}$

f) $\dfrac{0.28 \times 0.08}{1.4 \times 0.4}$

k) $\dfrac{0.4 + 0.4}{0.4 \times 4}$

b) $\dfrac{0.8 \times 0.6}{0.15}$

g) $\dfrac{0.28 \times 0.81}{0.24 \times 4.2}$

l) $\dfrac{2.7 \times 4.8}{2.4 \times 3.6}$

c) $\dfrac{0.12 \times 0.6}{0.06}$

h) $\dfrac{0.64 \times 0.55}{0.11 \times 0.08}$

m) $\dfrac{1.45 + 2.15}{0.72 - 0.5}$

d) $\dfrac{0.25 \times 5.4}{0.045}$

i) $\dfrac{0.25 \times 0.4}{0.03 + 0.02}$

n) $\dfrac{0.75 + 0.25}{0.65 - 0.4}$

e) $\dfrac{0.12 \times 5.4}{0.03 \times 0.6}$

j) $\dfrac{1.5 \times 0.6}{1.2 - 0.3}$

o) $\dfrac{0.69 + 0.15}{(0.8)^2}$

3. Simplify:

a) $\dfrac{0.8}{1.6 \div 0.1}$

e) $\dfrac{2.4 \times 0.54}{1.08 \div 1.5}$

e) $\dfrac{0.96 + 0.24}{1.44 \div 1.6}$

b) $\dfrac{0.4 \times 0.2}{1.2 \div 1.5}$

d) $\dfrac{0.24 \times 0.6}{0.08 \times 0.5}$

f) $\dfrac{0.48 \times 0.2}{0.192 \times 1.2}$

4. Work out:

a) $(0.62 \times 0.8) - (0.17x 0.8)$

c) $(11.876 \div 0.75) + (0.124 \div 0.75)$

b) $(5.1 \div 0.14) - (0.9 \div 0.14)$

d) $6 \div 0.75$ of 1.2

5. Given that $\dfrac{x \times 0.6}{0.08 \times 0.5} = 1.8$. Find the value of x

6. Given that $\dfrac{1.2 \times y}{3.2 - 2.96} = 0.8$. Find the value of y

Word problems involving mixed operations on decimals

Example

Mzee Kiviiri sold full jerry cans of cooking oil at sh. 25000 each. The total amount of cooking oil Mzee Kiviiri sold was 24.3 litres. Given that each jerry can holds 4.86 litres when full. How much money did he collect altogether?

Jerry cans sold

$24.3 \div 4.86$

$\dfrac{243}{10} \div \dfrac{4.86}{100}$

$\dfrac{243}{10} \times \dfrac{100}{486}$

5 jerry cans

Amount of money collected

sh. 25000

$\dfrac{x \qquad 5}{\text{sh. } 125000}$

By Sseggayi Benjamin Kasuka

Exercise 1:19

1. A pick up carries 984.75kg of sand in a trip. How many kilograms of sand will it carry in 6 trips?
2. A farmer gets 18.45 litres of milk from his farm every day. How much milk does the farmer get in a week?
3. Chumbi had 8.75kg of salt and packed it in sachets of 0.25kg. He sold each sachet at sh. 450. How much money did he get?
4. A container full of salt weighs 22.69kg and 4.69kg when empty. The salt in the container is to be packed in sachets weighing 0.75kg each. How many sachets will be obtained?
5. The mass of a pickup with bags of cement is 11.25 tonnes. The mass of the pickup without cement is 7.5 tonnes. Find the number of 50kg bags of cement on the pickup.
6. A jerry can weighs 10.64 kg when full of water and 5.39kg when half full. Find in kg, the weight of the jerry can.
7. A basket weighed 21.85kg when full of pawpaws and 11.05kg when half full. The average weight of the pawpaws was 1.2kg
   a) Find the total weight of the pawpaws in a full basket.
   b) A trader had a basket full of pawpaws. He sold each pawpaw at sh.1500. How much money did the trader collect altogether?

More problems involving application of decimals in real life situation

Example

The fraction of boys is 0.2 less than the fraction of girls in a school. There are 240 girls in the school.

a) Find the fraction of girls in the school.

Let the fraction of girls be g

Girls	Boys	Total
g	g - 0.2	1

$$g + g - 0.2 = 1$$
$$2g - 0.2 = 1$$
$$2g - 0.2 + 0.2 = 1.0 + 0.2$$
$$2g = 1.2$$
$$\frac{2g}{2} = \frac{1.2}{2}$$
$$g = 0.6$$

The fraction of girls is 0.6 or $\frac{6}{10}$ or $\frac{3}{5}$

b) Find the total number of pupils in the school

Approach a

Let the total number of pupils be y

0.6 of y = 240

$$\frac{6}{10} \times y = 240$$

$$10 \times \frac{6y}{10} = 240 \times 10$$

$$\frac{6y}{6} = \frac{2400}{6}$$

y = 400 pupils

Approach b

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

6 parts represent 240

1 part represents $\frac{240}{6}$

1 part represents 40

10parts represent 40x10

10 parts represent 400

There are 400 pupils in the school
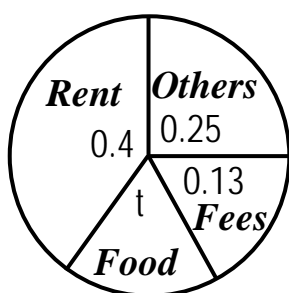
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Exercise 1:20

1. Pius, Bruno and Tendo shared some money. Pius got 0.3 of the total share, Bruno got 0.45 and Tendo got the rest which is sh. 5000.
   a) What fraction of the total share did Tendo get?
   b) How much money did they share altogether?

2. The fraction of boys in a class is 0.35. There are 52 girls in the class.
   a) Find the fraction of girls in the class
   b) Find the total number of pupils in the class.

3. The table below shows the fractions of different books in the school library. Use it to answer the questions that follow.

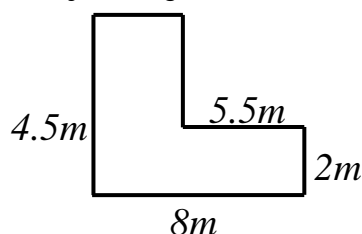| Subject	Science	Maths	English	SST
Fraction	0.2	0.35	0.3	k

   a) Find the value of k
   b) If there are 60 books of SST, find the total number of books in the school library.

4. After covering 0.3 of the journey. Kyuma still had 210 kilometres to go.
   a) How long was his journey?
   b) Given that Kyuma's car consumes 4.5 litres of petrol for every 10 kilometres. Find in litres, the amount of fuel he would use to cover the whole journey.

5. The circle graph below shows how Tr. Namusoke spends her monthly salary. Use it to answer questions that follow.

   a) Find the value of t
   b) If she spends sh. 132000 on food, find her monthly salary.
   c) How much more does she spend on rent than fees?

6. There were 400 pupils in a school last year. This year, the number of pupils in the school has dropped by 0.25 of the original number. Find the current number of pupils in the school.

7. The teacher's salary was increased by 0.3 of the original salary. His final salary is sh. 780,000. Find the teacher's salary before the increment.

8. When a number is increased by 0.45 of it, it becomes 290. Find that number.

9. After the lockdown, the transport fare from Kampala to Masaka was reduced by 0.2 of the transport fare in the lockdown to sh. 16,000.
   a) Find the taxi fare from Kampala to Masaka during the lockdown.

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b) Mr. Mapuku had three relatives in Kampala. During the lockdown, he went with them to village and came back with all of them after the lockdown. How much more money did he spend on transport during the lockdown than after the lockdown?

10. A tank was 0.75 full of water. When 0.4 of the water in the tank was used, 900 litres remained. Find the capacity of the tank when completely full.

11. A pen was 0.8 full of ink. When 0.4 of the ink was used, the remaining ink in the pen writes 96pages. How many pages does the pen write when 0.5 full of ink?

12. A jerry can was 0.75 full of water. When 0.8 of the water in the jerry can was used, 17 litres were needed to fill the jerry can. Find in litres the capacity of the jerry can when completely full.

13. In a class, the fraction of boys is 0.4 and 0.25 of the girls are day scholars. The class has 9 girls who are day scholars.
    a) Find the total number of pupils in the class.
    b) Calculate the number of boys in the class.

14. On a school staff, 0.6 of the teachers are females. 0.9 of the male teachers are married and 2 male teachers are not married.
    a) Find the total number of teachers on the staff.
    b) Find the number of female teachers on the staff.

15. In a school, 0.4 of the boys are in lower primary classes and 0.75 of the girls are in upper primary classes. The total number of pupils in upper primary classes is 138. The fraction of girls in the school is $\frac{3}{5}$. Find the total number of pupils in the school.

16. Given that 0.75 of Musa's salary is the same as 0.5 of Okello's salary. If Musa's salary is sh. 450000. Find Okello's salary.

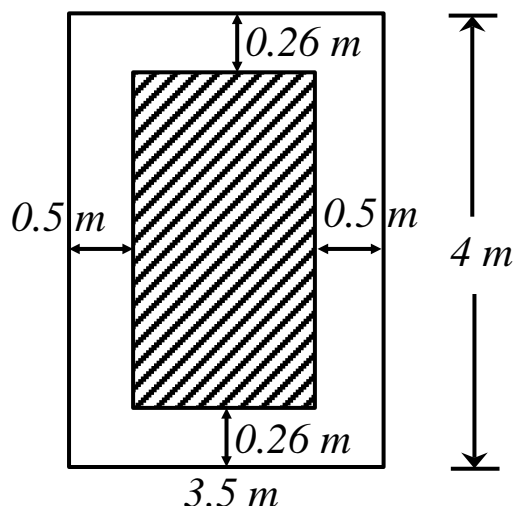17. Study the figure below and use it to answer questions that follow.

    a) Find the total distance around the shape.
    b) Calculate its area.

18. Given that 0.4 of the pens in the box are blue. 0.25 of the remainder are red and the rest are black. The number of black pens in the box is 36.
    a) Find the fraction of black pens in the box.
    b) Calculate the total number of pens in the box.

19. The fraction of goats on a farm is 0.6 more than the fraction of sheep. The number of sheep on the farm is 42.
    a) Find the fraction of goats.
    b) Find the total number of animals on the farm.
    c) Calculate the number of goats on the farm.

20. The fraction of men who attended the party was 0.4 less than the fraction of women. Given that the party was attended by 120 men. How many people attended the party?

21. Milk was mixed with water to form tea. The amount of milk used was 18 litres more than the amount of water. The fraction of water in tea was 0.25. How much tea was prepared?

22. In a school, the fraction of girls is 0.625 and the number of boys in the school is 125 less than the number of girls. Find the total number of pupils in the school.

23. Given that 4.25 is halfway between two numbers. If one of the numbers is 3.5, find the other number.

24. In a school, 0.25 of the pupils like posho, $\frac{1}{3}$ like matooke, $\frac{8}{15}$ of the remainder like cassava and the rest like rice. 119 pupils in the school like rice. Find the number of pupils who like cassava.

25. In a school, 0.14 of the boys are day scholars and 0.79 of the girls are boarders. The school has 306 pupils who are day scholars. The ratio of boys to girls in the school is 3:4 respectively.
    Find the;
         (i)   fraction of boys who are day scholars.
         (ii) total number of pupils in the school.

26. The figure below represents a carpet which was laid centrally on a rectangular floor. The length of the floor is 4 m and the width is 3.5 m. The area covered by the carpet is shaded. Study the figure and use it to answer the questions that follow.

a) Calculate the total distance round the floor

b) Find the length of the carpet.

c) Find the area of the floor **not** covered by the carpet.

RATIOS AND PROPORTIONS

RATIOS
The term ratio refers to the relationship between things or parts of things with respect to their comparative quantity or degree. Ratios are always expressed in simplest form.

Look at this

5parts are shaded
2 parts are not shaded

So,
* The ratio of shaded parts to un shaded parts is 5 to 2 written as 5:2
* The ratio of un shaded parts to shaded parts is 2 to 5 written as 2:5

Note:

- Fractions can be expressed as ratios e.g. $\frac{3}{5}$ = 3:5 read as 3 to 5

- For decimals, we first write the given decimal as a simplified common fraction
  then to ratio. e.g 0.75 = $\frac{75}{100}$ which is $\frac{3}{4}$ in its lowest term. So, $\frac{3}{4}$ = 3:4

Example 1	Example 2
Express $\frac{7}{10}$ as a ratio	Express 0.625 as a ratio
$\frac{7}{10}$ = 7:10	$0.625 = \frac{625 \div 125}{1000 \div 125}$ $= \frac{5}{8}$ $= 5:8$

Exercise

1. Write the following as ratios

   a) $\frac{1}{4}$ c) $\frac{3}{7}$ e) $\frac{9}{11}$ g) $1\frac{1}{7}$ i) $1\frac{7}{9}$

   b) $\frac{4}{9}$ d) $\frac{10}{13}$ f) $\frac{5}{8}$ h) $2\frac{3}{4}$ j) $9\frac{8}{13}$

2. Express the following as ratios.

   a) 0.5   e) 0.6   i) 0.75   m) 0.375   q) 0.33…
   b) 0.2   f) 0.9   j) 0.125   n) 0.875   r) 0.66…
   c) 0.7   g) 0.8   k) 0.15   o) 2.5   s) 1.33…
   d) 0.4   h) 0.25   l) 0.45   p) 22.5   t) 0.2$\overline{6}$

Expressing ratios as common fractions

Example

Express the following as fractions

a) 2:5   b) 6:11   c) 3:10

$2:5 = \dfrac{2}{5}$ $6:11 = \dfrac{6}{11}$ $3:10 = \dfrac{3}{10}$

Expressing ratios as decimals

- First express the given ratio as a common fraction, then change it into a decimal.

Example 1

Express 4:5 as a decimal

$4:5 = \dfrac{4}{5}$

$$
\begin{array}{r}
0.8 \\
5\overline{)4.0} \\
\end{array}
$$

$0\times4 = \underline{-0} \downarrow$

     4 0

$5\times8 = \underline{-4\,0}$

     0 0

$4:5 = 0.8$

Example 2

Express 2:3 as a recurring decimal

$2:3 = \dfrac{2}{3}$

$$
\begin{array}{r}
0.6\,6\,6\ldots \\
3\overline{)2.0\,0\,0}
\end{array}
$$

$0\times3 = \underline{-0}\downarrow$

     2 0

$6\times3 = \underline{-1\,8} \downarrow$

     2 0

$6\times3 = \underline{-1\,8} \downarrow$

     2 0

$6\times3 = \underline{-1\,8}$

     2

$2:3 = 0.666\ldots$

Simplifying ratios

Example 1

Find 2:3 plus 1:4

$2:3 + 1:4$

$\dfrac{2}{3} + \dfrac{1}{4}$

$\dfrac{8 + 3}{12}$

$\dfrac{11}{12}$

$11:12$

Example 2

Work out   4:5 – 3:4

$4:5 – 3:4$

$\dfrac{4}{5} - \dfrac{3}{4}$

$\dfrac{16 - 15}{20}$

$\dfrac{1}{20}$

$1:20$

Example 3

Simplify: 1:2 – 2:3 + 5:6

$1:2 + 5:6 – 2:3$

$\dfrac{1}{2} + \dfrac{5}{6} - \dfrac{2}{3}$

$\dfrac{3 + 5 - 4}{6}$

$\dfrac{4}{6}$

$\dfrac{2}{3} = 2:3$

      By Sseggayi Benjamin Kasuka

Example 4

Find the product of 2:3 and 3:4

2:3 x 3:4

$$\frac{2}{3} \times \frac{3}{4}$$

$$\frac{\overset{1}{\cancel{2}}}{\cancel{3}_1} \times \frac{\overset{1}{\cancel{3}}}{\cancel{4}_2}$$

$$\frac{1 \times 1}{1 \times 2}$$

$$\frac{1}{2} = 1:2$$

Example 5

Simplify: 1:4 ÷ 1:12

1:4 ÷ 1:12

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

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

$$\frac{1}{\cancel{4}_1} \times \frac{\overset{3}{\cancel{12}}}{1}$$

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

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

Example 6

Simplify: $\frac{4}{9} : \frac{8}{15}$

$$\frac{4}{9} : \frac{8}{15} = \frac{4}{9} \div \frac{8}{15}$$

$$\frac{4}{9} \times \frac{15}{8}$$

$$\frac{\overset{1}{\cancel{4}}}{\cancel{9}_3} \times \frac{\overset{5}{\cancel{15}}}{\cancel{8}_2}$$

$$\frac{1 \times 5}{3 \times 2}$$

$$\frac{5}{6} = 5:6$$

Exercise

1. Express the following as common fractions.
   a) 3:8   e) 4:5   i) 5:4
   b) 1:9   f) 9:10   j) 7:2
   c) 8:11   g) 3:13   k) 13:5
   d) 2:15   h) 5:12   l) 35:6

2. Express the following as decimals.
   a) 1:2   f) 3:8   k) 5:4
   b) 4:5   g) 7:8   l) 9:2
   c) 3:4   h) 5:16   m) 16:5
   d) 2:5   i) 1:8   n) 13:8
   e) 3:5   j) 5:8   o) 21:16

3. Express as recurring decimals.
   a) 1:3   e) 4:15   i) 7:12
   b) 2:3   f) 7:15   j) 4:11
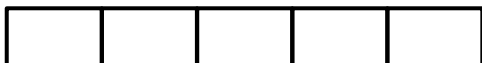   c) 2:9   g) 1:6   k) 8:33
   d) 4:9   h) 5:6   l) 11:90

4. In the drawing below, shade 4:5

5. The ratio of boys to girls is 3:5. Express as the fraction of the total, the number of:
   i) boys   ii) girls

6. Simplify:
   a) 1:3 plus 3:4   d) 4:5 + 1:3   g) 1:2 + 1:4 − 1:5
   b) 2:3 plus 1:5   e) 7:15 − 2:5   h) 7:12 − 1:4 + 1:5
   c) 7:15 plus 1:6   f) 2:3 − 1:6   i) 1:2 − 3:4 + 1:3

7. Increase 2:5 by 3:4

8. Take away 4:5 from 7:2

9. Use <, > or = to compare ratios
   a) 3:4 _____ 2:3
   b) 3:8 _____ 1:2
   c) 2:5 _____ 1:3
   d) 4:9 _____ 3:7
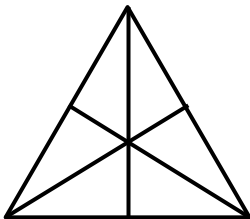
10. Arrange the following ratios in ascending order.
   a) 1:2, 1:3, 3:4, 1:6, 7:12
   b) 4:5, 8:15, 3:4, 5:12, 2:3
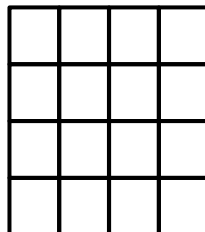
11. Write 2:3, 1:2, 3:4 and 1:6 starting with the largest.

12. In the diagrams below, shade:
   a) 2:3   b) 3:4   c) 1:2

13. Work out the product of the following;
   a) 3:4 and 2:3
   b) 5:9 and 3:10

14. Simplify:
   a) 1:4 ÷ 1:2   d) 9:2 ÷ 4:3   e) 8:10 ÷ 3:5
   b) 2:3 ÷ 3:4   c) 5:9 ÷ 20:3   f)   7:8 ÷ 1:2

15. Work out
   a) $\frac{2}{3} : \frac{5}{12}$ c) $\frac{1}{4} : \frac{2}{3}$ e) $\frac{7}{8} : \frac{1}{2}$
   b) $\frac{3}{4} : \frac{1}{2}$ d) $\frac{1}{3} : \frac{2}{9}$ f) $2\frac{1}{4} : 1\frac{4}{5}$

16. Work out: 3:2 ÷ 3:4 of 3:8

By Sseggayi Benjamin Kasuka

Ratios are used to compare quantities. Ratios help us to **compare quantities** and determine the relation between them. A ratio is a comparison of two similar quantities obtained by dividing one quantity by the other. Since a ratio is only a comparison or relation between quantities, it is an **abstract number**. For example, the ratio of 6kg to 3kg is only 2 to 1.

If two quantities cannot be expressed in terms of the **same unit**, there cannot be a ratio between them. Hence to compare two quantities, the units must be the same.

Consider an example to find the ratio of *3 km to 300 m*.

First convert both distances to the same unit.

1km = 1000m
3 km = 3 × 1000 m
*   = 3000 m.*
Thus, the required ratio, 3 km : 300 m is 3000m : 300m simplified to become 10 : 1

Example 1

Express 60cm as a ratio of 4m
 4m to cm
1m = 100cm
4m = 4x100cm
4m = 400cm

$\dfrac{60cm}{20cm} : \dfrac{400cm}{20cm}$

 3 : 20

Example 2

Express sh. 5000 as a ratio of 7500

$\dfrac{sh.\ 5000}{sh.\ 7500}$

$\dfrac{5000 \div 2500}{7500 \div 2500}$

$\dfrac{2}{3} = 2:3$

Example 3

In a bag, there are 8 red pens and 12 blue pens. Find the ratio of;
(i) red pens to blue pens

Red pens

Blue pens

$\dfrac{8}{12}$

$\dfrac{8 \div 4}{12 \div 4}$

$\dfrac{2}{3} = 2:3$

(ii) blue pens to red pens

Blue pens

Red pens

$\dfrac{12}{8}$

$\dfrac{12 \div 4}{8 \div 4}$

$\dfrac{3}{2} = 3:2$

By Sseggayi Benjamin Kasuka

Example 4

In a class of 45 pupils, 27 of them are boys and the rest are girls. Find the ratio of girls to boys.

Number of girls
45 – 27 = 18 girls

Ratio

$\dfrac{18}{27}$

$\dfrac{18 \div 9}{27 \div 9}$

$\dfrac{2}{3}$ = 2:3

Example 5

The fraction of bulls on a farm is $\dfrac{3}{8}$. If the rest of the animals on the farm are cows, find the ratio of cows to bulls.

Fraction of cows

$\dfrac{8}{8} - \dfrac{3}{8} = \dfrac{8 - 3}{8}$

$= \dfrac{5}{8}$

Ratio of cows to bulls

$\dfrac{5}{8} \div \dfrac{3}{8} = \dfrac{5}{8} \times \dfrac{8}{3}$

$= \dfrac{5}{3}$

= 5:3

Exercise

1. Express as ratios
   a) 80 metres to 50 metres
   b) 60 minutes to 12 minutes
   c) 1 week to 14 days
   d) 3 weeks to 30 days
   e) 1 hour to 40 minutes
   f) 30cm to 2m
   g) 50ml to 1litre
   h) 0.15kg to 48g
   i) 40 minutes to 2 hours
   j) 4km to 125m

2. Tom has 18 mangoes. Amini has 24 mangoes. Express as a ratio the number of Tom's mangoes to Amini's mangoes.

3. There are 16 men and 20 women in a meeting. Express the number of women as a ratio of the number of men.

4. In a class of 25 pupils, 15 are girls.
   a) Find the number of boys
   b) Find the ratio of girls to boys.

5. The fraction of sheep on a farm of animals is $\dfrac{7}{12}$. The fraction of goats on the same farm is $\dfrac{14}{15}$. Find the ratio of goats to sheep.

6. Benjamin is 10years older than Mulungi. If Mulungi is 18years old, find the ratio of Mulungi's age to Benjamin's age.

7. The sum of two numbers is 30. One of the two numbers is 12. Find the ratio of smaller to the larger number.

8. In a basket, there are 30 fruits. Of these, 9 are mangoes, 6 are oranges and the rest are apples. Find the ratio of mangoes to apples.

9. In a school of 720 pupils, 120 are in nursery section, 360 are in lower primary classes and the rest of the pupils are in upper primary classes. Express the number of pupils in upper primary and lower primary classes as a ratio.

10. In a village of 1080 people, 360 of them are males and the rest are females. $\frac{2}{3}$ of the males are boys and $\frac{3}{9}$ of the females are adults.
    a) Find the number of female adults in the village.
    b) Work out the ratio of boys to girls.

11. In a class of 48 pupils, the number of boys is 6 less than the number of girls.
    a) Find the number of girls in the class.
    b) Calculate the ratio of girls to boys.

12. The perimeter of a rectangular flower garden is 40 metres. If the length is 12 metres, Express its length as a ratio of its width.

13. The fraction of blue pens in a box is $\frac{3}{5}$ more than the fraction of red pens. The box contains 50 pens altogether.
    a) Find the total number of red pens in the box.
    b) Find the ratio of blue pens to red pens.

14. In a school, $\frac{4}{7}$ of the pupils like chicken and the rest of the pupils like beef.
    a) Find the fraction of pupils who like beef.
    b) Work out the ratio of boys to girls in the village.

15. The table below shows 240 of animals on Kamushaba's farm. Use it to answer questions that follow.

Animals	Cows	Bulls	Sheep	Goats
Number	60	36	x	90

    a) Find the value of x.
    b) Work out the ratio of goats to sheep.
    c) Find the ratio of cows to goats.
    d) Find the ratio of sheep to the total number of animals.

16. John bought 0.75 kg of sugar and 1.25 kg of rice. Express as the ratio of the quantity sugar and rice he bought.

Increasing and decreasing quantities

Multiply the fraction of the given ratio by the given quantity

Example 1

Increase sh 6000 in the ratio of 5:3

Approach 1

$5:3 = \frac{5}{3}$

$\frac{5}{3}$ x sh 6000

5 x sh 2000

sh 10000

Approach 2

3 parts represent sh 6000

1 part represents $\frac{\text{sh } 6000}{3}$

1 part represents sh 2000

5 parts represent sh 2000

$\quad\quad\quad\quad$ x$\quad$ 5

$\quad\quad\quad\quad$ sh 10000

Example 2

Decrease 480 in the ratio of 7:8

Approach 1

$7:8 = \frac{7}{8}$

$\frac{7}{8}$ x 480

7 x 60

420

Approach 2

8 parts represent 480

1 part represents $\frac{480}{8}$

1 part represents 60

7 parts represent 60

$\quad\quad\quad\quad$ x 7

$\quad\quad\quad\quad$ 420

Exercise

1. Increase 200 in the ratio of 7:5.
2. Increase sh 24000 in the ratio of 5:4.
3. The length of a rope was 24cm. It was increased in the ratio of 4:3. Find the new length of the rope.
4. The price of the radio was increased in the ratio of 8:7. Find the new price of the radio if the original price of the radio was sh 42000.
5. A school had 480 pupils last year. This year, the number of pupils has increased in the ratio of 9:8. Find the number of pupils in the school this year.

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6. The school fees at Baisse Primary school has been increased in the ratio of 5:4 from sh. 360000. What is the new school fees at Baisse Primary school?
7. The transport fare from Kampala to Entebbe was sh. 3000 last year. This year, it has been increased in the ratio of 7:6. Find the new taxi fare from Kampala to Entebbe.

8. Decrease 400 in the ratio of 3:4

9. Decrease 360 in the ratio of 5:6

10. A man's salary was sh. 24000. It was decreased in the ratio of 5:8. Find the man's final salary.
11. The marked price of a book was sh. 1800. The price was reduced in the ratio of 5:8. Find the actual price of the book.

Finding ratio of increase or decrease

Example 1

The number of animals on a farm increased from 120 to 200. In what ratio did the number increase?

$$\frac{\text{New number}}{\text{Original number}} = \frac{200}{120}$$
$$= \frac{5}{3}$$
$$= 5:3$$

Example 2

There were 48 tomatoes in a basket. 6 tomatoes got spoilt. In what ratio did the number of tomatoes decrease?

New number → 48–6=42 tomatoes
Original number → 48 tomatoes

$$\frac{42}{48} = \frac{42 \div 6}{48 \div 6}$$
$$= \frac{7}{8}$$
$$= 7:8$$

Example 3

A man's salary has been increased in the ratio of 5:3 by sh. 80,000. Find the man's original salary.

5 – 3 = 2 parts
2 parts represent sh 80,000
1 part represents sh 80,000 ÷ 2
1 part represents sh 40,000
3 parts represent sh 40,000 x 3
3 parts represent sh 120,000
The man's salary was sh 120,000

Example 4

When a farmer sold 42 goats, the number of animals on his farm decreased in the ratio of 3:10. Find the number of the remaining animals on the farm.

10 – 3 = 7 parts

7 parts represent 42
1 part represents 42 ÷ 7
1 part represents 6
3 parts represent 6 x 3
3 parts represent 18 animals
18 animals remained on the farm

Exercise

1. A man's salary was sh 500,000. It was increased to sh. 700,000. In what ratio was it increased?

2. A trader increased the price of a dress from sh 27,000 to sh 30,000. In what ratio did he increase its price?

3. The transport fare from Masaka to Kyotera was sh 4,000. It is now sh. 6,000. Find the ratio of increase.

4. Kasoma had 36 books, his father gave him more 6 books. In what ratio did the number of books increase?

5. The number of pupils in a school increased by 50 to 400. In what ratio did the number increase?

6. Promise scored 80% in the previous test. She has scored 72% in the current test. In what ratio has her performance declined?

7. A tank had 1800 litres of water. When it rained, the capacity increased by 200 litres. In what ratio did the amount of water increase?

8. Kadoma had sh. 60000 in his pocket. After spending some money on clothes, he remained with sh. 45000. Find the ratio in which his money reduced.

9. Mr. Sseggayi produced 1200 textbooks. Some books were sold off and only 90 textbooks remained. Work out the ratio of decrease.

10. The price of a bar of soap was sh. 8,000. It is now sh. 6,000. In what ratio has the price decreased?

11. There were 240 rats in the store. Mr. Butwa killed 80 rats. In what ratio did the number of rats decrease?

12. Nakate had 60 bulls on her farm. She slaughtered 12 bulls for Christmas. In what ratio did the number of bulls on the farm decrease?

13. A tank had 4800 litres of water. 600 litres were sold. In what ratio did the amount of water in the tank decrease?

14. A business woman bought 20 dozens at sh. 8000 per dozen. She sold some books and made a profit of sh. 32000. If she remained with 48 books,
    a) In what ratio did the number of books decrease?
    b) At what price did she sell each book?

15. When Mukiibi sold 160 litres of water, the amount of water in the tank decreased in the ratio of 1:5. Find in litres, the original amount of water in the tank.

16. A boy had some books. When his father gave him a dozen of books, the number of books increased in the ratio of 7:4. How many books did the boy have at first?

17. The height of a tree has increased in the ratio of 5:3 by 350 centimetres. Find the new height of the tree.

18. The price of a motorcycle has been increased in the ratio of 11:10 by sh 500,000. Find the new price of the motorcycle.

19. Kaye bought some eggs at sh. 9800. On his way back, 12 eggs got broken and the number of eggs decreased in the ratio of 4:7. How much money did he pay for each egg?

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Sharing quantities in ratios

Example 1

In a class of 72 pupils, the number of boys and girls is in the ratio of 7:5 respectively. Find the number of boys

Total ratio
7+5 = 12

Number of boys
$\frac{7}{12}$ x 72
7x6
42 boys

Example 2

Annet, Anord and Amos shared sh. 39,000 in the ratio of 3:8:2 respectively. How much money did each get?

Total ratio
3+8+2 = 13

Amount represented by each part
sh. 39,000 ÷ 13 = sh. 3,000

Annet's share
sh. 3,000 x 3 = sh. 9,000

Anord's share
sh. 3,000 x 8 = sh. 24,000

Amos' share
sh. 3,000 x 2 = sh. 6,000

Example 3

Kamada, Ashraf and Hafurah contributed sh. 60000, sh. 90000 and sh. 50000 respectively to start a joint business. After making sh. 12000 profit, they decided to share the total amount of money according to their initial contribution. How much money did each get?

Total amount of money contributed.
```
  sh. 6 0 0 0 0
  sh. 9 0 0 0 0
+ sh. 5 0 0 0 0
  sh. 2 0 0 0 0 0
```

Total amount after the profit
```
  sh. 2 0 0 0 0 0
+ sh.   1 2 0 0 0
  sh. 2 1 2 0 0 0
```

Kamada's share
$\frac{sh. 60000}{sh. 200000}$ x sh. 212000 = sh. 63600

Ashraf's share
$\frac{sh. 90000}{sh. 200000}$ x sh. 212000 = sh. 95400

Hafurah's share
$\frac{sh. 50000}{sh. 200000}$ x sh. 212000 = sh. 53000

Exercise

1. Share 180 in the ratio of 7:3

2. Divide sh. 20,000 in the ratio of 3:2

3. The ratio of boys to girls in a class is 4:7 respectively. The class has 66 pupils altogether. Find the number of girls in the class.

4. Milk was mixed with water to make tea in the ratio of 4:3 respectively. If 28 litres of tea was prepared, how much milk was used?

5. In a school of 600 pupils, the ratio of boarders to day scholars is 1:2. Find the number of day scholars in the school.

6. In P.7 class, the ratio of pupils who eat meat to those who do not eat meat is 3:2 respectively. There are 150 pupils in the class. Find the number of pupils who do not eat meat

7. Aminsi, Bashir and Araphat shared sh. 360,000 in the ratio of 1:9:2 respectively. How much money did each get?

8. In a box of 48 pens, there are red and blue pens in the ratio of 3:5 respectively. How many more blue pens than red pens are in the box?

9. On a farm of 816 cattle, the number of bulls, cows and calves is in the ratio of 1:3:4 respectively.
   a) Find the number of calves.
   b) How many less bulls than cows are on the farm?

10. During the election of the member of parliament in Nyendo Mukungwe, Mpuuga, Mbidde and Kiyimba got votes in the ratio of 5:1:3 respectively. They altogether got 45000 votes.
    a) How many votes did Kiyimba get?
    b) How many votes did Mbidde lose to Mpuuga?

11. A man's salary is sh. 510,000. He spends his salary on rent, food and fees in a ratio of 3:1:2 respectively. How much more does he spend on rent and fees than food?

12. In a class, there are 16 boys and 24 girls. Their class teacher gave them 120 sweets.
    a) Calculate the number of sweets boys got.
    b) How many more sweets did the girls get than boys?

13, A, B and C contributed sh. 2000, sh. 2400 and sh. 1600 respectively to buy pancakes. After buying 54 pancakes, the pancake seller added them more 6 pancakes. They decided to share the total number of pancakes according to their initial contribution.
    a) How many pancakes did B get?
    b) How many more pancakes did A get than C?

14. Ham, Sudir and Laponye contributed money shown in the table below to start a joint project.

Ham	Sudir	Laponye
sh. 1,200,000	sh. 900,000	sh. 1,500,000

They realized that the project was making a loss of sh. 200,000 per month. After 6 months, they decided to share the remaining amount of money according to each one's initial contribution.

a) Find Sudir's share.

b) How much less did Ham get than Laponye?

15. Jane, Joan and Josephine contributed sh. 240,000, sh. 180,000 and sh. 300,000 respectively to start a joint business. They made a profit of sh. 480,000 and agreed to share the total amount of money according to their initial contribution.

a) How much money did Josephine get?

b) How much more did Jane get than Joan?

16. A total of 60 desks in the three classes P.5, P.6 and P.7 were distributed according to the number of pupils in the class. There are 156 pupils in the three classes. Of these, 72 are in P.5, 48 are in P.6 and the rest of the pupils are in P.7. If 18 more desks are added,

a) How many desks will be in P.7 class?

b) How many more desks will be in P.6 and P.7 than P.5?

17. Chalk was packed in 6 boxes such that there are 15 coloured pieces for every 45 white pieces. A box of chalk contains 50 pieces of chalk. Find the number of white pieces of chalk in the 6 boxes.

18. In a school, 540 pupils were grouped such that in each group there are 12 boys and 18 girls.

a) Calculate the number of boys in the school.

b) If two thirds of the girls are boarders. Find the number of girls who are day scholars.

Finding the original number shared in the given ratio

Example 1

Peter, Paul and Penny shared some money in the ratio of 3:2:5 respectively. If Penny got sh. 25000. How much money was shared?

Approach 1

Total ratio
3+2+5 = 10 parts
Amount shared
5 parts represent sh. 25000
1 part represents $\dfrac{sh.\ 25000}{5}$

1 part represents sh. 5000
10 parts represent sh. 5000x10
10 parts represent sh. 50000
They shared sh. 50000

Approach 2

Total ratio
3+2+5 = 10 parts

Let the total amount shared be y

$\dfrac{5}{10}$ of y = sh. 25000

$\dfrac{5}{10}$ x y = sh. 25000

$\dfrac{5y}{10}$ = sh. 25000

10 x $\dfrac{5y}{10}$ = sh. 25000 x 10

$\dfrac{5y}{5}$ = $\dfrac{sh.\ 250000}{5}$

y = sh. 50000

They shared sh. 50000

Example 2

The number of black pens, blue and red pens in a box is in the ratio of 3:4:1 respectively. There are 18 more blue than red pens.

(a) Find the total number of pens

Difference
4-1 = 3 parts
Total ratio
3+4+1 = 8 parts
Total number of pens

3 parts represent 18 pens
1 part represents (18 ÷ 3) pens
1 part represents 6 pens
8 parts represent (8 x 6) pens
8 parts represent 48 pens
There are 48 pens in the box

b) If the cost of each blue pen is sh. 600, how much money will Rono spend on all blue pens in the box?

Number of blue pens
4x6 = 24 blue pens

Amount to be spent
sh. 600 x 24 = sh. 14400

Example 3

Men, children and women attended a party in the ratio of 5:2:7 respectively. The total number of children and women was 40 more than the number of men at the party. How many women attended the party?

Difference
(2+7) – 5 = 9 – 5
= 4 parts

Number of women
4 parts represent 40
1 part represents 40 ÷ 4
1 part represents 10
7 parts represent 10 x 7
7 parts represent 70 women

Exercise

1. The ratio of teachers to pupils in a school is 1:50. There are 12 teachers in that school. Find the number of pupils in the school.
2. The ratio of girls to boys in a class is 2:3 respectively. The class has 18 boys. Find the total number of pupils in the class.
3. The number of pupils in lower, middle and upper primary classes in the school is in the ratio of 4:2:3 respectively. The school has 150 pupils in upper primary classes.
   a) Find the total number of pupils in the school.
   b) How many pupils are in lower primary classes?
4. Cate and Hajarah shared mangoes in the ratio of 3:2 respectively such that Cate gets 15 mangoes.
   a) How many mangoes were shared?
   b) How many more mangoes did Cate get than Hajarah?

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5. Elvis, Mathias and Prossy contributed for the start of a business in the ratio of 3:4:5 respectively. Mathias contributed sh. 10,000. How much money did each of the rest contribute?

6. A smartphone costs sh. 100,000 more than a radio. The cost of the two items is in the ratio of 8:3 respectively. Find the cost of the radio.

7. In a market, the cost of a pineapple, a mango and a pawpaw is in the ratio of 5:1:4 respectively. The pawpaw costs sh1200 more than a mango.
   a) Find the total cost of the three items.
   b) Kato bought 3 pawpaws, a mango and 4 pineapples. How much money did he spend altogether?

8. On a farm, there are goats, sheep and cattle in the ratio of 2:7:5 respectively. The number of cattle is 40 less than the number of sheep on the farm.
   a) Find the total number of animals on the farm.
   b) Find the number of goats on the farm.

9. There are 45 more girls than boys in a class. The ratio of boys to girls is 1:6. Find the number of girls.

10. The ratio of John's age to Alex's age is 5:3 respectively. Alex is 12 years younger than John.
    a) Find their total age.
    b) How old was John 5 years ago?

11. Two numbers are in the ratio of 3:7 respectively. The larger number is 16 greater than the smaller number. Find the product of the two numbers.

12. In a box, there are blue, black and red pens in the ratio of 5:3:2 respectively. The box contains 10 more blue pens than black pens. Find the number of red pens in the box.

13. In a class of 60 pupils, pupils like mathematics, science and art. The number of pupils who like mathematics and art is in the ratio of 5:2 respectively. The number of pupils who like mathematics is 18 more than the number of pupils who like art. Find the number of pupils who like science in the class.

14. In a village, there are men, women and children in the ratio of 1:3:5 respectively and the number of children is 500 more than the number of adults.
    a) Find the total number of people in the village.
    b) If each woman has 4 goats, find the total number of goats in the village.

15. Mpiso, Lukato and Mkate contributed sh 1200, sh 4800 and sh 2000 to buy a dozen of books. After selling each book at sh 1000, they decided to share the total amount of money according to their initial contribution. How much money did each get?

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16. To each of the numbers 42 and 36, h is subtracted. The ratio of the resulting numbers is 4:3 respectively. Find the value of h.

17. At a birthday party, bottles of beer, soda and water were bought in the ratio of 2:3:6 respectively. Each bottle of water and beer was bought at sh 500 and sh 3000 respectively. The number of bottles of water bought was 20 more than the number of the bottles of beer. If sh 60000 was spent altogether, find the cost of each bottle of soda.

18. In a class, pupils were grouped such that there were 3 boys and 5 girls in each group. The class had 45 girls altogether. Find the number of boys.

19. While preparing tea, Teddy mixes 500 millilitres of water with 1200 millilitres of milk. One day, she used 14 litres of milk more than water. How much tea was prepared?

20. In a certain school, the ratio of pupils in Primary Five to Primary Six to Primary Seven is 7:5:4 respectively. In each class, groups with equal number of pupils were formed.
    a) Find the largest number of pupils in each group if there are 288 pupils in altogether.
    b) How many groups were formed in Primary Five?

More word problems involving application of ratios in daily life situation.

Example 1

The length and width of a rectangular garden are in the ratio of 5:3 respectively. The total distance around the garden is 48 metres.

a) Find the actual length of the rectangle

Let the HCF be y.

5y

3y

Value of y
$$L + W + L + W = P$$
$$5y + 3y + 5y + 3y = 48m$$
$$\frac{16y}{16} = \frac{48m}{16}$$
$$y = 3m$$

Actual length
5y
5 × 3m
15m

b) Calculate the area of the rectangle.

Actual width
3y
3 × y
3 × 3m
9m

Area
$$A = L \times W$$
$$A = 15m \times 9m$$
$$A = 135m^2$$

Example 2

In a class, pupils like science (S) and mathematics (M) in the ratio of 2:3 respectively. 5 pupils like both science and mathematics while 10 pupils like neither of the two subjects.

(a) Draw a complete Venn diagram to represent the above information
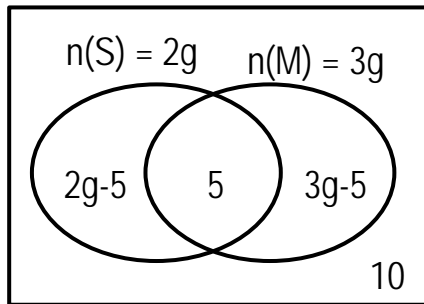
b) If 40 pupils like only one subject, find number of pupils who do not like science.

Let n(S) be 2g and n(M) be 3g

Value of g

$2g-5 + 3g-5 = 40$

$2g+3g-5-5 = 40$

$5g - 10 = 40$

$5g-10+10 = 40+10$

$$\frac{5g}{5} = \frac{50}{5}$$

$g = 10$

Number of pupils who do like science

$3g-5 + 10$

$(3 \times 10 - 5) + 10$

$(30 - 5) + 10$

$25 + 10$

35 pupils

Example 3

Mungholo's age and Kafuma's age is in the ratio of 9:5 respectively. Kafuma is 16 years younger than Mungholo. How old is Mungholo?

Using diagrams

Mungholo

Kafuuma

16 years

$16 \div 4 = 4$

Mungholo's age

$9 \times 4 = 36$ years

Approach 1

Difference

$9 - 5 = 4$ parts

4 parts represent 16 years
1 part represents $(16 \div 4)$ years
1 part represents 4 years

Mungholo's age
(9×4) years $= 36$ years

Approach 2

Let Mungholo's age be 9g and Kafuma's age be 5g

$9g - 5g = 16$

$$\frac{4g}{4} = \frac{16}{4}$$

$g = 4$

Mungholo's age
(9×4) years $= 36$ years

Approach 3

Total ratio

$9+5 = 14$

Value of y

$(\frac{9}{14}$ of y$)$ - $(\frac{5}{14}$ of y$) = 16$

$(\frac{9}{14} \times y)$ - $(\frac{5}{14} \times y) = 16$

$\frac{9y}{14}$ - $\frac{5y}{14} = 16$

$14 \times \frac{9y}{14}$ - $14 \times \frac{5y}{14} = 16 \times 14$

$9y - 5y = 224$

$$\frac{4y}{4} = \frac{224}{4}$$

$y = 56$ years

Mungholo's age

$\frac{9}{14} \times 56 = 36$ years

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Example 4

The ratio of Ayo's age to Bakesiga's age is 3:2 respectively. In 5 years' time, their total age will be 40years.

a) How old is Bakesiga now?

Let the HCF be p

	Ayo	Bakesiga	Total
Now	3p	2p	
5 yrs time	3p+5	2p+5	40

Value of p

$3y+5 + 2p+5 = 40$

$3p + 2p + 5 + 5 = 40$

$5p + 10 = 40$

$5p + 10 - 10 = 40 - 10$

$\dfrac{5p}{5} = \dfrac{30}{5}$

$p = 6$

Bakesiga's age

$2p = 2 \times 6$

$= 12$ years

Approach 2

Their total age now

$40 - (5+5)$

$40 - 10$

30 years

Bakesiga's age now

$\dfrac{2}{} \times 30 = 12$ years

b) How old will Ayo be then?

$3p+5$

$(3 \times p) + 5$

$(3 \times 6) + 5$

$18 + 5$

23 years

c) After how many years will Ayo be 31years old?

$31 - 3p$

$31 - (3 \times p)$

$31 - (3 \times 6)$

$31 - 18$

13 years

After 13 years

Example 5

Alex and Tom's age are in the ratio of 4:3 respectively. 4 years ago, their age was in the ratio of 10:7. How old is Tom?

Let the HCF be m

	Alex	Tom
Now	4m	3m
4 years ago	4m – 4	3m – 4

Value of m

$(4m - 4) : (3m - 4) = 10 : 7$

$\dfrac{4m - 4}{3m - 4} = \dfrac{10}{7}$

$7(3m - 4) \times \dfrac{4m - 4}{(3m - 4)} = \dfrac{10}{7} \times 7(3m - 4)$

$7(4m - 4) = 10(3m - 4)$

$28m - 28 = 30m - 40$

$28m - 28 + 40 = 30m - 40 + 40$

$28m + 12 = 30m$

$28m - 28m + 12 = 30m - 28m$

$\dfrac{12}{2} = \dfrac{2m}{2}$

$m = 6$

Tom's age now

$3m$

$3 \times m$

3×6

18 years

Tom is 18years

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Example 6

The base and the height of a right angled triangle are in the ratio of 3:4 respectively. Given that its area is 24cm². Find its height in centimetres.

Let the HCF be g

4g

3g

Value of g

$$\frac{1}{2} \times b \times h = A$$

$$\frac{1}{2} \times 3g \times 4g = 24cm^2$$

$$3g \times 2g = 24cm^2$$

$$\frac{6g^2}{6} = \frac{24cm^2}{6}$$

$$g^2 = 4cm^2$$

$$\sqrt{g^2} = \sqrt{4cm^2}$$

$$g = 2cm$$

Actual height

4g

4xg

4x2cm

8cm

Exercise

1. The length and the width of a rectangle are in the ratio of 3:2 respectively. Find the length if the perimeter of that rectangle is 30m.

2. The length and the width of a rectangle are in the ratio of 5:4 respectively. If the rectangle is 20cm wide, find its length.

3. The ratio of the length to the width of a rectangle is 4:3 respectively. Calculate its area if the perimeter is 42cm.

4. Kiptegei moved 3times around a rectangular plot of land. He covered 126 metres. The length and width of the plot are in the ratio of 4:3 respectively.
   a) How far did he go in one round?
   b) Find the actual width of the plot.

5. Henry is 15 years younger than Jazirah. The ratio of Jazirah's age to Henry's age is 5:2 respectively. How old is Jazirah?

6. The ratio of Sseggayi's weight to Kasuka's weight is 4:5 respectively. If each of the two boys loses 3kg, their total weight becomes 84kg. Find Kasuka's weight.

7. The ratio of Kenneth's age to Drake's age is 3:2 respectively. 2 years ago, their total age was 31years. How old is each now?

8. The cost of a geometry set and a book is in a ratio of 5:3 respectively. Lusozi bought 2 geometry sets and 5 books at sh. 15000. How much money did he spend on each item?

9. Two numbers are in the ratio of 3:2 respectively. Their lowest common multiple is 24. Find the numbers.

10. Below is triangle ABC whose perimeter is 39cm. Lengths AC and CB are in the ratio of 3:4 respectively. Use it to answer questions that follow.

A

18cm

C *B*

a) Find length AC in centimetres.
b) Calculate the area of the triangle ABC.

11. The ratio of two numbers is 3:5. To each of the numbers, 12 is added. The ratio of the resulting numbers is 7:9. Find the resulting numbers.
12. The ratio of Aine's age to Benja's age is 2:3 respectively. In 6 years' time, the ratio of their age will become 8:11.
    a) How old is Aine?
    b) How old will Benja be then?
13. The length and the width of a rectangular plot of land are in the ratio of 5:4 respectively. The area of the plot is 320m².
    a) Find the actual length.
    b) Calculate the total distance around the plot.
14. The ratio of girls to boys in a class was 5:4 last term. This term, 5 girls left and 6 boys joined class. The ratio of girls to boys is 5:9 respectively.
    a) Find the total number of pupils in the class last term.
    b) How many more boys than girls are in the class this term?

15. The ratio of Cissy's age to Tina's age is 4:3 respectively. 9 years ago, the ratio was 5:3 respectively.
    a) How old is Cissy?
    b) Work out Tina's age then.
16. The age of the father and his son is in the ratio of 7:2 respectively. The product of their age is 504.
    a) How old is the son?
    b) Find their total age in 7 years' time.
17. Zizinga, Zahab and Zalwango shared 22 sweets. Zizinga's share and Zahab's share was in the ratio of 2:3 respectively. Given that Zalwango got 2 sweets less than Zahab.
    a) How may sweets did Zalwango get?
    b) Find the number of sweets Zizinga and Zahab got altogether.
18. Two numbers are in the ratio of 3:7. Their GCF is 6.
    a) Find the numbers
    b) Find their lowest common multiple (LCM)

19. In a class party, pupils were served with matooke (M) and rice (R) in the ratio of 3:4 respectively. 10 pupils were served with both matooke and rice while 5 pupils were not served at all.
    a) Complete the Venn diagram below using the given information.

    b) Given that 30 pupils were served with rice only, how many pupils were served with matooke?
20. Asha, Gorreth and Richard shared 240 books in the ratio of 3:x:4 respectively. If Asha got 60 books
    a) Find the value of x
    b) How many more books did Gorreth get than Asha?

Word problems involving common fractions integrated with ratios.

Example

In a school, a quarter of the boys are in upper primary classes. $\frac{1}{6}$ of the girls are in lower primary classes. The ratio of boys to girls in the school is 2:3 respectively. There are 360 pupils in upper primary classes. Find the total number of pupils in the school.

Total ratio	Fraction for girls in upper primary	Fraction for pupils in upper primary	Number of pupils in the school
2+3 = 5	$(\frac{6}{6} - \frac{1}{6})$ of $\frac{3}{5}$	$\frac{1}{10} + \frac{1}{2}$	6 parts represent 360
Fraction for boys in upper primary	$\frac{5}{6} \times \frac{3}{5}$	$\frac{1+5}{10}$	1 part represents $\frac{360}{6}$
$\frac{1}{4} \times \frac{2}{5} = \frac{1}{10}$	$\frac{1}{2}$	$\frac{6}{10}$	10 parts represent $\frac{360}{6}$ x 10
			10 parts represent 600 pupils

Exercise

1. In a class of 72 pupils, the ratio of boys to girls is 3:5 respectively. $\frac{2}{3}$ of the boys eat meat and $\frac{3}{5}$ of the girls eat meat.
    a) Find the total number of boys in the class.
    b) Find the total number of pupils who eat meat.
    c) Calculate the number of boys who do not eat meat.

2. In a village of 1080 people, $\frac{1}{3}$ of the males are above 18 years and $\frac{3}{4}$ of the females are below 18 years. The ratio of males to females is 2:3 respectively.
   a) Find the number of males who are above 18 years of age.
   b) Calculate the total number of people below 18 years of age.

3. In a school of 420 pupils, $\frac{1}{4}$ of the boys are in upper primary classes and $\frac{2}{3}$ of the girls are in lower primary classes. Find the total number of pupils in upper primary classes if the ratio of boys to girls in the school is 1:4 respectively.

4. In the school, $\frac{2}{3}$ of the boys are boarders and $\frac{1}{4}$ of the girls are day scholars. The ratio of boys to girls in the school is 3:5 respectively. The number of girls who are day scholars is 64.
   a) Find the fraction of boys who are day scholars.
   b) Work out the total number of pupils in the school.
   c) Calculate the total number of pupils who are day scholars.

5. The ratio of boys to girls in a school is 1:2 respectively. $\frac{2}{5}$ of the boys are in lower primary classes and $\frac{3}{4}$ of the girls are in upper primary classes. The total number of pupils in upper primary classes is 420.
   a) Find the total number of pupils in the school.
   b) Calculate the number of pupils in lower primary classes.

6. Alex, Amos, Annet shared some money in the ratio of 1:2:3 respectively. Amos used $\frac{3}{4}$ of his share and remained with sh. 40,000.
   a) Find Amos' share.
   b) How much money did they share altogether?
   c) How much less did Alex get than Annet?

7. Jane and Joan shared some money in the ratio of 2:3 respectively. When Jane spent $\frac{1}{6}$ of her share and Joan spent $\frac{5}{6}$ of her share, Jane remained with sh. 14,000 more than Joan.
   a) How much money was shared altogether?
   b) Find Joan's share.

8. A boy and a girl shared a cake in the ratio of 5:3 respectively. The boy ate $\frac{3}{5}$ of his share and the girl ate $\frac{1}{3}$ of her share. Given that the boy ate 60g more than the girl.
   a) Find in grammes, the mass of the cake that was shared.
   b) Find the girl's share.

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9. The number of females to males in Nabigasa sub-county is in the ratio of 5:1 respectively. $\frac{2}{5}$ of the females are girls and $\frac{3}{4}$ of the males are boys. There are 250 more girls than boys in the sub-county.
   a) Find the fraction of girls in the sub-county.
   b) Calculate the total number of people in the sub-county.
   c) Work out the number of boys in Nabigasa sub-county.

10. Two numbers are in the ratio of 3:2 respectively. When the smaller number is increased by $\frac{1}{4}$ of it, the result is 22 more than $\frac{3}{8}$ of the larger number. Find the numbers.

11. The number of boys and girls in the school last year was in the ratio of 1:4 respectively. This year, the number of boys has increased in the ratio of 4:3 and the number of girls has reduced by $\frac{1}{6}$ of the original number. There are 240 more girls than boys in the school this year.
    a) Find the total number of pupils in the school last year.
    b) How many boys are in the school now?

12. The ratio of cattle to sheep on a farm is 8:1 respectively. The fraction of cows is $\frac{1}{5}$ more than the fraction of bulls on the same farm.
    a) Find the total number of cattle on the farm.
    b) Calculate the total number of goats on the farm.

13. A tank was $\frac{3}{8}$ full of water. When it rained, the volume of water in the tank increased in the ratio of 4:3. Two thirds of the new volume of water in the tank was used and 90 litres remained.
    a) Find the capacity of the tank.
    b) Find in litres the amount of water the tank holds when $\frac{3}{4}$ full.

14. In a sports club, $\frac{2}{3}$ of the boys play football and the rest play volleyball. $\frac{3}{4}$ of the girls play netball and the rest play volleyball. The ratio of boys to girls in the club is 3:2 respectively. 18 members play volleyball altogether.
    a) How many members are in the sports club?
    b) Find the number of girls in the club.

15. Mr. Kibala went to the market with mangoes and oranges. He sold $\frac{2}{3}$ of the mangoes and $\frac{3}{5}$ of the oranges and remained with 90 fruits altogether. The number of mangoes and oranges he had at first was in the ratio of 3:5 respectively.
    a) How many fruits did he have at first?
    b) Find the number of oranges he sold.

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16. SBK Junior School has two sections; Nursery section and Primary section. The number of pupils in the two sections is in the ratio of 1:8 respectively. $\frac{3}{8}$ of the pupils in nursery section and $\frac{5}{8}$ of the pupils in primary section are Catholics while the rest are Muslims. There are 340 Muslims in the school altogether.
   a) Find the total number of pupils in the school.
   b) How many pupils are in primary section?

17. In a school, $\frac{1}{6}$ of the boys went to the zoo and $\frac{2}{5}$ of the girls did not go to the zoo. The ratio of boys to girls in the school is 1:5 respectively. 270 pupils did not go to the zoo.
   a) Find the total number of pupils in the school.
   b) How many boys went to the zoo?
   c) Calculate the number of girls in the school.

PROPORTIONS

Applying direct proportions to solve problems

Example 1
The cost of 3kg of sugar is sh. 10500. What is the cost of 2kg of sugar?

3kg cost sh. 10500
1kg cost $\frac{sh. 10500}{3}$
1kg costs sh. 3500
2kg cost sh. 3500 x 2
2kg cost sh. 7000

Example 2
A woman bought 30 oranges at sh. 400 for every 6 oranges. How much money did she spend on oranges?

6 oranges cost sh. 400
1 orange costs $\frac{sh. 400}{6}$
30 oranges cost $\frac{sh. 400 \times 30}{6}$
30 oranges cost sh. 400 x 5
30 oranges cost sh. 2000

Example 3
2 bars of soap cost sh. 16000. How many bars of soap can I buy with sh. 32000?

sh. 16000 buy 2 bars

sh. 1 buys $\frac{2}{16000}$ bars

sh. 32000 buy $\frac{2 \times 32000}{16000}$ bars

sh. 32000 buy 4 bars

Example 4
Etoyi's car uses 14 litres of petrol to cover 35km. How much more petrol is needed to cover 105km?

35km consume 14 litres
1km consumes $\frac{14}{35}$ litres
105km consume $\frac{14 \times 105}{35}$ litres
105km consume 42 litres

(42 – 14) litres = 28 litres

Exercise

1. A plate costs sh. 1500. How much will 9 similar plates cost?

2. A taxi carries 14 passengers. How many passengers will 15 taxis carry?

3. $1\frac{1}{2}$ dozens of books cost sh. 16200. Find the cost of each book.

4. 3 pairs of balls cost sh. 120000. Find the cost of each ball.

5. The cost of 4 apples is sh. 4000. Find the cost of 6 apples.

6. If 3kg of meat cost sh. 45000. Find the cost of 4kg of meat.

7. A dozen of pencils costs sh. 2000. Find the cost of 9 similar pencils.

8. A girl bought 7 pens at sh. 4200 and a boy bought 9 similar pens. How much more did the boy spend than the girl?

9. A car moves 45km in 15 minutes. How far will it go in 2 hours?

10. Muhindo bought 4 eggs at sh.1300. How many eggs would he buy with sh. 6500?

11. Three rubbers cost sh. 1200. How many more rubbers can I buy with sh. 4000?

12. Kulamba bought 6 metres of cloth at sh. 48000 and made 4 shirts. How much money would he use to buy the metres of cloth to make 10 shirts?

13. Kasoma bought 30 books at sh. 10800 for every $1\frac{1}{2}$dozen. How much did he spend on books?

14. A school uses 550 litres of water every week. How many days will the school take to use 3300 litres of water?

15. Given that 3 dresses cost sh. 36000. How many dresses will Namuli buy with sh. 48000?

16. A car consumes 15 litres of petrol to cover 20 km. Each litre of petrol costs sh. 5400. How much money will be needed to buy the petrol to run the car for 28km?

17. Five workers earn sh. 90000 in 3 days. How much money will 4 workers earn in 8 days?

18. A taxi charges sh. 180000 to carry 10 passengers for 6km. How much would it charge to carry 8 passengers for 15km at the same rate?

19. A girl had sh. 2000. She bought 750 grams of salt at sh. 850 for every half kilogram. Find her change.

20. A cock costs sh. 12500 more than a hen. A poultry farmer sold 3 cocks at sh. 91500. She also sold 5 hens.
    a) Find the cost of each hen.
    b) How much money did she collect altogether?

21. In a shop, the cost of a geometry set is 3 times the cost of a compo pen. A girl paid sh. 27000 for half dozen of geometry sets. How much would she pay for 7 compo pens?

Applying inverse proportions to solve problems in real life situation

Example 1

12 women weed a field in 10 days. How long do 15 women working at the same rate take?

12 women take 10 days
1 woman takes (12x10) days
15 women take 12x10 days
            15
15 women take 8 days

Example 2

6 builders take 4 days to build a wall. How many men are needed to build the same wall in 1 day?

4 days require 6 builders
1 day requires (4x6) builders
1 day requires 24 builders

Example 3

4 girls take 12 minutes to sweep a compound. How many girls working at the same rate can sweep the compound in 6 minutes?

12 minutes require 4 girls
1 minute requires (12x4) girls
6 minutes require 12x4 girls
              6
6 minutes require 8 girls

Example 4

5 workers can repair the road in 21 days. How many more workers are needed to repair the same road in 15 days?

21 days require 5 workers
1 day requires (21x5) workers
15 days require 21x5 workers
              15
15 days require 7 workers

7 workers – 5 workers = 2 workers

Example 5

A school employed 20 workers to do a job which could be done by 15 workers in 40days. After 10 days, 5 more workers were employed. How long did it take to finish the job?

15 workers take 40 days
1 worker takes (15 x 40) days
20 workers take (15 x 40) days
              20
20 workers take 30 days

30 – 10 = 20 days needed

20 + 5 = 25 workers

20 workers need 20 days
1 worker needs (20 x 20) days
25 workers need (20 x 20) days
              25
25 workers need 16 days

(10 + 16) days = 26 days

Exercise

1. 3 men can do a piece of work in 4 months. how long will one man take to do the same piece of work?

2. 8 boys can do a piece of work in 10 days. How many days will 20 boys take?

3. 15 workers take 60 days to construct a road.
   a) How many days will one worker take?
   b) How long will 20 workers take?

4. Four tractors can plough a farm in 8 days. How long will it take to plough the land using three tractors?

5. There is enough food to last for 45 days for 15 boys. How long will the same food last if there were 25 boys?

6. A camp has enough food for 150 refugees for 8 days. How long will the same food last if 50 more refugees are brought in?

7. 20 men can complete a piece of work in 12 days. How many days will 30 men take?

8. A car travelling at a speed of 30km/hr covers a journey in 6 hours. How long will it take to cover the same journey at 18km/hr?

9. 15 pupils can mop the classroom in 16 minutes. How many more pupils are needed to mop the same class in 12 minutes?

10. Twenty four boys can slash a compound in 40 minutes how many boys can slash the same compound in 2 hours?

11. Adaku has enough money to buy 6kg of beans at sh. 2800 per kg. How many more kilograms of beans can he buy if the price is reduced to sh. 2100 per kg?

12. Julie was given enough money to buy 22 pens at sh. 500 each pen. She found out that the price of each pen was increased by sh. 50. How many pens did she buy?

13. Three men working for 10 hours a day can do a certain job in 8 days. How long would 2 men working 12 hours a day take to do the same job?

14. A factory employed 25 workers to do a job which could be done by 30 workers in 40 days. After 28 days, 5 workers left the factory. How long did it take to complete the job?

15. A company recruited 50 men to do a job which could be done by 40 men in 100 days. After 25 days, 5 more workers were employed. How long did it take to finish the job?

16. A juice producing factory wanted 200 workers in order to produce juice in 40 days but it registered 50 less workers. By how long did the production of juice delay?

17. In a factory, 24 workers working at the same rate can do a piece of work in 45 days. The factory employed 30 workers. After 16 days, 5 workers left. How long did the remaining workers take to finish the remaining part of work?

18. In a bag of pens, for every 3 black pens, there are 4 blue pens. 6 black pens in the bag. Find the number of blue pens in the bag.

19. On a farm, 1 in 4 animals is a sheep. If there are 120 animals, how many sheep are there?

20. David is making a cake. For every three eggs he uses, he needs 120 grams of flour. If he uses 480 grams of flour, how many eggs will he need?

Think as a mathematician

1. Nassan wants to make a rectangle with its length and width in the ratio of 7:8 respectively, using a 60cm string.
   a) Find the width of the rectangle.
   b) Calculate the area of the rectangle to be formed.

2. Shapes are triangles or rectangles and are either red or blue.

   The ratio of triangles to rectangles is 3:4
   Of the triangles, the ratio of red to blue is 2:3
   Of the rectangles, the ratio of red to blue is 4:1.

   a) What fraction of shapes is red?
   b) Find the ratio of red triangles to blue triangles.

3. The students in Maribu High School, walk, cycle or drive to school in the ratio of 2:1:5 respectively. 212 students walk. The fraction of girls in the school is a quarter more than the fraction of boys. Find the number of girls in the school.

4. In a class, the ratio of girls to boys is 2:3 respectively. 0.75 of the girls do eat meat and 0.32 of the boys do not eat meat. Given that 177 pupils eat meat, find the number of boys who eat meat.

5. Namu and Ben won some money. They shared the money in the ratio of 4:3 respectively. Namu decided to give sh. 4000 to her sister. The amount Namu and Ben have now is in the ratio of 7:6. Calculate the amount of money won by Namu and Ben.

6. In a library, the ratio of English books to Mathematics books is the same as the ratio of Mathematics books to Science books. If there are 1200 books of English and 1800 books of Mathematics, find the number of Science books.

7. Share sh. 3325000 among Betty, Henry and Brenda in the ratio of 0.5 : 0.3 : 1.2. How much less does Henry get than Brenda?

8. Kombo, Twaha and Mumbe contributed 40 goats, 36 goats and 24 goats respectively to start a joint farm. After 2 years, they separated and shared all the goats according to their initial contribution. If Kombo got 36 goats more than Mumbe,
   a) How many goats did Twaha get?
   b) How much money will Mumbe get after selling all the goats he got at sh. 150000 each?

9. Maria, Kenneth and Olivia share sh. 90000 so that for every sh 1 that Maria gets, Kenneth gets sh 3 and Olivia gets sh 2.
   a) Find how much each gets.
   b) How much more does Kenneth and Maria get than Olivia?

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PERCENTAGES

Meaning of percentages
* A percentage is a fraction whose denominators is 100.
* The symbol for percentage is %.
* Percent means out of a hundred.

Expressing percentages as decimals

Example 1
Express 35% as a decimal.

$$35\% = \frac{35}{100}$$

$$= 0.35$$

Example 2
Express 20% as a decimal.

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

$$= \frac{2}{10}$$

$$= 0.2$$

Exercise
Express each of the following as a decimal.

a)	30%	f)	9%	k)	78%
b)	60%	g)	7%	l)	125%
c)	40%	h)	8%	m)	117%
d)	90%	i)	12%	n)	108%
e)	4%	j)	19%	o)	102%

Expressing percentages as fractions

Example 1
Change 40% to a fraction.

$$40\% = \frac{40}{100}$$

$$= \frac{4 \div 2}{10 \div 2}$$

$$= \frac{2}{5}$$

Example 2
Convert 75% into a fraction.

$$75\% = \frac{75}{100}$$

$$= \frac{75 \div 25}{100 \div 25}$$

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

Example 3
Express $12\frac{1}{2}\%$ as a fraction.

$$12\frac{1}{2}\% = \frac{25}{2}\%$$

$$= \frac{25}{2} \div \frac{100}{1}$$

$$= \frac{25}{2} \times \frac{1}{100}$$

$$= \frac{1}{8}$$

Exercise
Express the following as common fractions.

a) 20%   f) 65%   k) $16\frac{2}{3}\%$

b) 50%   g) 45%   l) $6\frac{1}{4}\%$

c) 80%   h) 8%   m) 125%

d) 70%   i) $2\frac{1}{2}\%$ n) 175%

e) 15%   j) $33\frac{1}{3}\%$ o) 150%

Expressing percentages as ratios

Example 1
Express 80% as a ratio

$80\% = \frac{80}{100}$

$= \frac{8 \div 2}{10 \div 2}$

$= \frac{4}{5}$

$= 4:5$

Example 2
Write $33\frac{1}{3}\%$ as a ratio

$33\frac{1}{3}\% = \frac{100}{3}\%$

$= \frac{100}{3} \div \frac{100}{1}$

$= \frac{100}{3} \times \frac{1}{100}$

$= \frac{1}{3}$

$= 1:3$

Exercise
Express each of the following as ratios.

a) 30%   e) 9%   i) $1\frac{1}{4}\%$ m) 120%

b) 50%   f) 5%   j) $16\frac{2}{3}\%$ n) 225%

c) 40%   g) $12\frac{1}{2}\%$ k) $17\frac{1}{2}\%$ o) 150%

d) 37%   h) $6\frac{1}{4}\%$ l) $26\frac{2}{3}\%$ p) 125%

Expressing decimals as percentages

Example 1
Change 0.35 to a percentage.

$0.35 = \frac{35}{100}$

$= 35\%$

Example 2
Express 0.7 as a percentage.

$0.7 = \frac{7}{10}$

$= \frac{7 \times 10}{10 \times 10}$

$= \frac{70}{100}$

$= 70\%$

Approach 2

$0.7 = \frac{7}{10}$

$= \frac{7}{10} \times 100\%$

$= 70\%$

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Exercise

Express each of the following as a percentage

a)	0.73	e)	0.8	i)	0.672	m)	2.5
b)	0.24	f)	0.3	j)	0.005	n)	1.2
c)	0.25	g)	0.257	k)	0.009	o)	12.5
d)	0.98	h)	0.185	l)	1.7	p)	1.35

Expressing fraction as percentages

Example 1

Express $\frac{2}{5}$ as a percentage.

$\frac{2}{5} = \frac{2 \times 20}{5 \times 20}$

$= \frac{40}{100}$

$= 40\%$

Approach 2

$\frac{2}{5} = \frac{2}{5} \times 100\%$

$= 2 \times 20\%$

$= 40\%$

Example 2

Convert $\frac{3}{8}$ into a percentage.

$\frac{3}{8} = \frac{3}{8} \times 100\%$

$= \frac{300}{8}\%$

$= 37\frac{1}{2}\%$

Exercise

a)	$\frac{1}{2}$	f)	$\frac{1}{5}$	k)	$\frac{4}{15}$	p)	$\frac{3}{7}$
b)	$\frac{1}{4}$	g)	$\frac{1}{3}$	l)	$\frac{2}{3}$	q)	$\frac{7}{8}$
c)	$\frac{3}{4}$	h)	$\frac{1}{6}$	m)	$1\frac{1}{2}$	r)	$2\frac{3}{4}$
d)	$\frac{2}{5}$	i)	$\frac{7}{10}$	n)	$2\frac{3}{5}$	s)	$25\frac{1}{5}$
e)	$\frac{4}{5}$	j)	$\frac{3}{10}$	o)	$\frac{3}{8}$	t)	$5\frac{2}{3}$

Expressing ratios as percentages

Example 1

Change 5:8 to a percentage.

$5:8 = \frac{5}{8}$

$= \frac{5}{8} \times 100\%$

$= \frac{125}{2}\%$

$= 62\frac{1}{2}\%$

Example 2

Express $\frac{1}{3} : \frac{1}{2}$ as a percentage.

$\frac{1}{3} : \frac{1}{2} = \left(\frac{1}{3} \div \frac{1}{2}\right) \times 100\%$

$= \frac{1}{3} \times \frac{2}{1} \times 100\%$

$= \frac{200}{3}\%$

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

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Exercise

Express the following as percentages.

a) 1:2

b) 1:4

c) 2:5

d) 3:10

e) 3:8

f) 1:16

g) 2:3

h) 7:8

i) $\dfrac{1}{20} : \dfrac{1}{3}$

j) $\dfrac{1}{4} : \dfrac{1}{3}$

k) $\dfrac{3}{4} : \dfrac{9}{10}$

l) $\dfrac{1}{8} : \dfrac{1}{5}$

Expressing quantities as percentages

Example 1

Express 40 minutes as a percentage of 1 hour

1 hour = 60 minutes

$\dfrac{40 \text{ minutes}}{60 \text{ minutes}} = \dfrac{40}{60} \times 100\%$

$= \dfrac{2}{3} \times 100\%$

$= \dfrac{200}{3}\%$

$= 66\dfrac{2}{3}\%$

Example 2

What percentage of 2kg is 750g?

1kg = 1000g

2kg = 2 x 1000g

2kg = 2000g

$\dfrac{750g}{2000g} = \dfrac{750}{2000} \times 100\%$

$= \dfrac{3}{8} \times 100\%$

$= \dfrac{300}{8}\%$

$= \dfrac{75}{2}\%$

$= 37\dfrac{1}{2}\%$

Example 3

Mulaalo had 80 cows. He sold 20 of them. What percentage of cows was;

i) sold?

$\dfrac{20 \text{ cows}}{80 \text{ cows}} = \dfrac{20}{80} \times 100\%$

$= \dfrac{1}{4} \times 100\%$

$= 25\%$

ii) not sold?

80 cows – 20 cows = 60 cows

$\dfrac{60 \text{ cows}}{80 \text{ cows}} = \dfrac{60}{80} \times 100\%$

$= \dfrac{3}{4} \times 100\%$

$= 75\%$

Exercise

1. Express 15 as a percentage of 20
2. What percentage of sh. 3200 is sh. 800?
3. A box contains 24 red pens and 26 blue pens. What percentage of pens are blue?

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4. Express 200g as a percentage of 1kg

5. 50 out of 80 pupils in the class passed the exam. What percentage passed the exam?

6. Express 20 minutes as a percentage of 2 hours.

7. In a class of 150 pupils, 60 are boys the rest are girls. Find the percentage of girls.

8. The table below shows marks scored by Carol in different subjects.

Subject	MTC	SCI	SST	ENG
Marks gained	49	9	16	22
Out of	50	10	20	25

   Express as a percentage, the marks scored in each subject.

9. In a bag, there are 50 fruits. Of these, 16 are mangoes, 21 are oranges and the rest are apples.
   a) Find the number of apples in the bag.
   b) Express as a percentage, the number of apple in the bag.

10. In a class of 40 pupils, 8 of them are absent.
   a) Find the percentage of pupils who are absent.
   b) Express as a percentage the number of pupils who are present.

11. The table below shows the number of animals on Kasuka's farm. Use it to answer questions that follow.

Cows	Bulls	Goats	Sheep
80	40	120	60

   a) Find the total number of animals on the farm.
   b) Express as a percentage, the number of goats on the farm.

12. A tank was $\frac{3}{4}$ full of water. $\frac{1}{3}$ of the water in the tank was used. Express as a percentage the fraction of water that remained in the tank.

13. Pingu spent $\frac{1}{3}$ of his salary on rent, $\frac{3}{4}$ of the remainder on food and banks the rest. What percentage of the salary was banked?

14. While marking a test, a teacher awarded 3 marks for every correct answer and deducted 2 marks for each question failed. A test had 25 questions. Express as a percentage the score of a pupil who failed 3 questions in the test.

15. A pupil scored 48% in an exercise marked out of 50. How many marks did the pupil score?

16. A student scored 23 marks in an interview and this was 92% of the total score. Find the total score.

17. Express the difference between $\frac{3}{4}$ and $\frac{2}{3}$ as a percentage.

Finding parts of a percentages

Example 1

In a class, the percentage of boys is 55%. Find the percentage of girls.

100% - 55%
45%

Example 2

In a library, 10% of the books are English books, 47% are mathematics books and the rest are Science books. Find the percentage of Science books

100% - (10% + 47%)
100% - 57%
43%

Example 3

There are 20% more cows that bulls on a farm. Find the percentage of cows

Let the percentage of bulls be y

Cows	Bulls	Total
y + 20%	y	100%

Value of y
$$y + y+20\% = 100\%$$
$$2y + 20\% = 100\%$$
$$2y + 20\% - 20\% = 100\% - 20\%$$
$$2y = 80\%$$
$$\frac{2y}{2} = \frac{80\%}{2}$$
$$y = 40\%$$

Percentage of cows
y+20%
40% + 20%
60%

Example 4

The percentage of men is 10% less than the percentage of women in the village. Find the percentage of women.

Let the percentage of women be n

Men	Women	Total
n – 10%	n	100%

Value of n
$$n + n – 10\% = 100\%$$
$$2n – 10\% = 100\%$$
$$2n – 10\% + 10\% = 100\% + 10\%$$
$$2n = 110\%$$
$$\frac{2n}{2} = \frac{110\%}{2}$$
$$n = 55\%$$

The percentage of women is 55%

Exercise

1. Given that 12% of the pupils in the class are absent. Find the percentage of pupils who are present.

2. 65% of the vehicles in Uganda were made in Japan. Find the percentage of vehicles in Uganda not made from Japan.

3. 77% of the population in Kituntu village are children. Work out the percentage of adults.

4. Given that 65% of the bicycles in our town are black, 33% are blue and the rest are yellow in colour. Find the percentage of yellow bicycles in our town.

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5. A man spent 30% of his salary on rent, 20% on food and saved the rest. What percentage of his salary did he save?

6. A pupil did 24% of his holiday package in the first week, 17% in the second week, 35% in the third week and the rest in the fourth week. What percentage was done in the fourth week?

7. In a class, there are 20% more boys than girls.
   a) Find the percentage of girls.
   b) Work out the percentage of boys.

8. The percentage of boys in a school is 2y + 15% and the percentage of girls is 3y +5%.
   a) Solve for y
   b) Find the actual percentage of boys.

9. There are 50% more women than men in Butiti. Find the percentage of women.

10. Kiyingi got 40% less votes than Ndiwalana. What percentage of votes did Kiyingi get?

11. Maama Namu prepared tea such that the amount of water used was 48% less than the amount of milk.
    a) What percentage of milk was used?
    b) Find the percentage of water in the tea.

12. The percentage of boys in a class is 2h + 15% and this is 10% less than the percentage of girls.
    a) Solve for h
    b) Calculate the percentage of girls.

13. Given that 2y +15% of the pupils in the school are in upper primary classes, 6y + 10% are in lower primary classes and the rest are in upper primary classes. The number of pupils in upper primary classes is 5% less than the number of pupils in lower primary classes.
    a) Solve for y
    b) Find the percentage of pupils in upper primary classes.

14. On a farm, there are sheep, cattle and goats. The table below shows the percentage of sheep and cattle.

Sheep	Cattle
p + 6%	3p + 3%

If the percentage of sheep is 25% less than the percentage of cattle,
a) Solve for p
b) Find the percentage of goats on the farm.

15. The percentage of blue pens in the box is four times the percentage of red pens.
    a) Find the percentage of red pens
    b) Work out the percentage of blue pens.

16. The percentage of day scholars in the school is a third of the percentage of boarders. Find the percentage of;
    i) boarders
    ii) day scholars

17. The percentage of English books in the school library is two thirds the percentage of Mathematics books. Find the percentage of English books in the library.

Finding quantities equivalent to the given percentage.

Example 1
Find 25% of 2400 eggs.

25% of 2400 eggs

$\frac{25}{100}$ x 2400 eggs

25 x 24eggs

600 eggs

Example 2
Find $12\frac{1}{2}$ % of sh. 48000

$12\frac{1}{2}$ % of sh. 48000

$(\frac{25}{2} \div \frac{100}{1})$ x sh. 48000

$\frac{25}{2}$ x $\frac{1}{100}$ x sh. 48000

25 x sh. 240

sh. 6000

Example 3

Murungi has 400 heads of cattle. 75% of them are cows and the rest are bulls.

a) Find the number of cows.

   75% of 400

   $\frac{75}{100}$ x 400

   300 cows

b) How many more cows than bulls does she have?

   400 – 300 = 100 bulls

   300 – 100 = 200 more cows

By Sseggayi Benjamin Kasuka

Example 4

Dalil and Omar shared sh. 25000. Dalil got 12% more than Omar.

a) How much money did Omar's get?

Let Omar's percentage be k

Omar	Dalil	Total
k	k+12%	100%

Value of k

$$k + k+12\% = 100\%$$
$$2k + 12\% = 100\%$$
$$2k + 12\% - 12\% = 100\% - 12\%$$
$$2k = 88\%$$
$$\frac{2k}{2} = \frac{88\%}{2}$$
$$k = 44\%$$

Omar's share

$$\frac{44}{100} \text{ x sh. } 25000 = \text{sh. } 11000$$

b) If Dalil spent 40% of his share on food, how much money was left?

Dalil's share
sh. 25000 - sh. 11000 = sh. 14000

Percentage left
100% - 40% = 60%

Amount of money left
$$\frac{60}{100} \text{ x sh. } 14000 = \text{sh. } 8400$$

Example 5

A man spent 20% of his salary on rent, 30% of the remainder on food and saved the rest. The man's salary is sh. 400,000. Calculate the amount of money he saved.

Amount spent on rent
20% of sh. 400,000
$$\frac{20}{100} \text{ x sh. } 400,000$$
sh. 80,000

Remainder
sh. 400,000 – sh. 80,000
sh. 320,000

Amount spent on food
30% of 320,000
$$\frac{30}{100} \text{ x sh. } 320,000$$
sh. 96,000

Amount spent on rent + food
sh. 80,000 + sh. 96,000
sh. 176,000

Amount saved
  sh. 400,000
- sh. 176,000
  sh. 224,000

Example 6

A tank of capacity 7200 litres was 75% full of water. $33\frac{1}{3}$% of the water in the tank was used. Find in litres, the amount of water that remained.

Amount of water in the tank
75% of 7200 litres
$$\frac{75}{100} \text{ x 7200 litres}$$
75 x 72 litres
5400 litres

Amount of water used
$33\frac{1}{3}$% of 5400
$$(\frac{100}{3} \div \frac{100}{1}) \text{ x 5400}$$
$$\frac{100}{3} \text{ x } \frac{1}{100} \text{ x 5400}$$
1800 litres

Amount of water remained
  5400 litres
- 1800 litres
  3600 litres

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Exercise

1. Find

   a) 40% of 500 goats

   b) 25% of 800kg

   c) 11% of 1800 books

   d) 36% of 10800 people

   e) $12\frac{1}{2}$% of sh. 24000

   f) $33\frac{1}{3}$% of 4200 hens

   g) $16\frac{2}{3}$% of 900 grams

   h) $37\frac{1}{2}$% of 4000 cows

   i) $24\frac{1}{2}$% of 12800

   j) $12\frac{1}{4}$% of 16000

   k) $83\frac{1}{3}$% of 18000

   l) $62\frac{1}{2}$% of 120

2. In a class of 60 pupils, 75% of them are girls and the rest are boys.
   a) Find the number of girls
   b) Calculate the number of boys.
   c) If 20% of the boys are absent, find the number of boys who are absent.

3. Out of the 700 people who attended, 30% of them were girls, 20% were boys, 40% were women and the rest were men.
   a) Find the number of girls who attended the party.
   b) Calculate the number of men who attended the party.
   c) How many more women than men attended the party?

4. There were 50% more cows than bulls on a farm of 600 cattle.
   a) Work out the percentage of bulls on the farm.
   b) Find the number of bulls on the farm.
   c) Calculate the number of cows on the farm.

5. In a school of 300 pupils, there are 10% more girls than boys. Find the number of girls in the school.

6. A man spent 50% of his salary on food, 50% of the remainder on rent and saved the rest.
   a) What percentage of his salary was saved?
   b) How much money did he save if his salary is sh. 400,000?

7. Nkoye did 50% of his homework on Friday, 25% of the remainder on Saturday and completed the remaining numbers on Sunday.
   If the homework had 32 numbers altogether, how many numbers did he do on Sunday?

8. In a school of 400 pupils, 40% of the pupils are boys and 25% of the boys are day scholars the rest of the boys are boarders. Find the number of boys who are boarders.

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9. In a school of 1080 pupils, 60% of them are boys and 25% of the girls are in upper primary classes. Calculate the number of girls in upper primary classes.

10. In a school of 600 pupils, 40% are boys. 30% of the girls and 50% of the boys are boarders. Find the total number of pupils who are boarders

11. A tank of capacity 12000 litres was 80% full of water. When some water was sold using 20 litre jerry cans, 45% of it remained.
    a) Find in litres, the amount of water that was sold.
    b) If each jerry can was sold at sh. 250, how much money was collected altogether?

12. In a school of 900 pupils, 50% of them like mathematics, 25% like English, 40% of the remaining pupils like science and the rest of the pupils like social studies. Find the number of pupils who like social studies.

13. In a school of 720 pupils, 40% of them are boys and the rest are girls. 50% of the boys are boarders and 75% of the total number of pupils in the school are boarders.
    a) Find the number of boys in the school.
    b) Calculate the number of girls who are day scholars.

14. A fuel tank of capacity 9600 litres was 25% full of petrol. 40% of the petrol in the tank was sold.
    a) How many full 20 litre jerry cans are required to fill the tank?
    b) Given that a litre of petrol costs sh. 4995, how much money will be spent in order to fill the fuel tank to its capacity?

Forming and solving equations involving percentages

Example 1
If 30% of a number is 2400. Find the number.

Approach 1
Let the number be n
$$30\% \text{ of } n = 2400$$
$$\frac{30}{100} \times n = 2400$$
$$\frac{30n}{100} = 2400$$
$$100 \times \frac{30n}{100} = 2400 \times 100$$
$$\frac{30n}{30} = \frac{240000}{30}$$
$$n = 8000$$
The number is 8000

Approach 2
30% represent 2400
1% represents $\frac{2400}{30}$
1% represents 80
100% represents 80 x 100
100% represents 8000

The number is 8000

Approach 3
Let the number be k
$$30\% \times k = 2400$$
$$30\% \div 30\% \times k = 2400 \div 30\%$$
$$k = 2400 \div \frac{30}{100}$$
$$k = 2400 \times \frac{100}{30}$$
$$k = 8000$$
The number is 8000

By Sseggayi Benjamin Kasuka

Example 2

Given that $33\frac{1}{3}\%$ of a number is 1800. Find 60% of the same number.

Let the number be p

$33\frac{1}{3}\%$ of p = 1800

$(\frac{100}{3} \div \frac{100}{1})$ x p = 1800

$\frac{100}{3}$ x $\frac{1}{100}$ x p = 1800

$\frac{p}{3}$ = 1800

3 x $\frac{p}{3}$ = 1800 x 3

p = 5400

60% of 5400

$\frac{60}{100}$ x 5400

60 x 54

3240

Example 3

24 pupils in the class are absent and this is 20% of the total number of pupils in the class. How many pupils are present?

20% represent 24

1% represents $\frac{24}{20}$

100% represent $\frac{24}{20}$ x 100

100% represent 120 pupils

Number of pupils who are present

120

- 24

96 pupils

Example 4

In a school, 30% of the pupils are boys. If 240 pupils are day scholars and this is 60% of the total number of pupils in the school. Find the number of boys in the school.

Let the total number of pupils
in the school be n

60% of n = 240

$\frac{60}{100}$ x n = 240

$\frac{60n}{100}$ = 240

100 x $\frac{60n}{100}$ = 240 x 100

$\frac{60n}{60}$ = $\frac{24000}{60}$

n = 400 pupils

Number of boys

30% of 400

$\frac{30}{100}$ x 400

30 x 4

120 boys

By Sseggayi Benjamin Kasuka

Exercise

1. If 20% of a number is 80, find the number.
2. If 30% of a number is 90, what is the number?
3. Given that 16% of a number is 80. Find the number.
4. 130% of a number is 52. Find the number.
5. Nambiro spends sh. 40000 on books. This is 20% of her pocket money. Find her pocket money.
6. 15% of the price of a dress is 4500. Calculate the actual price of the dress.
7. 95% of the pupils in the school like mathematics. If 380 pupils like mathematics, find the total number of pupils in the school.
8. A fruit seller sold 21 mangoes and this was only 7% of the total number of mangoes he went with to the market. How many mangoes did he have at first?
9. 40% of the pupils in the school are girls. There are 416 girls in the school. Find the total number of pupils in the school.
10. Kasoro saves 28% of his monthly salary. He saves sh. 140000. Find Kasoro's monthly salary.
11. Bobi covered a distance in 3 hours at an average speed of 24km/h. The distance he covered was just 18% of his journey. Find his journey.
12. Given that 20% of a number is 90.
    a) Find the number.
    b) Find 60% of the same number.

13. Given that $37\frac{1}{2}$% of a number is 4500. What is 50% of the same number?

14. If $16\frac{2}{3}$% of a number is 120. Find $33\frac{1}{3}$% of the same number.

15. The sum of 20% and 45% of a number is 260.
    a) Find the number.
    b) Find 80% of the same number.
16. In the school library, 55% of the total number of books are mathematics books, 20% are English books. 10% are science books and the rest are SST books. There are 110 mathematics books in the library.
    a) Find the total number of books in the school library.
    b) Find the number of SST books in the school library.
17. In a school, 25% of the pupils are in nursery section, 45% are in lower primary classes and the rest are in Upper primary classes. There are 135 pupils in lower primary classes.
    a) Find the total number of pupils in the school.
    b) Calculate the number of pupils in upper primary classes.
18. In a village, 35% of the population are females and 60% of the males are boys. There are 420 females in the village.
    a) Find total number of people in the village.
    b) Calculate the number of boys.

19. In a school, 65% of the pupils in the school are girls and 60% of the boys are boarders. The number of girls in the school is 390.
    a) Find the total number of pupils in the school.
    b) If 80% of the girls are boarders, find the total number of boarders in the school.
20. In a group, 80% of the members are children and the rest are adults. 90% of the children and 40% of the adults eat ice cream. There are 240 children in the group.
    a) Find the total number of members in the group.
    b) How many members eat ice cream?
21. 40% of the traders in Lukaya sell mchomo, 30% sell drinks and the rest sell gonja. When river Katonga flooded, 25% of those who sell gonja went to Bukomansimbi town.
    a) If 150 traders sell drinks, find the total number of traders in Lukaya before the flooding of river Katonga.
    b) How many traders who sell gonja went to Bukomansimbi town?
22. There are 960 females in a certain village. 40% of the people in the village are males. If each person in the village received 200 coffee seedlings, how many seedlings were supplied to the village altogether?
23. The District Education Officer of a certain district registered 8,000 candidates to sit for PLE in 2022. Out of these, 60% were girls below 14 years and 45% were boys above 14 years. If there were 2700 girls were below 14 years of age,
    a) Find the number of girls who were registered for PLE that year.
    b) How many boys were registered for PLE in 2022?
    c) Find the total number of pupils who were below 14 years of age.
24. A party was attended by 1200 guests. Some guests were females and the rest were males. 40% of the female guests were girls and 70% of the male guests were men. 320 girls attended the party.
    a) Find the number of male guests who attended the party.
    b) Calculate the number of children who attended the party.
25. The table below represents the population of four counties A, B, C and D. The population of county A is 6000 people and that of B is 3600 people.
    Study the table and use it to answer questions that follow.

County	A	B	C	D
Percentage	$33\frac{1}{3}\%$	x	25%	y

    (a) Find the value of x.
    (b) Calculate the population of county D.

26. Mr. Okeru shared sh. 36000 among his two children. The son spent sh. 4200 on books and this was only 35% of his share. The daughter spent 60% of her share and saved the rest. How much money did the daughter save?

By Sseggayi Benjamin Kasuka

More problems involving application of percentage parts

Example 1
Joseph spends 55% of his salary on food and saves sh. 270000. What is his salary?

Approach 1
Percentage saved
100% - 55% = 45%
45% represent sh. 270000
1% represents sh. 270000
                    45
1% represents sh. 6000
100% represent sh. 6000 x 100
100% represent sh. 600000

Approach 2
Percentage saved
100% - 55% = 45%
Let his salary be y
45% of y = sh. 270000
$\frac{45}{100}$ x y = sh. 270000
$\frac{45y}{100}$ = sh. 270000

$100 \times \frac{45y}{100}$ = sh. 270000 x 100
$\frac{45y}{45}$ = $\frac{sh. 27000000}{45}$
y = sh. 600000

Example 2
A tank was 75% full of water, 120 litres were drawn, the tank became 35% full. Find the capacity of the tank when full.

Percentage drawn
75% - 35% = 40%

40% represent 120 litres
1% represents 120 litres
                    40
1% represents 30 litres
100% represent 100 x 30 litres
100% represent 3000 litres

Example 3
After covering 65% of his journey, Teddy still had 105km to go. How long was her journey?

Percentage left
100% - 65% = 35%

35% represent 105km
1% represents 105km
                    35
1% represents 3km
100% represent 100 x 3km
100% represent 300km

Example 4
The number of boys is a school is 132 less than the number of girls. Given that 72% of the pupils in the school are girls. Find the total number of boys

Percentage of boys
100% - 72% = 28%

Difference in percentage parts
72% - 28% = 44%

Total number of pupils
44% represent 132
1% represents 132
                    44

1% represents 3
100% represent 3 x 100
100% represent 300 pupils

Number of boys
28% of 300
$\frac{28}{100}$ x 300
3 x 28
84 boys

232

Exercise

1. If 30% of my salary is spent on food, I save sh. 350,000. Find my salary.

2. After spending 60% of her income, Gorreth had sh. 200,000 left.
   a) How much is her income?
   b) Calculate the amount of money she spent.

3. If 45% of the pupils in the class are absent, 22 pupils are present. Find the total number of pupils in the class.

4. Angume had 30 kilometres to go after covering 60% of the journey. How long was the journey?

5. In Dubaya Primary school, 75% of the pupils who sat for PLE last year passed. If those who failed were 30, find the number of pupils who passed.

6. Ngora earns 40% of his daily income by selling vegetables, 10% by selling eggs and the rest by selling milk. If he earns sh. 7500 by selling milk, find his daily income.

7. A man spends 15% of his salary on rent, 18% on fees, 22% on food, 25% on transport and saves sh. 80,000.
   a) Find the man's salary.
   b) How much more does he spend on food than on rent?

8. 40% of the cars in the car park were made in India, 25% of the remainder were made in America and the rest were made in Japan. Given that 360 cars were made in Japan.
   a) Find the percentage of cars made in America.
   b) Calculate the total number of cars in the car park.

9. In Muzuuka Primary school, $33\frac{1}{3}$% of the pupils in P.7 like eating matooke. 40% of the remainder like eating rice and the rest of the pupils like eating posho. If those who like eating posho are 42. Find the total number of pupils in the school.

10. Out of Taata Kimbowa's shirts in the bag, $66\frac{2}{3}$% of them are dirty and 25% of the remaining shirts are torn. If he has 6 good clean shirts left, how many shirts does he have in his bag altogether?

11. 75% of the water in the tank lasts a family 15 days.
    a) How long will 80% of the water in the tank last the family?
    b) If the family spends sh. 2500 per day on water, how much does it spend on a full tank?

12. Given that $66\frac{2}{3}$% of Alex's salary is equal to 75% of Hadijah's salary. Find Alex's salary if Hadijah's salary is sh. 360,000.

By Sseggayi Benjamin Kasuka

13. In Butayunja Primary School, 60% of the girls and 25% of the boys are in upper primary classes. There are 360 boys in the school. If 40% of the pupils in the school are girls,
    a) Find the total number of pupils in the school.
    b) Calculate the total number of pupils in upper primary classes.

14. In a certain county in Uganda, 120,000 people are males. 60% of the people are females and 60% of the females are girls.
    a) If $66\frac{2}{3}$% of the males are boys, find the ratio of boys to girls.
    b) What is the number of children in the county?

15. In a district mock, 18,000 of the candidates were boys. 60% of the boys and 80% of the girls passed the mock examination. 70% of candidates who sat for the mock examination were girls.
    a) How many girls passed the mock examination?
    b) Calculate the total number of candidates who failed the mock examination.

16. A bus taking passengers to Masaka from Kampala via Gomba covered 40% of its journey at a certain speed. It then changed the speed to 88 kilometres per hour and covered the remaining distance in $1\frac{1}{2}$ hours. How far is Masaka from Kampala via Gomba?

17. A bucket was 75% full of water. When 8 litres were removed, it became 50% full. Find in litres, the capacity of the bucket when completely full.

18. A pen was 75% full of ink. When some ink was used to write 120 pages, 60% of the ink remained. Find the number of pages the pen can write when full of ink.

19. A tank was $66\frac{2}{3}$% full of water. When 25% of the water in the tank was drawn, 5,000 litres remained. Find the capacity of the tank when full.

20. The difference between 65% and 30% of a number is 280. Find 40% of the same number.

21. In a class, 40% of the pupils are boys and the rest are girls. There are 16 more girls than boys in the class.
    a) Find the total number of pupils in the class.
    b) Calculate the number of girls.

22. Given that 70% of the people in our sub-county are females and the rest are males. The number of males is 480 less than the number of females.
    a) Find the total number of people in our sub-county.
    b) Find the number of males in the sub-county.

23. The number of cattle on the farm is 360 more than the number of goats. 41% of the animals on the farm are goats.
    a) Find the total number of animals on the farm.
    b) If 40% of the cattle are bulls and the rest are cows, find the number of cows on the farm.

24. The number of boys in the school is 72 less than the number of girls. 50% of the boys are boarders and 50% of the girls are day scholars. 38% of the pupils in the school are boys.
    a) Find the total number of pupils in the school.
    b) Calculate the number of pupils who are boarders.

25. The larger number is 20% more than the smaller number. If the smaller number is 80, find the larger number.

26. On a farm, there are 20% more cows than bulls. The number of cows on the farm is 240.
    a) Find the percentage of bulls on the farm.
    b) Calculate the total number of animals on the farm.

27. Kyanda and Lukyamuzi shared some money such that Lukyamuzi gets 40% more than Kyanda. If Kyanda got sh. 120,000,
    a) How much money did they share altogether.
    b) Find Lukyamuzi's share.

28. In 4 hours, a taxi covered a distance which was 20% less than the distance covered by a bus in 4 hours. If a bus covered 320 kilometres,
    a) How far did the taxi go in the 4 hours?
    b) Find the speed of the taxi in kilometres per hour.

29. There are 10% more girls than boys in Butiti Primary School. The number of boys in the school is 270.
    a) Find the total number of pupils in the school.
    b) If 20% of the girls are above 15 years of age, find the total number of girls below 15 years of age.

30. Kabuleta got 30% more votes than Katumba who got 5600 votes.
    a) How many votes did Kabuleta get?
    b) How many less votes did Katumba get than Kabuleta.

31. While preparing tea, Maama Nakamya used 12 litres of water and this was 40% less than the amount of milk used.
    a) How much tea was prepared?
    b) If each litre costs sh. 1800, how much money was spent on milk?

By Sseggayi Benjamin Kasuka

Problems involving percentage parts integrated with common fractions and ratios

Example

In a school, $\frac{2}{3}$ of the girls are Ugandans and $\frac{1}{6}$ of the boys are not Ugandans. The percentage of boys in the school is 30% and the school has 774 pupils who are Ugandans. Find the total number of pupils in the school.

Percentage of girls
100% - 30% = 70%

Girls who are Ugandans
$\frac{2}{3}$ of 70%
$\frac{2}{3} \times \frac{70}{100} = \frac{7}{15}$

Boys who are Ugandans
$(\frac{6}{6} - \frac{1}{6})$ of 30%

$(\frac{6-1}{6})$ of 30%

$\frac{5}{6} \times \frac{30}{100}$

$\frac{1}{4}$

Pupils who are Ugandans
$\frac{7}{15} + \frac{1}{4} = \frac{28 + 15}{60}$

$= \frac{43}{60}$

43 parts represent 774
1 part represents 774÷43
60 part represents 18 x 60
60 parts represent 1080 pupils

Exercise

1. In a school, $\frac{1}{5}$ of the girls are boarders while $\frac{1}{4}$ of the boys are day scholars. The percentage of girls in the school is 60%. The school has 116 pupils who are day scholars.
   a) How many pupils are in the school?
   b) Find the number of girls who are boarders.

2. In a school, 60% of the boys are below 13years of age while $\frac{3}{10}$ of the girls are above 13years of age. The ratio of boys to girls 3:5. There are 250 girls in the school.
   a) Find the number of pupils in the school.
   b) Calculate the total number of pupils who are above 13years of age.

3. In a meeting, the ratio of female head teachers to male head teachers is 2:3 respectively. $\frac{1}{6}$ of the male head teachers are not married but 50% of the female head teachers are married. Given that 42 head teachers are married.
   a) How many head teachers are in the meeting?
   b) Find the number of male head teachers who are married.

4. The fraction of sheep on a farm is three fifths less than the fraction of cattle. 40% of the cattle are bulls and the rest are cows. The number of cows on the farm is 120.
   a) Find the total number of cattle on the farm.
   b) Calculate the number of sheep on the farm.

5. Sylvia, Leticia and Jackie share money in the ratio of 3:2:5 respectively. When Leticia spent 60% of her share, sh. 80,000 was left.
   a) How much money did the three girls share altogether?
   b) How much money did Jackie get than Leticia?

6. A man spent 25% of his salary on rent, $\frac{1}{6}$ of the remainder on food and saves the rest which is sh. 80,000.
   a) Find the man's salary
   b) How much money does he spend on food?

7. A farmer used $\frac{1}{4}$ of his land for growing maize, 40% of the remainder for growing cassava and 26 hectares for growing sweet potatoes
   a) Find the total area of the land in hectares.
   b) Find the area of the land used for growing sweet potatoes.

8. 60% of the pens in the box are blue, $\frac{1}{4}$ are red and the rest are green. There are 30 more red pens than green pens in the box.
   a) Find the total number of pens in the box.
   b) Calculate the number of red pens.

9. 40% of the pupils in the group play football, $\frac{5}{6}$ of the remainder play volleyball and the rest play netball. The number of pupils who play football is 6 less than the number of pupils who play volleyball.
   a) Find the total number of pupils in the group.
   b) Find the number of pupils who play netball.

10. In a school, 80% of the girls eat ice cream and a third of the boys do not eat ice cream. The ratio of boys to girls in the school is 5:3.
    a) If the number of pupils who eat ice cream is 240, find the total number of pupils in the school.
    b) How many girls do not eat ice cream?

11. In library, there are English books, Mathematics books and Science books. 50% of the books are English books and this is $\frac{1}{5}$ more than the fraction of mathematics. If there are 60 science books,
    a) Find the total number of books in the library.
    b) Calculate the number of mathematics books.

12. A man's salary was increased by a quarter of the original salary. He decided to spend sh. 240,000 and this was 40% of his new salary.
    a) Find the man's salary before the increment.
    b) How much money was left?

13. Four fifths of the clothes produced by Mugagga Garments Ltd. In September were shirts and this was 8% less than the August production. If 550 shirts were produced in August, how many clothes were produced in September?

14. Two taps A and K are connected to a water tank of capacity 7200 litres. Tap A fills the tank in 4 hours and tap K takes 10 hours to empty the tank. One day, the tank was 55% full of water, the two taps were opened at the same time.
    a) How long did it take the tank to become full?
    b) Find in litres, the amount of water wasted by tap K by the time the tank became full.

15. A tap and a pipe are connected to a tank of capacity 48000 litres which is 40% full of water. A pipe fills the whole tank in 5 hours and a tap takes some hours to empty the tank when full of water. If the pipe and the tap are opened at the same time, it takes 8 hours for the tank to become full. Find in litres the amount of water in the tank after 3 hours.

16. Josh spent $\frac{1}{3}$ of his salary on food, 40% on school fees, 75% of the remainder on rent and saved the rest which is sh. 45000. Find the amount of money spent on rent.

17. A petrol station had some litres of petrol and diesel. 40% of the fuel was diesel. When $66\frac{2}{3}$% of the petrol and $\frac{5}{8}$ of diesel was sold, 29400 litres of fuel remained.
    a) Find in litres, the amount of petrol station had.
    b) If each litre of petrol was sold at sh. 5580, how much money was collected from petrol?

Increasing quantities by percentages

Example 1
Increase 2400 books by 12%

Approach 1
(100% + 12%) of 2400 books
112% of 2400 books
$\frac{112}{100}$ x 2400 books
112 x 24 books
2688 books

Approach 2

Increase

12% of 2400 books

$\frac{12}{100}$ x 2400 books

12 x 24 books

288 books

New number
2400 books
+ 288 books
2688 books

Example 2

A man's salary was sh. 210,000 last month. This month, it has been increased by $16\frac{2}{3}$. Find the man's salary new salary

Approach 1

$(100\% + 16\frac{2}{3}\%)$ of sh. 210,000

$116\frac{2}{3}\%$ of sh. 210,000

$(\frac{350}{3} \div \frac{100}{1})$ x sh. 210,000

$\frac{350}{3}$ x $\frac{1}{100}$ x sh. 210,000

35 x sh. 7000

sh. 245,000

Approach 2

Increment

$16\frac{2}{3}\%$ of sh. 210,000

$(\frac{50}{3} \div \frac{100}{1})$ x sh. 210,000

$\frac{50}{3}$ x $\frac{1}{100}$ x sh. 210,000

50 x sh. 700

sh. 35000

New salary

   sh. 210,000

+ sh.   35,000

   sh. 245,000

Exercise

4. Increase 6000 by 10%

5. Increase sh. 8000 by 20%

6. Increase 240 litres of milk by 25%

4. Increase 1500 cows by $16\frac{2}{3}\%$

5. Increase sh. 48000 by $22\frac{1}{3}\%$

6. Increase 320 pupils by $12\frac{1}{2}\%$

7. The taxi fare from Kampala to Masaka was increased by 20% from sh. 15,000. Find the new taxi fare.

8. The number of pupils at Kagologolo Primary School increased by 10% from 540. Find the new number of pupils in the school.

9. The price of a dress was sh. 20,000. Ankunda bought it at an increased price of $12\frac{1}{2}\%$. How much money did she pay for the dress?

10. Wamuseke's salary was increased by 48% from sh. 160,000. Find his new salary.

11. Nimu's weight was 48kg. He is now $33\frac{1}{3}\%$ heavier than before. Find Nimu's weight now.

12. Uganda's population in 2007 was 27million. In 2021, the population increased by $66\frac{2}{3}$% then by $11\frac{1}{9}$% by the end of 2023. Work out the number of people in Uganda by the end of 2023.

13. Increase sh. 18,000 by 20% then by 10%.

14. Increase 5400 eggs by 50% then by 20%.

15. Increase 75000 apples by $16\frac{2}{3}$% then by 20%.

16. Kaliisa had 500 cattle. His father gave him more cattle equivalent to 40% of what he had at first. After a year, the cattle increased by 20%. How many cattle did Kaliisa have at last?

17. The price of a radio was sh. 30,000. It was increased by $16\frac{2}{3}$% then by 10%. Find the final price of the radio.

18. Ssempiki was 150 centimetres tall. His height increased by 20% then by 30%. Find Ssekimpi's final height.

19. A tank of capacity 72000 litres was $\frac{1}{6}$ full of water. When it rained, the amount of water in the tank increased by 20%. Find in litres the amount of water needed to fill the tank.

20. A man's salary was sh. 120,000. It was then increased by $16\frac{2}{3}$%. He decided to buy $3\frac{1}{2}$kg of meat at sh. 15000 per kg and 2kg of rice at sh. 7000. Find his change.

Decreasing quantities by percentages

Example 1
Decrease 480 litres by 15%

Approach 1	*Approach 2*	*Approach 3*
(100% - 15%) of 480	Decrease	100% - 15% = 85%
85% of 480	$\frac{15}{100}$ x 480	100% represent 480 litres
$\frac{85}{100}$ x 480	$\frac{720}{10}$	1% represents $\frac{480}{100}$ litres
$\frac{4080}{10}$	72 litres	85% represent ($\frac{480}{100}$ x 480) litres
408 litres	New amount	80% represent 408 litres
	480 – 72 = 408 litres	

Example 2

Decrease 14400 books by $33\frac{1}{3}\%$

Approach 1

$(100\% - 33\frac{1}{3}\%)$ of 14400

$66\frac{2}{3}\%$ of 14400

$(\frac{200}{3} \div \frac{100}{1})$ x 14400

$\frac{200}{3}$ x $\frac{1}{100}$ x 14400

200 x 48

9600 books

Approach 2

Decrease

$33\frac{1}{3}\%$ of 14400

$(\frac{100}{3} \div \frac{100}{1})$ x 14400

$\frac{100}{3}$ x $\frac{1}{100}$ x 14400

4800 books

New number

  14400

 - 4800

   9600 books

Approach 3

$33\frac{1}{3}\% = (\frac{100}{3} \div \frac{100}{1})$

$= (\frac{100}{3} \times \frac{1}{100})$

$= \frac{1}{3}$

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

New number

$\frac{2}{3}$ x 14400 = 9600 books

Exercise

1. Decrease 2400 by 10%

2. Decrease 3600 by 15%

3. Decrease 6400 by 35%

4. Reduce 400 litres by $12\frac{1}{2}\%$

5. Decrease 14400 by $33\frac{1}{3}\%$

6. Reduce 7200 millilitres of milk in a jerry can by $66\frac{2}{3}\%$

7. Decrease 6400 hens by 20% then by 30%

8. Decrease sh. 150,000 by 10% then by 5%

9. Decrease 18000 by 20% then by 30%

10. There are 2400 iron sheets in a store. When some iron sheets were stolen, the number decreased by 20%
    a) How many iron sheets were stolen?
    b) Find the new number of iron sheets in the store.

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11. There were 800 pupils in Kibaati Primary School. When some pupils dropped out from school, the number of pupils decreased by 15%
    a) How many pupils dropped out from school?
    b) Calculate the new number of pupils in the school.

12. Mr. Uthman produced 1200 textbooks. When he sold some books at sh. 30,000 each, the number of textbooks decreased by $62\frac{1}{2}$%.
    a) How many textbooks did he sell?
    b) Calculate the total number of money he collected altogether.

13. The man's salary was sh. 480,000. It was decreased by 12% due to poor performance. Find his final salary.

14. The price of a pair of shoes was decreased by 15% from sh. 24000. Find the new price of the price of shoes.

15. The price of a radio was sh. 80,000. It was decreased by 20% in January then by 10% in February. Find the price of the radio in February.

16. The number of pupils in Kyempisi P/S was 1200. It decreased by 20% last year and then by 10% this year. Find the number of pupils in the school this year.

17. A tank of capacity 4800 litres was $\frac{2}{3}$ full of water. When some water was sold using 20 litre jerry cans at sh. 250 each. The amount of water decreased by 20%.
    a) How much water remained in the tank?
    b) Calculate the amount of money collected altogether?

18. Kasaato went shopping with sh. 40,000 to buy books. He found out that the price of a dozen of books was decreased by 5% from sh. 12,000. If he bought 38 books, how much money did he remain with?

19. A 40 litre milk can was $\frac{3}{4}$ full of milk which was sold in the morning and in the afternoon. The amount of milk in the can reduced by 40% then by $83\frac{1}{3}$% respectively.
    a) If each litre was sold at sh. 1500, how much money was collected in the afternoon?
    b) Find in litres the amount of milk that remained in the tank.

20. A trader had 84 dresses. When she bought more dresses at sh 252000, the number of dresses increased by 25%.
    a) How many dresses did she have at last?
    b) How much money did she pay for each dress?

21. There were 400 pupils in the school last year. This year, the number of pupils has increased by 15%. If 45% of the pupils in the school this year are boys, find the number of girls in the school this year.

Finding the original number after increase

Example 1

After increasing a number by 20% it became 10800. What is the number?

Approach 1

Let the number be n

$(100\% + 20\%)$ of n = 10800

$\qquad$ 120% of n = 10800

$\qquad \dfrac{120}{100} \times n = 10800$

$\qquad 100 \times \dfrac{120}{100} \times n = 10800 \times 100$

$\qquad\qquad 120n = 1080000$

$\qquad\qquad \dfrac{120n}{120} = \dfrac{1080000}{120}$

$\qquad\qquad n = 9000$

The number is 9000

Approach 2

$100\% + 20\% = 120\%$

120% represent 10800

1% represents $\dfrac{10800}{120}$

100% represent $\dfrac{10800}{120} \times 100$

100% represent 9000

Therefore, the number is 9,000

Example 2

A man's salary was increased by $16\frac{2}{3}\%$ to sh. 315000. Find the man's salary before the increment.

Let the man's old salary be y

$(100\% + 16\frac{2}{3}\%)$ of y = sh. 315000

$\qquad 116\frac{2}{3}\%$ of y = sh. 315000

$(\dfrac{350}{3} \div \dfrac{100}{1}) \times y$ = sh. 315000

$\dfrac{350}{3} \times \dfrac{1}{100} \times y$ = sh. 315000

$\qquad \dfrac{350y}{300}$ = sh. 315000

$\qquad 300 \times \dfrac{350y}{300}$ = sh. 315000 x 300

$\qquad \dfrac{350y}{350} = \dfrac{\text{sh. } 315000 \times 300}{350}$

$\qquad\qquad y$ = sh. 900 x 300

$\qquad\qquad y$ = sh. 270000

The man's salary was sh. 270,000

Example 3

Find the number increased by 10% then by 15% to become 5060

Let the number be k

$100\% + 10\% = 110\%$

$100\% + 15\% = 115\%$

$\qquad \dfrac{110}{100} \times \dfrac{115}{100} \times k = 5060$

$\qquad \dfrac{110}{100} \times \dfrac{115}{100} \times k = 5060$

$\qquad\qquad \dfrac{253k}{200} = 5060$

$\qquad 200 \times \dfrac{253k}{200} = 5060 \times 200$

$\qquad\qquad \dfrac{253k}{253} = \dfrac{5060 \times 200}{253}$

$\qquad\qquad k = 20 \times 200$

$\qquad\qquad k = 4000$

The number is 4000

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Exercise

1. What number is when increased by 20% become 720?
2. What amount of money when increased by 20% becomes sh. 28800?
3. When a number is increased by 15%, it becomes 920. What is the number?

4. By increasing a number by 30%, it becomes 650. Find that number

5. The number of pupils in the school increased by 10% to 132. Find the number of pupils in the school before the increase.

6. The price of a calculator was increased to sh. 23,600 by 18%. Find the original price of the calculator.

7. The price of a bar of soap rose up to 10,000 and this was a 150% increased. Find the original price of the bar of soap.

8. After increasing a sum of money by $12\frac{1}{2}$%, it becomes sh. 540,000. Find the sum of money before.

9. Irene harvested a certain amount of maize last season. This season, the harvest has increased by 6% to 1696 kilograms. Find in kilograms, the mass of maize she harvested last season.

10. The taxi fare from Kampala to Lyantonde was increased by $16\frac{2}{3}$% to sh. 3500. Find the old taxi fare.

11. Tr. Hellen's salary was increased by $7\frac{1}{3}$% to sh. 1,610,000. Calculate her salary before.

12. Find the number increased by 15% then by 20% to become 1104.

13. y was increased by 15% then by 20% to become 690. Find the value of y

14. The price of the radio was increased by $12\frac{1}{2}$% then by 20% to sh. 54000. Find the original price of the radio.

15. The number of animals on Kemigisha's farm increased by $6\frac{1}{4}$% then by 40% to 1190. Find the original number of animals on Kemigisha's farm.

16. Cissy's salary was increased by 15%. After spending $\frac{1}{3}$ of her new salary on transport, sh. 460,000 remained. Find Cissy's salary before the increment.

17. When it rained, the amount of water in the tank increased by $12\frac{1}{2}$% to 60750 litres. The tank holds 72000 litres when full. Calculate the fraction of water in the tank before the rain.

Finding the original number after the decrease

Example 1

What amount when decreased by 12% becomes sh. 528,000?

Approach 1

Let the number be y

$(100\% - 12\%)$ of y = sh. 528,000

$\qquad$ 88% of y = sh. 528,000

$\qquad \dfrac{88}{100}$ x y = sh. 528,000

$100 \times \dfrac{88}{100}$ x y = sh. 528,000 x 100

$\qquad$ 88y = sh. 1080000

$\qquad \dfrac{88y}{88} = \dfrac{\text{sh. } 1080000}{88}$

$\qquad$ n = sh. 600,000

The amount is sh. 600,000

Approach 2

100% - 12% = 88%

88% represent sh. 528000

1% represents $\dfrac{\text{sh. } 528000}{88}$

100% represent $\dfrac{\text{sh. } 528000}{88}$ x 100

100% represent sh. 600,000

The amount is sh. 600,000

Example 2

Find the number decreased by $37\frac{1}{2}\%$ to become 375.

Approach 1

Let the number be k

$(100\% - 37\frac{1}{2}\%)$ of k = 375

$\qquad 62\frac{1}{2}\%$ of k = 375

$(\dfrac{125}{2} \div \dfrac{100}{1})$ x k = 375

$\dfrac{125}{2}$ X $\dfrac{1}{100}$ x k = 375

$\qquad \dfrac{125k}{200} = 375$

$200 \times \dfrac{125k}{200} = 375 \times 200$

$\qquad \dfrac{125k}{125} = \dfrac{375 \times 200}{125}$

$\qquad k = 600$

The number is 600

Approach 2

Fraction of decrease

$37\frac{1}{2}\% = \dfrac{75}{2} \div \dfrac{100}{1}$

$\qquad = \dfrac{75}{2}$ X $\dfrac{1}{100}$

$\qquad = \dfrac{3}{8}$

New fraction

$\dfrac{8}{8} - \dfrac{3}{8} = \dfrac{5}{8}$

5 parts represent 375

1 part represent $\dfrac{375}{5}$

8 parts represent 75 x 8

8 parts represent 600

Therefore, the number is 600.

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Example 3

The price of an article was decreased by 36% then by 25% to sh. 24,000. Find the original price of the article

100% - 36% = 64%

100% - 25% = 75%

Let the original price be p

$(\frac{64}{100} \times \frac{75}{100})$ of p = sh. 24,000

$\frac{64}{100} \times \frac{75}{100} \times p$ = sh. 24,000

$\frac{12}{25} \times p$ = sh. 24,000

$\frac{12p}{25} \times 25$ = sh. 24,000 x 25

$\frac{12p}{12} = \frac{sh. 24,000 \times 25}{12}$

p = sh. 50,000

Exercise

1. What number when decreased by 20% becomes 160?

2. A certain number was decreased by 10% to 27. Find that number.

3. When a number is decreased by 15%, it becomes 2550. Find the original number.

4. What number is decreased by 20% to become 1080?

5. The amount of water in the tank decreased by 25% to 1500 litres. Find in litres, the amount of water in the tank before.

6. The price of a dress decreased by $12\frac{1}{2}$% to sh. 17500. Find the original price of the dress.

7. After decreasing a certain amount of money by 9%, it becomes sh. 36,400. What is the amount?

8. Akim's salary was decreased by 12.5% to sh. 210,000. Find the old salary.

9. A man's salary was decreased by 15% then by 20% to sh. 408,000. Find his original salary.

10. The price of a generator was decreased by 10% then by 20% to sh. 720,000. Find the original price of the generator.

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11. A jerry can was full of cooking oil. When some cooking oil was sold at sh. 6500 per litres, the amount of cooking oil reduced by $18\frac{3}{4}\%$ to $16\frac{1}{4}$ litres.
   a) Find in litres, the capacity of the jerry can.
   b) How much money was collected from cooking oil sold?

12. The taxi fare from Buddo to the new taxi park was decreased by $16\frac{2}{3}\%$. A conductor collects sh. 42000 from 14 passengers. Find the old taxi fare.

13. Aminah's salary was decreased by $33\frac{1}{3}\%$. Her new salary is $\frac{4}{5}$ of Sofia's salary. If Sofia's salary is sh. 300,000, find Aminah's original salary.

14. Oyem's wage was increased by 10% to sh. 88,000 per month.
   a) Find his old salary.
   b) If his new wage was decreased by 5%, find his final salary.

Finding percentage increase

Example 1
After increasing 600 by a certain percentage, it becomes 840. Find the percentage increase.

Old number is 600
New number is 840
Increase = 840 – 600
         = 240

Percentage increase = $\frac{\text{Increase}}{\text{Old number}}$ x 100%

= $\frac{240}{600}$ x 100%

= 40%

Example 2
The price of a geometry set increased by sh. 500 to sh. 4500. Find the percentage increased.

New price is sh. 500
Increase is sh. 4500
Old price = sh. 4500 – sh. 500
          = sh. 4000

Percentage increase = $\frac{\text{Increase}}{\text{Old number}}$ x 100%

= $\frac{\text{sh. 500}}{\text{sh. 4000}}$ x 100%

= $\frac{25}{2}\%$

= $12\frac{1}{2}\%$

Exercise

1. When 192 is increased by a certain percentage, it becomes 240. Calculate the percentage increase.

2. By what percentage will sh.12000 be increased to become sh. 15000?

3. When 400litres of water is increased by y% it becomes 440 litres. Find the value of y.

4. By what percentage will 900 be increased to become 1200?

5. The price of a bar of soap was increased from sh. 6000 to sh. 8000. Calculate the percentage increase.

6. The population of country increased by a certain percentage. The previous population census was 27,000,000 people . The current population is 36,000,000 people. By What percentage has the population increased?

7. The number of pupils in a school increased by 80 pupils to 400 pupils.
   a) How many pupils were in the school before the increase ?
   b) Calculate the percentage increase.

8. A worker's salary was increased by sh. 30,000 to sh.180,000. Find the percentage increase.

9. The number of animals on Deborah's farm increased by 24 to 168. What is the percentage increase in the number of animals?

10. A famer had 100 cattle on his farm last years. 40 of them were bulls and the rest were cows. This year each cow has produced one calf. Find the percentage increase in the number of cattle on the farm.

11. A bucket was $\frac{3}{4}$ full of water. When $\frac{1}{5}$ of the water was added, the amount of water in the bucket became 18 litres and this was $\frac{9}{10}$ of the capacity of the bucket.
   a) Find the capacity of the bucket .
   b) Calculate the percentage increase in the amount of water.

Percentage decrease

Example 1

When sh. 48,000 is decreased by n%, it becomes sh. 36,000. Find the value of n.

Old amount is sh. 48,000
New amount is sh. 36,000
Decrease = sh. 48,000 – sh. 36,000
         = sh. 12,000

Percentage decrease = $\frac{\text{Decrease}}{\text{Old number}}$ x 100%

n = $\frac{\text{sh.12000}}{\text{sh. 48000}}$ x 100%

n = 25%

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Example 2

The price of a TV set was reduced by sh.150,000 to sh. 300,000. Calculate the percentage decrease.

New price is sh. 300,000
Decrease is sh. 150,000
Old price = sh. 300,000 + sh. 150,000
            = sh. 450,000

$$\text{Percentage decrease} = \frac{\text{Decrease}}{\text{Old number}} \times 100\%$$

$$= \frac{\text{sh. 150,000}}{\text{sh. 450,000}} \times 100\%$$

$$= \frac{100}{3}\%$$

$$= 33\frac{1}{3}\%$$

Exercise

1. By what percentage will sh. 20,000 decrease to sh.18,000?

2. By what percentage will 600 be decreased to 540?

3. After decreasing 650 by a certain percentage, it becomes 520. Find the percentage decrease.

4. the number of pupils in the school at the beginning of the year was 240. They are now 210. Find the percentage decrease.

5. When 1000 is decreased by k%, it becomes 900. Find the value of k.

6. When 240 is decreased by p% it becomes 180. Find the value of p.

7. Naluze's pocket money was reduced from sh. 25,000 to sh. 15,000. By what percentage was it reduced?

8. A man's salary was decreased by sh. 50,000 to sh. 70,000. Calculate the percentage decrease.

9. The taxi fare from Kampala to Mbale was decreased by sh. 15,000 to sh. 45,000. Calculate the percentage decrease.

10. The new price of a pair of shoes is sh. 80,000. If it was decreased by sh. 8,000. Calculate the percentage decrease.

11. A tank was $\frac{3}{4}$ full of water. When some water was sold, $\frac{1}{6}$ of it remained. If 3000 litres were sold,
    a) Find in litres, the capacity of the tank when completely full.
    b) By what percentage did the amount of water in the tank decrease?

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12. A trader bought trays of eggs. On his way back to the shop, 60 eggs got broken. He remained with 180 eggs.
    a) If a tray holds 30 eggs, how many trays of eggs did the trader buy?
    b) Find the percentage decrease in the number of eggs.

Percentage profit / gain

Example 1

A trader bought a bag at sh. 10,000. She later sold it at sh.12500. What was her percentage profit?

Cost price is sh. 10,000
Selling price is sh. 12,500

Profit = sh. 12,500 – sh. 10,000
     = sh. 2500

Percentage profit = $\dfrac{\text{Profit}}{\text{Cost price}}$ x 100%

= $\dfrac{\text{sh. 2,500}}{\text{sh. 10,000}}$ x 100%

= 25%

Example 2

The profit on a goat which was sold at sh. 480,000 was sh. 30,000. Calculate the percentage gain.

Selling price is sh. 480,000
Profit is sh. 30,000

Cost price = sh. 480,000 – sh. 30,000
        = sh. 450,000

Percentage profit = $\dfrac{\text{Profit}}{\text{Cost price}}$ x 100%

= $\dfrac{\text{sh. 30,000}}{\text{sh. 450,000}}$ x 100%

= $\dfrac{20}{3}$%

= $6\dfrac{2}{3}$%

Exercise.
1. Lubwama sold a radio at sh. 50,000. He bought it at sh. 40,000. Calculate the percentage profit.

2. An exercise book was bought at sh 800 and sold at sh.900. calculate the percentage profit.

3. Akandwanaho bought a dozen of books at sh. 12000 , he later sold each book at sh. 1500. What was his percentage profit?

4. A shopkeeper bought a sack of maize flour at sh. 75,000 and sold it at sh. 80,000. Calculate the percentage profit.

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5. Gloria sold a mango at sh. 500 making a profit of sh.100. What was the percentage gain?

6. The profit made on an article bought at sh. 9000 is sh. 3000. Calculate the percentage gain.

7. By selling address at sh. 60,000 a trader makes a profit of sh. 10,000
   a) Find the cost price of the dress.
   b) Work out the percentage profit.

8. Kwijuka sold a school bag at sh. 18000. He made a profit of sh. 3000. Find the percentage profit.

9. The profit made on a television set sold at sh. 200,000 is sh. 20,000. Calculate the percentage gain

10. By selling 36 eggs at sh. 32,400, a trader makes a profit of sh. 150 per egg. Calculate the percentage profit.

Percentage loss

Example 1
Mukalazi bought a lap top at sh. 450,000 and made a loss after selling it at sh. 300,000. Calculate the percentage loss.

Cost price is sh. 450,000
Selling price is sh. 300,000

Loss = sh. 450,000 – sh. 300,000
 = sh. 150,000

Percentage loss = $\dfrac{\text{Loss}}{\text{Cost price}} \times 100\%$

$= \dfrac{\text{sh. 150,000}}{\text{sh. 450,000}} \times 100\%$

$= \dfrac{100}{3}\%$

$= 33\dfrac{1}{3}\%$

Example 2
A sales man made a loss of sh. 15,000 after selling a dining table at sh. 75,000. Find the percentage loss.

Loss is sh. 15,000
Selling price is sh. 75,000

Cost price = sh. 75,000 + sh. 15,000
 = sh. 90,000

Percentage loss = $\dfrac{\text{Loss}}{\text{Cost price}} \times 100\%$

$= \dfrac{\text{sh. 15,000}}{\text{sh. 90,000}} \times 100\%$

$= \dfrac{50}{3}\%$

$= 16\dfrac{2}{3}\%$

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Exercise

1. I bought a fan at shs.120,000 but I was forced to sell it at sh. 100,000. Calculate my percentage loss.

2. Atrader bought a dozen of books at sh. 10000. She later sold it at sh. 7500. Find the percentage loss.

3. After buying a radio at sh. 60,000, Ssebuufu was forced to sell it at sh. 48000. Calculate his percentage loss.

4. Cindy bought a shirt at sh. 40,000. She later sold it at sh . 30,000. Find the percentage loss.

5. The loss made on an article bought at sh. 5000 is sh. 500. Find the percentage loss.

6. By selling a phone at sh. 90,000 a trader makes a loss of sh.10,000.
   a) Find the cost price of the phone.
   b) Calculate the percentage loss..

7. After selling a bicycle at sh 150000, Kitunzi made a loss of sh. 30,000. Calculate the percentage loss.

8. A woman sold a tin of paraffin at sh. 60,000 and made a loss of sh. 15,000. Calculate the percentage loss.

9. A dress was bought from a trader at sh. 30,000. If a trader made a loss of sh. 6000, calculate his percentage loss.

10. By selling 2 dozen of pens at sh. 450 each, a trader makes a loss of sh. 1200. Find the percentage loss.

Finding profit / loss when percentage profit / percentage loss and cost are given.

Example 1
Alex bought a shirt at sh. 30,000 he sold it making a profit of 20%. Calculate the actual profit he made.

Profit = 20% of the cost price
= 20% of sh. 30,000
= $\frac{20}{100}$ x sh. 30,000
= sh. 6,000

Example 2
A trader made a loss of 5% on an article whose buying price is sh. 80,000. Find the loss.

Loss = 5% of the cost price
= 5% of sh. 80,000
= $\frac{5}{100}$ x sh. 80,000
= sh. 4,000

Exercise

1. Kimuli bought a calculator at sh. 20,000. He later sold it making a profit of 10%. Find the profit he made.

2. A trader bought an article at sh. 10,000 which she later sold making a profit of $12\frac{1}{2}$%. Calculate her profit

3. I bought a stool at sh. 12,000. By selling it I made a profit of 15%. Find my profit

4. Amos made a loss of 10% on a pair of shoes which he bought at sh. 180,000. Calculate his loss.

5. A goat bought at sh. 180,000 was sold at a loss of $12\frac{1}{2}$%. How much loss was made?

6. I bought a jerry can at sh. 6,000. I was forced to sell it making a loss of $16\frac{2}{3}$%. How much loss did I make?

7. Alex bought a dozen of books at sh. 800 per book. He later sold all the books making a profit of 25%. How much profit did he make altogether?

8. Katumba sold 9 turkeys at sh. 630,000 making a loss of 30%. Find the loss he made on each turkey.

9 A trader bought a shirt at sh. 24,000 and a trouser at sh. 30,000. He sold the shirt and the trouser making a profit of 15% and $16\frac{2}{3}$% respectively. Calculate his total profit.

Finding the selling price when percentage profit and cost price are given

Example

A trader bought a bench at sh. 20,000 and sold it making a profit of 10%. Calculate the selling price.

Approach 1

(100% + 10%) of cost price

110% of sh. 20,000

$\frac{110}{100}$ x sh. 20,000

110 x sh. 200

sh. 22,000

The selling price was sh. 22,000

Approach 2

Selling price = Cost price + Profit

= sh. 20,000 + (10% of sh. 20,000)

= sh. 20,000 + ($\frac{10}{100}$ x sh. 20,000)

= sh. 20,000 + (10 x sh. 200)

= sh. 20,000 + sh. 2,000

= sh. 22,000

The selling price was sh. 22,000

By Sseggayi Benjamin Kasuka

Exercise

1. Bernice bought a phone at sh. 200,000. She later sold it making a profit of 20%. How much money did she sell the phone?

2. Calculate the selling price of article bought at sh. 15,000 and sold at a profit of 14%

3. A girl bought a knife at sh. 4000. At what price must she sell it to make a profit of 15%?

4. Find the selling price of the broom bought at sh. 600 and sold at a profit of $33\frac{1}{3}$%.

5. A radio bought at sh. 54000 was sold at a profit of $16\frac{2}{3}$%.Calculate the selling price of the radio.

6. Eluga bought a mosquito net at sh. 10,000. He later sold it to Tenge making a profit of $12\frac{1}{2}$%. How much money did Tenge pay for the mosquito net?

7. Steven bought a dozen of book at sh. 7500. He later sold them making a profit of 20%
   a) How much money did he sell all the books?
   b) Find the cost of each book?

8. A trader made 15% profit after selling 69 mangoes. If he paid sh. 6000.
   a) How much money did he sell the mangoes?
   b) Calculate the selling price for each mango.

9. Arnold bought a 50kg sack of maize flour at sh. 100,000. At what price must he sell each kilogram to raise a profit of 20%?

10. A shopkeeper bought a box containing 50 pens at sh. 20,000. At what price must she sell each pen to make a profit of 25%?

11. A trader bought 14 shirts at sh. 360,000. At how much must the trader sell each shirt to raise a profit of $16\frac{2}{3}$%

12. Kasuka spent sh. 1920,000 to produce 80 text books. How much must he sell each copy to make a profit of 12 ½ %

13. A trader bought a wire at sh. 100,000. He sold each metre at sh. 3000 making a profit of 20%.
    a) How much money did he sell the wire?
    b) How many metres of wire did he buy?

14. A fruit seller bought some pineapples at sh. 21600. She later sold all of them making a profit of 25%.
    a) At what price did she sell the pine apple?
    b) If each pine apple was sold at sh. 1500. How many pineapples did she buy?

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15. Mukiibi bought some books at sh. 36,000. He sold each book at sh. 2000 making a profit of $33\frac{1}{3}$%. How many books did he buy?

16. A trader bought a 50kg sack of sugar at sh. 225,000. On his way to the shop, 5kg got poured. At what price must he sell the remaining kilogram to raise a profit of 20%?

17. Cate bought 35 eggs at sh. 300 each. Some eggs got broken. She sold each of the remaining eggs at sh. 420 making a profit of 20%. How many eggs got broken?

18. A shopkeeper bought some books at sh. 144,000. Ten books were destroyed by rats. She sold the remaining books at sh. 6000 each making a profit of 25%. How many books did the shopkeeper buy?

Finding the selling price when the buying price and percentage loss are given

Example 1
Kamara bought a dress at sh. 40,000. She later sold it to Twina making a loss of 15%. How much money did Kamara sell the dress?

Approach 1

(100% - 15%) of cost price

85% of sh. 40,000

$\frac{85}{100}$ x sh. 40,000

85 x sh. 400

sh. 34,000

The selling price was sh. 34,000

Approach 2

Selling price = Cost price - Loss

= sh. 40,000 - (15% of sh. 40,000)

= sh. 40,000 - ($\frac{15}{100}$ x sh. 40,000)

= sh. 40,000 - (15 x sh. 400)

= sh. 40,000 - sh. 6,000

= sh. 34,000

The selling price was sh. 34,000

Example 2
A trader bought 15 T-shirts at sh. 240,000. At what price did he sell each T-shirt if he made a loss of 20%.

Selling price for 15 T-shirts
(100% - 20%) of cost price
80% of sh. 240,000
$\frac{80}{100}$ x sh. 240,000
80 x sh. 2400
sh. 192,000

Selling price for each t-shirt

15 T-shirts were sold at sh. 192,000

1 T-shirt was sold at $\frac{sh.\ 192000}{15}$

1 T-shirt was sold at sh. 12800

By Sseggayi Benjamin Kasuka

Exercise

1. A radio bought at sh. 50,000 was sold at a loss of 10%. Calculate its selling price.

2. A man bought a motorcycle at sh. 2400,000 and sold it making a loss of 15%. Calculate the selling price of the motorcycle.

3. A trader bought a set of chairs at sh. 960,000. He sold it making a loss of $33\frac{1}{3}$%. Calculate the selling price.

4. A pair of shoes bought at sh. 35,000 was sold by a trader making a loss of 16%. At what price did the trader sell the pair of shoes?

5. A loss of $12\frac{1}{2}$% was made on a basket bought at sh. 8,000. Find the selling price of the basket.

6. Waiswa bought a geometry set at sh. 5000. He later sold it to Kato making a loss of 28% at how much money did Kato buy it?

7. Mande bought a phone at sh. 80,000. He sold it to Kefa making a loss of 25%. Kefa also sold it to Hilda making a loss 14%. Calculate the amount of money Hilda paid for the phone.

8. Yowasi bought 15 kg of rice at sh. 48000. He later sold the rice making a loss of $12\frac{1}{3}$%.
    a) How much money did he buy each kg of rice?
    b) At what price did he sell the rice?

9. Obonyo bought 12 apples at sh. 500 each. She sold all the apples making a loss of 50%. At what price did she sell each apple?

10. Yusufu bought 25 bottles of waters at sh. 500 each. How much did he sell each bottle, if he made a loss of 10%.

11. Atrader bought some oranges at sh. 19,200. He sold each orange at sh. 500 making a loss of $16\frac{2}{3}$%
    a) How much money did he sell all the oranges?
    b) How many oranges did he buy?

12. Kamasu bought some rat traps at sh. 36,000. He sold all the traps making a loss of 10%. How many rat traps did Kamasu buy?

13. A vegetable seller bought 60 carrots at sh. 200 each. After one week, some carrots got spoilt. She sold the remaining carrots making a loss of 20%. At what price did she sell each carrot?

14. Norah bought 40 mangoes at sh. 20,000. She gave some mangoes to her children. By selling the remaining mangoes at sh. 500 each, she realized a loss of 25%. How many mangoes did she give to her children?

Finding the cost price when loss or profit and percentage loss or profit are given.

Example 1
A trader sold a radio making a profit at sh. 8000 and this was 16% of the cost price. At what price did he buy the radio?

Approach 1
Let the cost price be y
16% of y = sh. 8,000
$\frac{16}{100}$ x y = sh. 8,000
100 x $\frac{16y}{100}$ = sh. 8,000 x 100

$\frac{16y}{16}$ = $\frac{sh.\ 800000}{16}$
y = sh. 50,000

Approach 2
16% represent sh. 8,000
1% represents $\frac{sh.\ 8,000}{16}$
100% represent $\frac{sh.\ 8,000}{16}$ x 100
100% represent sh. 50,000
Cost price = sh.50,000

Example 2
The loss made on a dress sold at a 15% loss is sh. 4500. Find the cost price of the dress.

Approach 1
Let the cost price be g
15% of g = sh. 4,500
$\frac{15}{100}$ x g = sh. 4,500
100 x $\frac{15g}{100}$ = sh. 4,500 x 100

$\frac{15g}{15}$ = $\frac{sh.\ 450,000}{15}$
g = sh. 30,000

Approach 2
15% represent sh. 4,500
1% represents $\frac{sh.\ 4,500}{15}$
100% represent $\frac{sh.\ 4,500}{15}$ x 100
100% represent sh. 30,000
The cost price was sh. 30,000

Exercise.
1. A trader sold an article making a profit of sh. 2500 and this was 5% of the cost price. Find the cost price of the article

2. A business woman sold a cock making a profit of 20%. If she made a profit of sh. 8000. How much money did she pay for the cock?

3. The profit got on a radio sold at 15% profit was sh. 15,000. Find the cost price of the radio.

4. The profit made on a pen is sh. 50. A trader sold a box containing 50 pens making a profit of 20%. Find the cost price of the box of pens.

5. The loss made on a shirt sold at 18% loss is sh. 3600. Find the cost price of the shirt.

6. Musoke sold his bicycle 23% loss which amounted to sh. 69,000. How much money did he buy it?

Finding the cost price when selling price and percentage profit are given

Example 1
By selling an article at sh. 144000, a trader makes a profit of 20%. Find the cost price of the article.

Approach 1
Let the cost price be y
100% + 20% = 120%
$\frac{120}{100}$ x y = sh. 144000
100 x $\frac{120}{100}$ x y = sh. 144000 x 100

$\frac{120y}{120} = \frac{sh.\ 14400000}{120}$
 y = sh. 120,000

Approach 2
100% + 20% = 120%
120% represent sh. 144000
1% represents $\frac{sh.\ 144000}{120}$
100% represent $\frac{sh.\ 144000}{120}$ x 100
100% represent sh. 120,000
Cost price = sh.120,000

Example 2
Mafabi sold a shirt to Ssimbwa making a profit of 10%. If Ssimbwa paid shs. 13200. How much money did Mafabi pay for the shirt?

100% + 10% = 110%
100% represent sh. 13200
1% represents $\frac{sh.\ 13200}{110}$
100% represent $\frac{sh.\ 13200}{110}$ x 100
100% represent sh. 12000
Mafabi paid sh. 12000

Exercise
1. By selling a mat at sh. 24000, a woman made 20% profit. Find its cost price

2. A trader made a profit of 10% by selling a phone at sh. 33000. Calculate the cost price of the phone.

3. Kasamba makes a profit of 15% by selling a jackfruit at sh. 4600. How much money did he pay for the jackfruit ?

4. A boy sold his pen at sh. 550 making a profit of 10%. Calculate the amount of money the boy paid for the pen.

5. By selling a dress at sh. 23600, a trader makes 18% profit. Find the cost price of the dress.

6. A trader sold a TV set at sh. 450,000 making a profit of 20%. How much money did the trader pay for the TV set?

7. Binti sold his goat to Kenti making a profit of $16\frac{2}{3}$%. If Kenti paid sh. 350,000. How much money did Binti buy the goat?

8. After selling a lap top at sh. 800000, Hamidu realized a profit of $33\frac{1}{3}$%. How much money did he pay for the laptop.

9. A trader from Nyendo farmers' market made a profit of $7\frac{1}{2}$% by selling a bunch of matooke at sh. 21,500. Find the cost price of the bunch of matooke.

10. Birabwa makes a profit of 24% by selling a dictionary at sh. 62000.
    a) Find the cost price of the dictionary.
    b) How much profit did she actually make?

11. Onencan sold his bicycle to Lakot making a profit of 28%. If Lakot paid sh. 192,000.
    a) How much money did Onencan pay for the bicycle.

    b) Calculate the profit Onencan made.

12. By selling a cock to David at sh. 25000, Shilla makes a profit of $66\frac{2}{3}$%
    a) How much money did Shilla buy the cock?
    b) Calculate shilla's profit

13. Eletu sold a radio to Tenywa making a profit of 20%. Tenywa later sold it to Nagaba making a profit of 10%. If Tenywa paid sh. 48000.
    a) How much money did Eletu buy the radio?
    b) Calculate the amount of money Tenywa sold the radio.
    c) How much profit did Tenywa make?

14. Kakaba sold his basin to Okiror making a profit of $16\frac{2}{3}$% . Okiror paid sh. 3500. Okiror later sold it to Ntambi making a profit of 20%.
    a) How much money did Kakaba pay for the basin?
    b) How much profit did Kakaba make?
    c) Calculate the amount of money Ntambi paid for the basin.

15. Okoed sold her cock to Kananaku making a profit of 20%. Kananaku later sold the same cock to Okurut at sh. 33,000 making a profit of 10%.
   a) How much money did Okoed pay for the cock?
   b) Calculate the profit Kananaku get.

16. Moses sold an article to Mike making a profit of $12\frac{1}{2}$%. Mike later sold the same article at sh. 54,000 making a profit of 20%. How much profit did Mike make than Moses?

Finding the cost price when the selling price and percentage loss are given.

Example 1
By selling an article at sh. 27000 a trader realizes a loss of 10%. Find the cost price of the article.

Approach 1
Let the cost price be m
(100% - 10%) of the cost price = sh. 27,000

$$\frac{90}{100} \times m = \text{sh. } 27,000$$

$$\frac{90m}{100} = \text{sh. } 27,000$$

$$100 \times \frac{90m}{100} = \text{sh. } 27,000 \times 100$$

$$90m = \text{sh. } 2700000$$

$$\frac{90m}{90} = \frac{\text{sh. } 2700000}{90}$$

$$m = \text{sh. } 30,000$$

Approach 2
100% - 10% = 90%
90% represent sh. 27,000

1% represents $\frac{\text{sh. } 27000}{90}$

100% represent $\frac{\text{sh. } 27000}{90} \times 100$

100% represent sh. 30,000
Cost price = sh. 30,000

Example 2
Kakuru bought a shirt from Buyera at sh. 12600. Buyera made a loss of 16%. How much money did Buyera buy the shirt?

100% - 16% = 84%
84% represent sh. 12,600

1% represents $\frac{\text{sh. } 12600}{84}$

100% represent $\frac{\text{sh. } 12600}{84} \times 100$

100% represent sh. 150,00
Cost price = sh.150,00

Exercise

1. Selling a book at sh.1200, Lutalo made a loss of 40%. Find the cost price of the book.

2. If a trader sells a wheelbarrow at sh. 90,000, she makes a loss of 25%. Find the cost price of the wheelbarrow.

3. By selling a blanket at sh. 36000, a trader makes a loss of 10%. Calculate the cost price of the blanket .

4. After selling a shirt at sh.17000, I made a loss of 15%. How much money did I pay for the shirt?

5. A 12% loss was made on a phone sold at sh. 44,000. Calculate the buying price of the phone.

6. A man made a loss of $12\frac{1}{2}$% by selling a trouser at sh. 17,500. How much money did he pay for the trouser?

7. Otim sold a rabbit to Odude at sh. 20500 making a loss of 18%. How much money did Otim buy the rabbit?

8. Ariko bought a loaf of bread from Apio at 5,000. Apio made a loss of $16\frac{2}{3}$%. Calculate the amount of money Apio bought the roaf of bread.

9. By selling a bar of soap to Chebet at sh. 7000, Chepele makes a loss of 12. 5%.
   a) How much did Chepele buy the bar of soap?
   b) Calculate the loss he made.

10. Kiviiri sold his mattress to Mulo at sh. 120,000 making a loss of 20%, Mulo later sold it to Bafa making a loss of 5%.
    a) How much money did Kiviiri buy the mattress?
    b) Calculate the loss made by Mulo.

11. Kintu bought a chair from Kasimu at sh. 465000. Kintu later sold it to Kamya making a loss of 20%. If Kasimu made a loss of 20%
    a) How much money did Kasimu buy the chair?
    b) At what price did Kamya buy the chair?

12. Joseph sold a radio to Jane making a loss of 20%. Ann bought the same radio from Jane .Ann paid sh. 42000. If Jane made a loss of $12\frac{1}{2}$%, how much money did Joseph buy the radio?

13. A trader sold a dress at sh. 13,200 more than a shirt making a profit of 15% on a dress and a loss of 7% on a shirt. If he bought the two items at the same price, calculate the amount of money he sold the shirt.

More problems involving percentage profit and percentage loss.

Example 1

Malevu is a trader who buys and sells mobile phones. He sold two phones, one at sh. 330,000 making a profit of 10% and the other phone at sh. 600,000 making a profit of 20%. How much money did Malevu pay for the phones?

Cost price of the 1st phone.	Cost price of the 2nd phone.	Total
100% + 10% = 110%	100% + 20% = 120%	sh. 300,000
		+ sh. 500,000
110% represent sh. 330,000	120% represent sh. 600,000	sh. 800,000
1% represents sh. 330,000	1% represents sh. 600,000	
110	120	*He paid sh. 800,000 altogether.*
1% represents sh. 3,000	1% represents sh. 5,000	
100% represent sh. 3000 x 100	100% represent sh. 5000 x 100	
100% represents sh. 300,000	100% represents sh. 500,000	

Example 2

By selling a geometry set at sh. 3,400, a trader makes a loss of 15% and a 20% profit is made on a box file sold at sh. 6000. How much money did the trader spend on a box file than a geometry set?

Cost price of a geometry set	Cost price of a box file.	Difference
100% - 15% = 85%	100% + 20% = 120%	sh. 5,000
		- sh. 3,400
85% represent sh. 3,400	120% represent sh. 6000	sh. 1,600
1% represents sh. 3,400	1% represents sh. 6000	
85	120	*He spent sh. 1,600 more on a box file than a geometry set.*
1% represents sh. 40	1% represents sh. 50	
100% represent sh. 40 x 100	100% represent sh. 50 x 100	
100% represents sh. 4,000	100% represents sh. 5000	

Exercise

1. Kadogo sold two story books. One for sh. 3,500 making a profit of 25% and another for sh. 6,000 making a 20% profit. How much had Kadogo paid for the two story books?

2. A business woman sold a radio at sh. 55000 and a TV set at sh. 230,000 making a profit of 10% and 15% respectively. How much more did she spend on a TV set than a radio?

3. Kenny bought a box of 50 pens at sh. 16,000 more than a geometry set. He later sold a geometry set at sh. 5,000 making a profit of 25%. At what price must he sell each pen to make a profit of 50%?

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4. Nichole bought a shirt at sh. 20,000. She later sold it making a profit of 20%. The amount of money she sold the shirt was sh. 4,000 more than a skirt which she sold it at a 25% profit. How much money did she pay for the skirt?

5. A shopkeeper bought a dozen of books at sh. 1,000 each and a tin of rubbers at sh. 250 per rubber. She sold all the books making a 50% profit and rubbers at twice as much as the amount of money she sold the books making a profit of 60%. Find the number of rubbers in the tin she bought.

6. A trader bought a 50kg sack of maize flour. On his way back home, 5 kilogrammes got poured. He sold the remaining kilogrammes at sh. 2400 each making a profit of $12\frac{1}{2}$%. How much money did he pay for each kilogram?

7. By selling a calculator at sh. 27,000 and a wall clock at sh. 34,000, Angel made a loss of 10% and 15% respectively. How much money did she pay for the two items?

8. Teddy sold a basin at sh. 4,000 and a jerry can at sh. 3,500. She realized a loss of 25% on a basin and a profit of $16\frac{2}{3}$% on a jerry can. How much more did she pay for a basin than a jerry can?

9. A poultry farmer bought 20 hens at sh. 8,000 each and 5 cocks. When 4 hens died, he was forced to sell the remaining hens and the cocks to Kifefe making a loss of 20% on hens and a profit of $4\frac{1}{6}$% on cocks. If Kifefe paid sh. 3,000 for hens more than cocks,
   a) How much money did Kifefe pay for each hen?
   b) Calculate the amount of money the farmer paid for each cock.

10. Maggie bought a tray of 30 eggs at sh. 400 per egg. Some eggs got broken. She sold the remaining eggs at sh. 500 each making a loss of $16\frac{2}{3}$%. How many eggs got broken?

11. Henry sold a radio to Saddam making a profit of 20%. Saddam later sold it to Jamir making a loss of 15%. If Jamir paid sh. 51,000 for the radio,
    a) How much money did Henry pay for the radio?
    b) Calculate the loss Saddam made.

12. When a certain quantity of sugar is sold at sh. 4000 per kg, the gain is 10%. If the total gain is sh. 20,000. What is the quantity of sugar sold?

13. A dishonest shopkeeper bought 24 kilograms of sugar. He pretends to sell his sugar at cost price but uses false weights and gains 20%.
    a) Find the false weight he is using instead of 1kg weight.
    b) If he sells all the sugar at sh. 108,000, find the amount of money he paid for the 24 kilograms of sugar.

DISCOUNT
A discount is the deduction from the usual price of something.

Finding discount when the marked price and cost price are given

Example 1

The marked price of a cock was sh. 42,000. Andrew paid sh. 37,000 after a discount. How much discount was offered?

Discount = Marked price – Cost price
$$= sh.\ 42,000 – sh.\ 37,000$$
$$= sh.\ 5,000$$

Example 2
John went to the shop and bought the following items.

2 bars of soap at sh. 5500 each
3kg of rice at sh. 12,000
$1\frac{1}{2}$kg of sugar at sh. 3000 per kg.

If he paid sh. 26000. How much was the discount?

Soap .... sh. 5500 x 2 = sh. 11000
Rice .... sh. 12000
Sugar .... sh. 3000 x $\frac{3}{2}$ = sh. 4500

Total .... sh. 11000 + sh. 12000 + sh. 4500 = sh. 27500

Discount .... sh. 27500 – sh. 26000 = sh. 1500

Exercise
1. The marked price of a geometry set is sh. 4500. If a customer is offered a discount and pays sh. 4000, how much is the discount?

2. The marked price of a generator was sh. 650,000. Benjamin paid sh. 520,000. How much discount was he offered?

3. In a shop, the marked price of a fan is sh. 93000. How much discount is offered to a customer who pays sh. 85000?

4. The marked price of a table in a workshop is sh. 62000. A customer paid sh. 59000. How much discount was offered?

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5. The taxi fare from Kyotera to Kampala was sh. 25,000. Mzee Kalali paid sh. 20,000. Calculate his discount.

6. The marked price of a book is sh. 1800. Mukisa bought 3 similar books and paid sh. 5000. How much was the discount.

7. Nsereko bought 2 iron sheets whose marked price is sh. 46,000 each. If he paid sh. 88,000. Calculate the discount.

8. The marked price of a heap of 5 mangoes is sh. 2,500. Ssewante bought 2 heaps of similar mangoes at sh. 450 per mango. How much discount was he offered?

9. Kwijuka went to the shop and bought the following items.
   - *1kg of sugar at sh. 3500*   - *1kg of rice at sh. 4000,*
   - *500g of salt at sh. 800.*   - *1 bar of soap at sh. 6500.*
   If he paid sh. 14,000. How much was the discount?

10. A girl went to market and bought the following items
    - *2 apples at sh. 1,000 each*   - *6 mangoes at 1800.*
    - *3 mangoes at sh. 500 each*
    If she paid sh. 4800. Find the discount.

11. Greg bought the following items from the shop.
    - *2kg of beans at 3200 per kg*   - *$2\frac{1}{2}$ kg of maize at sh. 1200 each*
    - *$1\frac{1}{2}$kg sorghum at sh. 2000*
    Given that Greg paid sh.10,000 only. Calculate the discount.

12. Akiki bought the following items from the market.
    - *2kg of rice at sh. 3000 per kg*   - *500g of salt at sh. 1,800 per kg*
    - *$1\frac{1}{2}$kg of meat at sh. 12,000 per kg*   - *A sachet of cooking oil at sh. 2500.*
    How much discount was she offered if she paid sh. 26,500?

13. Okot went to the market and bought the following items.
    - *3 litres of milk at sh. 2400 per litre*
    - *250g of salt at sh. 1600 per kg.*
    - *24 oranges at sh. 1100 for every 8 oranges.*
    If he paid sh. 10,500, calculate the discount.

14. A boy went to the shop with sh. 20,000 and bought the following items.
    8 books at sh. 24,000 per dozen, some pens at sh. 500 per pen, 6 pencils at sh. 200 each pencil. He remained with sh. 1800,
    a) How many pens did he buy?
    b) If he used all the amount of money he remained with to buy 3 rubbers at sh. 500 each, find the discount he was offered?

15. Mpya went to the market with sh.18,000 and bought the following items.
    2 litres of cooking oil at sh. 6400 per litre.
    500g of salt at sh. 2,000 per kg
    12 tomatoes at sh. 800 for every 6 tomatoes
    If he remained with sh. 3,000 after a discount. How much was the discount.

Finding percentage discount
Example I
The marked price of a rubber is sh. 500. A boy paid sh. 450 after a discount. Calculate the percentage discount.

Discount = sh. 500 – sh. 450
        = sh. 50

Percentage discount = $\frac{\text{Discount}}{\text{Marked price}}$ x 100%

               = $\frac{\text{sh. 50}}{\text{sh. 500}}$ x 100%

               = 10%

Example 2
The marked price of a ruler is sh. 2000. A trader brought a dozen of similar rulers and paid sh. 20000. Calculate the percentage discount.

1 ruler costs sh. 2,000
12 rulers cost 12 x sh. 2,000
12 rulers cost sh. 24,000

Discount = sh. 24,000 – sh. 20,000
         = sh. 4,000

Percentage discount = $\frac{\text{Discount}}{\text{Marked price}}$ x 100%

              = $\frac{\text{sh. 4000}}{\text{sh. 24000}}$ x 100%

              = $\frac{50\%}{3}$

              = $16\frac{2}{3}\%$

Exercise
1. The marked price of a bag is sh. 40,000. A trader paid sh. 36000 for the bag. Find the percentage discount

2. The marked price of a pair of shoes in a market is sh. 32000. The customer paid sh. 24000 after a discount. Calculate the percentage discount.

3. A man paid sh. 95000 for a phone whose marked price was sh. 100,000. Calculate the percentage discount.

4. The taxi fare from Kampala to Mbale is sh. 30,000. If an old woman pays sh. 25,000. Calculate the percentage discount.

5. The marked price of a stool is sh. 12000. Ruth paid sh. 55,000 for 5 stools after being given a discount. Calculate the percentage discount.

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6. The marked price of a pen is sh. 500. After being given a discount. A business woman paid sh. 22,000 for a box containing 50 pens. Find the percentage discount.

7. The marked price of a dozen of plates is sh. 18,000. Angume paid sh. 1250 per plate. Calculate the percentage discount.

8. The marked price of a dozen of books is sh. 10,000. Naluze bought 4 dozens of similar books at sh. 750 per book after being given a discount. Calculate the percentage discount.

9. The marked price of a dozen of cups is sh. 8000. A trader bought $2\frac{1}{2}$ dozens of similar cups at sh. 600 per cup after being given a discount. Calculate the percentage discount.

10. Mpuga bought the following items for his daughter.
    Books at sh. 23000
    Pens at sh. 2500
    Knickers at sh. 800
    A geometry set at sh. 6500.
    If he paid sh. 32000 after a discount, Calculate the percentage discount.

11. Kimera went to Nakasero and bought the following items.
    6 oranges at sh. 200 each
    4 pumpkins at sh. 1500 each
    $2\frac{1}{2}$kg of onions at sh. 15000
    A water melon at sh. 1800
    If he paid sh. 21000 after a discount, calculate the percentage discount.

12. Mwanja bought the following items from a shop
    $2\frac{1}{2}$kg of beans at sh. 2000 per kg
    $1\frac{1}{2}$kg of salt at sh. 1800 per kg
    Tomatoes at sh. 300.
    If he paid sh. 7800 after being given a discount, calculate the percentage discount.

13. Kadama went shopping with sh. 20,000 and bought the following items.
    2 bars of soap at sh. 4000 per bar
    $1\frac{1}{2}$kg of sugar at sh. 4200 each
    $\frac{1}{2}$kg of salt at sh. 2000 per kg
    2 eggs at sh. 700
    If she was given a discount and change of sh. 6000. Calculate the percentage discount.

14. Musiraamu went to the market with sh. 30,000. He bought the following items.

2kg of rice at sh. 3200 per kg.

1½kg of meat at sh. 12000 per kg.

500g of salt at sh. 1800 per kg

A sachet of cooking oil at sh. 1700

If he was given sh. 5700 as change. Find his percentage discount.

15. Eddy bought the following items in the table below.

ITEM	QUANTITY	UNIT COST	TOTAL COST
Sugar	_____	sh. 4000	sh. 12000
Books	5	_____	sh. 13000
Pens	_____	sh. 500	_____
Geometry set	2	sh. 5500	_____
		Total expenditure	sh. 44,000

a) Complete the table above.

b) If he paid sh. 42900, find the percentage discount.

16. A house wife went to market and bought the following items.

ITEM	QUANTITY	UNIT COST	TOTAL COST
Omo	2 sachets	sh. 1,000 each	_____
Maize flour	4kg	_____	sh.10,000
Chicken	_____	sh. 15,000	_____
		Total expenditure	sh. 42,000

a) Complete the table above.

b) If she paid sh. 39900, find the percentage discount.

17. Ssenkebe went to a shop with sh. 25000 and bought the following items.

ITEM	UNIT COST	TOTAL COST
_____ kg of sugar	sh. 3000	sh. 6000
3kg of rice	_____	sh. 12000
1½ litres of cooking oil	sh. 6000	_____
	Total expenditure	_____

If he remained with sh. 4700, find the percentage discount.

18. The marked price of a radio was sh. 60000. Due to high demand, it was increased by 20%. A customer paid sh. 65000 for the radio. Calculate the percentage discount.

19. The marked price of a pineapple was sh. 4000. It was then decreased by 10%. A woman bought it at sh. 2700. Find the percentage discount.

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Finding the cash price after a discount.

Example I
The marked price of an apple is sh. 1000. If a customer is given a discount of sh. 200, how much will he pay?

Cash price = Marked price – Discount
$\qquad$ = sh. 1000 – sh. 200
$\qquad$ = sh. 800

Example 2
The marked price of a dress is sh. 40000. A customer is offered a discount of 5%. How much money does the customer

Approach I

100% - 5% = 95%

$\frac{95}{100}$ x sh. 40000

= sh. 38000

Approach II

Discount = $\frac{5}{100}$ x 40000

$\qquad$ = sh. 2000

Cash price = sh. 40000 – sh. 2000
$\qquad$ = sh. 38000

Exercise
1. The marked price of a radio was sh. 45000. Mickey was given a discount of sh. 12500. How much money did he actually pay?

2. The marked price of a cock is sh. 37000. A customer is given a discount of sh. 2500. How much money does the customer pay?

3. A TV set had a marked price of sh. 585,000. My father was offered a discount of sh. 135000. How much money did he pay for the TV set.

4. The marked price of a box of chalk was sh. 3000. A customer was given a discount of 10%.
    a) How much was the discount?
    b) How much money did the customer pay?

5. Tulo bought a mattress whose marked price was sh. 120,000. He was given a discount of 15% .
    a) How much was the discount
    b) How much money did he pay for the mattress?

6. After ordering for scholastic materials worth sh. 60,000, a student was offered a discount of $16\frac{2}{3}$%. How much money did the student pay?

7. The marked price of a notebook is sh. 1500. Kasoma bought a dozen of the similar notebooks and was offered a discount of $12\frac{1}{2}$%. Calculate the amount of money he paid.

8. The marked price of a dozen of geometry sets is sh. 54,000. Lutalo bought 2 geometry sets. He was offered a discount of 10%. Calculate the amount of money he paid.

9. In the market, the marked prices of a cock and a hen are sh. 30,000 and sh. 20000 respectively. Mzee Munva bought 4 cocks and 3 hens. He was offered 15% discount on cocks and a $12\frac{1}{2}$% discount on hens. How much money did he pay?

10. Rashidah bought the following items from the market.
    2 books at sh. 7,000
    6 pens at sh. 3,000
    3 rulers at sh. 4,500
    8 pencils at sh. 1,600
    If she was offered a discount of sh. 250, how much money did she pay?

11. Mande bought the following items from a shop.
    $3\frac{1}{2}$kg of beans at sh. 2000 per kilogram

    $1\frac{1}{2}$kg sugar at sh. 4000 per kg

    4 bars of soap at sh. 3500 each.
    If Mande was given a discount of 20%,
    a) How much was the discount?
    b) How much money did he pay?

12. Owori went to the market and bought the following items.
    3 bars of soap at shs 2400 per bar
    250g of salt at sh 2000 per kg.
    18 mangoes at shs 1500 for every 6 mangoes
    If he was given a discount of sh. 200, how much money did Owori pay?

13. Adwaro went to the market with sh. 35,000 and bought the following items.
    2kg of rice at sh 4000 per kg
    $1\frac{1}{2}$kg of meat at sh. 14000 per kg
    500g of salt at sh. 2000 per kg
    A sacket of cooking oil at sh. 2000
    Given that Adwaro was given a discount of 10% . How much did she remain with?

14. Asiimwe bought the following items from a shop.

    $1\frac{1}{2}$*kg of sugar at sh. 3000 per kg*

    5 litres of milk at sh. 2400 per litre

    750g of salt at sh. 2400 per kg

    After being offered a discount of 5%, he remained with sh. 2900. How much money did he have at first?

15. The table below shows some items bought by Mr. Kyanda in 1999. Use it to answer questions that follow.

    a) Complete the table below.

ITEM	QUANTITY	UNIT COST	TOTAL COST
Rice	$1\frac{1}{2}$kg	sh. 1200	_____
Meat	$3\frac{3}{4}$kg	_____ per kg	sh. 15000
Sugar	_____	sh. 1000 per kg	sh. 500
Tomatoes	19	sh. 50 each	_____
Salt	_____grams	sh. 500 per kg	sh. 250
		Total expenditure	_____

    b) If he had sh. 18000 and he was given a discount of 10%, what was his change?

16. A boy was sent to the market to buy the items shown in the table below. Use it to answer questions that follow.

ITEM	UNIT COST	AMOUNT
3kg of beans	_____ per kg	sh. 9,000
$2\frac{1}{2}$kg of sugar	sh. 4800 per kg	_____
750g of meat	_____ per kg	sh. 12000
____ loaves of bread	sh. 3750 each	_____
	Total expenditure	**sh. 48000**

    a) Complete the table above.
    b) If he was given a discount of 5% and remained with sh. 4400, calculate the amount of money he had at first.

17. A trader bought a laptop whose marked price was increased by 40% from sh. 800000. If he was given a discount of 15% on the new marked price, how much money did the trader pay for the laptop?

Finding the marked price when percentage discount is given

Example I

A trader was offered a discount of sh. 24000 on an article and this was 20% of the marked price. Calculate the marked price of the article.

Approach I

20% represent sh. 24000

1% represents $\dfrac{\text{sh. 24000}}{20}$

1% represents sh. 1200

100% represent sh. 1200 x 100

100% represents sh. 120000

The marked price was sh. 120000

Approach II

Let the marked price be m

20% of the marked price = sh. 24000

$$\frac{20}{100} \times m = \text{sh. } 24000$$

$$\frac{20m}{100} = \text{sh. } 24000$$

$$100 \times \frac{20m}{100} = \text{sh. } 24000 \times 100$$

$$20m = \text{sh. } 2400000$$

$$\frac{20m}{20} = \frac{\text{sh. } 2400000}{20}$$

$$m = \text{sh. } 120000$$

Example 2

A customer paid sh. 34000 for a pair of shoes after being offered a discount of 15%. Find the original price of the pair of shoes.

Approach I

100% - 15% = 85%

85% represent sh. 34000

1% represents $\dfrac{\text{sh. 34000}}{85}$

1% represents sh. 400

100% represent sh. 400 x 100

100% represent sh. 40000

The marked price was sh. 40000

Approach II

Let the marked price be p

100% - 15% = 85%

85% of the marked price = sh. 34000

$$\frac{85}{100} \times p = \text{sh. } 34000$$

$$\frac{85p}{100} = \text{sh. } 34000$$

$$100 \times \frac{85p}{100} = \text{sh. } 34000 \times 100$$

$$85p = \text{sh. } 3400000$$

$$\frac{85p}{85} = \frac{\text{sh. } 3400000}{85}$$

$$p = \text{sh. } 40000$$

Exercise

1. A boy was given a discount of sh. 6,000 on a calculator and this was 12% of the original price of the calculator. Find the original price of the calculator.

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2. Mr. Mushikhan was offered a discount of sh 3000 on a textbook and this was 10% of the marked price of the textbook. Calculate the marked price of the textbook.

3. Sylivia paid sh. 36,000 for a dress after being given a discount of 10%. Calculate the marked price of the dress.

4. After being given a discount of 20%. Kikombe paid sh. 1600 for a cup. Calculate the marked price of the cup.

5. The customer paid sh. 39,000 for a shirt after being offered a discount of 35%. Find the marked price of the shirt.

6. Among paid sh. 7,000,000 for a car after being given a discount of $12\frac{1}{2}$%. Find the original price of the car.

7. After being given a discount of $16\frac{2}{3}$% on a pair of trousers, Mwambala paid sh. 15,000. Calculate the marked price of the pair of trousers.

8. After being given a discount of 20% on a dozen of books, Musomi paid sh. 800 per book. Find the marked price of the dozen of books.

9. Teddy paid sh. 15,000 for a dozen of knickers after being offered a discount of $16\frac{2}{3}$%. Calculate the marked price of each knicker.

10. Jose bought the following items from the market.
    2 loaves of bread at sh. 4000 per loaf
    Some cakes at sh. 500 each
    12 mangoes at sh. 500 for 3 mangoes
    A sugar cane at sh. 1000

    Given that Jose paid sh. 10,000 after a discount of $16\frac{2}{3}$%

    a) Find the total cost of all items
    b) How many cakes did he buy?

11. Allen bought the following items
    2kg of beans at shs 4500 per kg
    $\frac{1}{2}$ litre of cooking oil at shs 6,000 per litre
    Some tomatoes at shs 500 for every 4 tomatoes.
    500g of salt at 2,000 per kg
    If Allen paid shs 12,000 after being given a discount of 20%,
    a) Find the total cost of all items.
    b) calculate the number of tomatoes she bought.

12. Candy went shopping and bought the following items. She was given a discount of $12\frac{1}{2}$% which amounted to sh. 5,000.

Item	Quantity	Unit cost	Amount
Eggs	15	sh. 400 per egg	_____
Meat	_____kg	sh. 6000 per kg	sh. 15000
cooking oil	$\frac{1}{2}$ litre	_____ per litre	sh. 6000
Sugar	5 kg	_____ per kg	_____
		Total expenditure	_____

a) Find the total expenditure.
b) Complete the table above.

13. Siyema was given sh. 25,000 to buy things to take to school and she bought the following items. She was given a discount of 5%.
3 books at sh. 2800 per book
Bars of soap at sh. 3500 per bar
6 pens at sh. 600 each
a) How much money did she spend on books and pens altogether?
b) If she remained with sh. 300, find the number of bars of soap she bought.

14. The table below shows Nabisubi's shopping list. Use it to answer questions that follow.

Item	Unit cost	Amount
3kg of rice	sh. 3000 per kg	sh. _____
$1\frac{1}{2}$kg of salt	sh. _____ per kg	sh. 1200
_____ litres of milk	sh. 2000 per litre	sh. _____
	Total expenditure	sh. _____

She was given a discount of sh. 600 and this was only $2\frac{1}{2}$% of the total cost of the items.
a) Find the total cost of the items.
b) Complete the table above.
c) If she had sh. 25000, find her change

15. The price of a cock was increased by 25%. Nsimenta paid sh. 45000 after a discount of 10% on the new price. Find the price of the cock before the increment.
16. Henry paid sh. 45000 for geometry sets after a discount of 10%. He later sold each geometry set at sh 4500 making a profit of 20%.
a) Find the marked price of geometry sets he bought.
b) How many geometry sets did he buy?

SIMPLE INTEREST

This is a quick and easy method of calculating the interest charged on a loan which is determined by multiplying the principal by the interest rate by the number of days / weeks / months / years that elapse between payments.

Note:
- *Simple interest is an interest change that borrowers pay lenders for a loan. It is also the type of interest that banks pay customers on their savings accounts.*
- *The formula to determine simple interest is an easy one, just multiply the loan's principle by the time in days, weeks, months or years.*

Finding simple interest

Example 1

Calculate the simple interest on sh. 16,000 for 3 months at 20% per month.

SI = PXRXT

SI = sh. 16000 x $\frac{20}{100}$ x 3

SI = sh. 9,600

Example 2

Calculate the simple interest on sh. 36,000 for 2 years at a simple interest rate of 5% per year

SI = PXRXT

SI = sh. 36000 x $\frac{5}{100}$ x 2

SI = sh. 3600

Example 3

What is the simple interest on sh. 50,000 borrowed for $1\frac{1}{2}$ years at a simple interest rate of $2\frac{1}{4}$% per month?

1year = 12 months

$1\frac{1}{2}$years = $\frac{3}{2}$ x 12 months

= 18 months

SI = PXRXT

SI = sh. 50,000 x $(\frac{9}{4} \div \frac{100}{1})$ x 18

SI = sh. 50,000 x $\frac{9}{4}$ x $\frac{1}{100}$ x 18

SI = sh. 20,250

Example 4

Calculate the simple interest on sh. 180,000 for 9 months at a simple interest rate of 15% per year.

12 months = 1 year

9 months = $\frac{9}{12}$ years

SI = PXRXT

SI = sh. 180,000 x $\frac{15}{100}$ x $\frac{9}{12}$

SI = sh. 20250

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Example 5

Akiki deposited sh. 120,000 in a bank for 4 years at an interest rate of $3\frac{1}{3}$% per annum. Calculate the total amount of money on the account after the 4 years.

Simple interest

SI = PXRXT

SI = sh. 120,000 x $(\frac{10}{3} \div \frac{100}{1})$ x 4

SI = sh. 120,000 x $\frac{10}{3}$ x $\frac{1}{100}$ x 4

SI = sh. 16000

Amount = Principal + Interest

= sh. 120,000 + sh. 16000

= sh. 136000

Example 6

Kisinde bought 40 shares from UZALENDO SACCO at a simple interest rate of 18% per year. Each share costs sh. 2500.

Calculate the total amount of money Kisinde has in the SACCO after $3\frac{1}{2}$ years.

1 share costs sh. 2500
40 shares cost 40 x sh. 2500
40 shares cost sh. 100,000

Amount = Principal + Interest

= sh. 100,000 + sh. 63,000

= sh. 163,000

Simple interest

SI = PXRXT

SI = sh. 100,000 x $\frac{18}{100}$ x $\frac{7}{2}$

SI = sh. 63,000

Exercise

1. Calculate the simple interest on sh. 200,000 for 2 years at a simple interest rate of 10% per year.

2. Find the simple interest on;
   a) sh. 600,000 for 6 months at $2\frac{1}{2}$% interest per month.
   b) sh. 50,000 for 3 years at 15% interest rate per year.
   c) sh. 180,000 for 5 years at an interest rate of $12\frac{1}{2}$% per year.
   d) sh. 400,000 for 9 months at 15% interest rate per year.
   e) sh. 160,000 for 6 months at 15% interest rate monthly.
   f) sh. 20,000 for 9 years at $3\frac{2}{3}$% rate per annum.
   g) sh. 90,000 for $1\frac{1}{3}$ years at $12\frac{1}{4}$% rate per annum.
   h) sh. 36,000 for 8 months at $16\frac{2}{3}$% rate per year.

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3. A business woman deposited sh. 800,000 on her account in a bank which gives an interest of $12\frac{1}{2}$% for 2 years per annum. Calculate
   i) her simple interest after the 2 years
   ii) the amount of money on her account after that per period.

4. Find the simple interest and amount on;
   a) sh. 14,000 for 3 years at 6% interest per year.
   b) sh. 42,000 for 4 years at $2\frac{1}{2}$% interest per year.
   c) sh. 150,000 for 2 years at 15% interest per annum
   d) sh. 60,000 for 4 years at 10% interest per year.
   f) sh. 36,000 for 9 months at $12\frac{1}{2}$% interest per year.
   g) sh. 200,000 for 8 months at 5% interest per month.
   h) sh. 80,000 for 6 months at $16\frac{2}{3}$% per month.

5. Lukwago borrowed sh. 400,000 from the bank. He paid back sh. 30,000 per month for $1\frac{1}{2}$ years. How much money did he pay back?

6. A man has sh. 90,000 on his bank account.
   a) How much interest will he get after 3 years at 6% interest?
   b) How much money will be on his account after the 3 years?

7. Find the simple interest, sh. 240,000 for 4 months at $2\frac{1}{4}$% interest per month.

8. What will sh. 480,000 amount to, in 9 months at $4\frac{1}{6}$% interest per month?

9. Nalu borrowed sh. 150,000 from a money lender. She paid back sh. 6000 per day for 30 days. Calculate the amount of money she paid back altogether.

10. Chami borrowed sh. 90,000 from a village SACCO to be paid back in 8 weeks at $3\frac{1}{4}$% interest per week. Calculate the total amount of money Chami paid back.

11. A wheel barrow costs sh. 120,000. A farmer borrowed all the money at $3\frac{2}{3}$% interest per month for 4 months. What amount must she pay back?

12. Masika bought 30 shares from KAYONDE SACCO at a simple interest rate of $5\frac{1}{3}$% per annum. Each share costs sh. 5000. Calculate the total amount of money Masika had in the SACCO after 9 months.

13. In the village SACCO, Shares cost sh. 3000. How much money will a member who buys 60 shares have in 9 months at $6\frac{1}{3}$% interest per annum?

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14. Lukya wanted to buy a motorcycle worth sh4,800,000. He paid sh 1200,000 and borrowed the rest from the bank that charges 15% interest per year for 2 years. How much money did he buy the motorcycle?

15. A man bought a car worth sh. 7,500,000. He borrowed sh. 2,000,000 from a village SACCO at $12\frac{1}{2}$% interest per year and the rest from a commercial bank at 8% interest per year. If he cleared the two loans in 4 years, calculate the total amount of money he spent on the car.

16. A man deposited sh. 720,000 in a bank that offers an interest rate of $7\frac{1}{2}$% per year for 2 years and 8 months. How much money was on his account after that period?

Finding interest when amount and principal are given

Example
A man deposited sh. 80,000 in a bank. After 3 months, he had sh. 96,000 on his account. Calculate the interest.

Interest = Amount – Principal
= sh. 96000 – sh. 80000
= sh. 16000

Exercise
1. A business man borrowed sh. 180,000 from a bank and paid back sh. 225,000. How much interest was charged?

2. How much interest will sh. 420,000 yield to amount to sh. 457,000?

3. A boy borrowed sh. 25,000 from a friend and paid back sh. 27500. How much was the interest?

4. Barbie deposited sh. 780,000 in a bank. After some time her account had sh. 830,000. How much was the interest?

5. Complete the table below.

	A	B	C
Prinicipal	sh. 60,000	sh. 120,000	sh. _____
Interest	sh. 4000	sh._____	sh. 7850
Amount	sh_____	sh. 155,000	sh. 342500

6. Mulo borrowed sh. 300,000. He paid back sh. 12,000 per day for 30 days. Calculate the extra amount of money paid.

7. Sala bought 120 shares from a staff SACCO at sh. 4000 each. After a year, he had sh. 600,000. Calculate his interest.

Finding interest rate

Example 1

Calculate the rate of interest if sh. 120,000 yield sh. 28800 interest in 4 years.

Approach I

$$P \times R \times T = SI$$

$$\text{sh. } 120000 \times \frac{R}{100} \times 4 = \text{sh. } 28800$$

$$\text{sh. } 1200 \times 4 \times R = \text{sh. } 28800$$

$$\text{sh. } 4800R = \text{sh. } 28800$$

$$\frac{\text{sh. } 4800\,R}{\text{sh. } 4800} = \frac{\text{sh. } 28800}{\text{sh. } 4800}$$

$$R = 6\%$$

Approach II

$$\text{Rate} = \frac{SI \times 100}{P \times T}$$

$$\text{Rate} = \frac{\text{sh. } 28800 \times 100}{\text{sh. } 120000 \times 4}$$

$$\text{Rate} = 6\%$$

Example 2

Ssali deposited sh. 80,000 on his savings account for 1 year 8 months. At the end of that period, the interest earned was sh. 6,000. Calculate the rate of interest.

Approach 1

$$P \times R \times T = SI$$

$$\text{sh. } 80000 \times \frac{R}{100} \times (1\tfrac{8}{12}) = \text{sh. } 6000$$

$$\text{sh. } 80000 \times R \times (1\tfrac{2}{3}) = \text{sh. } 6000$$

$$\text{sh. } 80000 \times R \times \tfrac{5}{3} = \text{sh. } 6000$$

$$\frac{\text{sh. } 4000R}{3} = \text{sh. } 6000$$

$$3 \times \frac{\text{sh. } 4000R}{3} = \text{sh. } 6000 \times 3$$

$$\text{sh. } 4000R = \text{sh. } 18000$$

$$\frac{\text{sh. } 4000\,R}{\text{sh. } 4000} = \frac{\text{sh. } 18000}{\text{sh. } 4000}$$

$$R = 4\tfrac{1}{2}\%$$

Approach II

$$\text{Rate} = \frac{SI \times 100}{P \times T}$$

$$\text{Rate} = \frac{\text{sh. } 6000 \times 100}{\text{sh. } 80000 \times 1\tfrac{8}{12}}$$

$$\text{Rate} = \frac{\text{sh. } 6000 \times 100}{\text{sh. } 80000 \times 1\tfrac{2}{3}}$$

$$\text{Rate} = \frac{\text{sh. } 6000 \times 100}{\text{sh. } 80000 \times \tfrac{5}{3}}$$

$$\text{Rate} = \frac{\text{sh. } 6000 \times 100 \times 3}{\text{sh. } 80000 \times 5}$$

$$\text{Rate} = 4\tfrac{1}{2}\%$$

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Example 3

Oulanya borrowed sh. 50,000 for 6 months. He paid back a total amount of sh. 53,000.
Find the interest rate per year

Interest = sh. 53000 – sh. 50000

= sh. 3000

$$P \times R \times T = SI$$

$$sh. 50000 \times \frac{R}{100} \times \frac{6}{12} = sh. 3000$$

$$sh. 250R = sh. 3000$$

$$\frac{sh. 250R}{sh. 250} = \frac{sh. 3000}{sh. 250}$$

$$R = 12\%$$

Exercise

1. A man had sh. 80,000 on his savings account. He earned an interest of sh. 28,800 in 3 years. Calculate the rate of interest per year.

2. Calculate the rate of interest if sh. 40,000 yields sh. 8400 interest in 3 years.

3. The interest on a loan of sh. 240,000 for 2 years is sh. 86400. Calculate the rate of interest per year

4. Find the interest rate if sh. 40,000 yield sh. 6,000 in 3 years.

5. Complete the table below.

Principal	interest	Time	Rate per annum
Sh. 800,000	Sh. 2,000	6 months	_____
Sh. 1,200,000	Sh. 28800	4 years	_____
Sh. 70,000	Sh. 20,000	4 years	_____
Sh. 30,000	Sh. 3,000	$2\frac{1}{2}$ years	_____
Sh. 36,000	Sh. 3,000	9 months	_____
Sh. 1,500,000	Sh. 375,000	$2\frac{1}{2}$ years	_____

6. Calculate the interest rate if the interest on sh. 60,000 borrowed for $3\frac{1}{2}$ years is sh. 6300

7. If a loan of sh. 140,000 amount to sh. 145600 in 6 months. Find the interest rate per year.

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8. Calculate the interest rate per annum if sh. 90,000 amounts to sh. 95,400 in 2 years.

9. Find the simple interest rate per annum if.
   a) Sh. 960,000 yields sh. 172,800 interest in $2\frac{1}{2}$ years
   b) Sh. 24,000 yield sh. 5400 interest in $4\frac{1}{2}$ years
   c) Sh. 600,000 yields sh. 108,000 interest in $1\frac{1}{2}$ years
   d) Sh. 250,000 yields sh. 14,000 interest in 2 years 4 months
   e) Sh. 120,000 yield sh. 7200 interest in 1 year 4 months.
   d) Sh. 75,000 yields sh. 12,000 interest in $2\frac{2}{3}$ years

10. A trader borrowed sh. 500,000 for 6 months. She paid a total amount of sh. 515,000. Calculate the rate interest per annum.

11. Kenzo bought 60 shares in UMA SACCO at sh. 20,000 each. After $2\frac{1}{2}$ years, he had sh. 1,350,000 in the SACCO. Calculate the rate of interest per year.

12. A farmer borrowed sh. 500,000 for 4 years. He paid back sh. 545,000. Calculate the rate of interest at which he was charged.

13. After 1 year 3 months, Kim paid an interest of sh. 500 on a loan of sh. 8000. Calculate the interest rate.

14. A trader borrowed sh. 18,000 for 3 years. He paid back a total sum of sh. 21600. Calculate his percentage rate.

15. Sh. 55,000 is the interest charged after borrowing sh. 400,000 for $2\frac{1}{2}$ years. Calculate the rate of interest.

16. A man borrowed sh. 250,000 for 9 months. At the end of that period, he paid back the principal plus the interest of sh. 257,500. At what interest rate was he paying?

17. Find the simple interest rate per year if
   a) Sh. 80,000 amounts to sh. 98,000 in $3\frac{1}{3}$years
   b) Sh. 80,000 amounts to sh. 86,000 in 6 years.
   c) Sh. 80,000 amounts to sh. 102400 in 4 years 8 months.
   d) Sh. 100,000 amounts to sh. 150,000 in 3 years.

18. A businesswoman borrowed sh 100,000 from a savings group which charged her an interest rate of y% per month. After 6 months, she paid back an interest of sh 18,000. Find the value of y.

19. Calculate the rate of interest per month, if sh. 60,000 amounts to sh.69600 in 2 months.

Finding time.

Example 1
In what time will sh. 80,000 yield an interest of 28,800 at 12% per year?

Approach I

$$P \times R \times T = SI$$

sh. 80000 x $\frac{12}{100}$ x T = sh. 28800

sh. 9600T = sh. 28800

$$\frac{sh.\ 9600T}{sh.\ 9600} = \frac{sh.\ 28800}{sh.\ 9600}$$

T = 3 years

Approach II

$$Time = \frac{SI \times 100}{P \times R}$$

$$Time = \frac{sh.\ 288000 \times 100}{sh.\ 80000 \times 12}$$

Time = 3 years

Example 2
After what time will sh. 90,000 amount to sh. 98,000 at $2\frac{2}{3}$% per year?

Interest = sh. 98,000 – sh. 90,000
= sh. 8,000

$$P \times R \times T = SI$$

sh. 90000 x ($\frac{8}{3} \div \frac{100}{1}$) x T = sh. 8000

sh. 90000 x $\frac{8}{3}$ x $\frac{1}{100}$ x T = sh. 8000

sh. 2400T = sh. 8000

$$\frac{sh.\ 2400T}{sh.\ 2400} = \frac{sh.\ 8000}{sh.\ 2400}$$

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

Exercise
1. After how long will sh.12,000 yield an interest of sh. 1800 at 5% per year?

2. A man borrowed sh. 500,000 at a rate of 3% and paid sh. 150,000 as interest. For how long did he use the money?

3. If sh. 60,000 yields sh. 27,000 at an interest rate of 10% per annum, calculate the time.

4. What time will sh. 40,000 yield an interest of sh. 8,000 at 10% p.a?

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5. After how long will sh. 12,000 yield an interest of sh. 1,800 at 5% per annum?

6. A lady borrowed sh. 100,000 at a rate of $16\frac{2}{3}$% per annum and paid sh. 50,000 as interest. For how long did she use the money?

7. Complete the table below.

Principal	Interest	Amount	Rate	Time
Sh. 40,000	_____	Sh 48,000	8% p.a	_____
Sh.16,000	Sh 2,000	_____	5% p.a	_____
Sh. 60,000	_____	Sh 72,000	20% p.a	_____
Sh. 54,000	_____	Sh 180,000	10% p.a	_____
Sh. 20,000	Sh 5,000	_____	2% p.a	_____

8. After how long will;
   a) sh. 40,000 amount to sh. 52,000 at 6% interest per year ?
   b) sh.180,000 yield sh. 54,000 at 12% interest per annum?
   c) sh. 90,000 yield an interest of 9,000 at an interest rate of 8% per year?
   d) sh. 80,000 amount to sh. 86,000 at $2\frac{1}{2}$% interest per year?
   e) sh. 150,000 amount to sh. 178,500 at an interest rate of $4\frac{3}{4}$% annually
   f) sh. 480,000 amount to sh. 510,000 at $12\frac{1}{2}$% per annum.

9. A trader borrowed sh. 124,000 at an interest rate of $21\frac{1}{4}$%. After how long will she pay back sh. 150,350?

10. Hamis bought 12 shares from a company SACCO at sh. 500,000 each. The company SACCO offers an interest rate of $2\frac{1}{4}$% per year. After how long will the amount of money on his account amount to sh. 6,495,000?

Finding principal

Examples 1
What sum of money will yield an interest of sh. 12,000 at a rate of 4% per year in 3 years.

Approach I

$P \times R \times T = SI$

$P \times \frac{4}{100} \times 3 = $ sh. 12000

$100 \times \frac{12P}{100} = $ sh. 12000 x 100

$\frac{12P}{12} = \frac{\text{sh. 1200000}}{\text{sh. 12}}$

$P = $ sh. 100,000

Approach II

$\text{Principal} = \frac{SI \times 100}{R \times T}$

$\text{Principal} = \frac{\text{sh. 12000} \times 100}{4 \times 3}$

$\text{Principal} = $ sh. 100,000

Examples 2

A man borrowed money at $4\frac{3}{4}$% per annum. After 4 years an interest of sh. 28500 was paid. How much money did the man borrow?

$$P \times R \times T = SI$$

$$p \times \left(\frac{19}{4} \div \frac{100}{1}\right) \times 4 = \text{sh. } 28500$$

$$p \times \frac{19}{4} \times \frac{1}{100} \times 4 = \text{sh. } 28500$$

$$100 \times \frac{19p}{100} = \text{sh. } 28500 \times 100$$

$$19p = \text{sh. } 2850000$$

$$\frac{19p}{19} = \frac{\text{sh. } 2850000}{19}$$

$$p = \text{sh. } 150,000$$

Example 3

A company paid an interest of sh. 450,000 for a 9 month loan at $12\frac{1}{2}$% per annum. How much money did the company borrow?

$$P \times R \times T = SI$$

$$p \times \left(\frac{25}{2} \div \frac{100}{1}\right) \times \frac{9}{12} = \text{sh. } 450,000$$

$$p \times \frac{25}{2} \times \frac{1}{100} \times \frac{12}{9} = \text{sh. } 450,000$$

$$800 \times \frac{75p}{100} = \text{sh. } 450,000 \times 800$$

$$75p = \text{sh. } 360000000$$

$$\frac{75p}{75} = \frac{\text{sh. } 360000000}{75}$$

$$p = \text{sh. } 4,800,000$$

The company borrowed sh. 4800,000

Exercise

1. Find the sum of money which yields sh. 12,000 interest in 6 years at 4% per year.

2. What principal will yield sh. 24,000 interest in 5 years at 8% per annum?

3. A man paid an interest of sh. 24,000 after borrowing a certain sum of money for 4 years at 3% per year.

4. What sum of money will yield an interest of sh. 48,000 in 5 years at 12 % per annum?

5. After $2\frac{1}{2}$ years, Acen received an interest of sh.18,000 at 6% per annum?

6. What principal will yield sh. 19,500 in $3\frac{1}{4}$% at 4% per year?

7. Rajab borrowed some money from a bank which charges an interest rate of 16% per annum. After 1 year 3 months, he paid an interest of sh. 16,000. How much money did he borrow?

8. Sh.14,400 is an interest after depositing sh. K in a bank for 9 months at 8% per year. Find the value of k.

9. A company paid sh. 1600,000 as interest for a 8 month loan at 5% per annum .How much money did the company borrow?

10. Complete the table below.

Principal	Rate	Time	Interest
_____	6% per year	3 years	Sh.162,000
_____	15% per year	4 years	Sh. 54,000
_____	5 % years	8 months	Sh. 6,000
_____	4% per annum	6 months	Sh. 10,000
_____	$5\frac{1}{4}$% per year	8 months	Sh. 700

11. What principal will yield an interest of sh. 3750 in 4 months at 5% per year?

12. A woman deposited some money in a bank that offers an interest rate of $2\frac{2}{3}$% per year. After 9 months, she received an interest of 800. How much money did she deposit?

13. Find the principal that will yield an interest of sh. 16,000 in $5\frac{1}{3}$ years at $7\frac{1}{2}$% per year.

14. Calculate the principal that will yield an interest of sh. 90,000 in 2 years 3 months at $16\frac{2}{3}$% per annum.

15. What principal will yield an interest of 25,000 in 4 months at $12\frac{1}{2}$% per annum?

16. Robert bought some shares from a village SACCO at $12\frac{1}{2}$% interest per annum. After 3 years, he got an interest of sh. 225,000.
    a) How much money did he spend on shares?
    b) If each share costs sh. 1500, how many shares did he buy?

More problems involving finding principal.

Example

Moses deposited some money in a bank that offers an interest rate of $16\frac{2}{3}$% per annum. After 10 months, he had sh. 1,025,000 on his account. How much money did Moses deposit in the bank?

P + SI = A
p + (p x R x T) = A
p + (p x $16\frac{2}{3}$% x $\frac{10}{12}$) = sh. 1025000
p + (p x $\frac{50}{300}$ x $\frac{10}{12}$) = sh. 102500
p + $\frac{5p}{36}$ = sh. 102500

(36 x p) + (36 x $\frac{5p}{36}$) = sh. 102500 x 36
36p + 5p = sh. 102500 x 36
41p = sh. 102500 x 36
$\frac{41p}{41}$ = $\frac{sh. 102500 \times 36}{41}$

p = sh. 900,000
Moses deposited sh. 900,000

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Exercise

1. What principal will amount to
   a) Sh. 62,000 in 6 years at 4 % per annum?
   b) Sh. 84,000 in 5 years at 8% per annum?
   c) Sh. 96,000 in $1\frac{1}{4}$ years at 16% per annum?
   d) Sh. 5,200 in 4 months at 12% per year?
   e) Sh. 9,000 in 2 years at $6\frac{1}{4}$ % per annum?

2. Lagu borrowed some money from a bank that charges $2\frac{1}{4}$% interest per year. After 4 years, she paid back at amount of sh 218,000. How much money did she borrow?

3. Calculate the principal that will amount to sh 44,000 in 5 years at $16\frac{2}{3}$ % per annum.

4. After using a 6 month loan at 15% interest rates, Aine paid back sh. 860,000. How much money did she borrow?

5. A trader deposited sh. x in a bank that gives $2\frac{2}{5}$ % interest per annum. After 10 months, she had sh. 204,000 on her account. Find the value of x.

6. Habiba borrowed some money from a bank that charges $16\frac{2}{3}$ % interest per annum.
   After $2\frac{1}{4}$ years, she paid back sh. 330,000.
   a) How much was the loan?
   b) Calculate the simple interest charged.

7. I deposited some money in a bank for 1 year 9 months at $12\frac{1}{2}$% per annum. By the end of the period my account had sh. 195,000.
   a) How much money did I deposit?
   b) Calculate the interest I received.

8. Find the principal that will amount to sh. 40,800 in 9 months at $2\frac{2}{3}$% per year.

9. Calculate the interest on the principal that will amount to sh. 92500 in 6 years 3 months at $2\frac{1}{2}$% year.

10. Kisuule bought some shares from Katwe SACCO at a simple interest rate of $16\frac{2}{3}$ % per year. Each share costs sh. 3,000. By the end of 4 months, he had sh. 475000 in the SACCO. How many shares did he buy?

11. A lady deposits sh. 10,000 on her bank account every week. The bank charges sh. 3000 each month. Calculate the amount of money on her account after 8 weeks.

12. A boy deposits sh. 5000 weekly in a bank that charges sh. 2500 per month. Find the amount of money on his account after 8 months.

13. Every week, a business woman deposits sh. 10,000 in a bank which charges sh. 3000 per month. After how many weeks will her account amount to sh. 222,000?

14. A man deposits the same amount of money in a bank every week. The bank charges sh.2800 per month. After 5 months, he had sh. 286,000 on his account. How much money does he deposit in a week?

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