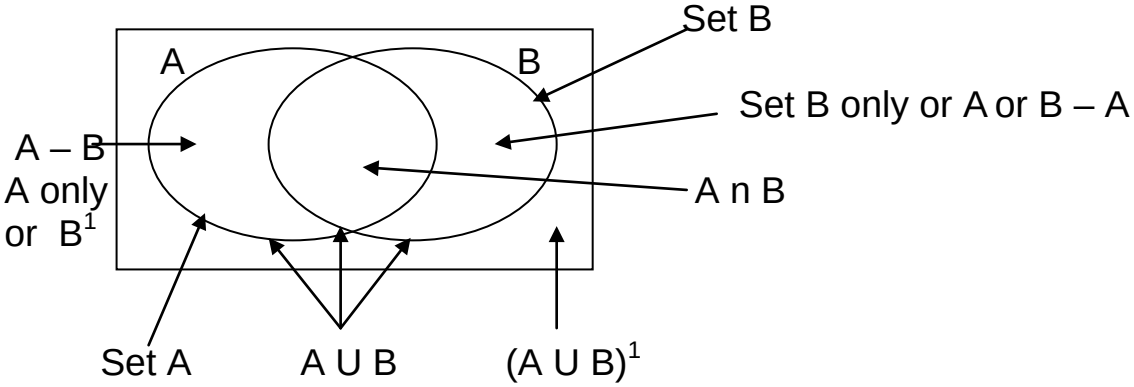
**TOPIC 1: SET CONCEPTS**
**SUB TOPIC: REVIEW OF SETS**
**C0ncepts:**

- Identifying the types of sets, symbols and their examples.
- Describing parts or regions of a venn diagram and listing the members.
- Representing sets on venn diagrams

Examples

- **Types of sets** like equal sets, un equal sets, equivalent sets, union set, intersection (joint) sets, empty (null) set, universal sets, complement of sets, disjoint sets, subsets.
- **Parts or regions of venn diagrams**




- **Represent these sets on the venn diagram.**

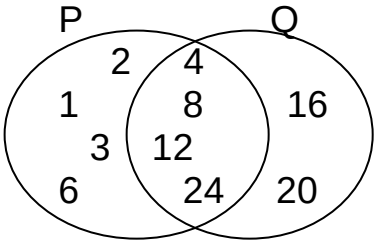
If set P = {Factors of 24} and set Q= {Multiples of 4 less than 25}

(i) List elements of sets P and Q.

Set P = {1, 2, 3, 4, 6, 8, 12, 24}

Set Q = {4, 8, 12, 16, 20, 24}

(ii) Represent the above sets on a venn diagram below:




(iii) What is: (a) n(P ∩ Q)? (b) n(P∪Q?

(a) P n Q = {4, 8, 12,24} (b) PuQ ={1, 2, 3, 4, 6.8, 12, 16, 20,24}

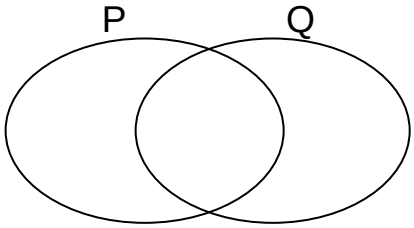
n(P n Q) = 4 n(P u Q) = 10

**ACTIVITY:**

1. Given that set A = {Even numbers less than 15} and set B = {Composite numbers less than 15}

(a) List down the members of sets A and B

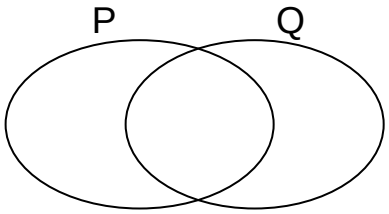
(b) Represent the above sets on a venn diagram below.



2. Given that ε = {whole numbers less than 15} , Set P = {4, 6, 14, 8, 0, 2, 3, 7} and Set Q = {1, 3, 5, 7, 9, 11, 13}.

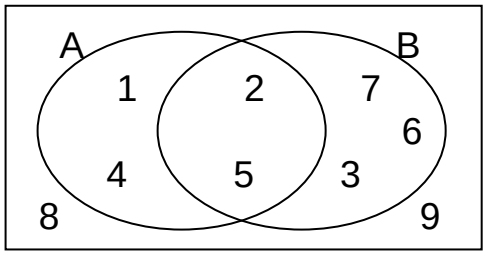
a) Write down the numbers of P n Q.

b) Represent the above sets on a venn diagram.




c) Find; (i) P – Q (ii) n(P – Q) (iii) $n(P \cap Q)^1$ (iv) $Q^1$.

3. Given the venn diagram below, list down the elements of the sets.




(i) n(A n B) (ii) n(A u B) (iii) n(A – B)

(iv) n(B – A) (v) $n(A \cap B)^1$ (vi) $n(A \cup B)^1$

**SUB TOPIC: USING A FORMULA TO FIND NUMBER OF SUBSETS**

- Using the formula $2^n$ where n = number of elements in the given set.
- To find the number of proper subsets, we use $2^n - 1$.

Examples:

1. Find the number of subsets and proper subsets of set Q, where Q = {4, 2, 9}.

n(Q) = 3

(i) Number of subsets = $2^n$

$= 2^3$

$= 2 \times 2 \times 2$

= 8 subsets

(ii) Number of proper subsets = $2^n - 1$

$= 2^3 - 1$

$= (2 \times 2 \times 2) - 1$

$= 8 - 1$

= 7 proper subsets

2. Given that set A = $\{0, 2, 4, 6, 8\}$. Find the;

(i) Number of subsets of set A.

n(A) = 5

Number of subsets = $2^n$

$= 2^5$

$= (2 \times 2 \times 2) \times (2 \times 2)$

$= 8 \times 4$

= 32 subsets

(ii) Number of proper subsets = $2^n - 1$

$= 2^5 - 1$

$= (2 \times 2 \times 2) \times (2 \times 2) - 1$

$= (8 \times 4) - 1$

$= 32 - 1$

$=$ 31 proper subsets

**ACTIVITY:**

1. Find the number of subsets from the following sets.
(a) E = {0, 1, 2} (d) F= {a, b, c, d} (e) G = {a, e, i, o. u}
2. Find the number of proper subsets of the above sets in no. 1 above.
3. If set Y has 7 members, how many subsets are in set Y?
4. If set T has 8 elements, how many proper subsets are in set T?
5. (a) If n(K) = 2, find number of subsets of K.
(b) If M = {d, e} find the number of proper subsets in set M.

**SUB TOPIC: FINDING THE NUMBER OF ELEMENTS**

Examples

1. A set has 256 subsets. How many elements are in the set?

$2^n$ = Number of subsets

$2^n = 256$ (Factorize 256 by 2)

| | |
|---|---|
| 2 | 256 |
| 2 | 128 |
| 2 | 64 |
| 2 | 32 |
| 2 | 16 |
| 2 | 8 |
| 2 | 4 |
| 2 | 2 |
| | 1 |

256 = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2

$= 2^8$

$2n = 2^8$

$n = 8$

**The set has 8 elements**

2. Set Y has 127 proper subsets. How many elements are set Y?

$2^n - 1$ = Number of proper subsets

$2^n - 1 = 127$

$2^n - 1 + 1 = 127 + 1$

$2^n = 128$ (Factorize 128 by 2)

| | |
|---|---|
| 2 | 128 |
| 2 | 64 |
| 2 | 32 |
| 2 | 16 |
| 2 | 8 |
| 2 | 4 |
| 2 | 2 |
| | 1 |

128 = 2 x 2 x 2 x 2 x 2 x 2 x 2

$= 2^7$

$2^n = 2^7$

$n = 7$

**Set Y has 7 elements.**

**ACTIVITY:**

1. D has 16 subsets. How many elements does set D have?
2. E has 15 proper subsets. How many members are in set E?
3. F has 32 subsets. Find the number of elements in set F.
4. G has 31 proper subsets. Find the number of elements in set Bg.

5. H has 64 subsets. How many elements are in set H?
6. J has 63 proper subsets. Find the number of elements in set J.

**SUB TOPIC: REPRESENTING INFORMATION ON VENN DIAGRAMS**

**Content**: - Interpreting and summarizing the information.

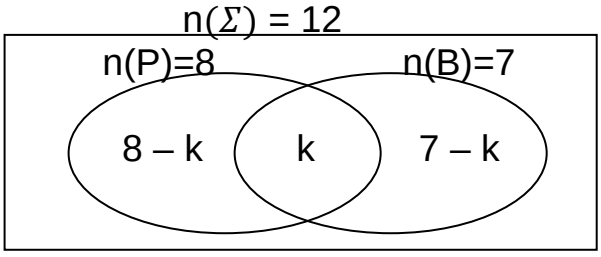
Examples:

1. In a group of 12 pupils, 8 pupils received pens (P) and 7 pupils received books (B)

a) Represent the above information on the venn diagram below.

$n(\Sigma) = 12$, $n(P) = 8$ $n(B) = 7$ $n(PnB) = ?$

Let the number who received both be k




b) From the venn diagram above, find the number of pupils who received both stationeries.

$8 - k + k + 7 - k = 12$

$8 + 7(- k + k) - k = 12$

$15 - k = 12$

$(15 - 15) - k = 12 - 15$

$- k = - 3$

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

$K = 3$

3 pupils received both stationeries.

c) How many pupils received only one type of stationery?

Those who received only one item

$= (8 - k) + (7 - k)$

$= (8 - 3) + (7 - 3)$

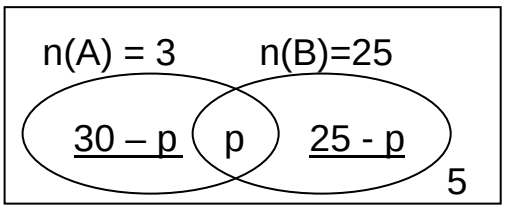
$= 5 + 4$

$=$ 9 pupils

2. Given that n(A) = 30, n(B) = 25, n(AUB) = 45 and $n(AUB)^1 = 5$

(a) Draw a venn diagram and show the above information.

Let p represent the intersection.




(b) Find the number of elements in;

(i) A n B

A n B = p

30 – p + p + 25 – p + 5 = 45

(b) A only = 30 – p

= 30 – 15

= 15

$$30 + 25 + 5 - p + p - p = 45$$
$$60 - p = 45$$
$$(60 - 60) - p = 45 - 60$$
$$-p = -15$$
$$\frac{-p}{-1} = \frac{-15}{-1}$$
$$P = 15$$

(iii) Probability of elements in the intersection

n(AnB) = 15 and n(AuB) = 45

$$\text{Probability} = \frac{n(DC)}{n(TC)} = \frac{15}{45}$$

c) How many pupils are in at least one set only?

At least one set = (30 – p) + p + (25 – p)

= (30 – 15) + 15 + (25 – 15)

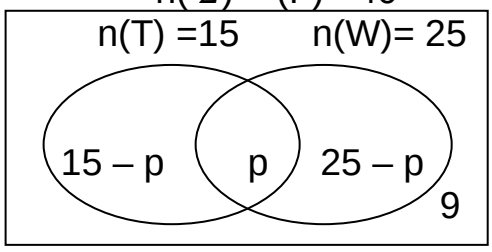
= 15 + 15 + 10

= 40 pupils

3. In a group of 40 people, all of them play football (F), 9 play football only,15 play tennis (T), 25 swim(S) and some enjoy all the three games.

(a) Draw a Venn diagram to represent the above information.

Let those who play all the three games be p




(b) How many people participate in all the three activities?

**Solution**

15 – p + p + 25 – p + 9 = 40

15 + 25 – p + 9 = 40

49 – p = 40

49 – 49 – p = 40 -49

-p = -9

$\frac{-p}{-1} = \frac{-9}{-1}$

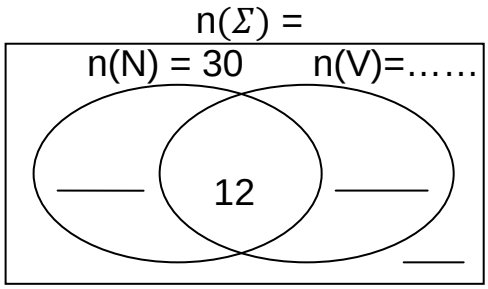
P = 9

9 people participate in all the three activities

**ACTIVITY:**

1. In a class, 30 pupils like net ball (N), (3p + 4) pupils like volley ball (V) only, 12 like both net ball and volley ball while (p – 4) pupils do not like any of the two games.

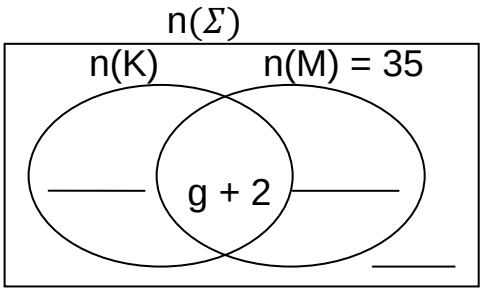
a) Complete the venn diagram below




b) Given that 28 pupils do not like net ball, find the value of p.

2. In a P.7 class, 35 pupils drink Mirinda (M), (2g – 3) drink Krest (K) but not Mirinda, (g + 2) drink both Mirinda and Krest while (g) pupils do not drink any of the two types of sodas.

a) Use the information given above to complete the venn diagram below.

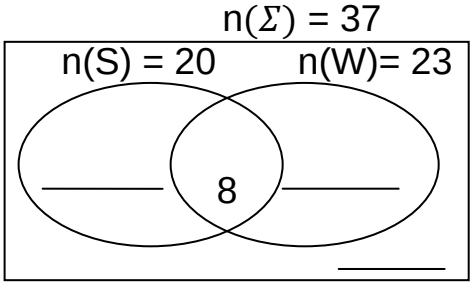



b) Given that 23 pupils drink Krest, find the value of g.

c) Find the total number of pupils in the P.7 class.

3. At a party of 37 people, 20 people took sodas (S), 23 took water (W), 8 took both sodas and water while y took none.

a) Using the information above, complete the venn diagram below.

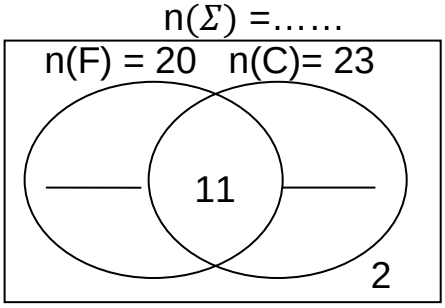



b) Work out the value of y.

c) Find the number of people who took one type of drinks.

4. At a party, x guests ate fish (F) only, (y+4) ate chicken (C) but not fish, 11 guests ate both types of sauce while 2 did not eat any of the sauce.

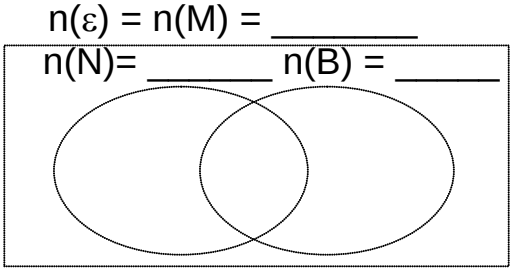
a) Use the information above to complete the venn diagram below.




b) Work out the value of y.

5. In a family, all the members eat Mukene (M), 5 of them eat Nile perch (N) and 4 eat beans (B). Q members eat beans only while 3 members eat Nile perch only. 1 member eats Mukene only.

(a) Represent the information on the venn diagram below



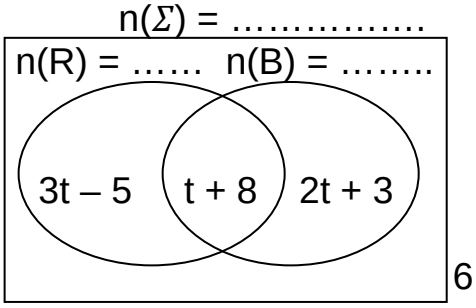

(b) How many members eat beans only?

(c) How many members are in the family?

**SUB TOPIC: SOLVING PROBLEMS FROM VENN DIAGRAMS**

Examples

The venn diagram below shows the number of pupils who preferred red colour (R) or blue colour (B). Use the information given to answer the questions that follow.




If 23 pupils preferred red colour;

a) Find the value of t.

Red colour = (3t – 5) + (t + 8)

3t + t + 8 – 5 = 23

4t + 3 = 23

4t + 3 – 3 = 23 – 3

4t = 20

$\frac{4t}{4} = \frac{20}{4}$

**t = 5**

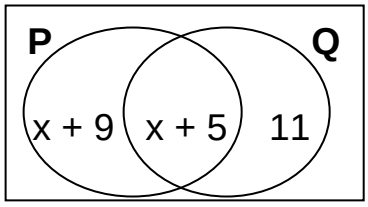
b) How many pupils do not like blue colour?
Those who don't like blue colour = B complement or $B^1$.
= 3t – 5 + 6
= (3 x t) + 6 – 5
= (3 x 5) + 1
= 15 + 1
= **16pupils**

c) Find the probability of picking a pupil who likes both colours.
Both colours = n (R n B)
= t + 8
= 5 + 8
= 13

n (RUB) = 3t – 5 + t + 8 + 2t + 3 + 6
= 3t + 2t + t + 8 + 6 + 3 – 5
= 6t + 12
= (6 x t) + 12
= (6 x 5) + 12
= 30 + 12
= 42

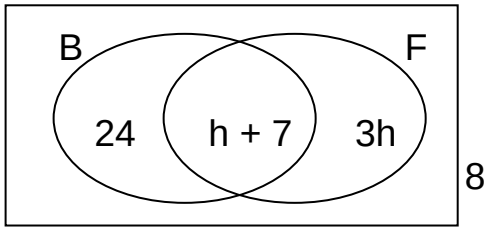
Probability = $\frac{n(DC)}{n(TC)}$
= $\frac{13}{42}$

**ACTIVITY:**
1. Study the venn diagram below given that n(Q) = 24




a) Find the value of x.
b) Find; (i) n(P) (ii) n(PUQ) (iii) n(PnQ)

2. The venn diagram shows the number of tourists who visited Mt. Elgon National game park. Some ate fish (F) while others ate beef (B) but some ate vegetables. Use it to answer the questions that follow.

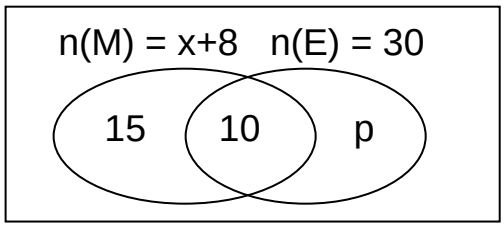



a) Find the value of x.

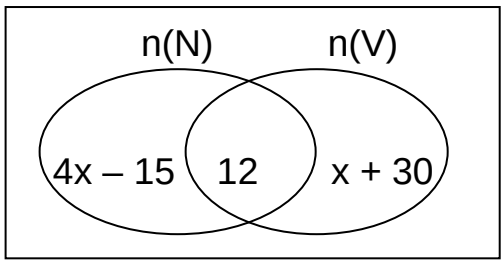
b) If 43 tourists ate fish, find the number of tourists who ate both fish and beef.

c) What is the probability that a tourist chosen at random ate beef only?

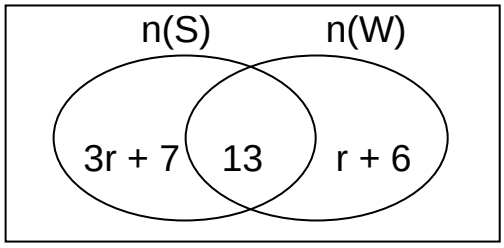
3. Use the venn diagram below to answer the questions that follow.




a) Find the value of x. b) Find the value of p.
c) What is the probability of picking a member in set E?
4. The venn diagram below shows the number of pupils who play net ball (N) or volley ball (V) or both.




If the number of pupils who play net ball only is equal to the number of pupils who play volley ball only;
a) Find the value of x.
b) How many pupils play net ball?
c) Work out the total number of pupils in the class.
5. At a party, visitors were served with Sodas (S) and mineral water (W) as shown on the venn diagram. Use it to answer the questions that follow.




a) If 32 visitors were served with sodas, find the value of r.
b) Find the total number of visitors who attended the party.
c) What is the probability that a visitor picked at random did not take any soda.

## TOPIC 2: NUMERACY (WHOLE NUMBERS)

## SUB TOPIC: APPLICATION OF VALUES AND PLACE VALUES

- Explain the terms place value, value, sum, difference, product and quotient.

Examples

1. Find the sum of the values of the underlined digits in 609,857.

| THOUSANDS | | | UNITS | | |
|---|---|---|---|---|---|
| HTH | TTH | TH | H | T | O |
| 6 | 0 | 9 | 8 | 5 | 7 |

9 x 1,000 = 9,000

5 x 10 = 50

Sum of the values = 9,000 + 50

Sum of the values

9,000

+ 50

9,050

2. Find the difference between the values of 8 and 3 in 785,342.

| HTH | TTH | TH | H | T | O |
|---|---|---|---|---|---|
| 7 | 8 | 5 | 3 | 4 | 2 |

3 x 100 = 300

8 x 10,000 = 80,000

Difference = 80,000 – 300

Difference in values

80,000

- 300

79,700

3. Find the quotient of the value of 6 and the place value of 9 in 736,940.

| HTH | TTH | TH | H | T | O |
|---|---|---|---|---|---|
| 7 | 3 | 6 | 9 | 4 | 0 |

Place value of 9 is hundreds (100s)

Value of 6 x 1,000

= 6,000

Quotient = 6,000 ÷ 100

= 60

Side work

6,000

100

= 60

**ACTIVITY:**

1. Find the sum of the value of 8 and the value of 2 in the number 7,258.
2. Find the difference between the values of 3 and 1 in 41,036.
3. Find the quotient of the values of 9 and 6 in the number 794,162.
4. Work out the product of the value of 2 and place value of 4 in 2,945.
5. Find the sum of the values of the underlined digits in 145,032.
6. What is the difference between the place value of 7 and the place value of 0 in the number 78,043?
7. Work out the product of the values of 4 and 2 in the number 1,932,143?
8. What is the difference between the place value of 8 and the value of 2 in the number 58,927?
9. Find the sum of the place value of 6 and the place value of 1 in the number 6,412.
10. Find the difference between the place value of 0 and the value of 3 in 54,013.

**SUB TOPIC: READING AND WRITING NUMBERS IN WORDS**

Example 1:

Write 20,480 in words.

| Thousand | Units |
|---|---|
| 20 | 480 |

Twenty thousand four hundred eighty

Example 2

Write 60,088,040 in words.

| Million | Thousand | Units |
|---|---|---|
| 60 | 088 | 040 |

Sixty million, eight- eight thousand forty

Example 3

Write 3,303,003 in words.

| Millions | Thousands | Units |
|---|---|---|
| 3 | 303 | 003 |

Three million, three hundred three thousand, three

**ACTIVITY:**

Write the following number figures in words.

1) 4,096 2) 32,404 3) 81,911 4) 500,007
5) 1,001,001 6) 6,600,001 7) 101,101,011 8) 11,111,111
9) 99,990,009 10) 21,021,021 11) 505,055 12) 808,808,808

**SUB TOPIC: READING AND WRITING NUMBERS IN FIGURES**

**Concepts:**

- Grouping the millions, thousands and units accordingly.
- Writing the equivalent values to correspond to the words.

Examples

1. Write in figures "Fifty-seven million, four hundred twenty-one thousand, nine hundred five."

57 million = 57,000,000
421 thousand + 421,000
905 905
57,421,905

2. Write in figures" a quarter of a million."

A million = 1,000,000

$^1/_4$ of 1,000,000

$^1/_4$ x 1,000,000

= 250,000

**ACTIVITY:**

Read and write the following in figures

1. Nine hundred four thousand, two hundred fifty-four
2. Three million, four hundred fifty-five thousand, two hundred nineteen
3. Twenty-four million, three hundred eighty-four
4. Seventy-seven million, seven thousand, seventy
5. Ninety-one million, one hundred ninety thousand, nineteen
6. Three quarter of a million
7. Seventeen million, seventeen thousand, seventeen
8. Sixty thousand, twenty-one
9. Nine hundred nine million, ninety-nine thousand, ninety-nine
10. One hundred one million, eleven thousand, eleven.

**SUB TOPIC: WRITING NUMBERS IN EXPANDED NOTATION/ FORM**

Expanding numerals using place values, values or powers/exponents/Indices.

Examples:

Expand: 5624 using:

1. Place values:

| TH | H | T | O |
|---|---|---|---|
| 5 | 6 | 2 | 4 |

= (5 x 1000) + (6 x 100) + (2 x 10) + (4 x 1)

2. Values

| TH | H | T | 0 |
|---|---|---|---|
| 5 | 6 | 2 | 4 |

:

5624 = (5 X 1,000) + (6 X 100) + (2 X 10) + (4 X 1)
= 5,000 + 600 + 20 + 4

3. Powers:

| $10^3$ | $10^2$ | $10^1$ | $10^0$ |
|---|---|---|---|
| 5 | 6 | 2 | 4 |

5624 = $(5 \times 10^3) + (6 \times 10^2) + (2 \times 10^1) + (4 \times 10^0)$

**ACTIVITY:**

Write the following numbers in expanded form / notation

1. Using place values

a) 54,572 b) 102,473 c) 4,875,301 d) 52,065,829 e) 687,167,593

2. Using values

a) 84,029 b) 673,964 c) 3,469,201 d) 474,023,716

3. Using powers of ten/ exponents/ indices

a) 5,892 b) 85,634 c) 427,168 d) 3,637,958 e) 13,074,867

**SUB TOPIC: WRITING EXPANDED NUMBERS IN SHORT**

- Adding the value of each number to get the total.

Examples:

Write as a single number for the following expanded forms..

(i) (6 x 10,000) + (4 x 10) + (5 x 1)

Solution:

(6 x 10000) + (4 x 100) + (5 x 1)

= 60,000 + 400 + 5

60,000
400
+ 5
60,405

(ii) 9000000 + 700 00 + 50000 + 1000 + 30 + 8

= 9,000,000
700,000
50,000
1,000
30
+ 8
9,750,038

(iii) $(2 \times 10^5) + (4 \times 10^3) + (6 \times 10^0) + (7 \times 10^2)$

= (2 x 10 x 10 x 10 x 10 x 10) + (4 x 10 x 10 x 10) + (6 x 1) + (7 x 10 x 10)

= (2 x 100,000) + (4 x 1,000) + (6 x 1) + (7 x 100)

= 200,000 + 4,000 + 6 + 700

200,000
4.000
700
+ 6
204,706

**ACTIVITY:**

Find the numbers that have been expanded to give the following:

1. $(2 \times 10^4) + (7 \times 10^3) + (5 \times 10^2) + (8 \times 10^1) + (4 \times 10^0)$
2. $(6 \times 10^5) + (4 \times 10^2)$
3. $(8 \times 10^6) + (8 \times 10^5) + (4 \times 10^4) + (6 \times 10^3) + (8 \times 10^0)$
4. 400 + 60,000 + 5,000,000 + 3 + 90 + 9,000
5. 9,000 + 5,000,000 + 600 + 30 + 9
6. (6 x 1,000,000) + (3 x 100,000) + (4 x 100) + (8 x 10) + (1 x 1)
7. (9 x 10) + (3 x 1) + (7 x 100,000) + (4 x 1,000,000) + (5 x 10,000)
8. (7 x 1) + (6 x 10) + (4 x 100) + (2 x 100,000) + (8 x 1,000,000)

**SUB TOPIC: STANDARD FORM /SCIENTIFIC NOTATION**

- In standard form or Scientific notation, we turn the given number into decimal by expressing the number between 0 and 10 in the ones place value followed by a decimal point multiplied to the required index.

i.e 34 → 3.4; 4.53→ 4.53; 6849 → 6.849 6,500,000 ⟶ 6.5

Examples:

(i) Express 58 in standard form.

T O
5 8
5.8 x 10

$58 = 5.8 \times 10^1$

(ii) Write 453 in standard form.

T H O
4 5 3
4.53 x 100
4.53 x 10 x 10

$453 = 4.53 \times 10^2$

(iii) Express 650,000 in Scientific notation.

HTH TTH TH H T O
6 5 0 0 0 0

650,000 = 6.5 x 100,000
= 6.5 x 10 x 10 x 10 x 10 x 10

$650{,}000 = 6.5 \times 10^5$

**ACTIVITY:**

Express the following numbers in Standard form or Scientific notation

1) 39 2) 753 3) 5,223 4) 6,697 5) 7,464
6) 353,200 7) 2,163,423 8) 3,065,000 9) 614,806

**SUB TOPIC: FINDING THE NUMBER EXPRESSED IN STANDARD FORM**

**Content**: Expressing standard forms in short form or as single numbers.

Examples

1. Express $2.34 \times 10^3$ as a single number.

$2.34 \times 10^3 = 234 \times 10 \times 10 \times 10$
$100$

= 234 x 10

$2.34 \times 10^3 = 2340$

2. What number has been expressed in standard form to give ($3.67 \times 10^4$)?

$3.67 \times 10^4 = \frac{367}{100} \times 10 \times 10 \times 10 \times 10$

$= 367 \times 100$

$3.67 \times 10^4 = 36{,}700$

**ACTIVITY:**

Write single numbers for the following expressions.

1) $3 \times 10^2$ 2) $2.76 \times 10^3$ 3) $4.38 \times 10^2$ 4) $6.0937 \times 10^5$ 5) $8.7 \times 10^6$

6) $7.43 \times 10^4$ 7) $1.8489 \times 10^3$ 8) $3.2 \times 10^3$ 9) $5.74 \times 10^5$ 10) $9.005 \times 10^4$

**SUB TOPIC: ROUNDING OFF NUMBERS**

- Identifying the required place value and the digit on the right hand side of it.
- Rounding up or down and express using approximation symbol.

Review – rounding off scale (rounding up or down)

Examples

Round off the following as instructed.

(i) 3864 to the nearest hundreds.

H - R P V

3 8 6 4

+1 0 0

3 9 0 0

3864 ~ 3 9 0 0

(ii) 214 (nearest tens)

Tens – RPV

214

+ 00

210

214 ~ 210

(iii) 4.78516 (nearest thousandths)

4.78516

+ 0

4.78500

4.78516 ~ 4.785

(iv) 75.634 (nearest whole number)

75.634

+ 1-000

76.000

75.634 ~ 76

**ACTIVITY:**

1) Round off the following to the nearest thousands:

(i) 4,743 (ii) 75,981 (iii) 67,846 (iv) 83,672 (v) 92,786

2) Round off the following to the nearest ten thousands:

(i) 43,263 (ii) 60,018 (iii) 62,791 (iv)146,005 (vii) 97,280

3) Round off the following to the nearest hundred thousand:

(i) 245,678 (ii) 861,042 (iii) 997,845 (iv) 4,832,872

4) Round off the following to the nearest millions:

(i) 1,245,614 (ii) 16,249,509 (iii) 57,849,612 (iv) 79,456,789

5) Round off the following to the nearest whole number (ones)

(i) 0.92 (ii) 7.198 (iii) 9.993 (iv)14.82 (v) 6.083

6) Round off the following to the nearest tenths:

(i) 2.36 (ii) 3.05 (iii) 2.98 (iv) 9.97 (v) 3.456

9) Round off the following to the nearest hundredths:

(i) 0.768 (ii) 5.463 (iii) 0.076 (iv) 146.041 (v) 39.99 vi) 34.567

10) Round off the following to the nearest thousandths:

(i) 46.2038 (ii) 1.8396 (iii) 0.18634 (iv) 84.9379 (v) 9.9999

11) Round off the following to the nearest ten thousandths.

(i) 0.46284 (ii) 0.00009 (iii) 3.456729 (iv) 7.572633 (v) 3.99997

12) Round off to the following to the nearest hundred thousandths

(i) 0.000294 (ii) 2.0456361 (iii) 8.4382968 (iv) 9.999999

**SUB TOPIC: CONVERTING HINDU ARABIC NUMERALS TO ROMAN NUMBERALS**

- Expanding value by value.
- Write each value in Roman numerals
- Write a bar on top of the letter which means multiply by 1000 if it's V, X or M.

Examples

1. Write the following in 124 in Roman numerals

(i) 124 = H T O
1 2 4
100 20 4
100 + 20 + 4
100 = C
20 = XX
4 = IV
124 = CXXIV

ii) 1962 TH H T O
1962 = 1000 + 900 + 60 + 2
= M CM LX II
= MCMLXII

3. What is 6000 in Roman numeral?

6000 = 6 x 1000
= $\overline{\text{VI}}$

**ACTIVITY:**

Write the following Hindu-Arabic numerals into Roman form;

1) 48 2) 59 3) 27 4) 44 5)123 6) 465 7)1959

8) 2010 9) 1847 10)1564 11) 10,000 12) 9,000

11) George is 34 years old. Express his age in Roman numerals,

12) Agnes earns sh.650 per day. Express his daily income per day in Roman numerals.

**SUB TOPIC: CONVERSION OF ROMAN NUMERALS INTO HINDU-ARABIC**

- Identify the different types of Roman numerals and expand each type.
- Read and write Roman numerals from the left to the right.

Example

Write the following numbers in Hindu Arabic numerals

(i) CXCV

C XC V

M – 1000

XL – 40

V – 5

MXLV = 1045

(iii) MMDLXXX

MM D LXXX

MM → 2000

D → 500

LXXX → 80

MMDLXXX = 2580

(iii) CDXCIV

CDXCIV

CD = 400

XC = 90

IV = + 4

CDXCIV = 494

(iv) A temple had MDCCLXIV written on top of it showing the year it was built. Which year is this in Hindu Arabic?

MDCCLXIV

M = 1,000

DCC = 700

LX = 60

IV =+ 4

**1,764**

MDCCLXIV = 1,764

**ACTIVITY:**

Express the following Roman numerals into Hindu-Arabic system.

1) DCII 2) CMLXXXIV 3) MCDXLIX 4) CMXCIX

5) MDCC 6) CMLXXIII

7) My father was born in MCMLXXV. Express the year of birth in Hindu-Arabic numeral.

8) Calvin was born in MCMXCVI. Express the year of his birth into Hindu-Arabic numeral.

**SUB TOPIC: OPERATION ON ROMAN NUMERALS**

Change value by value into Hindu-Arabic numerals

Add or subtract then change back to Roman numerals if required

Example

(I) Add CCXLIII + DCLXXV (answer in Roman numerals)

CCXLIII – Hindu Arabic

CC XL III

CC - 200

XL - 40

III - 3

243

DCLXXV – in Hindu-Arabic

DC LXX V

600 + 70 + 5

= 675

Sum = 243 + 675

= 918

918 – Roman numerals

918 = 900 + 10 + 8

900 = CM

10 = X

8 = VIII

918 = CMXVIII

(II) Find the difference between MMCMLX and MCDXL (answer in Hindu Arabic numerals).

MMCMLX - MCDXL

| | | | | | | |
|---|---|---|---|---|---|---|
| MM | CM | LX | M | CD | XL | Difference = 2,960 |
| MM | 2000 | | M | 1000 | | - 1,440 |
| CM | 900 | | CD | 400 | | 1,520 |
| LX | 60 | | XL | 40 | | |
| MMCMLX = 2960 | | | MCDXL =1,440 | | | |

**ACTIVITY:**

Work out the following and give your answer in Roman numerals.

1) MC + CIV 2) CCIX + DCXL 3) XIX + CCXI 4) CCVI – CIX

4) MCM + CMXC 6) M – CDXI 7) D – LVI 8) C – XCIX

**TOPIC: WHOLE NUMBERS (BASES)**

2. What number has been expanded to give:

$(1x2^3) + (0x2^2) + (0x2^1) + (1x2^0)$?

$= (1x2^3) + (0x2^2) + (0x2^1) + (1x2^0)$

$= (1x2x2x2) + (0x2x2) + (0x2) + (1x1)$

$= 8 + 0 + 0 + 1$

$= 9_{ten}$

Change 9 ten to base two (2)

$9_{ten}$ =

| B | No. | Rem |
|---|---|---|
| 2 | 9 | 1 |
| 2 | 4 | 0 |
| 2 | 2 | 0 |
| | 1 | |

:. Expanded base = $1001_{two}$.

**ACTIVITY:**

What base / number has been expanded to give;

(i) $(1x2^3) + (1x2^2) + (0x2^1) + (0x2^0)$? (ii) $(2x3^2) + (1x3^1) + (0x3^0)$?

(iii) $(1x4^2) + (1x4^1) + (1x4^0)$? (iv) $(3x5^3) + (2x5^2) + (1x5^1) + (0x5^0)$?

(v) $(1x2^4) + (0x2^3) + (1x2^2) + (0x2^1) + (1x2^0)$? (vi) $(1x6^1) + (1x6^0)$?

**SUB TOPIC: CHANGING NON DECIMAL BASES TO NON-DECIMAL**

CONTENT: - Dividing the base ten numerals by the required base.

- Listing the remainders and reading the numerals upwards.

Examples:

1. Change 25 to base seven

Side work

25 ÷ 7 = 3 rem. 4 ↑

3 ÷ 7 = 0 rem. 3 | Read upwards

| B | No | R |
|---|---|---|
| 7 | 25 | 4 |
| | 3 | |

$25_{ten}$ = 34 seven

2. Change 43 ten to binary.

Binary is base two

| B | No | R |
|---|---|---|
| 2 | 43 | 1 |
| 2 | 21 | 1 |
| 2 | 10 | 0 |
| 2 | 5 | 1 |
| 2 | 2 | 0 |
| | 1 | |

43ten = 101011two

Side work

43 ÷ 2 = 21 rem.1
21 ÷ 2 = 10 rem.1
10 ÷ 2 = 5 rem. 0
5 ÷ 2 = 2 rem. 1
2 ÷ 2 = 1 rem. 0
1 ÷ 2 = 0 rem. 1

↑ Read upwards

3. Which base eight numeral is equivalent to 54 ten?

| B | No | R |
|---|---|---|
| 8 | 54 | 6 |
| | 6 | |

54 ten = 66 eight

Side work

54 ÷ 8 = 6 rem. 6
6 ÷ 8 = 0 rem. 6

↑ Read upwards

**ACTIVITY:**

Express the following in the required base number system.

1) $20_{ten}$ to binary 2) $49_{ten}$ to base five 3) $87_{ten}$ to base six
5) $38_{ten}$ to base two 6) $34_{ten}$ to binary 7) $13_{ten}$ to base three
8) $61_{ten}$ to base seven 9) $112_{ten}$ to octal base
10) What base five numeral is equivalent to 52 ten?
11) Find the base two numeral equivalent to 20 ten?

**SUB TOPIC: CHANGING OTHER BASES TO DECIMAL BASE**

Examples:

1. Change 1101two to base ten

$1101_{two}$

| Two two twos | Two twos | Twos | Ones |
|---|---|---|---|
| 1 | 1 | 0 | 1 |

= (1 x 2 x 2 x 2) + (1 x 2 x 2) + (0 x 2) + (1 x 1)
= 8 + 4 + 0 + 1
= 13ten

2. Change 234 six to denary.

$234_{six}$
$= (2 \times 6^2) + (3 \times 6^1) + (4 \times 6^0)$
= (2 x 6 x 6) + (3 x 6) + (4 x 1)
= (12 x 6) + (18 + 4)
= 72 + 22
= 94 ten

**ACTIVITY:**

Change the following to decimal base.

1. a) $33_{five}$ b) $11_{five}$ c) $1010_{two}$ d) $1010_{two}$ e) $1111_{two}$ f) $11010_{two}$

2. Find the base ten numeral equivalent to these bases.

a) $100_{five}$ b) $132_{five}$ c) $143_{six}$ d) $231_{four}$ e) $413_{eight}$ f) $56_{seven}$

## SUB TOPIC: CHANGING OTHER BASES TO NON–DECIMAL BASES

**Concepts:**

- Change the non decimal base to base ten then change to the required base.

Example:

1. Change 123 five to base six.

$(1 \times 5^2) + (2 \times 5^1) + (3 \times 5^0)$
$(1 \times 5 \times 5) + (2 \times 5) + (3 \times 1)$
$(5 \times 5) + 10 + 3$
$25 + 10 + 3$
$35 + 3$
$= 38_{ten}$

Change $38_{ten}$ to base six.

| B | No | R |
|---|---|---|
| 6 | 38 | 2 |
| 6 | 6 | 0 |
| | 1 | |

Read upwards

$123_{five} = 102_{six}$

(ii) Express 2t eleven to base nine.

$2t_{eleven}$ to base nine

| 2 | t | |
|---|---|---|
| $11^1$ | $11^0$ | |

$(2 \times 11^1) \times (t \times 11^0)$
$(2 \times 11^1) + (10 \times 1)$
$22 + 10$
$= 32ten$

$32_{ten}$ to base nine

| B | No | R |
|---|---|---|
| 9 | 32 | 5 |
| | 3 | |

$2t_{eleven} = 35nine$

**ACTIVITY:**

Change the following as instructed

1) $231_{six}$ to base seven 2) $463_{seven}$ to base eight 3) $243_{five}$ to base eight
4) $1101_{two}$ to base three 5) $231_{five}$ to base six 6) $135_{six}$ to base nine
7) $1221_{three}$ to base five 8) $1011_{two}$ to base four 9) $314_{five}$ to base nine

## SUB TOPIC: ADDITION OF BASES

Example:

1. Add: $225_{six} + 434_{six.}$

$225_{six}$
$+ 434_{six}$
$1103six$

$9 \div 6 = 1$ rem. 3
$6 \div 6 = 1$ rem. 0
$7 \div 6 = 1$ rem. 1

2. Add: $143_{five} + 11_{five}$ (answer in base ten) 204five to base ten

$143_{five}$
$+ 11_{five}$
$204_{five}$

$= (2 \times 5 \times 5) + (0 \times 5) + (4 \times 1)$
$= 50 + 0 + 4$
$= 54_{ten}$

3. Add: $23_{seven} + 12_{six}$ (answer in base five)

$23_{seven}$
$= (2 \times 7^1) + (3 \times 7^0)$
$= (2 \times 7) + (3 \times 1)$
$= 14 + 3$
$= 17_{ten}$

$12_{six}$
$(1 \times 6^1) + (2 \times 6^0)$
$= (1 \times 6) + (2 \times 1)$
$= 6 + 2$
$= 8_{ten}$

$17_{ten} + 8_{ten} = 25_{ten}$

25ten to base five

| B | No | Rem. |
|---|---|---|
| 5 | 25 | 0 |
| 5 | 5 | 0 = $100_{ten}$ |
| | 1 | |

$23_{seven} + 12_{six} = 100_{five}$

**ACTIVITY:**

Work out the following

1) $11_{two} + 101_{two}$ 2) $1101_{two} + 111_{two}$ 3) $1011_{two} + 11_{two}$

4) $330_{five} + 123_{five}$ 5) $241_{six} + 421_{six}$ 6) $132_{four} + 332_{four}$

7) $1\ 2\ 4_{five}$ + $3\ 4\ 3_{five}$

8) $1\ 1\ 2_{three}$ + $2\ 2\ 2_{three}$

9) $2\ 4\ 5\ 6_{seven}$ + $2\ 4\ 6\ 3_{seven}$

## SUB TOPIC: SUBTRACTION OF BASES

Examples:

1. Subtract $1101_{two} - 101_{two}$

$1101_{two}$
$- 101_{two}$
$1000_{two}$

2. Subtract: $40_{five} - 22_{five}$

3 5
4 0 five
- 2 2 five
1 3 five

3. Subtract: $671_{nine} - 285_{nine}$.

Solution:

5 6 10
6 7 1 nine 9 + 1 = 10
- 2 8 5 nine 9 + 6 = 15
3 7 5 nine

4. Take away $433_{six} - 234_{six}$

Solution

433 six
- 234 six
155 six

389
$433_{six}$
$- 234_{six}$
155

## ACTIVITY:

**Simplify:**

1) $111_{two} - 10_{two}$ 2) $110\ t_{wo} - 100_{two}$ 3) $1111_{two} - 101_{two}$

4) $1020_{five}$ - 341 five

5) $431_{six}$ - $134_{six}$

6) $232_{four}$ - $123_{four}$

7) $341_{five}$ - $132_{five}$

8. Subtract $3\ 4\ 5_{six}$ from $4\ 3\ 1_{seven}$ and give your answer in octal base.

## SUB TOPIC: MULTIPLICATION OF BASES

Examples:

(i) 1 2 1 three
X 2 three
1012 three

1 x 2 = 2
2 x 2 = 4
4 ÷ 3 = 1 rem
1 x 2 = 2 + 1
3 ÷ 3 = 1 rem 0

(iii) $111_{two} \times 11_{two}$

111 two
x 11 two
111
+ 111
10101 two

## ACTIVITY:

Multiply the following numbers

1) $10_{two} \times 10_{two}$ 2) $101_{two} \times 11_{two}$ 3) $1011_{two} \times 10_{two}$

4) $111_{two} \times 100_{two}$ 5) $121_{three} \times 2_{three}$ 6) $24_{six} \times 32_{six}$

## SUB TOPIC: DIVISION OF BASES

- Expanding and converting bases then dividing to change to given base.

Examples:

(i) $204_{five} \div 14_{five}$.

Solution:

$204_{five}$ – base ten

14 five

$(2 \times 5^2) + (0 \times 5^1) + (4 \times 5^0)$
$(2 \times 5 \times 5) + (0 \times 5) + (4 \times 1)$
$(10 \times 5) + 0 + 4$
$50 + 4$
$54_{ten}$

$(1 \times 5^1) + (4 \times 5^0)$
$(1 \times 5) + (4 \times 1)$
$5 + 4$
$= 9_{ten}$

$54 \div 9_{ten} = 6_{ten}$

Change $6_{ten}$ to base five

| 5 | 6 | 1 |
|---|---|---|
| | 1 | |

$= 11$ ten

**$204_{five} \div 14_{five} = 11_{five}$**

(ii) $448_{nine} \div 17_{nine}$ (answer in Septenary base)

$448_{nine}$
$(4 \times 9^2) + (4 \times 9^1) + (8 \times 9^0)$
$(4 \times 9 \times 9) + (4 \times 9) + (8 \times 1)$
$(4 \times 81) + (4 \times 9) + (8 \times 1)$
$324 + 36 + 8$
$= 368_{ten}$
$368 \div 16 = 23$

$17_{nine}$
$(1 \times 9^1) + (7 \times 9^0)$
$(1 \times 9) + (7 \times 1)$
$9 + 7$
$= 16_{ten}$

$448_{nine} \div 17_{nine} = 32_{seven}$

$23_{ten}$ to base seven

| B | No | Rem |
|---|---|---|
| 7 | 23 | 2 |
| | 3 | |

$= 32_{ten}$

**ACTIVITY:**

Divide the following:

a) $144_{five} \div 12_{five}$ b) $10010_{two} \div 110_{two}$ c) $22_{five} \div 11_{five}$

d) $231_{six} \div 21_{six}$

## SUB TOPIC: FINDING THE UNKNOWN (MISSING) BASE

- Change the non decimal bases to decimal (base ten).

Examples:

(i) If 44p = 35 nine

Solution:

$(4 \times 0^1) + (4 \times p^0) = (3 \times 9^1) + (5 \times 9^0)$
$(4 \times p) + (4 \times 1) = (3 \times 9) + (5 \times 1)$
$4p + 4 = 27 + 5$
$4p + 4 = 32$
$4p + 4 - 4 = 32 - 4$
$4p + 0 = 28$
$\frac{4p}{4} = \frac{28}{4}$
**P = 7**

(ii) $X^2 = 71$ nine

$X^2 = (7 \times 9^1) + (1 \times 9^0)$
$X^2 = (7 \times 9) + (1 \times 1)$
$X^2 = 63 + 1$
$X^2 = 64$
$\sqrt[2]{X2} = \sqrt[2]{64}$
$\sqrt[2]{X2} = \sqrt[2]{8X8}$
$X = 8$

**X represents base eight**

(ii) $325$ six $= q^3$

$(3 \times 6^2) + (2 \times 6^1) + (5 \times 6^0)$
$(3 \times 6 \times 6) + (2 \times 6) + (5 \times 1)$
$(3 \times 36) + (2 \times 6) + (5 \times 1)$
$108 + 12 + 5$
$125$

$125 = q^3$
$\sqrt[3]{125} = \sqrt[3]{q3}$

| 5 | 125 |
|---|---|
| 5 | 25 |
| 5 | 5 |
| | 1 |

$5 \times 5 \times 5 = q^3$
$5^3 = q^3$
$5^{3x\ 1/3} = q^{3x1/3}$
$5 = q$
**q = 5**

**ACTIVITY:**

Solve for the unknown bases below;

1. $44p = 35_{nine}$
2. $23_x = 19_{ten}$
3. $55_n = 43_{eight}$
4. $112_{three} = 22_x$
5. $31_y = 221_{three}$
6. $P^2 = 54_{nine}$
7. $213_{six} = 100_n$
8. $P^3 = 121_{seven}$
9. $n^2 + n^2 = 112_{five}$

## TOPIC 3: OPERATION ON WHOLE NUMBERS

### SUB TOPIC: ADDITION OF LARGE NUMBERS

- Addition (sum, total, plus, altogether, increase) – to

Examples:

1. Add 615,146,144 to 320,005,614.

615,146,144
+ 320,005,614.
935,151,758

2. Increase 97,456 by 389,508.

389,508
+ 97,456
486,964

3. The population in four countries of a district shows that county A is 23,467, county B is 21 602, county C is 19466 and county D is 25 102. What is the total population in the district?

| | |
|---|---|
| County A | 23,467 |
| County B | 21,602 |
| County C | 19,466 |
| County D | +25,012 |
| | 89,547 people |

**ACTIVITY:**

Work out the following numbers:

a) 9,678,376 + 5,121,026.
b) sh.645,905 + sh.497,03
c) 10,853,453 + 846,907.
d) 93,464,185 + 86,759,988

2. A parent paid sh.133,850 for his child in P.1, sh. 197,000 for the one in P.7 and sh.235,900 in S.1. How much money did the parent pay for the school fees in that term altogether?
3. My father received sh. 29,547,790 from NSSF Savings and sh.53,870,900 from Stanbic Bank from his Savings account this year. Find the total amount of money my father received from both savings this year.
4. A garment factory produced 4,247,367 shirts and 4,143,785 pairs of trousers. What was the sum of the clothes produced?
5. A farm produced 6,740,850 eggs in a year and another produced 1,214,615 eggs. What was the sum of all the eggs?

### SUB TOPIC: SUBTRACTION OF LARGE NUMBERS

Examples:

1. Subtract 239,610,510 from 596,148,420

596,148,320
- 239,610,510
356,537,810

2. What is the difference between 3060 and 186?

3,060
- 186
2,874

3. Subtract 673,109,875 – 479,264,114.

673,109,875
- 479,264,114
193,845,761

4. Subtract 93,564 from100,872.

From 100,872

-93,564
7,308

5. Subtract ten thousand six hundred fifty-four from fifty thousand.

50,000
- 10,654
39,346

**ACTIVITY:**

1. Subtract the following numbers:

a) 876,758 – 654,531 b) 84,639 – 45,725 c) 786,954 – 354,114.

2. Find the difference between 84,836,053 litres and 75,100,163 litres

3. Subtract 999,999 from 1,000,000.

4. A metre reading of water at the beginning of the month was 0040702 units and at the end of the month, it was 0049611 units. How much water was used in the month?

5. A factory produced 6,740,850 cups but 1,475,950 were damaged. How many cups were good?

6. What must be added to sh.153,000 to give sh.250,000?

**SUB TOPIC: MULTIPLICATION OF LARGE NUMBERS**

- Re-group vertically according to place values then multiply

Examples

1. Find the product of 870 and 12.

870
x 12
1,740
+870
10,440

2. Multiply: 214,032 x 322.

214,032
x 322
428064
428064
+ 642096
68918304

3. A store can hold 1973 boxes each containing 34 pairs of shoes. How many pairs of shoes are in the store?

Total number of pairs of shoes

1973 x 34 = 973 x (30 + 4)

1973 x 3x 10 = 59,190

1973 x 4 =+ 7,892

67,082

**ACTIVITY:**

Work out the following:

1) 241 x 6 2) 954 x 14 3) 67230 x 10

4). Find the product of 24854 by 425.

5) A factory produced 4395 crates of soda. If each crate contains 24 bottles, how many bottles did it produce?

6) 14 of the Dream Africa Schools paid Examination fees to UNEB for PLE registration in 2020. If each school paid shsd.360,000, how much money did UNEB get from these schools?

7). There are 645 cartons of cooking oil in a pack and 50 containers in each pack. If each pack. If each container contains 20 tins, find the total number of tins which are there altogether.

8). The government has put a request that each Civil Servant should remit shs.10,000 to the COVID-19 Task Force to help fight the pandemic. If there are only 975 civil servants who are willing, how much money will the task force collect?

9). Paul has 354 cows in his farm. If each cow gives him an average of 23 litres of milk daily, how much milk does he get in a year?

**SUB TOPIC: DIVISION OF WHOLE NUMBERS**

In long division, divide beginning with the biggest place value, multiply in each case by the divisor then subtract as you re-group accordingly till the end.

**In division,**

100 ÷ 2 = 50, 100 is the dividend, 2 is the divisor and 50 is the quotient.

Examples

1. Divide 1414 ÷ 7

```
        202
   7 √1 4 1 4
 2x7= -1 4
       1
  0x7  = - 0
       1 4
   2x7 = - 1 4
       0 0
```

**1414 ÷ 7 = 202**

2. Divide 14136 ÷ 31

```
          4 5 6
    31 √1 4 1 3 6   | 31 x1 = 31
  4x31= -1 2 4      | 31 x 2 = 62
        1 7 3       | 31 x 3 = 93
 5x31 = - 1 5 5     | 31 x 4 =124
        1 8 6       | 31 x 5 =155
  6x31 = - 1 8 6    | 31 x 6 =186
        0 0 0
```

**14,136 ÷ 31 = 456**

3. Divide 3816648 by 132.

```
                  28914
          132 ) 3 8 1 6 6 4 8
2x132 =   -2 6 4
          1 1 7 6
8x 132 =  -1 0 5 6
              1206
9 x132 =  - 1188
               184
1x132 =   -132
               528
4x132 =   -528
               000
```

132 x 1 = 13
132 x 2 = 264
132 x 3 = 396
132 x 4 = 528
132 x 5 = 660
132 x 6 = 792
132 x 7 = 924
132 x 8 = 1056
132 x 9 = 1188

4. There are 6315 books to be packed in 15 boxes. How many books should be packed in each box?

```
          421
      15 ) 6 3 1 5
4x15 =  - 6 0
          31
2x15 =  - 3 0
            1 5
1x15 =  - 1 5
            0 0
```

421 books should be packed in each box.

**ACTIVITY:**

1. Divide 6363 ÷ 7
2. Share sh.10,000 among 20 children.
3. Work out: $68\overline{)5984}$
4. Distribute 12,800 textbooks equally among 64 schools.
5. Martha sold rolls of cloth for sh.1, 491,000. If she sold 142 rolls, what was the cost of each roll?
6. Godfrey was given 629,928kgs of maize flour to give 234 families during the Covid-19 lockdown for assistance by the government. How many kilograms of maize flour did each family get?
7. A farmer has sh.68,640 to pay 32 workers. How much money does each worker receive?

**SUB TOPIC: DISTRIBIUTIVE PROPERTY**

- Factorize and then multiply by the sum or difference by the fctor.

Examples:

Use the distributive property to work out:

(i) (379 x 27) + (27 x 21)
Re-arrange (27 x 379) + (27 x 21)
= 27 x (379 + 21)
= 27 x (400)
= 27 x 400

(iii) Work out (156 ÷ 13) + (260 ÷ 13)

(156 ÷ 13) + (260 ÷ 13)
(156 + 260) ÷ 13
416 ÷ 13
= 32

= 10,800

(ii) (137 x 42) – (37 x 42)
(137 x 42) – (37 x 42)
(42 x 137) – (42 x 37)
42 x (137 – 37)
42 x 100
= 4,200

(iv) Simplify: (630 ÷ 21) – (357 ÷ 21)
(630 ÷ 21) – (357 ÷ 21)
(630 – 357) ÷ 21
273 ÷ 21
= 31

**ACTIVITY:**

Work out the following using the distributive property.

a) (6 x 9) + (6 x 1) b) (17 x 93) + (17 x 7) c) (12 x 34) + (34 x 88)

d) (0.47 x148) + (52 x 0.47) e) (0.625 x 72) + (28 x 0.625)

f) (11 x 35) – (25 x 11) g) (529 ÷ 30) + (101 ÷ 30)

h) (606 ÷ 12) + (18 ÷ 12) i) (27 x 29) – (27 x 19)

**SUB TOPIC: ASSOCIATIVE PROPERTY**

- ✓ The alteration of the position of the bracket does not change the sum or product of the numbers.
- ✓ The associative property holds for both addition and multiplication

Example

Use the associative property to workout

1. (5 + 8) + 2= 5 + (8 + 2) = (5 + 2) + 8)
13 + 2 = 5 + 10 = 7 + 8
15 = 15 = 15

2. (5 x 8) x 2 = 5 x (8 x 2) = (5 x 2) x 8
40 x 2 = 5 x 16 = 10 x 8
80 = 80 = 80

**ACTIVITY:**

Fill in the missing numbers.

1. 4 + (6 + 3) = (4 +… ) + 3
2. (9 + 2) + 5 = 9 + (2 + …..)
3. 7 + (6 + 8) = (7 + ….) + 8
4. (5 x 3) x 6 = ….. x (3 x 6)
5. 9 x (5 x 2) = (9 x …..) x 2

Work out using the associative property.

6) 3 + 5 + 7
7) 16 + 14 + 10
8) 12 + 27 + 20
9) 24 + 26 + 28
10) 6 x 3 x 5
11) 10 x 5 x 8

**SUB TOPIC: COMMUTATIVE PROPERTY**

- The commutative property holds for both addition and multiplication only.

Example

4+3 = 3+4 (What you start with does not affect the result)
7 7
4x3 = 3x4 (What you start with does not affect the result)

12 = 12

Conclusion: The commutative property holds for both addition and multiplication

Given that t*y = ty + y

Find;

i) 2*3

2*3 = (2 x 3) + 3

= 6 + 3

= 9

ii) 5*7

5*7 = (5 x 7) + 7

= 35 + 7

= 42

**ACTIVITY:**

Complete using the commutative property

1) 5 x 2 = ….. x 5 2) 8 x 3 = …. x 8 3) 4 x 7 = 7 x ……

4) 11 x 5 = 5 x…… 5) 13 x 8 = 8 x ….. 6) 27 x …. = 21 x 27

Work out the following:

9) 5*6 10) 8*5 11) 12*9 12) 0*14

**SUB TOPIC: OPERATION OF NUMBERS WITH POWERS**

**Concepts:**

- When adding the same powers of the same base, add only the coefficients and leave the powers

Example

Simplify: $3m^2 + 4m^2$

$3m^2 + 4m^2 = (3 + 4)\ m^2$

$= 7m^2$

- When adding powers of the same base, express in multiplication and add their values

Example

Simplify: $2^2 + 2^3$

Solution

$2^2 + 2^3 = (2 \times 2) + (2 \times 2 \times 2)$

$= 4 + 8$

$= 12$

- When subtracting the same powers of the same base, subtract only the coefficients and leave the powers

Example

Simplify the following:

(a) $3p^3 - p^3$

Solution

$3p^3 - p^3 = (3 - 1)\ p^3$

$= 2p^3$

(b) $3^2 - 2^3$

Solution

$3^2 - 2^3 = (3 \times 3) - (2 \times 2 \times 2)$

$= 9 - 8$

$= 1$

**ACTIVITY:**

1. a) $2^1 + 2^2$ b) $7x^4 + 2x^4$ c) $2k^2 + k^2 + 3k^2$ d) $4n^2 - n^2$ e) $6^2 - 3^2$

**SUB TOPIC: LAWS OF INDICES IN MULTIPLICATION AND DIVISION**

**Concepts:**

**-** Using the index rule i.e maintaining the base and adding the powers

- Using expanded form in multiplication from given powers

- Differentiating between simplifying and working out (solving)

Examples:

(i) Evaluate: $4^2 \times 4^4$

Method 1: $4^{(2+4)}$ using index rule

$4^2 \times 4^4$

$= 4^{(2+4)}$

$= 4^6$

(ii) $4^2 \times 4^4$

Method 2: Using expanded form

$4^2 \times 4^4$

$= (4 \times 4) \times (4 \times 4 \times 4 \times 4)$

$= 4 \times 4 \times 4 \times 4 \times 4 \times 4$

$= 4^6$

(ii) Simplify: $5^3 \times 5^0 \times 5^7$

Method 1 – Expanded form

$5^3 \times 5^0 \times 5^7$

$= (5 \times 5 \times 5) \times 1 \times (5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5)$

$= 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 1$

$= 5^{10} \times 1$

$= 5^{10}$

Method 2 - Index rule

$5^3 \times 5^0 \times 5^7$

$= 5^{(3+0+7)}$

$= 5^{10}$

(iii) Simplify: $b^a \times b^x$

$b^a \times b^x$

$= b^{(a+x)}$

**ACTIVITY:**

Express the following in powers

1) $2 \times 2 \times 2 \times 2 \times 2$ 2) $7 \times 7 \times 7 \times 7$ 3) $a \times a \times a \times a$ 4) $2^3 \times 2^7$

5) $3^4 \times 3^3$ 6) $c^5 \times c^2$ 7) $10^2 \times 10^{-2}$ 8) $2^3 \times 2^2 \times 2$ 9) $5 \times 5^2 \times 5^3$

10) $7^2 \times 7^3 \times 7^0$ 11) $10^1 \times 10^2 \times 10^0$ 12) $q^3 \times q^4$

**SUB TOPIC: LAWS OF INDICES INVOLVING DIVISION**

**Concepts:**

- Index rule in division, maintain the base and subtract the powers.
- In expanded form, multiply the numerator then divide by denominator.
- Differentiating between simplifying and working out (solving)

1. Work out: $4^3 \div 4^2$

Method 1: Using the index rule.

$4^3 \div 4^2$

$= 4^{3-2}$

$= 4^1$

$= 4$

Method 2 (Expanded form)

$4^3 \div 4^2$

$= \frac{(4 \times 4 \times 4)}{4 \times 4}$

$= 4$

2. Simplify: $5^7 \div 5^3$ (Index rule)

$5^7 \div 5^3$

$= 5^{7-3}$

$= 5^4$

(Expanded form)

$5^7 \div 5^3$

$\frac{5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5}{5 \times 5 \times 5}$

$= 5 \times 5 \times 5 \times 5$

$= 5^4$

**ACTIVITY:**

Simplify the following:

1) $2^4 \div 2^2$ 2) $3^7 \div 3^2$ 3) $5^{12} \div 5^9$ 4) $9^{3x} \div 9^x$ 5) $7^3 \div 7^1$

6) $11^5 \div 11^5$ 7) $a^{10} \div a^7$ 8) $10^3 \div 10^2$ 9) $m^7 \div m^2$ 10) $9^{5y} \div 9^{4y}$

11) $b^6 \div b^6$ 12) $a^9 \div a^7$ 13) $5^3 \div 5^1$ 14) $y^6 \div y^4$ 15) $8^4 \div 8^4$

## SUB TOPIC: APPLICATION OF INDICES IN MULTIPLICATION

Examples:

(i) Solve: $2^x = 3^2$

Factorize 32 using 2.

| | |
|---|---|
| 2 | 32 |
| 2 | 16 |
| 2 | 8 |
| 2 | 4 |
| 2 | 2 |
| | 1 |

$2^x = 2 \times 2 \times 2 \times 2 \times 2$

$2^x = 2^5$

$\therefore X = 5$

(ii) Solve: $3^y \times 3 = 81$

Factorize 81 using 3.

| | |
|---|---|
| 3 | 81 |
| 3 | 27 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

$3^y \times 3^1 = 3 \times 3 \times 3 \times 3$

$3^{y+1} = 3^4$

$y + 1 = 4$

$y + 1 - 1 = 4 - 1$

$y = 3$

(iii) $2^t \times 3^3 = 108$

Factorize 108 using 2 and 3.

| | |
|---|---|
| 2 | 108 |
| 2 | 54 |
| 3 | 27 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

$2^t \times 3^3 = 2 \times 2 \times 3 \times 3 \times 3$

$2^t \times 3^3 = 2^2 \times 3^3$

$2^t \times 3^3 \div 3^3 = 2^2 \times 3^3 \div 3^3$

$2^t = 2^2$

**$t = 2$**

## ACTIVITY:

Solve for the unknown term:

1. a) $3^n = 9$ b) $4^x = 16$ c) $5^{2p} = 625$ d) $2^{3x} = 8$ e) $6^y = 216$
2. a) $2^n \times 2 = 16$ b) $3 \times 3^{2n} = 27$ c) $4^x \times 4^x = 256$ d) $2^r \times 2 = 32$ .

e) $2^{2x} \times 3^3 = 108$ f) $5^n \times 5^n = 625$ g) $2^3 \times 5^y = 200$

## SUB TOPIC:MORE APPLICATION OF INDICES IN DIVISION

- Factorization using the given base(s) then form and solve the equation.

Examples:

Solve:

(i) $2^x \div 2^1 = 8$

Factorize 8 using 2.

| | |
|---|---|
| 2 | 8 |
| 2 | 4 |
| 2 | 2 |
| 2 | 1 |

$2^x \times 2^1 = 2 \times 2 \times 2$

$2^x \times 2^1 = 2^3$

$2^{x-1} = 2^3$

$x - 1 = 3$

$x - 1 + 1 = 3 + 1$

**$x = 4$**

(ii) $4^y \div 4^x = 256$ Factorize 256 using 4.

| | |
|---|---|
| 4 | 256 |
| 4 | 64 |
| 4 | 16 |
| 4 | 4 |
| | 1 |

$4^{3x} \div 4^x = 4 \times 4 \times 4 \times 4$

$4^{3x} \div 4^x = 4^4$

$4^{3x-x} = 4^4$

$3x - x = 4$

$2x = 4$

$\frac{2x}{2} = \frac{4}{2}$

**$\therefore x = 2$**

**ACTIVITY:**

1. a) $3^x \div 3 = 32$ b) $2^{2n} \div 2^n = 16$ c) $2^{2x}\ 2^3 = 64$ d) $2^b \div 2^2 = 8$

2. a) $5^{3n} \div 5^n = 625$ b) $4^{2x} \times 4^x = 64$ c) $3^{2x} \div 3^x = 27$ d) $2^{3y} \div 2^y = 16$

## TOPIC 4 : NUMBER PATTERNS AND SEQUENCES
## SUB TOPIC: SQUARE AND SQUARE ROOTS OF NUMBERS

Examples:

(i) Find the square of 4.

Square of $4 = 4^2$

$= 4 \times 4$

$= 16$

(ii) Find the square of 3 ½.

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

$= \frac{49}{4}$

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

(ii) Find the square root of 4.

| | |
|---|---|
| 2 | 4 |
| 2 | 2 |
| | 1 |

$4 = \sqrt{2 \times 2}$

$= 2$

(iii) Find the square root of $7\ ^1/_9$

$\frac{(7 \times 9) + 1}{9}$

$\frac{63 + 1}{9} = \frac{64}{9}$

| | |
|---|---|
| 2 | 64 |
| 2 | 32 |
| 2 | 16 |
| 2 | 8 |
| 2 | 4 |
| 2 | 2 |
| | 1 |

| | |
|---|---|
| 3 | 9 |
| 3 | 3 |
| | 1 |

$3 \times 3$

$= 3$

$\frac{64}{9} = \frac{8}{3}$

**$= 2\ ^2/_3$**

$= (2 \times 2) \times (2 \times 2) \times (2 \times 2)$

$= 2 \times 2 \times 2$

$= 8$

(iv) Find the square root of 0.36

$0.36 = \frac{36}{100}$

36 =

| | |
|---|---|
| 2 | 36 |
| 2 | 18 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

100=

| | |
|---|---|
| 2 | 100 |
| 2 | 50 |
| 5 | 25 |
| 5 | 5 |
| | 1 |

$= (2 \times 2) \times (3 \times 3)$

$= 2 \times 3$

$= 6$

$= (2 \times 2) \times (5 \times 5)$

$= 2 \times 5$

$= 10$

$\frac{36}{100} = \frac{6}{10}$

**The square root of 0.36 is 0.6**

**ACTIVITY:**

Find the square root of each of the following;

(i) 100 (ii) 196 (iii) 400 (iv) 121 (v) 81 (vi) 256 (vii) 441 (viii) 625

(i) 0.4 (ii) 0.16 (iii) 0.0144 (iv) 0.49 (v) 1.69 (vi) 2.25 (vii) 2.89

(i) $1\frac{7}{9}$ (ii) $20\frac{1}{4}$ (iii) $\frac{16}{36}$ (iv) $\frac{100}{400}$ (v) $\frac{49}{81}$ (vi) $7\frac{1}{9}$

## SUB TOPIC: CUBE ROOTS OF NUMBERS

Example:

Find the cube root of 8.

$\sqrt[3]{8}$

| | |
|---|---|
| 2 | 8 |
| 2 | 4 |
| 2 | 2 |
| | 1 |

$\sqrt[3]{8} = 2 \times 2 \times 2 = 2$

Method 2:

$\sqrt[3]{8} = (2^3)^{1/3}$

$2^{(3 \times 1/3)} = 2^1$

$= 2$

**ACTIVITY:**

Calculate the cube root of each of these.

a) 27 b) 125 c) 64 d) 343 e) 216

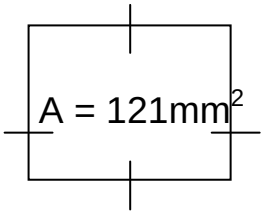
f) 512 g) 729 h) 1000

## SUB TOPIC: APPLICATION OF SQUARE AND CUBIC NUMBERS

Examples:

(i) The area of a square is 121 $mm^2$. Find the length of each of its sides.

Sketch:




Area of a square = $S^2$

$S^2 = 121mm^2$

$\sqrt{S^2} = \sqrt{121mm^2}$

$\sqrt[2]{S\ X\ S} = \sqrt[2]{11\ mm\ x\ 11\ mm}$

S = 11mm

(ii) The volume of a cube is 64$m^3$. Find the length of one side.

Vol of a cube = $S^3 = 64m^3$

$S^3 = 64m^3$

| | |
|---|---|
| 2 | 64 |
| 2 | 32 |
| 2 | 16 |
| 2 | 8 |
| 2 | 4 |
| 2 | 2 |
| | 1 |

$64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$= 2^{6 \times 1/3}$

$= 2^2$

$= 2 \times 2$

$= 4$

Length of one side is 4 m

**ACTIVITY:**

1. The area of a square room is $12\frac{1}{4}$ $m^2$. Find the length of one of its sides.

2. The area of a square flower garden is $5\frac{4}{9}m^2$. Find the length of one side of the garden.

3. The volume of a cube is 125 $cm^3$. Calculate the length of each side.

4. The volume of a cube is 343 $cm^3$. Find the length of one side of the cube.

**SUB TOPIC: APPLICATION OF BODMAS IN MIXED OPERATIONS**

Examples

1. Subtract: $^1/_5$ from $^1/_3$

$^1/_5$ from $^1/_3 = ^1/_3 - ^1/_5$ LCM = 15

$^1/_3 - ^1/_5 = \frac{(5x1) - (3x1)}{15}$

$= \frac{5 - 3}{15}$

$= \frac{2}{15}$

2. Work out $^5/_6 - ^1/_3 + ^1/_2 - ^1/_5$

$^5/_6 - ^1/_3 + ^1/_2 - ^1/_5$

$= ^5/_6 + ^1/_2 - ^1/_3 - ^1/_5$

$= (^5/_6 + ^1/_2) - ^1/_3 - ^1/_5$

$= \frac{(1x5) + (3x1)}{6} - \frac{1}{3} - \frac{1}{5}$

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

$= \frac{8}{6} - \frac{1}{3} - \frac{1}{5}$ LCM = 30

$= \frac{(5x8) - (10 \times 1) - (6x1)}{30}$

$= \frac{40 - 10 - 6}{30}$

$= \frac{24}{30}$

$= \frac{4}{5}$

**ACTIVITY**

Work out the following fractions:

a) $^3/_5 + ^3/_5$ b) $3 + ^1/_9$ c) $^1/_4 - ^1/_2$ d) $2 - ^1/_3$

e) $^1/_3 - ^1/_2 + ^3/_4$ f) $^1/_3 + ^1/_5 - ^1/_4$ g) $2\ ^2/_3 - 4\ ^1/_4 + 5\ ^1/_6$

**SUB TOPIC: MULTIPLICATION OF FRACTIONS**

Examples

1) What is $\frac{3}{4}$ of 24?

$\frac{3}{4}$ of 24 $= \frac{3}{4} \times 24$

$= 3 \times 6$

$= 18$

2) Find 1 ½ of 126

1 ½ of 126 = 1 ½ x 126

$= \frac{3}{2} \times 126$

$= 3 \times 63$

$= 189$

3) Multiply: $1\ ^1/_4 \times 1\ ^3/_5 \times ^1/_6$

$1\ ^1/_4 \times 1\ ^3/_5 \times ^1/_6 = ^5/_4 \times ^8/_5 \times ^1/_6$

$= \frac{5 \times 8 \times 1}{4 \times 5 \times 6}$

$= \frac{1x1x1}{1x1x3}$

$= {}^{1}/_{3}$

**ACTIVITY:**

Simplify the following fractions:

1). ${}^{1}/_{2}$ x 12  2) 22 x ${}^{7}/_{11}$  3) $({}^{3}/_{4})^{2}$ x ${}^{8}/_{9}$  4) ${}^{3}/_{5}$ of (1 ${}^{1}/_{5}$ x 1 ${}^{1}/_{4}$)

5) ${}^{3}/_{4}$ of ${}^{2}/_{5}$  6) ${}^{3}/_{7}$ x ${}^{3}/_{4}$x ${}^{1}/_{6}$  7) $1{}^{1}/_{3}$x$5{}^{1}/_{4}$  8) $1{}^{1}/_{4}$x$1{}^{1}/_{5}$x${}^{2}/_{5}$x$1{}^{2}/_{3}$

**SUB TOPIC: DIVISION OF FRACTIONS**

Multiply the first fraction by the reciprocals of the other fraction.

Examples:

1. ${}^{2}/_{5} \div 2$

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

   $= \frac{1}{5}$

2. ${}^{3}/_{4} \div ½$

   $= \frac{3}{4} \times \frac{1}{2}$  LCM = 4

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

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

   $= 1 ½$

**ACTIVITY:**

Work out the following:

a) ${}^{1}/_{3} \div {}^{1}/_{5}$  b) ${}^{1}/_{3} \div 2\ {}^{1}/_{12}$  c) $1 \div {}^{5}/_{7}$  d) ${}^{35}/_{60} \div {}^{7}/_{12}$

e) $3\ {}^{1}/_{3} \div 13{}^{1}/_{3}$  f) ${}^{2}/_{3} \div {}^{6}/_{7} \div {}^{3}/_{4}$  g) $6{}^{3}/_{4} \div 4{}^{1}/_{9}$

h) A boy was told to cut pieces of cloth of length ${}^{3}/_{4}$m from a big roll of ${}^{13}/_{12}$m. How many pieces did he cut?

i) A boy can carry a tin of ${}^{2}/_{3}$ litres from a well. How many rounds will be made to fill a container of $12{}^{1}/_{4}$ litres?

**SUB TOPIC: USE OF BODMAS IN COMBINED OPERATIONS**

BODMAS - Brackets Of Division Multiplication Addition Subtraction

Examples:

1. ${}^{2}/_{3}$ of ${}^{3}/_{4}$ - ${}^{1}/_{3}$

   ${}^{2}/_{3}$ x ${}^{3}/_{4}$ - ${}^{1}/_{3}$

   ${}^{1}/_{2}$ - ${}^{1}/_{3}$

   $= \frac{3 - 2}{6}$

   $= {}^{1}/_{6}$

2. ${}^{5}/_{6}$ - ${}^{3}/_{4} \div 1{}^{1}/_{2}$

   ${}^{5}/_{6}$ - ${}^{3}/_{4} \div {}^{3}/_{2}$

   ${}^{5}/_{6}$ - ${}^{3}/_{4}$ x ${}^{2}/_{3}$

   ${}^{5}/_{6}$ - ${}^{1}/_{2}$ $= \frac{5 - 3}{6}$

   $= {}^{2}/_{6}$ or ${}^{1}/_{3}$

2. Work out: $^3/_4$ of ($^2/_3 + {}^1/_6$) ÷ $1\,{}^1/_4$

$^3/_4$ of ($^2/_3 + {}^1/_6$) ÷ $1\,{}^1/_4$ =

$^3/_4$ x ($^2/_3 + {}^1/_6$) ÷ $^5/_4$

$= {}^3/_4 \times \frac{(4+1)}{6} \div {}^5/_4$

$= {}^3/_4 \times {}^5/_6 \times {}^4/_5$

$= \frac{1}{2}$

**ACTIVITY:**

Simplify the following**:**

**1)** $^{\mathbf{2}}/_{\mathbf{3}}$ of ($^3/_4 - {}^1/_3$) 2) $^7/_{12} - {}^1/_2$ of $^1/_3$ 3) ($^5/_6 - {}^1/_4$) ÷ $1^1/_2$

4) $^1/_3$ x $^1/_8 + {}^1/_4 \div {}^1/_7$ 5) $^1/_2$ x $^3/_5 + {}^1/_4$ of $^1/_2$

6) $1^1/_4 \div 3\,{}^1/_2$ of ($1^1/_2 - {}^3/_4$) 7) $({}^3/_4)^2$ x $^8/_9 + {}^1/_4$

8) ($^1/_2$ of 297) + ($^1/_2 \div {}^1/_4$) 9) $^2/_5 \div {}^4/_7 + {}^5/_8$

10) $^2/_3$x ($^1/_2 - {}^1/_8$) ÷ $^1/_4$ 11) $^3/_4$ of $^2/_3 - {}^1/_4 + {}^1/_2$

12) $^1/_3 + {}^5/_6 \div {}^7/_{12}$ x $^7/_8$

**SUB TOPIC: APPLICATION OF FRACTIONS**

Examples:

1. A boy had a jerry can full of water. He used 13/20. What fraction remained?

$1 - \frac{13}{20} = \frac{20}{20} - \frac{13}{20}$

$= \frac{20 - 13}{20}$

$= \frac{7}{20}$

2. A, B and C contributed to start a Company. A paid $^3/_{10}$ of the cost and B contributed $^5/_{10}$ of the cost.

(a) What fraction did C contribute?

Fractions for A and B = $\frac{3}{10} + \frac{5}{10}$

$= \frac{3+5}{10}$

$= \frac{8}{10}$

Fraction for C = $1 - \frac{8}{10}$

$= \frac{10}{10} - \frac{8}{10}$

$= \frac{2}{10}$ or $\frac{1}{5}$

(b) If C contributed sh. 30,000 what was their total contribution?

| Method 1 | Method 2 | Method 3 |
|---|---|---|
| 1 part = sh.30,000 | Let p be the total amount | sh.30,000 ÷ $\frac{1}{5}$ |
| 5 parts = sh.30,000 x 5 | $\frac{1}{5}$ of p = sh.30,000 | sh.30,000 x $\frac{5}{1}$ |
| = sh.150,000 | $\frac{1}{5}$ x p = sh.30,000 | = sh.150,000 |
| | 5 x $\frac{1}{5}$p = sh.30,000 x 5 | |
| | p = sh.150,000 | |

The total contribution was sh.150,000

**ACTIVITY:**

1. After using $^{5}/_{12}$ of the cooking oil, mother some oil left. What fraction was left?
2. A man had 144 heads of cattle, but $^{4}/_{9}$ of them are cows.

a) What fraction is for bulls? b) How many cows are there?

c) How many bulls are there?

3. If $^{7}/_{20}$ and $^{9}/_{20}$ are men and women in the district respectively.

a) What fraction is of the children?
b) If there are 6000 children in the district, how many people are there?
c) How much money will the district spend if it supplies a blanket of sh. 3500 to each member of the district?

**SUB TOPIC: APPLICATION OF FRACTIONS**

**Concepts:**

- First find the remaining fraction equivalence.
- Solve the problem as required

Examples

(1) After covering 2/3 of a journey, a motorist still had 40km to cover. How long was the whole journey?

| Fraction covered | Fraction left | Let whole journey |
|---|---|---|
| $\frac{2}{3}$ | $1 - \frac{2}{3}$ | $\frac{1}{3}$ of y = 40km |
| | $\frac{3}{3} - \frac{2}{3}$ | $\frac{1}{3}$ x y = 40km |
| | $\frac{1}{3}$ | 3 x $\frac{y}{3}$ = 40km x 3 |
| | | **y = 120km** |

2. In a group, $\frac{1}{6}$ of the pupils are girls. If there are 8 more boys than girls in the group

(a)Find the total number of pupils in the group.

Solution

Fraction of boys = $1 - \frac{1}{6}$

$= \frac{6}{6} - \frac{1}{6}$

$= \frac{5}{6}$

Fraction for more boys = $\frac{5}{6} - \frac{1}{6}$

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

$= \frac{4}{6}$

Let the total number be x.

$\frac{4}{6}$ of x = 8

$6 \times \frac{4x}{6} = 8 \times 6$

$\frac{4x}{4} = \frac{8 \times 6}{4}$

$x = 2 \times 6$

$x = 12$

There are 12 pupils in the group.

Or 4 parts = 8 pupils

1 part = $\frac{8}{4}$

6 parts = $\frac{8 \times 6}{4}$

$= \frac{48}{4}$

= 12 pupils

(b)How many girls are in the group?

Solution

$\frac{1}{6} \times 12$

2girls

**ACTIVITY:**:

1 Rehema was left with 36 km after covering $^1/_3$ of her journey.

a) What distance was covered? b) How long was the journey?

2. After using $^2/_3$ of her books, Betty had 3 books left.

a) How many books did she have altogether at the beginning?

b) If each book cost sh.3000, find the cost of a dozen of such books.

3. An athlete had 60 metres to finish the race when he got heart attack. If the athlete got it after covering $^2/_5$of the race distance, find how far the race distance was?

4. In a class, $^3/_5$ of the pupils are girls, If there are 60 boys in the class, find the total number of pupils in the class.

5. A village has 1 of its members as males. If 30 members are females, how many people are there in the village?

6. After covering $^3/_4$of his journey, a motorist had 25 km left. How long was the journey?

7. A bus travelling from Kampala to Tororo broke down after covering $^4/_5$ of the journey. If the remaining journey was 88 km, how long was the whole journey?
8. After spending $^2/_5$ of my money, I was left with sh.180,000. How much money did I have at first?

**SUB TOPIC: APPLICATION OF FRACTIONS INVOLVING TAPS**

- Expressing minutes or hours as a fraction and then dividing.
- Divide the product by the sum if two taps are both pouring in the water or by the difference if one pours in and the other draws (pours out) water from the tank.

Examples:

1. Tap A can fill a tank in 6 minutes and tap B can fill the same tank in 3 minutes. How long will both taps take to fill the tank if they are opened at the same time?

   Solution

   In one minute

   Tap A fills $^1/_6$ of the tank and tap B fills $^1/_3$ of the tank

   Both taps fill ($^1/_6 + ^1/_3$) of the tank

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

   $= \frac{3}{6}$

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

   Total time taken to fill tank

   = (1 ÷½) minutes

   = (1 x $\frac{2}{1}$) minutes

   **= 2minutes**

2. Tap A takes 3 minutes to fill a tank and tap B takes 4 minutes to draw water from the tank. How many minutes will it take to fill the tank if both taps are left running?

   In one minute

   Total time taken to fill the tank

   Tap A fills $\frac{1}{3}$ of the tank

   Tap B empties $\frac{1}{4}$ of the tank

   Both taps fill ($\frac{1}{3} - \frac{3}{4}$) of the tank

   $\frac{4 - 3}{12}$

   $\frac{1}{12}$

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

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

   **12 minutes**

3. Tap A and B are connected to a tank. Tap A can fill the tank in 3 minutes.

Tap B draws water from the tank. When both taps are running, it takes 12 minutes for the tank to be filled. How long does tap B take to draw water from the tank?

In 1 minute, tap A fills $\frac{1}{3}$ of the tank.

Total time taken to draw the water from the tank = $1 \div \frac{1}{4}$

In I minute both taps fill $\frac{1}{12}$ of the tank

In 1 minute tap B empties $\frac{1}{3} - \frac{1}{12}$ of the tank

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

$\frac{3}{12}$

$\frac{1}{4}$

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

$= \frac{4}{1}$

**= 4 minutes**

**ACTIVITY:**

1. A milk man fills a milk can in 10 minutes and his friend fills it in 5 minutes. How long will it take the two men to fill the same can if they both start at the same time?
2. Tap A takes 9 minutes to fill a tank. Tap B takes 12 minutes to fill a tank and tap C takes 18 minutes to fill a tank. How long will taps A, B and C take to fill the tank if they are all opened together at the same time?
3. One tap fills a tank in 8 minutes and another takes 4 minutes to fill the same tank. How long will both taps take to fill the same tank?
4. Tap A takes 6 minutes to fill the tank and tap B takes 8 minutes to draw water from the tank. How long will it take to fill the tank if both taps are left open at the same time?
5. A pump filled a barrel in 8 minutes and another emptied it in 10 minutes. How long would it take to fill the barrel if the two taps were opened at the same time?
6. A tank has two taps. One tap fills $^1/_3$ of the tank in one minute and another tap fills $^1/_{15}$ of the tank in one minute. How long will both taps take to fill the same tank?

7. Tap K takes 12 minutes to fill the tank. Tap L takes X minutes to fill the tank. Both taps take 4 minutes to fill the tank when left open at the same time. Find x.

**SUB TOPIC: MORE APPLICATION OF FRACTIONS**

**-**Finding the fraction of the remainder and subtracting the fraction of remainder from the first remainder.

**Examples**

1. John spent $\frac{1}{3}$ of his money on books and $\frac{1}{6}$ of the remainder on transport.

(a) What fraction of his money was left?

| Books | remainder | transport | fraction left |
|---|---|---|---|
| $\frac{1}{3}$ | $1 - \frac{1}{3}$ | $\frac{1}{6}$ of $\frac{2}{3}$ | $\frac{2}{3} - \frac{1}{9}$ |
| | $\frac{2}{3}$ | $\frac{1}{6} \times \frac{1}{3}$ | $\frac{6-1}{9}$ |
| | | $\frac{1}{9}$ | $\frac{5}{9}$ |

(b) If he was left with sh. 15,000, how much did he have at first?

Let the total be k

$\frac{5}{9} \times k = sh.15,000$

$9 \times \frac{5k}{9} = sh.1,5000 \times 9$

$\frac{5k}{5} = sh.\frac{15,000 \times 9}{5}$

$k = sh,3,000 \times 9$

$x = sh.27,0000$

or

5 parts represent sh.15,000

1 part represents $\frac{sh15,000}{5}$

9 parts represent sh.3,000 x 9

$= sh.27,000$

2. Rogers spent $^1/_3$ of his salary on food, $^1/_2$ of the remainder on rent and saved the rest.

a) What fraction did he remain with to save?

| Fraction spent on food | Remaining fraction | Fraction for rent | Fraction saved |
|---|---|---|---|
| $= \frac{1}{4}$ | $1 - \frac{1}{4}$ | $\frac{1}{2}$ of $\frac{3}{4}$ | $\frac{3}{4} - \frac{3}{8}$ |
| | $= \frac{4}{4} - \frac{1}{4}$ | $\frac{1}{2} \times \frac{3}{4}$ | $(8 \times \frac{3}{4}) - (8 \times \frac{3}{8})$ |
| | $= \frac{4-1}{4}$ | $\frac{3}{8}$ | $\frac{(2 \times 3) - (1 \times 3)}{8}$ |
| | $= \frac{3}{4}$ | | $= \frac{6-3}{8}$ |
| | | | $= \frac{3}{8}$ |

b) If he had sh. 240,000 left, how much did he have at first?

Method 1

3 parts rep. sh.240,000

1 part rep. $\frac{sh.240,000}{3}$

$= \frac{sh.80,000}{}$

8 parts rep. sh.80,000 x 8

$= sh.640,000$

Method 2

or Let the amount be k

$\frac{3}{8}$ of k = sh.240,000

$\frac{3}{8} \times k = sh.240,000$

$8 \times \frac{3}{8} k = sh.240,000 \times 8$

$3k = sh.240,000 \times 8$

$\frac{3k}{3} = \frac{sh.240,000 \times 8}{3}$

Method 3

Amount he had

sh. 240,000 ÷ $\frac{3}{8}$

$= sh.240.000 \times \frac{8}{3}$

$= sh.80,000 \times 8$

$= \frac{sh.\ 640,000}{}$

k = sh.640,000

**ACTIVITY**:

1. $^1/_3$ of a wire is painted black $^2/_5$ of the remainder is painted green and the rest is painted red. If 20metres are painted red;
a) What fraction of the wire was painted red? b) How long was the wire?
2. A man spent $^2/_6$ of his salary on food, $^1/_6$of the remainder on rent and saved sh.60,000.
a) Find the fraction of his income he saves b) Work out the man's salary.
3, A worker spends $^1/_4$of his salary on food and $^1/_3$ of the remainder on transport and saves sh.50,000. How much did he have at first?
4. A woman spent $^1/_5$ of her money on treatment, half of the remainder on transport and saves sh.50,000. How much did he have at first?
5. Teddy did $^1/_3$of her home work on Friday, $^1/_4$of the remainder on Saturday. If she completed 24 numbers on Sunday, how many numbers were given as homework during that week?
6. Mr. Bageya sells $^1/_2$of his daily milk collection from his farm. He gives out $^2/_5$ of the remaining amount of milk to his parents and remains with 9 litres for his family.How many litres of milk does he collect daily?

**SUB TOPIC: CHANGING FRACTIONS TO DECIMALS**

**Concepts:**

- Divide the numerator by the denominator and put a decimal point immediately the remainder is less than the divisor.
- Keep putting 0 to the remainder to make it bigger than the divisor.
- Write the repeating number (s) at least three times.
- Write your answer with three dots (…) or a bar or dot on top of the recurring numbers.

Examples:

1. Change these fractions to decimals:

a) $\frac{5}{8}$ = 8 √ 5000 = 0.625

- 48
20
-16
40
- 40
..

$\frac{5}{8}$ = 0.625

b) $\frac{1}{3}$ = 3 √ 10000 = 0.3333

- 9
10
- 9
10
- 9
10
- 9
1

$\frac{1}{3}$ = 0.333…

**ACTIVITY:**

Change the following fractions to decimals**.**

1) $\frac{2}{5}$ 2) $\frac{3}{5}$ 3) $\frac{3}{4}$ 4) $\frac{7}{8}$ 5) $\frac{1}{4}$ 6) $\frac{2}{3}$ 7) $\frac{4}{7}$

1) $\frac{2}{9}$ 2) $\frac{4}{9}$ 3) $\frac{4}{11}$ 4) $\frac{5}{11}$ 5) $\frac{3}{11}$ 6) $\frac{3}{7}$

**SUB TOPIC: CHANGE THESE DECIMALS INTO FRACTIONS:**

- Express the decimal number as a common fraction.
- Reduce the fraction to its lowest terms Examples:

Examples

Change the following decimal numbers into common simplified fractions

a) 0.25

$0.25 = \frac{25}{100}$

$= \frac{25}{100} \div \frac{25}{55}$

$= \frac{5}{20} \div 5$

$= \frac{1}{4}$

b) 0.125

$0.125 = \frac{125}{1000}$

$= \frac{125}{1000} \div \frac{25}{25}$

$= \frac{5}{40} \div 5$

$= \frac{1}{8}$

**ACTIVITY:**

Change the following decimal numbers into common simplified fractions

1) 0. 4 2) 2.5 3) 0.75 4) 3.5 5) 0.005 6) 0.015 7) 1.25

**SUB TOPIC: CHANGING RECURRING DECIMALS TO FRATIONS**

Examples:

1. Change 0.333... into a common simplified fraction.

Let the common fraction be y.

y = 0.333... equation (i)

10 x y = 10 x 0.333...

10y = 3.333... equation (ii)

10y = 3.333... subtract equation(i) from equation(ii)

$-\ \ y = \underline{0.333...}$

9y 3.000 divide by co-efficient which is 9

$\frac{9y}{9} = \frac{3}{9}$ reduce by 3

$y = \frac{1}{3}$ The common simplified fraction is $\frac{1}{3}$

2. Express 0.4545...as a rational number.

Let the fraction be k.

K = 0.4545...as equation (i)

100 x k = 100 x 0.4545...

100k = 45.4545... as equation (ii)

100k = 45.4545...subtract eq.i from eq. ii

$-k = \underline{-0.4545...}$

99k 45.0000

$\frac{99k}{99} = \frac{45}{99}$ divide by co-efficient which is 99.

reduce by 9

$K = \frac{5}{11}$

3. Change 0.1666... as a vulgar fraction.

Let the vulgar fraction be p.

$p = 0.1666...$ as equation (i)

$10 \times p = 10 \times 0.1666...$

$10p = 1.666...$ as equation (ii)

$100 \times p = 100 \times 0.1666...$

$100p = 16.666...$ as equation (iii)

$100p = 16.666...$ subtract eq. ii from eq. iii

$-\ 10p \quad -\ 1.666...$

$90p = 15.000$

$\frac{90p}{90} = \frac{15}{90}$ reduce by 15

$P = \frac{1}{6}$.

**ACTIVITY:**

Change the following decimals as common simplified fractions.

1) 0.222... 2) 0.444… 3) 0.666… 4) 0.555… 5) 0.1818…

6) 0.2727… 7) 0.3636… 8) 0.1222.. 9) 2.999... 10) 0.126126...

**SUB TOPIC: APPLICATION OF PLACE VALUES AND VALUES**

Examples:

1. Find the sum of the values of 6 and 8 in the figure 14.608.

| T | O | | Tth | Hth | THth |
|---|---|---|---|---|---|
| 1 | 4 | . | 6 | 0 | 8 |

$6 \times \frac{1}{10} = \frac{6}{10} = 0.6$

$8 \times \frac{1}{100} = \frac{8}{100} = 0.08$

sum of values of 6 and 8

$0.6 + 0.08 = 0.68$

2. Find the difference between the value of 4 and the place value of 0 in the number 145.08.

| H | T | O | | Tth | Hth |
|---|---|---|---|---|---|
| 1 | 4 | 5 | . | 0 | 8 |

Value of 4 = 4 x 10 = 40

Place value of 0 is $\frac{1}{10}$ or 0.1

Difference = 4 – 0.1

$4.0 - 0.1 = 3.9$

**ACTIVITY:**

1. Find the sum of the value of 6 and the value of 9 in the number16.942
2. Find the sum of the values of 1 and 3 in 436.218.

3. Work out the product of the value of 6 and the value of 9 in the number 176.89.
4. Find the difference between the place value of 3 and place value of 5 in 0.354.
5. Find the sum of the value of 3 and the value of 9 in 34.609.
6. Work out the quotient of the value of 5 and the place value of 2 in the decimal number 158.219.

## SUB TOPIC: WRITING DECIMALS IN EXPANDED FORM

Examples

1. Expand in the following decimal numbers in value form;

a). 79.62 b). 0.6259

Solution

a) 79.62 = (7x10) + (9x1) + (6x1/10) + (2x1/100)
= 70 + 9 + 6/10 + 2/100
= 70 + 9 + 0.6 + 0. 02

b) 0.6259 = $(6 \times {}^{1}/_{10}) + (2 \times {}^{1}/_{10}) + (5 \times {}^{1}/_{10}) + (9 \times {}^{1}/_{10,000})$

$= {}^{6}/_{10} + {}^{2}/_{100} + {}^{5}/_{1000} + {}^{6}/_{10,000}$

= 0.6 + 0.02 + 0.005 + 0.0006

2. Express 0, 6259 using powers of ten (exponents)

0.6259 = $(0x1) + (6 \times {}^{1}/_{10}) + (2 \times {}^{1}/_{100}) + (5 \times {}^{1}/_{1000}) + (9 \times {}^{1}/_{10,000})$

$= (0x1) + (6 \times {}^{1}/_{10}) + (2 \times {}^{1}/_{10}) + (5 \times {}^{1}/_{10}) + (9 \times {}^{1}/_{10})$

$= (6 \times 10^{-1}) + (2 \times 10^{-2}) + (5 \times 10^{-3}) + (9 \times 10^{-4})$

**ACTIVITY:**

1. Expand the following using values.

a) 3.4 b) 2.39 c) 125.4 d) 23.456 e) 3456.78 e) 0.00375

2. Expand using powers of ten:

a) 3.2 b) 13.4 c) 235.814 d) 1356.7893 e) 0.12345

## SUB TOPIC: EXPANDING DECIMALS USING VALUES AND EXPONENTS

- Expanding using values and exponents or powers of ten.

Examples

Expand 486.5729 using:

(a) Values:

(4 x 100) + (8 x 10) + (6 x 1) + (5/1 x 1/10) + (7/1 x 1/100) + (2/1 x 1/1000) + (9/1 x 1/1000)

400 + 80 + 6 + ${}^{5}/_{10} + {}^{7}/_{100} + {}^{2}/_{1000} + {}^{9}/_{10,000}$

486.5129 = 400 + 80 + 6 + 0.5 + 007 + 0.002 + 0.0009

(b)

| $10^2$ | $10^1$ | $10^0$ | $10^{-1}$ | $10^{-2}$ | $10^{-3}$ | $10^{-4}$ |
|---|---|---|---|---|---|---|
| 4 | 8 | 6 . | 5 | 7 | 2 | 9 |

$(4x10^2) + (8x10^1) + (6x10^0) + (5x10^{-1}) + (1x10^{-2}) + (2x10^{-3}) + (9x10^{-4})$

**ACTIVITY:**

1. Expand the following using values.

a) 3.4 b) 2.39 c) 125.4 d) 23.456 e) 3456.78 f) 0.00375

2. Expand using powers of ten:

a) 3.2 b) 13.4 c) 235.814 d) 1356.7893 e) 0.12345

## SUB TOPIC: WRITING DECIMALS IN SHORT FORM

- Arranging numbers according to place values vertically then add.

(i) 600 + 70 + 8 + 0.2 + 0.003

Solution:
600.000
70.000
8.000
0.200
+ 0.003
678.203

(ii) $(5 \times 10^3) + (7 \times 10^2) + (3 \times 10^1) + (4 \times 10^0) + (9 \times {}^1/_{10}{}^1) + (6 \times {}^1/_{10}{}^2)$ (5 x 1000) + (7 x 100) (3 x 10) + (4 x 1) + (9 x 0.1) + (6 x 0.01)

(5000 + 700 + 30 + 4 + 0.9 + 0.06)

= 5734.96

## ACTIVITY:

Express the following expanded numbers as single numbers/short forms

1. a) 30 + 4 + 0.06 + 0.6 + 0.0006? b) 1 + 40 + 0.4 + 0.004

2. a) $(2x10^0) + (3x10^2) + (5x10^1)$ b) $(3x10^{-1}) + (5x10^{-2}) + (7x10^{-3})$

c) $(3x10^4) + (4x10^3) + (5x10^2) + (6x10^1) + (7x10^0)$

d) $(7x10^0) + (3x10^{-1}) + (2x10^{-3})$

## SUB TOPIC: WRITING DECIMALS IN SCIENTIFIC NOTATION

- Movement of a decimal point to the left, positive power of 10.
- Movement of a decimal point to the right, negative power of 10.

Examples

Express the following decimals in standard notation/Scientific form.

(i) 365.72 (ii) 2.76 (iii) 0.67 (iv) 0 . 00098

(i) 365.72

365.72 = 365.72 ÷ 10 (first division by10)

= 36.572 ÷ 10 (second division by 10)

$365.72 = 3.6572 \times 10^2$

(ii) 2.76

$2.76 = 2.76 \times 10^0$ (No multiplication by 10)

(iii) 0.67

0.67 = 0.67 x 10 ($1^{st}$ multiplication by 10)

$0.67 = 6.7 \times 10^{-1}$

(iv) 0 . 00098

0.00098 = 0.00098 x 10 ($1^{st}$ multiplication by 10)

= 0.0098 x 10 ($2^{nd}$ multiplication by 10)

= 0.098 x 10 ($3^{rd}$ multiplication by 10)

= 0.98 x 10 ($4^{th}$ multiplication by 10)

$0 . 00098 = 9.8 \times 10^{-4}$

**ACTIVITY:**

Write the following numbers in standard form:

| | | | |
|---|---|---|---|
| 1) 3.2 | 2) 12.3 | 3) 0.78 | 4) 345.67 |
| 5 27.45 | 6) 0.00796 | 7) 1234.567 | 8) 468.1 |

**SUB TOPIC: MULTIPLICATION AND DIVISION OF DECIMALS**

**Example 1**

Simplify:

1) $\frac{24 \times 0.3}{0.8}$

$= \left(\frac{24}{100} \times \frac{3}{10}\right) \div \left(\frac{8}{10}\right)$

$= \frac{24}{100} \times \frac{3}{10} \times \frac{10}{8}$

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

$= \frac{9}{100}$

$= 0.09$

**Example 2**

2) $\frac{0.42 \times 6}{0.7 \times 0.3}$

$(0.42 \times 6) \div (0.7 \times 0.3)$

$\left(\frac{42}{100} \times \frac{6}{1}\right) \div \left(\frac{7}{10} \times \frac{3}{10}\right)$

$\frac{42}{100} \times \frac{6}{1} \times \frac{10}{7} \times \frac{10}{3}$

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

$= 12$

**Example 3**

Simplify: $\frac{3.2 - 0.08}{0.2 \times 0.3}$

$3.20 - 0.08 = \mathbf{2.12}$

$\frac{2}{10} \times \frac{3}{10} = \frac{6}{100} = \boldsymbol{0.06}$

$\frac{312}{100} \div \frac{6}{100}$

$\frac{312}{100} \times \frac{100}{6} = \boldsymbol{52}$

**Example4**

1. Work out: $-\frac{0.28 \times 0.81}{0.27 - 0.06}$

Solution

$\left(\frac{28}{100} \times \frac{81}{100}\right) \div \left(\frac{27}{100} - \frac{6}{100}\right)$

$\frac{28}{100} \times \frac{81}{100} \div \frac{21}{100}$

$\frac{28}{100} \times \frac{81}{100} \times \frac{100}{21}$

$\frac{4}{100} \times 27$

$\frac{108}{100}$

**= 1.08**

**Example 5**

2. Simplify: $\frac{13 + 1.4}{0.05 - 0.003}$

$\frac{13.0 \div 0.050}{+ 1.4 \quad - 0.003}$

$\frac{14.4}{144} \div \frac{0.047}{1000}$

$\frac{144}{10} \times \frac{1,000}{47}$

$\frac{14400}{47}$

**3.6.38 (2 decimal places)**

**ACTIVITY:**

Simplify the following decimals.

1) $\frac{0.36 \times 4.9}{0.07 \times 1.2}$ 2) $\frac{2.1 \times 0.36}{0.04 \times 0.7}$ 3.) $\frac{0.64 \times 0.16}{0.32}$

4) $\frac{3.6 \times 3.5}{0.15 \times 2.4}$ 5) $\frac{0.12 \times 0.8}{0.04}$ 6) $\frac{2.4 \times 18}{0.3 \times 3.6}$

7) $\frac{0.4 \times 0.6}{0.3 \times 0.2}$ 8) $\frac{0.72 \times 0.84}{1.2 \times 3.6}$ 9) $\frac{4.2 \times 0.024}{0.06 \times 0.07}$

10) $\frac{0.02 + 0.22}{0.65 - 0.53}$ 11) $\frac{0.24 \times 3.6}{0.18 - 0.06}$ 12) $\frac{0.12 \div 0.8}{0.6 \div 0.4}$

13) $\frac{13 + 1.4}{0.05 - 0.003}$ 14) $\frac{0.26 + 0.1}{0.09}$ 15) $\frac{1.12 - 0.06}{0.06}$

16) $\frac{14.4 + 3.6}{9.33 - 0.33}$ 17) $\frac{0.08 + 0.12}{0.04}$ 18) $\frac{0.45 - 0.15}{0.003}$

**SUB TOPIC: INCREASING AND DECREASING IN RATIOS**

- To increase a quantity means to make the quantity greater than it is.
- To decrease a quantity means to make the quantity less than it is.
- First express the ratio as a fraction then multiply by the quantity.

**Examples:**

1. Increase 80 kg in the ratio of 5 : 4

**Method 1**

New : Old

5 : 4

4 parts = 80 kg

1 part = $\frac{80kg}{4}$

= 20kg

5 parts = 5 x 20kg

= 100kg.

**Method 2**

New : Old

5 : 4

$\frac{\text{New}}{\text{Old}} \times \text{quantity}$

$\frac{5}{4} \times 80kg$

$= 5 \times 20kg$

$= 100kg$

2. Decrease sh.2, 000 in the ratio of 3 : 5.

Method 1

New : Old

3 : 5

Sh.2,000

5 parts = sh.2,000

1 part = $\frac{sh.2,000}{5}$

$= sh.400$

3 parts = 3 x sh.400

Method 2

New : Old

3 : 5

$\frac{\text{New}}{\text{Old}} \times \text{quantity}$

$\frac{3}{5} \times sh.2,000$

$3 \times sh.400$

$= sh.1,200$

= sh.1,200

3. The number of pupils in a school increased in the ratio of 4 : 3.What is the new number if the old number was 600?

New : Old
4 : 3
600
3 parts = 600
1 part = 600/3
= 200
4 parts = 4 x 200
= 800 pupils

New x quantity / Old
4 x 600 / 3
= 4 x 200
= 800 pupils

4. Philemon's salary was sh.600,000 last year. This year, his salary has been reduced in the ratio of 9:10. What is Philemon's salary for this year?

Method 1
New : Old
9 : 10
Sh.600,000
10 parts = sh.600,000/10
= sh. 60,000
9 parts = 9 x sh.60,000
= sh.540,000

Method 2
New : Old
9 : 10
New x quantity / Old
9 x sh.600,000 / 10
9 x sh.60,000
= sh.540,000

**ACTIVITY:**

1. Increase 1,500 in the ratio of 6 : 5.
2. Increase sh.1,800 in a ratio of 5 : 3.
3. Increase 2,400 in the ratio of 3 : 2.
4. The price of a radio was increased in the ratio of 9 : 7. What is the new price of the radio if the old price was sh.20,000?
5. The length of a wire is 12cm. If it was increased in the ratio of 4 : 3, what is the new length of the wire?
6. Decrease 2,000 in the ratio of 3 : 5.
7. A man's salary was decreased in the ratio of 1 : 2. What is his new salary if his old salary was sh.300,000?
8. The price of a car was increased in the ratio of 5 : 4. If the old salary was sh.2.400,000, what is the new price of the radio?

**SUB TOPIC: FINDING RATIO OF INCREASE OR DECREASE**

- To find the ratio of increase, divide the big by the small quantities given.
- To get the ratio of decrease, divide the small by the big quantities given.

Examples

1. The number of pupils in a school increased from 600 to 800. In what ratio did it increase?

Increase is from 600 to 800

Method 1
New : Old
800 : 600

Method 2
Ratio of increase = New number / Old number

$\frac{800}{100} : \frac{600}{100}$

$\frac{8}{2} : \frac{6}{2}$

**4 : 3**

$= \frac{800}{600}$

$= \frac{8 \div 2}{6 \div 2}$

$= \frac{4}{3}$

**= 4 : 3**

**The number increased in the ratio of 4 : 3**

2. A man's salary was decreased from sh.15,000 to sh.12,000. In what ratio was it decreased?

Decrease is from sh.15,000 to sh.12,000

Method 1

New : Old

Sh.12,000 : sh.15,000

$\frac{Sh.12,000}{Sh.1,000} : \frac{sh.15,000}{sh.1,000}$

$\frac{12}{3} : \frac{15}{3}$

4 : 5

Method 2

Ratio of decrease = $\frac{\text{New salary}}{\text{Old salary}}$

$= \frac{sh.12,000}{sh.15,000}$

$= \frac{12 \div 3}{15 \div 3}$

$= \frac{4}{5}$

= **4 : 5**

**The salary decreased in the ratio of 4 : 5**

**ACTIVITY:**

1. Asekenye's earning now is sh.300, 000. She was earning sh.250, 000. In what ratio did her salary increase?
2. Sh.108, 000 was increased to sh.360, 000. Find the ratio of increase.
3. In what ratio has the number of pupils increased from 24 to 36 pupils?
4. Mukasa had 20 oranges. If 4 of them were eaten, in what ratio were the oranges decreased?
5. In what ratio must 24 be decreased to 20?
6. In what ratio must 30 be decreased to become 24?
7 The number of Covid-19 patients in the Quarantine Centres in Uganda increased from 850 to 900. In what ratio did the number of Covid-19 patients increase?

**SUB TOPIC: SHARING IN RATIOS GIVEN TOTAL SHARE**

- Add the ratios to get the total parts shared.
- Express each share as a fraction of the total ratio.
- Multiply each fraction by the total quantity to get the share of each.
- Remember to supply the units used if only given.

Example 1

Share 18 mangoes in the ratio of 4 : 5.

| Solution | 1st share | 2nd share |
|---|---|---|
| Total ratio | $(\frac{4}{9} \times 18^2)$ mangoes | $(\frac{5}{9} \times 18^2)$ mangoes |
| 4 + 5 | | |
| **9** | (4 x 2) mangoes | (5 x 2) mangoes |
| | 8 mangoes | = 10 mangoes |

**Example 2**

Peter, Kato and Mike shared sh.270, 000 in the ratio of 2: 4: 3 respectively.

**a**) How much did each get?

| Solution | Peter's share | Kato's share | Mike's share |
|---|---|---|---|
| Total ratio. | 30000 | 30000 | 30000 |
| 2 + 4 + 3 | 2 x sh.270000 | 4 x sh. 270000 | 3 x sh.270,000 |
| = 9 | 9 | 9 | 9 |
| | 2 x sh.30,000 | 4 x sh.30,000 | 3 x sh.30,000 |
| | Sh.60,000 | sh.120,000 | sh.90,000 |

b) Express Kato's share as a fraction of the total.

Kato's share = sh.120,000 = 12

Total share = sh.270,000 27

As a fraction = sh.120,000 **= 4**

Sh.270,000 **9**

**ACTIVITY:**

1. Share 360 oranges in the ratio of 2 : 3.
2. Share 450 cakes in the ratio of 5 : 4.
3. Sh.1,000 was shared between A and B in a ratio of 2 : 3. How much did each get?
4. Share 90 kg of sugar between two people in a ratio of 7 : 3.
5. Distribute 210 cows between Pauline and Anne in the ratio of 3 : 7 respectively.
6. The ratio of boys to girls in Maliri Primary School is 7 : 4. If there are 748 pupils in the class, how many girls are there in the school?
7. The size of two angles on a straight line are in the ratio of 2 : 3. Find the size of each of the angles.
8. Joy, Mercy and Divine shared some money in the ratio of 2 : 3 : 5 respectively. If sh.300,000 was shared among the girls, how much money did each of them get?

**SUB TOPIC: APPLICATION OF RATIOS INVOLVING SHARING**

**Concepts:**

- Identify the ratio given.
- Find the difference in the ratios involved in the problem.
- Use the unitary method to solve the required values.

Example 1

Paul and James shared some money in the ratio of 3 : 5 respectively. If James got sh.3000,

(a) Find Paul's share

**Solution**

Paul : James — 5 parts represent sh.3000

3 : 5 — 1 part represent sh.3000 x 3
5

? : sh.3000 — 3 parts represent sh.3000 x 3
5

= sh.600 x 3

= sh.1,800

(b) What was their total share?

Solution

Paul's share = sh.1,800

James' share =+sh.3000

Total share = sh.4,800

OR Let x represent total share

$\frac{5}{8} \times X = sh.3,000$

$8 \times \frac{5x}{8} = sh.3,000 \times 8$

$\frac{5x}{5} = sh.\frac{3000}{5} \times 8$

$X = sh.600 \times 8$

$\boldsymbol{X = sh.4,800}$

Example 2:

In a library, English, Maths and Science textbooks are in the ratio of 3 : 4 : 5 respectively. If there are 20 Science textbooks in the library;

a) How many textbooks are there in there in the library?

Total ratio = 3 + 4 + 5

= 12 parts

English: Mathematics: Science

3 : 4 : 5

5 parts rep 20

1 part rep $\frac{20}{5}$

= 4

12 parts rep 12 x 4

= 48 textbooks

or Let the total number of textbooks be p.

$\frac{5}{12}$ of p = 20

$\frac{5}{12} \times p = 20$

$12 \times \frac{5p}{12} = 20 \times 12$

$5p = 240$

$\frac{5p}{5} = \frac{240}{5}$

$p = 48$

Example 3

A and B shared money in the ratio of 3 : 7 respectively. If B got sh.4,000 more than A,

(a) Find the share of A.

A : B Difference in ratios

3 : 7 7 – 3 = 4

4 parts represent sh.4,000

1 part represents $sh.\frac{4000}{4}$

= sh.1,000

3 parts represent 3 x sh.1,000

= Sh.3000

(b) Find their total share.

Total ratio = 3 + 7

= 10 parts

4 parts represent sh.4,000

1 parts represent $sh.\frac{4000}{4}$

= sh.1,000

10 parts represent 10 x sh.1,000

= Sh.10,000

Example 4

Lucy, Dan and Leticia share some money in the ratio of 2 :3: 5 respectively. If Lucy gets sh.1,500 less than Leticia,

a) How much did Leticia get?

**Solution**

Lucy : Dan : Leticia

2 : 3 5

Difference in ratio = 5 – 2

= 3

3 out of 10 shares = sh.1,500

1 out of 10 shares = $sh.\frac{1,500}{3}$

1 out of 10 shares = sh.500

5 out of 10 shares = 5 x sh.500
**= sh.2,500**

b) How much money is shared?
Total shares = 2 + 3 + 5
= 10
1 out of 10 shares = sh.500
10 out of 10 shares = 10 x sh.500
= sh.5,000
Sh.5,000 is shared.

**ACTIVITY:**

1. A and B shared some money in a ratio of 3 : 4. If A got sh.12,000,
   a) How much did B get?
   b) How much money was shared?
2. At a party, the ratio of the number of bottles of sodas to the number of bottles of beers is 5 : 3. If there are 24 bottles of beer, how many bottles of sodas are there?
3. A, B and C contributed some money for a business in a ratio of 3 : 4 : 5 respectively. If C contributed sh.10,000, how much did the rest pay?
4. Jim and Tom contributed for a party in the ratio of 2 : 3 respectively. If Jim contributed sh.60,000.
   a) Calculate Tom's contribution.
   b) How much money did they contribute altogether?
5. Henry and Patrick shared some money in the ratio of 2 : 5 respectively. If Patrick got sh.1,500 more than Henry.
   a) How much did Henry get? b) How much money was shared?
6. A certain sum of money was shared among three daughters Joy, Linus and Divine in the ratio of 2 : 3 : 5 respectively. If Divine gets sh.21,000 more than Joy;
   a) How much did each get? b) How much was shared?
   c) Express Linus' share as a percentage of the total.
7. The ages of a husband and a wife are in the ratio of 5 : 3 respectively. If the husband's age is 10 years more than that of his wife, find their total age.
8. Three sons Felix, Emma and Victor shared a certain amount of money in the ratio 2 : 3 : 7 respectively such that Felix gets sh.3,000 less than Emma.
   a) How much money was shared?
   b) How much more did Victor get than Emma?
9. David, Ben and Eddie shared money in the ratio of 3 : 5 : 7 respectively. If Eddie got sh.8,000 more than Ben.
   a) How much money did they share?
   b) How much less did David get than Ben?
10. The number of goats, cows and sheep on a farm are in the ratio of 4 : 3 : 5 respectively. There are 40 less goats than sheep on the farm.
   a) How many cows are on the farm?
   b) Find the total number of animals which are on the farm altogether.

**SUB TOPIC: SIMPLE OR DIRECT PROPORTION**

- In simple or direct proportion, when the quantity of an item increases, the cost also increases in the same ratio.

- When the quantity doubles, the cost also doubles in the same ratio.
- When working out the given problems, the required quantity is always put on the right hand side of the equation.

Example 1

3 books cost sh.6,000. What is the cost of 10 such books?

Method 1

3 books cost sh.6,000

1 book costs $\frac{\text{sh.6,000}}{3}$

$= \text{sh.2,000}$

10 books cost sh.2,000 x 10

$= \underline{\text{sh.20,000}}$

Method 2

Since the books required are more,

$= \frac{\text{More}}{\text{Less}} \times \text{Amount}$

$= \frac{10}{3} \times \text{sh.6,000}$

$= 10 \times \text{sh.2,000}$

$= \underline{\text{sh.20,000}}$

Example 2

The cost of 4kg of beans cost sh.2,400. How many kgs of beans can one buy with sh.3,600?

Sh.2,400 can buy 4kgs

Sh.3,600 can buy $\frac{\text{sh.3,600}}{\text{Sh.2,400}} \times 4\text{kgs}$

$= \frac{3}{2} \times 4\text{kgs}$

$= 3 \times 2\text{kgs}$

$= 6\text{kgs}$

One can buy 6kgs of beans with sh.3,600

Example 3

A car uses 6 litres of petrol to travel 30km. How many litres of petrol are required to travel 135km?

30 km require 6 litres

1 km requires $\frac{6}{30}$

45 km require $\frac{6}{30} \times 45$ litres

$= 1 \times 15$ litres

$= \mathbf{\underline{15 \text{ litres}}}$

Or $\frac{\text{More}}{\text{Less}} \times \text{Quantity}$

$\frac{135}{30} \times 6$

$= (15 \times 1)$ litres

$= \mathbf{\underline{15 \text{ litres}}}$

**ACTIVITY:**

1. 6kgs of sugar cost sh.15,000. What will be the cost of 8kgs of sugar?
2. 5 shirts cost sh.75,000. How many shirts will I buy with sh.45,000?
3. 5 metres of cloth can make 2 shirts. How many metres will be required to make 8 shirts?
4. A vehicle covers 48km in 20 minutes. How far will it go in one hour?
5. A dozen of books cost sh.18,000. What is the cost of 9 such books?
6. A school uses 200 litres of water every day. How many days will the school take to use 24,000 litres of water?
7. 8 loaves of bread cost sh.9,600. How much money will I need to buy 4 loaves of bread?
8. A car uses 8 litres of petrol to cover 40km. How many kilometres will it cover with 11 litres of petrol?
9. 3 shirts cost sh.33,000. How many shirts will I buy with sh.22,000?

## SUB TOPIC: MORE ABOUT DIRECT PROPORTION

- Use the unitary method to solve problems involving proportion in fractional form.
- Find the total quantity or fraction of the total quantity accordingly.

Examples:

1. $^{2}/_{3}$ of the textbooks in the bookshop are school textbooks. How many books are in the bookshop altogether if the school textbooks are 240?

2 out of 3 parts = 240
1 out of 3 parts = $\frac{240}{2}$
= 120
3 out of 3 parts = (120 x 3) books
= 360 books

Let the total books be y.
$\frac{2}{3}$ of y = 240
$\frac{2}{3}$ x y = 240
$3 \times \frac{2y}{3} = 240 \times 3$
$\frac{2y}{2} = \frac{240 \times 3}{2}$
Y = 360 books

There were 360 books in the bookshop altogether.

2) $^{1}/_{2}$ of my salary is sh.240,000. What is $^{1}/_{8}$ of the salary?

1part rep. sh.240,000
2 parts rep. (2 x sh.240,000)
= sh.480,000

$\frac{1}{8}$ of my salary
$\frac{1}{8}$ x sh.480,000
= sh.60,000

**ACTIVITY:**

1. $^{1}/_{3}$ of my salary is sh.90,000. What is my salary?

2. $^{1}/_{4}$ of a man's salary is spent on drinks qhich is sh.12,000.

a) How much is the man's salary? b) What is $^{1}/_{12}$ of the man's salary?

3. $^{2}/_{3}$ of the pupils in the class are absent.15 pupils are present. How many pupils are in the class?

4. $^{2}/_{5}$ of my father's salary is equivalent to $^{3}/_{4}$ of my mother's salary. What is my mother's salary if my mother's salary is sh.540,000. Find my father's salary.

5. $^{3}/_{4}$ of a kg of sugar costs sh.1,200. What is the cost of;

a)1 kg of sugar? b) 2 ½ kg of sugar?
c) How many kilograms of sugar can one buy with sh.8,000?

## SUB TOPIC: APPLICATION OF INDIRECT (INVERSE) PROPORTION

- In indirect proportion, an increase in one quantity causes a decrease in the other.
- A decrease in one quantity causes an increase in the other.

Therefore, we say that they are indirectly or inversely proportional.

- The required item should always be put on the right hand side.

Examples

1. A car takes 2 hours to cover a distance at 30km/hr. How long will it take the same car to cover the distance at 20km/hr?

30km/hr take 2 hours.
1 km/hr takes (2 x 30) hours
20 km/hr will take $\frac{2 \times 30}{20}$ hours
$= (1 \times 3)$ hours
$= 3$ hours

It will take the car 3 hours to cover the distance at 20 km/hr.

2. Six men can paint a house in 8 days. How many more men are needed to paint the same house in 3 days?

8 days require 6 men
1 day requires (8 x 6) men
3 days will require $\frac{8 \times 6}{3}$ men
$= 8 \times 2$
$= 16$ men

More men required = 16 – 6
= 10 more men

10 more men will be required to complete the work in 3 days.

3. A choir of 15 people takes 4 minutes to sing a song. How long will a choir of 20 people take to sing the same song?

- Since the choir is one team singing the same song in the same rhythm, they will take the same minutes to sing the song.( Constant proportion).

4. 20 eggs take 10 minutes to get ready. How long will I need to boil 25 eggs?

Since all the 25 eggs are boiled in one container, they will take the same minutes to boil.

Therefore, we say that the proportion is constant. It just requires common sense.

**ACTIVITY:**

1. 4 girls take 9 days to do a job. How long will 12 girls take to do the same job at the same rate?
2. 12 men can build a house in 5 days.
   a) How many men are needed to do the whole job in one day?
   b) How long will 10 men take to do the same job?
3. A car takes 2 hours to cover a distance at 30 km/hr. How long will it take to cover the same distance 15 km/hr?
4. Six porters can paint a house in 8 days. How many more porters are needed to paint the same house in 3 days?
5. Twelve men can dig a garden in six days. How many more days are needed by 4 men to complete the same work?
6. 8 men can take 21 days to slash a compound. How many more men are required to complete the work in 14 days?
7. A driver took 4 hours to cover a certain journey at 40 km/hr. How long would it take if it were driven at 48 km/hr?
8. 5 men can do a piece of work in 10 days. How many men are needed to do the same piece of work in 2 days?

9. 5 men can sing a song in 10 minutes. How long will 15 men take to sing the same song?
10. 25 choir members can sing the National Anthem in 8 minutes. How many minutes will 30 members take to sing the same Anthem?
11. a) 36 men working for 10 hours a day can build a house in 75 days. How many days will 60 men working 8 hours take to build the same house?
12. If 3 men can paint a 12-bed roomed house in 12 days, how long will 6 men to paint a 10-roomed house at the same rate if all rooms are of the same size?
13. The railway fare for a party of 20 students for a journey of 300 km is sh.5,000. What is the fare for a party of 30 students for 180km at the same rate?
14. The wages of 16 men for 10 days are sh.19,200. What are the wages for 10 men for 12 days at the same rate?
15. The salary for 12 workers for 14 days is sh.92,400. What is the salary for 15 workers for a month of 30 days at the same rate?

**TOPIC: FRACTIONS ( PERCENTAGES)**
**SUB TOPIC: FINDING THE REMAINING PERCENTAGES**

- Interpret the information given.
- If one percentage is given, subtract from the original percentage (100%).
- When given more than one percentage, first add the percentages then subtract.

Examples

1. If 40% of a class is absent, what percentage is present?
   Total percentage = 100%
   Those absent = 40%
   Those present = 100% - 40%
   = 60%
2. 35% of pupils in a school like rice while 10% like potatoes. If the rest like yams, find the percentage of the pupils who like yams.
   %ge for rice and potatoes = 35% + 10%
   = 45%

Percentage for yams = 100% - 45%
= 55%

3. There are 10% more girls than boys in the class. Find the percentage for the girls.

Let the percentage of boys be x.

| %age of boys | %age of girls | Total %age |
|---|---|---|
| x | X + 10% | 100% |

(X)% + (x + 10)% = 100%
x + x + 10 = 100
2x + 10 = 100
2x + 10 – 10 = 100 – 10
2x = 90
$\frac{2x}{2} = \frac{90}{2}$

X = 45

The percentage for boys is 45.

**ACTIVITY:**

1) 15% of the people in a class are absent. What is the percentage present?

2) A man spends 35% of his salary, what percentage does he save?

3) 60% of the villagers are men, x% are children and 25% are women. What percentage are children?

4) 10% of the books on the bookshelf are English, 48% are Science books, 27% are SST books. What percentage are the rest?

5) A parent spends as shown below: 25% on fees, 20% on clothing, 15% on transport and the rest of the money is spent on other family needs. What percentage is spent on other family needs?

9. A school spends 18% more money on food than on stationery.

(i) What percentage is spent on stationery?

(ii) Find the percentage spent on food.

10. A family spends 40% more on school fees than on clothing.

(i) What percentage is spent on clothing?

(ii) What percentage is spent is spent on school fees?

**SUB TOPIC: EXPRESSING QUANTITIES AS PERCENTAGES**

**Concepts:**

- Ensure that the units are the same i.e change the big units to small ones by multiplying.
- Express the given quantities as a fraction.
- Multiply the fraction by 100%
- Remember;

| | | |
|---|---|---|
| 1kg = 1000g | 1hour = 60 minutes | 1 metre = 100 cm |
| 1 week = 7 days | 1year = 12 months | 1 fortnight = 14 days |

**Examples**

1. Express 20 as a percentage of 80.

As a fraction = $\frac{20}{80}$

As a percentage = $\frac{20}{80} \times 100\%$

$= \frac{1}{4} \times 100\%$

$= \mathbf{25\%}$

2. Express 20cm as a percentage of 2metres.

Same units first 1m = 100cm

2m = 2 x 100cm

= 200cm

As a fraction = $\frac{20cm}{200cm}$

As a percentage = $\frac{1}{10} \times 100\%$

= **10%**

3. Amos got 12 out of 25 in a Maths test. Express his mark as a percent.

As a fraction = $\frac{12}{25}$

As a percentage = $\frac{12}{\cancel{25}_{1}} \times \frac{4}{1\cancel{00}}\%$

= (12 x 4)%

= 48%

**ACTIVITY:**

1. Express 20 as a percentage of 25.
2. Write 3 as a percentage of 50.
3. Express 20 grams as a percentage of 1 kg.
4. Express 40 minutes as a percentage of 2 hours.
5. 60 out of 80 pupils in a class passed the examinations. What percentage of the pupils in the class passed the examinations?
6. A bag contains 18 blue and 32 red pens. Find the percentage for the red pens.
7. What percentage are 15 girls in a class of 60 pupils?
8. Express 30 minutes as a percentage of 2 hours.
9. Express 24 cm as a percentage of 2 metres.
10. Express 4 days as a percentage of a fortnight.

**SUB TOPIC: FINDING PERCENTAGE PARTS OF QUANTITIES**

- First work out the percentages of each of the items given.
- Multiply the percentage by the total quantity given.
- If one quantity is given and its equivalent percentage is not given, first find its percentage.

Examples

1. Find 40% of 150.

40% of 150 = $\frac{40}{100} \times 150$

= 4 x 15

= **60**

2. George has 400 heads of cattle. 80% of them are cows and the rest are bulls.

a) Find the number of cows.

Solution

$\frac{80}{100} \times 400 = 80 \times 4$

= 80 x 4

**= 320 cows**

b) Find the percentage of bulls.

100% - 80%

**20%**

c) What is the total number of bulls?

$\frac{20}{100} \times 400 = 20 \times 4$

**= 80 bulls**

Or Number of bulls = 400 - 320

= 400

- 320

**80**

3. A piece of land is 200 hectares. A farmer used 60% of it for cultivation. How much land is used for cultivation?

Size of the land = 200 hectares

Land used = 60% of 200 hectares

$= \frac{60}{100} \times 200$ hectares

= (60 x 2) hectares

= **120 hectares**

**ACTIVITY:**

1. What is 20% of 240?
2. What is 25% of 600kg?
3. What is 18% of sh4,400?
4. What is 2 ½% of sh.400?
5. A school bought 500 bags of beans and maize. If 40% were bags of beans, how many bags of beans were there?
6. Evaluate the following:

a) 37 ½ % of 40. b) $33\ ^1/_3$ % of 810 c) 15% of 840 metres.

d) 12 ¼ % of 4,000. e) 83 ½ % of 800.

7. A mathematics test was marked out of out of 25. If Sina scored 72%, what was his original mark?
8. A school bought 450 kgs of rice at the beginning of the term. If 65% was used, how many kilograms were used?

**SUBTOPIC: APPLICATION OF PERCENTAGES**

- First find the percentage for the required quantity and solve.

Examples

1. If 20% of a number is 400. What is the number?

Method 1

20% represent 400

1% represents $\frac{400}{20}$

100% represent 20 x 100

= 2,000

Method 2

Let the number is x

20% of x = 400

$\frac{20}{100} \times X = 400$

$5 \times \frac{1}{5} X = 400 \times 5$

X = 2,000

**The number is 2,000**

2. If 30% of my salary is spent on food and I save sh. 210,000. What is my salary?

**Method 1**

**Method 2**

%age saved = 100% - 30%

= **70%**

70% represent sh.210,000

1% represents sh.$\frac{210,000}{70}$

100% represents $\frac{\text{sh.210,000}}{70} \times 100$

= sh.3000 x 100

= sh.300,000

**My salary is sh.300,000**

% saved = 100% - 30%

= 70%

70% of y = sh.210.000

$\frac{70}{100} \times y$ = sh.210,000

$\frac{100}{70} \times \frac{70y}{100} = \text{sh.210,000} \times \frac{100}{70}$

y = sh.300,000

3. After travelling 60% of his journey, Philip had 50km still to cover. How long is the journey?

Total percentage = 100%

Percentage covered = 100% - 60%

= 40%

40% out of 100% = 50km.

1% out of 100% = $\frac{50\text{km}}{40}$

100 out of 100% = $(\frac{5}{4} \times 100)$ km

= (5 x 25) km

= **125km**

**ACTIVITY:**

1. a) If 10% of a number is 48. Find the number.
   b) Given that 120% of a number is 288. What is the number?
   c) 20% of a number is 40, what is 60% of the same number?
2. After spending 40% of his money, he had sh. 1800 left. How much had he originally?
3. In a class there are 10% more boys than girls. If there are 18 girls in the class

a) Find the percentage of girls. b) Find the percentage of boys.

c) How many pupils are in the class altogether?

4. Rose, Mary and Robert shared a certain amount of money; Rose got X%, if Mary got twice as much as Rose and Robert got 16%more than Rose. If Robert got sh. 7400,

a) Find the value of x. b) Calculate what each person got.

c) How much money did they share?

4. If 20% of my salary is spent on fees and I save sh.20,000. What is my salary?
5. After spending 30% of his income, a man was left with only sh.210,000.
   a) How much is his income? b) How much did he spend?
6. After spending 40% of her money, Esther had sh.12,000 left. How much had she originally?
7. After covering 20% of her journey, Fred had 60km to go. How long was the journey?

8. If 60% of a plot of land contains banana plantation and the remaining 80 hectares are covered with coffee.
a) What is total number of hectares?
b) How many hectares are for banana plantation?

**SUB TOPIC: INCREASING QUANTITIES USING PERCENTAGES**

- Using the increased percentage to multiply by the quantity.
- Finding the increase then adding to the given quantity.

Examples

1. Increase sh.800 by 20%

Method 1

Solution
New % = 100% + 20%
= 120%
New amount $\frac{120}{100}$ x sh.800
= sh.120 x 8
= sh.960

Method 2

Increase
20% of sh.800
$\frac{20}{100}$ x 800
= sh.20 x 8
= **sh.160**

New amount
Sh.800
+ sh.160
Sh.960

2. Increase 800 cows by 22 ½ %.

22 ½ % of 800 cows
= $\frac{45}{2}$% of 800 cows
= ($\frac{45}{2}$ ÷ 100) x 800 cows
= ($\frac{45}{2}$ ÷ $\frac{100}{1}$) x 800 cows

($\frac{45}{2}$ x $\frac{1}{100}$ x 800) cows
= (45 x 4) cows
= 180 cows

New number =
800
+180
980 cows

New number of cows = (100% + 22 ½ %) of 800 cows
= 122 ½ % of 800 cows
= ($\frac{245}{2}$ ÷ $\frac{100}{1}$) x 800) cows
= $\frac{245}{2}$ x $\frac{1}{100}$ x ~~800~~) cows
= 245 x 4) cows
= 980 cows

3. Increase sh.2000 by 10% then by 20%

Method 1

10% increment
$\frac{10}{100}$ x sh.2000
10 x sh.20
=Sh.200

New amount
sh.2000
+ sh. 200
sh.2200

Or

20% increment
$\frac{20}{100}$ x sh.2200
20 x sh.22
= sh.440

New amount
sh. 2,200
+ sh 440
sh 2,640

**Method 2**

1st increment = 100% + 10%
= **110%**
2nd increment = 100% + 20%
= **120%**

New amount = $\frac{110}{100}$ x $\frac{120}{100}$ x sh.2000
= 11 x 120 x sh.2
= 132 x sh.2

= **sh.2640**

**ACTIVITY:**

1) Increase 540kgs of sugar by 30%.
2) Increase sh.360 by 20%.
3) Increase £6000 by 15 ¼%.
4) Increase 800 chairs by 25% then by 30%.
5) Increase 720 hoes by 10% then by 25%.
6) Increase 800 pupils by 12 ½%.
7) The price of a radio was increased by 30% from sh.90,000. What is the new price of the radio?
8) Norah's salary was increased by 24%. She used to earn sh.120,000. What is her new salary?
9) The population of a school is 400. The predicted increase in 10 years' time is 35%. What will be the population after the 10 years?
10) In 2019, the population of Uganda was 15 million. If the population increased by 40%, calculate the new population of Uganda?

**SUB TOPIC: DECREASING QUANTITIES USING PERCENTAGES**

- Decrease the percentage then multiply or find the decrease then subtract.

Examples

1. Decrease sh.12000 by 10%

New % = 100% - 10%
= **90%**

$\frac{90}{100}$ x sh.1500

90 x sh.15

**Sh.1350**

3. Decrease 720 by 12 ½%.

Decrease = $\frac{25}{2} \div \frac{100}{1}$ x 720

$= \frac{25}{2} \times \frac{1}{100} \times 720$

= **90**

New number = 720 – 90
= **630**

2. Decrease sh.12,000 by 5% then by 10%.

100% - 5% (5% reduction) = 95%

100% - 10% (10% reduction) = 90%

95% x 90% x sh.12,000

$\frac{95}{100} \times \frac{90}{100}$ x sh.12,000

95 x 9 x sh12

**Sh.1,026**

**ACTIVITY:**

1. Decrease 750 by 40%.
2. Decrease 800kg of sugar by 35%
3. Decrease 4,500 litres of water by 20% then by 30%.
4. Decrease sh.8,400 by 10% then by 10%.
5. Decrease 360 dollars by $33\frac{1}{3}\%$
6. Decrease sh.1,000 by 10% then by 20%.
7. Decrease 400 football fans by 12 ½%.
8. Jacob's salary of sh.100,000 was reduced by 20%. What is the new salary?

9. The number of pupils decreased by 10% for the first year and then by15% for the second year. How many pupils are in the school if they were 1,600 pupils before?

**SUB TOPIC: FINDING ORIGINAL NUMBER AFTER THE INCREASE**

- Using the unitary method to solve
- Using the unknown to represent the total quantity.

Examples

1. What amount when increased by 20% becomes sh.1440?
   After increase the new percentage is;

   Method 1

   100% + 20% = 120%

   120% rep. sh.1440

   1% rep. $\frac{\text{sh.1440}}{120}$

   100% rep. $100 \times \frac{1440}{100}$

   Sh.100 x 12

   Sh.1200

   Method 2

   Let the amount be x

   (100% + 20%) of x = sh.1440

   $100 \times \frac{120}{100} \times X = \text{sh.1440} \times 100$

   $\frac{120x}{120} = \frac{\text{sh.144000}}{120}$

   $x = \text{sh.1200}$

2. When the price of a radio was increased by 30% it becomes sh.16,900. What was the old price?

Method 1

New % = 100% + 30%

**= 130%**

130% rep sh.16,900

1% rep sh.$\frac{16,900}{130}$

= sh.130

130% rep 130 x sh.100

= sh.13,000

Method 2

Let the salary be y

100% + 30% = 130%

$\frac{130}{100} \times y = \text{sh.16,900}$

$100 \times \frac{130y}{100} = \text{sh.16,900} \times 100$

$\frac{130y}{130} = \frac{\text{sh.16,900} \times 100}{130}$

$Y = \text{sh.13,000}$

**ACTIVITY:**

1. What amount when increased by 10% becomes sh.8, 800?
2. What number when increased by 20% becomes 1,440?
3. What number when increased by 15% becomes 1,035?
4. After increasing the price of a shirt by 25%, it was priced at sh.2, 000. What was the price before the increase?
5. After increasing the price of an item by 20%, it becomes sh.36, 000. What was the amount before?
6. What was Opio's previous salary who earns sh.4, 000,000 now after an increase of $33\frac{1}{3}$%?
7. After increasing the price of an article by 20%, the article costs sh.48, 000. What was the original cost of the article?
8. What number when increased by 20% becomes 960?
9. When the coffee export increased from y tonnes to 750 tonnes, the increase was 25%. What was the value of y?

10. When a number is increased by 10%, it becomes 2500. What is the original number?

**SUB TOPIC: FINDING ORIGINAL NUMBER AFTER DECREASE**

- Using the unitary method to solve
- Using the unknown to represent the total quantity

**Examples**

1. If a man's salary is decreased by 35% it becomes sh.15600. What is his salary?

Method 1

100% - 35% = 65%

65% rep sh.15600

1% rep sh.$\frac{15600}{65}$

100% rep 100 x sh.$\frac{15600}{65}$

100 x sh.240

Sh.24000

Method 11

100% - 35% = 65%

Let the salary be x

$\frac{65}{100}$ of x = sh.15600

100 x $\frac{65x}{100}$ = sh.15600 x 100

$\frac{65x}{65}$ = sh.$\frac{15600 \times 100}{65}$

X = sh.24000

2. When the price of a radio is reduced by 25% it becomes sh.67500. What was the old price of the radio?

Method 1

New % = 100% - 25%

75%

75% rep sh.67,500

1% rep sh.$\frac{67,500}{75}$

Sh.900

100% rep 100 x sh.900

Sh.90,000

method 2

new % = 100% - 25%

= 75%

Let the old price be x

$\frac{75}{100}$ x X = sh.67,500

100 x $\frac{75x}{100}$ = sh.67,500 x 100

$\frac{75x}{75}$ = sh.$\frac{6,750,000}{75}$

X = sh.90,000

**ACTIVITY:**

1. What number of pupils when decreased by 20% becomes720 pupils?
2. What sum of money when decreased by 20% becomes sh.10, 800?
3. A teacher's salary was decreased by 10% to sh.120, 000. What was the teacher's salary before?
4. The price of a suit was reduced by 30% to sh.98, 000. What was the price of the suit before?
5. A car was bought at sh.4, 800,000 after a decrease of 20% of its original price. What was the price of the car before the decrease?
6. After reducing the price of a TV set by 25%, the customer paid sh.300, 000. What was the original price of the TV set?
7. Calculate the original number after decreasing it by 40% and it became sh24, 000.
8. What was the marked price of a chair which was bought at sh.60, 000 after a reduction of 20%?
9. A worker earns sh.150, 000 after reducing the original pay by 20%. What

was the worker's original pay?
10. The school fees was decreased by 5% this year at our school. What amount of money were we paying before the decrease?

## SUB TOPIC: FINDING PERCENTAGE OF INCREASE OR DECREASE

- Get the difference between the given quantities
- Express the difference as a fraction of the original quantity then multiply.

**Examples**

1. When 400kg are increased by p% they become 440kg. Find the value of p.

Increase = 440kg − 400kg = 40kg

$\frac{40kg}{400kg} \times 100\% = 10\%$

2. 800 pupils where decreased by y% to 680 pupils. Find the value of y.

Solution

Decrease = 800 − 680 = 120

$y = \frac{\text{Decrease}}{\text{Old no.}} \times 100\%$

$y = \frac{120}{800} \times 100\%$

$y = 15\%$

**ACTIVITY:**

1. By what percentage will 480 be increased to 540?
2. By what percentage will 960 be increased to become 1,056?
3. A worker's salary was increased from sh.13, 000 to sh.18, 000. By what percentage was the salary increased?
4. The number of cars in the country increased from 500,000 to 600,000. What is the percentage increased in the number of cars?
5. At a price of sh.24,000, a shirt is increased by p% to sh.25,000.Find the value of p
6. When 1,000 is decreased by x%, it becomes 900. Find the value of x.
7. By what percentage will 900 be decreased to become 810?
8. By what percentage will 1,440 be decreased to 1,152?
9. A man's salary was sh.18, 000. It was reduced to sh.15, 300. Find the man's percentage decrease in his salary.

## SUB TOPIC: PERCENTAGE PROFIT AND PERCENTAGE LOSS

- Increase can also be referred to as: gain, profit or raise or rise.
- Decrease can also be referred to as: loss, reduction or drop.

Examples:

1. An article was bought at sh. 100,000 and sold at sh.120000. Calculate the percentage profit.

Profit = SP – CP

= sh.(120,000 – 100,000)

= sh.20,000

$\%\ \text{profit} = \frac{\text{Profit}}{\text{B.P}} \times 100\ \%$

$= \left(\frac{\text{sh.}20000}{100000} \times 100\right)\%$

$= 20\%$

**2.** Otim bought a shirt at sh. 4,000 and sold it at sh.3,000. Find his percentage loss.

Loss = BP - SP

$\%\ \text{loss} = \frac{\text{loss}}{} \times 100\ \%$

= sh.(4,000 – 3000)
= sh.1,000

B.P
= sh.(1000 x 100) %
Sh. 4000
= 25%

**ACTIVITY:**

1. A lady sold a radio for sh.85,000 making a profit of sh.5,000. Calculate the percentage profit.
2. A man sold a jerry can of oil at sh.60,000 and made a loss of sh.15,000. Calculate the percentage loss.
3. A book was bought at sh.800 and later sold at sh.900. Calculate the percentage profit.
4. After selling a piece of land at sh.800, 000, Okurut gained sh.200, 000. Calculate Okurut's percentage gain.
5. A man bought a car at sh.4, 200,000 and sold at a profit of sh.200, 000. Calculate the percentage profit.
6. The cost price of an article was sh.50, 000. It was sold at a gain of sh.6, 000. Calculate the percentage gain.
7. A loss on a shirt which was sold at sh.50, 000 was sh.6, 000. Calculate the percentage loss.
8. By selling a school bag at sh.12, 000, a student made a loss of sh.2, 000. Calculate her percentage loss.
9. Calculate the percentage loss if the cost price of an item is sh.42, 000 and the selling price is sh.30, 000.
10. By selling a mattress at sh.120, 000, a trader made a loss of sh.18, 000. Calculate the percentage loss.

**SUB TOPIC: FINDING SELLING PRICE GIVEN PERCENTAGE PROFIT OR PERCENTAGE LOSS AND BUYING PRICE**

- First find the new percentage after the increase or decrease.
- Identify the cost or buying price or the original price.
- Work out the profit or loss then calculate the selling price.

Examples

1. Divine bought a DVD player at sh. 300,000 and sold it at 10% profit. Find his selling price.

Solution new % = 100% + 10%
= 110%
110 x sh.300,000
100
Sh.330,000

or New percentage = 100% + 10%
= 110%
100% = sh.300,000
1% = sh.300,000
100
110% = sh.3000 x 110
= sh.330,000

2. A fridge bought for sh.600,000 was sold at a loss of 25%. Calculate the selling price.

Solution new % = 100% -25%
**= 75%**

or New percentage = 100% - 25%
= **75%**

New amount = 75 x sh.60,000

100% = sh.60,000

100 1% = sh.60,000

= 75 x sh.6,000 100

**Selling price = sh.450,000** 75% = sh.600 x 75

**Selling price = sh.450,000**

**ACTIVITY:**

1. A man bought a goat at sh.24, 000 and sold it and made a profit of 30%.At how much did he sell the goat?
2. A shop keeper bought a 50kg bag of sugar at sh.15, 000. He then sold the sugar at sh.1,200 per kg. Calculate the selling price of the 50 kg bag of sugar.
3. Kevin bought a goat at sh.35, 000 and later sold it and made a profit of 15%. At what price did Kevin sell the goat?
4. Adoa bought a dress at sh.56, 000 and sold it later making a profit of 20%. How much did she sell the dress?
5. Teddy bought a pair of shoes at sh.40, 000 and later sold it at a loss of 15%. What was her selling price?
6. Mr. Okello spent sh.120, 000 to grow ground nuts in his plantation. When he sold the ground nuts, he made a loss of 10%. How much did he sell the ground nuts?
7. Mr. Lukyamuzi bought a hat at sh.25, 000. When he sold it, he realized a loss of 15%. Calculate the selling price of the hat.
8. Dennis bought a shirt at sh.24, 000 but later sold it at a loss of 10%. At what price did he sell the shirt?
9. A shop keeper bought a watch at sh.30, 000 and sold it at a loss of 12 ½%. Find his selling price.
10. A shop keeper bought 30 books at sh.24, 000. At what price did he sell each book if he made a loss of 20%?

**SUB TOPIC: FINDING COST PRICE WHEN GIVEN PERCENTAGE PROFIT OR PERCENTAGE LOSS AND SELLING PRICE**

- Find the new percentage fro given percentage profit or loss.
- Work out the equivalence of 1% then multiply by 100%.

Example

1. By selling a blanket at sh. 36,000, a trader made a profit of 20%. Calculate the cost price of the blanket.

New % = 100% + 20% 1% rep. = sh. 36,000

**= 120%** 120

Cost price = 100% 100% = sh. 300 x 100

120% rep. sh.36,000 CP = sh.30,000

2. A dealer sold a bicycle for sh.45,000 there by losing 10%.

(a) Calculate the original price of the bicycle.

Solution

New % = 100% - 10% 100% = sh.45,000 x 100

**= 90%** 90

Original % = 100% = sh.500 x 100

90% rep. sh.45,000 = **sh.50,000**

1% rep. sh.45,000

(b) How much did he lose?

$\frac{10}{100}$ x sh.50,000 = **sh.5,000**

Or Loss = BP – SP

Sh.50,000

- Sh.45,000

**He lost Sh. 5,000**

**ACTIVITY:**

1. After selling a book at sh.2, 200, a boy made a profit of 10%. Calculate the cost price of the book.
2. By selling a shirt at sh.18, 000, Kato made a profit of 20%. Calculate the cost price of the shirt.
3. Mr. Obbo sold an article for sh.180, 000 and realized a loss of 10%. At how much would he have sold it in order to gain a profit of 10%.
4. A man's salary after the increase was sh.107, 000. Calculate his original salary if there was an increase of 7%.
5. Mr. Ochai got sh.300, 000 from the sales of his beans in one season. If this was 25% of what he got in the previous season. How much did he get in the previous season?
6. During the Covid-19 lockdown, the price of a bag of a bag of 100kg of cassava flour cost sh.120, 000. If this was 10% increase, what was the original price of the100 kg bag of cassava flour?
7. By selling a radio at sh.40, 000, a trader lost 20% of what she used for buying it. At what price did she buy the radio?
8. Mr. Katumba bought a car at sh.200, 000. He later sold it to Mr. Mukiibi at a loss of 10%. Mr. Mukiibi also sold it to Mr. Mpagi at a loss of 5%. Find how much money Mr. Mpagi paid for the car.

**SUB TOPIC:MORE PERCENTAGE PROFIT OR PERCENTAGE LOSS**

- Finding the real cost price or buying price of the item.
- Finding the new percentage from percentage profit or percentage loss.
- Find the selling price of the item from percentage profit or percentage loss.
- Dividing the selling price by the quantity.

Examples:

1. The cost price of a 50kg bag of sugar is sh.45,000. At what price must a trader sell each kg in order to make a profit of 20%?

Cost price of 50kg bag = sh.50,000

New percentage = original% + % profit

= 100% + 20%

= 120%

Selling price = $\frac{120}{100}$ x sh.45,000

= 12 x sh.4,500

= sh.54,000

Cost of each kg = $\frac{\text{sh.54,000}}{50}$

= sh.1,080

2. Mr. Okello bought 3 bags of soya beans at sh.21,000 each. If each bag weighed 70kg and he sold each kg at sh.250.

a) Calculate his percentage gain or loss.

Cost of 3 bags = sh.21,000 x 3
= sh. 63,000

Total number of kgs = 70kg x 3
= 210kgs

Selling price = sh.250 x 210
= sh.52,500

Loss = CP – SP
= Sh.63,000
-Sh.52,500
Sh.10,500

Percentage loss = Loss x 100
CP
= Sh.10,500 x 100%
Sh.63,000
= 105 x 10%
63
= 1,050%
63
= 16 2%
3

b) At what price must he sell each kg in order to make a profit of 20%

Cost price of 3 bags of sugar = sh.63,000

New percentage = original% + % profit
= 100% + 20%
= 120%

Selling price = 120 x sh. 63,000
100
= 12 x sh.6,300
= sh.75,600

Total number of kgs = 70 x 3
= 210kgs

Cost of each kg = sh.75.600
210
= sh.360

Each kg costs sh.360

**ACTIVITY:**

1. The cost of 100kg bag of sugar is sh.120,000. At what price must I sell each kilogram in order to get a profit of 30%?
2. At what price must Justine sell each kg of Irish potatoes in order to gain a 20% if the cost price of a 50kg sack of Irish potatoes is sh.60, 000?
3. a trader bought 30 pineapples at sh.20,000. At what price did he sell each pineapple if he made a loss of 10%?
4. Mrs Okurut bought 30 eggs at sh.90 each but X eggs got broken. She sold the remaining eggs at sh.120 each making a profit of sh.180. Find the value of X.
5. A book seller bought 40 Primary Mathematics textbooks at sh.200, 000. At what price must he sell each copy to get a profit of 15%?
6. A trader bought 2 bags containing 300 passion fruits each bag at a cost of sh.25,000 each. In each bag, there were y bad fruits. The rest of the fruits were sold at sh.400 a heap of 5 fruits and made a profit of sh.4, 400. How many passion fruits were bad?
7. Dorah bought a goat weighing 15kg at sh.30, 000. She sold the meat at sh. X per kg and made a profit of 15%. Find the value of X.

**SUB TOPIC: DISCOUNT**

- Discount is realized when a trader sells an item at a price less than the marked price.
- Discount is the difference between the cost of an item and the amount paid.
- The marked price is the amount written on a paper and put on an article.
- The cash price is the amount paid for an article after the discount.

Examples

1. The marked price of a book is sh.4000. If a customer is offered a 10% discount:

(a) How much is the discount?

= 10 x sh.4,000
100
= 10 x sh 40
= sh.400

(b) How much does the customer pay?
Solution

| | | |
|---|---|---|
| Sh.4000 | or new % = 100% - 10% | = 90 x sh 40 |
| - sh.400 | = 90% | = sh.3,600 |
| Sh.3600 | = 90 x sh.4000 / 100 | |

2. The marked price of a shirt was sh. 1500. After a discount a customer paid sh.1200.

a) How much was the discount
Solution
Discount = marked price – cash price
= sh.1500 - sh.1200
= sh.300

(a) Calculate the percentage discount.
Solution
% discount = (Discount x 100) / Marked price %
= (sh.300 x 100) / 1500 %
= 20%

**ACTIVITY:**

1. The marked price of a shirt is sh.40, 000. If a customer is offered a 10% discount;
a) How much is the discount? b) How much did the customer pay?
2. A set of chairs is marked sh.250, 000. If a customer is offered a 20% discount;
a) How much is the discount? b) How much does the customer pay?
3. A TV set is priced at sh.400, 000. If a customer is offered a 15% discount;
a) How much does the customer pay? b) How much is the discount?
4. The marked price of a bag of sugar is sh.160, 000. If a customer is offered a 5% discount;
a) How much does the customer pay? b) How much is the discount?
5. A retail trader is offered a discount of 10% for cash on an item.. Find the cash price if the marked price of the item is sh.150, 000.
6. Trisha bought a coffee set whose marked price was sh.220, 000. If she was offered a discount of 12%, how much did she pay for the coffee set?
7. Jimmy bought 4 pairs of trousers at sh.24, 000 each and was given a 12 ½% discount. What price did he pay for each pair of trousers?

**SUB TOPIC: FINDING THE MARKED (ORIGINAL) PRICE OR PERCENTAGE DISCOUNT**

**Concepts**:

- Marked price = 100%
- Marked price = cash price + discount.
- Percentage discount = $\frac{\text{Discount}}{\text{Marked price}} \times 100\%$

**Example**

1. Mary paid sh. 180,000 for a hand bag after being offered a discount of 10%.
   a) Calculate the marked price of the bag?

Cost price = sh.180,000
Discount = 10%

New % = 100% - 10%
= 90%
90% rep sh180,000
1% rep sh.$\frac{180,000}{90}$
= sh.2,000
100% rep = 100 x sh.2,000
**= sh.200,000**

Let the marked price be m.
100% - 10% = 90%

$\frac{90}{100}$ of m = sh.180,000
$100 \times \frac{90}{100} \times m = sh.180,000 \times 100$
90m = sh.18,000,000
$\frac{90m}{90} = \frac{sh18,000,000}{90}$
**m = sh.200,000**

b) How much was the percentage discount?

Sh.200,000
-sh.180,000
Sh.**20,000**

or Discount = $\frac{10}{100}$ x sh.200,000
= 10 x sh.2,000
**= sh.20,000**

Percentage discount = $\frac{\text{Discount}}{\text{Marked price}} \times 100\%$
$= \frac{sh.20,000}{Sh.200,000} \times 100\%$
=1 x 10%
**= 10%**

**ACTIVITY:**

1. Samuel paid sh.36, 000 for an article after a discount of sh.4, 000.
   a) Calculate the marked price of the article.
   b) Work out the percentage discount offered to Samuel.
2. Racheal paid sh.4, 000,000 for a brand new motorcycle after being given a discount of 20%. What was the price of the motorcycle before the discount was offered?
3. Jamwa was given a discount of 12 ½% which amounted to sh.50, 000. Calculate the marked price.
4. A man paid for an article. If he paid sh.28, 000 and its marked price was 32,000. Calculate the percentage discount of the article he bought.
5. After being offered a discount of 7 ½% on a dress, a girl paid sh.37, 000.What was the marked price of the dress?
6. Praise paid sh.36, 000 after a discount of sh.4, 000. Calculate the percentage discount.
7. The marked price of a suitcase is sh.45, 000. A customer paid sh.42, 000;

a) How much was the discount?
b) Calculate the percentage discount.

## SUB TOPIC: CALCULATING THE MARKED PRICE AND SELLING PRICE GIVEN DISCOUNT AND PERCENTAGE DISCOUNT

- Identify the percentage discount equivalent to the discount given.
- Use the discount and its equivalent percentage discount.
- Work out the required values.

**Examples:**

1. Karen was given a discount of 17% of the marked price of an article which amounted to sh.8,500. Calculate the marked price and the selling (cash) price of the article.

Percentage discount = 17%
Discount = sh.8,500
17% represent sh.8,500
1% represents $\frac{\text{sh.8,500}}{17}$
$= \frac{\text{sh.500}}{}$
100% represent sh.500 x 100
= sh.50,000
The marked price was sh.50,000.

Selling (cash) price = MP - Discount

| | |
|---|---|
| | sh.50,000 |
| - | sh. 8,500 |
| | sh.41,500 |

## ACTIVITY:

Work out the following:

1. Alice was given a discount of 12 ½% on an article which amounted to sh.5,000.
   a) Calculate the marked price of the article
   b) How much did he pay for the article?
2. If 7½% discount on an article is worth sh.45, 000.
   a) Calculate the marked price of the article.
   b) What was the selling price of the article?
3. Juliana bought a suitcase and other goods from a wholesale shop. If she was given a discount of 12 ½% which amounted to sh.108, 000, what was the cost of the suitcase?
4. Mildred bought a goat and was a discount of 3 1/3% which amounted to sh.15,000.
   a) Calculate the original cost of the goat.
   b) How much did she pay for the goat?
5. Medard bought textbooks from a vendor who offered him a discount of 6 ½% which amounted to sh.3, 900. Calculate the marked price of the textbooks.
6. Juliet bought an Android phone from a wholesale shop which offered her a discount a 10% discount which amounted to sh.12, 000.
   a) Calculate the marked price of the android phone.
   b) Work out the amount he paid for the Android phone.

## SUB TOPIC: COMMISSION

- A commission is an amount of money charged for carrying out a transaction by a commission agent or a broker.
- A commission agent or a broker are also referred to as " go betweens".

- Commission agents are people who sell other people's properties or just connect.

**Examples**

1. A salesman was paid a salary of sh.10,000 plus a commission of 10% of the value of goods sold. If he sold goods worth sh 6,500, how much did he earn altogether?

Solution

Salary = sh.10,000

Commission = $\frac{10}{100}$ x sh.6500

= sh.**650**

Total amount earned = sh.10,000

+sh. 650

**Sh. 10,650**

2. Kamara was given a commission of 3% of his sales. How much did he earn if he sold 50 toys at sh. 15000 each?

Total sales = 80 x sh.150,00

= sh.1,200,000

His commission = $\frac{3}{100}$ x sh.1200, 000

= sh.**36,000**

**ACTIVITY:**

1. A salesman is paid a commission of 6% of his sales. Calculate his commission if he sold goods worth sh.sh.18, 000.
2. A saleswoman is paid sh.12, 000 plus a commission of 5% of her sales. Calculate the total amount she receives if she sold goods worth sh.70, 000.
3. A saleslady gets a commission of 5% for every item she sells. If she sells 200 items at sh.4, 500 each item, calculate her commission.
4. For every 20 copies of handwriting books sold, the author gets money worth 2 copies as commission. Calculate the commission he gets after selling 4,000 copies at sh.1, 500 each.
5. A wholesaler employs 5 salesmen at 25% commission. If they sell goods worth sh.800, 000, how much does each salesman get?
6. A salesman received a commission of 8% for the goods sold. If he sells goods worth sh.84, 000, calculate the amount he gets as commission.
7. A trader gives a salesman 60 bunches of matooke to sell at sh.2, 000 each. Calculate the total pay if he is given a commission of 9% plus lunch of sh.1, 800.
8. The Monitor Newspaper gave a vendor a commission of 18% after selling 400 copies of its Newspapers at sh.500 each.
   a) Calculate the commission the vendor gets on each Newspaper.
   b) What will be the vendor's total commission?
9. Calculate the commission a salesman will receive if 12 ½% of the goods worth sh.10, 000 is sold.
10. A saleslady was given a 20% commission. If she sold mattresses worth sh.24, 000,000, calculate the amount she gets as commission.

**SUB TOPIC: SIMPLE INTEREST AND AMOUNT**

- Simple interest (SI) is an additional amount given to a person for using his money.
- Principal (P) is the amount deposited, borrowed or lent for commercial purpose(s).
- Rate (R) is the percentage used to charge the interest per annum ( per year).
- Time (T) is the period the money is used or kept.
- Amount is the sum of the principal and the interest one gets back or receives.

Examples

1. Calculate the simple interest on sh.8,000 for 2yrs at 10% per annum

S.I = P x T x R

= sh.8000 x 2 x $\frac{10}{100}$

= .sh.80 x 20

S.I = sh.1,600

2. Calculate the simple interest on sh.24000 for 8 months at simple interest rate of 15% per year.

S.I = P x T x R

= sh.24, 000 x $\frac{8}{12}$ x $\frac{15}{100}$

= sh.20 x 8 x 15

S.I = sh.2400

3. Calculate the simple interest on sh. 24000 for 8 months at a simple interest rate of 2 ½ % per month.

S.I = P x T x R

= 24000 x 8 x $\frac{2}{200}$

= 240 x 8

S.I = sh.1, 920

**ACTIVITY:**

1. A man deposited sh. 40,000 at Stanbic Bank for 5 years at a simple interest rate of 2 ½% per annum.
a) Calculate his simple interest.
b) How much money will he get back altogether after the 5 years?
2. A lady borrowed sh.800, 000 for 6 months 5% per annum. What simple interest did she pay?
3. Calculate the simple interest on sh.120, 000 after 1 year and 3 months at 20% per annum.
4. Brian borrowed sh.480, 000 from Centenary Bank and promised to pay back sh.2, 500 every month for 2 years. What amount did he pay back?
5. Find the simple interest on sh.40, 000 after 9 months at 15% per year.
6. A lady borrowed was lent sh.300, 000 from a SACCO group which charges an interest rate of 1% for 9 months. Find the simple interest and amount she will pay back.

**SUB TOPIC: FINDING RATE, PRINCIPAL OR TIME (APPLICATION)**

1. Sabrina deposited sh.50,000 on her saving s account. At the end of 3 years, the simple interest earned was sh.15, 000. Calculate the rate of interest.

P x T x R = I or Rate = $\frac{SI \times 100}{}$

50000 x 3 x $\frac{R}{100}$ = sh.15.000

$\frac{1500R}{1500} = \frac{sh.15000}{1500}$

Rate = 10%

$\frac{P \times T}{} = \frac{15,000 \times 100}{50,000 \times 3}$

= 1 x 10

Rate = 10%

2. Davis borrowed money at 12 ½% per year. After 2 years, a simple interest of sh.8, 000 was paid. Find the amount he borrowed.

P x T x R = I

P x 2 x $\frac{R}{100}$ = sh.8, 000

$\frac{P \times 2 \times 25}{200}$ = sh.8, 000

P x $\frac{1}{4}$ = sh.8, 000

4 x $\frac{1}{4}$ P = sh.8,000 X 4

Principal = Sh.32,000

Or $\frac{SI \times 100}{R \times T}$

$\frac{Sh.8, 000 \times 100 \times 2}{25 \times 2}$

= sh. 8,000 x 2 x 2

Principal = sh.32, 000

3. In what time will sh.12, 000 yield an interest of sh. 1800 at 5% per year?

Solution

P x T x R = I

12000 x T x $\frac{5}{100}$ = sh.1800

$\frac{600T}{600} = \frac{1800}{600}$

Time = 3years

or Time = $\frac{SI \times 100}{P \times R}$

$= \frac{1,800 \times 100}{12,000 \times 5}$

= 3 x 1

Time = 3 years

**ACTIVITY:**

1. Fred had sh.18,000 in the savings account. He earned an interest of sh.1, 080 in 2 years. Calculate the rate of interest he was getting.
2. Okisong deposited sh.1, 500,000 for 2 ½ years and earned sh.375, 000 as an interest. Calculate the rate of interest he was given.
3. Violet borrowed sh.500, 000 in a Bank. After 4 years, she paid a total of sh.660, 000 to clear the bank loan. What was the interest rate percentage per year?
4. Alice borrowed sh.180,000 for 3 years. He paid back a total sum of sh.216, 000. Calculate the percentage rate of interest offered to him.
5. What sum of money will yield an interest of sh.3, 000 at a rate of 4% for 3 years?
6. What sum of money will yield an interest of sh.21, 000 at 7% for 3 years?
7. What principal will yield sh.18, 000 as interest for 3 months at 20% per annum?
8. Simon borrowed sh.50, 000 at a rate of 3% and paid sh.15,000 as interest. How long did he use the money?
9. A company paid a loan plus interest worth sh.560, 000 after borrowing sh.840,000 at 10% per annum. For how long did the company use the money?

## TOPIC 6: INTEGERS

### SUB TOPIC: REVISION OF MULTIPLICATION OF INTEGERS.

Multiplication of similar signs = positive while different signs = negative.

Examples

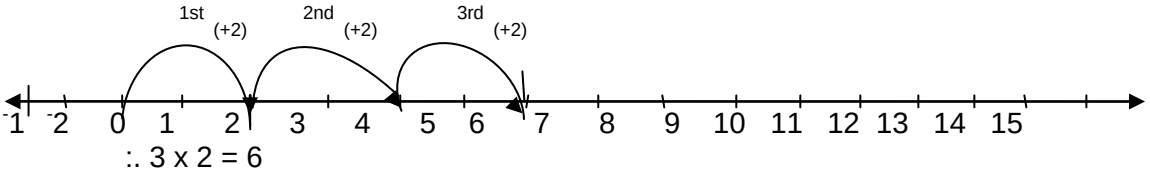
Work out:

| 1) $^{+}3 \times {}^{+}3$ | 2) $-2 \times {}^{+}3$ | 3) $-4 \times -3$ | 4) $+4 \times {}^{-}5$ |
|---|---|---|---|
| $^{+}3 \times {}^{+}3$ | $-2 \times +3$ | $-4 \times -3$ | $+4 \times {}^{-}5$ |
| $= 9$ | $= -6$ | $= +12$ | $= -20$ |

2. Work out the following using a number line:

(i). 3 x 2

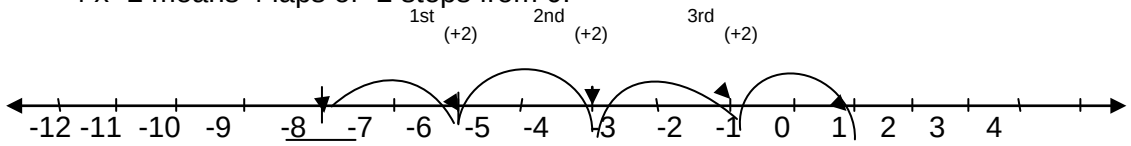
3 x 2 = means 3 laps of 2 steps from 0.




:. 3 x 2 = 6

(ii) -2 x 4 = Re-arrange (Commutative property)

4 x -2 means 4 laps of -2 steps from 0.




:. -2 x 4 = -8

**ACTIVITY**:

1. Multiply the following numbers without a number line.

| a) 3 x 3 | c) -5 x -4 | e) -4 x -8 | g) -4 x 0 | i) +2 x -7 |
|---|---|---|---|---|
| b) 8 x -3 | d) -10 x 3 | f) 3 x 9 | h) $^{+}6 \times -5$ | j) +6 x +8 |

2. Work out the following numbers using a number line.

| a) 2 x 3 | c) 5 x -3 | e) $-4 \times {}^{+}2$ | g) +3 x +3 | i) +2 x -7 |
|---|---|---|---|---|
| b) -3 x 4 | d) -5 x 2 | f) +4 x -3 | h) -2 x +4 | j) +6 x -2 |

## SUB TOPIC: REVISION ON ADDITION AND SUBTRACTION

## 1. ADDITION OF INTEGERS

Your face is a positive while your back is a negative.

Addition means moving to the positive direction moving to the direction you want is a positive (right).

Examples

Workout the following:-

a) $^{+}5 + {}^{+}3$

(i) Without using a number line

Solution

$^{+}5 + {}^{+}3 = +5 + (^{+}3)$

$= {}^{+}5 + 3$

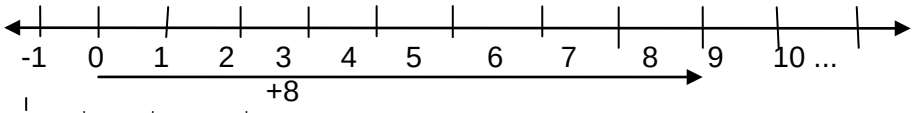
$= 5 + 3$

:. $^{+}5 + {}^{+}3 = 8$

b) Using a number line

+3

+5




∴ $= {}^{+}5 + {}^{+}3 = {}^{+}8$

**ACTIVITY:**

1. Addition the following integers.

a) $^{+}7 + {}^{+}3$ c) $^{-}5 + {}^{+}2$ e) $^{+}5 + {}^{-}2$ g) -9 + -2 i) +9 + -2

b) $^{+}2 + {}^{-}3$ d) +6 + +3 f) -4 + +7 h) +6 + -5 j) -3 + -7

**SUB TOPIC: SUBTRACTION OF INTEGERS WITH OR WITHOUT A NUMBER LINE.**

**Concepts:**

- Your back is a negative while your face is a positive.
- Backwards is a negative while forwards is a positive.
- Subtraction means moving to the negative direction (left).
- Subtraction of integers is the same as adding the opposite of second to the first.

Examples

**WITHOUT USING A NUMBER LINE**

Work out:

1. $^{+}5 - {}^{+}6$

Solution

$^{+}5 - {}^{+}6 = {}^{+}5 – ({}^{+}6) = {}^{+}5 – 6 = -1$

$^{+}5 - {}^{+}6$

opposite of +6 = -6

$^{+}5 + ({}^{-}6)$

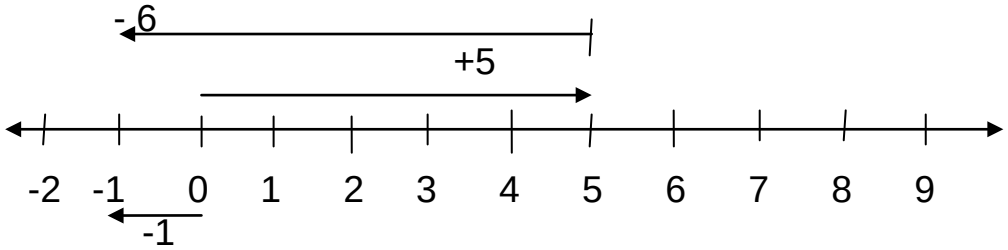
+5 - 6

= -1

OR

**USING A NUMBER LINE**

2. Subtract $^{+}5 - {}^{+}6$




∴ $^{+}5 - {}^{+}6 = {}^{-}1$

OR

+5 - +6 = +5 – (+6)

= 5 - 6

| = | -ve | +ve |
|---|---|---|
| | - - - | + + + |
| | - - - | + + |
| | -1 | Nil |

∴ $^{+}5 - {}^{+}6 = -1$

2. Work out: $^{+}4 - {}^{-}3$

Solution

$^{+}4 - {}^{-}3 = {}^{+}4 - (^{-}3)$

$= {}^{+}4 + 3$

$= 4 + 3$

$\therefore {}^{\pm}4 - {}^{-}3 = {}^{-}7$

**ACTIVITY:**

Subtract the following integers.

a) $^{+}6 - {}^{+}3$ c) $^{-}15 - {}^{+}2$ e) $-3 - {}^{-}7$ g) $+5 - {}^{-}5$ i) $-4 - {}^{-}3$

b) $^{+}13 - {}^{+}8$ d) $^{-}7 - {}^{+}8$ f) $^{-}9 - {}^{-}6$ h) $-3 - {}^{+}7$ j) $-6 - {}^{-}8$

## SUB TOPIC: SUBTRATION BY NAMING WITH LETTERS

a) **BY NAMING WITH LETTERS**

Re-name the two integers with letter a and b

Put (a) on top of the first integer then (b) on top of the second integer.

Move backwards from the second / last integer to the first one.

Examples

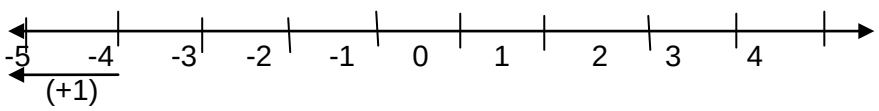
Simplify: $^{-}5 - {}^{-}4$

Solution

a ← b

$^{-}5 - {}^{-}4$

a b




$\therefore {}^{-}5 - {}^{-}4 = {}^{-}1$

b) **USING A MIND MAP.**

i) Have only one sign in the middle by multiplying.

ii) Cancel pairs of negatives and positives and take the remainder as the answer.

Example

Simplify:

a) $^{+}3 - 5$

Solution

a) $^{+}3 - 5 =$ -ve | +ve

- - - + +

- - | + + + + +

-2 | Nil

$\therefore +3 - 5 = -2$

b) $^{+}3 - {}^{-}4$

$^{+}3 - {}^{-}4 = {}^{+}3 - (^{-}4)$

$= +3 + 4$

-ve +ve

+ + + + |

+ + +

Nil +7

$\therefore {}^{\pm}3 - {}^{-}4 = {}^{\pm}7$

**ACTIVITY:**

1. Subtract the following by re-naming with letters.

a) $10 - 3$ c) $^{-}9 - {}^{-}5$ e) $^{-}2 - {}^{+}9$ g) $+5 - -3$

b) $5 - {}^{-}3$ d) $^{-}4 - 9$ f) $^{-}1 - {}^{+}10$ h) $-3 - -7$

2. Subtract the following using mind maps.

a) $^{-}12 - {}^{+}2$ c) $^{+}9 - {}^{+}11$ e) $^{-}7 - {}^{-}2$ g) $-9 - -5$

b) $^{+}7 - {}^{+}5$ d) $9 - {}^{-}10$ f) $-10 - {}^{-}12$ h) $+9 - -3$

## SUB TOPIC: DIVISION OF INTEGERS

**Concepts:**

- A negative ÷ a negative = a positive.

Examples

1. Work out: $^{-}12 \div {}^{-}3$ (- ÷ - = +) - A negative ÷ a positive

Solution

$$^{-}12 \div {}^{-}3 = \frac{^{-}12}{^{-}1} \div \frac{^{-}3}{^{-}1}$$

$$= \frac{12}{^{+}1} \times \frac{^{-}1}{3}$$

$$\therefore {}^{-}12 \div {}^{-}3 = 4$$

2) Simplify: -8 ÷ +2

$$^{-}8 \div 2 = \frac{-8}{1} \div \frac{2}{1} \quad (- \div + = -)$$

$$= \frac{8}{1} \times \frac{1}{^{-}2}$$

$$\therefore {}^{-}8 \div 2 = {}^{-}4$$

- A positive ÷ a positive = a positive

3) Divide 20 ÷ 5

Solution

$$20 \div 5 = \frac{20}{1} \div \frac{5}{1} \quad (+ \div + = +)$$

$$= \frac{20}{1} \times \frac{1}{5_1}$$

$$\therefore 20 \div 5 = 4$$

## ACTIVITY:

1. Work out the following addition and subtraction.

a) $6 - {}^{-}4$ b) $^{-}7 + {}^{-}3$ c) $^{-}11 - {}^{-}9$ d) $^{-}13 - {}^{+}13$ e) $^{-}9 - {}^{-}4$ f) $6 + 7$

2. Divide the following integers.

a) $12 \div 4$ b) $-12 \div 6$ c) $63 \div 9$ d) $-18 \div 3$ e) $-19 \div -1$ f) $50 \div -2$

## SUB TOPIC: APPLICATION OF INTEGERS

**Concepts:**

Debt = $^{-}$ve, Loss = negative, profit = positive,
Gain = positive Pay = positive
Starting time of an event = 0
Time before the start = negative
Time later / after the start = positive

Examples

1. Aguti arrived at the station 15 minutes before the normal departure time for the train to Kasese. If the train was 35 minutes late, for how long did she wait for the train?

Solution

Before departure = negative (15) minutes.
Later time = positive (35) minutes.
Duration = later time – time before departure
= (+35 - $^{-}$15) minutes
= 35($^{-}$)15
= 35 + 15

= 50 minutes

She waited for 50 minutes.

2. Tendo had a debt of shs.15,000 from each of his 3 friends. She received shs 40,000 as salary. Find Tendo's financial position after paying off his debts.

Debt = -ve (shs. ⁻ 15,000)
Total debt = shs. ⁻15,000
x 3
shs. ⁻45,000
Salary = shs. 40,000
Remaining debt = shs. ⁻45,000 + 40,000
= shs. 40,000 – 45,000
= shs. ⁻5,000
Kayemba still had a debt of sh.5,000

3. A lady born in 17 BC and died in 35 AD. How old was she when she died?
Solution
Time of birth = -17 BC
Time of death = +35 Ad
Age = Death – birth
= 35 - ⁻17
= 35(-⁻)17
= 35 + 17
= 52 years

**ACTIVITY:**

1. A geologist was born in 20 BC and died in 45 AD. How old was he when he died?
2. Teddy borrowed sh. 40,000. She received sh. 72,000 at the end of the month as salary. How much did she remain with after paying the debt?
3. Rita borrowed a loan of 35 million shillings from the bank. She used the loan and borrowed another 45 million shillings. How much does she owe the bank now?
4. In an interview, one mark is deducted for every wrong answer made and 2 marks awarded for every correct answer. What does a candidate get when she scores?
a) 3 correct answer and 2 wrong ones? b) 5 correct answers and 3 wrong ones?
5. When marking a test, a teacher awards 3 marks for every correct answer and subtracts a mark for every wrong answer. The test contained 30 questions.
a) What mark does a candidate get if he passes 20 questions?
b) A candidate gets 70 marks. How many correct answers does he get?
c) How many questions did the candidate fail?
6. Job misses a bus by 5 minutes. If the next bus arrives 5 minutes after, for how long does he have to wait for the next bus to arrive?
7. Joy moved 6 spaces forward then 3 spaces backward and 2 more spaces forward. How many spaces did he move forward?
8. A patient's temperature rose by $4^0$Cfrom $37^0$C. Later, the temperature dropped by $2^0$C. What is the patient's final temperature?

9. Joshua scored 57 points then another 20 points but lost 31 points and another 50 points. What was his final score?
10. Olivia borrowed sh.50,000. She received sh.72,000 as salary. What was her balance after paying the debt?

## SUB TOPIC: FINITE/MODULAR SYSTEM OR CLOCK ARITHMETIC

**Concepts:**

- Review addition in finite using the dial or clock arithmetic.

Examples:

1. Add 6 + 7 = ___ (finite 9)
6 + 7 = ___ (finite 9)
13 ÷ 9 = 1 rem 4
∴ 6 + 7 = 4 (finite 9)

2. 8 + 6 + 3 = ____ (finite 13)
17 = 17 ÷ 13 (finite 13)
= 1 rem. 4 (finite 13)
8 + 6 + 3 = 4 (finite 13)

3. Add: 3 + 4 + 5 = x (mod 7)
3 + 4 + 5 = x (mod 7)
12 ÷ 7 = x (mod 7)
1 rem. 5 = x (mod 7)
5 = x (mod 7)
X = 5 (mod 7)

**ACTIVITY**:

Add the following using the dial.

i) 1 + 3 =---( finite 5) ii) 2+ 3 = ----( mod 5) iii) 3 + 2 = ---( finite 4)
iv) 7 + 6 = ---( finite 8) v) 3 + 2 = ---( finite 4) vi) 3 + 4 + 7 = --(mod 12 )

## SUB TOPIC: SUBTRACTION IN THE FINITE SYSTEM

**Concepts:**

- Adding the finite then subtracting using the clock arithmetic or dial.

Examples:

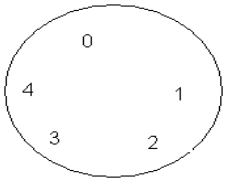
We following:ork ouit t

1) 1 – 3 = ___(finite 4)
(1 + 4) – 3 = (finite 4)
5 – 3 = 2 (finite 4)
∴ 1 – 3 = 2 (finite 4)

2) $2^2$ – 5 = ___ (finite 7)
(2 x 2) – 5 = ___ (finite 7
4 – 5 = ___ (finite 7)
(4 + 7) – 5 = ….(finite 7)
11 – 5 = 6 (finite 7)
∴ $2^2$ – 5 = 6 (finite 7)

3) 6 – 8 = ___ (finite 9)
(9 + 6) – 8 = (finite 9)
15 – 8 = 7 (finite 9)
6 – 8 = 7 (finite 9)

4) Work out: 2 – 3 = ---- (finites)




:. 2 – 3 = 4 (finites)

**ACTIVITY:**

1. Simplify:

a) 2 – 4 = --- (finite 5)  b) 1 - 2 = p (mod 5)  c) 9 – 12 = x (finite 11)

2. Work out the following using the dial.

a) 12 – 4 = ---(finite 5)  b) 5 – 8 = ---(finite 7)  c) 1 – 7 = --(mod 8)

## SUB TOPIC: MULTIPLICATION USING THE FINITE SYSTEM

- The product must be less than the finite in the equation.
- With a dial, the first number represents the laps of the second number from zero

Examples:

Simplfy the following:

1) 5 x 7 = ____ (finite 9)
= 5 x7
= 35 ÷ 9
3 rem 8
∴ 5 x 7 = 8 (finite 9)

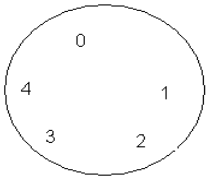
2) $2^3$ = ___(finite 7)
$2^3$ = 2 x 2 x 2 (finite 7)
= 8 ÷ 7 (finite 7)
= 1 rem. 1 (finite 7)
∴ $2^3$ = 1 (finite 7)

3) (5 x 2) = ___ (mod 6)

OR

(Mod 5) = {0, 1, 2, 3, 4}

4) Simplify: 2 x 3 = -- (mod 5) 2 laps of 3 steps from 0




:. 2 x 3 = 1 (mod 5)

## ACTIVITY:

Work out:

a) 4 x 5 = --- (mod 7)  b) $2^2$ x $3^2$ =…(finite 11)  c) $4^3$ = ……(mod 7)

d) $3^1$ x $3^0$ = --- (finite 5)  e) $4(4)^2$ =….. (mod 9)  f) 9 x 11 = …..(finite12)

g) $(2 \times 7)^2$ = ….(mod 9)  h) 4 x $3^2$ = …(finite 12)  i) 6 x 4 = …..(finite 7)

## SUB TOPIC: SOLVING EQUATIONS USING THE FINITE SYSTEM

Examples:

Work out the value of the unknown:

1) x – 4 = 3 (mod 7)
x – 4 + 4 = 3 + 4 (mod 7)
x = 7 ÷ 7 (mod 7)
x = 1 rem 0 (mod 7)
x = 0 (mod 7)

2) m + 4 = 3 (mod 5)
m + 4 – 4 = 3 – 4 (mod 5)
m = (3 + 5) – 4 (mod 5)
m = 8 – 4 (mod 5
m = 4 (mod 5)

3) 2x – 3 = 3 (finite 4)
2x – 3 + 3 = 3 + 3 (finite 4)
2x + 0 = 6 (finite 4)
2x = 6 (finite 4)
2  2
x = 3 (finite 4)

4) 2(2x – 1) = 4 (finite 7)
4x – 2 = 4 (finite 7)
4x – 2 + 2 = 4 + 2 (finite 7)
4x = 6 (finite 7)
4x = 6 + 7 (finite 7)
4x = 13 + 7 (finite 7)
4x = ~~20~~ (finite7)

4 4

X = 5 (finite 7)

**ACTIVITY:**

A. Solve the following equations

1. x – 2 = 4(finite 5) 2. y – 2 = 2(finite 5) 3. y – 5 = 4(finite 7)
4. p – 4 = 3(mod 7) 5. x – 6 = 5(mod 8) 6. m – 9 = 6(finite 12)

B. Work out the following equations

a) 2x = 3(finite 5) b) 3y = 3(mod 4) c) 3m = 5(finite 7)
d) 2(x – 2) = 1(mod 3) e) 5(x – 1) = 6 (finite 6) f) 4(x – 2) = 3 (finite 5)

**SUB TOPIC: DIVISION IN THE FINITE SYSTEM**

**Concepts:**

- Review use of dial clock in dividing numbers
- Get the multiple of the divisor then divide to get the answer ie adding the finite in the equation. OR
- Apply repeated subtraction till the result is zero, count the number of subtractions.

Examples:

1. Divide 2 ÷ 5 = ___ (Mod 7)

2 ÷ 5 = ___ (mod 7)
= 2 + 7 ÷ 5 (mod 7)
= 9 ÷ 5 (mod 7)
= 9 + 7 ÷ 5 (mod 7)
= 16 ÷ 5 (mod 7
= 16 + 7 ÷ 5 (mod 7)
= 23 ÷ 5 (mod 7
= 23 + 7 ÷ 5 (mod 7)
= 30 ÷ 5 = 6 rem 0 (mod 7

∴ 2 ÷ 5 = 6 (mod 7)

2. Work out: 1 ÷5 = --- (mod 6)

Multiple of the divisor
1 ÷5 = (mod 6)
(6 + 1) ÷ 5 = --- (mod 6)
7 ÷ 5 = -- (mod 6)
(6 + 7) ÷ 5 = -- (mod 6)
13 ÷ 5 = (mod 6)
(6 + 13) ÷ 5 = -- (mod 6)
19 ÷ 5 = --- (mod 6)
(6 + 19) ÷ 5 = -- (mod 6)
25 ÷5 = 5 (mod 6)

∴ 1÷5 = 5 (mod 6)

**ACTIVITY:**

Divide:

a) 4 ÷3 = --- (finite 5) b) 3 ÷4 = --- (mod 7) c) 5 ÷ 4 = --- (mod 7

d) 2 ÷3 = --- (finite 5) e) 3 ÷ 2 = ….(mod 5) f) 6 ÷ 9 = ..(finite12)

g) 11 ÷ 7 = ….(mod 12) h) 3 ÷ 5 = …..(finite7)

**SUB TOPIC: APPLYING FINITE 7 TO TELL THE DAY OF THE WEEK**

Concepts:

- Finite 7 is applied in the days of the week because a week has 7 days.
- Equivalences of finite 7

| Sun | Mon | Tue | Wed | Thu | Fri | Sat |
|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |

- "will it be" – means future or forward movement - add.
- "was it ago" – means past or backward movement– subtract.

Examples:

1. Today is Thursday, what day of the week will it be 82 days from today?

Solution:

Thursday is represented by 4

4 + 82 = ___ (finite 7)

86 = ___ (finite 7)

86 ÷ 7 = __ (finite 7)

12 rem 2

2 stands for Tuesday

The day of the week will be Tuesday.

2. Today is Tuesday what day of the week was it 85 days ago.

2 represents Tuesday

2 – 85 = ___ (finite 7)

2 – 85 = – (finite 7)

2 – 85 ÷ 7 = 12 rem 1

2 – 1 = 1 (finite 7)

1 stands for Monday.

The day of the week was Monday.

3. Today is Wednesday, 14th June, what day of the week will it be on 20th August the same year?

Solution

Days from 14th June to July = 30 – 14 = 16 days

Days from July to August 20th = 31 + 20 = 51 days

Total days = 51 + 16 = 67 days

Day + Days = ------- (finite 7)

3 + 67 = -------- (finite)

3 + 67 = 70 (finite 7)

70 ÷7 = 10 r 0 (finite 7)

:. 3 + 67 = 0 (finite 7)

O stands for Sunday

The day of the week will be Sunday

4. If today is Thursday 18th August. What day of the week was it 15th April of the same year?

Solution

Days from April to May = 30 – 15 = 15 days

Days from May to August = 15 April + 31 May + 30 June + 31 July + 18 August = 125 days.

Day – Days given = ------ (finite 7)

$4 - \frac{125}{7}$ = -- (finite 7)

4 – (125 ÷7 )= 17r (6) (finite 7)

4 – 6 = ---- (finite 7)

(7 + 4) – 6 = -------- (finite 7)

11 – 6 = 5 (finite 7)

:. 4 – 125 = 5 (finite 7)

5 stands for Friday

The day of the week was Friday

**ACTIVITY:**

1. Today is Tuesday, what day of the week will it be 16 days from now?
2. If today is Friday, what day of the week will it be 27 days from today?
3. Today is Tuesday, what day of the week was it 6 days ago?
4. If today is a Wednesday, what day of the week was it 172 days ago?
5. If today is Friday, what day of the week will it be 536 days from now.
6. If today is Saturday, what day of the week will it be after 85 days from now?
7. Given that today is Tuesday. What day of the week was it 46 days ago?
8. It is given that today is Monday. What day of the week will it be after 1234 from now?
9. Today is Thursday. What day of the week was it 169 days from now?
10. Today is Sunday. What day of the week will it be 281 days ago?
11. Today is Wednesday 12th July. What day of the week will it be on 15th August the same year?
12. If today is Thursday, 26th June 1996, which day of the week was it on 11th September 1996?
13. If today is Monday 10 th March, what day of the week will it be on the 21 st May, this same year?
14. Akello reported back to her office on Tuesday 14 th October, 2012. If she had left on 18 th May, 2012, which day was it?
15. If 5 th November, 2014 was Wednesday, what day of the week was 30 th January, 2015?

**SUB TOPIC: APPLYING FINITE 12 TO TELL THE MONTH OF THE YEAR**

Finite 12 is applied in the months of the year because 12 months make up a year.

Equivalences

| J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | t | e | 0 |

Examples

1. This month is July. Which month of the year will it be after 2132 months?

Solution

Month + months = --- (finite 12)

7 + 2132 = -- (finite 12)

7 + 2132 = --- (finite 12)

7 + 2132 = 2139 (finite 12)

$2139 \div 12 = \frac{2139}{12}$ (finite 12)

= 178 rem (3) (finite 12)

:. 7 + 2132 = 3 (finite 12)

3 stands for March

The month will be March

2. It is April now. Which month of the year was it 346 months ago?

Solution

Month – months = --- (mod 12)

$4 - \underline{346}$ = --- (mod 12)

12
28
4 – ~~346~~ = 28 rem 10 (mod 12)
~~12~~
4 – 10 = --- (mod 12)
(12 + 4) – 10 = --- (mod 12)
16 – 10 = 6 (mod 12)
:. 4 – 346 = 6 (mod 12)
6 stands for June
The month month of the year was June

**ACTIVITY:**
1. It is February now. Which month of the year was it 134 months ago?
2. If this month is September, which month of the year will it be 242 months from now?
3. It is October now, which month of the year will it be 92 months to come?
4. Karuma was born 1341 months ago, in which month was he born if it is August now?
5. If this month is October, which month of the year will it be 438 months to come?

**SUB TOPIC: APPLYING FINITE 12 TO TELL TIME OF THE DAY**

**The 12 hour clock**

- ✓ Finite 12 can also be applied in the 12 hour clock system.
- ✓ An odd quotient got changes in "pm to am" and or "am to pm".
- ✓ An even quotient got doesn't make any given time.

Examples:
1) It is 7:00 am. What time will it be after nine hours from now?
Solution:
7 + 9 = __ (finite 12)
16 = __ (finite 12)
16 ÷ 12 = 1 rem 4(finite 12) – odd quotient
It will be 4:00pm

2) It is 11:00 pm what time will it be nineteen hours from now?
Solution:
11 + 19 = __ (finite 12)
30 = __ (finite 12)
30 ÷ 12 = 2 rem 6 (finite 12) – even quotient
It will be 6:00pm

**ACTIVITY:**
1. It is 3:00am now. What time will it be after 14 hrs now?
2. A plane left London at 7:30am. If it landed at Entebbe after 36 hrs, at what time did it land?
3. A meeting started at 8:00am, if lasted for 8hrs, at what time did it end?
Cissy travelled for 81hrs after leaving at 2:00pm. At what time did she arrive at her destination?

4. A train left Mombasa at 5:00am, it reached Kasese after 83hrs. Find its arrival time.
5. It is 9:00am, what time will it be after 17 hrs from now?
6. It is 10:00pm now, what time will it be after 42hrs from now?

## SUB TOPIC: APPLYING OF FINITE SYSTEM IN GROUPING ITEMS

- Get the equivalent numbers of each given finite.
- From the equivalent numbers, get the common factor/ number to be the answer.

Example:

Mr.Onyango bought some pens. When he grouped them in groups of nines, seven pens were left and when they grouped them in groups of 8's, 4 pens were left and when they grouped them in 3's only 1 pen was left. How many pens were bought by the head teacher?

Solution:

7 (finite 9) = 7, 16, 25, 34, 43, 52, 61……
4 (finite 8) = 4, 12, 20, 28, 36, 44, 52, 60….
1 (finite 3) = 1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 40, 43, 46, 49, 52, 55….

The common number for all is 52 so they were 52 pens.

## ACTIVITY:

1. What is the least number of cows such that when divided by 4 people 3 cows remain, when divided by 8 people 7 cows remain?
2. Find the least number such that when divided by 5, 2 remain and when divided by 8, 3 remain.
3. M is a number when divided by 7, the remainder is 6, when divided by 3, 1 remains and when divided by 9, 7remains. Find the value of M.
4. A man had some oranges, when he grouped them in heaps of 6, 5 oranges were left and when he put them in heaps of 7, 6 remained. How many oranges did he have?
5. A class teacher arranged the children in his class in groups of 15 pupils, but 10 remained when he arranged in groups of 11 pupils, 8 remained, find the least number of pupils in that class.

## TOPIC 7: DATA HANDLING – (STATISTICS)

## SUB TOPIC: MODE, MEDIAN, RANGE AND MEAN

Example:

1. The table below represents the goals scored by different teams.

| Goals scored | 2 | 3 | 6 | 7 | 10 |
|---|---|---|---|---|---|
| Number of teams | 4 | 1 | 2 | 1 | 2 |

a) How many teams were represented on the table above?
Number of teams = 4 + 1 + 2 + 1 + 2
= 10 teams

(b) Find the mode score.

Modal score = most common score

= 2 goals

(c) What was the modal frequency?

Modal frequency = 4 times

(d) Calculate the medium (median).

Medium (median) = middle score after re-arranging according to size.

= 2, 2, 2, 2, 3, 6, 6, 7, 10, 10

Middle numbers are 3 and 6

$$\text{Even median} = \frac{3 + 6}{2}$$

$$= \frac{9}{2}$$

= 4 ½ or 4.5

(e) Calculate the mean and range.

$$\text{Mean (average)} = \frac{\text{sum of items}}{\text{Number of items}}$$

$$= \frac{(2 \times 4) + (3 \times 1) + (6 \times 2) + (7 \times 1) + 10 \times 2)}{4 + 1 + 2 + 1 + 2}$$

$$= \frac{8 + 3 + 12 + 7 + 20}{10}$$

$$= \frac{50}{10}$$

Mean = 5

(f) Range = Hv – Lv

= 10 – 2

Range = 8

2. Find the median of the following scores 3, 1, 2, 0, 6, 1, 4

First re-arrange in order of size = 0, 1, 1, **2**, 3, 4, 6

Medium (median) = 2

**ACTIVITY:**

1. Atai scored the following marks in a series of tests:
80 , 20 , 60 , 10 , 30 , 70 and 80. Work out the;

a) mode. b) range. c) median.

d) modal frequency. e) mean.

2. The marks below were scored by P.7 pupils in a weekly test marked out of 20:
18 , 12 , 10 , 18 , 14 , 20 , 18 , 12 , 10 , 16 , 15 , 18 and 14.

a) Tabulate using tallies. b) Find the modal frequency.

c) Find the range. d) What is the mode?

e) Find the median. f) Calculate the mean.

3 . Use the table below to answer the questions that follow:

| Marks scored | 50 | 40 | 20 | 60 |
|---|---|---|---|---|
| No. of pupils | 1 | 2 | 1 | 5 |

a) How many pupils sat for the test? b) What was the modal frequency?

c) Work out the range of the scores?
d) Calculate the mean mark of pupils who scored 60marks and above.

4. The table below shows the marks attained by a group of candidates in a test.

| Percentage mark | 92 | 70 | 86 | 88 |
|---|---|---|---|---|
| Frequency | 5 | 2 | 4 | 1 |

a) How many candidates were in this group?
b) How many candidates in this group scored above the average mark?

5. The table below shows marks obtained by some primary six pupils in a Mathematics test.

| Marks obtained | 40 | 55 | 70 | 60 | 80 |
|---|---|---|---|---|---|
| No. of pupils | 1 | 4 | 1 | 3 | 1 |

a) How many pupils did the test? b) What was the modal mark?
c) Find the median mark. d) Calculate the mean.

## SUB TOPIC: APPLICATION OF MEAN (AVERAGE)

**Concepts:**

1. The mean of y + 1, 5 and y is 6. Find the value of y.

**Solution**

$$\frac{(y + 1) + 5 + y}{3} = 6$$

$$\frac{y + 1 + y + 5}{3} = 6$$

$$3 \times \frac{2y + 6}{3} = 6 \times 3$$

$$2y + 6 = 18$$

$$2y + 6 - 6 = 18 - 6$$

$$\frac{2y}{2} = \frac{12}{2}$$

$$\mathbf{y = 6}$$

2. The average of a, a – 7, 3 and 2a is 8.

(a) Find the value of a.

Solution

$$\frac{a + a + 3 + 2a + 3 - 7}{4} = 8 \times 4$$

$$\frac{4 \times (a + a + 2a + 3 - 7)}{4} = 8 \times 4$$

$$4a - 4 = 32$$

$$4a - 4 + 4 = 32 + 4$$

$$\frac{4a}{4} = \frac{36}{4}$$

$$\mathbf{a = 9}$$

(b) Find the range.

Solution

(i) a = 9 (ii) a – 7 (iii) 2a = 2 x a ( iv) 3

9 – 7 = 2 x 9

= 2 = 18

Range = Hv – Lv

= 18 – 2

= 16

**ACTIVITY:**

1. T he mean of 4, 3x, 2 and 3 is 3. Find the value of x.
2. The average of the scores 5, 9, k, 7 and 5 is 6. Find the value of k.
3. The mean of 5, 9, p+2, 6 and 4 is 7.

a) Find the value of p. b) Work out the range of the numbers.

4. Find the mean of p-2, 2p and 5.
5. What number is half way of 2/3 and 1/4?
6. The mean of six numbers is 11. If the numbers are 4, 8, 10, y,15 and 17.

a) Find the value of y. b) Find the median number.

7. Candidates scored the following marks in a test:

| Percentage mark | 42 | r | 58 | 49 | 83 |
|---|---|---|---|---|---|
| No. of candidates | 3 | 2 | 1 | 3 | 1 |

a) How many candidates sat for the test?

b) If the average mark is 48, find the value of r. c) Work out their range.

**SUB TOPIC: MORE APPLICATION OF INVERSE OF AVERAGE**

Example 1:

1. The average of 4 boys in a group is 12 years. A young boy of 7 years joined the group. Find the average age of the 5 boys.

$$\text{Mean} = \frac{\text{Total age}}{\text{Number of boys}}$$

Total age of 4 boys = Mean age x number of boys

= 12 x 4

= 48 years

$$\text{Mean age of 5 boys} = \frac{\text{Sum of ages}}{\text{Number of boys}}$$

$$= \frac{48 + 7}{5}$$

$$= \frac{55}{5}$$

**The mean age of the 5 boys = 11 years.**

Example 2:

The average mark of 36 pupils in a class is 5. Two pupils whose marks are 20 and 24 leave the group. Find the average mark of the remaining pupils.

Total marks of 5 pupils = average x Number of pupils

= (36 x 5) marks

= 180 marks

Total marks of 2 pupils who left = (20 + 24) marks

= 44 marks

Remaining marks of 3 pupils = (180 – 44) marks

= 136 marks

$$\text{Average marks of 3 remaining pupils} = \frac{\text{Total marks}}{\text{Number of pupils}}$$

$$= \frac{136}{3}$$

$= 45\frac{1}{3}$ marks

**ACTIVITY:**

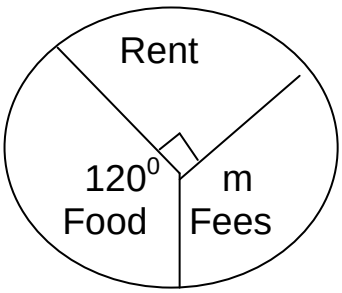
1. The average weight of 3 boys is 18kg. If two of the boys weigh 16kg and 15kg, what is the weight of the third boy?
2. The mean weight of 3 boys is 36kg. Two of the boys weigh 35kg and 40 kg. Find the weight of the third boy.
3. The average age of three girls in a class is 12 years. If the third girl whose age is 14 years leaves the class, find the age of the third girl.
4. The average mass of five boxes is 55kg. Two boxes of average mass 40kg were removed. What is the average mass of the remaining boxes?
5. The mean mass of 4 boys is 22kg. When the fifth boy joins them, their mean mass becomes 20kg. Find the mass of the 5th boy.
6. The average weight of 7 girls is 42kg. If four of the girls whose average weight is 48kg leave the group, find the average weight of the remaining girls.
7. The average weight of 4 boys is 34kg. If three of the boys weigh 40kg , 30kg and 28kg. Find the weight of the fourth boy.
8. The average age of 2 candidates is 30 years. When their sister joins the group, their average age is 28years. Find the age of the sister.
9. The average age of 10 boys is 12 years. When two boys leave the group, their average age becomes 11 years. What is the average age of the two boys?

**SUB TOPIC: INTERPRETING INRFORMATION ON PIE CHARTS**

- A pie chart or circle graph is a circle which contains data.
  - Fractions which totals up to 1 whole number, percentages which add up to 100% and degrees which add up to $360^0$.
- All the parts of a pie-chart are called sectors.

Example 1:

1. The pie chart below represents Mugisha's monthly expenditure and saving. If he earns sh.72,000;




(a) How much does he spent on fees?

M + 90 + 120 = 360˚

M + 210 = 360˚

M + 210 – 210 = 360˚ – 210˚

**M = 150˚**

**Fees**

150 x sh.72,000

360˚

15 x sh.2,000

**= Sh.30,000**

(b) What percentage of his salary is spent on food?

$= \frac{120}{360} \times 100\%$

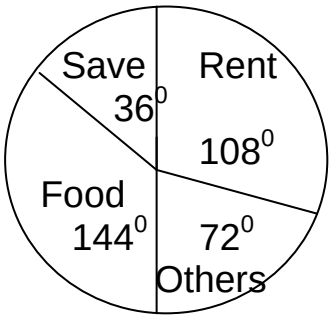
$= \frac{1}{} \times 100\%$

$$= \frac{100}{3}\%$$

$$= 33\frac{1}{3}\%$$

Example 2:

1. The pie chart below shows the monthly expenditure and savings of Mr Mugisha who earns sh.72,000




(a) How much does he spend on each item?

| Food = $144^0$ | Rent = $108^0$ | Others = $72^0$ | Savings = $36^0$ |
|---|---|---|---|
| $\frac{144}{360}$ x sh.72000 | $\frac{108}{360}$ x sh.72000 | $\frac{72}{360}$ x sh.72000 | $\frac{36}{360}$ x 72000 |
| Sh.(144 x 200) | sh.(108 x 200) | sh.(72 x 200) | sh.(36 x 200) |
| Sh.28,800 | sh.21,600 | sh.14,400 | sh.7,200 |

(b) Change the given degrees to percentages.

Food = $\frac{144}{360} \times 100\%$

= (4 x 10)%

= 40%

Rent = $\frac{108}{360} \times 100\%$

= (3 x 10)%

= 30%

Others = $\frac{72}{360} \times 100\%$

= (2 x 10)%

= 20%

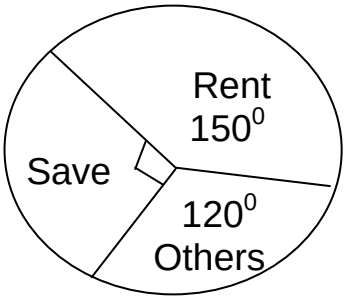
Savings = $\frac{36}{360} \times 100\%$

= (1 x 10)%

= 10%

**ACTIVITY:**

1. The pie chart below shows a man's expenditure and savings if he earns sh.10,800.



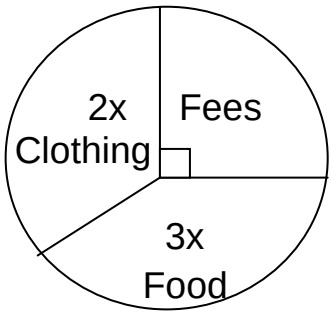

(a) How much does she spend on rent?

(b) Express the savings as a percentage of the total.

(c) How much more does he spend on other than he saves?

2. The pie chart below shows Mr. Ofamba's monthly expenditure.

`




a) Find the value of x.
b) If he spends shs360,000 0n fees, calculate his total monthly expenditure.

4. The pie chart below shows the number of pupils in P.5, P.6 and P.7 in Dream Africa School- Kansanga campus.

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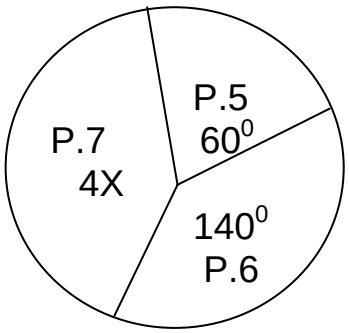


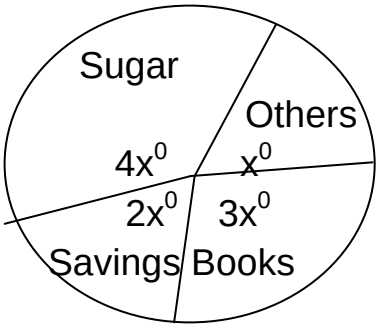

a) Find the value of X.
b) If there are 18 more pupils in P.7 than in P.6, find the total number of pupils in the three classes?

**SUB TOPIC: INTERPRETING PIE- CHARTS FROM UNKNOWNS**

- Total for all the sectors is $360^0$
- Substitute for the value for each sector and solve the problem.

**Examples**

**1.** David was given sh.12,000 for his pocket money and spent it as below.




a) Find the value of x

Solution

$4x^0 + 3x^0 + 2x^0 + x^0 + 360^0$

$4x + 3x + 2x + x = 360$

$\frac{10x}{10} = \frac{360}{10}$

**$X = 36$**

(a) How much does he save?

Savings = $2x$ $\quad\quad$ $\frac{72}{360}$ x sh.12, 000

$= 2 \times 36^0$ $\quad\quad$ = 2 x sh, 1,200

**$= 72^0$** $\quad\quad$ **= sh.2, 400**

(b) How much does he spend on sugar than on books

Solution

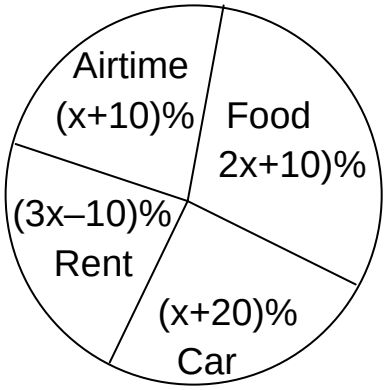
| Sugar = 4x | Books = 3x | Difference |
|---|---|---|
| $= 4 \times 36^0$ | $= 3 \times 36^0$ | $= 144^0 - 108^0$ |
| **$= 144^0$** | **$= 108^0$** | **$= 36^0$** |

= $\frac{36}{360}$ x sh12, 000

= 1 X sh.1, 200

= **Sh.1,200 more**

2. The pie chart below represents the expenditure of a family.




(a) Find the value of x.

$(x + 10)\% + (3x - 10)\% + (x + 20)\% + (2x + 10)\% = 100\%$

$x + 3x + x + 2x + 10 + 20 + 10 - 10 = 100\%$

$7x + 30 = 100$

$7x + 30 - 30 = 100 - 30$

$\frac{7x}{7} = \frac{70}{7}$

**$x = 10$**

(b) If the family spends sh 40,000 more on car than on rent, find the family's total expenditure.

| %ge of car | %ge of rent | Difference in %ge |
|---|---|---|
| x + 20% | 3x – 10% | 30% - 20% |
| 10% + 20% | 3 x 10% - 10% | **10%** |
| 10% + 20% | 30% - 10% | |
| **30%** | **20%** | |

Total expenditure in % = 100%

10% represents sh. 40,000

1% represents sh. $\frac{40,000}{10}$

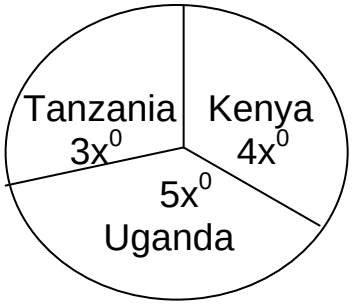
100% represents 100 x sh.4,000

= sh.400,000

The family's total expenditure is sh.400,000

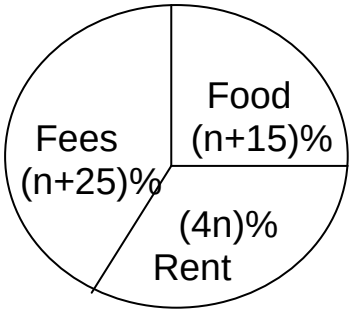
**ACTIVITY:**

1. The graph below represents how USD 48,000 donated by the European Community to some of the African countries were distribute




a) Find the value of x in degrees.
b) How much money was given to each of the three countries?
c) How much more did Uganda get than Tanzania?
d) What percentage of the donation went to Ken?

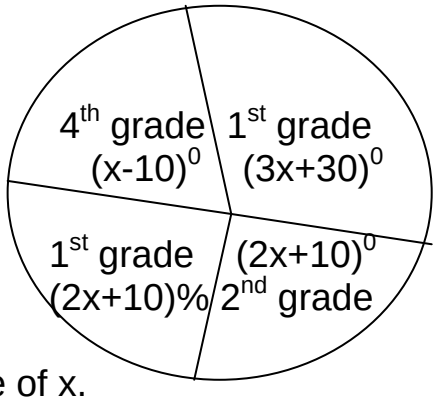
2. The pie chart below shows how Noeline spent her monthly salary.




`

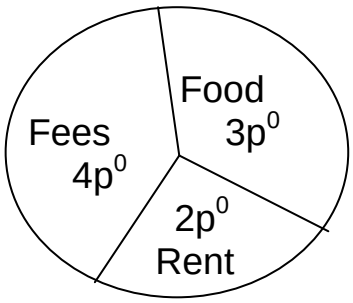
a) Find the value of n.
b) If she spends shs240,000 on rent, how much money does she earn in a month?
c) What percentage of her salary does she spend on food?

3. The pie chart below represents the grades obtained by candidates in Okwara Primary School in Tororo District in 2019 PLE. Use the information to answer the questions that follow.



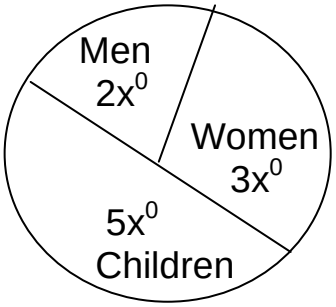

a) Find the value of x.
b) If the number of candidates who got $3^{rd}$ grade were 35, what was the total number of candidates who sat for PLE?

4. The pie chart below shows how Tr. Leonard's monthly expenditure. Study it carefully and answer the questions that follow.



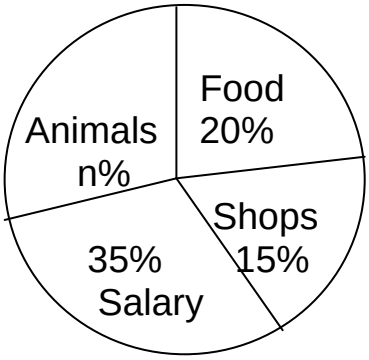

a) Calculate the value of p in degrees.
b) If her monthly income is shs540,000. How much money is spent on food?
c) What percentage of her income does she spend on rent?

5. The pie chart shows the total population in Maliri village in Tororo District.




a) Calculate the degrees representing children in Maliri village.
b) If there are 9,600 more children than men who live in Maliri village, how many people are in this village?

6. The pie- chart shows the monthly income of Mr. Apedun. Use it to answer the questions that follow.




a) Find the value of n.
b) If he earns sh.180,000 from the sales of food, find his total earnings.

**SUB TOPIC: DRAWING PIE CHARTS GIVEN FRACTIONS, PERCENTAGES AND QUANTITIES**

- Total percentage is 100%

- Express each percentage out of the total x $360^0$.
- Add all the given quantities first then express each quantity as a fraction of the total then multiply by $360^0$
- Construct an accurate pie-chart using given radius.

Examples

1. Akon spends ¼ of his income on rent, $^4/_9$ of the remainder on food and saves the rest.

(a) What fraction does she save?

Solution

Fraction for rent = ¼

Remaining fraction = $\frac{4}{4} - \frac{1}{4}$

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

$\frac{3}{4}$

Fraction for food = $\frac{4}{9} \times \frac{3}{4}$

$= \frac{1}{3}$

Fraction for savings $\frac{3}{4} - \frac{1}{3}$

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

$= \frac{5}{12}$

(b) Using the above information, draw an accurate pie chart.

Solution

**Rent** $\frac{1}{4} \times 360^0$

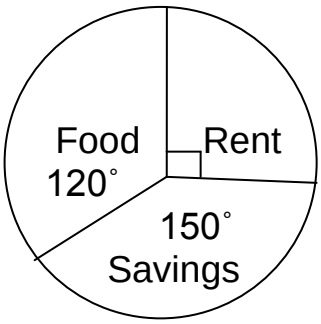
**90°**

**food** $\frac{1}{3} \times 360^0$

**120°**

**savings** $\frac{5}{12} \times 360^0$

**150°**




2. In a certain town, 40% of the population are Baganda, 10% are Basoga, 30% are Bagisu and the rest are Acholi.
   Draw an accurate pie-chart for the above information.

Baganda $\frac{40}{100} \times 360$

$4 \times 30$

**144°**

Basoga $\frac{10}{100} \times 360$

$1 \times 36$

**36°**

Bagisu $\frac{30}{100} \times 360$

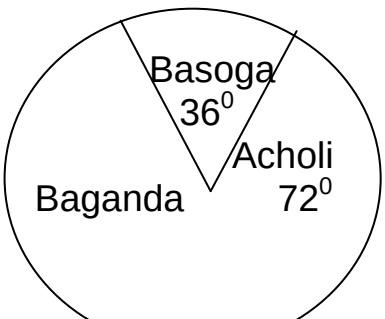
$3 \times 36$

**108°**

Acholi $360 - (144 + 36 + 108)$

$360 - 288$

**72°**



$144^0$ $108^0$

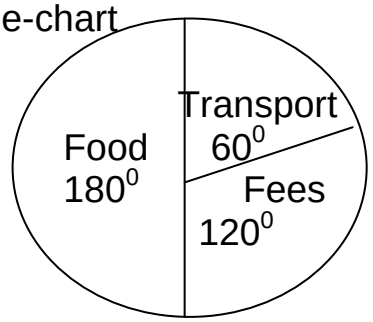
Bagishu

3. Dickens spends his monthly salary as follows; sh. 12,000 on school fees, sh. 6,000 on transport and sh. 18,000 on food

Draw an accurate pie chart for this information

| Total expenditure | Fees | Transport | Food |
|---|---|---|---|
| Sh. 12,000 | $\frac{12000}{36000} \times 360^0$ | $\frac{6000}{36000} \times 360^0$ | $\frac{18000}{36000} \times 360^0$ |
| Sh. 6,000 | | | |
| Sh. 18,000 | $= 120^0$ | $= 60^0$ | $= 180^0$ |
| **Sh. 36,000** | | | |

Accurate pie-chart




**ACTIVITY:**

1. The table below shows how Mr. Mutu spends his salary.

| ITEMS | FEES | TRANSPORT | FOOD | OTHERS | CAR |
|---|---|---|---|---|---|
| PERCENTAGE | 15% | X% | 20% | 10% | 15% |

(a) Calculate the value of X.

If he spends shs 60,000 on others, calculate his salary.

Using a radius of 3.5cm, draw a pie- chart to represent the information.

2. Liz spends ½ of her income on food, 2/5 of the remainder on transport and saves the rest.

a) What fraction of her income does she save?

b) If she saves sh.93, 000. How much does she earn?

c) Using a radius of 3.5cm, draw a pie- chart to represent the above information

3. A man spends 35% of the money on medical treatment, 50% on meals and saves the rest of the money. Construct an accurate pie-chart to represent his expenditure. (Use radius of 4cm)

4. A farmer used ¾ of his land to grow coffee, ½ of the remainder to grow food and the rest for growing pasture. Draw a pie-chart to represent the information. (Use radius of 4.5cm)

5. Geoffrey uses his pieces of land as follows: 5 hectares for growing Vanilla, 10 hectares for growing Coffee, 20 hectares for growing Bananas and 25 hectares for growing pastures.

Using a radius of 5cm, draw a pie-chart and represent the above information.

6. A farmer planted crops on his land as follows:

$\frac{2}{5}$ of the land for maize growing

$\frac{1}{}$ of the land for Banana growing

3
1 of the land for Cassava growing
5

The remaining land was planted with Elephant grass.
Draw a pie-chart to represent the information above.

7. In our class library, there are 30 textbooks for English, 45 for Mathematics, 35 for Science and 40 for Social Studies. Draw a pie chart of radius 4cm to represent the information above.

8. The pie- chart below shows how a farmer uses his plot of land to plant his crops:

- 20 acres for maize.
- 10 acres for rice.
- 6 acres for Matooke.

Represent the information above on a pie- chart using a radius of 4cm.

9. Jude had the following monthly expenditure: Fees sh.10,000 , theatre sh.8,000, transport sh.12,000 and house rent sh.6,000. Draw a pie-chart to represent his expenditure.

10. Out of 60 candidates who sat for P.L.E at Merikit Primary School, 20 got Grade 1, 25 got Grade II and the rest got Grade III. Draw a pie-chart to represent the information. (Use radius of 3.5cm)

**TOPIC: INTERPRETATION OF GRAPHS AND DATA**
**SUB TOPIC: CO – ORDINATE GRAPH**

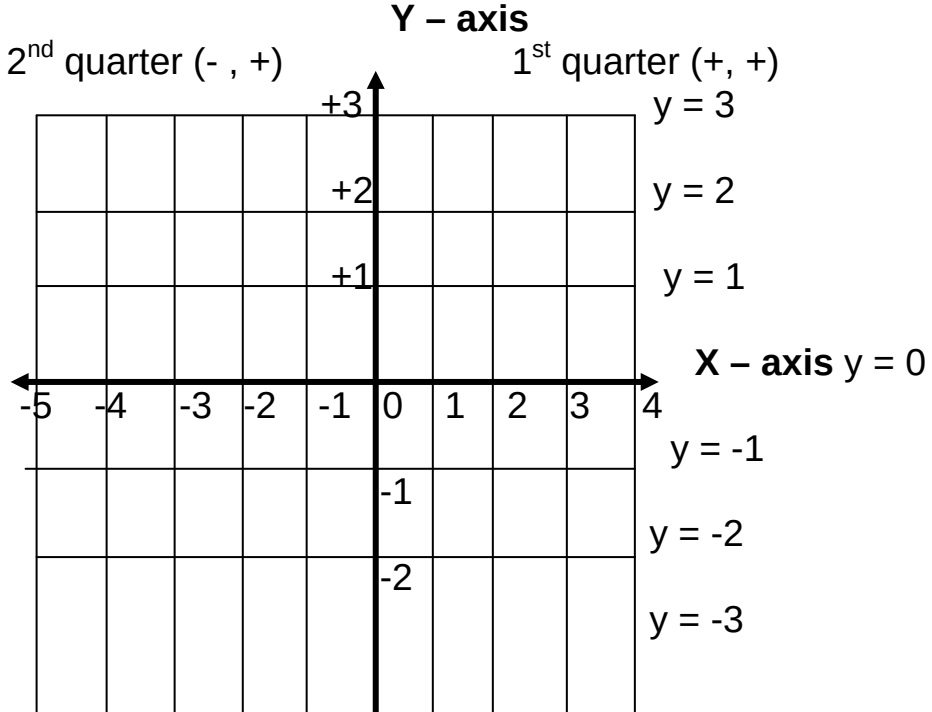
- ✓ Co-ordinates – are ordered pairs of numbers used to mark or plot a point on a graph in the order x : y.

a) The X – axis is the horizontal number line in the graph.
b) The Y – axis is the vertical number line in the graph.

- ✓ The point of origin is the area where the two axes cross each other.
- ✓ The grid (Cartesian plane) is the surface containing the X and Y axes.
- ✓ The four quadrants of a grid or the four (quarters) are the divisions of a grid showing the co-ordinates as shown on the graph below.

**Identifying the given points on a grid**

Example:



-3

y = -4

x=-5 x=-4 x=-3 -4x=0

3rd quarter (-, -) 4th quarter (+, -)

- X – lines and y – lines are named according to the points through which they cross on the x and y – axes.

a) Name the vertical line numbered “x= 0”

- The vertical line “x = 0” is the y – axis.

b) Name the horizontal line numbered “y = 0”.

- The horizontal line numbered “y = 0” is the “x – axis”.

c) What name do we give to point “0” on the grid?

- Point 0 on the grid is “point of origin”.

**ACTIVITY:**

Draw 10 vertical lines and 10 horizontal lines to cross the vertical lines then name the following lines.

1) x = 2 2) x = 4 3) x = -3 4) x = -5 5) y = 3

6) y = 5 7) y = -1 8) y = -4 9) y = -6

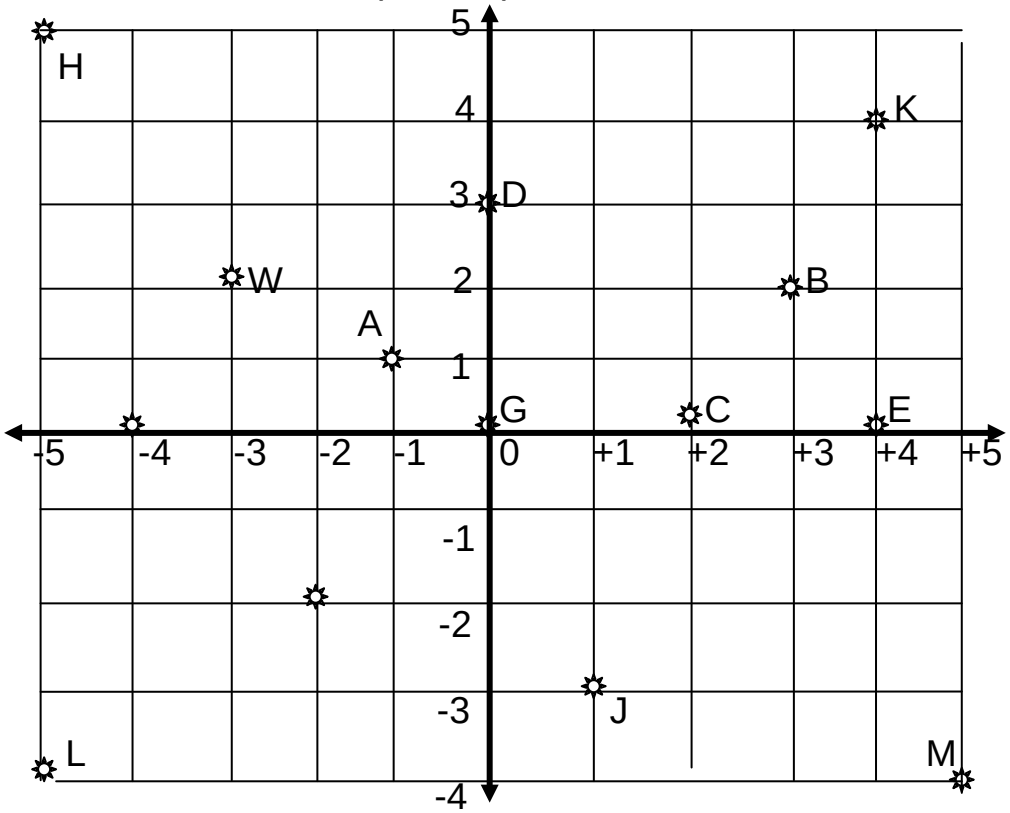
**SUB TOPIC: FINDING THE CO-ORDINATES OF A POINT ON A GRID**

**Concepts:**

- Co – ordinates are plotted in the order of (x, y) i.e. 1st in X – axis and 2nd in Y – axis.
- To name the co-ordinates of a point formed, start by naming the x – line then the y – line i.e (x, y)

Example

Name the coordinates of the plotted points below.




(i) Point A x = +1, y = +1 (ii) Point B x = 3, y = 2 (iii) Point C x = 2, y = 0

A (+1, +1) B (+3, +2) C (+2, 0)

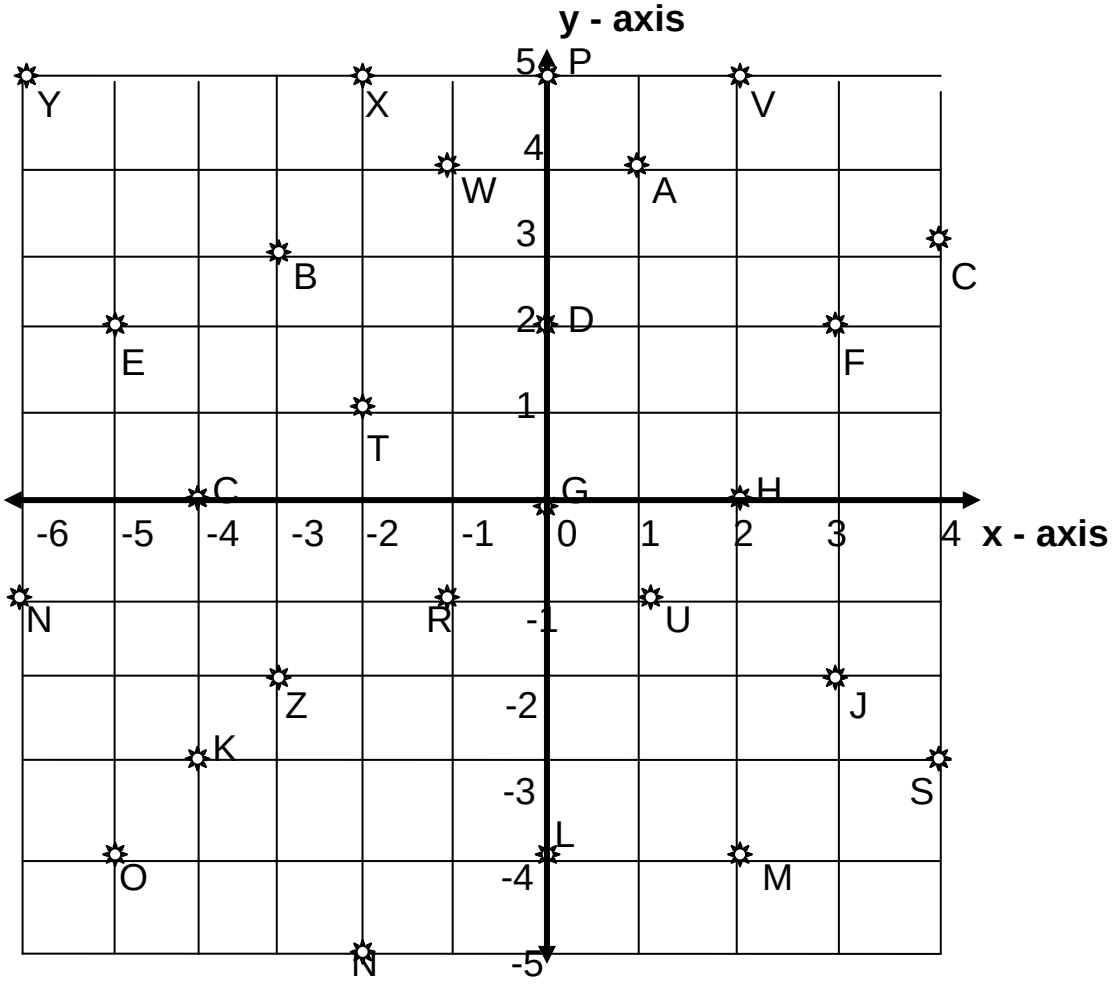
(iv) Point D x = 0, y = 3 (v) Point E x = 4, y = 0 (vi) Point F x = -2, y = -2

D (0, 3) E (4, 0) F(-2, -2)

(vii) Point G x = 0, 0)  (viii) Point H x = -5, y = 5  (ix) Point J x= 1, y = -3

Exercise

Name the co-ordinates for the given points on the grid below.




**SUB TOPIC: PLOTTING CO-ORDINATES ON THE GRID**

- To plot or mark a point on a grid, start reading from x – line then read the y – line.

Example

Draw 8 by 6 grid and plot the following points.

A (-3,2)  B (3,2)  C (0,1)  D (2,0), E (1,-2)  F(-2,-2) G(-4, -2)  H(+4, -3)

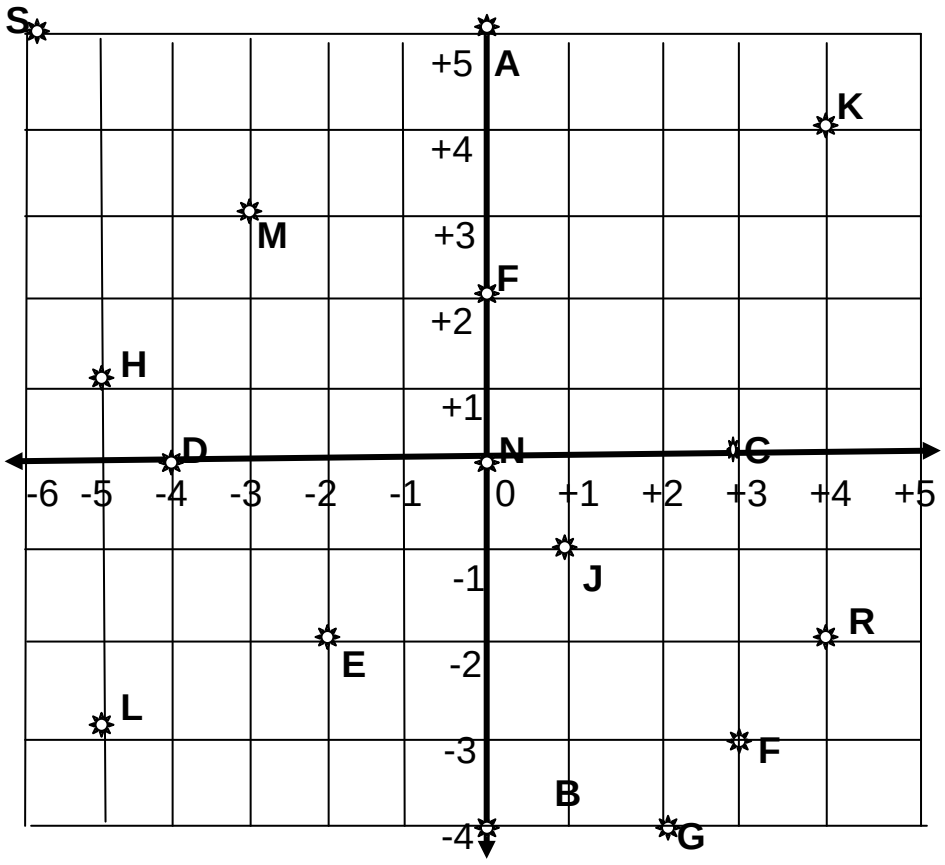
Example 2

Plot the following points on a grid

1. A(0,5)  2.  B(0,-4)  3. C(3,0)  4.  D(-4,0)  5. E(-2,-2)  6) F(+3,-3)

7. G(+2,-4)  8. H(-5,+1)  9. K(4,4)  10. J(+1, -1)  11) L(-5, -3) 12) N(0, 0)

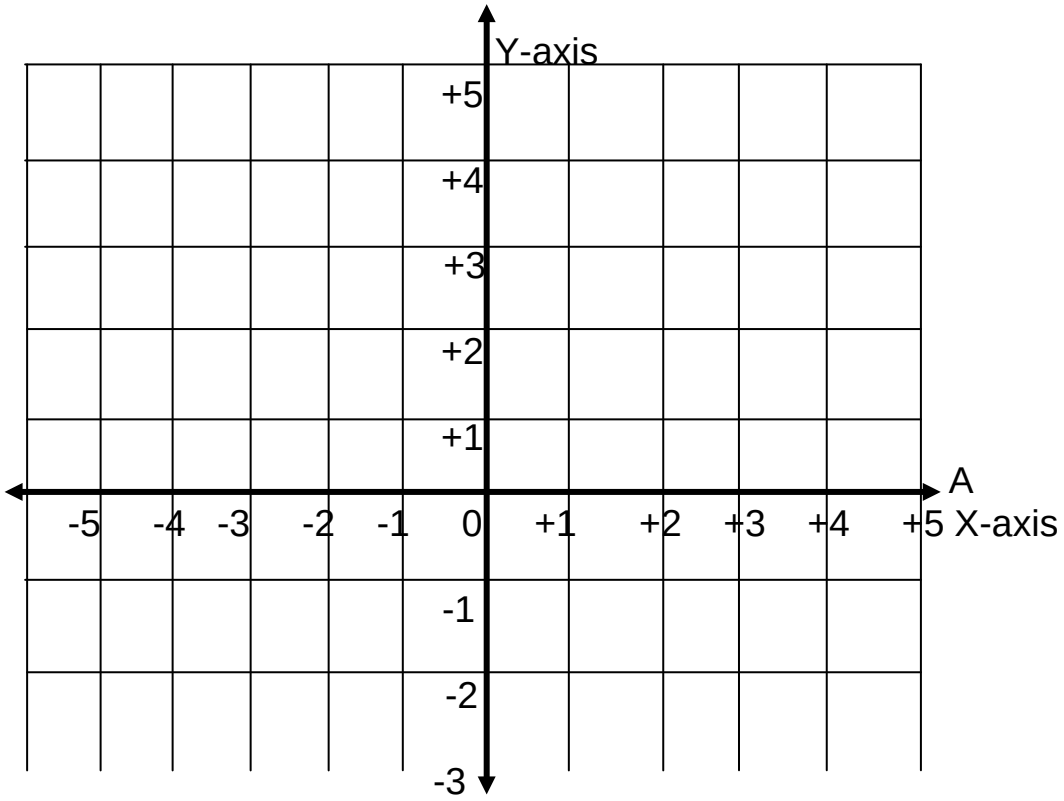
13) M(-3, +3)  14) R(+4, -2)  15)  **S**(-6, +5)



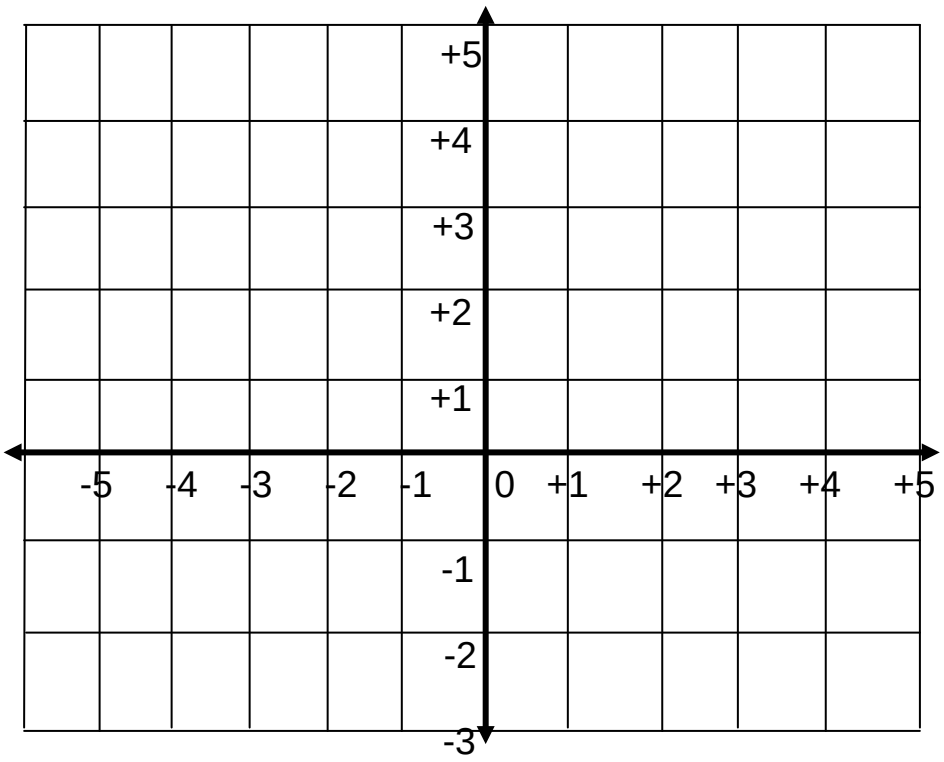

**ACTIVITY:**

1. Plot following points on the grid below..

a) Point A(2, 2) b) Point E (3, 4) c) Point C(4, 1) d) Point G(0, -5)
e) Point D(3, 2) f) Point H(2, 0) g) Point F(-3, 0)



2. Use the co-ordinate graph below to plot the following points.
a) A (4, 4) b) B(-5, 2) c) C(0, 0) d) D(3, 5) e) P(2, 2) f) Q(2, -4)

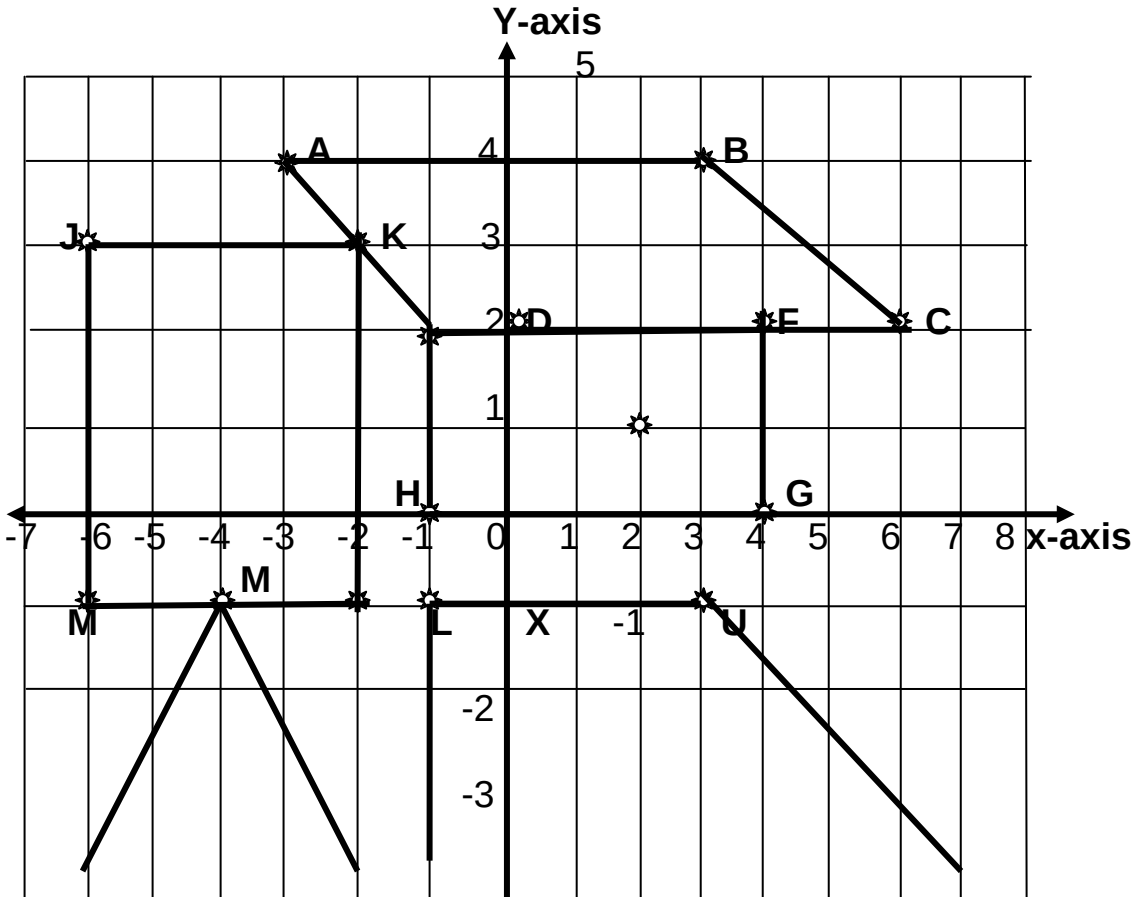


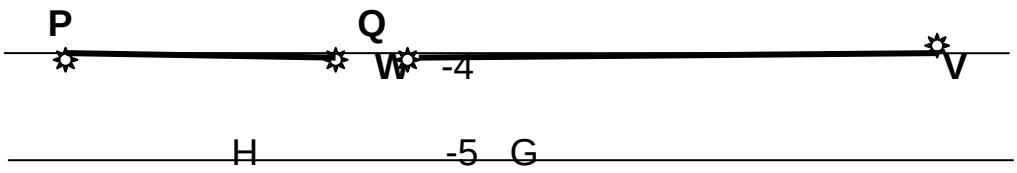

**SUB TOPIC: FORMING FIGURES BY PLOTTING AND FINDING AREA**

- Plot the given points and join them to form a shape or polygon formed
- Name the figure or the polygon and find its area in square units accordingly.

Examples

On the grid below, plot and join the points then find their areas accordingly.
(i) A (-3,4) B (3,4) C (6,2) D (0,2) (ii) E (-1,1) F (3,0) H (-4,-5) G (0,-5)
(iii) X (-1,-1), U (3,-1), V (7,-4) W (-1,-4)
(iv) P (-6,3), Q (-2,3), R (-2,-1) and S (-6,-1)






(i) A, B, C,D-parallelogram
Area = B x H
= (6 x 2) sq. units
Area = 12 sq. units

ii) J,K, L, M-square
Area = S x S
= (4 x 4) sq. units
Area = 16 sq. units

iii) E, F, G, H- rectangle
Area = L x W
= (5 x 2) sq. units
Area = 10 sq. units

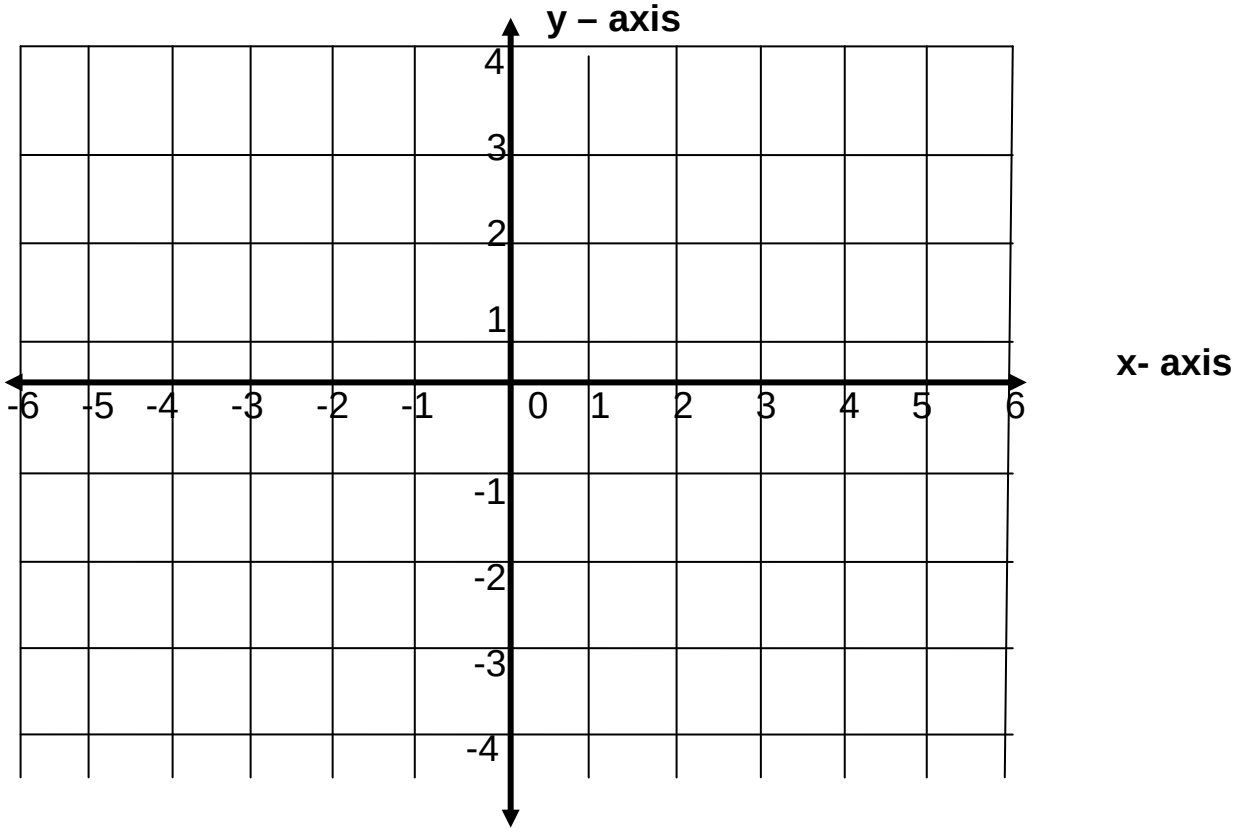
(iv) X, U, V, W is a trapezium
Area = $^1/_2$ h (a + b)
= $^1/_2$ x 3 (4 + 8) sq. units
= $^1/_2$ x 3 x 12) sq. units
= (3 x 6) sq. units
Area = 18 sq. units

(v) P, Q, M is a triangle
Area = $^1/_2$ x b x h
= ($^1/_2$ x 4 x 3) sq. units
= (2 x 3) sq. units
Area = 6 sq. units

(iii) If each small square is represented with metric units , then apply the units given.

**ACTIVITY:**

1. a) Draw and plot the following points on a grid.
   P (-4, 2), Q (2, 2), R (4, -2) and S (-2, -2)
   b) Join the points and name the figure formed.
   c) If 1 unit represents 1cm, find the area of the figure formed.
2. Draw and plot V (3, -1), X (-3, -1), Y (0, 3) and Z (3, 3)
   a) Join the points and name the polygon formed.
   b) Calculate the area of the polygon formed in square units.



## SUB TOPIC: USING EQUATION OF THE LINE TO COMPLETE TABLES

Substitute for the given value then solve the equation.

Examples

1. Given that y = x + 1, complete the table below.

| X | -3 | -2 | -1 | 0 |
|---|---|---|---|---|
| Y | -2 | -1 | 0 | 1 |

| | | | |
|---|---|---|---|
| Y = X+1<br>= - 3 + 1<br>Y = -2 | Y = X + 1<br>-1 = X + 1<br>-1- 1 = X + 1 – 1<br>**-2 = X**<br>X = -2 | Y = X+ 1<br>Y = -1 + 1<br>Y = 0<br>**0 = X**<br>X = 0 | Y = X + 1<br>1 = X + 1<br>1 – 1 = X + 1 – 1<br>**0 = X**<br>X = 0 |

2. Given that y = x - 2, complete the table below.

| X | -2 | -1 | 0 | 1 |
|---|---|---|---|---|
| Y | -4 | -3 | -2 | -1 |

| | | | |
|---|---|---|---|
| Y = X – 2<br>-4 = X – 2<br>-4 + 2 = X – 2 + 2<br>-2 = X<br>X = -2 | Y = X – 2<br>Y = -1 – 2<br>Y = -3 | Y = X – 2<br>-2 = X – 2<br>-2 + 2 = X -2 + 2<br>0 = X<br>X = 0 | Y = X – 2<br>Y = 1 – 2<br>Y = -1 |

**ACTIVITY :**

1. Given that Y = X – 1, complete the table below.

| X | ..... | 0 | ..... | 7 | ..... |
|---|---|---|---|---|---|
| Y | 2 | ..... | 4 | ..... | 9 |

2. Given that Y= 2x-1, complete the table below.

| X | 5 | ..... | 1/2 | ..... | -5 |
|---|---|---|---|---|---|
| Y | ..... | 7 | ..... | -9 | ..... |

3. Given that X=Y+ 2, complete the table below.

| X | 6 | ..... | -2 | ..... | 1/2 |
|---|---|---|---|---|---|
| Y | ..... | 1 | ..... | 0 | ..... |

4. Given that Y = -2X + 4, use the equation to complete the table below.

| X | -3 | -2 | -1 | 0 | 1 | 2 |
|---|---|---|---|---|---|---|
| Y | 10 | ..... | ..... | ..... | ..... | ..... |

5. Given the table below for the line Y = 2X – 3. Use the equation to complete it.

| | | | | | |
|---|---|---|---|---|---|
| X | -2 | ..... | 0 | ..... | 2 |
| Y | ..... | -5 | ..... | -1 | ..... |

## SUB TOPIC: PLOTTING LINES ON A GRID FROM EQUATIONS

Example:

Draw a graph with x and y axes and plot the line y = x + 1.

Let the co-ordinates for x be {-2, -1, 0, 1, 2}

| | | | | | |
|---|---|---|---|---|---|
| x | -2 | -1 | 0 | 1 | 2 |
| y | -1 | 0 | 1 | 2 | 3 |

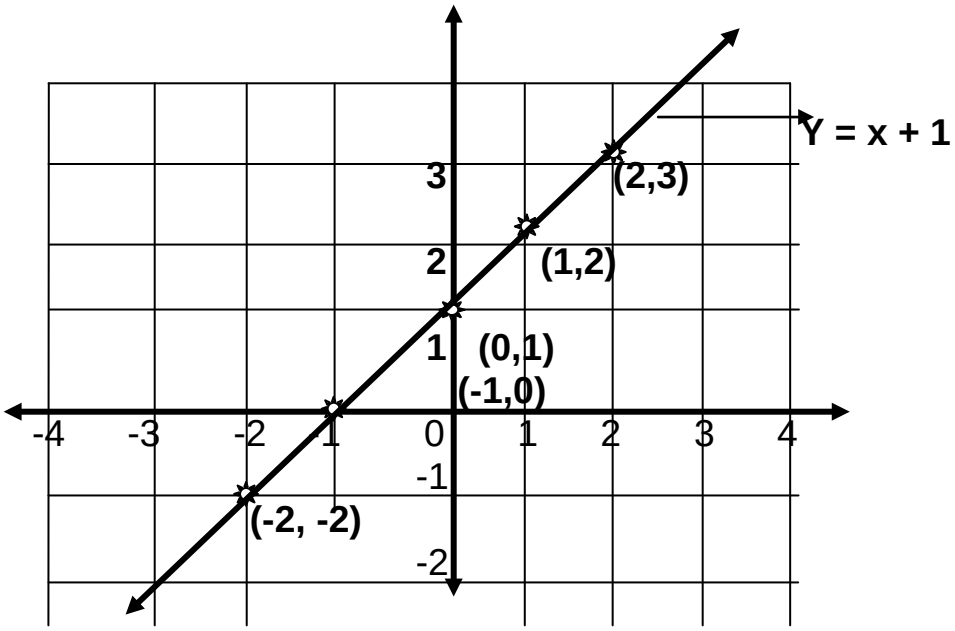
a) y = x + 1
= -2 + 1
= -1

b) y = x + 1
= -1 + 1
= 0

c) y = x + 1
= 0 + 1
= 1

d) y = x + 1
= 1 + 1
= 2

e) y = x + 1
= 2 + 1
= 3




## ACTIVITY:

1. The equation of the line is Y = X + 4.
   a) Make a table for the co-ordinates of the line using the values of X such that X are values between -2 and +6.
   b) Draw the line on the co-ordinate graph to show the X and Y co-ordinates.

2. Draw a co-ordinate graph and plot a line Y = X + 5

3. Given that the set of X- co-ordinates is { -1, 0 ,1 ,2 ,3, ...}.Calculate the corresponding co-ordinates using the equation of the line Y= 2x - 3.

4. Draw and represent the following equations on the grid if x = 4 - y

5. a) If y = x – 2, complete the table below.

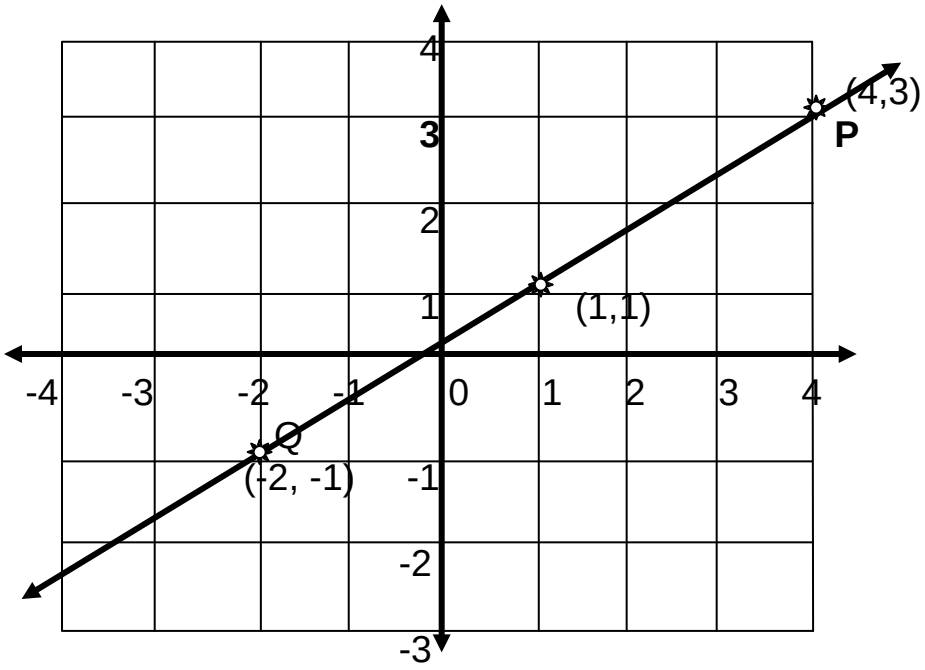
| | | | | | |
|---|---|---|---|---|---|
| x | ……. | -3 | …… | ……. | 5 |
| y | 1 | …… | -2 | -4 | …… |

b) Plot and draw the equation of the line from the information above.

**SUB TOPIC: FINDING THE MID POINT OF A LINE ON A GRID**

Example

Use the grid below to find the midpoint of points P and Q.




Point P (4, 3) $x_1 = 4$, $x_2 = -2$

Point Q (-2, -1) $y_1 = 3$, $y_2 = -1$

Midpoint of P and Q $= \frac{(X_1 + X_2)}{2} , \frac{(y_1 + y_2)}{2}$

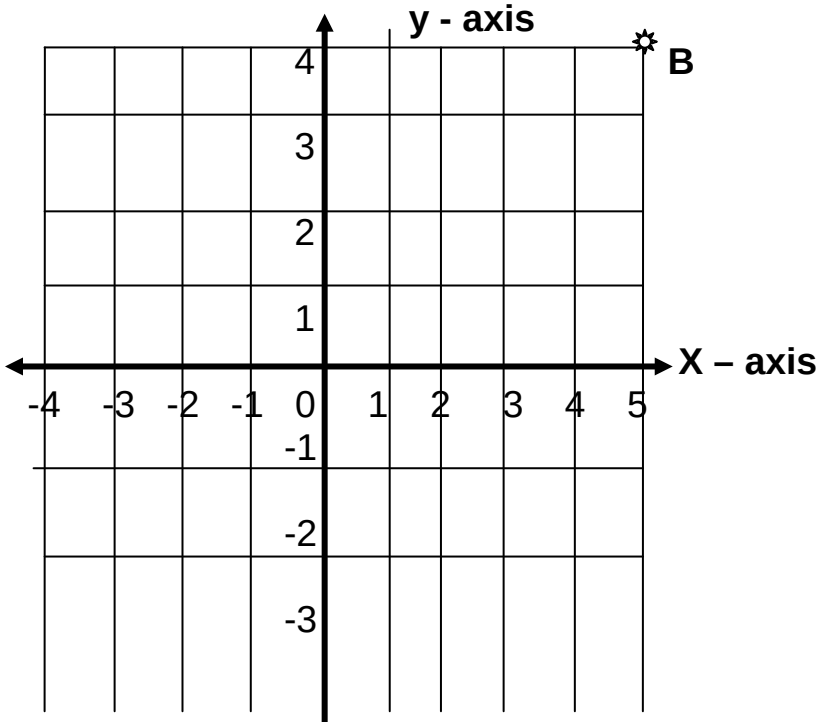
$= \frac{(4 + -2)}{2} , \frac{(3 + -1)}{2}$

$= \frac{(2}{2}, \frac{2)}{2}$

The midpoint of P and Q is (1, 1).

**ACTIVITY:**

1. Use the grid below to answer the questions that follow.



a) Join point C to point B and name it line y = x – 1.
b) Calculate the midpoint of points C and B.
2. Find the midpoint of the following pairs of points:
a) A (3, 5) and B (-3, -1). b) P (0, 2) and Q (1, 3)
c) K (1, 2) and L (-2, -1)

## TOPIC 8: MONEY (SHOPPING BILLS)

- Change mixed number into an improper fraction the multiply by the unit cost.
- Divide the grams by 1,000 if the unit cost is per kilogram.
- Interpret any other information given like some quantity out of the total.
- Multiply the quantity by the unit cost where applicable.

Examples:

1. A mother had a 5,000 shillings note and bought the following items.
   1 ½ kg of beans at sh.600= per kg.
   500g of salt at sh. 700 each kg
   2 bars of soap at sh.1400
   (a) How much did she spend and what was her change?

| Beans | Salt | Soap | Total Expenditure |
|---|---|---|---|
| 1 1/2kg x sh.600<br>3 xsh.600<br>2<br>3 x sh.300<br>=Sh. 900 | 500g<br>1kg = 1000g<br>500 x sh.700<br>1000<br>5 x sh70<br>= sh.350 | 2 bars =<br>sh.1400 | Sh.1400<br>Sh. 900<br>+ sh. 350<br>Sh.1,650 |

Change = Money at hand – Total expenditure

Sh.5000
- sh.1650
Sh.3350

b) Given that she was given a discount of 10% on the total expenditure. How much money did she pay?

Total expenditure = 100%
Discount = 10%
%age of money paid = 100% - 10%
= 90%

Money paid is referred to as the cash price.
Amount = 90 x sh.1650
100
= 9 x sh165
= sh.1,485

## ACTIVITY:

1. Joshua went to a supermarket and bought the following items.
   2 bars of soap at sh.2,500 each.
   1 ½ kg of rice at sh.3,200 a kg.
   2kg of beans at sh.3,600

a) Calculate his total expenditure if he was given a discount of 10%.
b) If he was given a change of sh.7,490, what amount of money did he go with at first?

2. Divine had shs 50,000 and bought the following items from the market.
3kgs of beans at sh1,800 per kg.
1 ½ kg of meat at sh.8,000 per kg.
250gms of salt at sh.1,200 per kg.
3 apples at sh.1,200 for 2 apples.

a) Find John's expenditure.
b) If he was given a discount of 5% and he used sh.3,000 for transport, how much money did he remain with?

3. Anne went with shs 21,000 and bought the following:
3kg of sugar at sh.2,400 per kg.
4 packets of salt for sh.1,000
2kg of rice at sh. 2,400 per kg
1½kg of meat at sh. 2,500 for 1/2kg

a) How much did she spend altogether?

b) How much change did she get after paying for all the items?

23. The list below shows prices of different items in a certain shop.
- 2 kg of sugar cost sh.6,800
- 500 gm of posho cost sh.1,600
- 1 kg of beans costs sh. 3,000
- 3 bars of soap cost sh. 10,500

(a) How much money will Opio pay for 3 kg of sugar?

(b) Nakitto buys 1 kg of beans, 1 ½ kg of posho and 3 bars of soap. How much does she pay?

**SUBTOPIC: COMPLETING TABLES OF SHOPPING:**

- Multiply the quantity by the unit cost accordingly.

Example:

2. Bonnie bought the following items from a shop:
3½ kg of beans at shs.1400 per kg
1½ Kg of salt at shs.1000 per Kg
4 bars of soap at Shs.1500 per hour
(a) If Bonnie was given a discount of 20% on his total expenditure, how much was the discount?

| Items | Quantity | Unit cost | Amount |
|---|---|---|---|
| Beans | 3 ½ kg | Sh.1,400 per kg | Sh.4,900 |
| Meat | 1 ½ kg | Sh.10000 per kg | Sh. 15,000 |
| Soap | 4 bars | Sh.1,500 per bar | Sh.6,000 |

| Beans | Meat | Soap | Total expenditure |
|---|---|---|---|
| sh. 1,400 x 7/2 | sh. 15000 ÷ 3/2 | sh.6,000 | sh. 15,000 |
| | | sh.1,500 | sh. 4,900 |
| Sh. 700 x 7 | sh. 15,000 x 2 | = 4 bars | + sh. 6,000 |

= sh. 4,900 3 sh.25,900

Sh.10,000

Discount =20% of total cost

= 20 x sh. 25,900
100

= 2 x sh. 2,590

= sh. 5,180

(b) How much did Bonnie pay?

Cash price = Amount – discount

Sh.25, 900

- sh. 5, 180

Sh.20, 720

Cash price = (100% - 20% = 80%)

= 80 x sh. 25,900
100

= 8 x sh. 2,590

= sh. 20,720

**ACTIVITY:**

1. Monica went to the market and bought the following items shown on the table below.

| Items | Quantity | Unit cost | Amount |
|---|---|---|---|
| Mangoes | 13 | Sh. 500 each | Sh. …… |
| Sugar | ……kg | Sh. 3,000 per kg | Sh. 7,500 |
| Soap | 4 bars | Sh. 2,500 each | Sh…….. |
| Milk | 1 ½ litres | Sh.……per litre | Sh. 1,800 |
| Total expenditure | | | Sh……. |

a) Complete the table below

b) If Babirye received a change of sh.4,200 ,how much did she have before

5. Mr. Olinga bought the items in the table below from a shop.

a) Complete the table below.

| ITEMS | QUANTITY | UNIT COST | TOTAL COST |
|---|---|---|---|
| Soap | ……bars | Sh. 2,400 each bar | sh. 7,200 |
| Rice | ……kg | Sh…….per kg | sh. 7,000 |
| Salt | 2 ½ kg | Sh. 1,200 per kg | Sh……. |
| Total expenditure | | | Sh. ……. |

b) If he was given a change of sh.2,800, how much did he go with to the shop?

6. Peter went to the Supermarket and bought the items as shown in the table below.

| ITEM | UNIT COST | AMOUNT |
|---|---|---|
| 3 bars of soap | sh.3,500 per bar | sh …… |
| …….tins of blue band | sh. 3,000 per tin | sh 9,000 |
| 750g 0f sugar | Sh. …… | sh. …… |

| | | |
|---|---|---|
| Total expenditure | | sh…… |

a) Complete the table below.
b) If Peter was given a discount of 10%, how much did he pay for all the items?

7. Study the table below and use it to answer the questions that follow.

| TEM | QUANTITY | UNIT COST | AMOUNT |
|---|---|---|---|
| Sugar | 3kg | sh……. | sh 14,400 |
| Rice | ……..kg | sh.5,000 per kg | Sh. 2,500 |
| Milk | 250ml | sh.3,000 per litre | sh……. |
| Biscuits | 2 packets | sh….per packet | sh……. |
| Total expenditure | | | Sh.29,650 |

8. Study the table below and answer the questions that follow.

| ITEM | UNIT COST | AMOUNT |
|---|---|---|
| 2kg of beans | sh. 3,400 per kg | sh…….. |
| ……..litres of cooking oil | sh. 1,800 per litre | sh.5,850 |
| 1 ½ kg of salt | sh. …….per kg | sh.900 |
| 750g of tea leaves | sh.2,000 per gram | sh…….. |
| | | sh…….. |

a) Complete the table above.
b) Lenny was given sh.1, 450 as a change, how much did he have at first?

## SUB TOPIC: CURRENCY (COMPARING VALUES OF CURRENCIES)

- Currency is the type of money used in a country.
- Different countries have different names of their currencies.

| COUNTRY | CURRENCY |
|---|---|
| Burundi | Burundi francs (BF) |
| Zambia | Kwacha (Kch.) |
| Zimbabwe | Zimbabwe Dollar (Z$) |
| German | Deutsch mark (DM) |
| Egypt | Egyptian pound |

| Other countries | | Uganda shilling |
|---|---|---|
| Kenya shillings (Ksh 1) | ⟷ | Ushs 20 |
| Tanzania shilling (TZ sh) | ⟷ | Ushs 2.2 |
| USA dollar (US$ 1) | ⟷ | Ushs 1050 |
| Great Britain pound (£ 1) | ⟷ | Ushs 1650 |
| Rwanda Francs (RF 1) | ⟷ | Ushs 2.5 |

Examples:

1. A trader sold maize to Kenya for K shs 150,000. How much money did he get in Uganda money?
   Ksh 1 equivalent to U sh 20
   K sh 150,000 = Ushs 20 x 150,000
   = U shs 3,000,000
2. How much Uganda shillings is equivalent to £ 20 plus Tz hs 30,000?
   Tz shs 30,000 — Ushs 1650
   20 = Ush 1650 x 20
   = U sh 33,000

   Total Uganda currency
   Ush 33,000
   + Ush 66,000
   Ush.99,000

TZ sh = Ush 2.2

TZ shs 30,000 = Ush $\frac{22}{10}$ x 30,000

= Ush.22 x 3000

= Ush.66,000

**ACTIVITY:**

1. One dollar buys Ugsh.3500. How much will 7 dollars cost in Uganda shillings?
2. Given that 1 United States Dollar = Ugsh.2,35. How much money in Uganda currency is 20US dollars?
3. The exchange rate at Bank of Baroda is 1US dollar for Ugsh.2,500. If a tourist had 280US dollars, how much money in Uganda shillings will the tourist get from the bank?
4. Given that 1USD costs Ugsh.2,500, how many dollars will one get from Ugshs175,000?
5. Convert 250US dollars to Pound Sterling (£), if 1USD = Ugsh2,680 and 1£ = Ugshs3,350.
6. The exchange rate for Kenya shillings (K.sh) into Uganda shillings (Ug.sh) and United States dollars (USD) to Uganda shillings are as shown below:

   Ksh.1 = Ug.shs 30.

   USD 1 = Ugshs2580.

How many United States dollars will one get from 21,500 Kenya shillings?

7. If the cost of a new bicycle is 90 United States dollars, how much would this be in Uganda shillings?
8. In Centenary Rural Development Bank, the buying rate of 1USD is Ugsh.3,500 and the selling rate is Ugsh.3,600. How much money in Uganda shillings will one get if one has 250 USD?
9. At a Forex Bureau, the exchange rate is 1USD = Ugsh.2,600 and Ksh.1 = Ugsh.25. A tourist had a total of 200USD and K.shs 500.
10. How much money in Uganda currency will one get from the bank?
11. If the tourist used Ugsh.86,000 for hotel expenses for 2 days Ugsh.300,000 for transport, what was his balance?
12. Kizito works with the Tanzania high commission and his monthly salary is TZ sh 15,000. What is his salary in Uganda currency?

**SUBTOPIC:EXCHANGE RATES**

- The bank buys foreign currency from you. Foreign currency = Foreign currency X buying rate equivalence in Uganda shillings.
- The bank sells foreign currency to you. Uganda shillings = Divide the Uganda shillings by the selling rate equivalence in Uganda shillings.
- Foreign currency to another foreign currency, first convert the foreign currency to Uganda shillings by multiplying then divide the Uganda shillings by the equivalence of the required foreign currency to Uganda shillings.

Examples:

1. The table below shows the rate at which a bank buys and sells different currencies. Use it to answer the questions that follow.

| CURRENCY | BUYING RATE | SELLING RATE |
|---|---|---|

| | | |
|---|---|---|
| 1US dollar (USD 1) | Ugsh.3,500 | Ugsh.3,600 |
| 1 Kenya shilling( Ksh.1) | Ugsh.30 | Ugsh.35 |
| 1 British Pound ( £ 1) | Ugsh.4,200 | Ugsh.4,500 |

a) How much in Uganda shillings will Emma get from the bank if he has 700 British pounds?

Multiply by the buying rate

£ 1 = Ugsh.4,200

£ 700 = Ugsh.4,200 x 700

= Ugsh.2,940,000

Emma will get Ugsh2,940,000.

b) If Mr. Obbo has Ugsh.270,000. How much will he get in United States dollars?

Divide by the selling rate

Ugsh.3,600 = 1 USD

Ugsh.270,000 = Ugsh.270,000 x 1 USD

= Ugsh.3,600

= 75 USD.

c). Henry bought a radio at Ksh.1,500. How much did he pay for the same radio in United States dollars?

Change Ksh.1,500 to Ugsh by multiplying

Ksh.1 = Ugsh.30

Ksh.1,500 = Ugsh.30 x 1,500

= Ugsh.45,000

Change the Ugsh to USD by dividing

Ugsh.4500 = 1 USD

Ugsh.45,000 = Ugsh.45,000

= Ugsh4,500

= 10 USD

**ACTIVITY:**

1. The table below shows the Foreign Exchange for Premier Forex Bureau in Malaba boarder. Use it to answer the questions that follow.

| CURRENCY | BUYING RATE | SELLING RATE |
|---|---|---|
| 1 USD(US Dollar) | 3,500 | 3,600 |
| €1( Euro) | 4,000 | 4,100 |
| Tz sh. 1 | 1 | 1.2 |
| Rwanda Francs | 4 | 5 |
| Ksh.1 | 35 | 36 |

a) Mother went to Premier Forex Bureau with 2,400 USD. How much in Uganda shillings did she buy from there?

b) If then decided to convert her money in Tanzania shillings, how much did she get?

2.The rate at which a Forex Bureau buys and sells different foreign currencies are given below. Use it to answer the questions that follow.

| CURRENCY | BUYING RATE | SELLING RATE |
|---|---|---|
| 1 USD | Ugsh.3,700 | Ugsh.3,800 |
| 1Euro( Eur) | Ugsh.4,300 | Ugsh.4,400 |
| 1 Pound Sterling (£) | Ugsh.5,400 | Ugsh.5,500 |

| | | |
|---|---|---|
| Ksh.1 | Ugsh.37 | Ugsh.39 |

a) Akiror has 350 USD and 900 Euros. How much in Uganda shillings will she get from the Forex Bureau?
b) If David has 650 Pound Sterling, how many Kenya shillings can he get from the Forex Bureau?

3. The table below shows the rate at which a bank buys and sells various currencies. Use it to answer the questions that follow.

| **CURRENCY** | **BUYING RATE** | **SELLING RATE** |
|---|---|---|
| USD 1 | Ugsh.3,700 | Ugsh.3,750 |
| K sh. 1 | Ugsh.35 | Ugsh.37 |
| British Pound (£ 1) | Ugsh.4,300 | Ugsh.4,500 |

a) How much money in Uganda shillings will one get from the bank if one has 800 British pounds?
b) Rose bought a watch for Kshs1,500. What was the cost in US dollars?

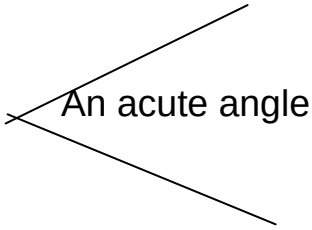
## TOPIC 9: LINES, ANGLES AND GEOMETRIC FIGURES

An angle is the measure of turning.
An angle is the amount of opening between two adjacent lines with the same end point (vertex).

## TYPES OF ANGLES AND THEIR DESCRIPTIONS

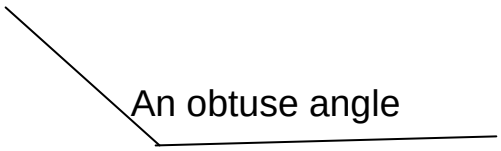
- Angles are described according to their sizes of degree ranges.

a) Acute angles – are angles which are less than $90^0$.
The degrees range from $1^0$ to $89^0$ or angles between $0^0$ and $90^0$.



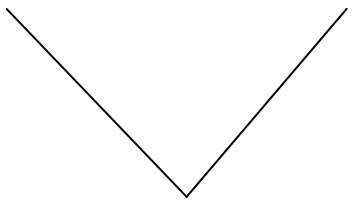
An acute angle

b) Obtuse angles – Angles greater than $90^0$ but less than $180^0$.
They range from $91^0$ to $179^0$ or angles between $90^0$ and $180^0$.



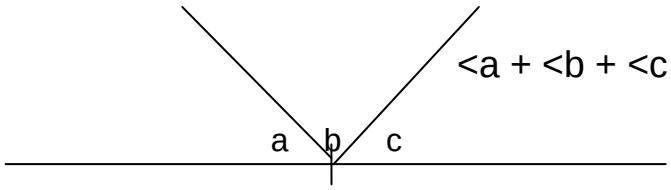
An obtuse angle

c) Reflex angles – Angles that are greater than $180^0$ but less than $360^0$.
They range from $181^0$ to $359^0$ or angles between $180^0$ and $360^0$.

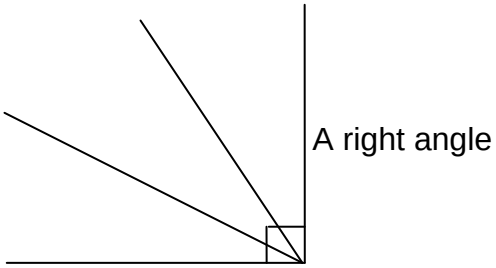


A reflex angle

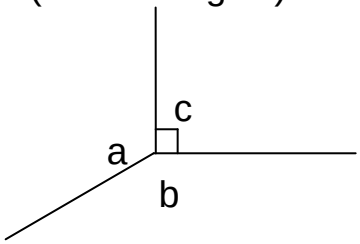
d) Straight line angles – are angles on a straight line that add up to $180^0$.




e) Right angles – are angles that add up to $90^0$.




f) Angles at a point (Centre angles) – are angles that add up to $360^0$.




$a + b + c = 360^0$

**ACTIVITY:**

1. State the property of each type of the angles below:

a) Right angles b) Obtuse angles c) Acute angles d) Reflex angles

2. Name the angles below:

a) $07^0$ b) $350^0$ c) $111^0$ d) $92^0$ d) $181^0$ f) $91^0$

3. What is the largest;

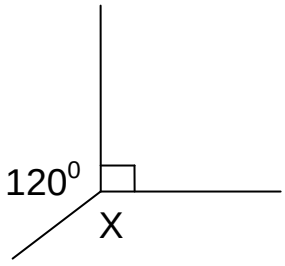
a) acute angle? b) obtuse angle? c) reflex angle?

**SUB TOPIC: FINDING UNKNOWN ANGLES FROM CENTRE ANGLES**

- Angles at a point or centre angles add up to $360^0$.

Example 1

Find the size of the angle marked r in the figure below in degrees.




$X + 120^0 + 90^0 = 360^0$

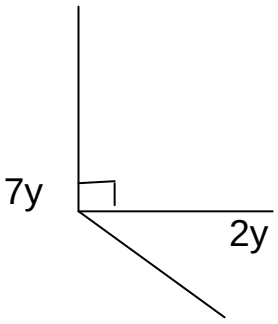
$X + 210^0 = 360^0$

$X + 210^0 - 210^0 = 360^0 - 210^0$

$X = 150^0$

Example 2

Find the value of y in degrees in the figure below.




$7y + 2y + 90^0 = 360^0$

$9y + 90^0 = 360^0$

$9y + 90^0 - 90^0 = 360^0 - 90^0$

$9y = 270^0$

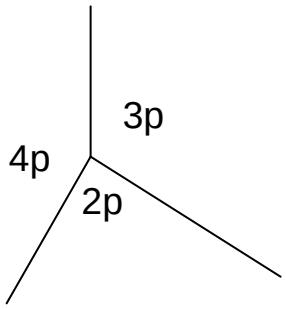
$\frac{9y}{9} = \frac{270^0}{9}$

Y $= 30^0$

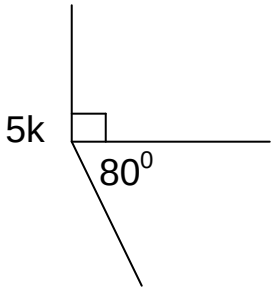
**ACTIVITY:**

Find the value of the unknown angles in the figures below.

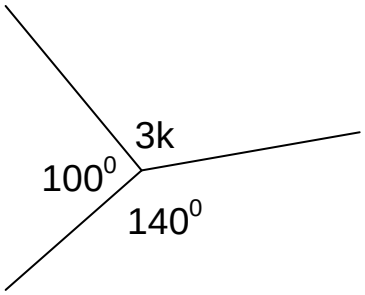
a)




b)



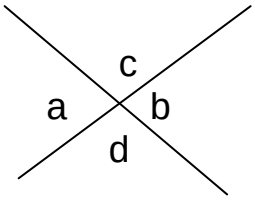

c)




**SUBTOPIC: VERTICALLY OPPOSITE ANGLES**

These are sets of equal angles formed after two intersecting lines.

They are diagonally adjacent to each other i.e they face each other.




<a = <b (vertically opposite angles)

<c = <d (vertically opposite angles)

<a + <c = $180^0$

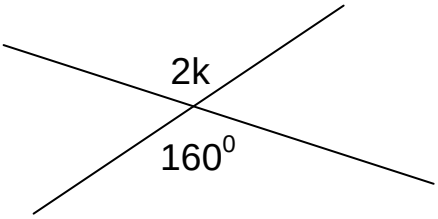
<a + <d = $180^0$

<c + <b = $180^0$

<b + <d = $180^0$ These are supplementary angles

**Examples**

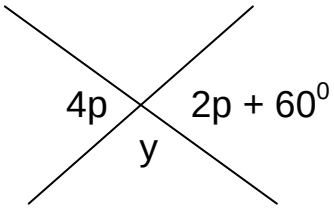
Find the values of the unknown angles in the following.




$2k = 160^0$ (vert. opposite angles)

$\frac{2k}{2} = \frac{160^0}{2}$

**$K = 80^0$**




$4p = 2p + 60^0$ (vert. opp. angles)

$4p - 2p = 2p - 2p + 60^0$

$2p = 60^0$

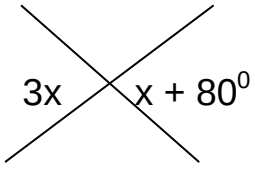
$\frac{2p}{2} = \frac{60^0}{2}$

**$p = 30^0$**

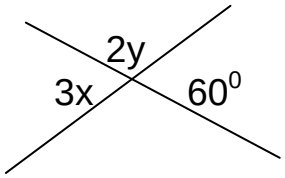
**ACTIVITY:**

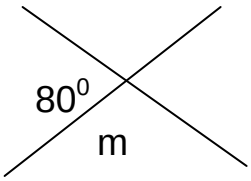
Find the value of the unknown represented by letters

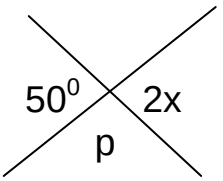
1.




2.



3. 


4. 


**SUBTOPIC: COMPLEMENTARY ANGLES AND RIGHT ANGLES**

- Complementary angles are any two angles that add up to $90^0$.
- A right angle is an angle that is exactly $90^0$.

Examples

1. What is the complement of $30^0$?

Let the complement be X.

$y + 30^0 = 90^0$

$y + 30^0 - 30^0 = 90^0 - 30^0$

$y = 60^0$

The complement of $30^0$ is $60^0$.

2. What is the complement of $p^0$?

Complement of $p^0$ is $(90^0 - p^0)$

$= (90 - p)^0$.

**3**. Find the complement of ;

a) $(X + 40)^0$

$90^0 - (X + 40)^0$

$90^0 - X^0 - 40^0$

$90^0 - 40^0 - X^0$

$50^0 - X^0$

**$(50 - X)^0$**

b) $(y - 20)^0$

$90^0 - (y - 20)^0$

$90^0 - y^0 + 20^0$

$90^0 + 20^0 - Y^0$

$110^0 - Y^0$

**$(110 - Y)^0$**

4. What angle is ½ of its complement?

Let the complement be y

Complement of y is $(90 - y)^0$

$y = \frac{1}{2}(90 - y)^0$

$2 \times y = 2 \times \frac{1}{2}(90 - y)$

$2y = 90 - y$

$2y + y = 90 - y + y$

$3y = 90$

$\frac{3y}{3} = \frac{90}{3}$

$y = 30$

The angle is 30

5. Two angles $(2x+10)^0$ and $(3x+20)^0$ are complementary. Find the value of x.

$2x + 10^0 + 3x + 20^0 = 90^0$

$2x + 3x + 10^0 + 20^0 = 90^0$

$5x + 30^0 = 90^0$

$5x + 30^0 - 30^0 = 90^0 - 30^0$

$\frac{5x}{5} = \frac{60^0}{5}$

$X = 12^0$

**ACTIVITY:**

1. Find the complement of the following angles.

a) $15^0$ b) $72^0$ c) $80^0$ d) $25^0$

e) $(X + 20)^0$ f) $(30 – x)^0$ g) $(y – 10)^0$ h) $m^0$

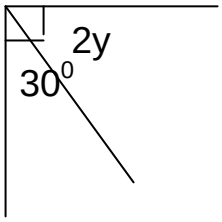
2. What angle is $\frac{1}{5}$ of its complement?

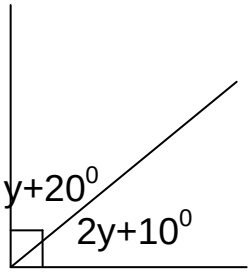
3. What is $\frac{2}{3}$ of the complement of $60^0$?

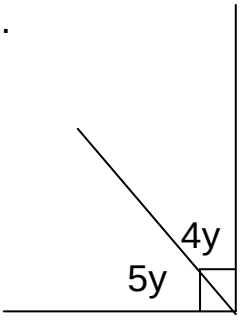
4. Two angles $2x^0$ and $(x + 30)^0$ are complementary. Find the value of x.

5. If $(x+ 20)^0$ and $(x+ 40)^0$ are complementary angles. Find the value of x.

6. Calculate the size of the y in the following figures.




## SUB TOPIC: SUPPLEMENTARY AND STRAIGHT LINE ANGLES

**Concepts:**

- Supplementary angles are any two angles that add up to $180^0$.
- Any angles on a straight line add up to $180^0$.

Examples

1. Find the supplement of ;

a) $110^0$

Let the complement be p.

$p + 110^0 = 180^0$

$p + 110^0 – 110^0 = 180^0 – 110^0$

**$p = 70^0$**

b) $(2x)^0$

$180^0 – (2x)^0$

= **$(180 – 2x)^0$**

2. Find the supplement of ;

a) $(x + 100)^0$

$180^0 – (x + 100)^0$

$180^0 – x – 100^0$

$180^0 – 100^0 – x$

$80^0 – x^0$

**$(80 – x)^0$**

b) $(x – 50)^0$

$180^0 – (x – 50)^0$

$180^0 – x + 50^0$

$180^0 + 50^0 – x$

$230^0 – x^0$

**$(230 – x)^0$**

3. What angle is ¼ of its supplement?

Let the supplement be k

Supplement of x is $(180 – k)^0$

k = ¼ of $(180 – k)^0$

k = ¼ x (180 – k)

4 x k = 4 x ¼ $(180 – k)^0$

$4k = 180^0 – k$

$4k + k = 180^0 – k + x$

$\frac{5x}{5} = \frac{180^0}{5}$

**X = 36**

**The angle is $36^0$.**

4. Two angles $(4x - 40)^0$ and $(x - 20)^0$ are supplementary. Find the value of x.

$(4x - 40)^0 + (x - 20)^0 = 180^0$

$4x - 40 + x - 20 = 180$

$4x + x - 40 - 20 = 180$

$5x - 60 = 180$

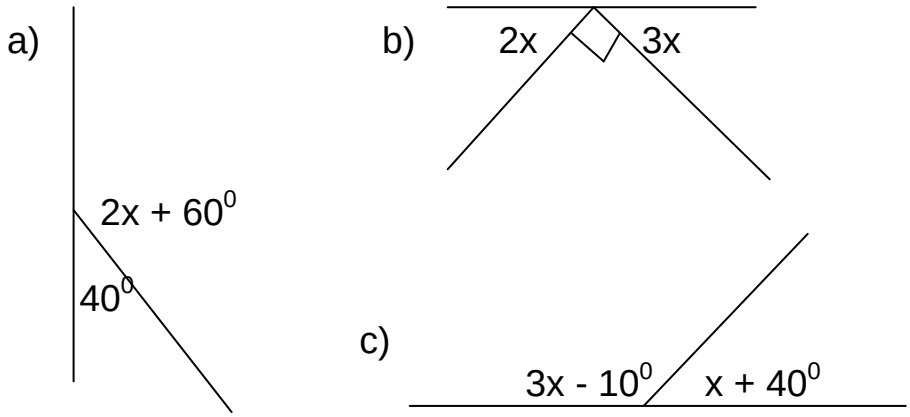
$5x - 60 + 60 = 180 + 60$

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

$x = 48$

**ACTIVITY:**

1. Find the supplement of the following angles.
   a) $43^0$ b) $136^0$ c) $p^0$ d) $(x - 40)^0$ e) $(30 + x)^0$ f) h) $(x + 80)^0$
2. What angle is $^1/_2$ of its supplement?
3. Two angles $(4x - 40)^0$ and $(x + 20)^0$ are supplementary. Find the size of each angle.
4. Two angles are supplementary. If one of them is $(p - 70)^0$, what is the other angle?
5. Calculate the size of the supplementary angles marked with letter p in the figures below.



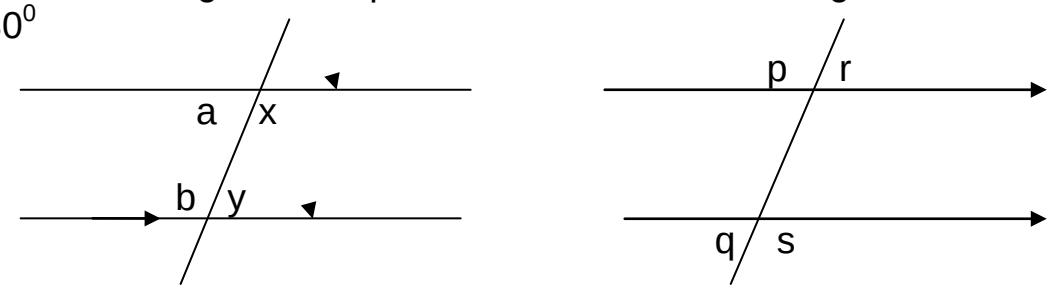

**SUBTOPIC: ANGLES FORMED ON PARALLEL LINES**

Angles formed when parallel lines are crossed by a transversal lineare:-

- Co-interior and Co-exterior angles(Co- angles)
- Alternate angles(Alternate interior and Alternate exterior angles)
- Corresponding angles

**1. CO-INTERIOR AND CO-EXTERIOR ANGLES**

- Co-interior angles are angles that lie on the same side of a transversal line but inside the parallel lines.
- Co-exterior angles are angles that lie on the same side of a transversal line but outside the parallel lines.
- Co- interior angles add up to $180^0$ and co-exterior angles also add up to $180^0$

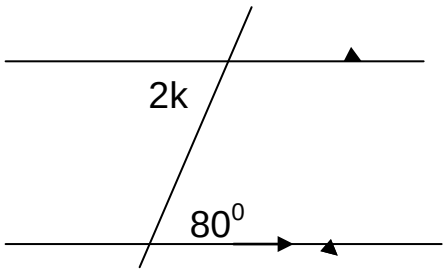


$<a + <b = 180^0$ **(Co-int. angles)** $<p + <q = 180^0$ (**Co-ext. angles**)

$<X + <y = 180^0$ $<r + <s = 180^0$

Examples

1. Find the value of k in the figure below.




$2k + 80^0 = 180^0$(co-int.<s)

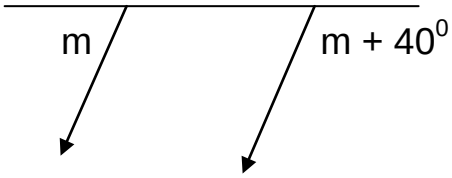
$2k + 80^0 - 80^0 = 180^0 - 80^0$

$2k = 100^0$

$\frac{2k}{2} = \frac{100^0}{2}$

**$k = 50^0$**

2. Find the size of angle m.




$m + m + 40^0 = 180^0$(co-ext.<s)

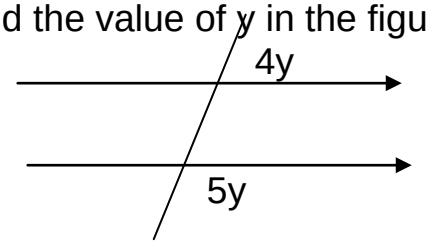
$2m + 40^0 - 40^0 = 180^0 - 40^0$

$2m = 140^0$

$\frac{2m}{2} = \frac{140^0}{2}$

**$m = 70^0$**

3. Find the value of y in the figure below.




$4y + 5y = 180^0$(co-ext.<s)

$9y = 180^0$

$\frac{9y}{9} = \frac{180^0}{9}$

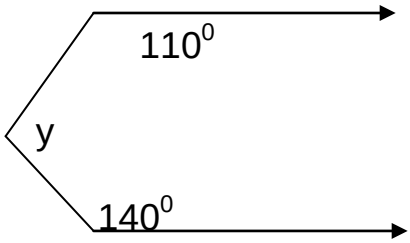
**$y = 20^0$**

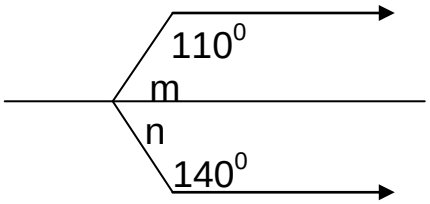
**More angles formed on parallel lines**

- Draw an imaginary (dotted) line at the vertex of the angle required.
- Re-name the angles then apply the property on the parallel lines.

**Example 3**

Find the value of y in the figure below.




$<m + 110^0 = 180^0$ (co-int.<s)

$<m + 110^0 - 110^0 = 180^0 - 110^0$

**$<m = 70^0$**

or $<y = (180^0 - 140^0) + (180^0 - 110^0)$

$= 40^0 + 70^0$

**$<y = 110^0$**

$<n + 140^0 = 180^0$ (Co-int.<s)

$<n + 140^0 - 140^0 = 180^0 - 140^0$

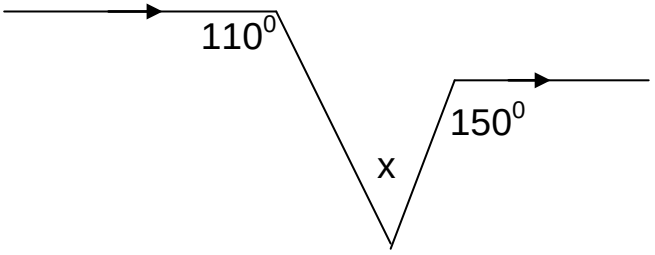
**$<n = 40^0$**

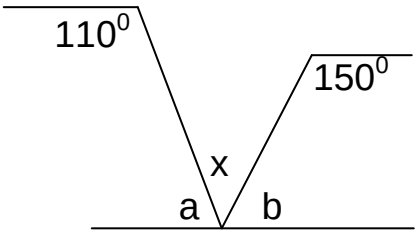
$<y = <m + <n$

$<y = 70^0 + 40^0$

**$<y = 110^0$**

2. Find the value of angle x in the diagram below.



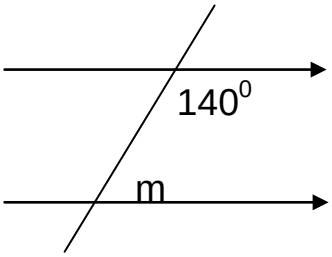

$<a + 110^0 = 180^0$(Co-int.<s)
$<a + 110^0 = 180^0$
$<a + 110^0 – 110^0 = 180^0 – 110^0$
**$<a = 70^0$**
$<x + <a = 150^0$ (Alt. int. <s)
$<x + 70^0 = 150^0$
$<x + 70^0 – 70^0 = 150^0 – 70^0$
**$<x = 80^0$**

$<b + 150^0 = 180^0$ (Co-int.<s)
$<b + 150^0 = 180^0$
$<b + 150^0 – 150^0 = 180^0 – 150^0$
**$<b = 30^0$**
or $<x + <b = 110^0$ (Alt. int. <s)
$<x + 30^0 = 110^0$
$<x + 30^0 – 30^0 = 110^0 - 30^0$
**$<x = 80^0$**

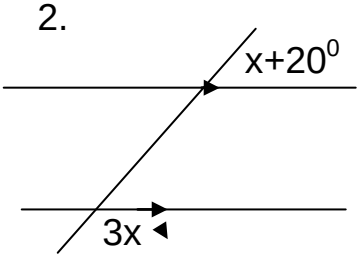
Or $<x + <a + <b = 180^0$(Straight line angles)
$<x + 70^0 + 30^0 = 180^0$
$<x + 100^0 = 180^0$
$<x + 100^0 – 100^0 = 180^0 – 100^0$
**$<x = 80^0$**

**ACTIVITY:**
Find the sizes of the angles marked with letters in the diagrams below.

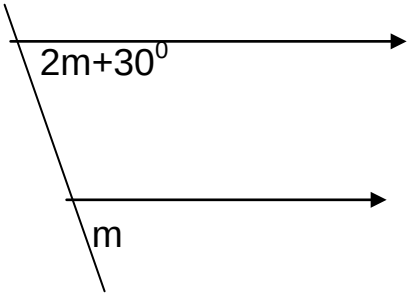
1.



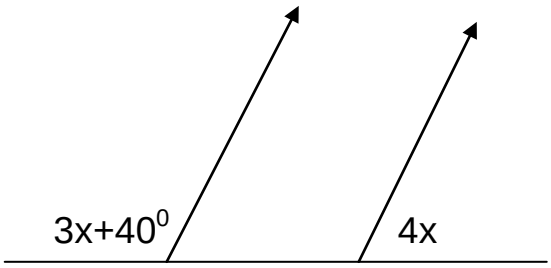

2.



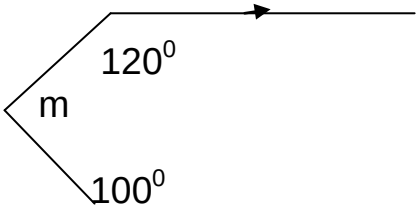

3.



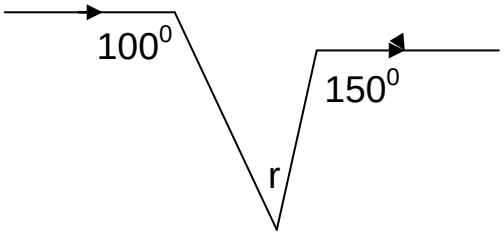

4.



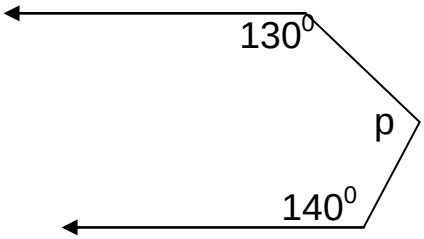

**5**.



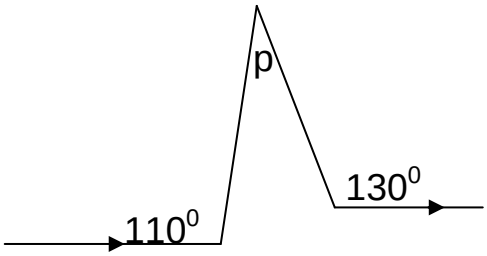

**6.**



**7.**



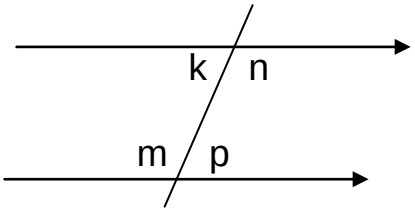

**8.**

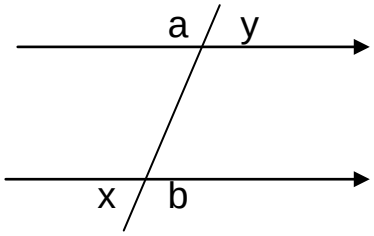



## 2. ALTERNATE ANGLES (INTERIOR AND EXTERIOR ANGLES)

**Concepts:**

- Alternate angles are equal angles that form a z-shape.
- Alternate angles lie either inside or outside the parallel lines but on the opposite sides of the transversal line.



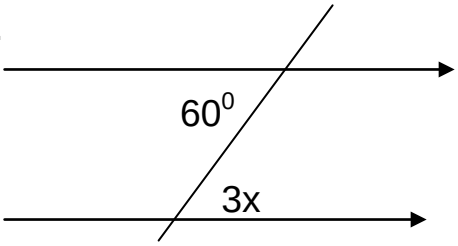

Alternate interior angles)
< k = <p and <n = <m

(Alternate exterior angles)
<a = <b and <y = <x

Examples

Find the size of the unknown angles in the figures below.

1.



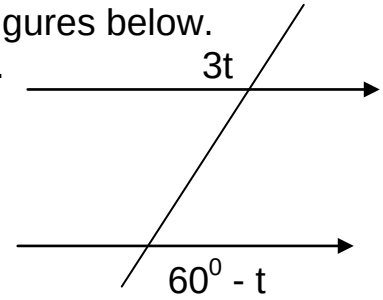

$3X = 60^0$ (Alternate interior angles)

$3X = 60^0$

$\frac{3X}{3} = \frac{60^0}{3}$

**$X = 20^0$**

2.




$3t = 60^0 - t$ (Alternate exterior angles)

$3t = 60^0 - t$

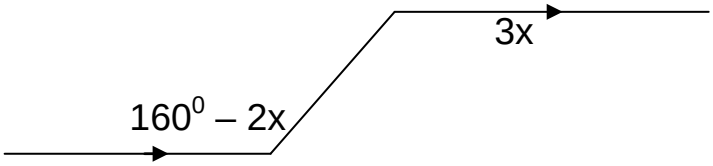
$3t + t = 60^0 - t + t$

$4t = 60^0$

$\frac{4t}{4} = \frac{60^0}{4}$

**$t = 15^0$**

3.




$3x = 160^0 - 2x$ (Alternate interior angles)

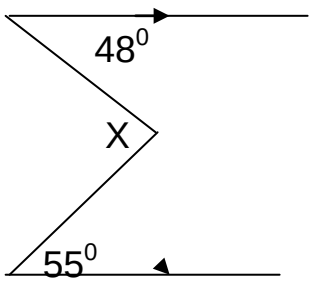
$3x = 160^0 - 2x$

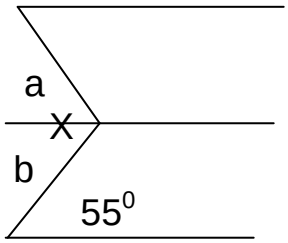
$3x + 2x = 160^0 - 2x + 2x$

$\frac{5x}{5} = \frac{160^0}{5}$

**X = $32^0$**

4. Find the value of angle x in the figure below.




Alternate angles

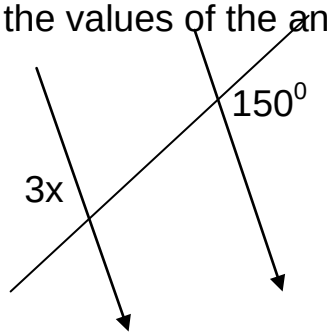
<a = $48^0$
<b = $55^0$
<X = <a + <b
= $48^0 + 55^0$
**<X = $103^0$**

- Draw an imaginary (dotted) line at the vertex.
- Re-name the angles with letters then apply the property required.
- Find the angle involving the property applied.

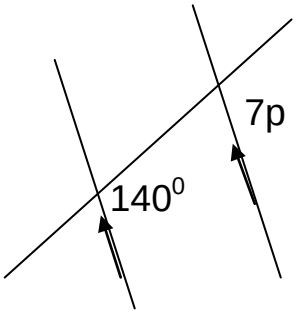
**ACTIVITY:**

Find the values of the angles marked with letters.

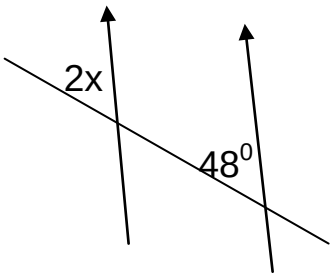
1)



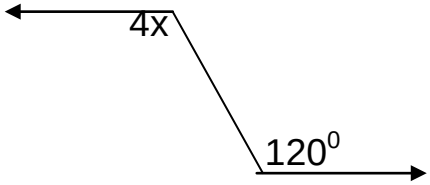

2)



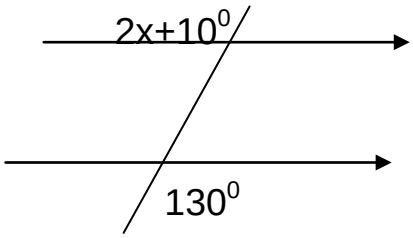

3)




4)




5)

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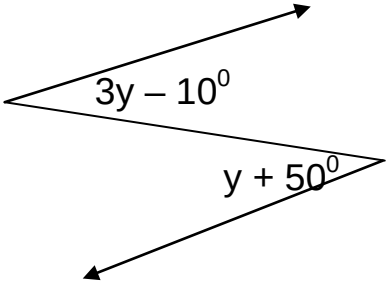
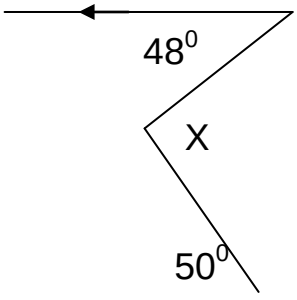
6)

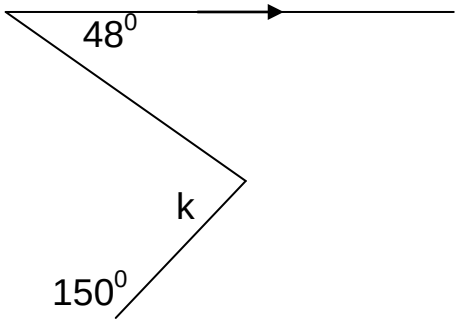



Find the value of the unknown represented by letters in the figures below.

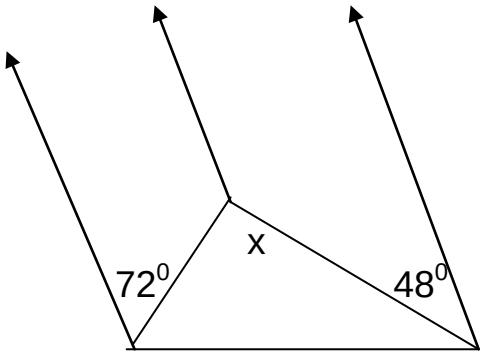
**6**.



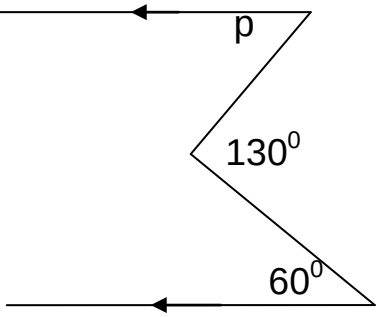

**7.**



**8.**




**9.**

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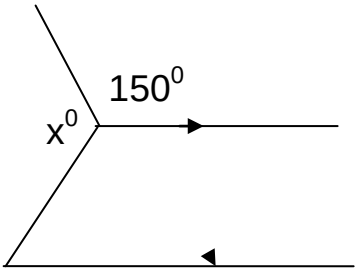
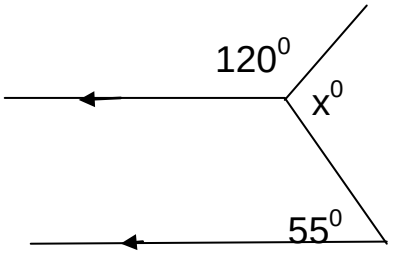



**11.**



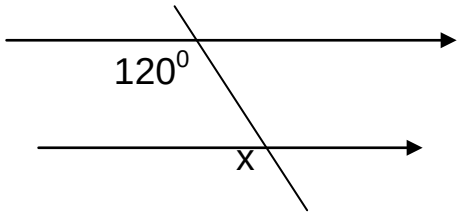

**3. <u>CORRESPONDING ANGLES</u>**

- Corresponding angles are equal angles which lie at the same position at each point of intersection of two parallel lines by a transversal line.

<u>Examples</u>

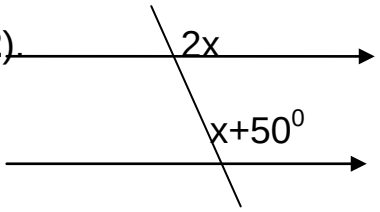
Find the values of the unknown marked with letters.

**1**)




**x = $120^0$** (Corresponding angles)

**2**).



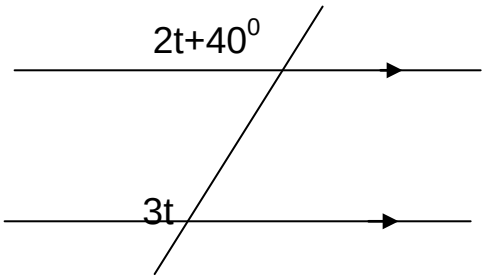

$2x = x + 50^0$ (Corresponding angles)

$2x = x + 50^0$

$2x – x = x – x + 50^0$

**<u>x = $50^0$</u>**

**3.**




$3t = 2t + 40^0$ (corresponding angles)

$3t = 2t + 40^0$

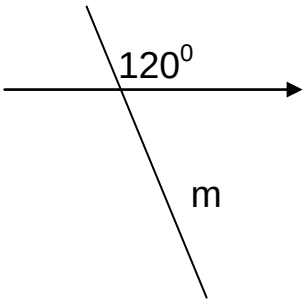
$3t – 2t = 2t – 2t + 40^0$

$t = 40^0$

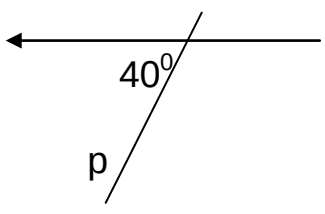
**<u>ACTIVITY:</u>**

Find the values represented by the letters in the figures below.

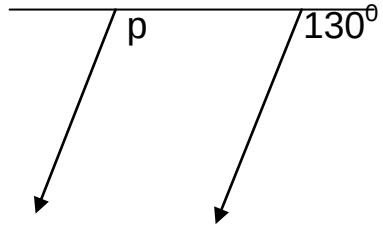
**1.**



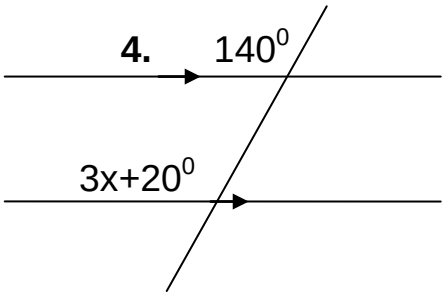

**2.**



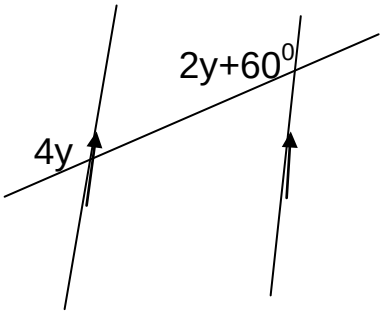
**3.**



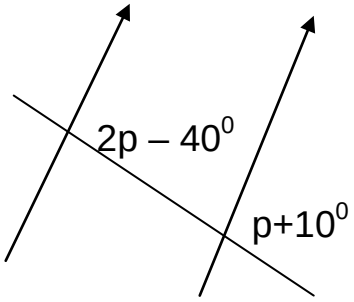

**4.**




**5.**




**6.**

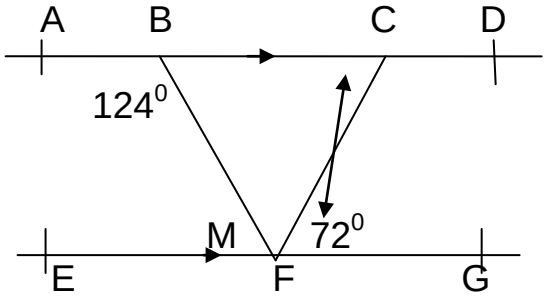



## SUB TOPIC: PARALLEL LINES AND ANGLES OF TRIANGLES

- Here, the angles can be got by using a combination of angle properties of parallel lines, triangles and quadrilaterals.

Example 1

Find the value of x.




**Method 1**

<BFG = <ABF (Alternate interior angles) or

$X + 72^0 = 124^0$

$X + 72^0 - 72^0 = 124^0 - 72^0$

$\mathbf{X = 52^0}$

**method 2**

<BFC = <BCF (Int. and ext. <s)

$x + 72^0 = 124^0$

$x + 72^0 - 72^0 = 124^0 - 72^0$

$\mathbf{X = 52^0}$

**Method 3**

$<m + 124^0 = 180^0$ (Co-int. <s)

$<m + 124^0 - 1240^0 = 180^0 - 124^0$

$<m = 56^0$

$<x + <m + 72^0 = 180^0$ Str. line <

$<x + 56^0 + 72^0 = 180$

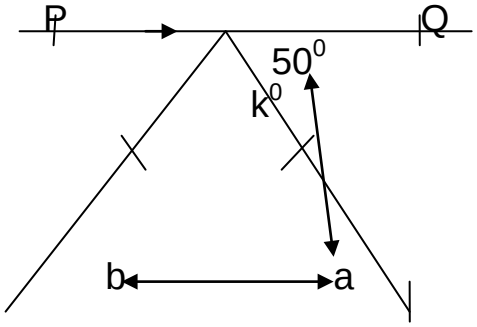
$x + 128^0 = 180 - 128^0$

$x + 128^0 - 128^0 = 180^0 - 128^0$

$\mathbf{X = 52^0}$

Example 2

Find the value of angles k and m in the diagram below.




$<a = 50^0$ (Alternate interior angles)

$<a = <b$ (base <s of isos. △ )

$k^0 + 50^0 + 50^0 = 180^0$

$k + 100 = 180$

$k + 100 - 100 = 180 - 100$

$k = 80$

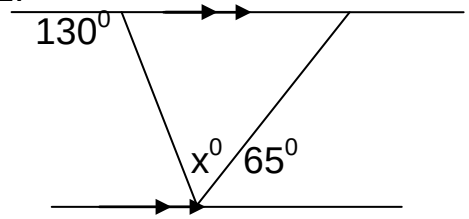
R S

ii) $<m = <k + 50^0$
$= 80^0 + 50^0$
$= \mathbf{\underline{130^0}}$

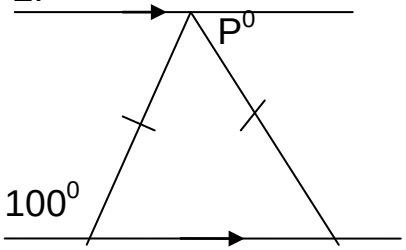
**ACTIVITY:**

Find the size of the unknown angle.

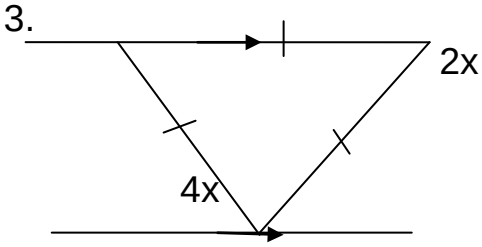
1.



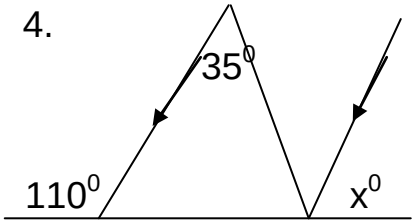

2.



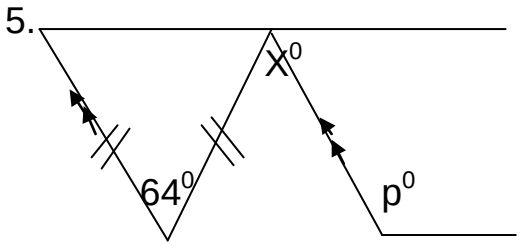

3.




4.




5.

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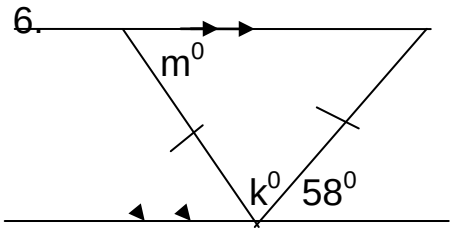


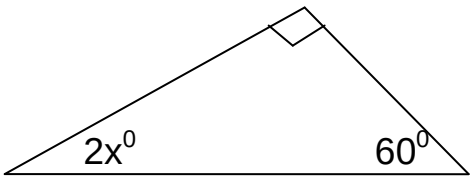

**SUBTOPIC: INTERIOR AND EXTERIOR ANGLES OF TRIANGLES**

- All the three interior angles of a triangle add up to $180^0$.
- Exterior angles are angles outside the vertex of any polygon.
- Interior and exterior angles of a polygon at a vertex add up to $180^0$. **i.e.**

a) $130^0 + 50^0 = 180^0$ b) $120^0 + 60^0 = 180^0$ c) $110^0 + 70^0 = 180^0$.

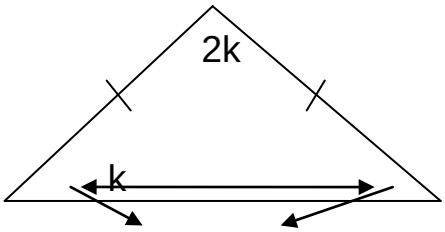
Examples

1. Find the value of x in the triangle below.




$2X + 60^0 + 90^0 = 180^0$ ( Int. <sum)
$2X + 150^0 = 180^0$
$2X + 150^0 - 150^0 = 180^0 - 150^0$
$2X = 30^0$
$\frac{2X}{2} = \frac{30^0}{2}$
$\mathbf{X = 15^0}$

2. Find the value of k in the figure below**.**

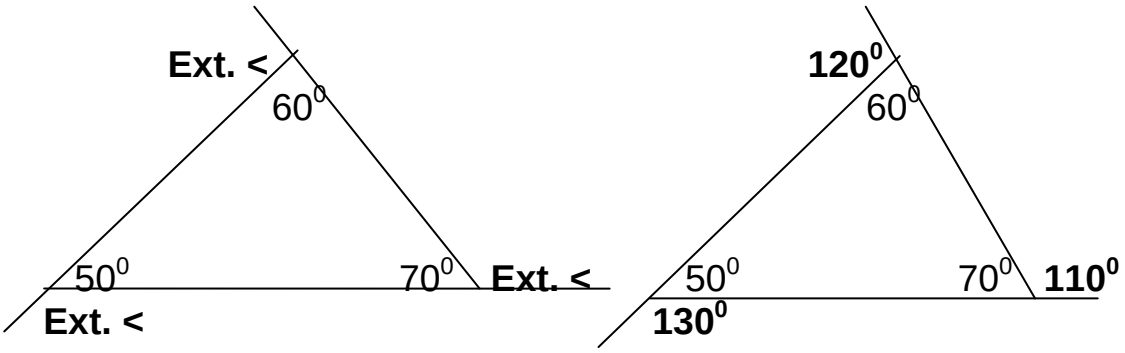



**Base angles**

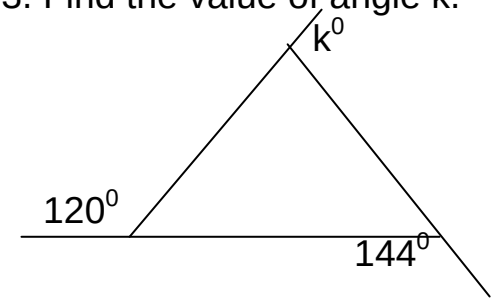
$2k + k + k = 180^0$
$4k = 180^0$
$\frac{4k}{4} = \frac{180^0}{4}$
$k = 45^0$

- All exterior angles of any polygon add up to $360^0$.
  $130^0 + 120^0 + 110^0 = 360^0$.

Study the figures below.

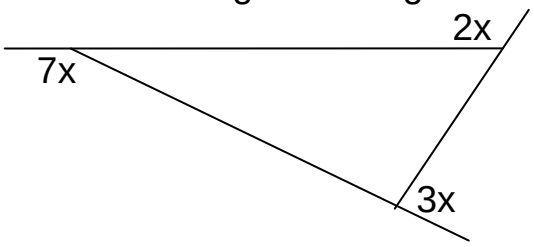



3. Find the value of angle k.




$k + 120^0 + 144^0 = 360^0$
$k^0 + 264^0 = 360^0$
$k^0 + 264^0 - 264^0 = 360^0 - 264^0$
$k^0 = 96^0$
**$k = 96$**

4. Find the value of angle k in degrees.

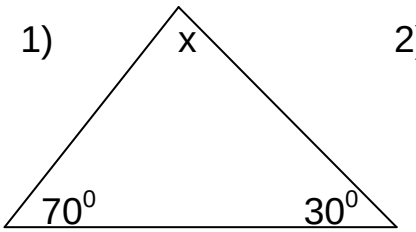



$7x + 3x + 2x = 360^0$
$12x = 360^0$
$\frac{12x}{12} = \frac{360^0}{12}$
**$x = 30^0$**

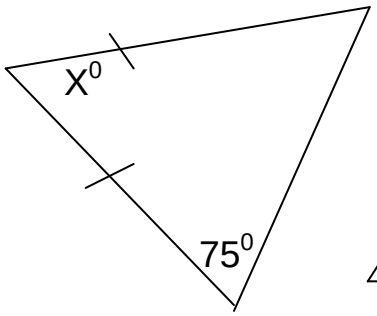
**ACTIVITY:**

Find the value of X in the following figures below

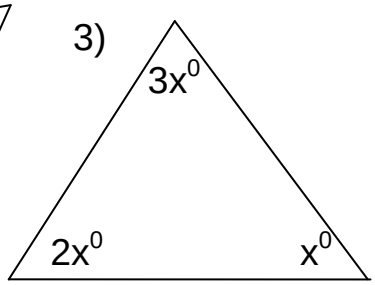
1)



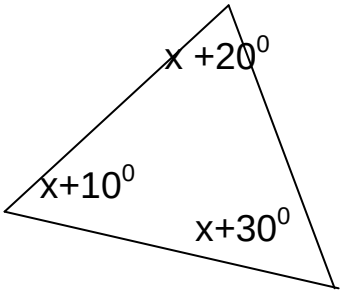

2)



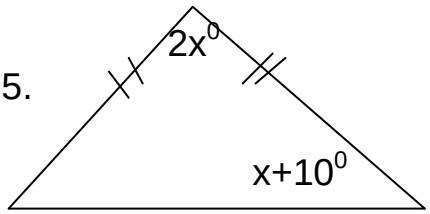

3)



4.

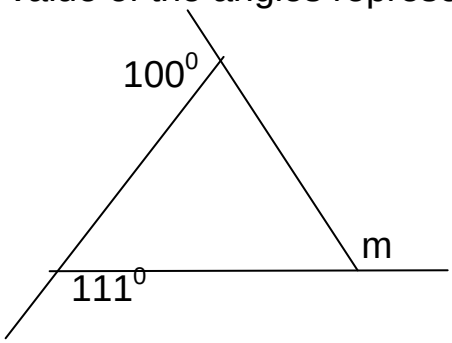



5.




Find the value of the angles represented by the letters.

6.

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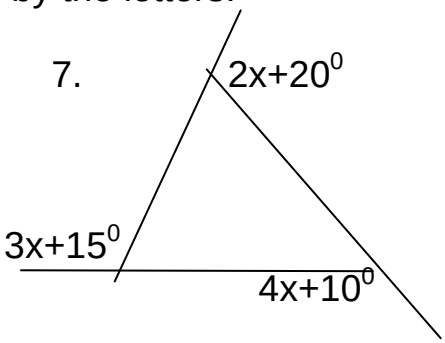
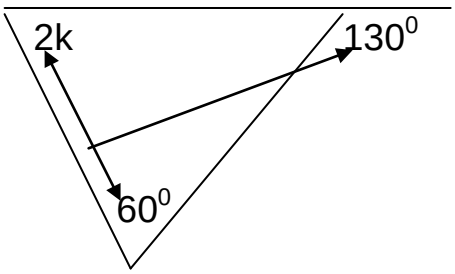



**SUB TOPIC: INTERIOR AND EXTERIOR ANGLES OF TRIANGLES**

- Sum of two interior angles is equal to one opposite exterior angle.

Examples:

1. Find the value of k.




Sum of two opp. < = one opp. ext. <

$2k + 60^0 = 130^0$

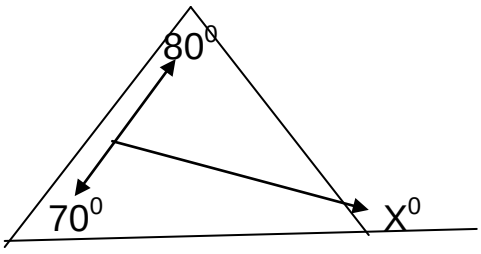
$2k + 60^0 - 60^0 = 130^0 - 60^0$

$2k = 70^0$

$\frac{2k}{2} = \frac{70^0}{2}$

$\mathbf{k = 35^0}$

2. Find the value of X.




Sum of 2 int. <s = 1 opp. Ext. <

$80^0 + 70^0 = X^0$

$150^0 = X^0$

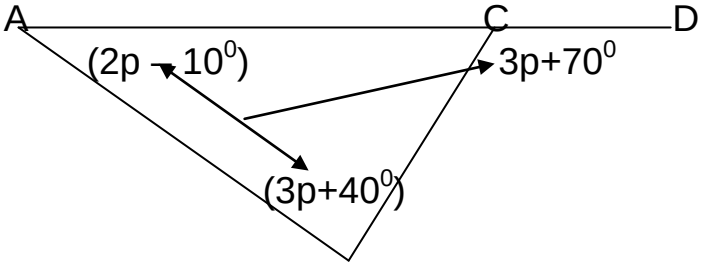
$\frac{150^0}{1^0} = \frac{X^0}{1^0}$

$150 = X$

$\mathbf{X = 150}$

3. In the figure below, ABC is a triangle. Angle BCD = $(3p + 70^0)$.

a) Find the value of p.



Sum of two interior angles = one opposite exterior angle

$(3p+40^0) + (2p - 10^0) = 3p + 70^0$ | $2p = 40^0$

$3p + 2p + 40^0 - 10^0) = 3p + 70^0$ | $\frac{2p}{2} = \frac{40^0}{2}$

$5p + 300 = 3p + 70^0$ | $p = 20^0$

$5p = 3p + 40^0$

$5p - 3p = 3p - 3p + 40^0$

b) Find angle ACB.

Angle ACB $= 180^0 - (3P+70^0)$

$= 180^0 - (3XP + 70^0)$

$= 180^0 - (3X20^0 + 70^0)$

$= 180^0 - (60^0 + 70^0)$

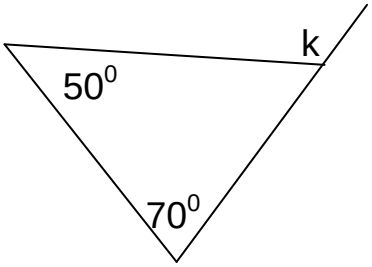
$= 180^0 - 130^0$

Angle ACB $= 50^0$

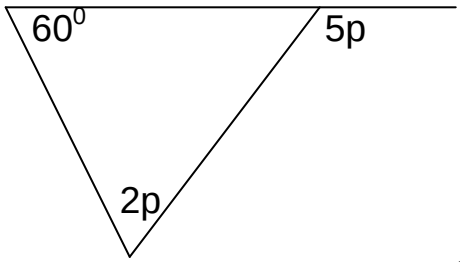
**ACTIVITY:**

Work out the unknown values in the following figures.

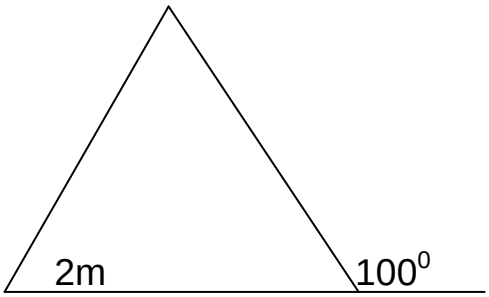
1.



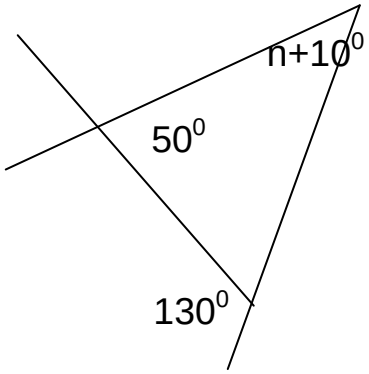

2.



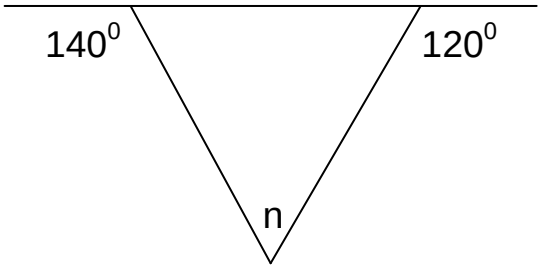

3.



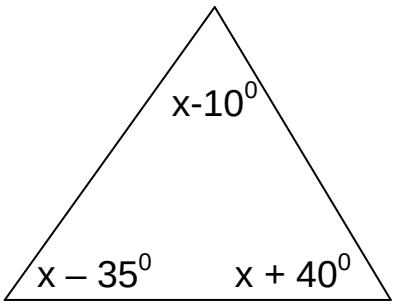

4.




5.




6.




8. The two interior angles of a triangle are $(2x - 20^0)$ and $(3x - 15^0)$. If the opposite exterior angle is $(3x + 40^0)$, Find the;

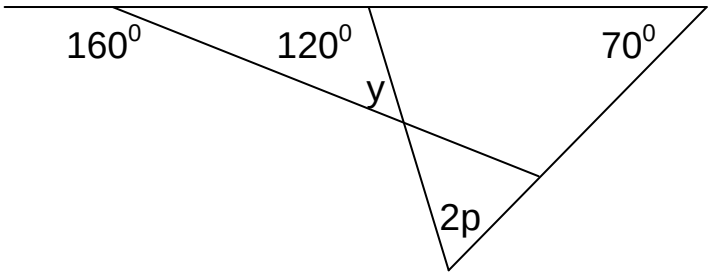
a) value of X. b) size of each angle in degrees.

**SUB TOPIC: APPLICATION OF INTERIOR AND EXTERIOR ANGLES OF TRIANGLES**

- Identify the triangle and its interior and exterior angles.
- Apply the idea of the sum of two opposite interior angles of a triangle equals to one opposite exterior angle.

Examples

Find the value of the angles marked p and y.




Sum of two interior angles = one opposite exterior angle

i) $2p + 70^0 = 120^0$

$2p + 70^0 - 70^0 = 120^0 - 70^0$

$2p = 50^0$

$\frac{2p}{2} = \frac{50^0}{2}$

$p = 25^0$

ii) $y + 120^0 = 160^0$

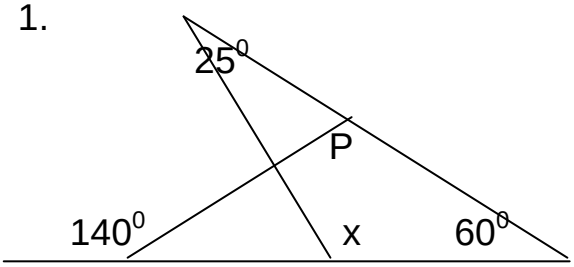
$y + 120^0 - 120^0 = 160^0 - 120^0$

$y = 40^0$

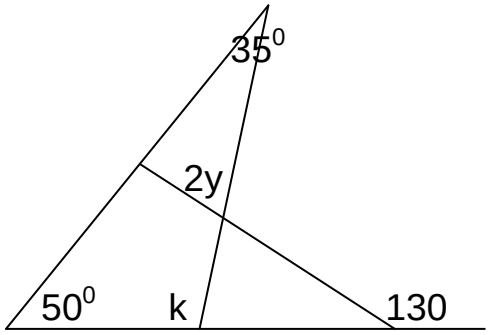
**ACTIVITY:**

Find the values represented by letters in the figures below.

1.




2.

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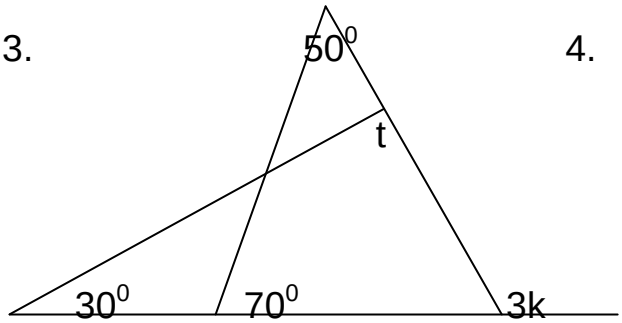


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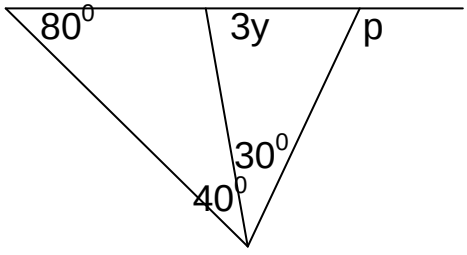


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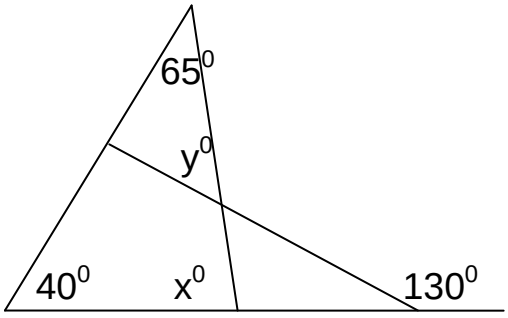


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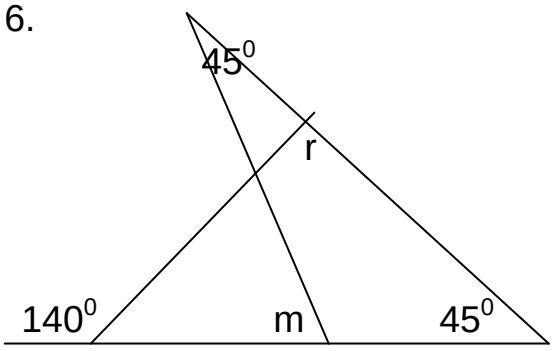


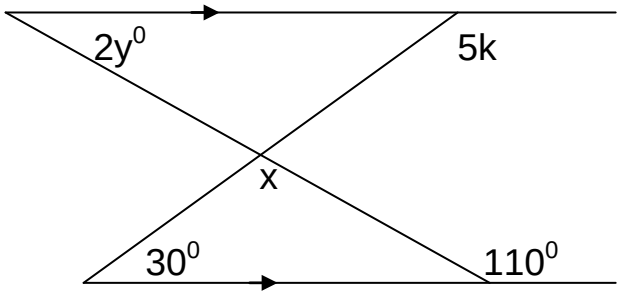

**SUB TOPIC: ANGLES ON PARALLEL LINES AND OF TRIANGLES**

Apply the idea of the properties of angles formed on parallel lines and that of

sum of two interior angles equals to one opposite exterior angle.

Examples

Find the value of angle x then find the value of angles y and k.




(i) $x + 30^0 = 110^0$ ( 2 int.<s = 1 ext.<)

$X + 30^0 - 30^0 = 110^0 - 30^0$

$X = 80^0$

(ii) $5k + 30^0 = 180^0$ (co-int.<s)

$5k + 30^0 - 30^0 = 180^0 - 30^0$

$5k = 150^0$

$\frac{5k}{5} = \frac{150^0}{5}$

$K = 30^0$

(iii) $2y^0 + 110^0$ $180^0$ (co-int.<s)

$2y^0 + 110^0 - 110^0 = 180^0 - 110^0$

$2y^0 = 70^0$

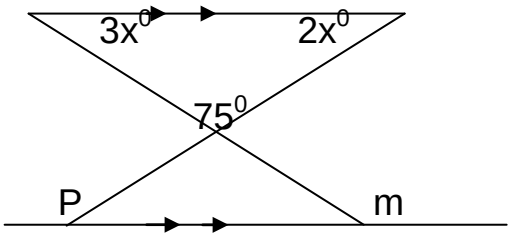
$\frac{2y^0}{2^0} = \frac{70^0}{2^0}$

$y = 35$

**ACTIVITY:**

Find the values represented by letters in the following figures.

1.

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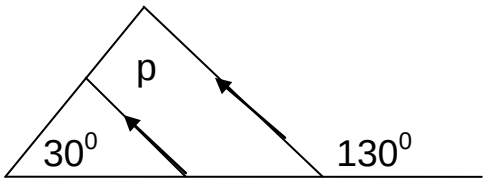


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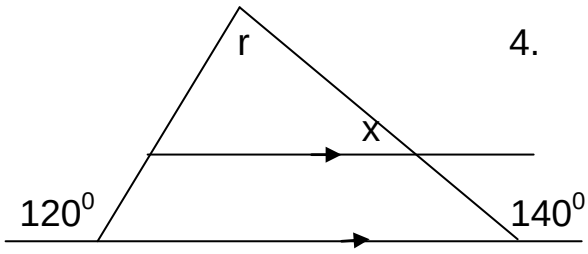


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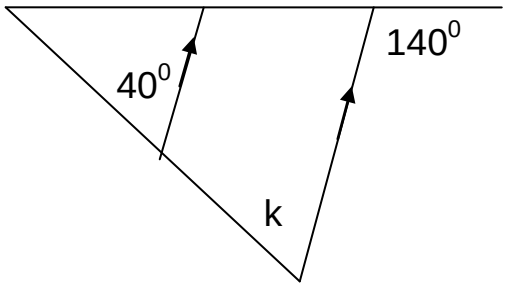



**SUBTOPIC: EXTERIOR/CENTRE AGLES OF REGULAR POLYGONS**

- T he sum of all exterior angles of any regular polygon is $360^0$.
- The sum of all centre angles of any regular polygon is $360^0$.
- The centre angles and exterior angles of any regular polygons are equal.
- The centre angle or exterior angle is equal to the number of sides of the polygon.

Exterior angle = $\frac{\text{All exterior angles}}{\text{Number of sides}}$ or $\frac{360^0}{\text{No. of sides}}$

Centre angle = $\frac{\text{All centre angles}}{}$ or $\frac{360^0}{}$

Number of sides No. of sides

Examples

1. Calculate the size of each centre angle of a regular polygon with 5 sides.

$$\text{Each centre angle} = \frac{\text{All centre angles}}{\text{No. of sides}}$$

$$= \frac{360^0}{5}$$

$$= 72^0$$

2. Find the exterior angle of a regular polygon with sides.

$$\text{Each exterior angle} = \frac{360^0}{\text{No. of sides}}$$

$$= \frac{360^0}{4}$$

$$= 90^0$$

3. Work out the size of each exterior angle of a regular hexagon.

A regular hexagon has 6 sides

$$\text{Each exterior angle} = \frac{360^0}{\text{No. of sides}}$$

$$= \frac{360^0}{6}$$

$$= 60^0$$

**ACTIVITY:**

1. Find the size of each centre angle of a regular polygon with;
   a) 8 sides b) 9 sides c) 10 sides d) 12 sides

2. Find the size of each exterior angle of a regular polygon with;
   a) 3 sides b) 18 sides c) 20 sides d) 15 sides

3. What is the size of each exterior angle of a regular nonagon?

4. What is the size of each centre angle of a regular quadrilateral?

**SUB TOPIC: NUMBER OF SIDES OF REGULAR POLYGONS**

- Number of sides is got by dividing sum of all centre or exterior angles by each centre or exterior angle.

$$\text{Number of sides} = \frac{\text{All exterior angles}}{\text{One exterior angle}} \quad \text{or} \quad \frac{\text{All centre angles}}{\text{One centre angle}}$$

Examples

1. The exterior angle of a regular polygon is $60^0$. Find the number of sides of the regular polygon.

$$\text{Number of sides} = \frac{\text{Sum of all exterior angles}}{\text{One exterior angle}}$$

$$= \frac{360^0}{60^0}$$

$$= 6 \text{ sides}$$

The regular polygon has 6 sides.

2. The centre angle of a regular polygon is $72^0$. Work out the number of sides of the polygon.

Number of sides = $\frac{\text{Sum of all centre angles}}{\text{Each centre angle}}$

$= \frac{360^0}{72^0}$

$= 5$ sides  The regular polygon has 5 sides.

3. The exterior angle of a regular polygon is $x^0$. Calculate the number of sides of the regular polygon.

Number of sides = $\frac{\text{All exterior angles}}{\text{One exterior angle}}$

$= \frac{360^0}{X^0}$

$= \frac{(360)}{x}$

The polygon has $\frac{(360)}{x}$ sides

**ACTIVITY:**

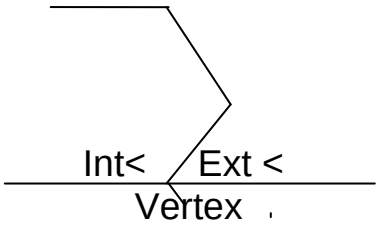
1. Find the number of sides of a regular polygon whose;
   a) exterior angle = $45^0$.  b) centre angle = $30^0$.  c) exterior angle =$120^0$.
2. One of the exterior angles of a regular polygon is$36^0$. How many sides has the polygon?
3. Name the polygon whose exterior angle is $72^0$.
4. Each centre angle of a regular polygon is $(x+2)^0$. Find the number of sides of the regular polygon.

**SUB TOPIC: INTERIOR AND EXTERIOR ANGLES OF REGULAR POLYGONS**

- Interior and exterior angles of any polygon at the vertex add up to$180^0$.
- To name a polygon, first find the number of sides of the polygon.

Examples

1. Find the size of each interior angle of a regular polygon if the exterior angle is $30^0$.




Interior angle + exterior angle = $180^0$.

Let the interior angle be X.

$X + 30^0 = 180^0$

$X + 30^0 - 30^0 = 180^0 - 30^0$

$X = 150^0$

The interior angle is $150^0$.

2. The size of each interior angle of a regular polygon is $144^0$.
   a) Calculate the size of each exterior angle.
   Let the exterior angle be k.

Exterior angle + interior angle = $180^0$.

$k + 144^0 = 180^0$

$k + 144^0 - 144^0 = 180^0 - 144^0$

$k = 36^0$

The exterior angle is $36^0$.

b) Name the polygon.

Number of sides = $\frac{360^0}{\text{One ext.}<}$

$= \frac{360^0}{36^0}$

= 10 sides

The polygon is called a decagon.

3. The interior and exterior angles of a regular polygon are in the ratio of 3 : 2 respectively.

a) Find the size of the interior and exterior angles.

Total ratio = 3 + 2

= 5

Interior angle = $\frac{3}{5} \times 180^0$

$= 3 \times 36^0$

$= 108^0$

Exterior angle = $\frac{2}{5} \times 180^0$

$= 2 \times 36^0$

$= 72^0$

b) What is the name of the polygon?

Number of sides = $\frac{360^0}{\text{One ext.}<}$

$= \frac{360^0}{72^0}$

= 5 sides

The name of the regular polygon is a pentagon.

4. The interior angle of a regular polygon is $90^0$ more than the exterior angle.

a) Calculate the size of the exterior angle.

Let the exterior angle be y.

| Ext. < | Int. <. | Total |
|---|---|---|
| y | $y + 90^0$ | $180^0$ |

Ext. < + Int. < $= 180^0$

$y + y + 90^0 = 180^0$

$2y + 90^0 = 180^0$

$2y + 90^0 - 90^0 = 180^0 - 90^0$

$2y = 90^0$

$\frac{2y}{2} = \frac{90^0}{2}$

$y = 45^0$

The exterior angle is $45^0$.

b) How many sides does the polygon have?

Number of sides = $\frac{360^0}{45^0}$

= 8 sides

The polygon has 8 sides.

5. The exterior angle of a regular polygon is $36^0$ less than the interior angle.

a) Calculate the size of each interior angle.

Let the interior angle be p.

| Int. < | Ext. < | Total |
|---|---|---|
| p | $P - 36^0$ | $180^0$ |

$p + p - 360 = 180^0$

$2p - 36^0 + 36^0 = 180^0 + 36^0$

$2p = 216^0$

$\frac{2p}{2} = \frac{216^0}{2}$

$p = 108^0$

b) Name the polygon.

Number of sides $= \frac{360^0}{\text{One ext.}<}$

$= \frac{360^0}{72^0}$

= 5 sides

The polygon is a pentagon.

**ACTIVITY:**

1. Calculate the size of the interior angle of a regular polygon whose exterior angle is $80^0$.
2. The interior angle of a regular polygon is $120^0$.
   a) What is the size of each exterior angle?
   b) Calculate the number of sides of the regular polygon.
   c) Name the polygon.
3. The interior angle of a regular polygon is $108^0$.
   a) Calculate the size of each exterior angle. b) Name the polygon.
4. The exterior angle of a regular polygon is $40^0$. Calculate the size of each interior angle.
5. The interior and exterior angles of a regular polygon are in the ratio 5 : 1 respectively.
   a) What is the size of each interior and exterior angles?
   b) What is the name of the polygon?
6. The interior angle of a regular polygon is $120^0$ more than the exterior angle.
   a) What is the size of each exterior angle?
   b) Calculate the number of sides of the polygon.
7. The exterior angle of a regular polygon is $100^0$ less than the interior angle.
   a) What is the size of each exterior angle? b) Name the polygon.

8 The interior angle of a regular polygon is five times the exterior angle.
   a) Calculate the size of the exterior angle.
   b) Find the number of sides of the polygon.

9. The exterior angle of a polygon is a fifth of the interior angle.
   a) Work out the size of each interior and exterior angles.
   b) How many sides does the polygon have?

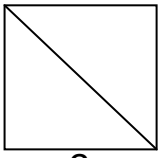
**SUB TOPIC: FORMING TRIANGLES FROM POLYGONS**

- Forming triangles from polygons is referred to as "**triangulation**".
- Subtract 2 from the number of sides of the polygon i.e "n – 2" where "n" stands for the number of sides of the polygon.
- The number of right angles doubles the number of triangles

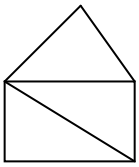
i. e the formula is 2(n – 2) or 2n – 4 .

Examples

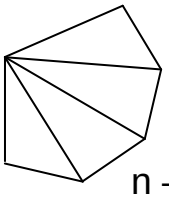
1. Form triangles from the shapes below:



n - 2
= 4 – 2
= **2 triangles**



n – 2
= 5 – 2
= **3 triangles**



n – 2
= 6 – 2
= **4 triangles**

2. How many triangles can be formed from a nonagon?

A nonagon has 9 sides
Number of triangles = n – 2
= 9 – 2
= **7 triangles**

3. If 10 triangles can be formed from a regular polygon. How many sides has the polygon?

Number of triangles = 10
n – 2 = 10
n – 2 + 2 = 10 + 2
n = 12

4. Calculate the number of right angles in a polygon with 5 sides.

Number of right angles = 2(n – 2)
= 2(5 – 2)
= 2 x 3
**= 6 right angles**

5. The number of right angles of a polygon is 12. Calculate the number of sides of the polygon and name the polygon.

Number of right angles = 12
Number of right angles = 2n – 4
2n – 4 = 12
2n – 4 + 4 = 12 + 4
2n = 16
$\frac{2n}{2} = \frac{16}{2}$
n = 8 sides

**The polygon is an octagon.**

**ACTIVITY:**

1. Find the number of triangles from polygons wit

a) 6 sides b) 15 sides c) 12 sides d) 7 sides

2. Find the number of sides of polygons with the following:
a) 8 triangles b) 20 triangles c) 12 triangles d) 6 triangles

3. Find the number of right angles of a polygon of;
a) 4 sides b) 6 sides c) 9 sides d) 11 sides
e) 13 sides f) 18 sides g) 20 sides

4. Find the number of sides of a polygon with;
a) 8 right angles b) 20 right angles c) 18 right angles
d) 24 right angles e) 16 right angles f) 10 right angles

**SUB TOPIC: FINDING SUM OF INTERIOR ANGLES OF REGULAR POLYGONS**

- Identify the number of sides of the regular polygon.
- If given the interior or exterior angle only, first find the exterior or interior angle and the number of sides of the polygon.
- Sum of all interior angles = Interior angle x No. of sides.
- Apply the formula $180^0(n - 2)$ or $90^0(2n - 4)$ where "n" stands for the number of sides of the regular polygon.

Examples

1. The interior angle of a regular pentagon is $108^0$. Calculate the sum of all the interior angles of the polygon.

Pentagon has 5 sides.

Interior angle sum $= 180^0(n - 2)$
$= 180^0(5 - 2)$
$= 180^0 \times 3$
$= \mathbf{540^0.}$

2. Calculate the interior angle sum of a regular polygon of 7 sides.

Sum of all interior angles $= 180^0(n - 2)$
$= 180^0(7 - 2)$
$= 180^0 \times 5$
$= \mathbf{900^0.}$

3. Each exterior angle of a regular polygon is $30^0$. Calculate the sum of all the interior angles.

Number of sides $= \frac{360^0}{\text{One ext.<}}$
$= \frac{360^0}{30^0}$
$= \mathbf{12sides}$

Sum of interior angles $= 180^0(n - 2)$
$= 180^0(12 - 2)$
$= 180^0 \times 10$
$= \mathbf{1800^0}$

**ACTIVITY:**

1. A regular polygon has 10 sides. Calculate the sum of all the interior angles.
2. Calculate the sum of the interior angles of a regular hexagon whose interior

angle is $120^0$.
3. One of the interior angles regular octagon is$135^0$. Calculate the sum of its interior angles.
4. Calculate the sum of all the interior angles of a regular Duo-decagon whose interior angle is $150^0$.
5. The size of each exterior angle of a regular polygon is $72^0$. Calculate the sum of all its interior angles.
6. The exterior angle of a regular polygon is $45^0$.Work out the sum of its interior angles.
7. A regular polygon has 9 sides. Find its interior angle sum.
8. Calculate the sum of the interior angles of a regular decagon.

**SUB TOPIC: APPLYING INTERIOR ANGLE SUM OF POLYGONS**

- Identify the formula for finding the sum of all the interior angles.
- Apply the formula to form an equation then solve.

Example

Method 1

The interior angle sum of a regular polygon is $1440^0$.

a) How many sides has the polygon?

Sum of all interior angles = $180^0(n - 2)$

$180^0(n - 2) = 1440^0$

$\frac{180^0(n - 2)}{180^0} = \frac{1440^0}{180^0}$

$n - 2 = 8$

$n - 2 + 2 = 8 + 2$

**$n = 10$**

Method 2

Sum of all interior angles = $1440^0$

$180^0(n - 2) = 1440^0$

$(180^0 \times n) - (180^0 \times 2) = 1440^0$

$180n^0 - 360^0 + 360^0 = 1440^0 + 360^0$

$180n^0 = 1800^0$

$\frac{180n^0}{180^0} = \frac{1800^0}{180^0}$

$n = 10$

**The polygon has 10 sides.**

b) Calculate the size of each exterior and interior angles.

Exterior angle = $\frac{360^0}{\text{No. of sides}}$

$= \frac{360^0}{10}$

$= \mathbf{36^0}$

Interior angle = $\frac{1440^0}{\text{No. of sides}}$

$= \frac{1440^0}{10}$

$= \mathbf{144^0}$

**ACTIVITY:**

1. The sum of the interior angles of a regular polygon is $1260^0$. Calculate the size of each interior and exterior angles.
2. The sum of the interior a regular polygon is $1,080^0$.
   a) How many sides has the polygon? b) Name the polygon.

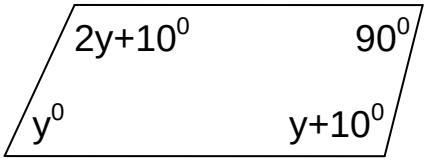
3. The sum of the interior angles of a regular polygon is $540^0$.
   a) Calculate the size of each centre angle of the polygon.
   b) How many triangles does it have?
   c) Calculate the number of right angles the polygon has.
4. The sum of the interior angles of a regular polygon is $900^0$.
   a) How many sides does the polygon have?
   b) Work out the size of each interior and exterior angles.

## SUB TOPIC: MORE ABOUT INTERIOR ANGLE SUM OF POLYGONS

- Apply the interior angle sum in forming an equation.
- Solve the problem involving interior angle sum of polygons**.**
- Each polygon has its interior angle sum different from the other.

Examples

2. Find the value of y in the figure below.




Interior angle sum of quadrilaterals is $360^0$.

$2y + 2y + 10^0 + y + 10^0 + 90^0 = 360^0$

$2y + 2y + y + 10^0 + 10^0 + 90^0 = 360^0$

$5y + 110^0 = 360^0$

$5y + 110^0 - 110^0 = 360^0 - 110^0$

$5y = 250^0$

$\frac{5y}{5} = \frac{250^0}{5}$

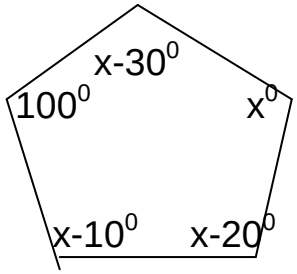
**$Y = 50^0$**

## ACTIVITY:

Find the value of X in the figures numbers 1- 4 below.

1.

2.

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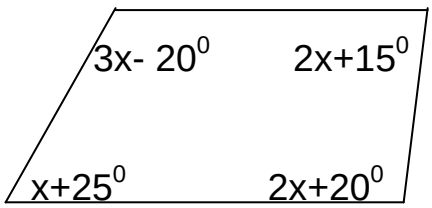


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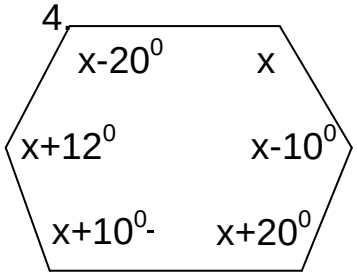


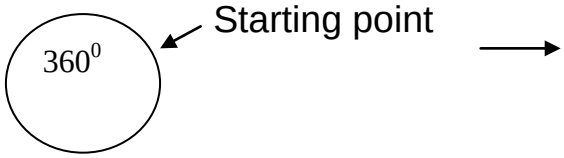

5. The three angles of a triangle are x, 2x and 3x.
   i) Find the value of x.
   ii) Find the size of the largest angle.

6. The three angles of a triangle are 2p, $p+10^0$ and $3p+50^0$.
   i) Find the value of p.

   ii) Find the size of the largest angle.

**TOPIC: GEOMETRY (BEARING AND SCALE DRAWING)**
**SUB TOPIC: ROTATION (REVOLUTIONS)**
**Concepts**

- Geometry is a branch of mathematics which deals with shapes, angles, links, surfaces, points and so on.
- Rotation is the complete turn from a point and back to a point (practically).
- Rotation is the same as revolution which has one complete turn = 360




1 revolution = $360^0$

Examples

1. How many degrees make $^2/_3$ of a revolution?

1 revolution = $360^0$

:. $^2/_3$Revolution = $360^0$ x $^2/_3$

= $120^0$ x 2

= $240^0$

2. Find the angle made by the minute hand of a clock if it turns 50 minutes.

1 revolution = 1 hour = $360^0$

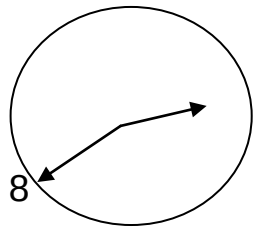
1 minute = $\frac{360^0}{60}$

1 minute = $6^0$

50 minutes = 50 x $6^0$

= $300^0$

3. The time is 2:40pm. What is the smaller angle between the hands of the clock?




From 2 → 2:40pm = 30 minutes

1 minute = $6^0$

:. 30 minutes = $(6 \times 30)^0$

= $180^0$

4. Find the angle made by the hour hand of a clock in 2 hours?

Half day = 12hours

2 hours = $\frac{2}{12} \times 360^0$

$= 2 \times 30^0$

$= 60^0$

**ACTIVITY:**

1. Find the angle made in each of the following movements /revolution).

$a)\ {}^{2}/_{5}$ b) ${}^{1}/_{2}$ c) ${}^{1}/_{20}$ d) $2{}^{1}/_{4}$ e) ${}^{3}/_{4}$ f) 0.5 g) 12 h) 3 ½

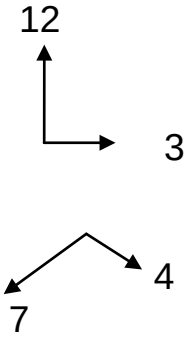
2. a) It is 30 minutes past 6pm. What angle is made by the hands of the clock?

b) The time is a quarter to ten in the morning.

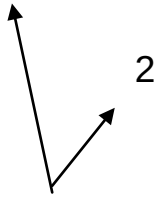
3. What angle does the minute hand of a clock make in;

(i) 30 minutes? (ii) 12 minutes? (iii) 50 minutes?

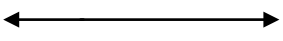
4. Calculate the size of the angle made the hands of the clock below.




(iii)




(iv)




5. If it is 8:05am now, through what angle does the minute hand turn to make 8:15am?

6. What angles are made by the hour hand of a clock in;

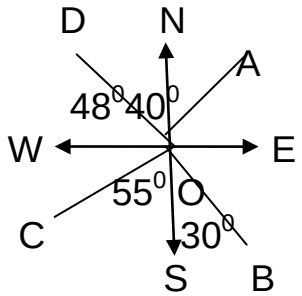
a) 2.5 hours? b) $\frac{2}{3}$ hour? c) $\frac{1}{5}$ hour?

**SUB TOPIC: ORDINARY BEARING (DIRECTION)**

- Ordinary bearing means simply "direction" clockwise or anticlockwise.
- The acute angle describing ordinary bearing is measured from "North" or "South" but not from East or West.

Example

Find the direction of the given points below on the compass.




i) The point of origin or observation is O.

ii) The direction of A from origin O is $40^0$ East of North.

So the direction of A from the origin O is $N40^0$ E

iii) The direction of B from origin O is $30^0$ East of South

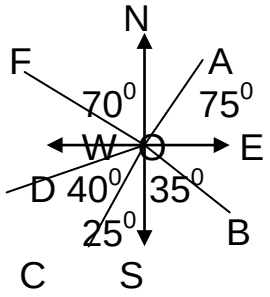
So the direction of B from the origin O is $S30^0$ E

iv) The direction of C from origin is $55^0$ West of South.
So the direction of C from the origin O is S$55^0$ W

v) The direction of D from the origin is $48^0$ West of North
So the direction of D from the origin D is N$48^0$ W

**ACTIVITY:**

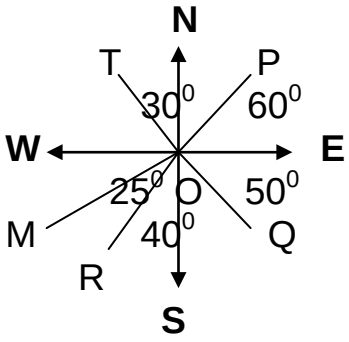
Use the compass below to answer the following questions that follow.




1. What is the direction of;

i) A from O? ii) B from O? iii) C from O?

iv) D from O? v) F from O?



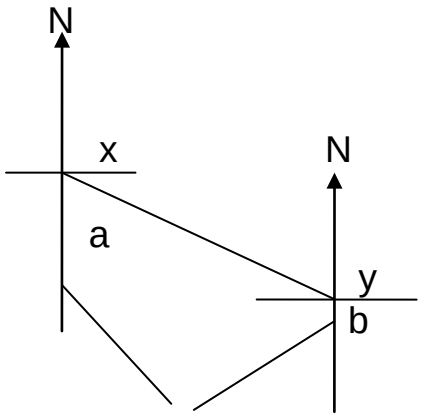

2. What is the direction of;

a) P from O? b) Q from O? c) R from O?

d) M from O? e) T from O?

**SUB TOPIC: MORE ABOUT ORDINARY BEARING**

- Show the North direction at any point i.e the lines that show the North direction of any two or more places must be parallel. Ie\




Parallel Lines

The two co-interior angles between the lines showing the North add up to $180^0$.

ie

$\angle x + \angle y = 180^0$

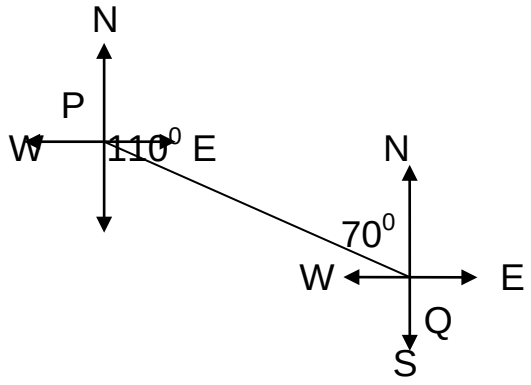
$\angle a + \angle b = 180^0$

The two alternate with between the lines showing the North direction are equal in size ie

$\angle a = \angle y$ $\angle x = \angle b$

Examples

Use the figure below to answer questions that follows;



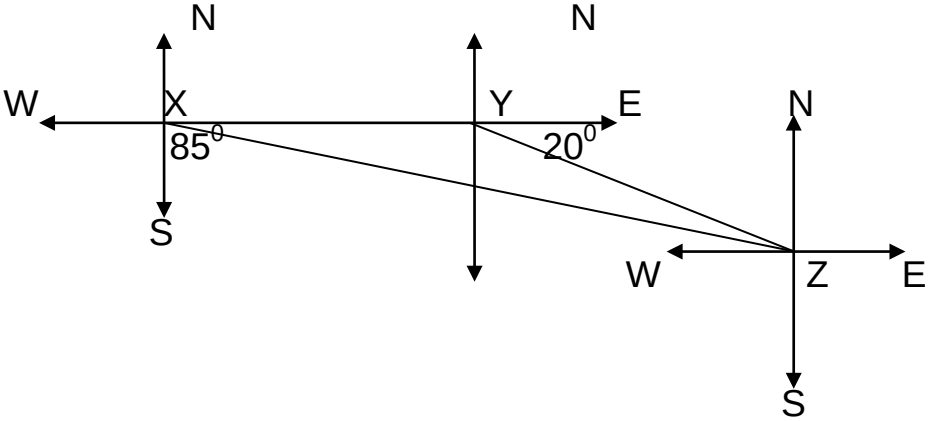

a) Find the direction of Q from P.

The direction of Q from P is $70^0$ East of South expressed as S$70^0$E.

b) What is the direction of P from Q?

The direction of P from Q is $70^0$ West of North expressed as N$70^0$W

Use the figure below to answer questions that follow;




(i) What is the direction of Y from X?

The direction of Y from X is $90^0$ East of North expressed as N$90^0$E.

(ii) What is the direction of Z from Y?

The direction of Z from Y is ($90^0 - 20^0$) West of Y expressed as S$70^0$E.

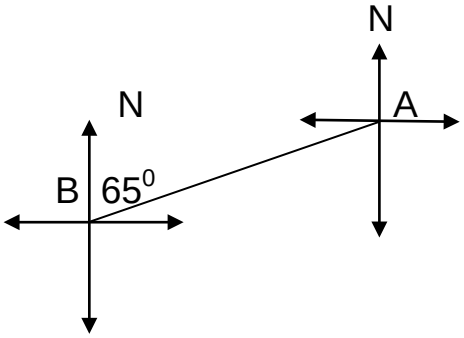
(iv) What is the direction of Y from Z?

The direction of Y from Z is ($90^0 - 20^0$) West of North written as N$70^0$W.

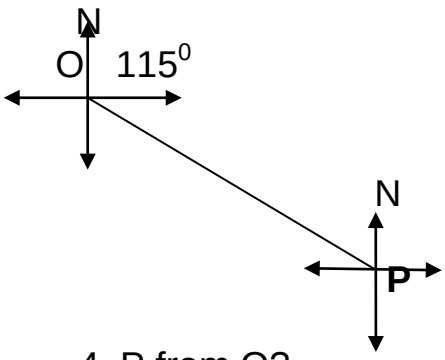
**ACTIVITY:**

What is the direction of the following points?

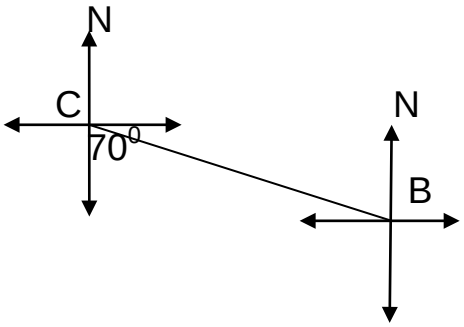
1) A from B?



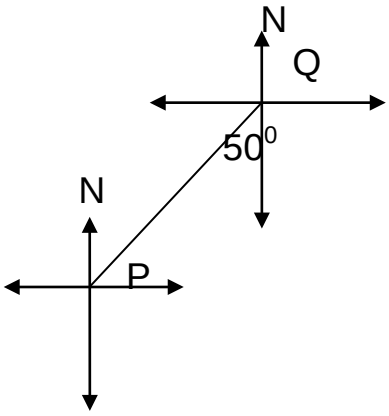

2) P from O?



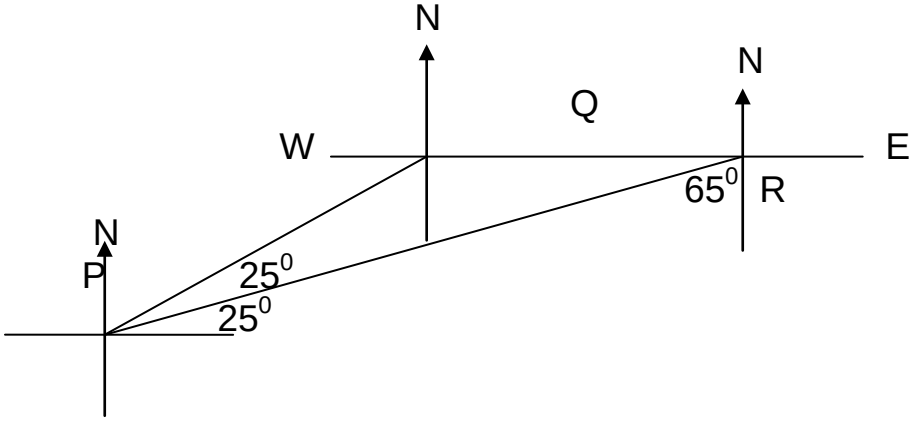

3. B from C?




4. P from Q?

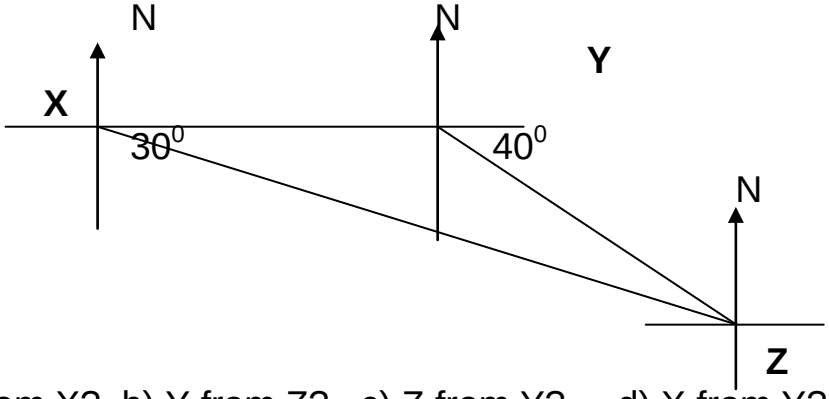



5. Find the direction of the following points below.




a) Q from P? b) P from R? c) R from Q? d) P from Q? e) R from P?

2. What is the direction of the following points indicated below;



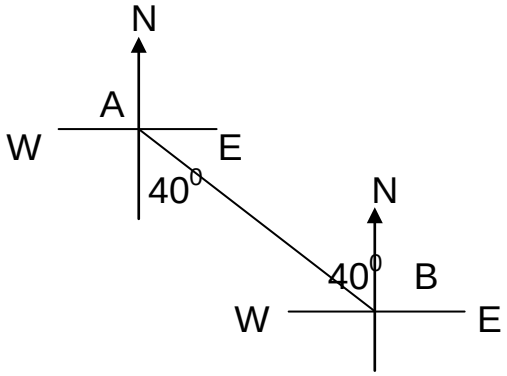

a) Y from X? b) Y from Z? c) Z from Y? d) X from Y? e) Z from X?

**SUB TOPIC: OPPOSITE DIRECTION OF ORDINARY BEARING**

- The opposite direction of North is South
- The opposite direction of East is West
- The opposite direction of North-East is South-West.
- The opposite direction of South-East is North-West

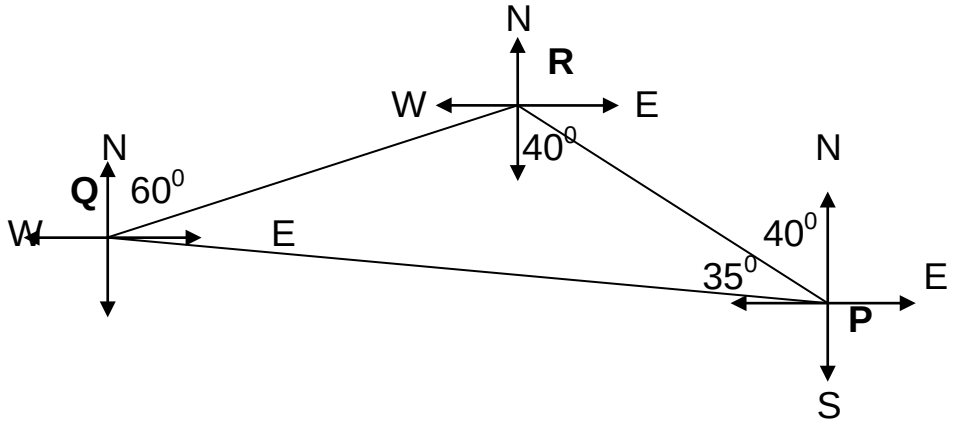
Examples

1. From the diagram given below, find the opposite directions of;




(i) The opposite direction of A from B is $N40^0W$.
(ii) The opposite direction of B from A is $S40^0E$

2. State the opposite direction for the following points:




a) The direction of R from Q is N $60^0$ E.
Its opposite direction is S $60^0$ W.

b) The direction of P from Q is S $40^0$ E.
Its opposite direction is N $40^0$ W.

c) The direction of R from P is N $75^0$ W
Its opposite direction is S $75^0$ E

**ACTIVITY:**

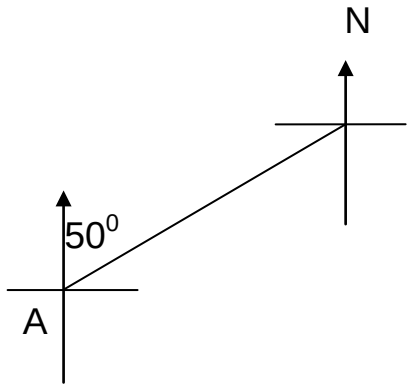
1. Given the opposite directions for;
a) S $40^0$ W b) N $37^0$ W c) N $15^0$ E d) S $60^0$ E e) N $75^0$ W

2. The direction of Q from P is N $40^0$ E. Find its opposite direction.

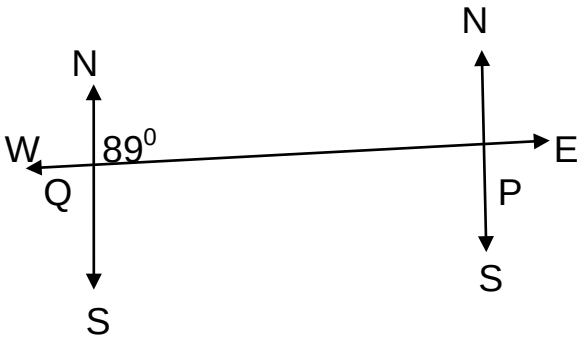
3. The direction of Mukono from Lugazi is S $85^0$ W. What is the direction of Lugazi from Mukono?

4. Use the figure below to find the opposite bearing of;

a)




b)




(i) Find the bearing of B from A? (ii) What is the bearing of A from B?

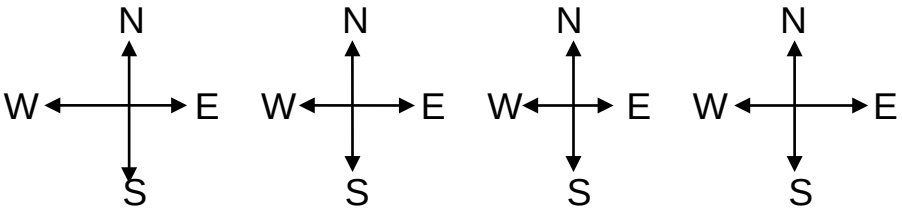
(iii) Find the bearing of P from Q?(iv) What is the bearing of Q from P?

**<u>TOPIC: GEOMETRY (BEARING AND SCALE DRAWING)</u>**
**<u>SUB TOPIC: TRUE BEARING</u>**

- <u>True bearing</u> is the angle measured always from North in a clockwise direction only.
- <u>The angles less than $90^0$ must be written in three digits.</u>

The 3 rules on bearing: (NC3 rule)
N ⟷ Face North C ⟷ Measure clockwise 3 ⟷ Use 3 digits

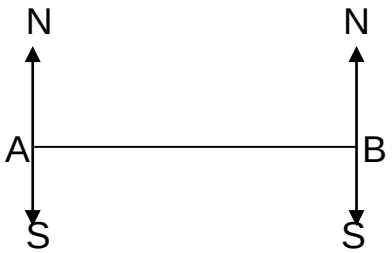
- Bearings are used to describe the position of one place with reference to another.
- Bearings are used by <u>pilots,</u> <u>sailors,</u> <u>soldiers</u>, etc.




<u>Bearing of East is $090^0$</u>, <u>Bearing of South is $180^0$</u>, <u>Bearing of West is $270^0$</u> and the <u>Bearing of North is $360^0$</u>

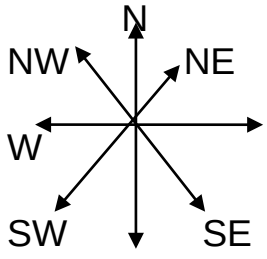
<u>Examples</u>

1. What is the bearing of A from B?




<u>The bearing of B from A is $090^0$.</u>

2. Find the bearing of South West from the compass direction below.
Face North, move clockwise up to South-West = 5 movements of $45^0$ each.




Solution

$180^0 + 45^0 = 225^0$

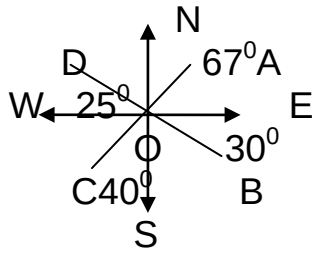
The bearing of South-West direction has 5 points from North direction clockwise

$= 45^0$

<u>x 5</u>

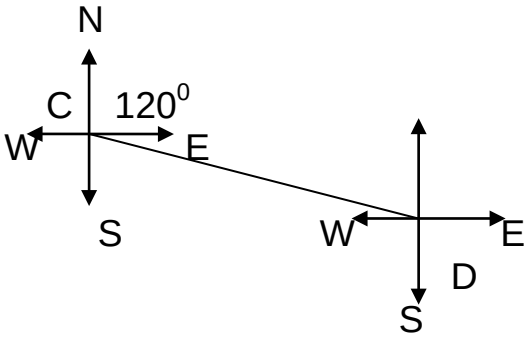
S $225^0$

3. Give the bearing of the points below from the origin.




(i) The bearing of A from O is $067^0$
(ii) The bearing of B from O is $90^0 + 30^0 = 120^0$
(iii) The bearing of C from O is $180^0 + 40^0 = 220^0$
(iv) The bearing of D from O is $270^0 + 25^0 = 295^0$

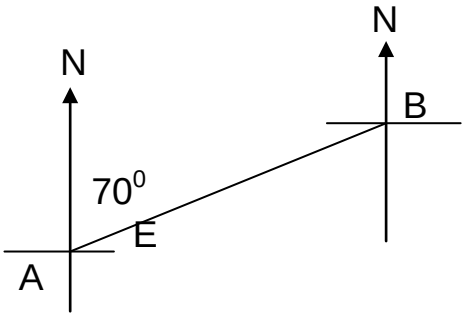
3. Find the bearing of C from D in the figure below




The bearing of C from D = $180^0$
$+ 120^0$
$300^0$

**The bearing of D from C is $300^0$**

2. What is the bearing of B from A?




Clockwise movement from point A $70^0$
The bearing of B from A is $070^0$.

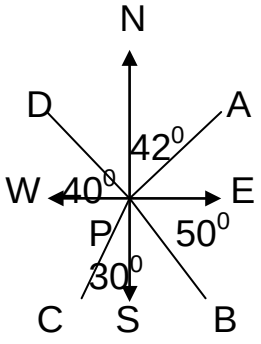
The bearing of A from B is $180^0 + 070^0 = 250^0$ (opposite bearing)

**ACTIVITY:**

1. What is the bearing of the following directions from O;

i) Western? ii) North Western? iii) SE? iv) NE? v) SW?

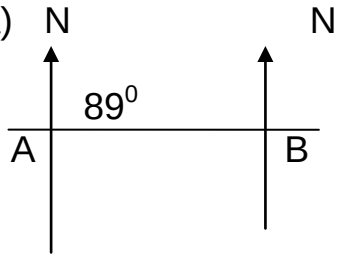
2. Using the compass below, what is the bearing of the following points;



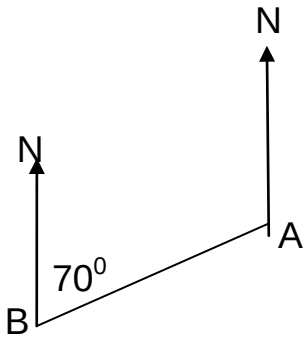
i) A from P? ii) B from P? iii) C from P? iv) D from P?

3. Find the bearing of A from B in each figure below;

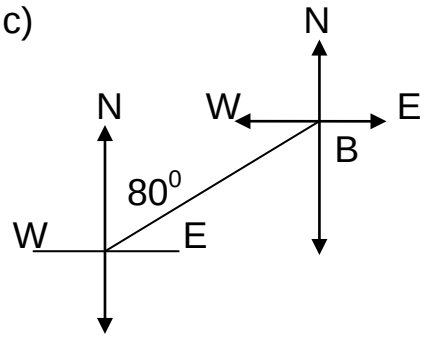
a)



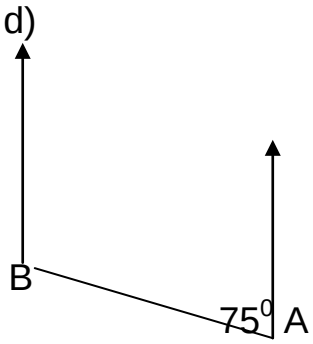

b)



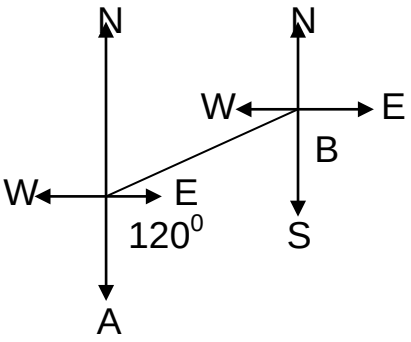

c)



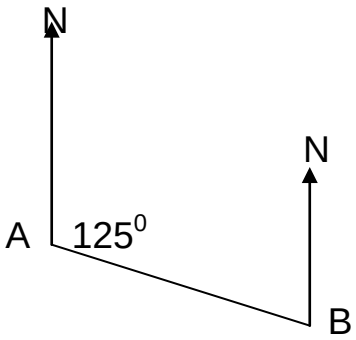

d)




e)




f)




**SUB TOPIC:OPPOSITE BEARING OF TRUE BEARING**

- Add $180^0$ to an angle which is less than $180^0$ i.e (from $1^0$ to $179^0$)
- Subtract $180^0$ from an angle more than $180^0$ i.e (from $181^0$ to $359^0$)
- Show the opposite bearing on a diagram using NC3 rule if required.
  Table showing opposite bearing

| Bearing | Opposite bearing |
|---|---|
| $045^0$ | $225^0$ |
| $090^0$ | $270^0$ |
| $135^0$ | $315^0$ |
| $225^0$ | $045^0$ |

Examples:

1. If the bearing P from Q is $060^0$. What is the bearing of Q from P?

   Bearing of Q from P (Opposite bearing)

   = $060^0 + 180^0$

   = $\underline{240^0}$

2. The bearing of A from B is $270^0$. Find the bearing of B from A.

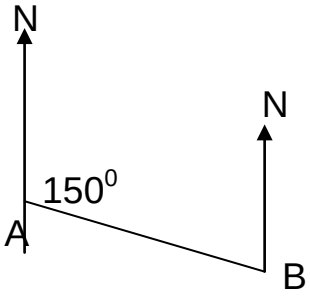
   Bearing of B from A (Opposite bearing)

   = $270^0 – 180^0$

= $\underline{090^0}$

3. Show the bearing of A from B using a diagram.
   Bearing of A from B (Opposite bearing)

Use NC3↔ Face North at B, turn clockwise and answer with 3 digits




$= 150^0 + 180^0$
$= \underline{330^0}$

4. The bearing of X from Y is $315^0$. Find the bearing of Y from X.
   X from Y= $315^0$ more than $180^0$ (opposite bearing)
   Y from x = $315^0 - 180^0$
   $= \underline{135^0}$

$\underline{\therefore \text{The bearing of Y from X is } 135^0}$

**ACTIVITY:**

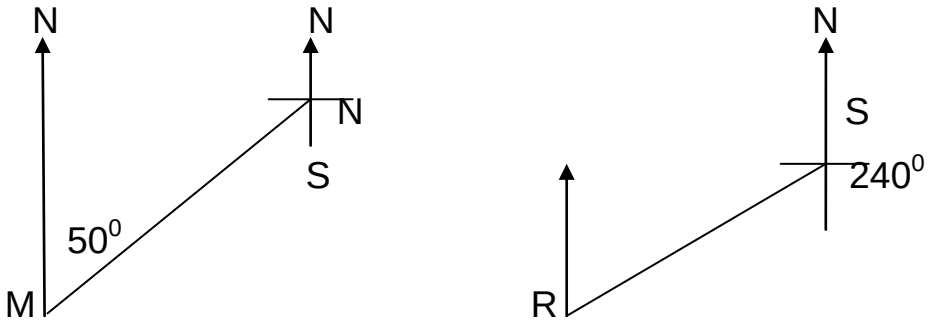
1. ) The bearing of A from B is $315^0$. What is the bearing of B from A?

a) The bearing of H from G is $330^0$. Calculate the bearing of G from H.

b) Find the bearing of B from A if the bearing of A from B is $189^0$.

c) Calculate the bearing of Mukono from Lugazi, given the bearing of Lugazi from Mukono is $200^0$

2. Use the sketch to help you answer the questions below.




(i) What is the bearing of M from N? (ii) Find the bearing of S from R.

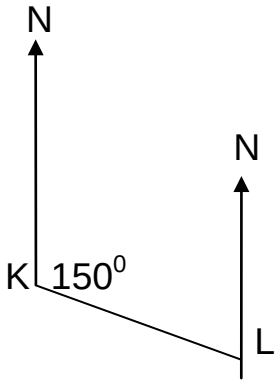
3. Find the bearing of X from Y if the bearing of Y from X is $030^0$.

4. What is the bearing of A from B, given that the bearing of B from A is $175^0$?

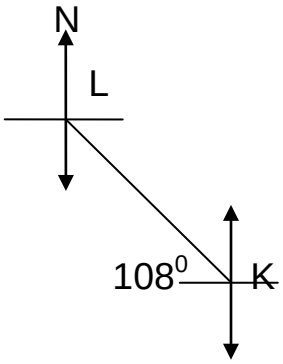
5. Calculate the bearing of V from U if the bearing of U from V is $120^0$.

6. Find the bearing of K from L below.

a)




b)




**SUB TOPIC: SCALE DRAWING**

- Scale drawing is the construction of big figures using smaller units.
The smaller units in construction are centimetres and millimetres.
The two types of length used in construction are:
Actual length - the distance on the ground in (km).
Drawing length – the distance on a map in (cm/mm).
A scale is what one centimetre represents in kilometres.
I.e. I cm represents 10km or 1 cm represents 100 km

**(i) Conversion from drawing length to actual length.**
**Concepts**

- Multiply the given drawing length by the scale given. I.e small to big – multiply

Example
If 1cm rep. 10km, what will be the actual length of;

a) 8cm
1 cm rep 10 km
8 cm rep 10 x 8 cm
= (10 x 8) km

8cm = 80 km

b) 7.5cm
1cm rep 10km
7.5cm rep 10 x 7.5km
= 10 x $^{75}/_{10}$ km

7.5cm = 75 km

**(ii) Conversion from actual length to drawing length**
**Concepts:**
- Divide the given km by the scale unit (km).

Example
If 1cm = 10km, what will be the drawing length of;

a) 80km
1km = $^{1}/_{10}$cm

:. 80km = $^{1}/_{10}$ x 80 cm

80km = 8cm

b) 14km
1km = $^{1}/_{10}$cm

: .14km = $^{1}/_{10}$ x $^{14}/_{1}$cm
= $^{14}/_{10}$m

: .14km = 1.4cm

**ACTIVITY:**

1. What will be the actual length on the ground that represents the following lengths on the map if 1cm rep. 10km?

a) 4cm b) 11cm c) 14.8cm d) 0.5cm e) 1 ½ cm f) 0.125cm

2. What will be the drawing length on the map that represents the following distances on the ground, given 1cm rep. 10km?

a) 9km b) 90km c) 2.5km d) 250km e) 45km f) 0.05km

**SUB TOPIC: APPLICATION OF BEARING AND SCALE DRAWING**

**Concepts**

- Begin your plan with a rough sketch.
- Start the construction with the working line / base line.
- Change the km to cm by dividing by the scale.
- Apply NC3 rule – Face North at every point), measure clockwise and use a 3 digit answer.
- Shortest distance always back to km by multiplying by the scale.

**Examples**

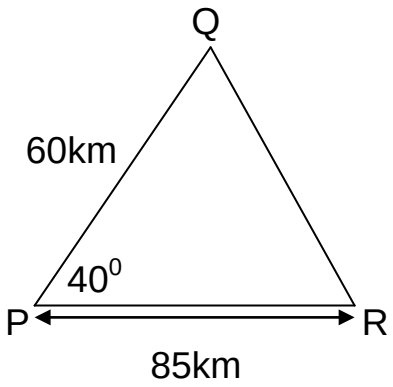
1. A plot of land is in form of a triangle PQR. The distance from P to Q is 60km, Q to R is 85km and angle QPR is $40^0$. Use a scale of 1cm :10km.

a) Construct an accurate sketch.

b) Find the shortest distance between Q and R.

(i) P to Q = 60km, P to R = 85km and $<QPR = 40^0$

Sketch




Scale: 1cm represents 10km

| Actual length | Drawing length |
|---|---|
| 60km | $^{60}/_{10}$ = 6 cm |
| 85km | $^{85}/_{10}$ = 8.5 cm |

An accurate diagram

b) Shortest distance (QR) = 5.5 cm

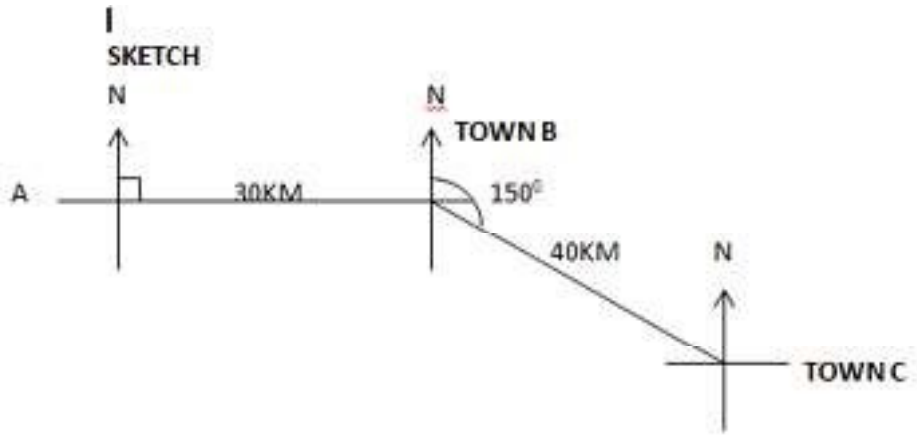
= 5.5 x 10 km

= 55 km

2. A is 30 km west of town B and town C is 40 km from town B on a bearing of $150^0$ using a scale 1 cm to rep 10 km

a) What is the shortest distance between town A and town C?

Sketch drawing




Accurate diagram

b) Find the bearing of B from C.

a) A – B = 30 km to the East

b) B – C = 40 km to the SE

ABC = $150^0$ (SE)

c) Drawing lengths

d) Scale: 1cm represents 10km

| Actual length | Drawing length |
|---|---|
| 30km | $^{30}/_{10}$ = 3 cm |
| 40km | $^{40}/_{10}$ = 4 cm |

e) Shortest distance A – C = 6 cm or 6.1 cm or 6.2 cm

= 6 x 10km or 6.1 x10km or 6.2 x10km

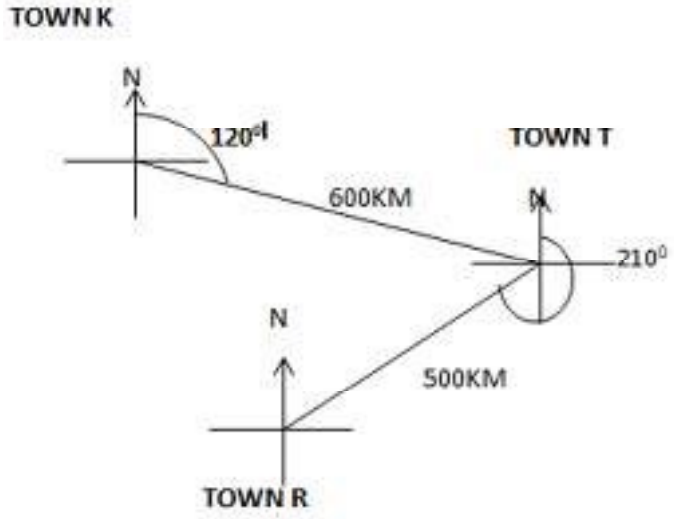
= 60 km or 61 km or 62 km

f) The bearing of B from C = $180^0 + 150^0$

$= 330^0$

3. A plane flew from airport K to airport T on a bearing of $120^{0.}$ The distance between airport K and airport T is 600 km. It then left airport T for airport R on a bearing of $210^0$. The distance between T and R is 500 km.

(a). Sketch the Plane's journey.




(b). Using a scale of 1 cm = 100 km, draw an accurate diagram to show the journey made by the plane.

(c). Find the bearing of airport R from K.

**ACTIVITY:**

1. Peter left town P and travelled 16 km southwards to town R. He then travelled 12 km west wards to town Q from town R.
a) Draw a sketch diagram to show the three towns.
b) Using a scale of 1 cm to 10 km, draw an accurate diagram.
c) Find his shortest distance between O and Q.
2. George left village X and drove west wards to village Y, a distance of 30 km. He then drove southwards from village Y to village Z a distance of 24 km and returned directly to X from Z.
a) Using a scale of 1 cm = 6km, draw an accurate diagram.
b) Find his shortest distance.
3. A steamer sailed from port D to port P a distance of 270 km on a bearing of $120^0$, from P it sailed to port Q a distance of 180 km on a bearing of $030^0$
a) Draw a rough sketch
b) Using a scale of 1 cm = 30 km, construct an accurate diagram.
4. Town C is on a bearing of $150^0$ from town A which is 40km away and town C is 50 km away from town B which is $070^0$
(a). Using a scale of 1cm = 10km, Draw an accurate diagram locating the above towns.

5. A school Library is 70 metres East of the Main hall. The staffroom is 60 metres from the Library on a bearing 0f $240^0$
(a). Using a scale of 1cm represents 10 km. Show the three points on an accurate diagram,

(b). Find the shortest distance between the main hall and the Staffroom.

6. A Tourist left town A and travelled 55km westwards to town B. He then turned on a bearing of $215^0$ and travelled to town C which is 65km away.

(a). Draw a sketch diagram to show the journey.

(b). Using a scale of 1cm = 10km, draw an accurate diagram to show the tourist's journey.

(c). Find the shortest distance from town C to town A.

7. Town Q is 40 km away from town A on a bearing of $080^0$ and town P is 50 km away from town Q on a bearing of $120^0$.

Using a scale of 1cm : 10 km, find the shortest distance between town P and town A.

8. Town K is 30km west of town L and town M is 40 km from town L on a bearing of $150^0$.

(a). Use a scale of 1cm represents 5km to show the location of the three towns.

(b). Find the shortest distance between town K and town M

(c). What is the bearing of town M from town K?

## UB TOPIC: CONSTRUCTION OF PERPENDICULAR LINES

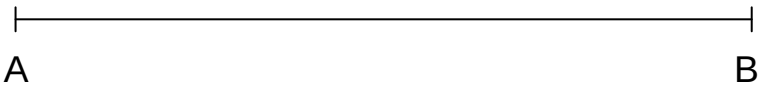
### a) Constructing a perpendicular on to another line

i). If not given a line, draw a line of any length and mark any point on it.

ii) Construct $90^0$ at that point.

Example

Given the line AB below, draw a perpendicular line to AB at O

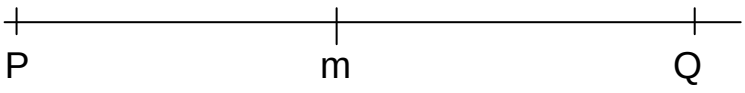



### b) Constructing a perpendicular at a given point

i). construct $90^0$ at given point on the line given.

Example

Construct a perpendicular line at m




MN is perpendicular PQ.

**c) Constructing a perpendicular by bisecting a given line**

i). To bisect a line is to divide it into two equal parts.

ii). Measure the exact length / partly less and mark 2 arcs on top and on bottom.

E,g. Bisect the line XY below

**d) Constructing a perpendicular by dropping from a given point**.

1) Measure from the given point to the base line (beyond) and mark 2 points on either side of the base line.

b). Construct $90^0$ using the 2 points on the base line

1) Drop a perpendicular from C to meet AB at X

**ACTIVITY:**

1. Copy each line below and construct a perpendicular at the given point.

2. Bisect each line below using a pair of compasses and a ruler.

3. Copy and drop a perpendicular from given point(s).

**SUB TOPIC: BISECTING ANGLES**

To bisect an angle is to divide it into 2 equal parts

Procedure

a) With the pointer at the vertex of the angle given, open radius and mark 2 points one on each arm of the angle.

b) With the 2 parts, mark 2 intersecting areas in front.

Example

Bisect the angle PQR below

- Draw the arc for the first angle then transfer the same radius to the 2nd point repeat the steps.

**SUB TOPIC: CONSTRUCTING DIFFERENT ANGLES**

**CONTENT**:Review bisecting angles

1. Construct the following angles using a pencil, ruler and a pair of compasses only:-

i) $60^0$ ii) $75^0$ iii) $30^0$ iv) $15^0$ v) $150^0$ vi) $120^0$.

2. i) $90^0$ ii) $45^0$ iii) $135^0$ iv) $165^0$ v) $22\frac{1}{2}^0$

**SUB TOPIC: CONSTRUCTING REFLEX ANGLES**

- Subtract $180^0$ from the given angle to get the angle to be added to $180^0$.
- Draw a line segment and construct the angle to be added to $180^0$.
- Show the reflex angle by adding the angle you constructed to $180^{0.}$

Examples:

a) Construct an angle of $210^0$

$210^0 = 180^0 + 30^0$

b) Construct an angle of $300^0$.

$300^0 = 180^0 + 120^0$ or $360^0 - 60^0$

**ACTIVITY:**

Construct the following angles:

1) $225^0$ 2) $195^0$ c) $240^0$ d) $270^0$

**SUB TOPIC: CONSTRUCTING A TRANGLE GIVEN 3 SIDES (SSS)**

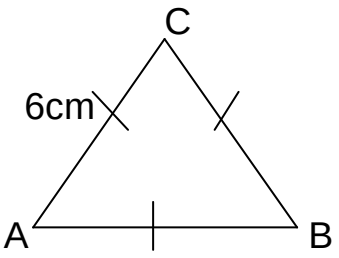
**Concepts:**

- Draw a sketch first.
- Draw the base line preferably the longest side
- Mark off the length(s) given and name the points accordingly.
- Use the given points to mark off the third point and name all parts.
- Name each part of the figure drawn.

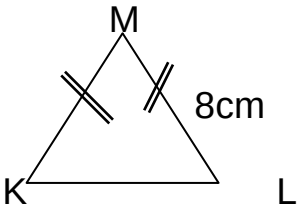
Examples:

1. Construct an equilateral triangle ABC of side 6cm. Drop a perpendicular at C to meet line AB at O.

Sketch



2. Construct an isosceles triangle KLM in which KL = 7.3cm KM = LM = 8cm




**ACTIVITY:**

1. Using a pair of compasses, a ruler and a sharp pencil only, construct an equilateral triangle PQR where line PQ = PR = RQ =6cm.
2. Using a ruler, a sharp pencil and a pair of compasses, construct a scalene triangle ABC in which line AB = 7cm, BC = 5cm and CA = 3cm.
   a) Measure (i) angle CAB (ii) angle BCA.
3. Using a sharp pencil, a ruler and a pair of compasses only, construct an isosceles triangle LMN such that line LM = MN = 6cm and line LN = 7cm. Measure angle LNM.
4. Using a pair of compasses, a ruler and a pencil, construct a triangle XYZ in which line XY = XZ = 6cm and Z Y = 6.7cm.Drop a perpendicular from X to meet line segment ZY at O. Measure line XO and find the area of the triangle.

**SUB TOPIC: CONSTRUCTING A TRIANGLE GIVEN SIDE, ANGLE AND SIDE (SAS)**

**Concepts:**

- Draw a sketch
- Draw the base line preferably the longest side.
- Mark off the length(s) given and name the points accordingly.
- Construct the angle given and name it and all the line segments..

Examples:

1. Using a pair of compasses, a ruler and a pencil only, construct a triangle PQR in which line QR = 8cm, angle PQR = $45^0$ and length PQ = 5.5cm.
(i) Measure line PR. (ii) Measure angle PRQ.

2. Using a ruler, a pencil and a pair of compasses only, construct a triangle RST where angle R = $75^0$, line RS =6cm and line RT = 7cm.
a) Measure line ST. b) Measure angle RST.

**ACTIVITY:**

1. Using a ruler, a pencil and a pair of compasses only, construct a triangle WXY where line segment WX = 7cm, angle YWX = $45^0$ and line segment WY = 6cm. Drop a perpendicular from Y to meet line segment WX at C.
a) Measure line YC. b) Measure angle WXY.

2. Using a well sharpened pencil, ruler and a pair of compasses only, construct a triangle RST such that ST = 6cm, angle RST = $135^0$, and line RS = 4cm. Drop a perpendicular line from R to meet ST at P. Measure line RP.

3. Construct a triangle BET such that BE = 8cm and <BET = $105^0$, line ET = 4cm, Measure line BT and angle EBT.

4. Construct a triangle ANC such that NC = 6cm ANC = $120^0$ and NA = 4cm. Drop a perpendicular line from A to meet NC at X.

a) Measure AX
b) Find the area of the triangle ANC.

5. Using a ruler, a pencil and a pair of compasses only, construct a triangle WXY where line segment WX = 7cm, angle YWX = $60^0$ and line segment WY = 6cm. Drop a perpendicular from Y to meet line segment WX at C.
a) Measure line YC. b) Measure angle WXY.

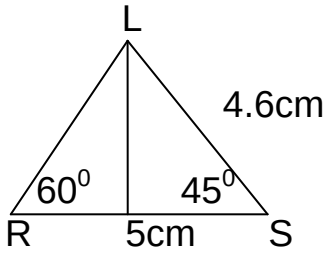
**SUB TOPIC: CONSTRUCTING A TRIANGLE GIVEN SIDE ANGLE, ANGLE (SAA)**

**Concepts:**

- Draw a sketch
- Draw the base line.
- Mark off the length given and name the points accordingly.
- Construct the given angles at their respective points accurately.
- Join the points and name the angles and line segments.

Examples:

1. Using a pair of compasses, a ruler and a pencil only, construct a triangle RST where angle = $60^0$ angle S = $45^0$ and RS = 5cm.




**ACTIVITY:**

1. Using a pair of compasses, a pencil and a ruler only, construct a triangle XYZ in which line XY = 7cm, angle XYZ = $105^0$ and angle YXZ = $30^0$. Measure the length of line segment XZ in cm.
2. Using a ruler, a pencil and a pair of compasses only, construct a triangle CHL in which line CH = 7cm, angle CLH = $60^0$ and angle HCL = $90^0$. Measure the length line segment HL in cm.
3. Construct a triangle STV such that TV = 6cm, angle STV = $45^0$, and angle TVS = $60^0$.
Drop a perpendicular line from S to meet TV at X. Measure SX and find the area of the triangle STV.
4. Construct a triangle WXY such that WX = 8cm, <YWX = $75^0$, <WXY = $45^0$, Measure line XY and angle WYX.

5. Construct a triangle XYZ such that XY = 6cm, angle XYZ = $120^0$ , angle ZXY = $30^0$ , Drop a perpendicular line from Z to meet line XY at P. Measure line ZP Find the area of the triangle XYZ.
6. Construct a triangle PQR such that QR = 6.5cm, angle PQR = $135^0$ and angle QRP = $30^0$.
7. Construct a triangle KLM such that KL = 6cm, angle KLM = $60^{0,}$ angle KML = $75^{0.}$ Drop a perpendicular from M to meet KL at X. Measure MX
8. Construct a triangle ABC such that BC = 6.5cm, and angle ABC = $75^0$, and angle BAC = $60^0$. Measure line AC.
9. Construct triangle BHG such that HG = 7cm, angle BHG = $105^0$ and angle HBG = $45^0$. Measure line BH.

## SUB TOPIC: CONSTRUCTION OF REGULAR POLYGONS

### a) Constructing regular polygons with given radii

- Sketch the polygon.
- Calculate the centre angle.
- Draw a circle of the given radius
- Draw the radius line
- Measure and draw the centre angle
- Mark the points of intersection of angle arms to circumference A and B respectively.
- Open the pair of compasses along are AB and use the pair of compasses to mark off other arcs. (name the arcs C,D,E)
- Join the adjacent points BCDEA to form the polygon.

### b) Constructing a regular polygon when given length of its side

- Construct a line segment of the given length.
- Determine the base angles and draw them at both points of the line segment.
- Draw a circle through the points on the line segment.
- Open the pair of compasses to the radius of the line segment continue to draw arcs on circumference.
- Join the adjacent points to form a figure/polygon.

## ACTIVITY:

1. Construct a regular pentagon ABCDE in a circle of radius 4cm. Measure the length of each side and angle CDE
2. Construct a regular pentagon using the centre angle. Measure the length of each side.
3. Construct a regular hexagon in a circle of radius 5cm. Measure the side and find its perimeter.
4. Construct a regular hexagon of side 5cm. Measure the length of the side.
5. Construct a regular octagon whose side is 3cm.
6. Construct a regular octagon in a circle whose radius is 3.5cm.

## SUB TOPIC: CONSTRUCTING A SQUARE FROM GIVEN SIDE OR DIAGONALS

Example:

Constructing a square PQRS of side 4cm

Draw sketch of the square to be constructed.

- Draw line PQ = 4cm
- Through point P construct a line perpendicular to PQ.
- With the centre P and radius PQ, make an arc on the perpendicular line cutting it at points.
- With centre S and Q and with the same radius make arcs to cut each other at R.
- Join SR and QR

**ACTIVITY:**

1. Using a pair of compasses, a pencil and a ruler only, construct a regular quadrilateral PQRS such that line segment PQ = 5cm. Measure the length of the diagonal QS.

2. Using a pencil a ruler and a pair of compasses only, construct a square ABCD where the diagonals AC = BD = 4cm. Measure the length of each side.

3. Using a ruler, a well-sharpened pencil and a pair of compasses only, construct a square PQRS such that diagonal PR = QS = 8cm:

4. Using a ruler, a well-sharpened pencil and a pair of compasses only, construct a square in a circle of radius 3.5 cm, measure the length of each side. Calculate area of the square above

## ➢ CONSTRUCTING A RECTANGLE

Constructing of a rectangle ABCD of length 7cm and width 4cm:

- Draw a sketch of the rectangle ABCD
- Draw line AB = 7cm
- At A construct a line perpendicular to AB.
- Place the compass at A and with a radius of 4cm make an arc on the perpendicular cutting it at point D.
- Place the compass at B and with the same radius make an arc above AB.
- With a radius of 7cm, place the compass at D and make an arc to cut the previous arc at point C
- Join DC and BC

**ACTIVITY:**

1. Using a ruler, a pencil and a pair of compasses only, construct a rectangle RSTU in which line RS = 7cm and ST = 4cm. Measure the length of diagonal SU.

2. Using a pair of compasses, a ruler and a pencil only, construct a rectangle ABCD such that line AB = 8cm and BC = 6cm. Measure the length of diagonal BD.

3. Using a ruler, a well-sharpened pencil and a pair of compasses only, construct a rectangle RSTU where RS = 12cm, and ST = 5cm,

b) Measure diagonal RT.

c) Calculate the area and the perimeter of the above rectangle

**SUB TOPIC: CONSTRUCTION OF A RHOMBUS**

Example 1:

Using a ruler and a pair of compasses only, construct a rhombus ABCD of side 5cm and angle ABC $60^0$

Steps:

- Draw a sketch
- Draw line BC = 5cm
- Construct an angle of $60^0$ at B and mark line AB = 5cm.
- With centres A and C and with the same radius of 5cm, mark arcs to cut each other at D
- Join A to D and C to D.

Example 2

Using a ruler, a well-sharpened pencil and a pair of compasses only,

construct a rhombus ABCD where diagonal AC = 8cm and diagonal BD =

10cm Measure the length AB.

**ACTIVITY:**

1. Using a ruler, a well-sharpened pencil and a pair of compasses only, construct a rhombus ABCD where
AB = 5cm and angle ABC = $60^0$ Measure diagonal BD
2. Using a ruler, a well-sharpened pencil and a pair of compasses only, construct a rhombus RSTU where
RS = 7cm and angle URS = $120^0$ Measure diagonal SU
3. With the aid of a ruler, a well-sharpened pencil and a pair of compasses only, construct a rhombus
PQRS where angle RPQ = $105^0$ and line PQ = 5.4cm
4. With the aid of a ruler, a well-sharpened pencil and a pair of compasses only, construct a rhombus
BCDE where side BC = 6.5 cm and angle BCD = $135^0$
Measure diagonal BD
5. Using a ruler, a pencil and a pair of compasses only, construct a rhombus RSTU where angle S = $60^0$ and line ST = 6cm. Drop a perpendicular line from R to meet ST at O. Measure the angle TRU.
6. Using a pencil, a ruler and a pair of compasses only, construct a rhombus PQRS in which line PQ = QR = RS = SP = 4cm and angle PQR = $45^0$.
Measure the length of the diagonal QS.
7. Using the pair of compasses, a ruler and a pencil only, construct a rhombus ABCD such that angle ABC = $120^0$ and line AB is 5.5cm.
    a) Measure the longer diagonal.
    b) Work out the perimeter of the figure.

8. Using a pair of compasses, a pencil and a ruler only, construct a rhombus KLMN of side 5cm with diagonals KM = 8cm and LN = 6cm

## SUB TOPIC: CONSTRUCTING A PARALLELOGRAM:

- Draw a sketch of the parallelogram
- Draw line ST = 6cm
- Construct an angle of $60^0$ at S and mark off 4cm at R.
- With centre T and radius line ST.
- With centre R and radius equal to ST draw an arc to cut the first arc at U.
- Join TU and RU to form the required parallelogram

Examples

1. Using a ruler, a pencil and a pair of compasses only, construct a parallelogram ABCD where line AB = 8cm, angle DAB = $45^0$ and line AD = 6cm. Measure angle ABC.

2. Construct a parallelogram PQRS where line QR = 6cm and line PQ = 4cm and angle PQR = $60^0$. Measure the length of the diagonal PR.

## ACTIVITY:

Using a ruler, a well-sharpened pencil and a pair of compasses only, construct a a parallelogram:

1. ABCD such that angle ABC = $120^0$ and line AB = 7cm, line BC = 5cm
2. PQRS, where QPR = $105^0$, line PQ = 7.5 cm and line PS = 4.5cm
3. RSTV where RST = $135^0$, line RS = 8cm, and the line ST = 4cm. Drop a perpendicular line from T to meet line RS at P.
   a) Measure line TP b) Find the area of the above figure
4. UVWX where UVW = $60^0$, UV = 7cm, and VW = 3.5cm, Drop a perpendicular line from X to meet UV at point Y.

   a) Measure line XY
   b) Calculate the area of the above figure.
5. Using a pair of compasses, a ruler and a pencil only, construct a parallelogram ABCD such that line AB = 7.8cm, BC = 6cm and angle ABC = $135^0$. Measure the length of diagonal AC.

## SUB TOPIC: CONSTRUCTING A TRAPEZIUM

Example:

Construct a quadrilateral PQRS where angle SPQ = PQR = $60^0$ and PS = QR= 3.5cm while PQ = 7cm Measure side RS

## ACTIVITY:

1. Construct a trapezium ABCD where <DAB = <ABC = $60^0$ and line CB = 6cm
   a) Measure line DC b) Find the area of the trapezium above.
2. ABCD where AB = 8cm, angle DAB = ABC= $45^0$ and line AD =BC = 4cm. Drop a perpendicular line from C to meet AB at x.
   (i) Measure line CX
   (ii) Calculate the area of the above quadrilateral.
3. Construct a Trapezium TUWX where angle XTU = $90^0$ and line TU = 7cm, line TX = XW= 4cm. Measure line UW.

4. Construct a trapezium SPQR where PQ = 7cm, PS = 5cm, angle SPQ = $90^0$ and angle PQR = $45^0$. Measure lines SR and QR.
5. Construct a trapezium PQRS where PQ = 8cm, angle QPS = $60^0$, PS = 6cm, angle PQR = $90^0$ and PQ is parallel to RS.

**SUB TOPIC: CONSTRUCTING A KITE**

Example

Using a ruler, pencil and a pair of compasses only, construct a kite RSTU of diagonal RT = 7cm and OS = 4cm then OU = 8cm, O being the Centre at which the diagonals meet.

**ACTIVITY:**

1. Using a ruler, pencil and a pair of compasses only, construct a Kite KLMN where diagonal KM is the ratio of 2:2 cm respectively and NL is in the ratio of 3:7 in cm respectively.

**TOPIC 10: TIME**

**SUB TOPIC: THE 12 AND 24 HOUR CLOCK TIME**

| 12 HOUR CLOCK | 24 HOUR CLOCK |
|---|---|
| 12 midnight | 24.00hrs (Full day) |
| 11.00pm | 23.00hrs |
| 10.00p.m | 22.00hrs |
| 9.00p.m | 21.00hrs |
| 8.00p.m | 20.00hrs |
| 7.00p.m | 19.00hrs |
| 6.00p.m | 18.00hrs |
| 5.00p.m | 17.00hrs |
| 4.00p.m | 16.00hrs |
| 3.00p.m | 15.00hrs |
| 2.00p.m | 14.00hrs |
| 1.00p.m | 13.00hrs |
| 12.00 mid-day | 12.00hrs (1/2 day) |
| 11.00a.m | 11.00hrs |
| 10.00a.m | 10.00hrs |
| 9.00a.m | 09.00hrs |
| 8.00a.m | 08.00hrs |
| 7.00a.m | 07.00hrs |
| 6.00a.m | 06.00hrs (sun rising) |
| 5.00a.m | 05.00hrs |
| 4.00a.m | 04.00hrs |

| | |
|---|---|
| 3.00a.m | 03.00hrs |
| 2.00a.m | 02.00hrs |
| 1.00a.m | 01.00hrs |
| 12.00midnight | 00.00hrs(New day starts) |

**SUB TOPIC: CONVERSION OF 12 HOUR TIME IN 24 HOUR TIME**

**Concepts:**

- Time in 24-hour clock is also referred to as **military time.**
- To change "am" time to 24-hour clock, the time remains the same but expressed using four digits.
- This is because they are in the first 12 hours after midnight.

Therefore;

From 1:00 am to 12:59 pm, add 0000hrs to change to 24-hr clock time.

From 1:00 pm to 11:59 pm, add 1200 hrs to change to 24-hr clock time.

- Mid-day or noon time or 12:00 noon to 12:59 pm remains 1200hrs -1259hrs respectively in 24-hr clock time.
- Mid night or 12:00 midnight to 12:59 am is 0000 hrs or 2400 hrs but 0000hrs is preferred because it's just the beginning of the day.

Examples:

1. Change 2:30 am to 24-hr clock.

2:30
\+ 0000 hrs
0230 hrs

3. Change 9:45 pm to 24-hr clock.

9:45
\+ 1200 hrs
2145 hrs

2. Express 12:30 am in 24-hr clock.

12:30
\- 1200 hrs
0030 hrs

4. Change 12:15 pm to 24-hr clock.

12:15
\- 0000 hrs
1215 hrs

**ACTIVITY:**

Change the following from 12-hr clock to 24-hr clock time.

1) 7:00 a.m. 2) 7:30 a.m. 3) 12:55 p.m.

4) 3:00 a.m. 5) 2:00 p.m. 6) 8:30 p.m.

7) 10:00 p.m. 8) 12:07 a.m. 9) 6:58 p.m.

10) An examination stated at 8:30 a.m. What time is this in a 24-hr clock system?

11) A radio station closed down its transmission at 12:15 a.m. What time is this in a twenty-four hour clock?

12) At a wedding party, lunch was served at 2:40 p.m. Write the time in military time.

13) The sports competition started at 7:15 a.m. Express the time in a 24-hr clock system.

14) The president always addresses the people at 8:00 p.m. Express this time in 24-hr clock system.

**SUB TOPIC**: **CHANGING 24-HR CLOCK TO 12- HR CLOCK SYSTEM**

**Concepts**:

To change 24-hour clock time to 12-hour clock time;

Subtract 1200hrs from any time which is after 1200hrs and write your time with "pm".

Subtract 0000hrs from any time which is before 1200hrs and write your time with "am".

Therefore;

- From 1300 hrs to 23:59 hrs, subtract 1200hrs to change to 12-hr clock time.
- From 0100 hrs to 1259 hrs, subtract 0000hrs to change to 12-hr clock time.
- Mid-day or noon time or 1200hrs to 1259 hrs remains 12:00 pm -12:59 pm respectively in 12-hr clock time.
- Mid night or 0000 hrs to 0059 hrs is 12:00 am or 12:59 am but 00:00 am or 00:59 am is preferred because it's just the beginning of the day.

Examples

1. Change 1045 hrs to 12-hr clock.

10 45
- 00 00
10:45 = 10:45 a.m.

**1045 hrs = 10:45 a.m**.

2. Express 1414 hrs in 12-hr clock.

14 14
- 12 00
= 2:14 p.m.

**1414 hrs = 2:14 p.m**.

3. Change 0145 hrs to 12-hr clock.

01 45
- 00 00
1:45 =1:45 a.m.

**0145 hrs = 1:45 a.m.**

4. Change 2340 hrs to 12-hr.

23 40
- 12 00
11:40 = 11:40 p.m.

**2340 hrs = 11:40 p.m.**

**ACTIVITY:**

Change the following from 24-hr clock to 12-hr clock time.

1) 0840 hrs 2) 1950 hrs 3) 0627 hrs 4) 2258 hrs
5) 0100 hrs 6) 1300 hrs 7) 2300 hrs 8) 1207 hrs
9) Our lessons started at 0830 hrs. What time is this in a 12-hr clock system?
10) The net ball match started at 1745 hrs. What time is this in a 12-hour clock?
11) An examination ended at 1245 hrs. Write the time in 12-hr clock. tim
12) The night bus left Kampala for Gulu at 0153 hrs. Express the time in a 12-hr clock system.
13) The presidential address on Covid-19 was at 2100 hrs. Express this time in 12-hr clock system.
14) Write 0040 hrs in a 12 hour clock system.

**SUB TOPIC: FINDING DURATION (TIME SPAN)**

- Duration (Time span) = Ending time(ET) – Starting time(ST)
- Starting time(ST) = Ending time – Duration
- Ending time(ET) = Starting time + Duration

Example

1. A bus left Nairobi at 1315 hours and arrived in Kampala at 1630 hrs. How long did the journey take?
   Subtract 16:30 hrs
   - 13:15 hr
   3:15hrs
   The journey took 3hrs and 15 minutes.

2. A party started at 2000hrs and ended at 11:30 p.m. How long did the party last?
   (Express 11:3pm in 24 hr-clock)
   11:30pm Then subtract 23:30hrs
   +12:00hrs -20:00hrs
   2330 3:30
   The party lasted for 3 hours and 30 minutes.

**ACTIVITY:**

1. A PIASCY seminar which lasted for 40 minutes ended at 9:10a.m. At what time did it start?
2. An old man went to sleep at 8:10p.m and woke up at 4:15a.m the next day. For how long did he sleep?
3. It started raining at 11:40a.m and went on up to 2:40 p.m. How long did it rain?
4. A staff meeting at Dream Africa School Kansanga started at 9:55a.m and ended at 12:00 noon. How long did the meeting take?
5. Sarah slept for 2hours and 15 minutes. At what time did she wake up if she went to bed at 8:30p.m?
6. An English lesson started at 11:20a.m and ended at 1:30p.m. How long was the lesson?
7. A mathematics quiz that lasted for 3 ½ hours ended at 5:00p.m. At what time did it start?
8. A forty-five minute lesson started at 7:30a.m. When did it end?

**SUB TOPIC: TIME (SCHOOL TIMETABLE)**

- Duration (Time span) = Ending time(ET) – Starting time(ST)

Example:

1. Study the time table below for a P.6 class in Primary School and answer the questions that follow.

| From | 8:30 am | 9:10 am | 9:50 am | 10:30 am | 11:10 am | 11:50 am | 12:30 pm | 2:00 pm | 2:40 pm |
|---|---|---|---|---|---|---|---|---|---|
| To | 9:10 | 9:50 | 10:30 | 11:10 | 11:50 | 12:30 | 2:00 | 2:40 | 3:20 |
| Mon | PAPE | ENG | PAPE | **B** | MTC | R.E | **L** | MDD | MD |
| Tue | SCI | MTC | R.E | **R** | R.E | ENG | **U** | SST | SST |
| Wed | SST | ENG | IPS | **E** | SCI | SCI | **N** | ENG | ENG |
| Thu | Eng | SCI | MTC | **A** | MTC | LLG | **C** | R.E | MTC |
| Fri | MTC | MTC | KIS | **K** | ENG | SCI | **H** | IPS | IPS |

(i) How long does each lesson last?

9:10 am (60 + 10) = 70 minutes

- 8:30 am - 30

40 40 = 40 minutes

Each lesson lasts for 40 minutes.

(ii) At what time does break end?

Break ends at 11:10 am

(iii) For how long do the pupils take studying Science the whole week?

5 lessons x 40 minutes = 200 minutes

$60\sqrt{200}$ (3) 3 hours rem. 20 minutes

3x60= -180

020

The pupils take 3 hours and 20 minutes.

**ACTIVITY:**

Use the time table above to answer the questions that follow.

1. How long is lunch break?
2. How long do the lessons between break and lunch time take?
3. How many lessons are there in a week in the above school?
4. How long do the pupils take learning English in a week?
5. At what time do lessons begin each morning?
6. How long do the pupils spend in class studying every day?
7. When do the pupils leave for home each day?
8. How long do the pupils take learning local language (LLG) each day?
9. When do the pupils learn Kiswahili language (KIS)?
10. How many Mathematics lessons are in the week?

**SUB TOPIC: TIME TABLES (TAXI AND BUS TIME TABLES)**

- When reading timetables, the duration or time span is as follows:
  - Resting or stopover at the same point = Departure – Arrival time.
  - Resting or stopover from different points = Arrival – Departure time.

Example

1. The table shows the departure and arrival time of a taxi at given stations. Study it and answer the questions that follow:

| Station | Arrival | Departure |
|---|---|---|
| Tororo | | 6:00am |
| Iganga | 7:30am | 7:45am |
| Jinja | 8:35am | 8:50am |
| Kampala | 10:50am | |

a) How long did the taxi take to move from Tororo to Iganga?

Solution: Time of arrival – Time of departure

Subtract 7:30am

- 6:00am

1:30

**The taxi took 1 hour 30 minutes**

(b) How long was the taxi's stopover at Jinja?

Subtract 8:50 am

- 8:35 am

0:15

**The taxis stopover was 15 minutes.**

(c) How long did the taxi take to move from Iganga to Kampala?

Subtract 10:50am

- 7:45am

3:15

**The taxi took 3 hours and 15 minutes.**

**ACTIVITY:**

1. The time table below shows the bus movement from Kampala to Entebbe. Use it to answer the questions that follow.

| STAGES | ARRIVAL TIME | DEPARTURE TIME |
|---|---|---|
| Kampala | | 8:45am |
| Najjanankumbi | 9:00am | 9:05am |
| Zana | 9:15am | 9:20am |
| Kanjansi | 9:34am | 9:39am |
| Kisubi | 9:54am | 10:00am |
| Entebbe | 10:15am | |

a) How long did the bus take to travel from Kampala to Zana?
b) For how long did the bus stay at Kanjansi?
c) At what time did the bus leave Kisubi?
d) How long did the bus take to travel from Kampala to Entebbe?

2. The time-table below shows the arrival and departure time for a bus travelling from Tororo to Kampala. Use it to answer the questions below

| TOWN | ARRIVAL TIME | DEPARTURE TIME |
|---|---|---|
| Tororo | | 0840hrs |
| Iganga | 0930hrs | 0935hrs |
| Jinja | 1000hrs | 1010hrs |
| Mukono | 1045hrs | 1055hrs |
| Kampala | 1140hrs | 1200hrs |

a) How long did the bus take to travel from Jinja to Kampala?
b) For how long did the bus stay at Jinja?
c) If the total distance covered by the bus from Tororo to Kampala was 259km, calculate the average speed for the whole journey.

3. Study the time table below describing the bus' journey from Soroti to Tororo. Use it to answer the questions that follow.

| DISTANCE | STATION | ARRIVAL | DEPARTURE | FARE (SHS) |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| | Soroti | ..... | 7:00a.m | Sh.2,000 |
| 34km | Okungulo | 7:30a.m | 7:40a.m | Sh.3,000 |
| 14km | Kumi | 7:55a.m | 8:10a.m | Sh.2,800 |
| 19km | Bukedea | 8:30a.m | 8:35a.m | Sh.2,100 |
| 37km | Mbale | 9:25a.m | 9:40a.m | Sh.1,900 |
| 21km | Manafa | 10:10a.m | 10:15a.m | Sh.1,400 |
| 18km | Magodes | 10:35a.m | 10:45a.m | Sh.1,050 |
| 18km | Tororo | 11:10a.m | | Sh.1,050 |

**Note carefully**.

- The distance from Soroti to Okungulo is 34km.The bus fare is sh.2,000.
- The distance from Okungulo to Kumi is 14 km and the fare is sh.800.

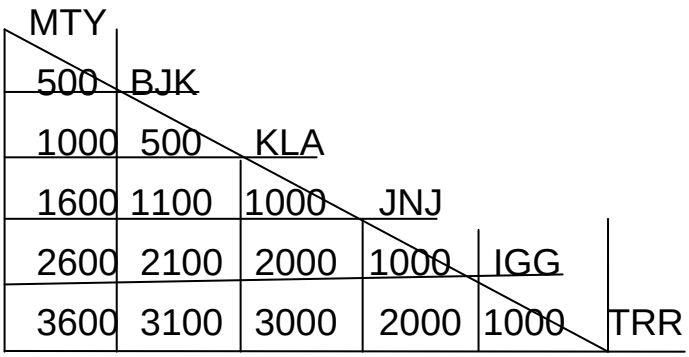
a) How long does the journey from Soroti to Okungulo take?
b) What is the distance between Bukedea and Manafa?
c) How long does the journey from Kumi to Mbale take?
d) What is the bus fare from Mbale to Tororo?

**SUB TOPIC: TIME (TRAIN TIMETABLES)**

Example

1. The table below shows the departure, the arrival time and the fares for a train from Mityana to Tororo.
   Study the table carefully and use it to answer the questions

| Station | Arrival | Departure |
|---|---|---|
| Mityana | | 11:00pm |
| Bujjuko | 11:45pm | 12:00 Mid night |
| Kampala | 12:30am | 12:45am |
| Jinja | 1:30am | 1:40am |
| Iganga | 2:10am | 2:30am |
| Tororo | 3:30am | |




(a) How long does the train take to move from Mityana to Kampala?

Solution12:30 pm
- 11:00am
1:30

**The train takes1 hour and 30 minutes**

(b) Three tourists boarded the train from Kampala to Iganga. How much did they pay?

Solution: Kampala to Iganga costs shs 2,000
3 tourist paid shs 2000 x 3
= shs6,000

**The three tourists paid sh.6,000**

**ACTIVITY:**

Use the time table above to answer the questions that follow.

a) How long does the train take to travel from Mityana to Bujjuko?

b) How long does the train stay at Bujjuko?

c) For how long did the train take to travel from Kampala to Jinja?

d) How much money will one pay to travel from Jinja to Tororo?

e) Tom moved with his wife and two other visitors. How much did they pay altogether?

f) For how long does the train stay on the way from Mityana to Tororo?

**SUB TOPIC: TIME (MARINE TIMETABLES)**

Example

1. The table below describes the MV Victoria journey on the Island. Study it and answer the questions that follow:

| Port | | Day | Time | Fares (shs) |
|---|---|---|---|---|
| Port Bell (KP) | Departure | Wed | 06:00 | |
| Bukoba | Arrival | Wed | 09:15 | 1500 |
| | Departure | Wed | 09:55 | |
| Mwanza | Arrival | Wed | 15:55 | 3000 |
| | Departure | Wed | 19:55 | |
| Musoma | Arrival | Thurs | 02:00 | 3000 |
| | Departure | Thurs | 04:00 | |
| Kisumu Pier | Arrival | Thurs | 14:00 | 5000 |

(i) How long does the steamer take to move from Port Bell to Mwanza?

Different towns = Arrival (Mwanza) – Departure (Port Bell)

Subtract 15:55

-06:00

9:55

**It takes 9 hours and 55 minutes**

(ii) How long does the steamer take to move from Mwanza to Musoma?

Time moved on Wednesday + time moved on Thursday

24:00 – 19:55 = 4:05

1 hour = 60 minutes

23:60 - 19:55 = 4:05

**The steamer takes 4 hours and 5 minutes.**

(iii) How much does it cost one to move from Mwanza to Kisumu Pier?

Mwanza to Musoma = shs 3000

Musoma to Kisumu Pier = +shs 5000

Shs 8000

**One pays shs 8000 from Mwanza to Kisumu Pier**

**ACTIVITY:**

The time table below describes the MV Barbus journey in the island. Study it and answer the questions that follow.

| Island or Port | Arrival time | Departure time | Fares (shs) |
|---|---|---|---|
| Luzira | | 0900hrs | |
| Kome | 1230hrs | 1305hrs | 3,500 |
| Bubeke | 1545hrs | 1620hrs | 1,800 |
| Buyange | 1740hrs | 1800hrs | 1,200 |
| Bukasa | 1910hrs | 1940hrs | 1,500 |
| Kalangala | 2125hrs | | 2,200 |

1. How long does the steamer take to move from;
   a) Kome to Bubeke? b) Bukasa to Kalangala?
2. How long does the steamer take to cover the distance from Luzira to Kalangala?
3. What is the fare between Luzira and Bubeke?
4. Study the time table and find the longest distance between the stop overs

**SUB TOPIC: TIME (AIR TIMETABLES)**

Example

1. Below is Uganda Airlines timetable for daily flights between Entebbe, Soroti and Kasese. Use it to answer the questions which follow:

| From | To | Flight | Departure | Arrival |
|---|---|---|---|---|
| Entebbe | Soroti | QU 740<br>QU 758 | 07: 00hrs<br>1700hrs | 08:00 hrs<br>1800hrs |
| Entebbe | Kasese | QU 702<br>QU 730 | 07:00 hrs<br>2100hrs | 08:15 hrs<br>2215hrs |
| Kasese | Entebbe | QU 703<br>QU 731 | 07:00 hrs<br>2145hrs | 08:15 hrs<br>2300hrs |
| Soroti | Entebbe | QU 741<br>QU 759 | 08:30 hrs<br>1830hrs | 09:30 hrs<br>1930hrs |

a) How long does the flight from Entebbe to Soroti take?

Duration = Arrival at Entebbe – departure from Soroti

Subtract 0800

- 0700

1:00

The flight from Entebbe to Soroti takes 1 hour

b) Owori travelled from Entebbe to Kasese in the evening. He then travelled to Entebbe by the earliest flight.

(i) For how long did Owori wait at Kasese?

Same point = Departure time – arrival time

24:00 Add 0700 hours 1:45

- 22:15 +07:00

1:45 8:45

Owori waited at Kasese for 8 hours and 45 minutes

**ACTIVITY:**

1. The time table below shows how Uganda Air-lines Plane travelled from Airport A to Airport D. Use it to answer the questions that follow.

| Airport | Arrival time | Departure time |
|---|---|---|
| A | | 0930hrs |
| B | 1015hrs | 1030hrs |
| C | 1145hrs | 1150hrs |
| D | 1220hrs | |

a) At what time does the plane arrive at town C?
b) How long does the plane take to fly from town A to town B?
c) If the distance from town A to town D is 1700km, find the average speed of the plane for the whole journey?

2. The time-table below shows the flight of an aeroplane from Cairo to Entebbe. Use it to answer the questions that follow.

| | |
|---|---|
| Cairo | Departure – 1200hrs |
| Addis- Ababa | Arrival – 1400hrs<br>Departure - 1530hrs |
| Nairobi | Arrival – 1740hrs<br>Departure – 1850hrs |
| Kampala | Arrival – 2030hrs |

a) When does the plane arrive at Addis-Ababa?
b) Write the time the plane reaches Nairobi in 12 hour clock.
c) How long does the plane take at Addis-Ababa?
d) Calculate the total time taken by the plane for the whole journey.

**SUB TOPIC: TIME (APPLICATION OF TIMETABLES)**

Example

1. The table below shows a morning programme line up on star FM. Study the programme and answer the questions:

| Time | Programme | Presenter |
|---|---|---|
| 8:00am – 8:15 am | News | Aisha Nambedha |
| 8:15 am – 10:15am | Healthy tips | Apio Olga |
| 10:15am – 10:30am | News | Muwanga Kisolo |
| 10:30am – 11:30 am | Educational Programme | Birungi Apuuli |
| 11:30am – 11:45am | News | Muwanga Kisolo |
| 11:45 am – 12:30pm | Farmers' platform | Iriko Tasiko |

(i) How many programmes are covered from 8:00am up to 12:30pm?
Six programme are covered from 8:00am up to 12:30pm.
(ii) Which presenter is concerned with farming?
Iriko Tasiko is concerned with farming.
(iii) Which programme in the table is the longest?
The healthy tips programme is the longest.
(iv) How long does the health tips programme last?

10:15 am
-8:15 am
2:00
The healthy tips programme lasts 2 hours.

**ACTIVITY:**

1. The time table below shows how a student spent his time over a certain weekend. Use it to answer the questions that follow.

| ACTIVITY | STARTING TIME | ENDING TIME |
|---|---|---|
| Digging | 7:00am | 10:30am |
| Washing | 10:45am | 12:45pm |
| Lunch and resting | 1:00pm | 2:45pm |
| Playing | 3:00pm | 4:30pm |
| Reading | 5:00pm | 7:30pm |

a) How long did he take playing?
b) For how long does the student work after lunch and rest?

c) If he dug his sun flower garden at a rate of 2 rows in every 30 minutes, find the number of rows he dug that day.

**TOPIC: DISTANCE, SPEED AND TIME**
**SUB TOPIC: AVERAGE SPEED**

- Average speed = $\frac{\text{Total distance}}{\text{Total time}}$

Examples

1. A man covered 50km in 2hours and another 50km in 3hours.
Find his average speed for the whole journey.

Average speed $= \frac{\text{Total distance}}{\text{Total time}}$

$= \frac{50\text{km} + 50\text{km}}{2\text{hrs} + 3\text{hrs}}$

$= \frac{100\text{km}}{5\text{hrs}}$

Average speed = 20km/hr

2. Calculate the average speed of a motorist who rode from X to Y at 60km/hr for 3hrs and continued to Z at 40km/hr for another 3hrs.

Distance from X to Y $= \frac{60\text{km}}{1\text{hr}} \times 3\text{hrs} = 180\text{km}$

Distance from Y to Z $= \frac{40\text{km} \times 3\text{hrs}}{1\text{hr}} = 120\text{km}$

Averasge speed from X to Z $= \frac{180\text{km} + 120\text{km}}{3\text{hrs} + 3\text{hrs}}$

$= \frac{300\text{km}}{}$

6hrs

Average speed = 50km/hr

**ACTIVITY:**

**1**. Nyangweso drove a distance of 40km at a speed of 20km/hr. Due to the bad road, she slowed down speed to 15km /hr to cover 45km. Find the average speed for the whole journey.

**2**. Kato left town A driving at 75km/hr. After 2hrs, his car got a puncture and he delayed for 45minutes. He then continued at 60km/hr for 2hours and 15minutes to town B.

a) What distance had Kato covered before his car got a puncture?

b) How far is town B from town A?

c) Calculate Kato average speed for whole journey.

**3**. A motor cyclist travelled at 60km/hr for 3 hours from town P to town Q. He then continued to town R at a speed of 70km/hr for another 2 hours.

a) Work out the average speed for the whole journey.

b) If he started travelling at 7:30a.m, at what time did he complete his journey?

**4**. Joy drove from town A to town B a distance of 120km in 2 hours. If she took 2 ½ hrs to drive from town B to town C at the same speed, how far is town C from town A?

**6**. A motor cyclist leaves his home at 7:00a.m for Iganga town which is 45km away, riding at a speed of 16km/hr. At 8:15a.m, he gets a puncture and delays for 15 minutes. At what speed must he cover the remaining journey in order to reach Iganga at 9:00a.m? (Give your answer in km/hr)

**7.** A UTC bus travelling from Lira to Kampala at an average speed of 60km/hr, broke down after 2 ½ hrs's drive. The repairs took 30 minutes. The bus continued with the journey at an average speed of 50km/hr for an hour.

a) Find the total distance covered by bus.

b) Calculate the average speed of the bus for the whole journey while travelling

**SUB TOPIC: AVERAGE SPEED OF RETURN JOURNEYS, RESTS AND STOPPAGES**

Example 1

A and B are two towns 80km apart. Lunyolo drove from A to B at 40km/hr and then returned to A through the same route at 60km/hr. Calculate Lunyolo's average speed for the whole journey.

Time taken at 40km/hr

Distance = 80km

Speed = 40km/hr

Time = $\frac{80km}{40km} \times 1hr$

= 2hrs

Time taken at 60km/hr

Distance = 80km

Speed = 40km/hr

Speed = $\frac{80km}{60k} \times 1hr$

$= \frac{4}{3}$ km/hr

$= 1\frac{1}{3}$ km/hr

Total distance from A and B and back = $\frac{80km + 80km}{2hrs + 1\ 1/3hrs}$

Average speed = Total distance ÷ Total time

= 160km ÷ 3 1/3hrs

= 160km ÷ 10hrs
3

= 160km x 3
10 hrs

= 16km x 3
1 hr

Average speed = 48km/hr

Example 2

Towns R and S are 120km apart. Okiror drove from town R starting at 10:30am, he arrived at town S where he stayed for 1hr and then returned to town R through the same road at a speed of 60km/hr.

(a) At what time did Okiror arrive at town R from town S?

Time taken from R to S = 120km x 1hr
60km

Time he left S = 10:30am
+ 1:00
11:30am

The time when he arrived at R = 11:30am
+ 2:00
13:30

13:30
- 12 00
1:30p.m.

Okiror arrived at town R at 1:30p.m.

b) Calculate Okiror's average speed for the whole journey.

Time taken from R to S = 10:30am – 9:00am

| Hrs | Min |
|---|---|
| 10 | 30 |
| - 9 | 00 |
| 1 | 30 |

= 1hrs 30 minutes or 1 ½ hrs

Total time = 1 ½ hrs + 2hrs + 1hr
= 4 ½ hrs

Average speed = Total distance ÷ total time
= 240km ÷ 4 ½ hrs
= 240km ÷ 9/2hrs
= 240km x 2
9h

= 480km
9hrs

Average speed = **53 $^{1}/_{3}$km/hr**

c) Calculate Okiror average speed for the whole journey while travelling.

Total distance = 240km

Total time = 1 ½ hrs + 2hrs

Average speed = 240km ÷ 3 ½ hrs
= 240km ÷ 7 hrs
2

= 240km x 2 hrs
7

= 480km

7hrs

Average speed = **68 $^{4}/_{7}$ km/hr**

**ACTIVITY:**

**1**. A motorist left town A at 8:00a.m and travelled to town B at 60km/hr for 2 ½ km/hr. He then returned through the same route at 75km/hr.

a) Calculate the distance between town A and town B.

b) Calculate the motorist's average speed for the whole journey.

**2**. Amelia drove her car at a speed of 120km/hr for 2 hours from town K to town Y. She rested at town Y for one hour and then returned to town K at a speed of 80km/hr.

a) Find the distance between towns K and Y.

b) Calculate the average speed for the whole journey while travelling.

c) Work out the average speed for the whole journey.

**3**. The head teacher drove from school to town P for 3 hours at a steady speed of 60km per hour. He left town P at bb 11:00a.m and drove back to the school through the same route at a steady speed of 90km/hr.

a) At what time did the head teacher arrive at the school?

b) Work out the head teacher's average speed for the whole journey.

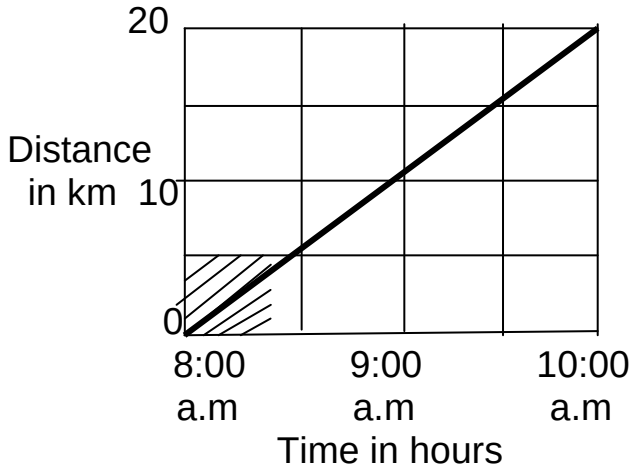
**4**. Fred drove at 55km/hr for 4 hours .if he returned following the same road at 110km/hr, find his average speed for the whole journey.

**SUB TOPIC: INTERPRETING HORIZONTAL AND VERTICAL AXES**

- A travel graph also called distance and time graph is a graph which shows the relationship between distance travelled and time taken.
- Identification of horizontal and vertical axes.

Example 1

Interpreting and reading scales correctly study the travel graph below and answer the questions that follow.




1. What is shown on the vertical axis?

   Distance in km is shown on the vertical axis.

2. What is the scale on the vertical axis?

   I small square rep. 5km on the vertical axis.

3. What is shown on the horizontal axis?

   Time of the day is shown on the horizontal axis.

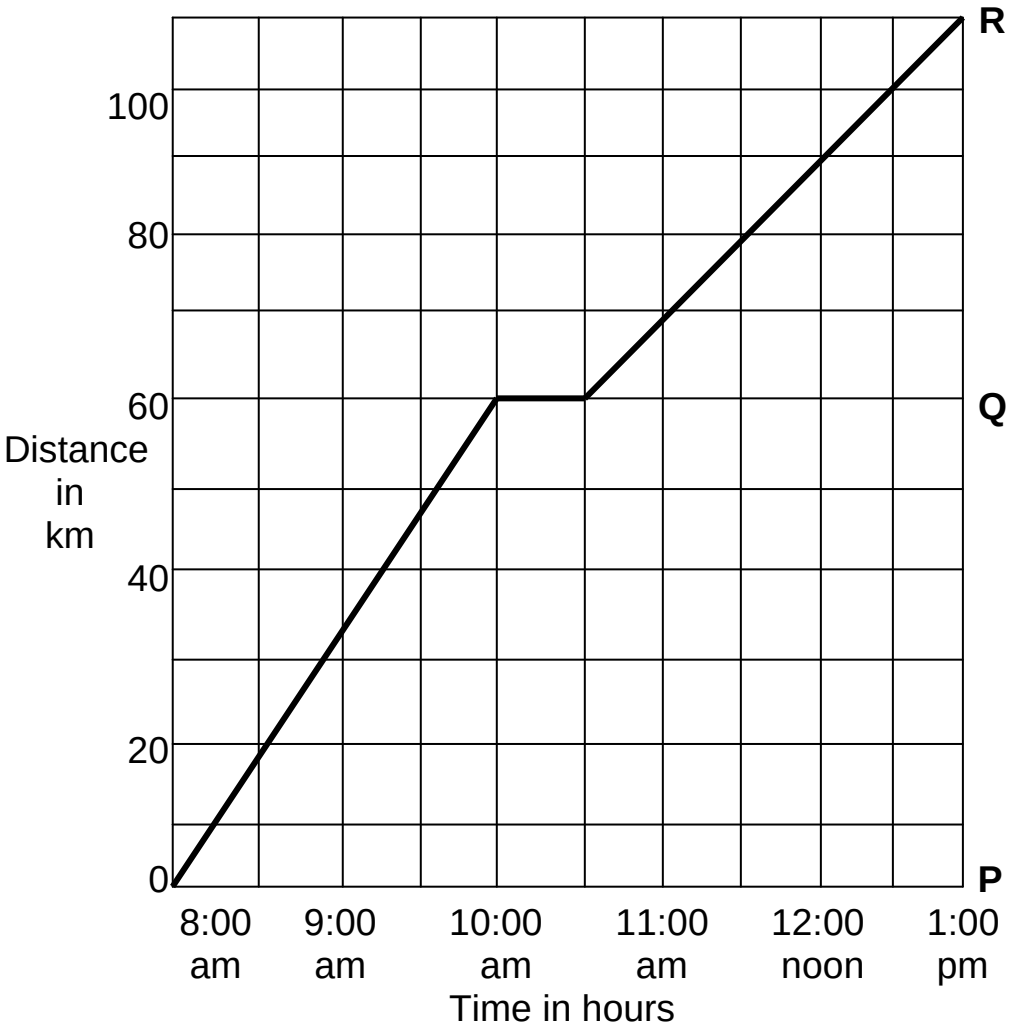
4. What is the scale on the horizontal axis?
I small square rep. 30 minutes on the horizontal axis.

5. How many hours are shown on the graph above?
3 hours are shown on the graph above.

6. How far is the journey?
The journey is 15 km.

Example 2

Study the graph below carefully and use it to answer the questions that follow back to town A. use it to answer questions that follow.




Questions

1. What is the scale on the vertical axis?
I small square represents 10km.

2. What is the scale on the horizontal axis?
I small sq rep 30minutes

3. At what time was the stopover?
At 10:00 am

4. How long was the rest or stopover?
The rest took 30 minutes or ½ hour.

5. What was the average speed for the first part of the journey?

Average speed = Distance / Time

= 60 km / 2 hrs

Average speed = 30 km/ hr

6. Find the motorist's average speed for the whole journey.

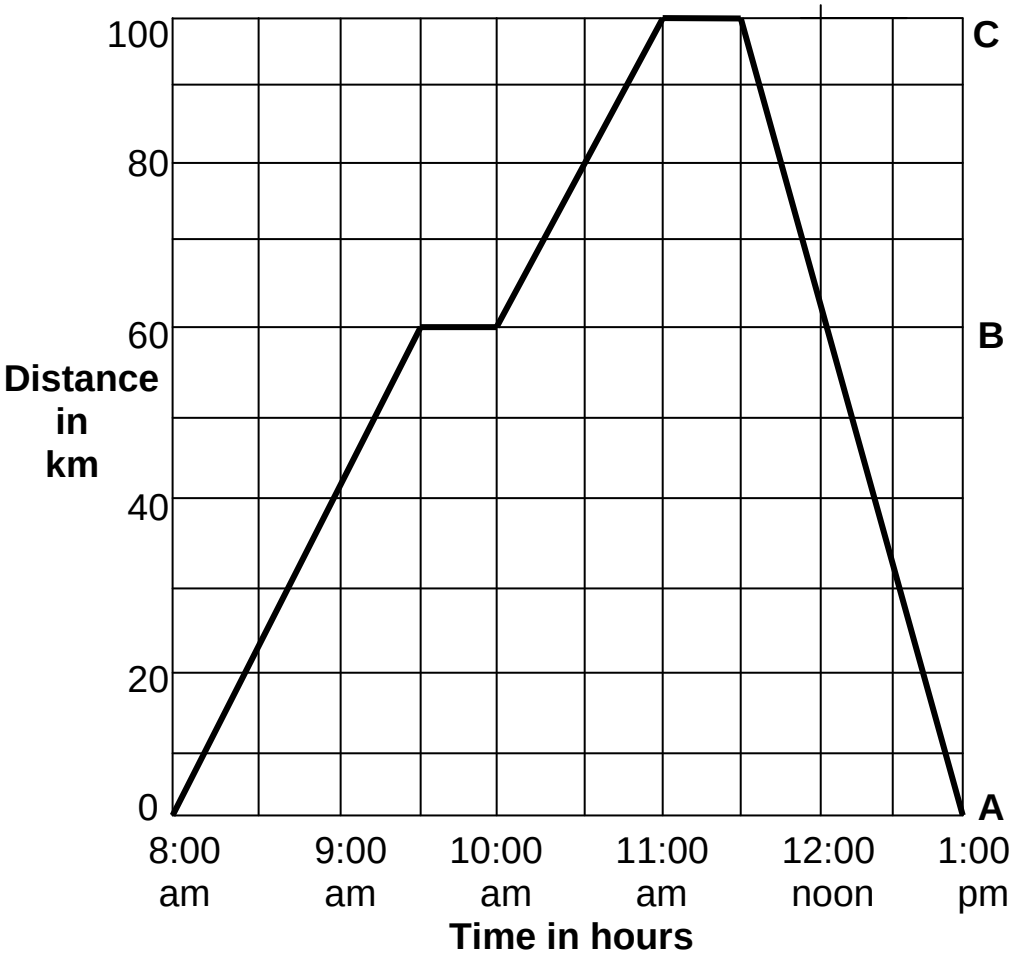
Average speed = Total distance covered / Total time taken

= 110km / 5hrs

Average speed = 22 km/hr

Example 2

The travel graph below shows a journey of a motorist from town A to town B and back to town A. use it to answer questions that follow.




a) At what time did the motorist leave town B?

At 9:30am

b) For how long was the motorist at B?

For 30minutes or ½ hr

c) What was the motorist's speed between town A and B?

Solution

$S = D \div T$

$= 60km \div 1\frac{1}{2} hrs$

$= 60km \div \frac{3}{2}$

$= 60km \times \frac{2}{3} hr$

$= \frac{20km \times 2}{1hr}$

The motorist's speed = 40km/hr

d) Calculate the motorist's total distance for the whole journey.

100km + 100km = 200km

e) What was the total rest time?

30min + 30min = 60minutes or 1hr.

f) Find the motorist's average speed for the whole journey.

$$\text{Average speed} = \frac{TDT}{TT}$$

$$= \frac{200km}{5hrs}$$

Average speed = 40km/hr

1. Find the motorist's average speed of the whole journey while travelling

$$\text{Average speed while travelling} = \frac{200km}{4hrs}$$

$$= 50km/hr$$

**ACTIVITY:**

**1**. A motorist left town A at 8:00a.m and travelled to town B at 60km/hr for 2 ½ km/hr for. He then returned through the same route at 75km/hr.

a) Calculate the distance between town A and town B.

b) Calculate the motorist's average speed for the whole journey.

**2**. Amelia drove her car at a speed of 120km/hr for 2 hours from town K to town Y. She rested at town Y for one hour and then returned to town K at a speed of 80km/hr.

a) Find the distance between towns K and Y.

b) Calculate the average speed for the whole journey while travelling.

c) Work out the average speed for the whole journey.

**3**. The head teacher drove from school to town P for 3 hours at a steady speed of 60km per hour. He left town P at bb 11:00a.m and drove back to the school via the same route at a steady speed of 90km per hour.

a) At what time did the head teacher arrive at the school?

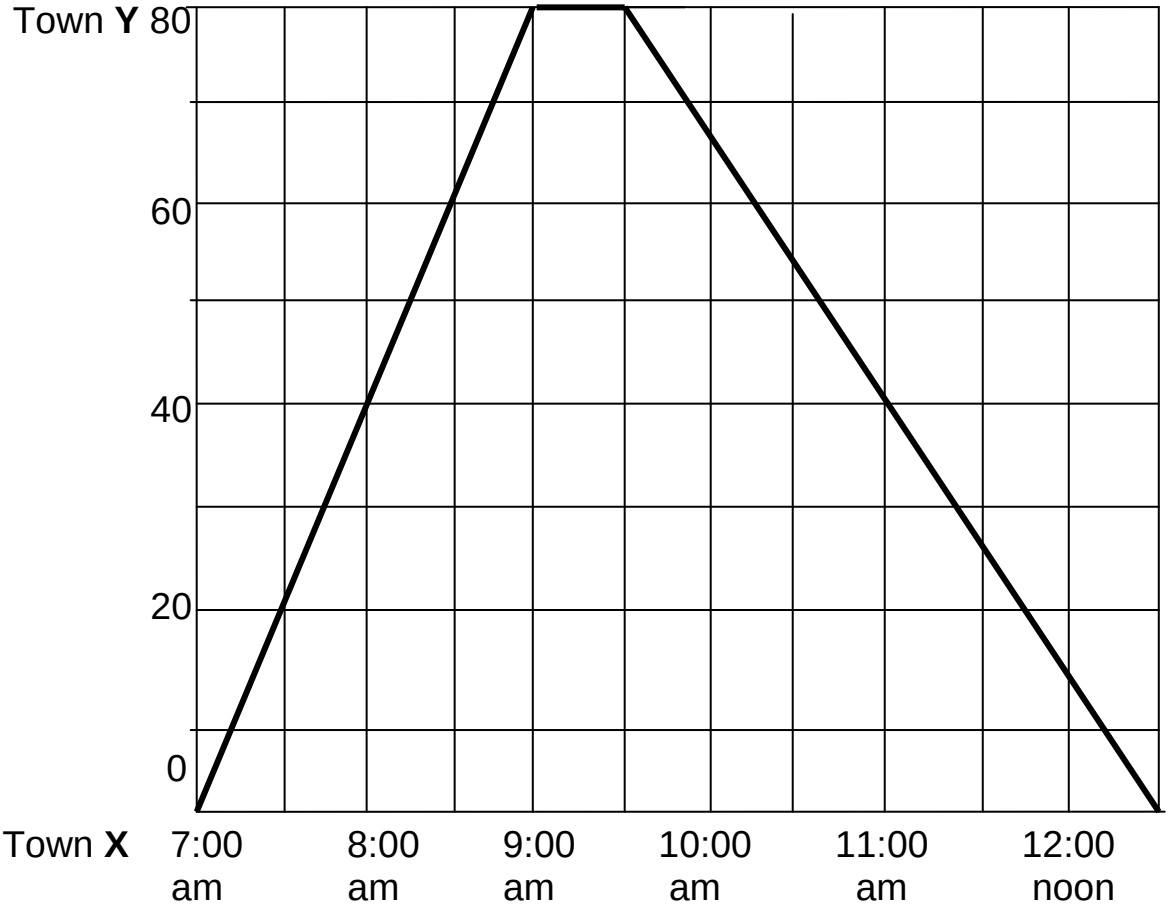
b) Work out the head teacher's average speed for the whole journey.

**4**. Lubwama drove at 55km/hr for 4 hours .if he returned following the same road at 110km/hr, find his average speed for the whole journey.

**SUB TOPIC: DRAWING TRAVEL GRAPHS**

1. A Bus left X at 7:00am for town Y. It travelled for 2hrs at an average speed of 40km/hr from X to Y, it stayed at Y for 30minutes before returning to X arriving at 12:00 noon.

a) Draw a travel graph to show the movement of the bus.




Distance from X to Y = S x T

= 40km x 2hrs  Rest
hr  30 minutes or ½ hr

= 80km

b) Calculate his average speed for the whole journey.

Total distance to and fro = 80 km + 80 km

= 160 km

Total time = 12 : 00

- 7 : 00

5 : 00 = 5 hours

Average speed = Total distance
Total time

= 160 km
5 hrs

= 32 km/hr

**ACTIVITY:**

**1**. Mutono left town left town X at 8:00a.m and drove at 90km/hr for one hour to town Y. He rested for half an hour at town Y. He left town Y and drove for 1 hour at 75km per hour to town Z. He then left town Z and drove back to town X at a steady speed of 40km per hour.

a) Draw Mutono's journey on the graph provided below.

b) Work out Mutono's average speed for the whole journey.

**2**. Mr. Katongole rode a bicycle from town A to town C through town B as follows:
He rode from town A to town B a distance of 30km in 3 hours and rested for ½ hour. From town B, he rode to town C a distance of 20km in 2 ½ hours.
Draw a line graph on the graph given below to show Mr. Katongole's movement from town A to town C.

**3**. Mr. Kaija left town P at 9:00 a.m and drove at 55km per hour for 2 hours to town Q. He rested at town Q for half an hour. He left town Q and drove for 1 ½ hours at 40km/hr to town R. He then left town R and drove back to town P at a speed75km/hr.
a) Show Mr. Kaija's journey on the graph below.
b) Calculate the average speed for the whole journey.

**4**. A motorist left Dabani at 7:00 a.m and covered a distance of 30km to Majanji in 1 ½ hrs. He rested for 30 minutes and then continued to Lugala a distance of 50km at a speed of 25km/hr. He had a break of ½ hr and then back to Mayuge where he arrived at 12:00 noon.
a) Show the motorist's journey on a travel graph.
b) Calculate the motorist's average speed for the whole journey.

**5**. Patrick left K at 9:00a.m and drove at 60km/hr for 2 hours to village Y. He rested for 1 hour at village Y and then drove for 1 ½ hrs at 40km/hr to village Z.
a) Draw Patrick's journey on the graph below.

b) At what time was he at village Y?

c) Calculate Patrick's average speed for the whole journey.

## SUB TOPIC: TIME (CONVERSION OF TIME)

**CONTENT**: **Changing "km/hr" to "m/s" and (or) "m/s" to "km/hr"**

- Change km to metres and hours to seconds
- Express metres as km and seconds as hour.

Examples:

1. Change10m/s to km /hr

| Change metres to km | Change second to hr |
|---|---|
| 1 m = $\frac{1}{1000}$ km | 1 sec = $\frac{1}{3600}$ hr |
| 10m = $\frac{1}{1000}$ x10 | Speed = Distance ÷ Time |
| = $\frac{1}{100}$ km | = $\frac{1}{100}$ ÷ $\frac{1}{3600}$ |
| | = [ $\frac{1}{100}$ x $\frac{3600 \text{ km/hr}}{1}$ |

**10m/sec = 36km/hr**

2. A cyclist covers a distance of 30 metres in 2 seconds. Calculate his speed in K.P.H.

1000 m = 1 km
1 m = ( $\frac{1}{1000}$ ) km
30m = ($\frac{30 \times 1}{1000}$) km

2 seconds = $\frac{2}{3600}$ hr
Speed = D ÷ T
= $\frac{3}{100}$ ÷ $\frac{2}{3600}$

= 3 km
100

3600 seconds = 1 hr

1 second = ( 1 ) hr
3600

= 3 x 3600
100 2

= 3 x 18

= 54

**180m/2secs = 54 km/hr**

3. Change 90km/hr to m/s.

Convert km to m

1km = 1000m

90km = 90 x 1000m

= 90,000m

1hr = 3,600 seconds

Speed = Distance
Time

= 90000m
3600

= 25m/sec

**90km/hr = 25m/sec**

4. A cyclist covered 180 km in 2 hours. Express this in m/s.

1 km = 1000m

180 km = 180 x 1000m

= 180,000m

1 hour = 3600 seconds

2 hours = 2 x 3600) seconds

= 7200 seconds

Speed = D
T 25

= 180,000m
7200 secs

**= 25m/s**

**ACTIVITY:**

1. Express the following speed below in m/sec.

a) 36 km/hr b) 72 km/hr c) 180 km/hr d) 18 km/hr

e) The distance between town A and town B is 540km. A car takes 3 hours to cover the journey. Calculate the speed in m/sec.

f) An aeroplane covered 1800 km in 1 hour. Find its speed in m/s.

2. Change the following speed below in km/hr.

a) 10m/s b) 50m/s c) 60m/s d) 120m/s

e) In a rally, a car covered 200m in 5 seconds. Calculate its speed in km/hr.

f) A bus covered a distance at 15m/sec. Calculate its speed in km/hr.

g) An aeroplane covered 10,000m in 3 sec

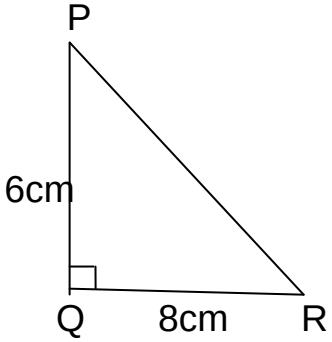
## TOPIC: LENGTH, MASS AND CAPACITY

## SUBTOPIC: AREA OF A TRIANGLE AND ITS APPLICATIONS

- To find the area of a triangle, use the formula ½ x b x h.
- The base and height are determined by a right angle symbol at the vertex of the two adjacent sides.
- Area is expressed in square units.

Example 1

Find the area of the triangle PQR below.




Area = ½ x b x h

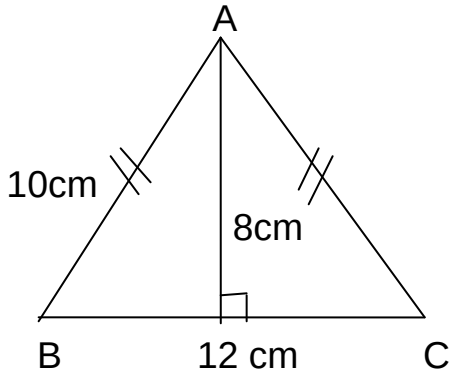
= ½ x 8cm x 6cm

= 4cm x 6cm

= **24cm²**

Example 2

Find the area of the triangle ABC below.




Area = $^1/_2$ x b x h

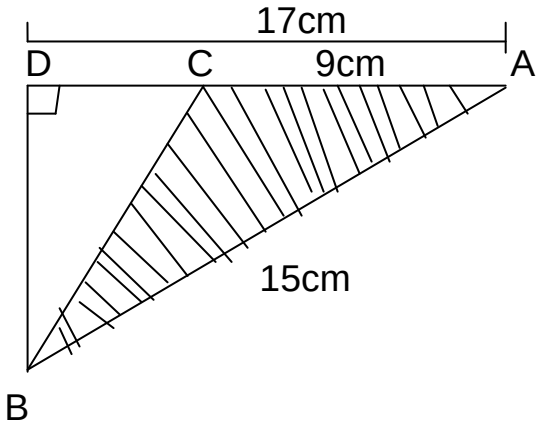
= $\frac{1}{2}$ x 12 cm x 8 cm

= 6 cm x 8 cm

= 48 $cm^2$

Example 3

The area of the shaded part of the triangle below is 36$cm^2$. Find length BD.




BD = 17cm – 9cm

= **8cm**

Area = ½ x b x h

½ x b x h = Area

½ x 9cm x BD = 36$cm^2$

9cm x BD = 36$cm^2$

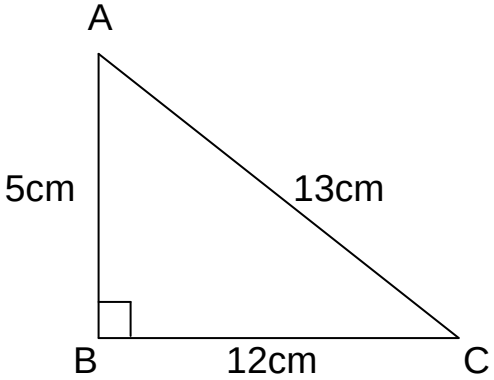
$\frac{9cm \times BD}{9cm} = \frac{36cm \times cm}{9cm}$

**BD = 4cm**

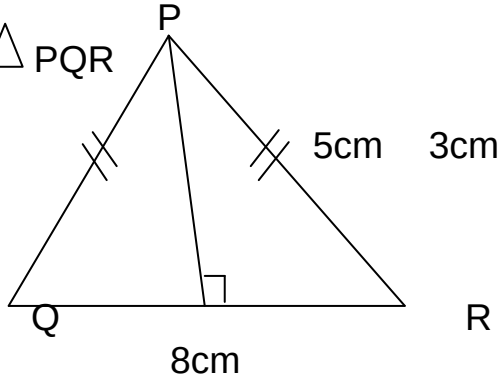
**ACTIVITY:**

Find the area of the following triangles below.

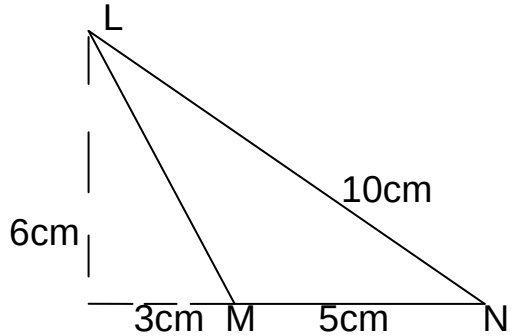
1.




2. △PQR



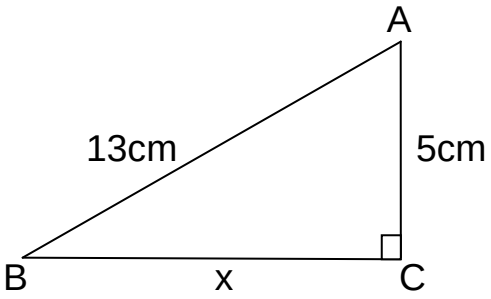

3. Use the figure LMN below to answer questions that follow.




a) Calculate the area of the figure above.

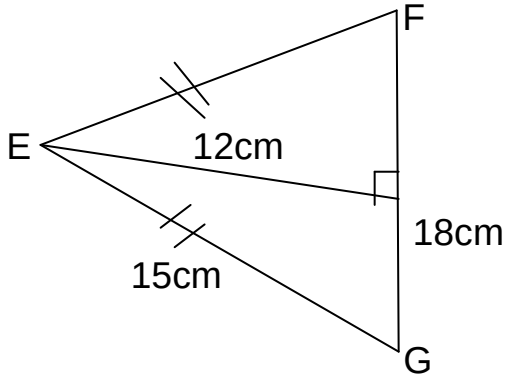
b) Find the perimeter of the shape LMN above

4. Find the value of length BC, area and perimeter in the figure below.

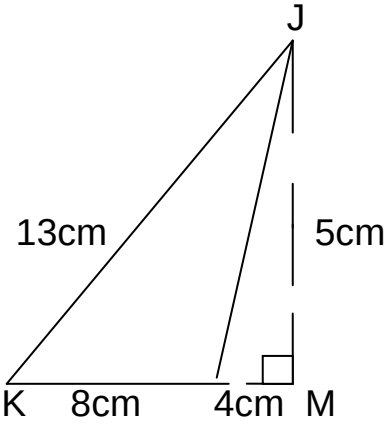



In the numbers 5 and 6, find the area and perimeter of the figures.

5. △EFG




6. △JKL




7. A triangular piece of land has an area of $42cm^2$.If its height is 7cm, calculate its base.

8. Work out the area of a triangular piece of land whose area is $81cm^2$ and has a height of 9cm.

9. A triangle has a base of 16cm and an area of $64cm^2$. Find the length of its height.

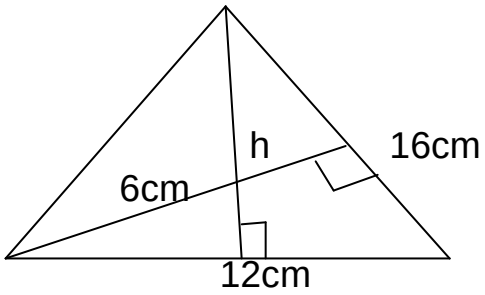
10. The area of a triangle is $36cm^2$. If its height is 8cm, find the base length.

**SUB TOPIC: COMPARING AREA OF A TRIANGLE**

- Different heights of the same triangle give the same area.
- First identify the bases and heights of the triangle given.
- Compare the areas of the two triangles.

Example 1

Find the height marked h in the figure below.




Solution

Area of a triangle = ½ x b x h

$\frac{1}{2} \times b \times h = \frac{1}{2} \times b \times h$

$\frac{1}{2} \times 12cm \times h = \frac{1}{2} \times 16cm \times 6cm$

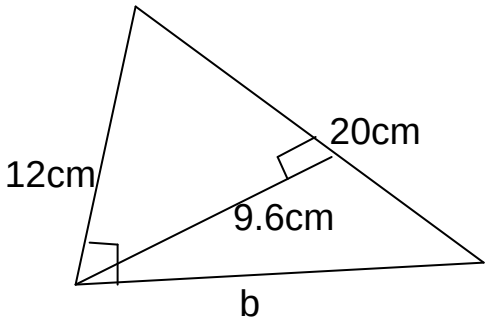
$6cm \times h = 16cm \times 3cm$

$\frac{6cm \times h}{6cm} = \frac{16cm \times 3cm}{6cm}$

**h = 8cm**

Example 2

Find the base marked in the figure below.




$\frac{1}{2} \times b \times h = \frac{1}{2} \times b \times h$

$\frac{1}{2} \times b \times 12cm = \frac{1}{2} \times 20cm \times 9.6cm$

$b \times 6cm = 10cm \times \frac{96cm}{10}$

$\frac{b \times \cancel{6}cm}{\cancel{6}cm} = \frac{1cm \times \cancel{96}cm}{\cancel{6cm}\ 1}$

**b = 16cm**

(ii) Perimeter = s + s + s

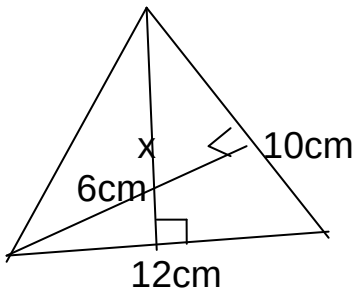
= 12cm + 16cm + 20cm

= 48cm

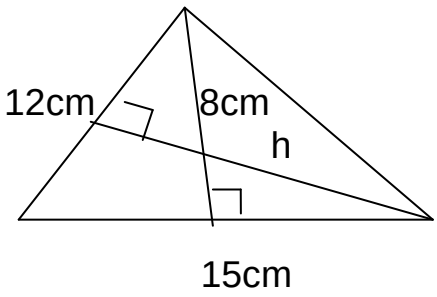
**ACTIVITY:**

Calculate the length x, of the lines marked with letters.

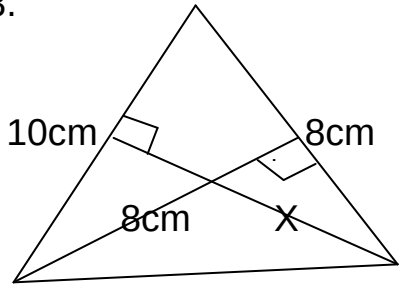
1.



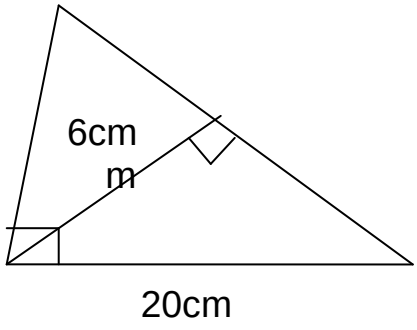

2.



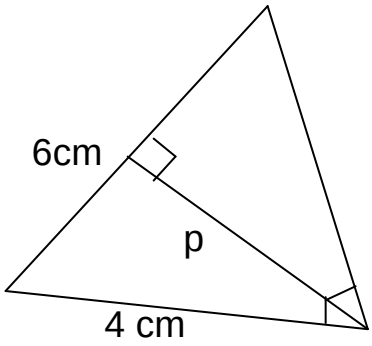

3.



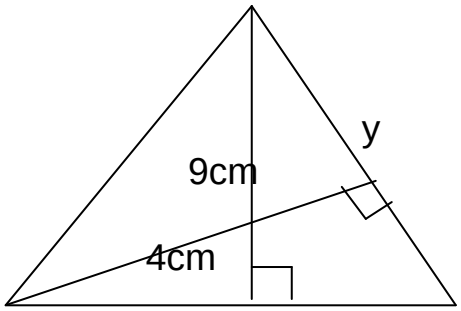

4.



5.




6.

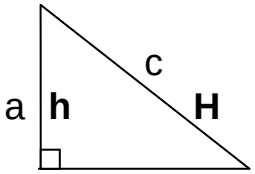



**SUB TOPIC: TRIANGLES AND PYTHAGORAS THEOREM**

**Concepts:**

- Apply the Pythagoras theorem, the property of an isosceles triangle to solve.
- Substitute for the unknowns then find the area and perimeter of the triangle.

➢ The sum of the squares of the two short sides of a right angled triangle is equal to the square of the longest side.



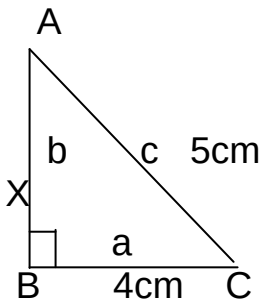

**H** – is the **hypotenuse** (longest side)
**b** – is the **base**
**h** – is the **height** } the two short sides

$\mathbf{a^2 + b^2 = c^2}$ **or** $\mathbf{b^2 = c^2 + a^2}$

$\mathbf{a^2 = c^2 + b^2}$ $\mathbf{c^2 = a^2 + b^2}$

Examples

Find the value of x, area and perimeter of the figure below.




(i) $a^2 + b^2 = c^2$

$(4cm)^2 + X^2 = (5cm)^2$

$(4cm \times 4cm) + X^2 = (5cm \times 5cm)$

$16cm^2 + X^2 = 25cm^2$

$16cm^2 - 16cm^2 + X^2 = 25cm^2 - 16cm^2$

$x^2 = 9cm^2$

$\sqrt[2]{x2} = \sqrt[2]{9\ cm2}$

**x = 3cm**

(ii) Area = $\frac{1}{2}$ x b x h

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

= 2cm x 3cm

Area **= 6cm$^2$**

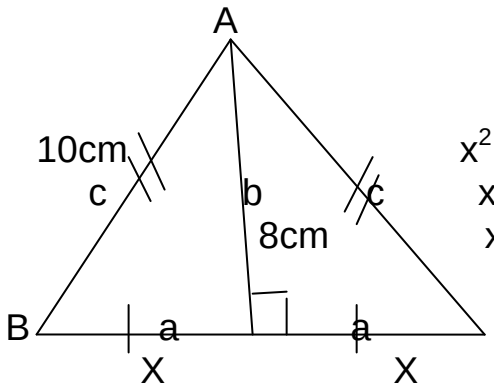
(iii) Perimeter = s + s + s

= 3cm + 4cm + 5cm

= 12cm

Example 2

Find the value of X, area and perimeter of the figure ABC below.




(i) Value of x

$a^2 + b^2 = c^2$

$x^2 + (8cm)^2 = (10cm)^2$

$x^2 + (8cm) \times (8cm) = 10cm \times 10cm$

$x^2 + 64cm^2 = 100cm^2$

$x^2 + 64cm^2 - 64cm^2 = 100cm^2 - 64cm^2$

$x^2 = 36cm^2$

$\sqrt[2]{\mathbf{x2}} = \sqrt[2]{\mathbf{36cm2}}$

**X = 6cm**

(ii) Area of triangle ABC

$= \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times 2X \times 8cm$

$= \frac{1}{2} \times (2 \times 6cm) \times 8cm$

$= 6cm \times 8cm$

$\mathbf{= 48cm^2}$

(iii) Perimeter of figure ABC

$= s + s + s$

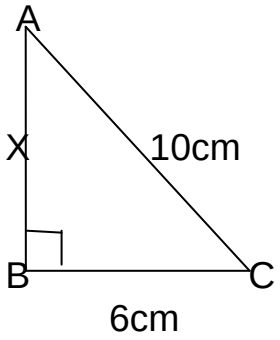
$= 12cm + 10cm + 10cm$

$= 32cm$

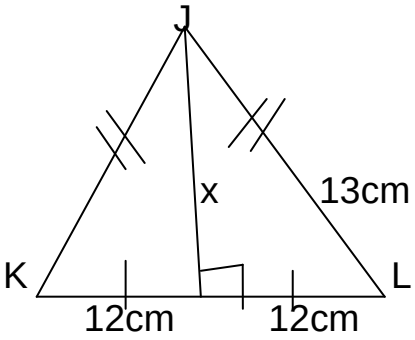
**ACTIVITY:**

Find the value of x, area and perimeter in the triangles below.

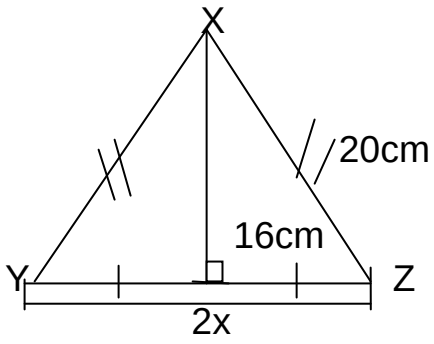
1. △ ABC




2. △JKL




3.

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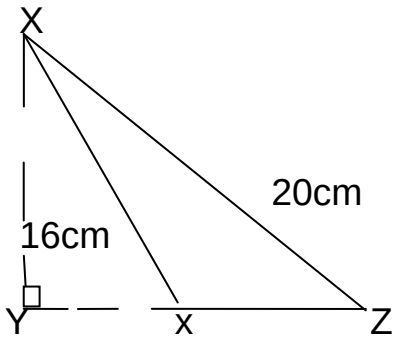
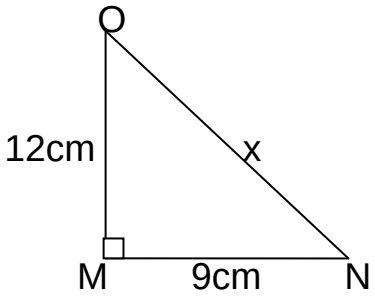
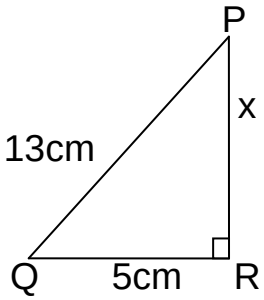



7. △ MNO




8. △ PQR

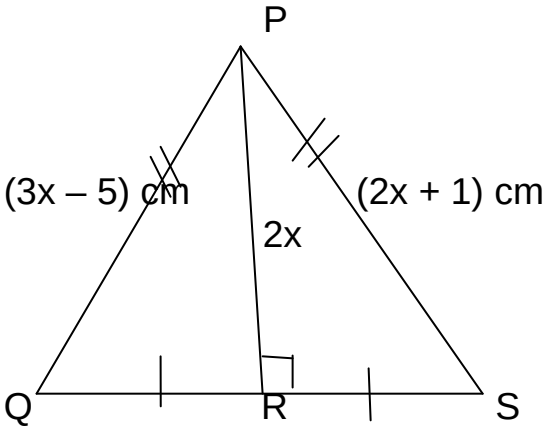



**SUB TOPIC: FINDING THE UNKNOWN SIDE OF A TRIANGLE**

- Compare the opposite sides of the isosceles triangle.
- Find the actual length of the unkown sides.
- Apply the Pythagoras theorem to find the unknown side.

Example

PQS is an isosceles triangle.




a) Find the value of X

Opposite sides are equal

$(3x - 5)\underline{cm} = (2x + 1)\underline{cm}$

cm cm

$3x - 5 = 2x + 1$

$3x - 5 + 5 = 2x + 1 + 5$

$3x - 5 = 2x + 1$

$3x - 5 + 5 = 2x + 1 + 5$

$3x = 2x + 6$

$3x - 2x = 2x - 2x + 6$

**X = 6**

b) Find the value of lengths PQ and PS.

| PQ | PS |
|---|---|
| (3x – 5)cm | ( 2x + 1)cm |
| (3 x X) – 5cm | (2 x X) + 1cm |
| (3 x 6) – 5cm | (2 x 6) + 1cm |
| (18 – 5)cm | (12 + 1) cm |
| **= 13cm** | **= 13cm** |

d) Find the area of the triangle.

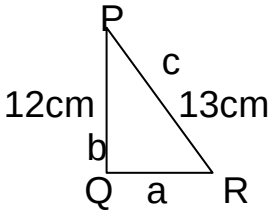
Area = $\frac{1}{2}$ x b x h

= $\frac{1}{2}$ x 10cm x 12cm

= 10cm x 6cm

**= 60cm$^2$**

c) Find the length of line QS.




$a^2 + b^2 = c^2$

$a^2 + (12cm)^2 = (13cm)^2$

$a^2 + (12cm \times 12cm) = 13cm \times 13cm$

$a^2 + 144cm^2 = 169cm^2$

$a^2 + 144cm^2 - 144cm^2 = 169cm^2 - 144cm^2$

$a^2 = 25cm^2$

$\sqrt[2]{a2} = \sqrt[2]{25cm2}$

a = 5cm

e) Find the perimeter of the figure.

QS = PR + RS

= 5cm + 5cm

= 10cm

Perimeter = S + S + S

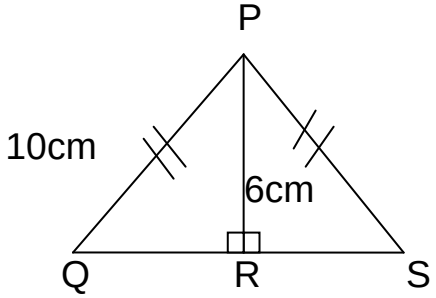
= (13cm+13cm) +10cm

= 26cm + 10cm

**= 36cm**

**ACTIVITY:**

1. Given that PS = PQ = 10cm and PR = 6cm bisects angle P.

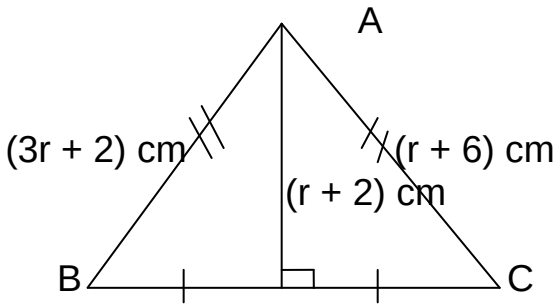



a) Calculate the length of QS.

b) Calculate the perimeter of the figure above,

c) Calculate the area of the figure.

2. Study the figure below and use it to answer the questions that follow.

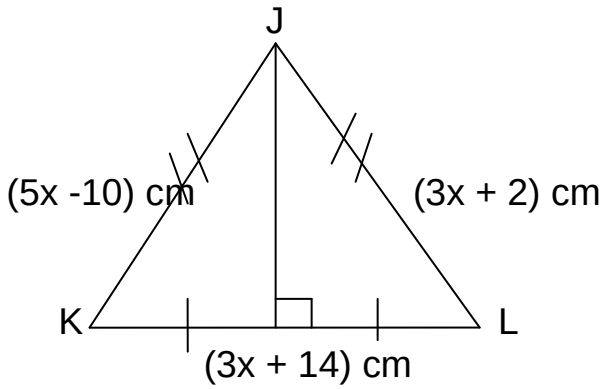



a) Find the value of r.

b) Calculate the area of the figure below.

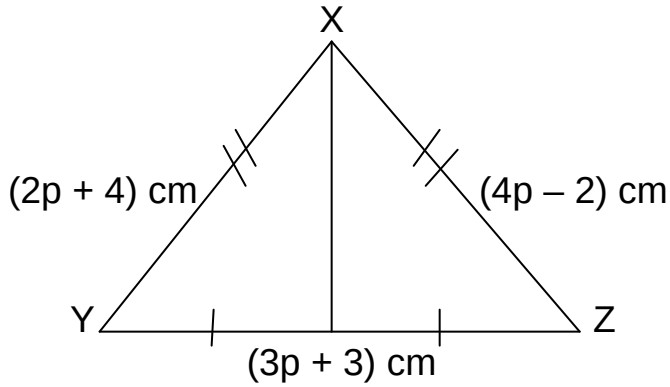
c) Find the perimeter of the figure ABC above.

3. Given the triangle JKL below.




a) Find the value of X. b) Work out the area of the triangle JKL.
c) What is the area of the figure?

4. Study the triangle XYZ below and use it to answer the questions that follow.




a) Find the value of p.

b) Work out the area of the triangle XYZ.

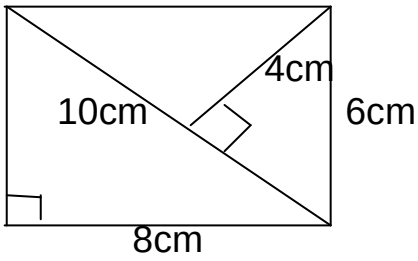
c) Find the perimeter of triangle XYZ.

## SUB TOPIC: FINDING AREA OF COMBINED TRIANGLES

- Work out the area of each triangle separately then add.

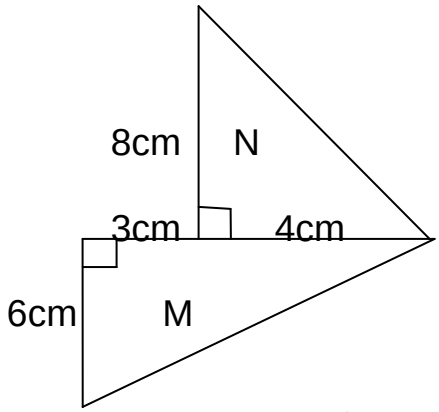
Examples

1. Find the area of the whole figure below.




| Area of triangle A | Area of triangle B | Area of whole figure |
|---|---|---|
| $\frac{1}{2}$ x b x h | $\frac{1}{2}$ x b x h | $24cm^2$ |
| $\frac{1}{2}$ x 8cm x 6cm | $\frac{1}{2}$ x 10cm x 4cm | + $20cm^2$ |
| 4cm x 6cm | 5cm x 4cm | $44cm^2$ |
| = $24cm^2$ | = $20cm^2$ | |

2. Find the area of the figure below.

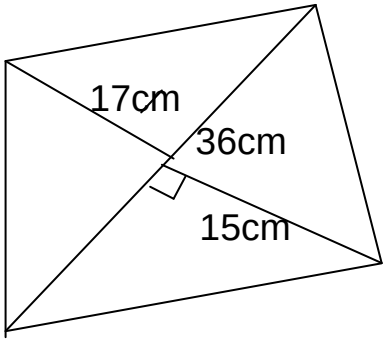



| Area of triangle M | Area of triangle N | Area of figure |
|---|---|---|
| $\frac{1}{2}$ x b x h | $\frac{1}{2}$ x b x h | $21cm^2$ |
| $\frac{1}{2}$ x 6cm x (3 + 4) cm | $\frac{1}{2}$ x 4cm x 8cm | +$16cm^2$ |
| = 3m x 7cm | = 2cm x 8cm | $37cm^2$ |
| = $21cm^2$ | = $16cm^2$ | |

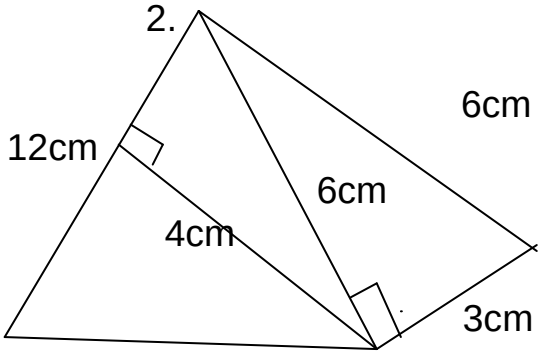
**ACTIVITY:**

Find the areas of the following figures below

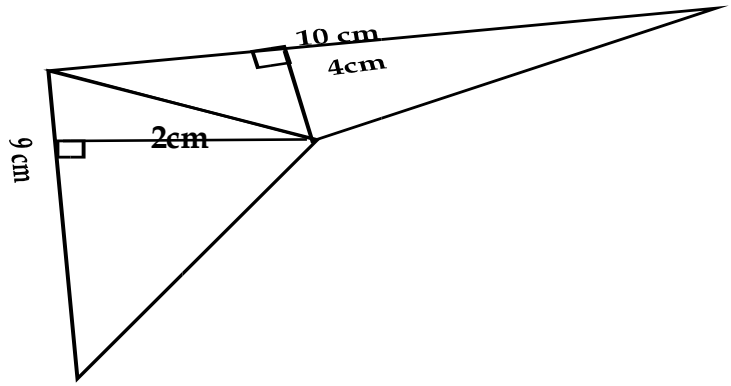
1.

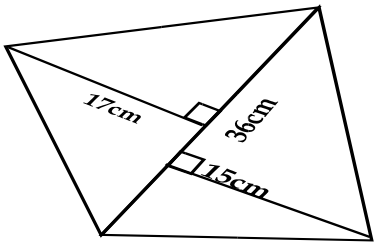


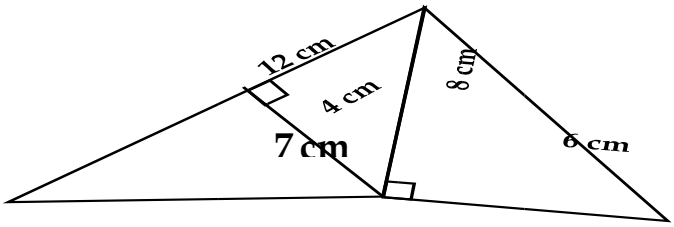

2.



3.



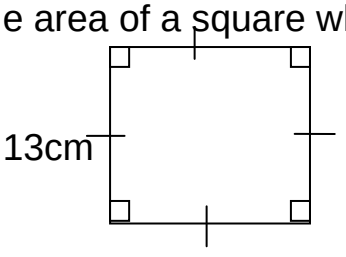




**SUB TOPIC: AREA OF A SQUARE AND ITS APPLICATIONS**

- To work out its area, square the length of the side given in square units.
- To find its perimeter, add the length of all the four sides or multiply the length of one side by 4.
- Apply the square root to find the unknown side of a square.
- Apply Pythagoras theorem to work out the area given the length of the diagonal..

Example 1

Find the area of a square whose side is 13cm.




Area = side x side
= 13cm x 13cm
= **169cm$^2$**

```
  1 3
x 1 3
  3 9
+ 1 3
  1 6 9
```

Example 2

The area of a square is 144cm$^2$. Find its perimeter.

Area = side x side
S x S = Area
S x S = 144cm$^2$
$S^2$ = 144cm$^2$
$\sqrt[2]{S\ x\ S} = \sqrt[2]{2\ x\ 2\ x\ 2\ x\ 2\ x\ 3\ x\ 3}$
S = 2 x 2 x 3
S = 12cm$^2$

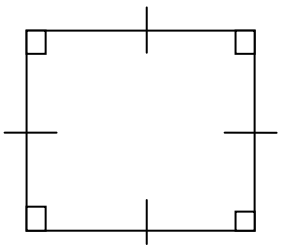
| | |
|---|---|
| 2 | 144 |
| 2 | 72 |
| 2 | 36 |
| 2 | 18 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

Perimeter = S + S + S + S
= 12cm+12cm+12cm+12cm
**= 48cm**

or Perimeter = 4 x side
= 4 x 12cm
= **48cm**

Example 3

The figure below has a perimeter of 80cm. Calculate its area.



Perimeter = 80cm

Perimeter = 4 x S

4 x s = 80cm

4s = 80cm

$\frac{4s}{4} = \frac{80cm}{4}$

S = 20cm

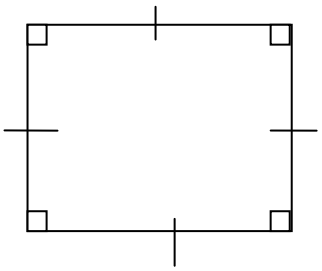
Area = S x S

= 20cm x 20cm

= $400cm^2$

Example 4

The figure below is a square. Find the value of p if the diagonal is $\sqrt[2]{32\ cm}$ .



$a^2 + b^2 = c^2$

$p^2 + p^2 = \sqrt[2]{32\ cm}$ .

$2p^2 = \sqrt[2]{32}$cm

$\frac{2p^2}{2} = \frac{\sqrt[2]{32}}{2}$

$P^2 = 16$

$\sqrt[2]{p2} = \sqrt[2]{16}$

$\sqrt[2]{p \times p} = \sqrt[2]{4 \times 4}$

P = 4cm

b) Find its area.

Area = s x s

= 4cm x 4cm

= $16cm^2$

c) Find the perimeter of the figure

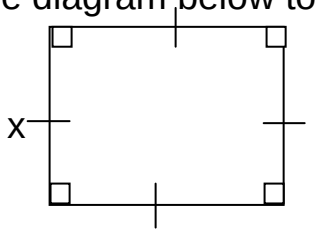
Perimeter = 4 x S

= 4 x 4cm

= 16cm

**ACTIVITY:**

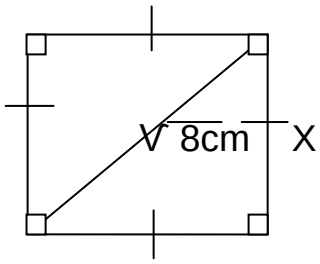
1. Find the area of a square of side 11cm.
2. A square has an area of $81cm^2$. Work out its perimeter.
3. The distance around a square plot of land is 100cm. What is the length of one side?
4. The perimeter of a square of 52cm. Find the length of one side.
5. The perimeter of a square compound is 40cm. Calculate its area.
6. Use the diagram below to answer the questions that follow.



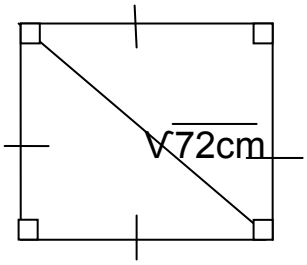

a) If the figure has a perimeter of 120cm, find the length of one side,

b) Work out its area.

7. Find the perimeter and area of the figure below if the diagonal is √8cm.

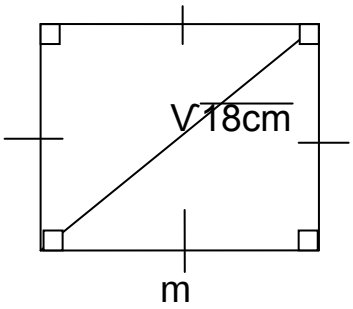


8. Given the diagram below;




a) Find the length of each side
b) Work out the distance round the figure
c) Calculate its area.

9. Use the figure below to answer the questions that follow.




a) Find the value of m.
b) Find the area of the figure.

## SUB TOPIC: AREA OF A RECTANGLE AND ITS APPLICATIONS

- Apply Pythagoras theorem to work out the length of the diagonal.

**Examples**

1. The perimeter of a rectangle is 40cm. If its length is 12cm, find the area.

$2(L + W) = \text{Perimeter}$
$2(12\text{cm} + W) = 40\text{cm}$
$24\text{cm} + 2W = 40\text{cm}$
$24\text{cm} - 24\text{cm} + 2W = 40\text{cm} - 24\text{cm}$
$2W = 16\text{cm}$
$\frac{2W}{2} = \frac{16\text{cm}}{2}$
$\text{Width} = 8\text{cm}$

$\text{Area} = L \times W$
$= 12\text{cm} \times 8\text{cm}$
$\text{Area} = 96\text{cm}^2$

2. The length of a rectangular field is 700 m long and 600 m wide. Find the area in square kilometres.

$\text{Area} = L \times W$
$= 700\text{m} \times 600\text{m}$
$= 420{,}000\text{m}^2$

$1\text{ km} \times 1\text{km} = 1\text{ km}^2$
$1{,}000\text{m} \times 1{,}000\text{m} = 1\text{km} \times 1\text{km}$
$1{,}000{,}000\text{m}^2 = 1\text{km}^2$
$1\text{m}^2 = \frac{1}{1{,}000{,}000}\text{km}^2$
$420{,}000\text{m}^2 = \frac{1}{1{,}000{,}000} \times 420{,}000\text{km}^2$
$420{,}000\text{m}^2 = \frac{42}{100}\text{km}^2$
$\text{Area in km} = 0.42\text{km}^2$

3. The length of a rectangle is 3 times its width. If the perimeter of the rectangle is 56cm. Find its area.

Let the width be y.

Length be y x 3 = 3y

2( L + W ) = Perimeter

2(3y + y) = 56cm

2 x 4y = 56cm

8y = 56cm

$\frac{8y}{8} = \frac{56cm}{8}$

y = 7cm

Width = 7cm

Length = 3y

= 3 x y

= 3 x 7cm

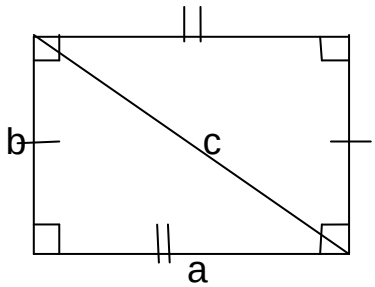
= 21cm

Area = L x W

= 21cm X 7cm

$= 147cm^2$

4. The area of a rectangle is $108cm^2$. If its length is 12cm, find the length of the diagonal.




Area = L x W

L x W = Area

$12cm \times w = 108cm^2$

$\frac{12cm \times w}{12cm} = \frac{108cm \times cm}{12cm}$

Width = 9cm

$a^2 + b^2 = c^2$

$(12cm)^2 + (9cm)^2 = c^2$

$(12cm \times 12cm) + (9cm \times 9cm) = c^2$

$144cm^2 + 81cm^2 = c^2$

$225cm^2 = c^2$

$\sqrt[2]{225} = \sqrt[2]{C2}$

$\sqrt[2]{3\ x\ 3\ x\ 5\ x\ 5} = \sqrt[2]{C\ x\ C}$

3 x 5 = C

15 = C

C = 15

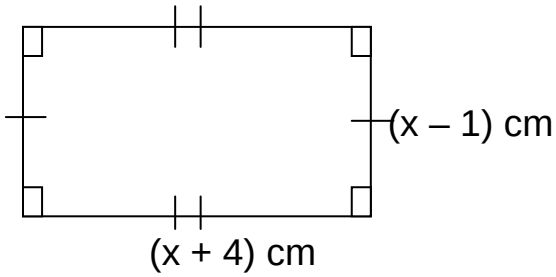
The length of the diagonal is 15cm

**ACTIVITY:**

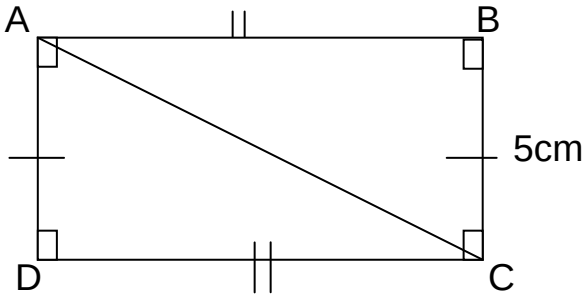
1. The perimeter of a rectangle is 32cm. Its length is 10cm. Find the width of the rectangle.
2. Calculate the area of a rectangle whose perimeter is 42cm and width is 9cm.
3. The perimeter of a rectangle is 60cm. If its width is 12cm, work out the length of the rectangle.
4. The length of a rectangle is 4cm more than the width. If its perimeter is 48cm;
   a) Find the length and width of the rectangle.
   b) What is the area of the rectangle?
5. The width of a rectangle is 3cm less than the length. If the perimeter is 30cm;
   i) Find the width of the rectangle.
   ii) Work out the area of the rectangle.
6. The length and width of a rectangle are 16cm and 12cm respectively. Find the length of the diagonal.

7. The area of a rectangle is 48cm$^2$. Its width is 6cm. Find the length of its diagonal.
8. The perimeter of a rectangle is 14m. If its length is 4m, what is the length of its diagonal?
9. A rectangle has an area of 63cm$^2$.Calculate the length of its width and the perimeter.

10. The perimeter of a rectangle below is 34cm. Find the area.




11. The figure ABCD below is a rectangle. AC = 13cm and BC = 5cm. Find the length AB.

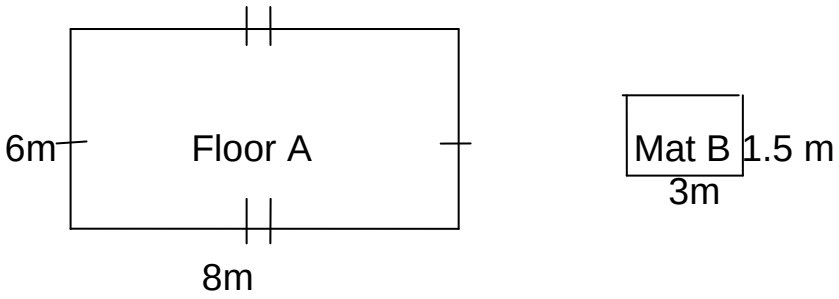



**SUB TOPIC: COMPARING AREAS OF RECTANGLES AND SQUARES**

- Find the number of mats along the length and the width.
- Solve problems involving comparing areas of figures.

Example 1

How many mats (B) can cover floor (A)?




1 m = 100cm
8 m = (8 x 100cm)
= **(800cm)**
6 m = (6 x 100)
= **600cm**

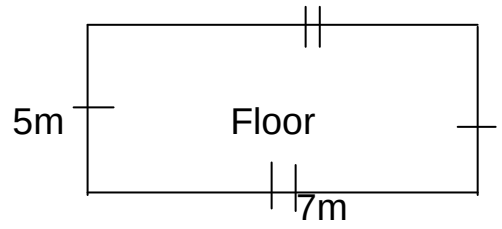
2m = (2 x 100cm)
= **200cm**
1.5cm = (15 x 100cm)
10
= (15 x 10cm)
= **150cm**

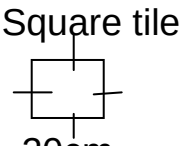
Total number of mats
= Length x Width
Length x Width
= 800cm x 600cm
200cm 150cm
= 4 x 4

**Total number = 16 mats**

Example 2

a) How many square tiles of side 20cm can cover a floor 7m by 5m?




1 m = 100cm
7 m = (7 x 100cm)
= **700cm**
5 m = (5 x 100cm)
= **500cm**

Number of square tiles
= length x width
side side
= 700cm x 500cm
20cm 20cm

= 35 x 25
= **875 square tiles**

b) If each square tile costs sh.250, how much money is required to complete the floor?

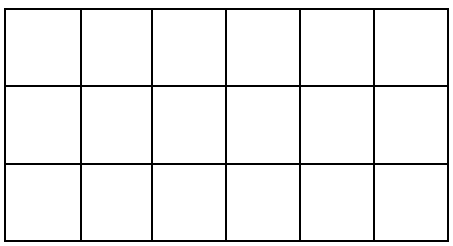
1sq. tile costs sh.250

875 sq. tiles will cost sh.250 x 875

= **shs218,750**

**ACTIVITY:**

1. How many square tiles each 30cm are needed to cover a floor of 15m long by 9m wide?
2. How many mats each 2 metres by 1.2 metres can be used to cover a sitting room 10 metres by 6 metres?
3. A table cloth 4 metres by 2 metres has square patterns each side 20cm. How many square tiles are there?
4. Mercy used small bricks each measuring 15cm by 8cm to cover his rectangular compound 30 metres by 20 metres. How many bricks were used?
5. Square tile of side 40cm each are laid on a floor of a room measuring 800cm by 400cm.
   a) How many square tiles are needed to cover the floor?
   b) If each box containing 25 tiles costs sh.30,000, find the total cost of the tiles needed to cover the floor of the room.
6. Iron sheets each 150cm by 75cm are used to cover on a rectangular roof of 45m by 7m. How many iron sheets were used on the roof?
7. How many square tiles of 20cm by 20cm can cover a ground of 3m by 15m?
8. How many square slabs of side 15cm by 15cm can cover a ground of 15m by 30m?
9. The figure below represents a rectangular floor which is covered by square tiles 400cm2 each. Use it to answer the questions that follow.



a) Find the area of the rectangular floor.

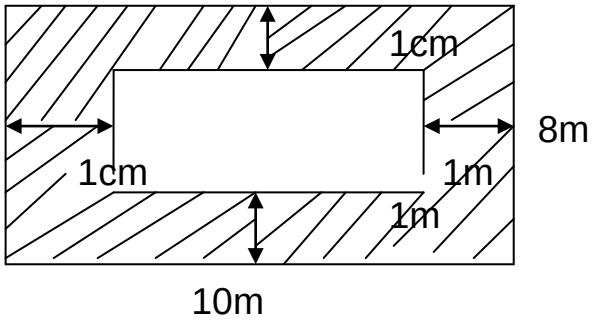
b) Calculate the perimeter of the rectangular floor.

**SUB TOPIC: SHADED AND UNSHADED PARTS OF FIGURES**

- Compare the side to get the unknown length and width
- Get the area of each shape

Examples:

1. A carpet is laid centrally on a floor of a room 10m by 8m. Find the area of the uncovered part of the floor if the carpet is left 1m on all sides.




a) Find the length and width of the carpet.

i) Length of the carpet = 10m – (1 + 1) m
= 10m – 2m
= 8m

ii) Width of the carpet = 8m – (1 + 1) m
= 8m – 2m
= 6m

b) Work out the area of the part not covered by the carpet.

(i) Area of a floor = L X W
= 10m X 8m
= $80m^2$

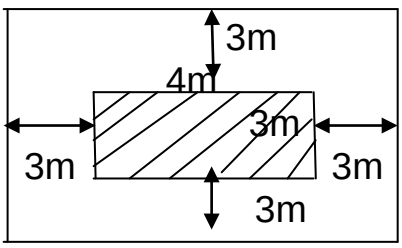
ii) Area of a carpet = L X W
= 8m x 6m
= $48m^2$

c) Area of uncovered part = Area of floor – Area of a carpet

$$\begin{array}{r} 80\ m^2 \\ -\ 48\ m^2 \\ \hline 32\ m^2 \end{array}$$

**ACTIVITY:**

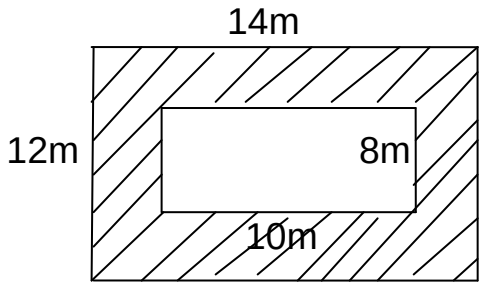
1. The figure below shows Mr. Opio's sitting room covered with a woollen carpet measuring 9m by 6m. If the woolen carpet is left 3m on all sides of the room;



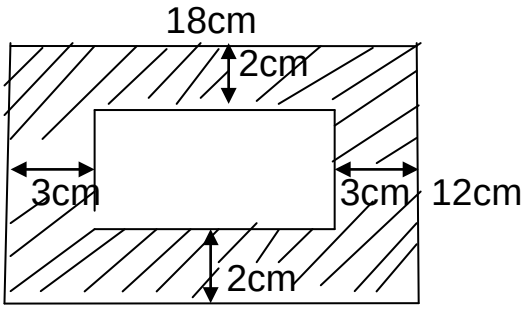

a) Calculate the area covered by the carpet.

b) Work out the area not covered by the carpet.

2. Find the area of the shaded part of the figure below.

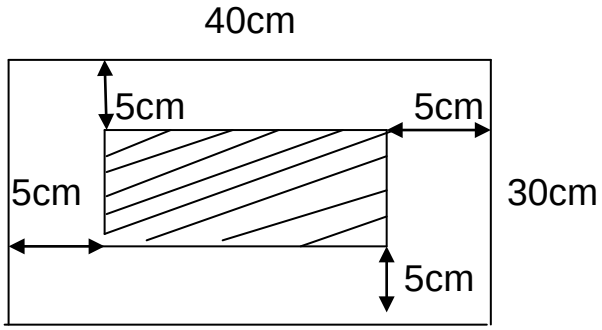



3. Use the figure below to answer the questions that follow.



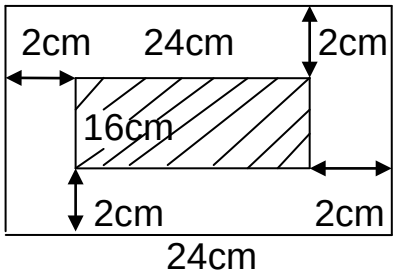

a) Calculate the perimeter of the outer figure.
b) Find the area of the un shaded part of the figure.

4. Study the figure below and use it to answer the questions that follow.




Find the area of the un shaded part of the figure above.

5. Find the area of the un shaded part of the figure below.



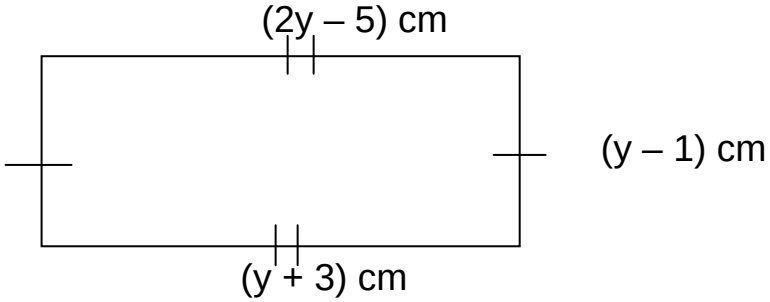

**SUB TOPIC: FINDING UNKNOWN SIDES, AREA AND PERIMETER**

**Concepts:**

- Compare the equal sides of the given figure(s).
- Form and solve an equation.
- Find the required values accordingly.

Examples

1. Find the value of y, perimeter and area of the figure below.




Length = Length

a) (2y – 5) cm = (y + 3) cm

cm cm

2y – 5 = y + 3

2y – 5 + 5 = y + 3 + 5

2y = y + 8

2y – y = y – y + 8

Y = 8

b)

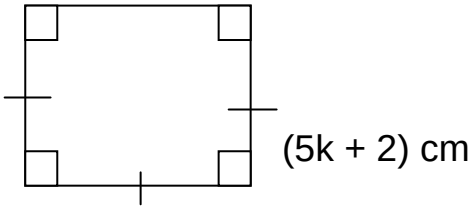
| Actual length | Actual width | Perimeter |
|---|---|---|
| (y + 3) cm | (y – 1) cm | = 2(L + W) |
| (8 + 3) cm | (8 – 1) cm | = 2(11 cm + 7cm) |
| 11cm | 7cm | = 2 x 18cm |
| | | = 36cm |

c) Area = L x W

= 11cm x 7cm

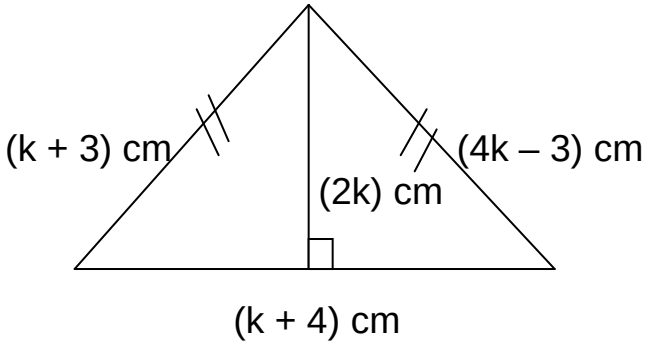
Area = $77cm^2$

2. Find the value of k, perimeter and area of the figure below.




| Value of x | Length of side | Perimeter | Area |
|---|---|---|---|
| (6k – 3) ~~cm~~ = (5k + 2) ~~cm~~ | (5k + 2) cm | = 4 x L | = S x S |
| ~~cm~~ ~~cm~~ | 5 x 5) cm + 2cm | = 4 x 27cm | = 27cm x 27cm |
| 6k – 3 = 5k + 2 | 25 cm + 2cm | = 108 cm | = $729cm^2$ |
| 6k – 3 + 3 = 5k + 2 + 3 | = 27cm | | |
| 6k = 5k + 5 | | | |
| 6k – 5k = 5k – 5k + 5 | | | |
| k = 5 | | | |

3. Use the figure below to answer the questions that follow.



a) Name the shape above.
An isosceles triangle

b) Find the value of k.

$(4k - 3)$ ~~cm~~ $= (k + 3)$ ~~cm~~
~~cm~~ ~~cm~~

$4k - 3 = k + 3$
$4k - 3 + 3 = k + 3 + 3$
$4k = k + 6$
$4k - k = k - k + 6$
$3k = 6$
$\frac{3k}{3} = \frac{6}{3}$
$K = 2$

c) Work out the perimeter of the figure.

Actual lengths
$(k + 3)$ cm $(k + 4)$ cm
$(2 + 3)$ cm $(2 + 4)$ cm
$= 5$cm $= 6$cm

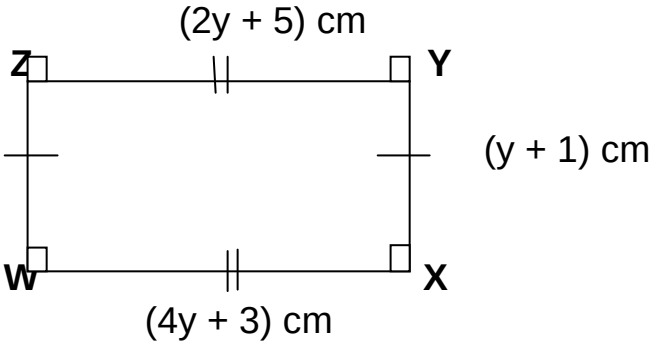
Perimeter
$= S + S + S$
$= (6 + 6 + 5)$ cm
$= 17$cm

d) Work out the area of the figure.

Area $= \frac{1}{2} \times b \times h$
$= \frac{1}{2} \times 6\text{cm} \times (2k)$ cm
$= \frac{1}{2} \times 6\text{cm} \times 2 \times 2\text{cm}$
$= 6\text{cm} \times 2\text{cm}$
$= 12\text{cm}^2$

**ACTIVITY:**
Study the figures below and use to answer the questions that follow:

**1.**

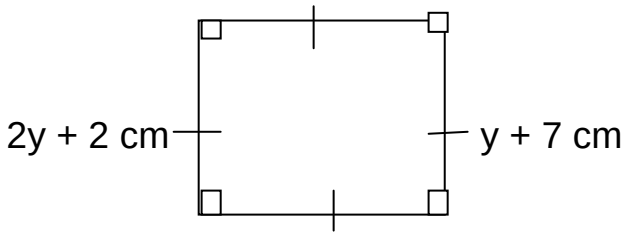



a) Find the value of y.

b) Calculate its area.

c) Work out the perimeter of the figure.

**2.** Study the figure below and use it to answer questions that follow.

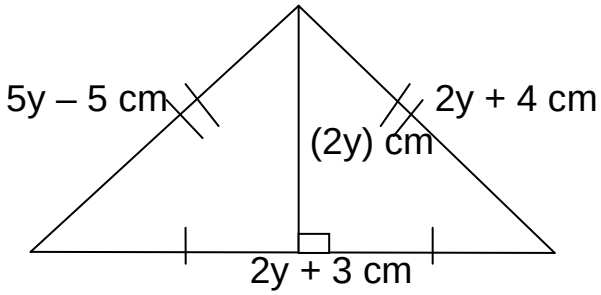



(i) Find the value of y in the figure.

(iii) Find the area of the figure.

(ii) Calculate the perimeter of the figure.

3. Study the figure below and use it to answer the questions that follow.




(a) Find the value of y in the figure above.

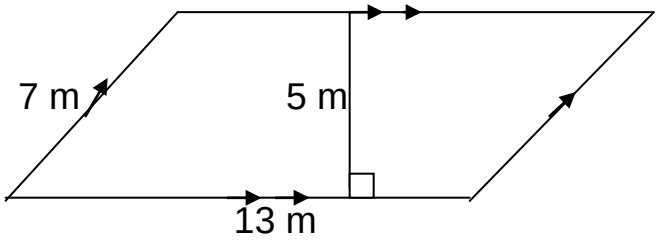
(b) Calculate the area of the figure. (c) Work out the area of the figure.

## SUB TOPIC: FINDING THE AREA OF PARALLELOGRAM

- Opposite sides of a parallelogram are equal and parallel.
- The area of a parallelogram = base (b) x height (h).
- Squares, rectangles and rhombuses are parallelograms.

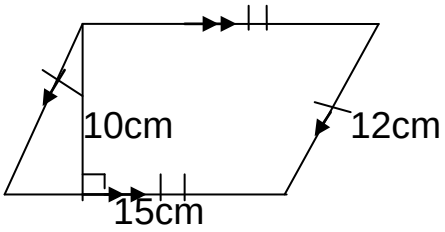
Examples

1. Find the area of the figure below.




Area = b x h
= 13 m x 5 m
Area = 65 $m^2$

2. a) Find the area of the parallelogram below.



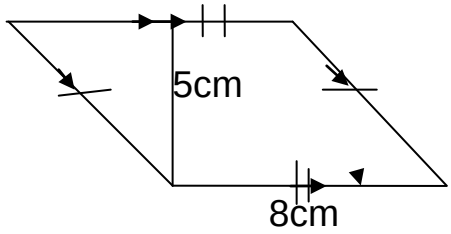

Area = base x perpendicular height
= 15cm x 10cm
Area = **150$cm^2$**

b) Work out its perimeter.
Perimeter = s + s + s + s
= (15cm + 12cm) + (15cm + 12cm)
= 27cm + 27cm
= **54cm**

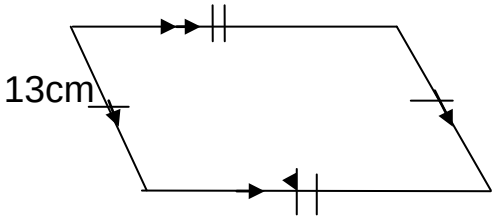
**ACTIVITY:**

Find the area of the following parallelograms.

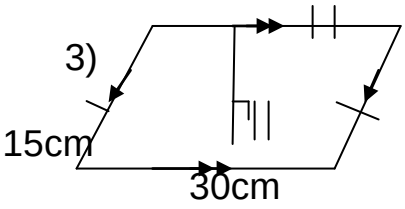
1)




2)

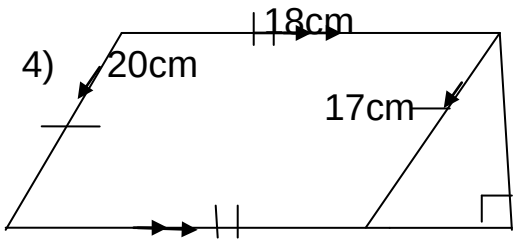


3)

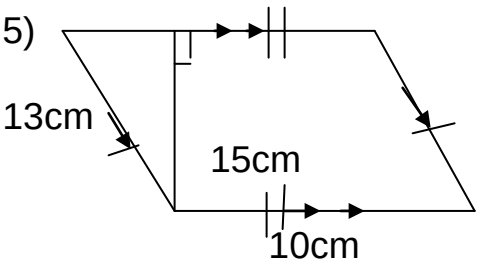



15cm

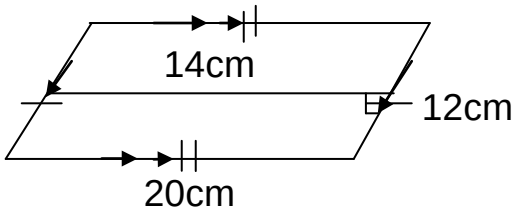
4)




5)



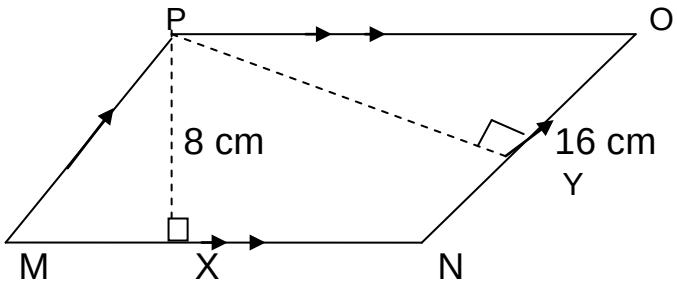

6)




**SUB TOPIC: PPPLICATION OF AREA OF A PARALLELOGRAM**

Examples

1. In the parallelogram *MNOP* below, line *PX* and *PY* are perpendicular to *MN* and NO respectively. Line *MN* =12cm, *NO*=16 cm and *PX* = 8 cm.




a) Calculate the area of the parallelogram.

Area = base x height

= 12 cm x 8 cm

= 96 $cm^2$

b) Find the length of PY.

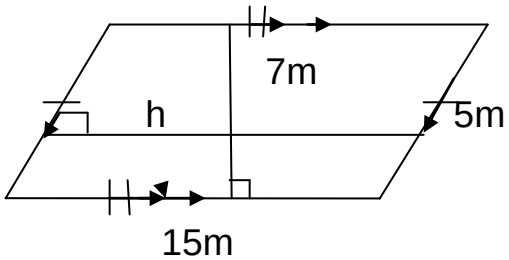
Base x height = Area

16 cm x PY = 96 $cm^2$

$\frac{16\text{ cm} \times PY}{16\text{ cm}} = \frac{96\text{ cm} \times \text{cm}}{16\text{ cm}}$

Length PY = 6 cm

2. Study the parallelogram ABCD below and use it to answer the questions that follow.




a) Work out the value of h in the figure.

Base x height = Base x height

5m x h = 15m x 7m

$\frac{5\text{m} \times h}{5\text{m}} = \frac{15\text{m} \times 7\text{m}}{5\text{m}}$

h = 3 x 7m

**h = 21m**

b) Find its perimeter

Perimeter = s + s + s + s

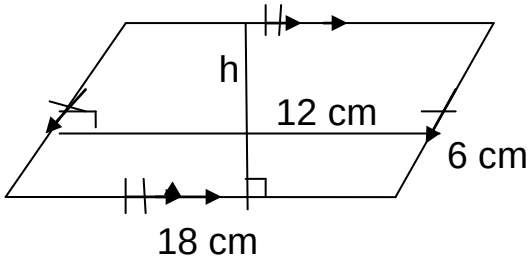
= 15m + 7m + 15m + 7m

= 22m + 22m

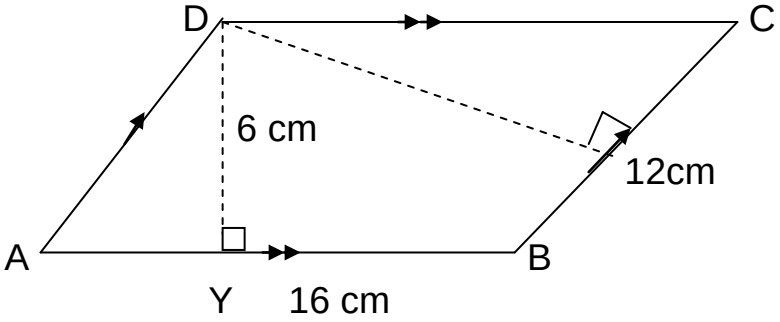
= **44cm**

**ACTIVITY:**

1. Calculate the value of the unknown marked with letter h..

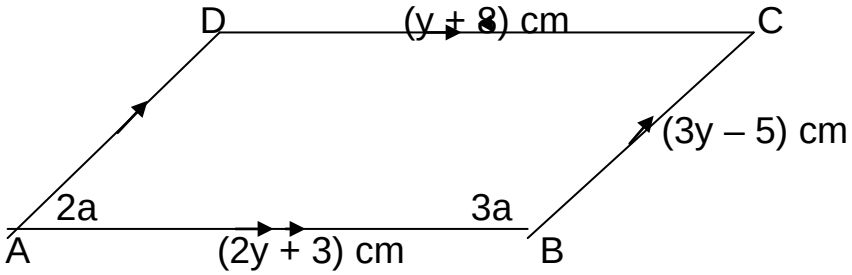



2. In the figure *ABCD* below, line *DX* and *DY* are perpendicular to *AB* and *BC* respectively. Line *AB* = 16 cm, *BC* = 12 cm and *DX* = 6 cm.




(a) Calculate (i) the area of the parallelogram. (ii) Work out its perimeter.
(b) Find the length *DY*.

3. Use the figure below to answer questions that follow:

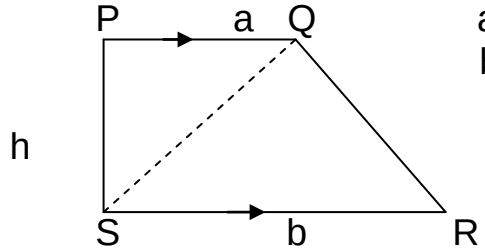



Find the value of; (i) y (ii) a (iii) angle *BAC* in degrees.

**SUB TOPIC: FINDING AREA OF A TRAPEZIUM**

Examples:

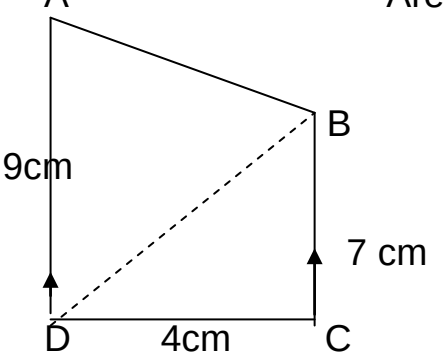
**1.** Finding the area of a trapezium




a = short parallel side
b = long parallel side
h = height
Area of △ PQS = ½ x a x h = ½ a h
Area of △ QRS = ½ x b x h = ½ b h

Area of two triangles = ½ ah + ½ b h or ½ h (a + b)

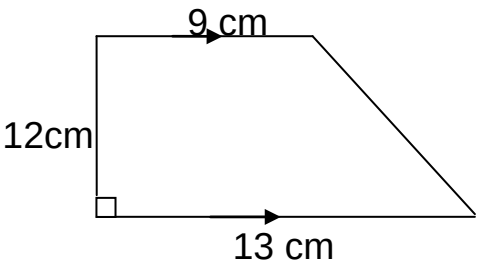
2. Work out the area of the figure below.



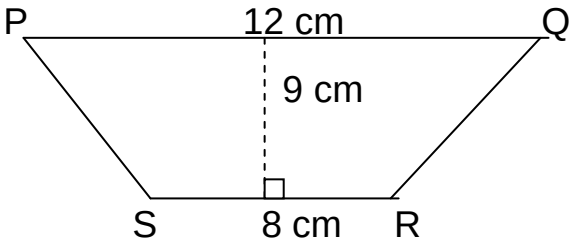

Area of a trapezium = ½ h (a + b)
= ½ x 4 x (7 + 9)
= ½ x 4cm x 16cm
= 2cm x 16cm
**Area = 32cm$^2$**

**ACTIVITY:**

1. Find the area of the figure below..




2. Calculate the area of the figure below.




3. A = $\frac{1}{2}$ x h(a + b). Find A if a = 6 cm, b = 12 cm and h = 9 cm.
4. The equal sides of an isosceles trapezium are 10 cm each and the parallel sides
   are 14cm and 30 cm.
   (a) Find the perimeter of the figure.
   (b) Find the area of the figure if the height is 6 cm.

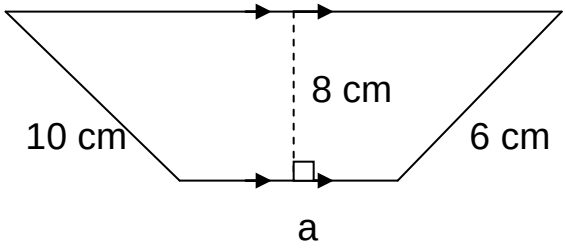
**SUB TOPIC: APPLICATION OF AREA OF A TRAPEZIUM**

- Applying formula to find the unknown side.
- Applying Pythagoras theorem in finding the unknown side.

Examples

1. The given figure has an area of 136 $cm^2$. Find the value of *a*.

24 cm




$\frac{1}{2}$ xx h (a + b) = Area

$\frac{1}{2}$ x 8cm (a + 24 cm) = 136 $cm^2$

4cm (a + 24 cm) =136 $cm^2$

(4 cm x a) + (4 cm x 24 cm) = 136 $cm^2$

(4a) cm + 96 $cm^2$ = 136 $cm^2$

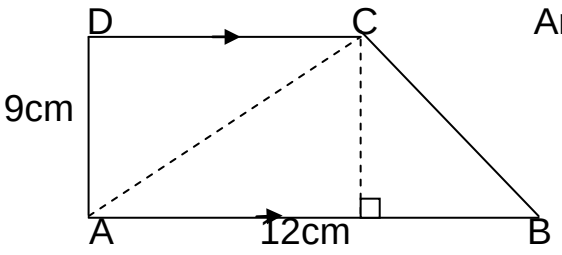
(4a) cm + 96 $cm^2$ – 96 $cm^2$ = 136 $cm^2$ – 96 $cm^2$

(4a) cm = 40 $cm^2$

$\frac{(4a)\ cm}{4cm} = \frac{40\ cm \times cm}{4\ cm}$

a = 10 cm

2. In the trapezium ***ABCD*** below, ***AB*** = 12 cm, and ***XC*** = 9 cm. Calculate the area of triangle ***ABC***.



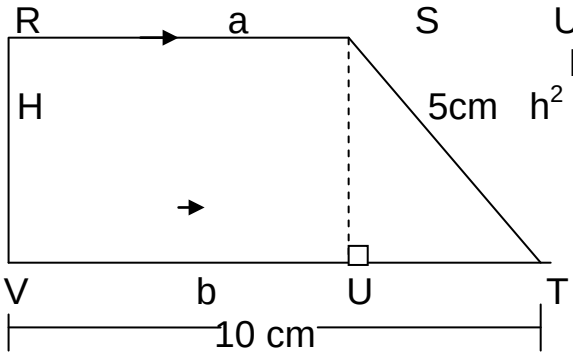

Area of triangle ABC = $^1/_2$ x b x h

ABC = $^1/_2$ x 12 cm x 9 cm

= 6 cm x 9 cm

Area = 54 $cm^2$

3. Find the unknown side of a trapezium. Calculate the length of *h*.




$US^2 = ST^2 - UT^2$

$h^2 = (5\ cm)^2 - (3\ cm)^2$

$h^2 = (5cm \times 5cm) - (3cm \times 3cm)$

$h^2 = 25\ cm^2 - 9\ cm^2$

$h^2 = 16\ cm^2$

$\sqrt[2]{h2} = \sqrt[2]{16\ cm2}$

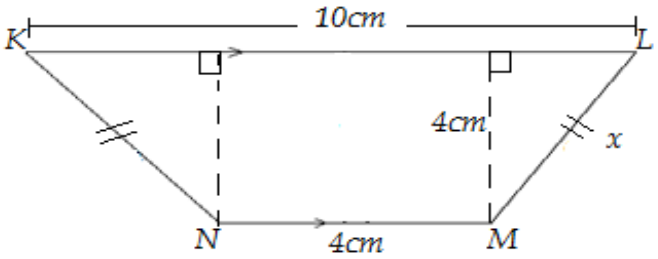
$\sqrt[2]{hxh} = \sqrt[2]{2 \times 2 \times 2 \times 2}$

h = 2 x 2

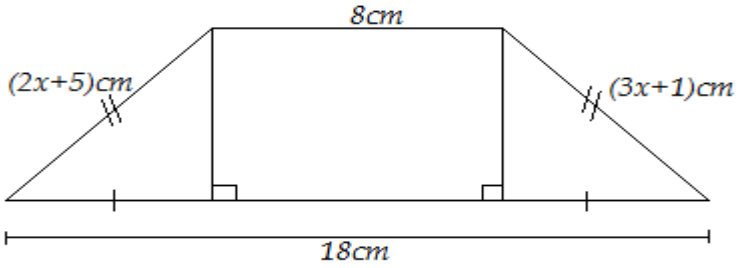
h = 4cm

**ACTIVITY:**

1. Calculate the length of the unknown line, the perimeter and of the figure below.

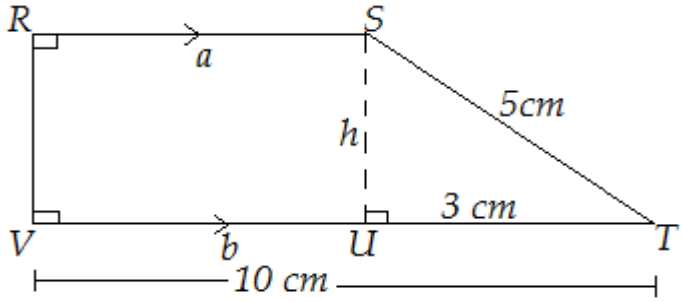



2. Below is a trapezium. Use it and answer the questions that follow.




a) Find the value of *x*.
b) Calculate the perimeter of the figure.
c) Work out its area.

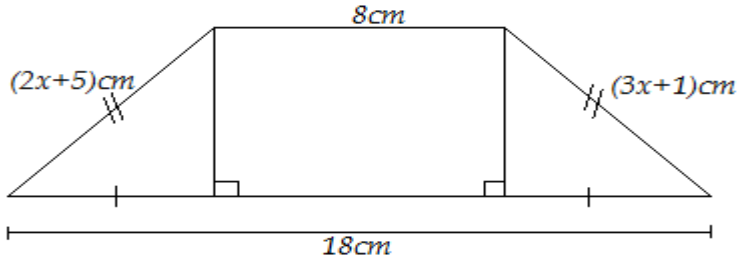
3. Stud the figure below and answer questions that follow:




a) Find the unknown side of a trapezium.

b) Work out the area of the figure above.
c) Workout its perimeter

4. Below is a trapezium. Use it and answer the questions that follow.



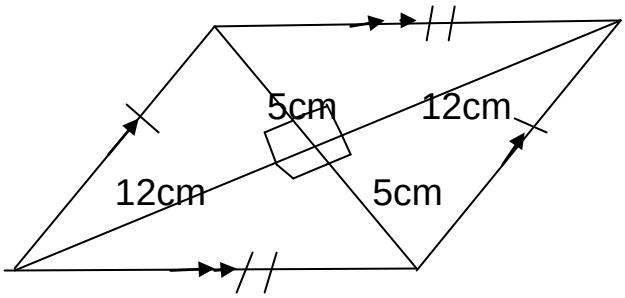

a) Find the value of *x*.  b) Calculate the perimeter of the figure.
c) Work out its area.

## FINDING THE AREA OF A RHOMBUS AND ITS APPLICATION:

- When the lengths of diagonals, Area = ½ x $d_1$ x $d_2$ .
- The diagonals of a rhombus bisect each other at $90^0$ to form 4 congruent right triangles. Use (½ x b x h) x 4 to find area.

Examples:

1. Find the area of the rhombus below:



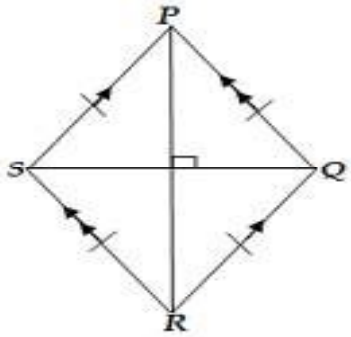

Area = $^1/_2$ x $d_1$ x $d_2$

= $^1/_2$ x 24 cm x 10 cm

= 12 cm x 10 cm

= 120 $cm^2$

2. The diagram below is a rhombus ***PQRS***. Its perimeter is 80cm if the diagonal ***SQ*** is 24cm long.




(a) Calculate the length of each side of the rhombus.
Perimeter = 80 cm
Perimeter = 4 x length of one side

4 x s = P

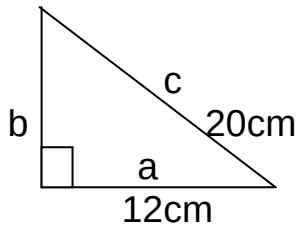
4 x s = 80 cm

$\frac{4 \times s}{4} = \frac{80}{4}$ cm

S = 20 cm

Length of side of the rhombus is 20 cm.

(b) Find the length of diagonal ***PR***.




$a^2 + b^2 = c^2$

$(12\ cm)^2 + b^2 = (20\ cm)^2$

$(12\ cm \times 12\ cm) + b^2 = 20\ cm \times 20\ cm$

$144\ cm^2 + b^2 = 400\ cm^2$

$144\ cm^2 - 144\ cm^2 + b^2 = 400\ cm^2 - 144\ cm^2$

$b^2 = 256\ cm^2$

$\sqrt[2]{b2} = \sqrt[2]{256\ cm2}$

$\sqrt[2]{b \times b} = \sqrt[2]{2 \times 2 \times 2 \times 2x\ 2x2 \times 2 \times 2}$

b = 2 x 2 x 2 x 2

b = 16

Length of PR is 16 cm.

(b) Find the area of the rhombus in $cm^2$.

*Area = ½ x $d_1$ x $d_2$*

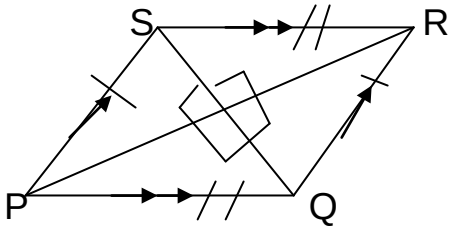
*= ½ x 24cm x 32cm*

*= 12cm x 32cm*

*= 384 $cm^2$*

**ACTIVITY:**

1. Find the area of a rhombus with the two diagonals measuring 16cm and 12cm respectively.
2. The base and height one of the four congruent right triangles of a rhombus are 9cm and 12cm. calculate its area.
3. Calculate the length of each side of a rhombus whose diagonals are 8cm and 6cm.
4. The diagram below shows a rhombus PQRS. The diagonals PR = 24cm and QS = 10cm.




(a) Calculate the area of the rhombus.

(b) Find the perimeter of the rhombus.

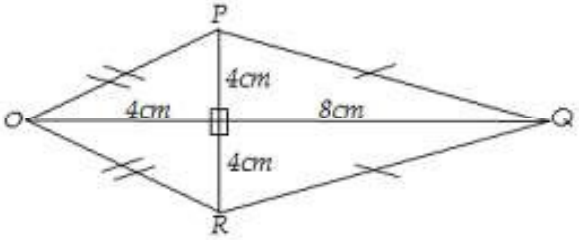
5. The diagonals of a rhombus are in the ratio 3:4. If the area of the rhombus is $24m^2$, find the perimeter of the rhombus.

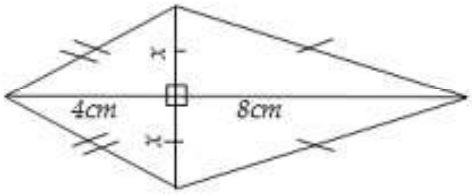
## SUB TOPIC: AREA OF A KITE AND ITS APPLICATIONS:

- When the lengths of the diagonals of a kite are given, use the formula, Area = $^1/_2$ x $d_1$ x $d_2$.
- A kite may be divided into 2 isosceles triangles. So we can also use the formula; *Area* = ($^1/_2$ *X b X h*) + ($^1/_2$ *X b X h*).

Examples:

1. Calculate the area of a kite below.




Method 1

Area = $\frac{1}{2}$ x d1 x d2

= $\frac{1}{2}$ x 8 cm x 12 cm

= 4 cm x 12 cm

Area = 48 $cm^2$

Method 2

Area = ($\frac{1}{2}$ x b x h) + ($\frac{1}{2}$ x b x h)

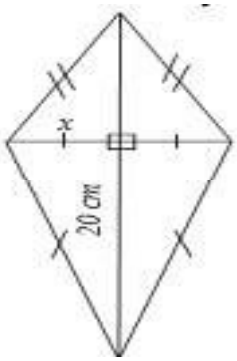
= ($\frac{1}{2}$ x 8 cm x 4 cm) + ($\frac{1}{2}$ x 8 cm x 8 cm)

= (4 cm x 4 cm) + (4 cm x 8 cm)

= 16 $cm^2$ + 32 $cm^2$

Area = 48 $cm^2$

2. The area of a kite below is 160 $cm^2$. One of the diagonals is 20 cm. Find the length of the second diagonal.




$^1/_2$ x $d_1$x $d_2$ = Area

$^1/_2$ x ~~20~~$^{10}$ cm x $d_2$ = 160 $cm^2$

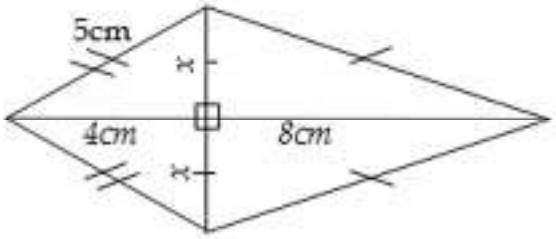
10 cm x $d_2$ = 160 $cm^2$

$\frac{10 \text{ cm} \times d_2}{10 \text{ cm}} = \frac{160 \text{ cm} \times \text{cm}}{10 \text{ cm}}$

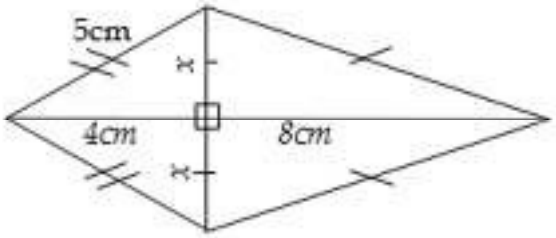
$d_2 = 16 \text{ cm}$

Second diagonal = 16 cm

3. The diagram below is of a kite. Find the value of *x* and the area of the kite.




*Solution*




***Value of x***

$a^2 + b^2 = c^2$

$4^2 + x = 5^2$

$(4 \times 4) + x^2 = (5 \times 5)$

$16 + x^2 = 25$

$16 - 16 + x^2 = 25 - 16$

$\sqrt[2]{x2} = \sqrt[2]{9}$

X = 3 cm

Diagonal = x + x

= 3 cm + 3 cm

= 6 cm

Area = $\frac{1}{2} \times d_1 \times d_2$

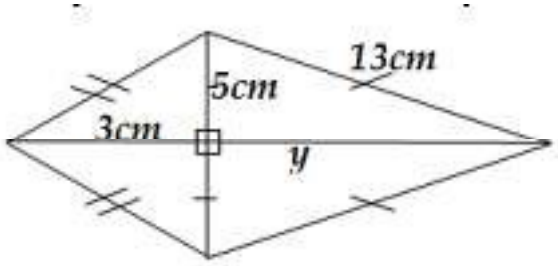
$= \frac{1}{2} \times 12 \text{ cm} \times 6 \text{ cm}$

= 6 cm x 6 cm

$= 36 \text{ cm}^2$

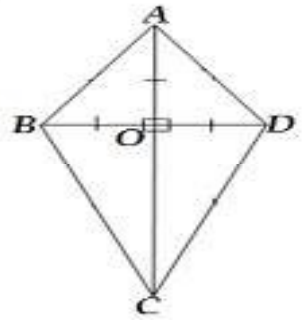
**ACTIVITY:**

1. Find the area of the kite whose diagonals measure 8cm and 14 cm.
2. A kite has an area of 72cm2. One of its diagonals is 8cm. Find the length of the second diagonal.
3. The figure below is of a kite. Study it carefully and answer the questions that follow.




(a) Find the value of y.
(b) Find the length of its diagonals.
(c) Calculate its area.

4. Given that BD= 10 cm, AC = 17cm and AO = 5cm. Study it carefully and answer the questions that follow.



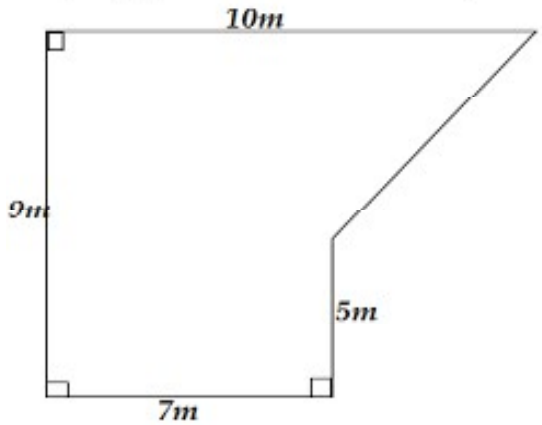

(a) Find the area of the figure.
(b) Find length BC.
(c) Work out its area

***SUB TOPIC: AREA OF IRREGULAR QUADRILATERALS***

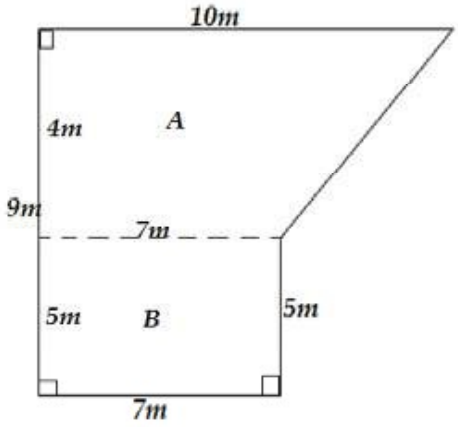
- To get the area of irregular quadrilaterals, you must first study it carefully and form smaller regular figures whose area can be got. Then sum up the area of the smaller shapes to get the area of given shape.

Examples

1. Study the figure below and answer the questions that follow.




*(a)* Calculate the area of the figure.

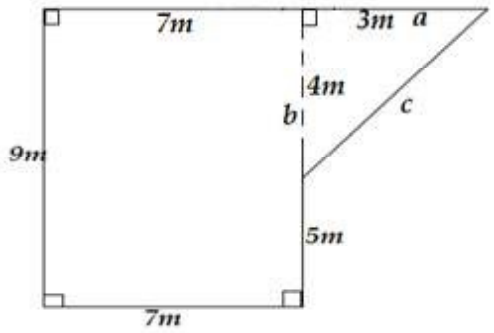



Area of figure A
= ½ x h (a + b)
= ½ x 4m (7m + 10m)
= 2m x 17m
= $34m^2$

Area of figure B
= L x W
= 7m x 5m
= $35m^2$

Area of whole figure
$34m^2$
+ $35m^2$
$69m^2$

(b) Work out the perimeter of the figure.




*Length of the slope*

$a^2 + b^2 = c^2$

$(3m)^2 + (4m)^2 = c^2$

$(3m \times 3m) + (4m \times 4m) = c^2$

$9m^2 + 16m^2 = c^2$

$25\ m^2 = c^2$

$\sqrt[2]{25m2} = \sqrt[2]{c2}$

$\sqrt[2]{5m\ x\ 5m} = \sqrt[2]{c\ x\ c}$

$5m = c$

$C = 5m$

Length of slope is 5m.

*Perimeter = s + s + s + s + s*

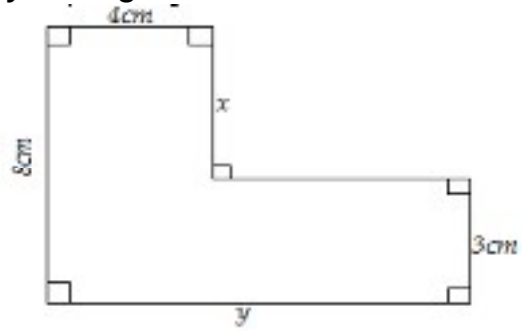
= (9m + 7m)+(5m + 5m + 10m)

= 16m + 20m

= 36m

**ACTIVITY:**

Study the figure below and use it to answer questions that follow



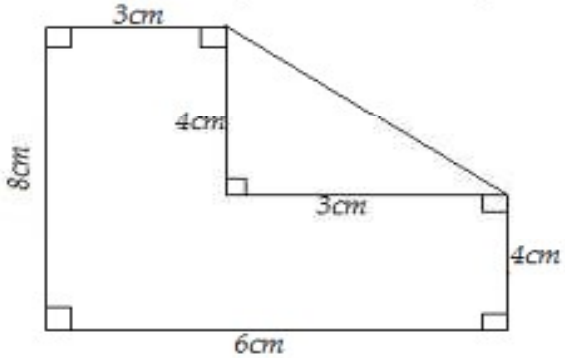

(a) Find the value of:

*(i)* *x* (ii) y

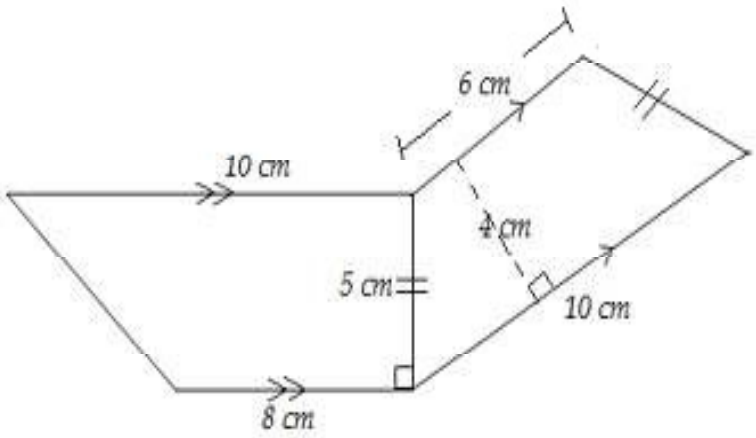
(b) Calculate the area of the above figure.

(c) Work out the perimeter of the above figure.

2. Find the area and perimeter of the figure below.



3. Find the area of the figure below.




**SUB TOPIC: FINDING THE CIRCUMFERENCE OF A CIRCLE**

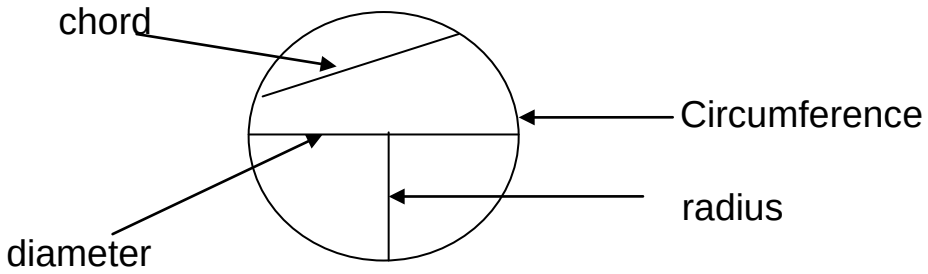
Term used in circles:

**1. Chord –** This is a line segment from the any point to another point on the circumference of a circle.

**2. Diameter – I**s a line segment passing through the centre of a circle.
Diameter (D) = 2 *x* radius = 2r or Diameter = r + r

**3. Radius –** This is any line segment from the centre to the circumference.
Radius = D ÷ 2

**4. Circumference -** This is the distance round the circle.
Circumference is the perimeter of a circle.




Examples

1. Find the circumference of a circle whose radius is 7 cm. (Use $\pi = {}^{22}/_{7}$)

Circumference = $2\pi r$

$= 2 \times {}^{22}/_{7} \times 7$ cm

$= 2 \times 22 \times 1$ cm

$= 44$ cm

*2. Find the circumference of a circle whose radius is 20 cm.(Use $\pi = 3.14$)*

*Circumference = $2\pi r$*

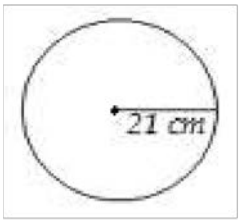
*= 2 x 3.14 x 20 cm*

*= 2 x 314 x 20 cm*
*100*

*= 1256 cm*
*10*

*= 125.6 cm*

3. Find the circumference of a circle whose radius is 21cm. (Use $\pi = {}^{22}/_{7}$)




$C = 2\pi r$

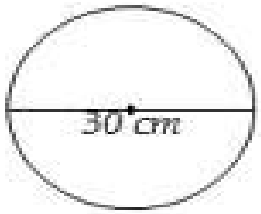
$= 2 \times \frac{22}{7_1} \times \cancel{21}^{3}\ cm$

$= 2 \times 22 \times 3\ cm$

$= 44 \times 3\ cm$

$= 132\ cm$

4. Find the circumference of the circle below.(Use $\pi$ = 3.14)




$C = \pi d$

$= 3.14 \times 30\ cm$

$= \frac{314}{\cancel{100}} \times \cancel{30}\ cm$

$= \frac{314}{10} \times 3\ cm$

$= 942\ cm$

10

$= 94.2\ cm$

***Note carefully:***

Use $\pi = {}^{22}/_{7}$ when radius or diameter is a multiple of 7 like: 7, 14, 21, 28, …

Use $\pi$ = 3.14 when radius or diameter is a multiple of 10 like: 10, 20, 30, 40,…

**ACTIVITY:**

1. Find the circumference of a circle whose radius is 42 cm. (Take $\pi = {}^{22}/_{7}$)

2. A wheel of a car is 35 cm in diameter. What distance does it cover in one complete revolution? (Take $\pi = {}^{22}/_{7}$)

3. A minute hand is 7 cm long. What distance will its tip cover in 1 hour? (Take $\pi = {}^{22}/_{7}$)

4, A boy made 2 laps on a circular field of diameter 49 m. what distance did he cover? (Take $\pi = {}^{22}/_{7}$)

5. A minute hand of a clock is 3 ½ cm long. What distance will its tip cover in 1 hour? (Use π = 22)

7

**SUB TOPIC: FINDING RADIUS AND DIAMETER GIVEN CIRCUMFERENCE**

- Apply the formula $\pi$D when a diameter or 2$\pi$r if the radius is required.

Examples

1. The circumference of a circle is 44cm. Find the diameter of the circle. (Use π = 22/7)

πD = C

22D = 44cm
7

7 X 22D = 44cm x 7
7

22D = 44cm x 7
22 22

D = 2cm x 7

**D = 14cm**

2. Calculate the radius of a circle whose circumference is 44m. (use $\pi$ as 22/7)

2πr = C

2 x 22 x R = 44m
7

7 X 44R = 44m x 7
7

44R = 44m x 7
44 44

**R = 7m**

**ACTIVITY:**

1. Find the diameter of a circle whose circumference is:

a) 22cm b) 66cm c) 88cm d) 176cm

e) 440cm f) 39.6cm g) 220cm h) 880cm

2. The circumference of a circle is 132dm. Find the radius of the circle.

3. The distance round a circular pond is 308cm. Find the radius of the pond.

4. A circular water tank has a circumference of 1320cm. Calculate the radius of the tank. (Take $\pi = {}^{22}/_{7}$)

5. Find the radius of a circle whose circumference is 314 m. (Take $\pi$ = 3.14)

6. A goat is tied to a stump such that the furthest distance around its grazing place is 44 m. Find the length of the rope.

7. The distance around the circular pond is 440 dm. find the distance across the pond.

**SUB TOPIC: FINDING THE PERIMETER OF SECTORS OF A CIRCLE**

**Concepts:**

- Apply the formula for semi-circle = $^1/_2\ \pi$D + D,
- Quadrant = $^1/_4\ \pi$ x 2$\pi$r + 2r and
- Sector with degrees = $^\theta/_{360}$ x 2$\pi$r; to find their perimeter.

Examples

1. Find the perimeter of a semi-circle whose diameter is 14 cm.

Method 1

Length of arc AB = $^1/_2\ \pi$D

= $^1/_2\ x\ ^{22}/_7$ x 14 cm

= 11 x 2 cm

= 22 cm

Perimeter = length of arc + diameter

= 22 cm + 14 cm

= 36 cm

Method 2

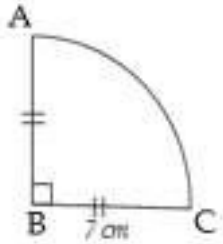
Perimeter = $^1/_2\ \pi$D + D

= $^1/_2\ x\ ^{22}/_7$ x 14 cm) + 14 cm

= 22 cm + 14 cm

= 36 cm

2. Find the perimeter of a quadrant of radius 7 cm.




***Method 1***

*The length of arc* ***AC = Circumference***

= $^1/_2$ *x* 2$\pi$*r*

= $^1/_2$ *x 2 x* $^{22}/_7$ *x 7 cm*

= 1 x 1 x 22 x 1 cm

= 22 cm

Perimeter = Circumference + 2r

= 22 cm + (2 x 7 cm)

= 22 cm + 14 cm

= 36 cm

***Method 2***

***Circumference***

= $^1/_2$ *x* 2$\pi$*r + 2r*

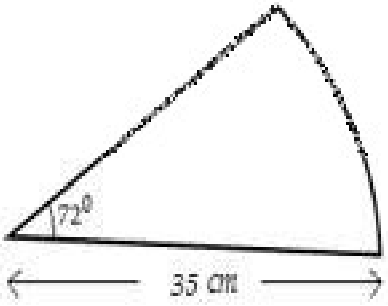
= $^1/_2$ *x 2 x* $^{22}/_7$ *x 7 cm) + (2 x r)*

= (1 x 1 x 22 x 1 cm) + (2 x 7cm)

= 22 cm + 14 cm

= 36 cm

3. Find the perimeter of a sector whose radius is 35 cm.




Length of arc = $^{\theta}/_{360}$ x 2πr)

= $^{72}/_{360}$ x 2 x $^{22}/_{7}$ x 35 cm

= 1 x 22 x 2 x 1 cm

*= 44 cm*

**Method 2**

The perimeter of a semi-circular region

= ($^{\theta}/_{360}$ x 2πr) + 2r

= $^{72}/_{360}$ x 2 x $^{22}/_{7}$x 35 cm) + (2 x 35 cm)

= (1 x 22 x 2 x 1 cm) + 70 cm

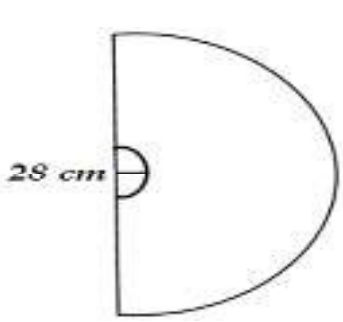
= 44 cm + 70 cm

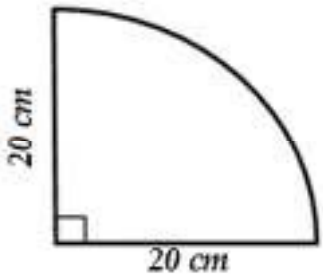
= 114 cm.

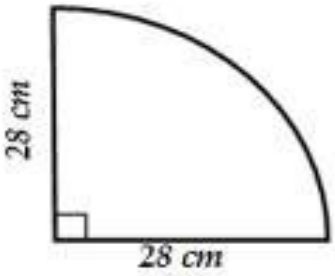
**ACTIVITY:**

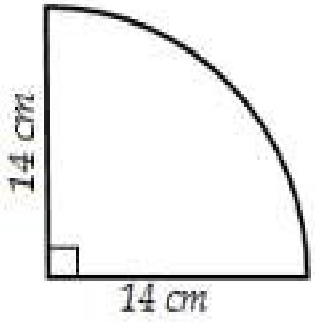
Find the perimeter of the following figures.

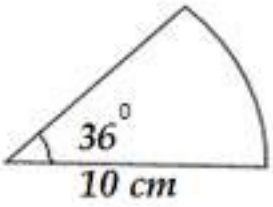
1. 2.

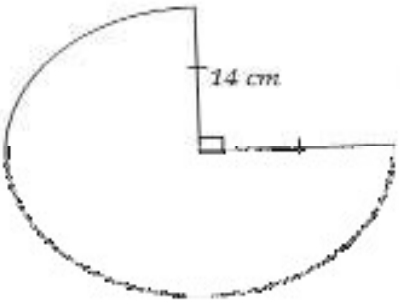


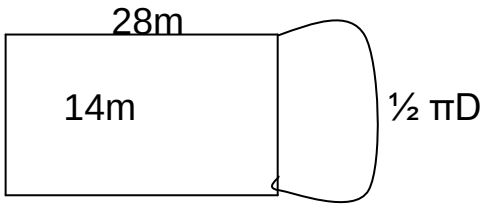



**SUB TOPIC: FINDING PERIMETER OF COMBINED FIGURES**

- Identify the shapes that form the combined figure then apply the formula.
- Don't add dotted or imaginary lines when finding perimeter of combined figures.

Examples

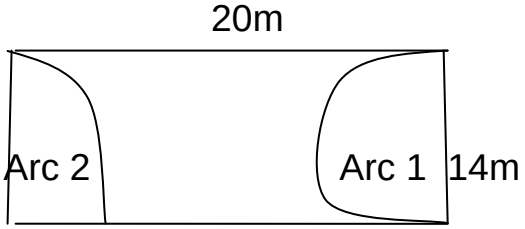
1. Find the distance round the figure below.




Length of arc = ½ πD
= ½ x 22/7 x 14m
**= 22m**

Perimeter = 22m + 28m + 14m + 25m
= (50 + 42) m
**= 92m**

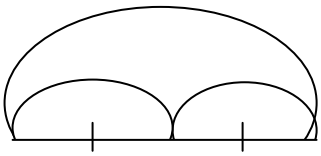
2. Find the distance around the shaded part of the figure below.




(20 – 14)m
= 6m

| **Length of arc 1** | **Length Arc 2** | **Perimeter** |
|---|---|---|
| ½ πD | ¼ x 2πr | (22m + 22m) + (20m + 6m) |
| ½ x 22/7 x 14m | ¼ x 2 x 22/7 x 14m | 44m + 26m |
| **= 22m** | **= 22m** | **= 70m** |

3. Find the perimeter of the figure below. (Use $\pi = {}^{22}/_{7}$)



14cm

Length of arc of big semi-circle
Diameter = 28cm
= ½ x πD
= 1/2 x 22/7 x 28m
= (1 x 11 x 4)m
= **44m**

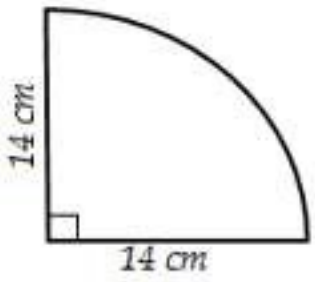
Length of 2 arcs of 2 small semi circles
Diameter = 14m
= 2 x ½ x πD
= 2 x 1/2 x 22/7 x 14m
= (1 x 1 x 22 x 2)m
= **44m**

Perimeter = 44m + 44m
**= 88m**

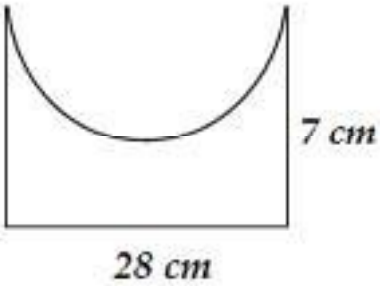
**ACTIVITY:**

Find the perimeter of the following figures.

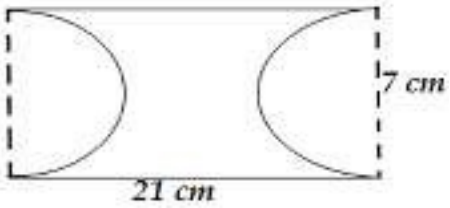
1.



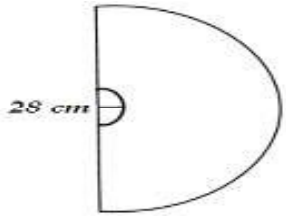

2.

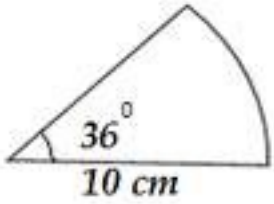



3.




4.




**SUB TOPIC: CIRCLES**

**CONTENT: APPLICATION OF PERIMETER**

**Concepts:**

- When poles/posts are planted or fixed at equal intervals on an open space/fence or straight line;
  - The number of spaces = Number of posts/poles – 1
  - The number of poles/posts = $\frac{\text{Distance}}{\text{Interval}} + 1$ or $\frac{\text{Length}}{\text{Interval}} + 1$
- Distance/ Length covered = Number of spaces x interval

Example 1

10 electric poles are planted 20 metres apart.

Find the distance that was covered from the 1st to the 10th pole.

Number of spaces = Number of posts – 1

= 10 – 1

= 9 spaces

Distance = 20m x 9

= 180 metres

- When poles/posts are planted or fixed at equal intervals on a closed figure or fence;

The number of poles/posts = Number of spaces.

The number of poles/posts = $\frac{\text{Perimeter}}{\text{Interval}}$ or $\frac{\text{Circumference}}{\text{Interval}}$

Example 2:

Mr. Mukasa's rectangular flower garden measures 10m by 8m. He fences it by putting the poles at intervals of 2m apart. How many poles does he need?

Perimeter = 2( L + W)

= 2(10m + 8m)

= 2 x 18m

= 36metres

Number of poles needed = $\frac{\text{Perimeter}}{\text{Interval}}$

= $\frac{36\text{m}}{2\text{m}}$

= 18 poles

**ACTIVITY:**

1. Oprah is the 6t**h** pupil from either side of the line. How many pupils are on the line?
2. Teddy is the ninth girl from one side and the thirteenth from the other side of the line of girls getting lunch from school. How many girls are in the line?
3. Levi built a circular hutch of circumference 66 metres using poles fixed at intervals of 1.5 metres. Calculate the number of poles he used.
4. Trees were planted along a straight road 305 metres long. If the trees were planted 5 metres apart, how many trees were planted along the road?
5. A rectangular garden measures 20m by 13m. If posts are planted 5m apart around the garden, how many posts are used?
6. Fred has to fence around his rectangular plot of land 225 metres by 165 metres using poles placed at 3 metres apart.
    a) How many poles will he need?
    b) If each pole costs sh.2,000, how much will he spend on fencing his plot of land?
7. Twenty-two poles were fixed around a circular fish pond.
    a) Calculate the diameter of the fish pond if the interval between poles was 6 metres.
    b) Calculate the area of the fish pond.
8. Sixty-six poles are fixed on a straight line along the side of the road. The poles are fixed at intervals of 10 metres. Calculate the length of the road.
9. Moses wanted to fence his farm of diameter 14m using poles placed at intervals of 80cm.
    a) How many poles are needed to fence the farm?
    b) If each pole costs sh.2,500, how much money will he spend on the poles?
10. 11 posts were fixed at a distance of 4m apart to make a circular fence.
    a) Calculate the total distance around the fence.
    b) Calculate the radius of the fence.

11. When sprinting, an athlete covers 180cm with every stride.
    (a) How many strides does he take to finish 100m?
    (b) How far does he run in 200 strides?

12. Telephone poles are 20m apart. What is the distance from the first pole to the $16^{th}$ pole?

13. The distance around my farm is 400m. If I want posts for fencing spaced 4m apart, how many posts will I need?

14. John is $6^{th}$ from one side of a line and $8^{th}$ from the other side of the same line. How many people are in the line?

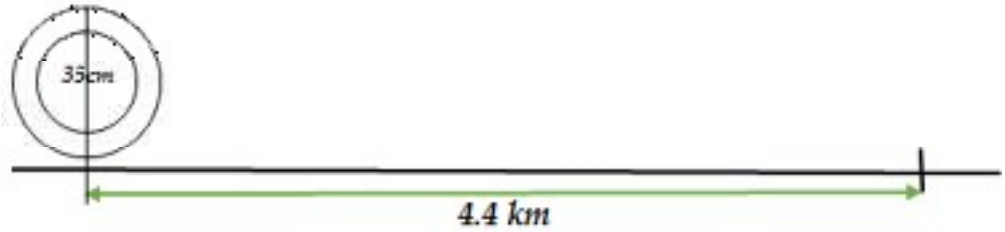
15**.** Aida is the ninth from either side of the line. How many pupils are in the line?

**CONTENT**: **APPLICATION OF CIRCUMFERENCE (REVOLUTIONS)**

- To find circumference, divide the length or diameter by the number of revolutions.
- Apply the formula for circumference to find radius or diameter in same units.

Examples:

How many revolutions can a wheel of a car 35cm in diameter make in a distance of 4.4km?




$C = \pi D = \frac{22}{7} \times 35cm$

$= 22 \times 5cm$

$= 110cm$

1km = 100,000 cm

4 .4km = 44 x 100,000 cm

= 44 x 10,000 cm

= 440,000 cm

1 revolution = 110 cm

No. of revolutions = $\frac{440{,}000\ cm}{110\ cm}$

= 4,000 revolutions

2. The length of a wire is 176m. If the wire is wound around a cylindrical tin 4 times, find the diameter of the tin.(use $\pi = {}^{22}/_{7}$)

Solution

Circumference = $\frac{\text{Length of wire}}{\text{No. of rev.}}$

$= \frac{176m}{4}$

$= 44m$

$\pi D = C$

$\frac{22}{7} \times D = 44m$

$7 \times \frac{22}{7} \times D = 44m \times 7$

$22D = 44m \times 7$

$\frac{22D}{22} = \frac{44m \times 7}{22}$

Diameter = 14m

3. A wire of length 352 metres is wound round a cylindrical tin 400 turns. Find the radius of the tin.

Distance = 352m

1m = 100cm

352m = 352 x 100cm

= 35,200cm

No. of revolutions = 400

Circumference = $\frac{\text{Distance}}{\text{No. Of revolutions}}$

$= \frac{35{,}200cm}{400}$

$= 88\ cm$

Circumferencen = $\pi D$

$2\pi r = C$

$2 \times \frac{22}{7} \times r = 88cm$

$\frac{44r}{7} = 88cm$

$7 \times \frac{44r}{7} = 88cm \times 7$

$44r = 88cm \times 7$

$\frac{44r}{44} = \frac{88cm \times 7}{44}$

Radius = 14cm

**ACTIVITY:**

1. A bicycle wheel has a radius of 14 dm.
a) What distance can it cover in 1 revolution?
b) What distance can it cover in 3 revolutions?
2. Opoka rides a distance of 2.97 km from his home to school on a bicycle. The wheel of a bicycle has a diameter of 63 cm.
a) How many revolutions does the wheel make to cover the distance?
(*Take* $\pi = \frac{22}{7}$ )
b) If Opoka makes 50 revolutions in one minute, how long does he take to reach the school?
3. A string of length 176 m is wound round a circular log 400 times, find the diameter of the log.
4. Owor rolled a drum of diameter 42 cm. How many times will he roll it to cover a distance of 6.6m
5. The distance around a circular pond is 440cm. Calculate the radius of the pond.
6. A cylindrical tank has a circumference of 1,320cm. Find the radius of the tank.
7. The length of a wire wound around a tin is 88metres.Find the diameter of the tin.
8. A thread of length 4,400cm has been wound 50 times around a cylindrical tin. Calculate the diameter of the cylindrical tin.
9. A wheel of a bicycle makes 1500 rotations to cover a distance of 1.32km. Find the radius of the wheel.( use $\pi = {}^{22}/_{7}$ )

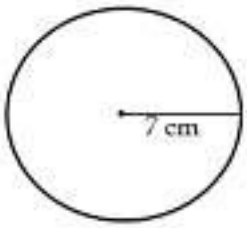
10. The wheel of a motor car makes 1000 revolutions to cover a distance of 8.8 km. Calculate the diameter of the wheel.

**SUB TOPIC: FINDING THE AREA OF A CIRCLE AND ITS PARTS**

**Area of a circle =** π*r2*

Examples

Find bthe area of the circle below. (Use $\pi = {}^{22}/_{7}$)

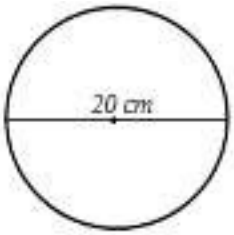



*Area* = π*r2*

$= {}^{22}/_{7}$ *X* 7cm *X* $7^{1}$cm

= 22 *X* 7cm *X* 1cm
= 22 *X* $7cm^2$
= 154 $cm^2$

2. Find the area of a circle whose diameter is 20 cm.




*Area* = $\pi r^2$

= 3.14 *X* 20cm *X* 20cm

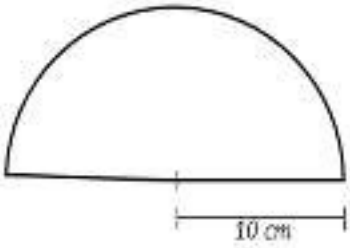
= $\frac{314}{100}$ x 20 cm x 20 cm

= 314 *X* 1cm *X* 1cm

= 314 *X* 1 $cm^2$

= 314 $cm^2$

3. Calculate the area of a semi-circle of radius 10 cm. (*Take* $\pi$ = *3.14*)




Area = $\frac{1}{2}$ $x\ \pi r^2$

= $\frac{1}{2}$ X 3.14 X 20cm X 20cm

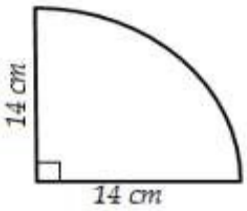
= $\frac{1}{2}$ x $\frac{314}{100}$ X 20cm X 20cm

= 157 X 2cm X 2cm

= 314 X 4 $cm^2$

**Area = 628 $cm^2$**

4. (i) Find the area of a quadrant of a circle with radius 14cm. (Take $\pi$ = 3.14 )




*Area* = $\frac{1}{4}$ *X* $\pi r^2$

= $\frac{1}{4}$ *X* $\frac{22}{7}$ *X* ~~14~~$^{21}$cm *X* ~~14~~$^{7}$cm

= 22 cm *X* 7cm

*Area* = 154 $cm^2$

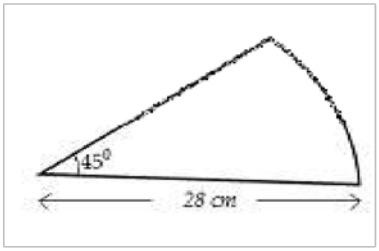
(ii) Find the area of a quadrant of a circle with radius 14cm. *use* $\pi$= *3.14*)

*Area* = $\frac{1}{4}$ *x* $\pi r^2$

$= {}^{1}/_{4}$ *x 3.14 x 14 cm x 14 cm*

*= 314 x* 1cm *x* 1cm
= 314 *x* 1 $cm^2$
= 314 $cm^2$

5. Calculate the area of a sector of a circle of radius 28 cm and the centre angle $45^0$




$\frac{45^0}{360^0} \times \pi r^2$

$= \frac{45^1{}^0}{360^{8}41^0} \times \frac{22^{2}11}{7_1} \times 28^4 cm \times 28^7 cm$

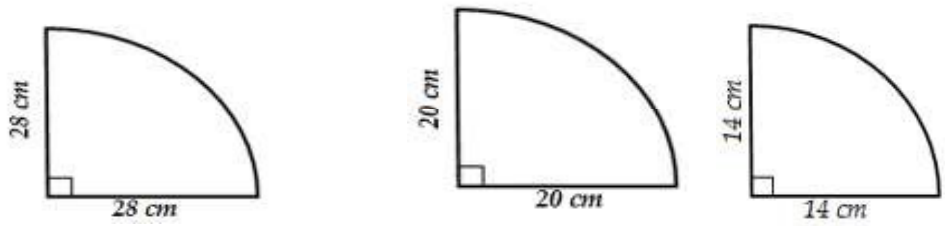
= 11 x 4 cm x 7 cm
= 44 cm x 28 cm
= 308 $cm^2$

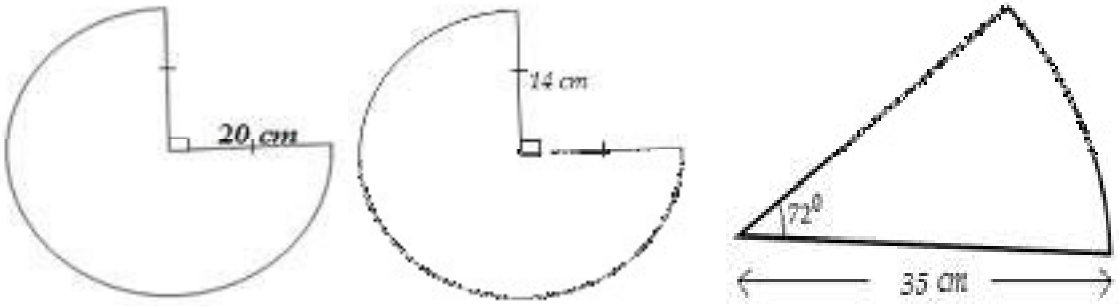
**ACTIVITY:**

1. Find the area of a circular grass thatched hut whose radius is 7 metres. (*Take* $\pi$ *= 3.14*)

2. Calculate the area of the circular door mat of radius 100 cm. (*Take* $\pi = {}^{22}/_{7}$)

3. Use the examples to find the area of the figures below.




***SUB TOPIC:*** **FINDING AREA OF A CIRCLE WHEN GIVEN CIRCUMFERENCE**

***Example:***

Find the area of a circle of a circle whose circumference is 880 cm.

**ACTIVITY:**

1. Find the area of a circle of a circle whose circumference is.
   (a) 88 cm (b) 352 cm
2. The distance round a circular field whose circumference is 13.2 m. Calculate the area of the garden.
3. A goat is tied to a stump such that the furthest distance round its grazing place is 44 m.

(a) Find the length of the rope.
(b) Calculate the area of the grazing ground.

**SUB TOPIC: FINDING RADIUS OF A CIRCLE GIVEN ITS AREA**

Concepts:

- Use to the formula to work out radius i.e $\pi r^2$ = Area

Examples

Find the radius of circle whose area is $154m^2$.
(Use $\pi = \frac{22}{7}$)

**Solution**

$\pi r^2$ = Area

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

$7 \times \frac{22r^2}{7} = 154m^2 \times 7$

$22r^2 = 154m^2 \times 7$

$\frac{22r^2}{22} = \frac{154m^2 \times 7}{22}$

$r^2 = 49m^2$

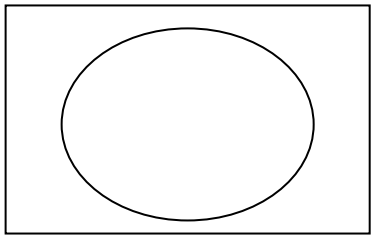
$\sqrt{r^2} = \sqrt{49m^2}$

**R adius = 7m**

**ACTIVITY:**

1. Calculate the circumference of a circle whose area is;
   a) $616cm^2$ b) $308cm^2$ c) 38 ½ $cm^2$ d) $9\ ^5/_8 cm^2$

2. A cow was tied on a tree such that its grazing area is $38.5m^2$. Calculate the distance around its grazing area.
3. The area of a circular field is $77cm^2$. Calculate its circumference.
4. Work out the circumference of a circle whose area is $184cm^2$.
5. A circular flower garden of area $13.86cm^2$ was dug in the middle of a rectangular compound of 10m by 8m as shown in the figure below.



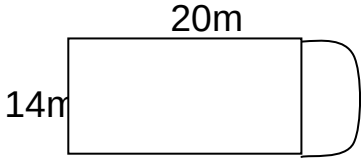

a) Find the radius of the flower garden.
b) Work out the area of the remaining compound.

**SUB TOPIC: AREA OF IRREGULAR (COMBINED) SHAPES.**

- ✓ First identify the figures that make up the irregular shape.
- ✓ Work out the perimeter of each figure then add to get the area of the shape.

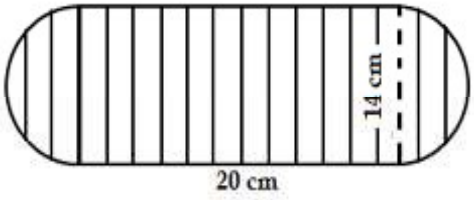
***Example:***

1. Find the area of the figure below.




| Area of rectangle | Area of semi-circle | Total area |
|---|---|---|
| = L x W | = ½ x $\frac{22}{7}$ x $\frac{14m}{2}$ x $\frac{14m}{2}$ | 280m² |
| = 20m x 14m | = 11m x 7cm | + 77m² |
| = 280m² | = 77cm² | 357m² |

2. Find the area of the shape below.



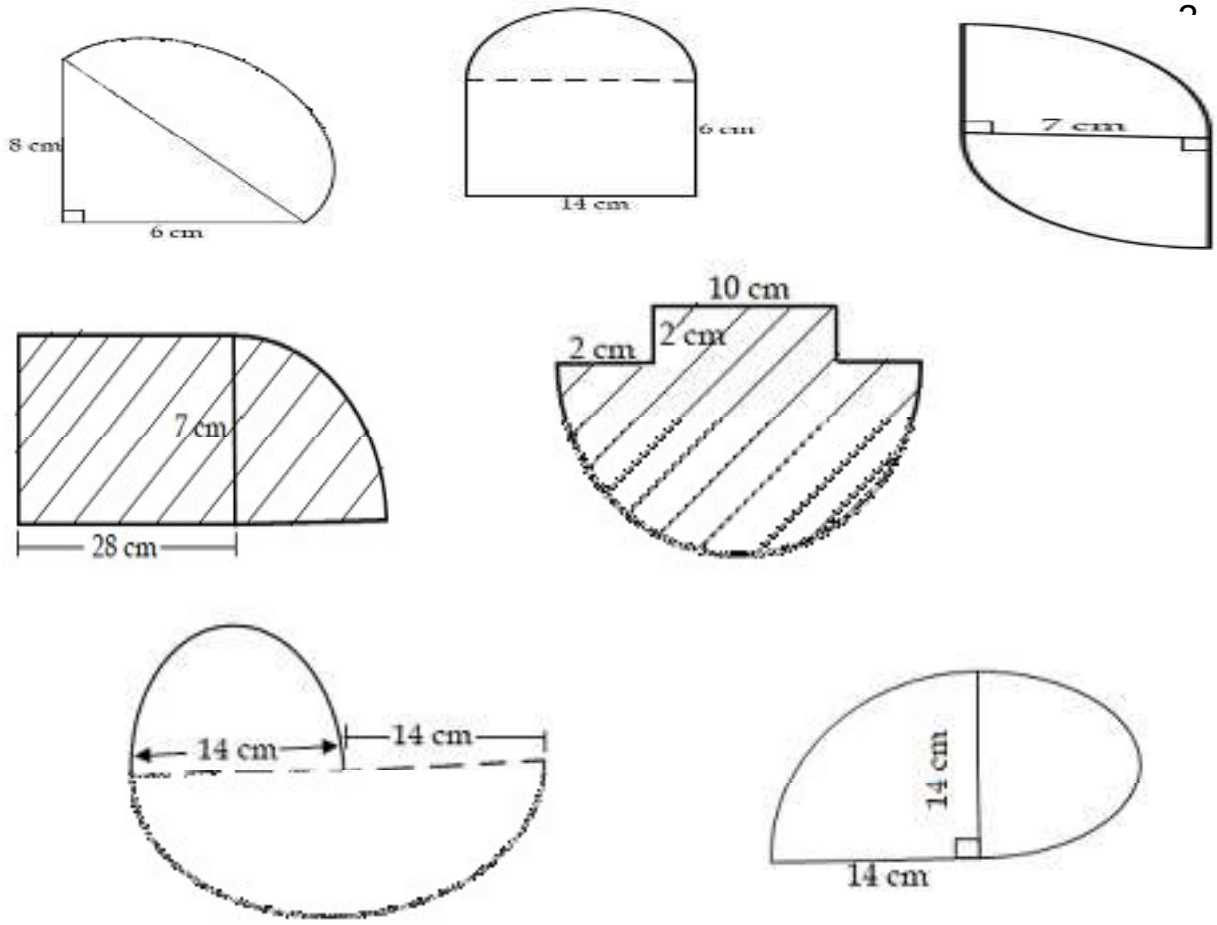

The figure has 3 parts.
2 semi-circles and a rectangle
Area of a rectangle = L *X* W
= 20cm *X* 14cm
= 280cm²

Radius = 14 cm ÷ 2 = 7 cm
Area of 2 semi-circles = 2 $\pi r^2$
= 2 x $^{1}/_{2}$ x $^{22}/_{7}$ x 7 cm x 7cm
***= (1 x 1 x 22) x (1cm x 7 cm)***
***= 22 x 7 cm²***
= 154 cm²

Area of the figure = 280 cm²
+154 cm²
434 cm²

**ACTIVITY:**

Find the area of the shapes below:




## SUB TOPIC: FINDING AREA OF SHADED PARTS OF FIGURES

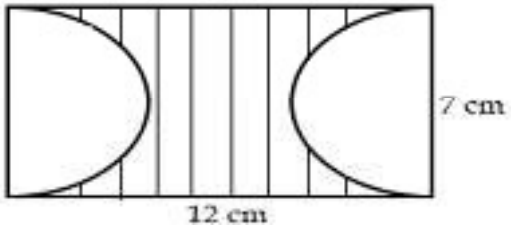
Concepts:

Find the area of the outer figure.

- Find the area of the un shaded part(s) of the figure(s)
- Subtract the area of the un shaded part(s) from the area of outer figure.

Example

Find the area of the shaded part in the figure below.



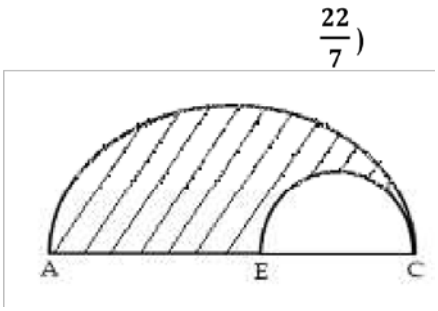

Area of rectangle
= L X W
= 12cm x 7cm
= **84cm²**

Area of 2 semi-circles
= (½ Πr²) x 2
= ½ x 22/7 x 7cm/2 x 7cm/2 x 2
= 11cm x 7cm / 2
= 77cm² / 2
= **38.5cm² or 38 ½ cm²**

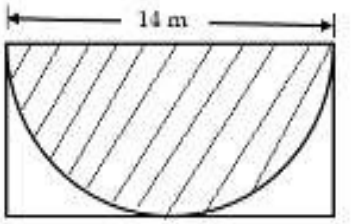
Area of shaded part
84.0cm²
- 38.5cm²
**45.5cm²**

**ACTIVITY:**

**1.** In the diagram below, AC = 56 cm and EC is half of AC. Find the area of the shaded part. (Take $= {}^{22}/_{7}$)

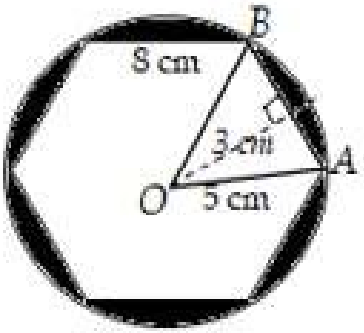



**2.** The figure below shows a semi-circle enclosed in a rectangle. Use it to answer the questions that follow.




(a) Find the area of the rectangle.
(b) Work out the area of the un-shaded part.

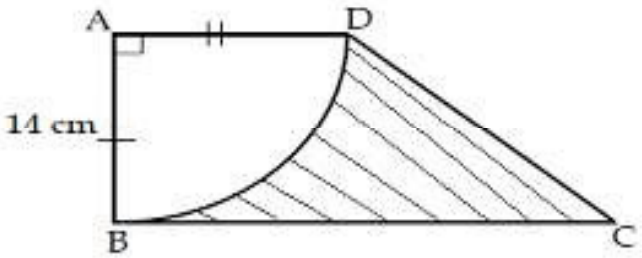
**3.** The figure below shows a regular six – sided polygon of sides 8 cm long enclosed in a circle of radius 5 cm. triangle *OAB* of height 3 cm is part of the polygon.



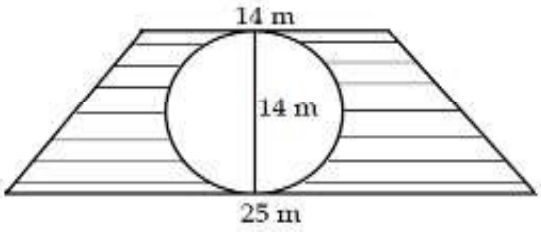

(a) Find the area of the polygon.
(b) Find the area of the shaded region.

**4.** The figure below is a trapezium where AB = AD = 14 cm, BC = 28 cm and ABD forms a quarter of a circle.

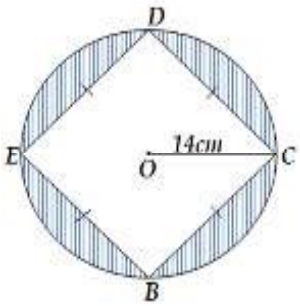
Calculate the area of the shaded part. (Use $\pi = {}^{22}/_{7}$).



**5.** Find the area of the shaded part in the diagram below. (Take $\pi=^{22}/_{7}$)



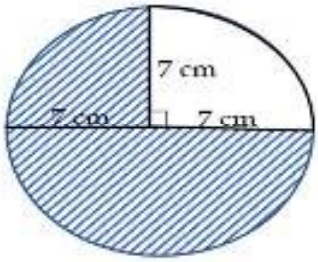

**6.** The diagram below shows a square BCDE enclosed in a circle with a centre O and radius 14 cm. parts of the circle are shaded as shown.
Study the diagram and use it to answer the questions that follow.



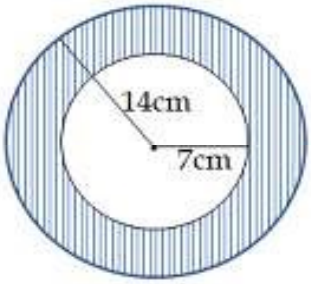

Calculate the area of the circle. (Use $\pi$ = $^{22}/_{7}$ ).

(a) Find the area of the shaded part.

**7.** Find the area of the shaded part in the diagram below. (Use L = ).



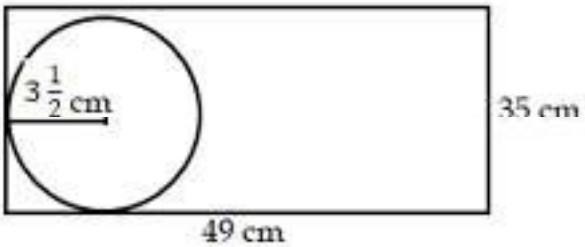

**8.** Find the area of the shaded part in the figure.




**SUB TOPIC: MORE APPLICATION OF AREA**

*Example:*

1. A rectangular manila card is 49 cm by 35 cm. Circular cards of radius 3 ½ cm are cut out of the manila card.




(a) Find the total number of cards cut out of the manila card.

*Number of circular cards along the sides*

*A long the length* = $\frac{49\text{cm}}{7}$ = 7 cards.

*A long the length* = $\frac{35\text{cm}}{7}$ = 5 cards

*Number of the circular cards = 7* x *5*

*= 35 cards.*

*The area of the rectangular manila card* = L x W

= 49 cm x 35 cm

= 1,715 $cm^2$

(b) Find the area of the manila card wasted.

*Area of the 35 cards*

*= 35 x* $\pi r^2$

$=35 \times {}^{22}/_{7} \times {}^{7}/_{2}cm \times {}^{7}/_{2}cm$

*=770 cm x 1.75 cm*

=1347.5 $cm^2$

*Area of the wasted manila* = 1715 $cm^2$ - 1347.5 $cm^2$

= 377.5 $cm^2$

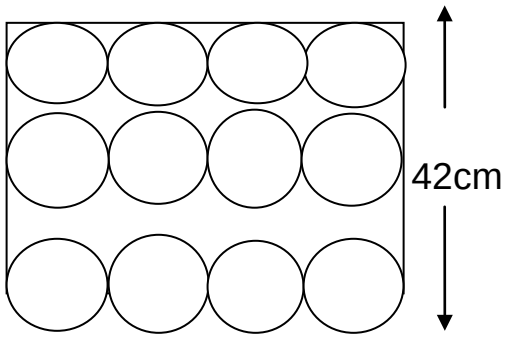
Note: remainders are not considered, only record the quotient.

**ACTIVITY:**

1. Jacob has a rectangular manila card of 20 cm by 10 cm. If he cuts out a circular card of radius 3 cm. How many circular cards did he cut out of the manila?
2. Birungi prepared rectangular dough of 40 cm by 56 cm. If he cut out pancakes of radius 7 cm.
   **(a)** How many pancakes did he cut out?
   **(b)** Calculate the area of the remaining dough.
3. How many circular discs of diameter 7 cm can be cut from a square metal of side 42 cm?
4. A mother prepared square dough of side 70 cm and cut circular chapatis of diameter 14 cm.
   **(a)** How many chapatis did she make?
   **(b)** What is the area of the remaining dough?
5. A piece of a rectangular paper 35 cm by 21 cm is designed with circular paints each of diameter 7 cm.
   **(a)** How many circles were in the design?

**(b)** What is the area of the paper without circles?

6. Lukwago cut out circular cards from a rectangular manila paper whose width is 42 cm as shown in the diagram below. Study the diagram and answer the questions that follow.




(a) Find the length of the paper.

(b) Calculate the area of the pieces of Manila paper that remained.
(Use $\pi = {}^{22}/_{7}$)

**SUB TOPIC: FINDING RADIUS AND CIRCUMFERENCE OF A CIRCLE WHEN AREA IS GIVEN.**

Concepts:

- Use the given area to find radius i.e $\pi r^2$ = Area.
- Use the radius to find circumference i.e Circumference = $2\pi r$.

Examples

The area of a circle is 154cm². Find the circumference of the circle.
(Use π as $\frac{22}{7}$)

Radius of the circle

$\pi r^2$ = Area

$\frac{22r^2}{7} = 154cm^2$

$7 \times \frac{22r^2}{7} = 154cm \times 7$

$\sqrt{r^2} = \sqrt{49}cm^2$

Radius = 7cm

circumference

$C = 2\pi r$

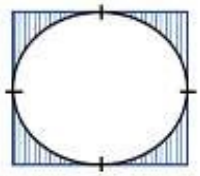
$= 2 \times \frac{22}{7} \times 7cm$

$= 2 \times 22 \times cm$

**$= 44cm$**

**ACTIVITY:**

1. The area of un shaded part is 154 $cm^2$.



a) Find the length of the sides of a square. b) Find the area of the shaded part.

2. The area of a circular field is 616$m^2$. Calculate its circumference.

3. A cow is tied on a tree such that its grazing area is 38.5$m^2$. Calculate the distance around its grazing area.

4. Calculate the radius of a circle whose area is 5544 $cm^2$.use $\pi = \frac{22}{7}$

**5.** Calculate the circumference of a circle whose area is;

a) 616$cm^2$ b) 308$cm^2$ c) 38 ½ $cm^2$ d) 9 5/8$cm^2$

6. A cow was tied on a tree such that its grazing area is 38.5$m^2$. Calculate the distance around its grazing area.

7. The area of a circular field is 77$cm^2$. Calculate its circumference.

8. Work out the circumference of a circle whose area is 184$cm^2$.

## SUB TOPIC: VOLUME OF THE CUBES AND CUBOIDS:

Examples:

1. Find the volume of a square box (cube) whose side length is 6 cm.

Volume = base area x height. Volume = (S x S) x S

= (6cm x 6cm) x 6cm

= 36$cm^2$ x 6cm

= 216$cm^3$

2. Calculate the volume of a rectangular tank (cuboidal tank) which measures 60 cm by 20 cm by 40 cm.

Volume = base area x height.

= (L x W) x H

= (60cm x 20cm) x 40cm

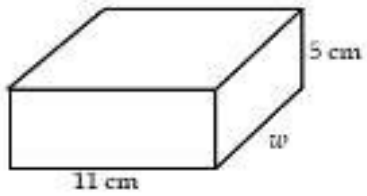
= 1200$cm^2$ x 40cm

= *48000$cm^3$*

## ACTIVITY:

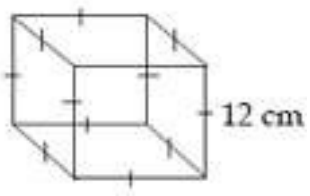
1. The volume of a cube is 125 $cm^3$, find the length of its edges.

2. The width of the cuboid below whose volume is 0.22 litres.



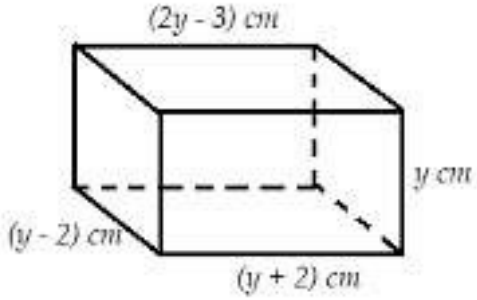

3. The base area of the cuboid is 12 $cm^2$. Calculate the volume of the cuboid if its height is 7 cm.

4. The figure below shows a cube whose edges are made of metal wire.




(a) Find the length of the wire needed to cover its edges. (b) Find the length of the wire needed to make the cube.

5. The figure below is a cuboid. Study and use it to answer the questions that follow.




(a) Find the value of y. (b) Find the volume of the cuboid.

6. Find the width of the rectangular prism whose length = 9 cm, height = 5 cm and volume = 180 $cm^3$.

7. A rectangular tank is 30 cm by 60 cm by 90 cm. Find its capacity in litres.

## SUB TOPIC: TOTAL SURFACE AREA OF A CUBE AND CUBOID

A cube has all its 6 square sides equal.

The total surface area of all the six square faces equals to the surface area of a cube.

The total surface area = six times (the area of one square).

Area of one face = s x s

Total surface area = 6 x $s^2$

= $6s^2$

A cuboid has 6 faces. 2 faces of length x width, 2 faces of length x height and 2 faces of width x height

Its total surface area = $2(l \times w) + 2(l \times h) + 2(w \times h)$

$= 2lw + 2lh + 2wh$

Examples:

1. Find the total surface area of a cube whose side is 4 cm.

$TSA = 6 \times s^2$

$= 6 \times 4\ cm \times 4\ cm$

$= 6 \times 16\ cm^2$

**$= 96\ cm^2$**

2. The total surface area of a cube is 384 $cm^2$. Find the length of each side of a square.

$6 \times s^2 = TSA$

$6s^2 = 384\ cm^2$

$\frac{6}{6}s^2 = \frac{384}{6}\ cm^2$

$S^2 = 64\ cm^2$

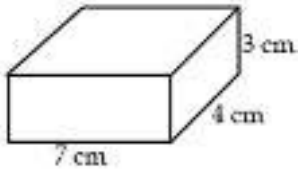
$\sqrt[2]{s2} = \sqrt[2]{64\ cm2}$

$\sqrt[2]{s \times s} = \sqrt[2]{(2 \times 2) \times (2 \times 2) \times (2 \times 2)}$

S = 2 x 2 x 2

Each side = 8 cm

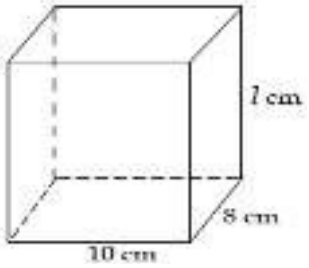
3. Find the total surface area of the cuboid below.




TSA = 2(L x W) + 2(L x W) + 2(L x H)
= 2(7cm x 4cm) + 2(7cm x 3cm) + 2(4cm x 3cm)
= (2 x 28 $cm^2$) + (2 x 21 $cm^2$) + (2 x 12 $cm^2$)
= 56 $cm^2$ + 42 $cm^2$ + 24 $cm^2$.

T.S.A =122$cm^2$

4. The sum of the length of all the edges of the prism below is 96 cm.




(a) Find the length of edge *L*.

4(10 + 8 + *l*) = 96 40 + 32 + 4*l* = 96
72 + 4*l* = 96
72 - 72 + 4*l* = 96 – 72
4*l* = 24
4l = 24
*l* = 6

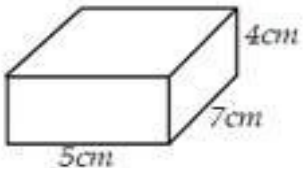
(b) Calculate the volume of the prism.

Volume = (L x W) x H
= (10cm x 8cm) x 6cm
= 80$cm^2$ x 6cm

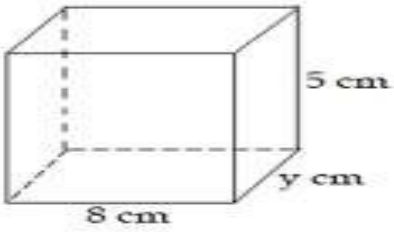
Volume =480$cm^3$

**ACTIVITY:**

1. Find the total surface area of a cube whose side is 20 cm.
2. The total surface area of a cube is 2400 $cm^2$. Find the length of each side of a square.
3. Find the total surface area of the cuboid below.




4. The sum of the length of all the edges of the prism below is 68cm.



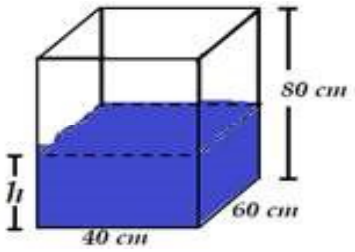

(c) Find the length of edge y.

(d) Calculate the volume of the prism.

## SUB TOPIC: MORE APPLICATION ON CAPACITY OF CUBOIDS:

### Example:

This tank is holding 72 litres of water.




(i) Calculate the value of h.

1 litre = 1,000$cm^3$

72 litres = (72 x 1,000) $cm^3$

= 72,000$cm^3$

L x W x H = Volume

40cm x 60cm x h = 72,000$cm^3$

2400cm2 x h = 72,000$cm^3$

2400cm2 x h = ~~72,000~~cm x ~~cm~~ x ~~cm~~

2400cm2 x h ~~2400cm~~ x ~~cm~~

H = 30cm

(ii) How many litres are needed to fill the tank?

Number of litres needed to fill the tank

= $\frac{L \times W \times H}{1000cm^3}$

height = (80 – 30)cm

= 50cm

= $\frac{40cm \times 60cm \times 50cm}{1000cm \times cm \times cm}$

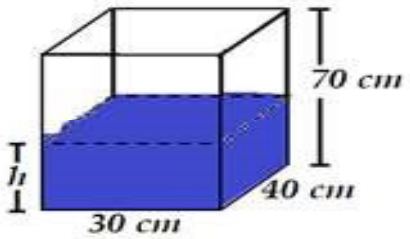
= (4 x 6) x 5

= 24 x 5

= 120 litres needed to fill the tank

### ACTIVITY:

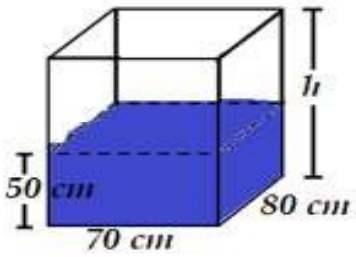
1. The tank below is 72 litres full of water.




(i) Calculate the value of h.

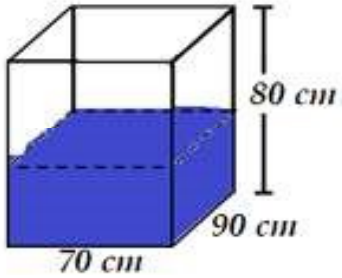
(ii) How many litres are needed to fill the tank?

2. The given tank is full of water.




a) How many litres of water are in the tank?
b) How many litres are needed to fill the tank?
c) What is the height (h) of the tank?

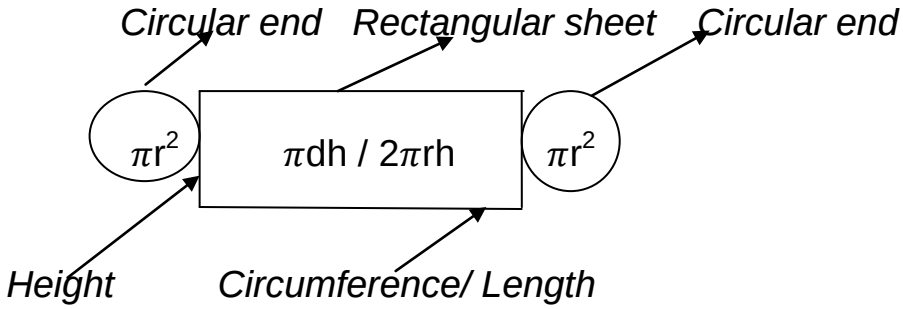
3. The tank is full of water.




**(i)** How many litres of water are in the tank?
**(ii)** What will be the new water level if 126 litres of water are drawn from the tank when full?

## SUB TOPIC: FINDING THE TOTAL SURFACE AREA OF CYLINDERS:

A cylinder has three main ends and a curved surface in form of a rectangle.




Note: The length of the curved surface equals to the circumference of the circular

Note: The length of the curved surface equals to the circumference of the circular end since the curved surface is binding round the circular end.

TSA = Area of the 3 faces (2 circular faces and a curved surface in form of rectangle)

$= \pi r^2 + \pi r^2 + 2\pi rh$
$= 2\pi r^2 + 2\pi rh$
$= 2\pi r (r + h)$

Examples:

1. Find the total surface area of a cylinder whose radius is 7 cm and height is 10cm.

TSA = $2\pi r\ (r + h)$

= 2 x $^{22}/_{7}$ x $\cancel{7}^{1}$ cm (7cm + 10 cm)

= 44 cm x 17 cm

= **748 $cm^2$**

2. Calculate the total surface area of an open cylinder whose radius is 7 cm.

TSA = $\pi r2 + 2\pi rh$

= $\frac{22}{7}$ x 7cm x $\cancel{7}^{1}$ cm + (2 x $\frac{22}{7}$ x $\cancel{7}^{1}$ cm x 8 cm)

= 154 $cm^2$ + 352 $cm^2$

= **506 $cm^2$**

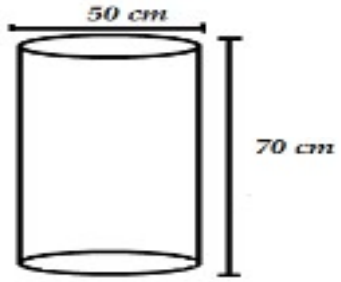
**ACTIVITY :**

1. A cylindrical tank of radius 14 cm has a height of 15 cm. find its total surface area.

2. The radius of a cylindrical tin is 3.5 cm and its height is 8 cm. find its total surface area.

3. Calculate the total surface area of an open tank with radius 7 dm and height 11 dm.

3. Find the total surface area of the cylinder below.




**SUB TOPIC: VOLUME AND CAPACITY OF A CYLINDERS**

Remember:

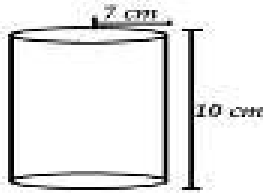
Volume = base area x height.

Volume of a cylinder = ($\pi r^2$) x h

= $\pi r^2$ x h

Examples

1. A cylindrical tin has a radius of 7 cm. calculate its volume.




Volume = base area x height

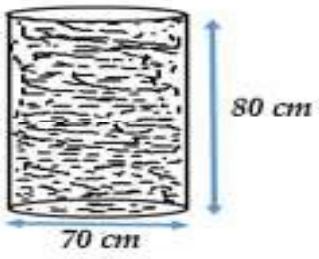
= $\pi r^2$ x h

= ( $\frac{22}{7}$ x $\cancel{7}^{1}$ cm x 7cm) x 10 cm

= 154 $cm^2$ x 10 cm

= 1540 $cm^3$

2. Find the capacity of the container below in litres.




Radius = d ÷ 2

= 70 cm ÷ 2

= 35 cm

Height = 80 cm

Volume = base area x height

= $\pi r^2$ x h

= ( $\frac{22}{7}$ x ~~35~~ [5] cm x 35cm) x 80 cm

= 110 cm x 35 cm x 80 cm

= 3850 $cm^2$ x 80 cm

= 308,000 $cm^3$

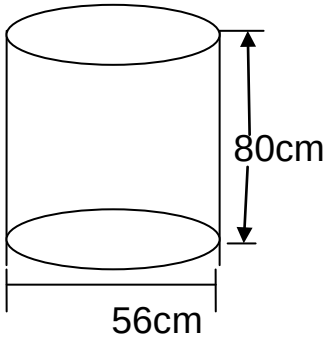
Capacity = 308 litres

**ACTIVITY:**

1. Find the volume of a cylindrical cup whose radius is 14 cm and height 20 cm.
2. The base area of a cylinder is 140 $cm^2$. Find its volume if its height is 30 cm.
3. Find the capacity of the tin that has a volume of 24000 $cm^3$.
4. A cylindrical tank of diameter 70 cm contains water to a height of 100 cm. Find in litres the amount of water in the tank. (Take π = $\frac{22}{7}$)
5. Calculate the capacity of a cylindrical tank in litres whose radius is 40cm and height is 70cm.
6. Calculate the capacity of a cylinder whose radius is 7 cm and height 10cm.
7. The radius of a tank is 0.7m and its height is 120cm. Find the volume of the tank in litres when it is $\frac{1}{2}$ full.
8. A petrol tank of height 8m and diameter of 140cm is full of fuel. How many litres of petrol can it hold when it is $\frac{3}{4}$ full.
9. A cylindrical tank of water diameter of 28cm, has a height of 100cm.
   (i) Work out the volume of the tank.
   (ii) Calculate the capacity of the tank when full.

10. The cylindrical tank below is full of water. Use it to answer the questions that follow.

a) What will be the level of water when it is $\frac{3}{4}$ full?




b) How many litres does it hold when $\frac{2}{3}$ full?

**SUB TOPIC: MORE VOLUME AND CAPACITY OF CYLINDERS**

- Find the sum or difference or product of the given fractions.
- Find the difference in heights of the figure.
- Solve problems involving volume and capacity of cylinders.

Example 1

. A tank is $\frac{2}{3}$ full of water. When ¼ of the water is drawn, 2,500 litres remained. Find the capacity of the tank when full.

Fraction of water in the tank = $\frac{2}{3}$

Fraction of water drawn = $\frac{1}{4}$ of $\frac{2}{3}$

$= \frac{1}{4} \times \frac{2}{3}$

$= \frac{1}{6}$

Fraction remaining = $\frac{2}{3} - \frac{1}{6}$ LCM= 6

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

$= \frac{3}{6}$

Capacity of the tank when full

$= 2500 \div \frac{3}{6}$

$= 2500 \times \frac{6}{3}$

$= 2500 \times 2$

= 5,000 litres.

Example 2

A tank is ½ full of petrol. When 800 litres are added, it becomes ¾ full.

a) How many litres does the tank hold when completely full?

Fraction of water in the tank = $\frac{1}{2}$

Fraction of water added = $\frac{3}{4} - \frac{1}{2}$

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

$= \frac{1}{4}$

Capacity of the tank when full

$= 800 \div \frac{1}{4}$

$= 800 \times \frac{4}{1}$

= 3,200 litres

b) What will be the quantity of petrol in the tank when $\frac{3}{8}$ full?

Amount of petrol in the tank when $\frac{3}{8}$ full = $\frac{3}{8}$ x 3200 litres

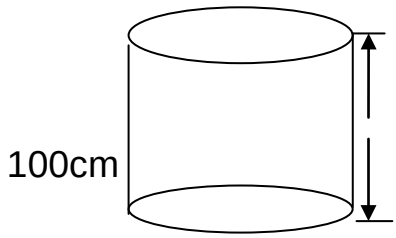
= (3 x 400) litres

= 1,200 litres

Example 3

The tank below holds 385 litres of fuel.If 154 litres areremoved,

a) Find the number of litres that will remain in the tank..




Total number of litres in the tank = 385
Number of litres removed -154
Number of litres that remained 231

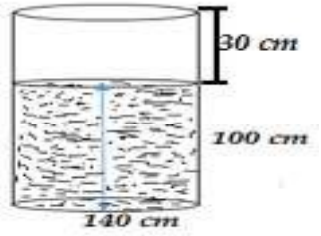
b) What will be the level of fuel that will remain in the tank?
Level of will of water that will remain = $\frac{231}{385} = \frac{3}{5}$

c) Calculate the radius of the tank.
1 litre = $1000cm^3$
385 litres = 385 x $1000cm^3$
= $385{,}000cm^3$
$\pi r^2 h = 385{,}0000cm^3$
$\frac{22}{7}$ x r2 x100cm = $385{,}000m^3$
$\frac{2200}{7}$cm x $r^2$ = $385{,}000cm^3$
7 x $\frac{2200cm}{7}$ x $r^2$ = $385{,}000cm^3$ x 7
2200cm x $r^2$ = $385{,}000cm^3$ x 7

$\frac{2200cm}{2200cm} \times r^2 = \frac{385{,}000cm^3}{2200cm} \times \frac{175}{7}$
$r^2 = 175cm^2 \times 7$
$r^2 = 1225cm^2$
$\sqrt[2]{r2} = \sqrt[2]{1225}$
$\sqrt[2]{r \times r} = \sqrt[2]{35 \times 35}$
r = 35cm

Radius of the tank is 35cm.

4. Study the cylinder below and use it to answer the questions that follow.




(a) How much water is in the tank?
Radius = 140 cm ÷ 2
= 70 cm
Volume = base area x height
= $\pi r^2$ x h
= ($\frac{22}{7}$ x 70 [10] cm x 70cm) x 100 cm
= 220 cm x 70 cm x 100 cm
= 15,400 $cm^2$ x 100 cm
=1,540,000 $cm^3$
Capacity = $\frac{1{,}540{,}000\ cm^3}{1{,}000\ cm3}$
=1,540 litres
1,540 litres of water are in the tank.

(b) How many litres are needed to fill the tank?
Volume = base area x height

$= \pi r^2 \times h$

$= (\frac{22}{7} \times \cancel{70}\ ^{10}\text{cm} \times 70\text{ cm}) \times 30\text{ cm}$

$= 220\text{ cm} \times 70\text{ cm} \times 30\text{ cm}$

$= 15400\text{ cm}^2 \times 30\text{ cm}$

$= \underline{462{,}000\text{ cm}^3}$

$\text{Capacity} = \frac{\underline{462{,}000\text{ cm}^3} \times 1\text{ litre}}{1000\text{cm}^3}$

$= 462\text{ litres}$

462 litres of water are needed to fill the tank the tank

(c) Find the capacity of the tank when full?

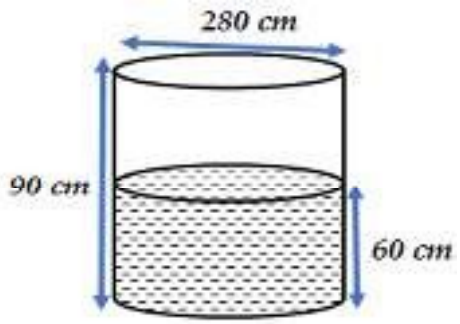
Capacity of the tank = 1540 litres

+ 462 litres

= 2,002 litres

**ACTIVITY:**

1. Study the figure below to answer the questions that follow




a) Find the amount of water in the tank?

b) How much water is needed to fill the tank?

c) Find the capacity of the tank when completely full.

2. A cylinder with radius 7 cm contains 2,926 $cm^3$ of liquid soap.

(i) If 616 $cm^3$ of the liquid soap is used, what is the height of the liquid remaining?

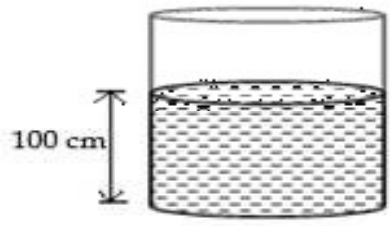
(ii) If 616 $cm^3$ was allowed to pour into a rectangular tin with base area of 88 cm2, to what height will the liquid soap rise?

3. A cylindrical tin of radius 7 cm contains 3080 $cm^3$ of cooking oil.

(a) Joan used 2,156 $cm^3$ of the cooking oil. What is the height of the cooking oil remaining in the tin?

(b) Joan poured the remaining cooking oil into a rectangular tin with base area 77 $cm^2$. What was the height of the oil in the tin?

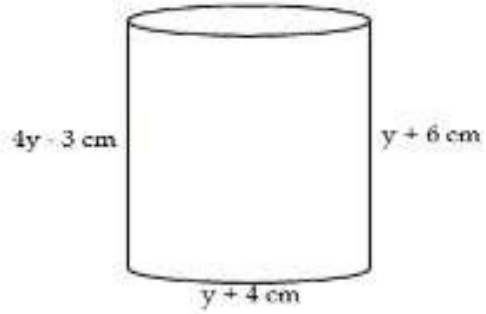
4. The figure below is a cylindrical tank containing 1540 litres of water.




(a) Find the radius of a tank.

(b) If the tank is full, find its capacity.

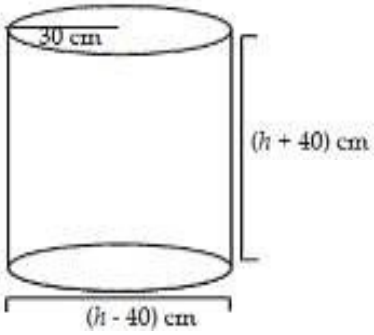
5. Study the cylinder below and answer the following questions.




(c) Find the value of y.

(d) Calculate the capacity of the cylinder.

6. Study the cylinder below and answer the following questions.




(a) Find the value of *h*.

(b) Calculate the volume of the cylinder.

7. A tank was ¾ full of water. When 4 litres were removed, it became ½ full. What is the capacity of the tank?

8. A tank is ¾ full of milk. When 600 litres of milk is added, the tank becomes $\frac{5}{6}$ full.

a) What is the capacity of the tank when it is completely full of milk?

b) How many litres of milk does the tank hold when it is $\frac{2}{3}$ full?

9. The tank is $\frac{5}{6}$ full of kerosene. When 120 litres of the kerosene are removed, it becomes ¾ full. How many litres does it contain when it is $\frac{2}{5}$ full?

10. A tank is ¾ full of water. When $\frac{1}{5}$ of the water in the tank is removed, 1200 litres remained. Find the capacity of the tank.

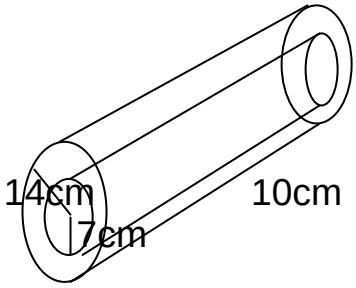
11. A tank was $\frac{5}{7}$ full of paraffin. When 2,200 litres of the paraffin were removed, it became $\frac{2}{5}$ full. Find the capacity of the tank when completely full paraffin.

**SUB TOPIC: SUBTRACTION OF VOLUMES – HOLLOW PIPES**

- Concrete is the material used inside any pipe .i.e. inner space left empty.
- Volume of concrete is got by subtracting the volume of outer cylinder and inner cylinder.

Examples

. Calculate the volume of the metal in the hollow metallic pipe.




Volume of whole figure (outer cylinder)

Volume = πr²h

$= {}^{22}/_{7}$ x 14cm x 14cm x 10cm

= (22 x 2cm) x 140cm$^2$

= 44cm x 140cm$^2$

= <u>6,160 cm$^3$</u>

Volume of inner cylinder

=πr$^2$h

$= {}^{22}/_{7}$ x 7cm x 7cm x10cm

= (22 x 1cm) x (7cm x 10cm)

= 22cm x 70cm$^2$

= <u>1,540cm$^3$</u>

Volume of concrete = Difference

6,160cm$^3$

\- <u>1,540cm$^3$</u>

<u>4,620cm$^3$</u>

Method II

Volume of concrete = π h (R$^2$ – r$^2$)

Where by R$^2$ = Radius of outer cylinder and r$^2$ = radius of inner cylinder

Volume of concrete = $ {}^{22}/_{7}$ x 10cm (14 cm X 14cm) – (7cm X 7 cm)

$= {}^{220}/_{7}$ cm (196 cm$^2$ – 49cm$^2$)

$= {}^{220}/_{7}$ cm X 147 cm$^2$

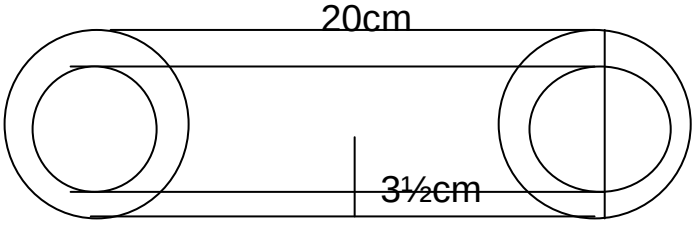
= 220 cm X 21cm$^2$

= <u>4,620 cm$^3$</u>

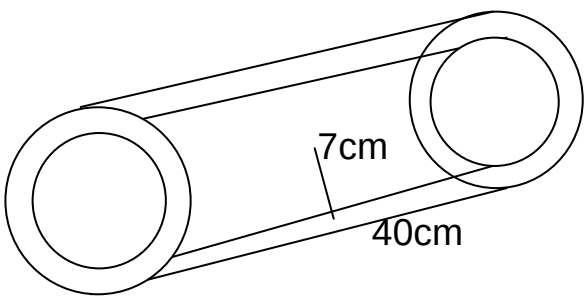
**<u>ACTIVITY:</u>**

Calculate the volume of each concrete pipe in the cylinder.

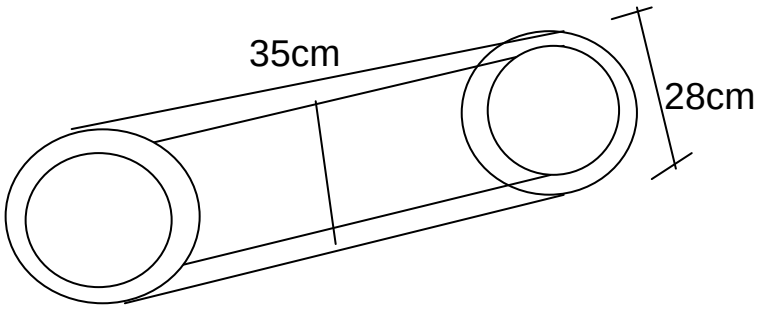
1.



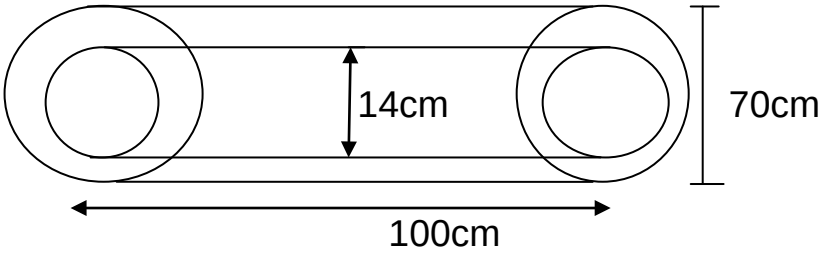

2.



3..

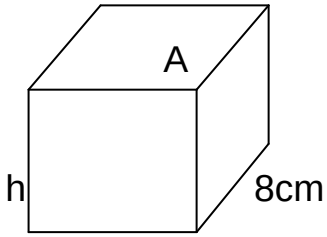


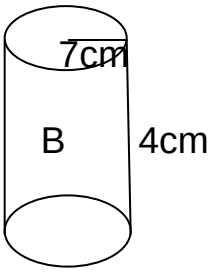

4. The diagram below shows a pipe from a metal. Find the volume of the metal used to make the pipe.




**SUB TOPIC: COMPARING VOLUMES OF CYLINDERS AND CUBOIDS**

1. The figures below have the same volume. Use the information to answer the questions that follow.




(a) Find the height of A.

**Solution**

Volume of B

Vol. = $\pi r^2 h$

$\frac{22}{7}$ x 7cm x 7cm x 4cm

(22cm x 7cm) x 4cm

= 154cm² x 4cm

= **616cm³**

Height of A

L x W x h

11cm x 8cm x h

$\frac{11cm \times 8cm \times h}{11cm \times 8cm}$

Volume

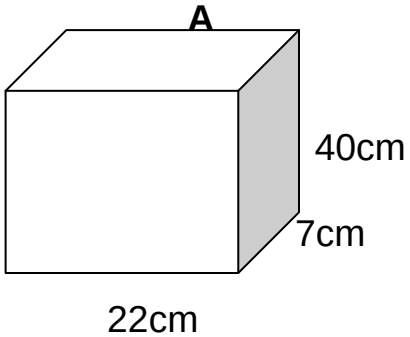
= 616cm$^3$ (same Vol.)

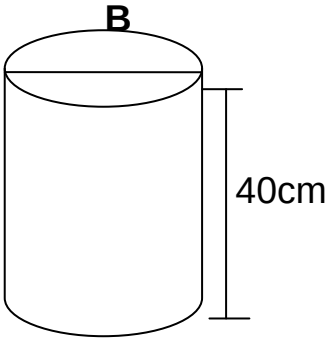
= $\frac{616cm \times cm \times cm}{11cm \times 8cm}$

**h = 7cm**

**ACTIVITY:**

.1. Given the tanks the tanks below have the same volumes. Use them to answer questions that follow.

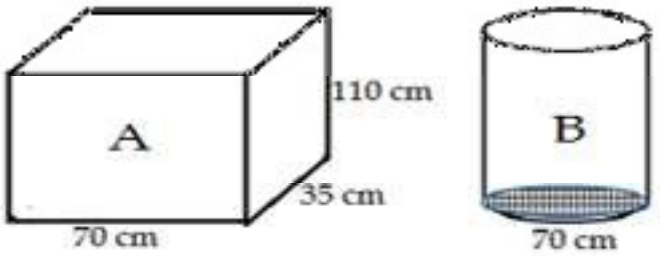



a) Find the capacity of the rectangular tank.

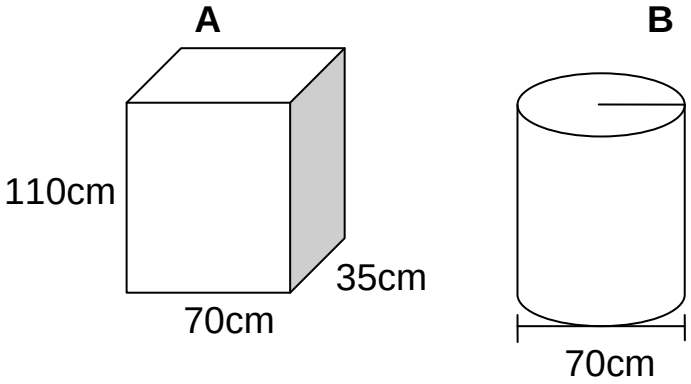
b) Calculate the radius of the cylindrical tank

2. A cuboidal water tank A which is 70 cm long by 35 cm wide by 110 cm high was filled with water. The water from tank (A) was all poured into the cylindrical tank (B) of diameter 70 cm.




(a) Find the volume of water in tank A when it is full.
(b) Find the new height of water after it has been poured into tank.

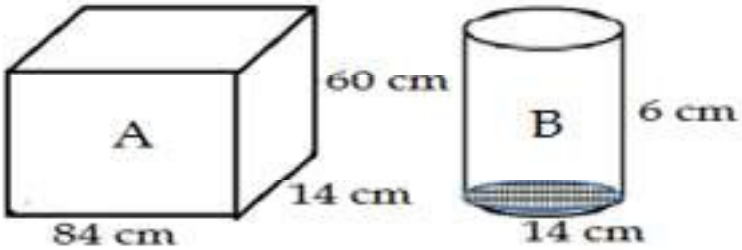
3. A cuboidal water tank (A) which is 70cm long by 35cm wide by 110cm wide was filled with water. The water in tank (A) was all poured into the cylindrical tank (B).




a) Find the volume of water in tank (A) when it is full.

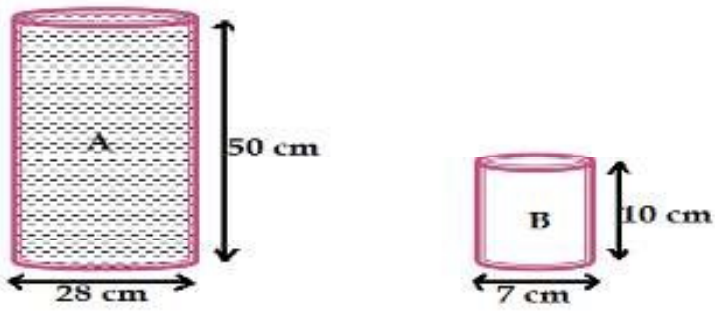
b) Find the new height of water after it has been poured into tank (B) (Take $\pi$ = $\frac{22}{7}$

4. Study the figures below and use it to answer the questions that follow.




(a) Find the volume of the figure A.
(b) How many such cups B can be got from container (A). (use $\pi = {}^{22}/_{7}$)

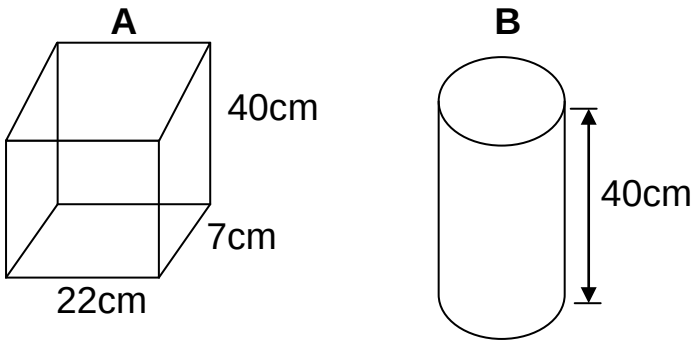
5. Betty filled container A of diameter 28 cm and height of 50cm with drinking water. She served visitors with the water using cups of size B of diameter 7 cm and height 10 cm as shown in the diagram.




Find the total number of full cups of water she served the visitors.

6. Two petrol tanks **A** and **B** hold the same amount of petrol when filled up.

a) Find the amount of petrol tank **A** can hold in litres.



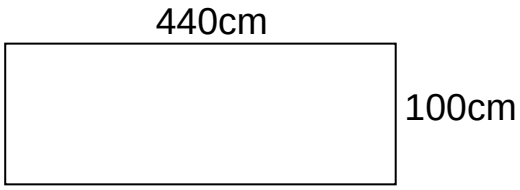

b) Find the diameter of tank **B**

## SUB TOPIC: VOLUME AND SURFACE AREA OF CYLINDERS

- Apply the formula for circumference to find radius then use it to find area.
- Solve problems involving surface area and volume of cylinders.

Example:

1. A welder was given a metal sheet with measurements as shown in the diagram below. He welded it into a hollow cylinder making the height 1000cm. (Use $\pi = {}^{22}/_{7}$)




(a) What is the surface of the metal needed to cover the bottom of the cylinder?

Radius

$2\pi r = C$

$2 \times {}^{22}/_{7} \times r = 440cm$

$7 \times {}^{44}/_{7} r = 440cm \times 7$

$44r = 440cm \times 7$

$\frac{44r}{44} = \frac{440cm \times 7}{44}$

$R = 70cm$

Area of metal needed to cover the bottom

$= \pi r^2$

$= {}^{22}/_{7} \times 70cm \times 70cm$

$= 22 \times 10cm \times 70\ cm$

$= 220\ cm \times 70\ cm$

$= 15{,}400\ cm^2$

(b) Calculate the maximum volume of water the cylinder will hold.
Solution

Vol. in cc = $\pi r^2 h$
= $\frac{22}{7}$ x 70cm x 70cm x 100cm
= 22 x 70cm x $1000cm^2$
= $1{,}540{,}000cm^3$

Volume in litres
1000cm =IL
1540cm = $\frac{1{,}540{,}000}{1000}$ x 1 litre
= 1,540Litres

**ACTIVITY :**

**1.** A rectangular metallic sheet below has a length of 880cm and width of 20cm was curved to form a hollow cylinder.

20cm

880cm

a) Find the radius of the hollow cylinder.
b) What is the surface area needed to cover the bottom of the cylinder?

2. The figure below shows a rectangular sheet of metal. The sheet is curved to form the wall of a cylindrical tank whose height is 100 cm.

100cm

220 cm

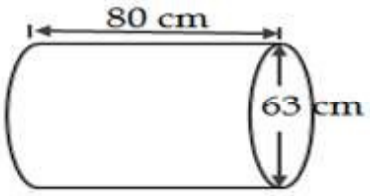
(a) Find the diameter of the tank formed.
(b) Calculate the;
(i) area of the sheet needed to cover the base of the tank.
(ii) capacity of the tank.

3. A hollow cylinder was cut open and formed in length of 440cm and width 10cm. Calculate the surface area that will be required to cover the top and bottom of the cylinder.

4. The area of curved surface of a closed cylinder is $220cm^2$. If the height of the cylinder is 10cm, find the radius of the cylinder.

5. The diagram below shows a metallic drum which was cut open to form a door sheet. Use it to answer the question that follow.

(a) Find the length of the door which was made out of the sheet.




(b) Work out the area of the door in metres.

**SUB TOPIC: SURFACE AREA AND VOLUME OF TRIANGULAR PRISMS.**

Concepts:

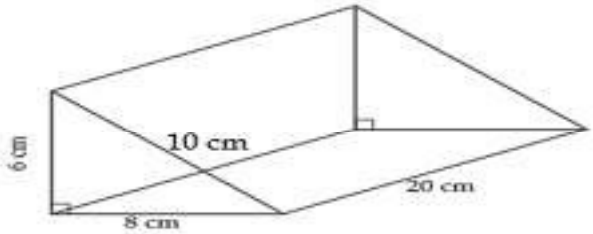
- Total surface area of a triangular prism

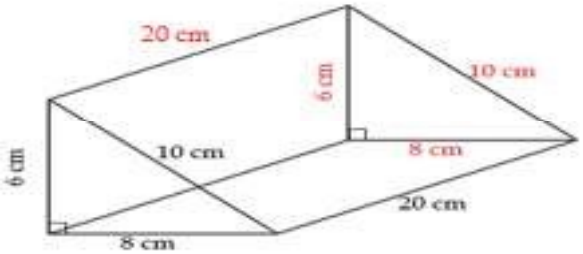
= ($\frac{1}{2}$ x b x h) + ($\frac{1}{2}$ x b x h) + (L x W) + (L x W)+ (L x W)

- When the triangular face is right angled, you may use the Pythagoras theorem to find the hidden side.
- Volume of a triangular prism = Area of triangular face x height).

Example:

a) Study the figure below and use it to answer questions that follow.




Find the total surface area of the figure above.

TSA = ( $\frac{1}{2}$ x b x h) x 2 + (L x W) + (L x W) + (L x W)

= ($\frac{1}{2}$ x 8cm x 6cm) x 21 + (20cm x 8cm) + (20cm x 6cm) + (20cm x 10cm)

= 48 $cm^2$ + 160 $cm^2$ + 120 $cm^2$ + 200 $cm^2$

= 548 $cm^2$

b) Work out the volume of the figure above.

Volume = Area of the cross section x length

= ($^1/_2$ x b x h) x L

= (1 x 84cm x 6cm) x 20cm

2

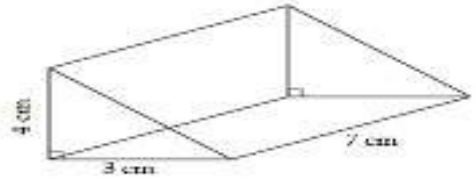
= (4cm x 6cm) x 20cm

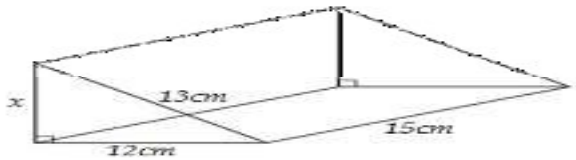
= 24$cm^2$ x 20cm

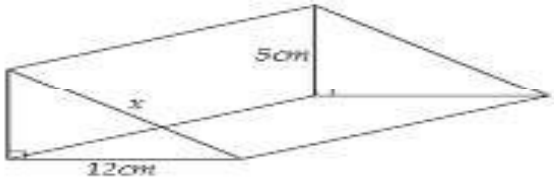
= 480 $cm^3$

**ACTIVITY:**

a) Find the total surface area of the following prisms.



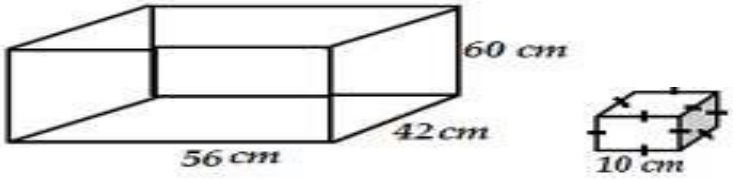

b) Find the volume of the following prisms above.

**SUB TOPIC: PACKING CUBES AND CUBOIDS IN BOXES:**

- Packing refers to putting items in containers; the items and the containers may be in different shapes as we can see here under.
- Divide the length by the length, width by the width and height

Examples:

1. How many cubes of 10 cm side can be packed in the box?




*Cubes along the sides of the big box:*

Total number of cubes = base cubes x layers
= (5 x 4) x 6
= 20 x 6
= 120 cubes

2. Calculate the space left after packing 3 cm cubes in a box measuring 30 cm by 16 cm by 9 cm.

Along length = $\frac{30cm}{3cm}$ Along width = $\frac{16cm}{3cm}$ Along Height = $\frac{9cm}{3cm}$

= (10 x 5) x 3
= 50 x 3
= 150 cubes

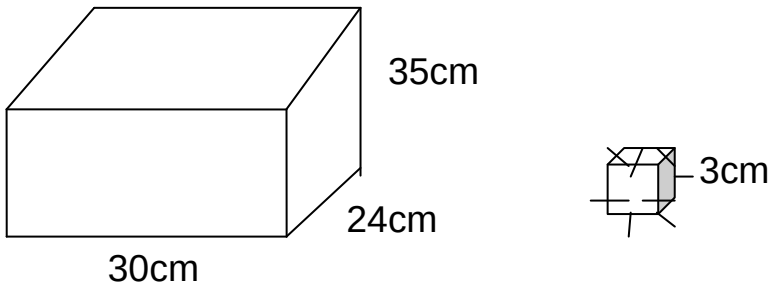
Volume of 150 cubes = ( s x s x s) x 150
= (3cm x 3cm x 3cm) x 150
= $9cm^2$ x 3cm x 150
= $9cm^2$ x 450cm
= $4,050cm^3$

Volume of box = ( L x W) x H
= (30 cm × 16 cm) × 9 cm
= $480\ cm^2$ x 9 cm
= $4320\ cm^3$

Volume of space left = $4,320cm^3$
$- 4,050cm^3$
$270cm^3$

Examples

1. A box measures 24cm by 30cm and height of 35cm
   (a) How many cubes of sides 4cm can fit into the box?



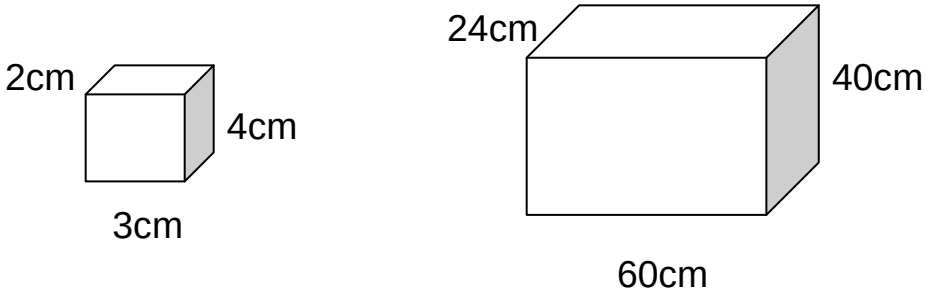

No of cubes = L X W X h
= $\frac{30cm}{4cm}$ x $\frac{24cm}{4cm}$ x $\frac{35cm}{4cm}$
= 7 x 6 x 8
= 336 cubes

(b) Find the space left empty after packing all the cubes in the box.

| Volume of big box | Volume of 336cubes | Space left |
|---|---|---|
| = L x W x h | = S x S x S x 336 | 25200$cm^3$ |
| = 30cm x 24cm x 35cm | = 4cm x 4cm x 4cm x 336 | - 21504$cm^3$ |
| = 720$cm^2$ x 35cm | = 64$cm^3$ x 336 | 3696$cm^3$ |
| = 25200$cm^3$ | = 21504$cm^3$ | |

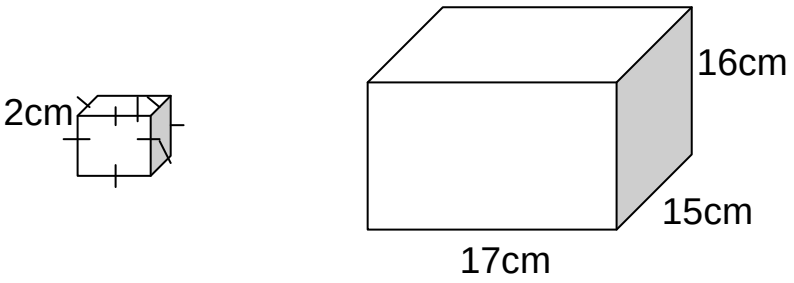
**ACTIVITY:**

1. A box measures 24cm by 30cm and a height of 35cm. How many cubes of 4cm square sides can be packed in the box?
2. What is the maximum number of small cuboids will fill the bigger box?

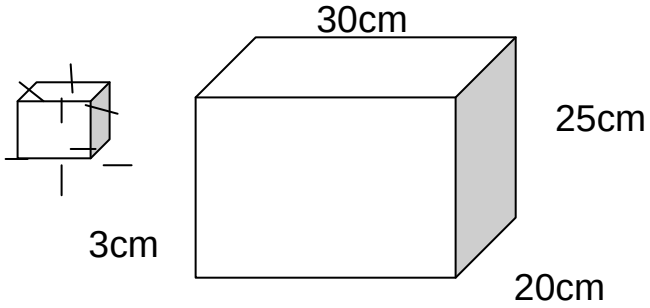



3. a) How many cubes of side 3cm can be packed in a box 25cm by 18cm by 12cm?
   b) Find the volume of the space left un occupied.

4. Amos was given a task of packing small cubes (A) into box (B).



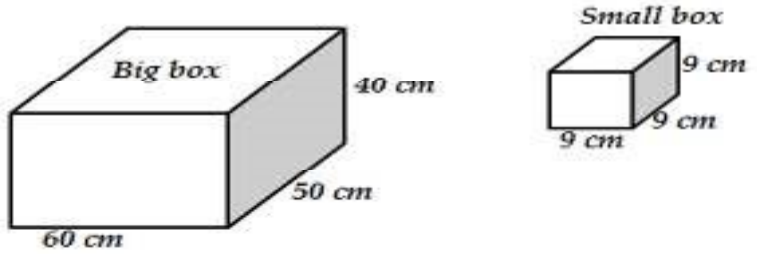

   a) How many small cubes will fill the first layer of the box?
   b) How many layers will he make to fill the box?
   c) Calculate the volume of the space left empty in the box.
5. Cubes of side 4cm each were packed in a box of 50cm by 30cm by 45cm.
   a) How many cubes were packed in the box?
   b) Find the space left after packing the cubes in the box?
6. Pieces of soap each measuring 3cm by 3cm by 3cm are packed into a box measuring 30cm by 25cm by 20cm.



a) How many pieces of soap can be packed into the box?

b) Calculate the space left empty after the pieces of soap have been packed into the box.

7. The diagram below shows a big box of 60cm long, 50cm wide and 40 cm high.




If such small boxes are packed into the big box,

(a) Find the number of boxes that will be packed in the first layer.

(b) How many layers will fill the big box?

(c) How many small boxes will fill the big box?

(d) Calculate the space left after packing all the small boxes in the big box?

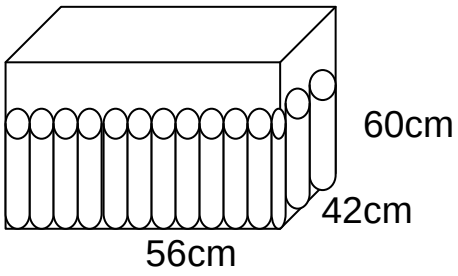
8. A box measuring 24 cm by 30 cm and height of 35 cm. how many cubes of 4 cm square sides can be packed into the box?

**SUB TOPIC: PACKING CYLINDERS IN BOXES**

- Ensure the units are the same.
- Finding the number of tins packed along each layer of the 3-dimensions.
- Volume of empty space = difference between the volume of the box and the total volume of all the cylinders.

Examples

1. How many cylindrical tins of diameter 7cm and height 10cm can be packed in a box measuring 56cm by 42 cm by 60 cm.




Total number of tins (base x no. of tins along height)

Number along = $\frac{\text{Length}}{\text{Diameter}} \times \frac{\text{Width}}{\text{Diameter}} \times \frac{\text{Height}}{\text{Height}}$

$= \frac{56 \text{ cm}}{7 \text{ cm}} \times \frac{42 \text{ cm}}{7 \text{ cm}} \times \frac{60 \text{ cm}}{10 \text{ cm}}$

$= (8 \times 6) \times 6$

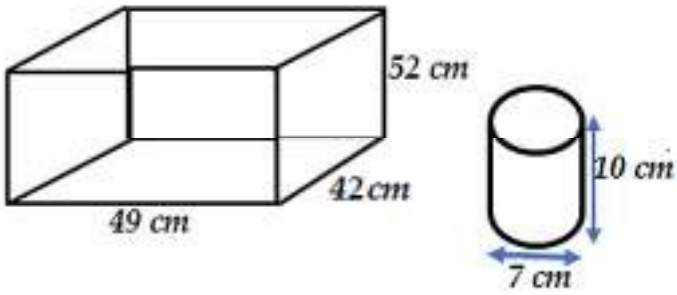
$= 48 \times 6$

$= 288$ tins

Altogether = 288 tins

2. In a factory, the blue band cylindrical tins of diameter 7 cm and height 10 cm are packed in large boxes measuring 49cm by 42 cm by 52 cm.

a) Calculate the space left unoccupied.




Number of tins along:

Length = $\frac{\text{Length}}{\text{Diameter}} = \frac{49\text{ cm}}{7\text{ cm}} = 7$ cubes

Width = $\frac{\text{Width}}{\text{Diameter}} = \frac{42\text{ cm}}{7\text{ cm}} = 6$ cubes

Height = $\frac{\text{Height}}{\text{Height}} = \frac{52\text{ cm}}{10\text{ cm}} = 5$ cubes

Total number of cubes = (7 x 6) x 7
= 42 x 5
= 210 cubes

b) Calculate the space left unoccupied.

Volume of 210 tins = ($\pi r^2$ x h) x 210
= ( $\frac{22}{7}$ x $\frac{7}{2}$cm x $\frac{7}{2}$cm x 5cm) x 210
= 77 $cm^2$ x 5 cm x 210
= 385 $cm^3$ x 210
**= 80,850 $cm^3$**

Volume of the box
= (L ×W) × H
= (49cm × 42cm) × 52cm
= 2,058$cm^2$ x 52 cm
**= 107,016 $cm^3$**

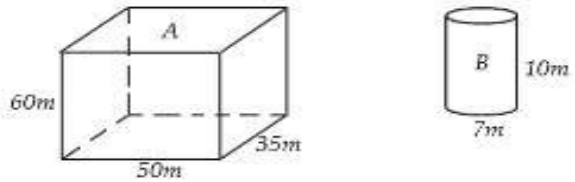
Space left = 107,016 $cm^3$
- 80,850 $cm^3$
26,166$cm^3$

**ACTIVITY:**

1. How many mugs of 5 cm in diameter and height of 14 cm can be packed in a square box of 30cm?

2. Calculate the space left after packing tins of 7 cm in diameter and height of 8 cm in a box measuring 42cm by 35 cm by 56 cm.

3. Given that cylindrical tins B are packed in box A.



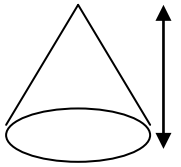

a) How many tins will be packed in the box?

b) Milk is sold using tins of B. How much will the seller get after selling all the milk if 1 tin costs sh. 500?

**SUB TOPIC: SOLID FIGURES (VOLUME OF A CONE)**

Examples:

1. Given the cone below, the diameter is 14cm height is 15cm. Calculate the volume of the cone.




14cm

Diameter = 14cm

R = $\frac{14\ cm}{2}$

= 7cm

Volume = $^1/_3\pi r2h$

Volume = $\frac{1}{3}$ x $\frac{22}{7}$ x 7cm x 7cm x 15cm

= 22 cmx 7cm x 5cm

= 154 cm2 x 5cm

Volume = 770cm$^3$

**ACTIVITY:**

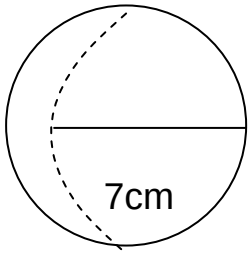
A New MK Primary Mathematics Bk 7 exercise 20:9 Pg 407 (New Edition)

**SUB TOPIC: SOLID FIGURES (VOLUME OF A SPHERE)**

Examples:

1. Calculate the volume of a sphere whose radius is 7cm.

Volume of a sphere = $\frac{4\pi\ r^3}{3}$




= ($\frac{4}{3}$ x $\frac{22}{7}$ x 7 x 7 x 7) cm$^3$

= $\frac{(4 \times 22 \times 7 \times 7)}{3}$ cm$^3$

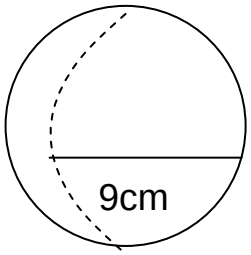
= $\frac{(88 \times 49)}{3}$ cm$^3$

= $\frac{4312}{3}$ cm$^3$

= 1437 rem 1

= 1437 $^1/_3$ cm$^3$.

2. Calculate the volume of a sphere whose radius is 9cm.




V = $\frac{4\pi r^3}{3}$

=( $\frac{4}{3}$ x 3.14 x 9 x 9 x 9) cm$^3$

=( $\frac{4}{3}$ x $\frac{314}{100}$ x 9 x 9 x 9)cm$^3$

= (4 x $\frac{314}{100}$ x 9 x 9 x 3) cm$^3$

= $\frac{(1256 \times 81 \times 3)}{100}$ cm$^3$

= $\frac{(305208)}{100}$ cm$^3$

= 3052.08 cm$^3$

**ACTIVITY:**

A New MK Primary Mathematics Bk 7 exercise 20:6 Pg 395 (Old Edition)

**SUB TOPIC: MASS**

Examples:

1. Express 2500kg to tons.

1000 kg = 1 ton

2500 kg = $\frac{2500\ kg}{1000\ kg} \times 1$ ton

2500 kg = 2.5 ton

2. Convert 550 kg to quintal and tons

100 kg = 1 quintal

550 kg = $\frac{550\ kg}{100\ kg} \times$ I quintal

550kg = 5.5 quintal

3. Express 2tons as kg

1ton = 1000kg

2 tons = 2 x 1000 kg

2 tons = 2000 kg

4. Express 12.6 tons as kg

1tons = 1000kg

12.6 tons = $\frac{126}{10}$x1000 kg

12.6tons = 12600 kg

3. Express 24000 kg as tons

1000 kg = 1tonne

24000 kg = $\frac{24000}{1000}$

24000 kg = 24tons

Exercise

Change the following to kilograms

1) 4 tons 2) 8 tons 3) 11 tons 4) 15.5 tons

Change the following to tons

1) 1500 kg 2) 100,000 kg 3) 80,000 kg 4) 1,000,000 kg

**TOPIC 12: ALGEBRA**

**SUB TOPIC: REVISION ON ALGEBAIC EXPRESSIONS**

1. Increase, sum, total, altogether = Add to.
2. Decrease, difference, taken away, minus = Subtract from.
3. Product, times, groups of = Multiplication.
4. Over, quotient = Division.
5. Double / twice = x 2
6. Triple / thrice = x 3

7 Square = to power 2

8. Average = $\frac{\text{Total}}{\text{No.}}$

Examples:

1) Sum of 8 and K. K + 8

2) Subtract 3 from m M – 3

3) Product of n and 9 9 x n = 9n

4) Divide w by 6 $\frac{W}{6}$

5) Double g 2 x g = 2g

6) Tripple p 3 x p = 3p

7) Square x Solution $X \times X = X^2$

8) Square root of x $\sqrt[2]{x}$

9) r divided by 2 r ÷ 2 or $\frac{r}{2}$

9. Half of y
½ x y = or $\frac{y}{2}$

11) ¾ of a number
¾ x n = ¾ n

12) Increase p by 3
p + 3

13) Decrease 3 by p
3 – p

14) Average of a, b, and c
$\frac{a + b + c}{3}$

**ACTIVITY:**

Write the algebraic expressions for:

1) Sum of U and 4

2) Subtract 9 from p

3) Product of m and n

4) Divide 3 by m

5) Triple n

6) Square k

7) A quarter of n

8) Square root of 3

9) Decrease 7 by x

10) Increase m by 20%

11) Average of x and y

**SUB TOPIC: REVIEW ALGEBRAIC NOTATION**

1. Thrice the difference between x and y.
3 (x – y)

2. Five times the sum of x and y
5(x + y)

3. Divide twice the difference between m and n by 5.
$2(\frac{m - n}{5})$

**ACTIVITY**:

Express in algebraic notation.

1) Double the difference between a and b
2) The total of 2a and 3 times 4b.
3) The difference between 3b and 4 divided by a.
4. Triple the difference between x and y.
5. Divide the difference between 4 and k by the product of b and 3.
6. The sum of m and 5n multiplied by 2 minus 2n.
7. Multiply the difference between 2b and c by 3d.
8. Add the sum of 4a and 3b times 5 to twice the difference between b and c.

**SUB TOPIC: REVIEW ALGEBRAIC PHRASES:**

1. 2n + 12 = Double a number and add 12 to the result.
2. 2(n + 6) = Add 6 to a number and multiply the result by 2.
3. $\frac{n}{3} - 5$ = Divide a number by 3 and subtract 5 from the result.
4. $\frac{x - 5}{3}$ = Subtract 5 from the number and divide the result by 3.
5. $X^2 + 7$ = Square the number then add 7 to the result.
6. $(x + 7)^2$ = Add 7 to the number then square the result.
7. $\frac{5x + 2}{6}$ = Add 2 to 5 times a number divided by 6
8. $5(\frac{x + 2}{6})$ = 5 times the sum of x and 2 divided by 6.

**ACTIVITY:**

Write the phrases for each of:

1) $x+15$ 2) $n-19$ 3) $3x$ 4) $y^2$ 5) $\sqrt{a}$

6) $\frac{n}{8}$ 7) $\frac{3x}{10}$ 8) $\frac{w+x+y+2}{4}$ 9) $3x+15$

**SUB TOPIC: SUBSTITUTION**

(i) $a+b = (a) + (b)$ (ii) $m-n = (m) - (n)$

(iii) $ab = (a) \times (b)$ iv) $\frac{ab}{c} = \frac{(a) \times (b)}{(c)}$

(v) $ab + ac = (a \times b) - (a \times c)$ (vi) $a(b-c) = (a \times b) - (a \times c)$

Examples

1. If a = 5, b = 2 and c = 0, evaluate 2a + 3c – b

$2a + 3c - b = (2 \times a) + (3 \times c) - b$
$= (2 \times 5) + (3 \times 0) - 2$
$= 10 + 0 - 2$
$= 10 - 2$
$= 8$

2. Given that a = 3, b = $^-2$, and c = 5, find the value of $a(b^2 - c)$

$a(b^2 - c) = (a) \times (b^2 - c)$
$= 3(^-2^2 - 5)$
$= 3(^-2 \times {}^-2) - 5$
$= 3(4 - 5)$
$= 3(^-1)$
$= {}^-3$

3. If a = $^3/_4$ and b = $^1/_3$. Work out a + b

$a + b = {}^3/_4 + {}^1/_3$ LCM = 12

$= \frac{(3 \times 3) + (4 \times 1)}{12}$
$= \frac{9+4}{12}$
$= \frac{13}{12}$
$= 1\ {}^1/_{12}$

**ACTIVITY:**

Given that a = 3, b = 2, c = -1 and d = 4.

Evaluate:

1) $a + b + c + d$ 2) $abc$ 3) $2a + 2b + 2c + 2d$ 4) $2a^2 - c^2$

5) $d^2 (a - c)$ 6) If x = $^3/_4$, y = $^2/_5$, evaluate xy. 7) If m = $^4/_5$, n = $^1/_5$. Find $\frac{m}{n}$

8) If p = $1\ ^1/_3$ and q = $2^1/_2$. Evaluate pq - $^1/_3$

## SUB TOPIC: COLLECTING LIKE TERMS

- Like terms have exactly the same letters grouped together.
- Multiplication, division and brackets make one single term.

Examples

1. When all terms are positives, add their co-efficient then put the constant

(a) Simplify: $8a + 5a + a + 2a$

$8a + 5a + a + 2a = (8 + 5 + 1 + 2)a$

$= 16a$

(b) Simplify: $a^2bc + 2a^2bc + 7a^2bc$

$a^2bc + 2a^2bc + 7a^2bc = (1+2+7)\ a^2bc$

$= 10a^2bc$

2. When all terms are negative, add their co-efficients and put the negative sign before their sum.

Simplify: $^-3x - 2x - x - 3x$

Solution

$^-3x - 2x - x - 3x = {}^- (3 + 2 + 1 + 3)\ x$

$= -9x$

3. When the terms are both positives and negatives, group the positives first followed by the negatives.

(i) Simplify: $-2k - k + 10k - 2k$

Solution

$3k - 2k - k + 10k - 2k = 3k + 10k - 2k - k - 2k$

$= (3 + 10)k - (2 + 1 + 2)k$

$= 13k - 5k$

$= 8k$

(ii) Simplify: $3ab - 2ab + 5a + 2a$

Solution

$3ab - 2ab + 5a + 2a = 3ab - 2ab + 5a + 2a$

$= (3 - 2)ab + (5 + 2)a$

$= ab + 7a$

## ACTIVITY:

Work out the following:

1) $2ab + ab$ 2) $a + a + a + 3a$ 3) $^-2b - b - 3b - b$

4. $12x - 3x + 2x - 4x$ 5) $^-8y - y - 2y$ 6) $6a + 7p - a - p$

7) $2x + 3 + 4x + 3x + 1$ 8) $2p + 2p + 2p + 2p$ 9) $^-a - 2a - 3a - 4a$

## SUB TOPIC: FACTORIZATION OF ALGEBRAIC EXPRESSIONS

- Factorization is the breaking down of an algebraic expression into separate parts (features)
- Identify common factors then use them to divide the terms.

Examples

Factorize the following completely.

i) $6x - 4y$

$6x - 4y = 2(6^3x - 4^2y)$

$= 2(3x - 2y)$

(ii) $a^2b - ab^2$

$a^2b - ab^2 = (a \times a \times b) + (a \times b \times b)$

$= ab\ (\frac{a \times a \times \cancel{b}}{\cancel{a} \times \cancel{b}}) - (\frac{\cancel{a} \times \cancel{b} \times b}{\cancel{a} \times \cancel{b}})$

$= ab\ (a - b)$

iii) $ax + ay + bx + by$

$a(ax + ay) + b(b + by)$

$a(\cancel{a}x + \cancel{a}y) + b(\cancel{b} + \cancel{b}y)$

$\cancel{a} \quad \cancel{a} \qquad \cancel{b} \quad \cancel{b}$

$a(x + y) + b(x + y)$

$= (a + y)(x + y)$

(iv) ) $x^2 – x + xy – y$

$= x(x^{\cancel{2}}\cancel{y} – x) + y(xy – \cancel{y})$

$\cancel{x} \qquad \cancel{y}$

$= x(x – 1) + y(x - 1)$

$= (x + y)(x – 1)$

v) $px – qy + qx – py$

Solution

$px – qy + qx – py = px – py + qx – qy$

$= p(\cancel{p}x – \cancel{p}y) + q(\cancel{q}x – \cancel{q}y)$

$\cancel{P} \qquad \cancel{q}$

$= p(x – y) + q(x – y)$

$= (p + q)(x – y$

**ACTIVITY:**

Factorize the following completely:

1) $abc – bcd$ 2) $3a – 6b – 9c$ 3) $a^2b^2 – ab^2$ 4) $3a^2 – 9a$

5) $54 – 81a$ 6) $x^2 – xy – 3x + 3y$ 7) $15x^2y + 9xy^2$ 8) $3q – 9s + 6r$

9) $14m + 35n – 21p$ 10) $4 – 8x – 12y + 4z$ 11) $7a^2b^2 – 21a2b$

**SUB TOPIC: SIMPLIFYING BY REMOVING BRACKETS**

**Concepts:**

- Identify the term, applying brackets, collecting like term and simplifying the expression.
- A term without a sign is a positive term e.g $5 = {}^+5$, $y = {}^+y$. Multiply every term inside by a factor outside.
- A positive term before the brackets doesn't change any sign inside that bracket

Examples

1. Simplify: $3(x + y)$

$3(x + y) = 3x + 3y$

- A negative sign / term outside the brackets or before changes all the signs inside that bracket.

(i) Simplify: $-(5 – q)$

$-(5 – q) = -5 + q$ or $= q – 5$

(ii) Simplify: $3(x + 1) – (x – 1)$

$3(x + 1) – (x – 1)$

$3x + 3 – x + 1$

$= 3x – x + 3 + 1$

$= 2x + 4$

2. Add: $x + 4$ to $x + 1$

$(x + 4) + (x + 1)$

$X + x + 4 + 1$

$2x + 5$

3. Add: $x – 4$ to $3x – 5$

$(x – 4) + (3x – 5)$

$x + 3x – 4 – 5$

$4x – 9$

4. Subtract y + 1 from 2y + 3

From (2y + 3) – (y + 1)

2y + 3 – y – 1

2y – y + 3 – 1

y+ 2

5. Subtract 3p – 1 from 5p – 3

From (5p – 3) – (3p – 1)

5p – 3 – 3p + 1

5p – 3p + 1 – 3

2p - 2

**ACTIVITY:**

Simplify the following fractions algebraic expressions.

1) 2(x + y) 2) -2(-3x) 3) -(x – y - z) 4) x(2 + y)

5) (x + 2) – (x + 3) 6) $-3\,(m-1) - 2m\,(1-2)$ 7) Subtract -6 from 8

8) Add y + 6 to y +8 9) Add m + 12 to m + 8 10) Add x – 1 to 3x – 5

11) Find the sum of 3(x + 6) and -2(x – 7)12) Subtract 2k – 4 from 5k – 4

13) Subtract (2a – 3) from (4a – 5) 14) Subtract 2p – 4 from p + 11

15) Subtract 2(x + 3) from 3(x + 1) 16) Subtract 2y + 1 from 3y – 2

**SUB TOPIC: MORE ABOUT REMOVING BRACKETS**

- Multiply each term inside the brackets by a fraction outside.

Examples

1. Simplify

(i) $^1/_3$ (3a + 9b)

$^1/_3$ (3a + 9b)

= ($^1/_3$ x 3a) + ($^1/_3$ x 9b)

= a + 3b

(ii) $^3/_{i4}$ (8m – 12p)

= ($^3/_4$ x 8m) – ( $^3/_4$ x 12p)

= (3 x 2m) – (3 x 3p)

= 6m – 9p

2. Simplify: $^1/_2$ of (2x + 4y) + $^1/_3$ of (6x + 9y)

$^1/_2$(2x + 4y) + $^1/_3$(6x + 9y)

= ($^1/_2$ x 2x) + ( $^1/_2$ x 4y) + ($^1/_3$ x 6x) + ( $^1/_3$ x 9y)

= x + 2y + 2x + 3y)

= (x + 2x) + (2y + 3y)

= 3x + 5y

3. Simplify: ½(4a + 6ab) – $^2/_3$(9a – 12ab)

½(4a + 6ab) – $^2/_3$(9a – 12ab)

= (½ x 4a) + (½ x 6ab) – ($^2/_3$x 9a) + ($^2/_3$x 12ab)

= 2a + 3ab – 6a + 8ab

= 2a – 6a + 3ab + 8ab
= - 4a + 11ab or 11ab – 4a

4. Subtract $^1/_2$ (4x – 2y) from $^1/_3$(6x – 9y)

( $^1/_3$(6x – 9y) – $^1/_2$ (4x – 2y)

= ($^1/_3$ x 6x) – ($^1/_3$ x 9y) – ($^1/_2$x 4x) + ($^1/_2$ x 2y)

= 2x – 3y – 2x + y
= 2x – 2x + y – 3y
= - 2y

**ACTIVITY:**
Simplify the following:
1) $^5/_9$ (18a – 27x  2) $^1/_5$(20a – 15b)

3) $^1/_9$ (45n – 18m) - $^1/_7$(21n – 35m)  4) ½ (2a – 4b) - $^1/_3$(6a – 12ab)

5) $^2/_9$(18b – 9c) + $^3/_8$(24a – 32b)  6) $^2/_3$(6q – 12p) - $^3/_4$(12q – 8q)

7) Subtract $^2/_3$ of (6x + 9c) from $^3/_4$(8b – 12c).

8) A third the sum of (9x and 12p) minus half the sum of (2x and 6p).

9. Find the difference between $^1/_7$(7ab – 14pq) and $^1/_5$(10ab + 15pq)?

**SUB TOPIC: OPERATIONS ON FRACTIONAL TERMS**
Examples
Workout: (a) $\frac{x}{2} + \frac{x}{3}$  (b) $\frac{m}{2} - \frac{m}{5}$

$\frac{x}{2} + \frac{x}{3} = \frac{(3x x) + (2 x x)}{6}$ LCD = 6  $\frac{m}{2} - \frac{m}{5} = \frac{(10 x m) - (10 x m)}{10}$

$= \frac{3x + 2x}{6}$  $= \frac{5m - 2m}{10}$

$= \frac{5x}{6}$  $= \frac{3m}{10}$

(c) $p + \frac{p}{3}$  (d) $x + \frac{x}{4} - \frac{x}{8}$

$\frac{p}{1} + \frac{p}{3} = \frac{(3 x p) + (3 x p)}{3}$ LCD = 3  $\frac{x}{1} + \frac{x}{4} - \frac{x}{8} = \frac{(8 x x) + (8 x x) - (8 x x)}{8}$ LCD = 8

$= \frac{3p + p}{3}$  $= \frac{8x + 2x - x}{8}$

$= \frac{4p}{3}$  $= \frac{10x - x}{8}$

$= \frac{9x}{8}$

(e) $\frac{x}{2} \times \frac{x}{5}$

$\frac{x}{2} \times \frac{x}{5} = \frac{x \times x}{2 \times 5}$

$= \frac{x^2}{10}$

(f) $\frac{2m}{3} \times \frac{5p}{8}$

$\frac{2m}{3} \times \frac{5p}{8} = \frac{2m \times 5p}{3 \times 8}$

$= \frac{5mp}{12}$

**ACTIVITY:**

Simplify the following:

1. a) $\frac{b}{2} + \frac{b}{5}$ b) $\frac{a}{6} - \frac{a}{8}$ c) $\frac{3x}{2} + \frac{5x}{4}$ d) $\frac{x}{2} + 3x$ e) $5a + \frac{a}{3}$

2. a) $\frac{2k}{3} + \frac{k}{5} + \frac{3k}{2}$. b) $\frac{a+3}{2} - \frac{a+2}{3}$ c) $\frac{2}{7}(2x - 3) - \frac{2}{7}(x + 4$

d) $m + \frac{2m}{3} + \frac{m}{5}$ e) $\frac{6a}{7} + \frac{3a}{5} + \frac{2a}{3}$ f) $\frac{y}{2} + \frac{y}{3} + \frac{y}{4}$

3. (a) $\frac{x}{3} \times \frac{x}{5}$ b) $\frac{w}{11} \times \frac{x}{9}$ c) $\frac{m}{21} \times \frac{3m}{5}$ d) $\frac{3p}{5} \times \frac{4m}{7}$ e) $\frac{k}{21} \times \frac{3k}{15}$

**SUB TOPIC: REVIEW OF SOLVING SIMPLE EQUATIONS**

**Concepts:**

- Collecting like terms and solving simple equations.
- Using inverses to subtract, add and multiply.

Examples

Solve the following equations

(a) $2x + 6 = 18$

$2x + 6 = 18$

$2x + 6 - 6 = 18 - 6$

$\frac{2x}{2} = \frac{12}{2}$

$\therefore x = 6$

b) $-8 + p = 5$

$-8 + p = 5$

$-8 + 8 + p = 5 + 8$

$p = 13$

c) $3a - 8 = 7$

$3a - 8 = 7$

$3a - 8 + 8 = 7 + 8$

$3a = 15$

$\frac{3a}{3} = \frac{15}{3}$

$a = 5$

d) $5x = 25$

Solution

$5x = 25$

$\frac{5x}{5} = \frac{25}{5}$

$\therefore x = 5$

e) $-p = 10$

Solution

$-p = 10$

$\frac{-p}{-1} = \frac{10}{-1}$

$p = -10$

f) $\frac{n}{2} = 8$

$\frac{n}{2} = 8$

$2 \times \frac{n}{2} = 8 \times 2$

$n = 16$

**ACTIVITY:**

Solve the following equations:

1. a) $b - 8 = 3$ b) $5y - 7 = 18$ c) $-3 + 2x = 9$ c) $y + 2 = 10$

d) $3y + 5 = 14$ e) $4p - 3 = 9$ ) $2x = 16$ b) $-2x = 2$ c) $\frac{4}{3}n = 4$

2. a) $6x - 8 = 16$ b) $3x + 5 = 14$ c) $5y + 7 = 17$

## SUB TOPIC: SOLVING EQUATIONS WITH BRACKETS

- Multiply each term inside the bracket by a factor outside it.
- Collect unknown terms first by using the additive inverse.

Examples

1. Solve: $3(x + 2) = 21$

$3(x + 2) = 21$
$3x + 6 = 21$
$3x + 6 - 6 = 21 - 6$
$3x = 15$
$\frac{3x}{3} = \frac{15}{3}$
$\therefore X = 5$

2. Solve: $(2m + 4)\ cm = (m + 6)\ cm$

$\frac{(2m + 4)\ cm}{cm} = \frac{(m + 6)\ cm}{cm}$
$2m + 4 - 4 = m + 6 - 4$
$2m = m + 2$
$2m - m = m - m + 2$
$m = 2$

3. Simplify: $3(2x + 1) - 2(x + 4) = 35$

$3(2x + 1) - 2(x + 4) = 35$
$6x + 3 - 2x - 8 = 35$
$6x - 2x + 3 - 8 = 35$
$4x - 5 = 35$
$4x - 5 + 5 = 35 + 5$
$4x = 40$
$\frac{4x}{4} = \frac{40}{4}$
$X = 10$

4. Solve: $2(3X - 1) - 4(X - 1) = 4$

$2(3x - 1) - 4(x - 1) = 4$
$6x - 2 - 4x + 4 = 4$
$6x - 4x + 4 - 2 = 4$
$2x + 2 = 4$
$2x + 2 - 2 = 4 - 2$
$2x = 2$
$\frac{2x}{2} = \frac{2}{2}$
$x = 1$

## ACTIVITY:

Solve the following equations.

1. a) $5(m + 4) = 30$ b) $7(k - 5) = 70$ c) $2(x + 3) = 18$ d) $4(x - 1) = 28$

2. a) $2(x + 1) + 3(x + 1) = 0$ b) $3(3x - 1) - 6(x - 2) = 24$

c) $5(3x - 1) - 4(3x + 1) = 18$ d) $4(3x - 2) - 5(x - 3) = 28$

3. a) $8x - 13 = 3x - 3$ b) $5(2x - 1) = 5(x + 5)$ c) $4(5x - 3) = 2(5x + 9)$

## SUB TOPIC: SOLVING EQUATIONS WITH SQUARES

- Collect like terms and get the required square root.

Examples:

Simplify the following:

1. $y^2 + 1 = 10$

$Y^2 + 1 = 10$
$Y^2 + 1 - 1 = 10 - 1$
$Y^2 = 9$
$\sqrt[2]{y2} = \sqrt[2]{9}$
$\sqrt[2]{y \times y} = \sqrt[2]{3 \times 3}$
$Y = 3$

2) $x^2 - 3 = 33$

$x^2 - 3 = 33$
$x^2 - 3 + 3 = 33 + 3$
$x^2 = 36$
$\sqrt[2]{x2} = \sqrt[2]{36}$
$\sqrt[2]{x \times x} = \sqrt[2]{2 \times 2 \times 3 \times 3}$
$x = 2 \times 3$
$x = 6$

3) $\frac{1}{2} p^2 = 8$

$\frac{1}{2} p^2 = 8$
$2 \times \frac{1}{2} p^2 = 8 \times 2$
$p^2 = 16$
$\sqrt[2]{p2} = \sqrt[2]{16}$
$\sqrt[2]{p \times p} = \sqrt[2]{2 \times 2 \times 2 \times 2}$
$p = 2 \times 2$
$p = 4$

4. $9n^2 = 121$

Solution

$9n^2 = 121$

$\frac{9n^2}{9} = \frac{121}{9}$

$n^2 = 121$

$\sqrt[2]{n2} = \frac{\sqrt[2]{121}}{9}$

$\sqrt[2]{n \times n} = \frac{\sqrt[2]{11 \times 11}}{3 \times 3}$

$n = \frac{11}{3}$

5) $\frac{2y^2}{3} = 24$

$\frac{2y^2}{3} = 24$

$3 \times \frac{2y^2}{3} = 24 \times 3$

$\frac{2y^2}{2} = \frac{72}{2}$

$y^2 = 36$

$\sqrt[2]{y2} = \sqrt[2]{36}$

$\sqrt[2]{y \times y} = \sqrt[2]{(2 \times 2) \times (3 \times 3)}$

$y = 2 \times 3$

$Y = 6$

**ACTIVITY:**

Simplify the following:

1. a) $x^2 + 11 = 36$ b) $y^2 + 5 = 9$ c) $p^2 + 4 = 20$ d) $q^2 - 7 = 18$

e) $\frac{1}{3}y^2 = 3$ f) $\frac{3}{5}m^2 = 15$ g) $\frac{2}{7}m^2 = 14$ h) $3\frac{1}{8}k^2 = 8$

2. a) $7x^2 = 567$ b) $3n^2 = 75$ c) $4y^2 = 196$

**SUB TOPIC: USING LCD TO SOLVE FRACTIONAL EQUATIONS**

-Multiply by LCM on either side of the expression then solve.

Examples:

Solve the following fractional equations;

1. $\frac{2p}{3} - p = 5$

$\frac{2p}{3} - \frac{p}{1} = \frac{5}{1}$

$3 \times \frac{2p}{3} - \frac{p}{1} \times 3 = \frac{5}{1} \times 3$

$2p - 3p = 15$

$-p = 15$

$\frac{-p}{-1} = \frac{15}{-1}$

$P = -15$

2. $3x + 7 - \frac{3x}{4} = 10$ LCD = 4

$4x \frac{3x}{1} + \frac{7x\ 4}{1} - \frac{3x}{4} \times 4 = \frac{10x4}{1}$

$12x + 28 - 3x = 40$

$12x - 3x + 28 = 40$

$9x + 28 - 28 = 40 - 28$

$9x = 12$

$\frac{9x}{9} = \frac{12}{9}$

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

3) Simplify: $\frac{m + 1}{3} + \frac{m}{4} = 2$

$\frac{m + 1}{3} + \frac{m}{4} = 2$ LCD = 12

$12x \frac{(m + 1)}{3} + 12x \frac{(m)}{4} = 2 \times 12$

$4m + 4 + 3m = 24$

$4m + 3m + 4 - 4 = 24 - 4$

$7m = 20$

$\frac{7m}{7} = \frac{20}{7}$

$M = 2\frac{6}{7}$

4) Simplify: $\frac{3x+ 1}{4} = \frac{x+ 2}{2}$

$\frac{3x + 1}{4} = \frac{x + 2}{2}$ LCD = 4

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

$(3x + 1) = 2(x + 2)$

$3x + 1 = 2x + 4$

$3x + 1 - 1 = 2x + 4 - 1$

$3x = 2x + 3$

$3x - 2x = 2x - 2x + 3$

$x = 3$

**ACTIVITY:**

Solve the following fractional equations below:

1) $\frac{2}{3}x = 10$

2) $2\frac{1}{5}p - 2 = 12$

3) $2\frac{1}{3}x + 2 = 9$

4) $\frac{2}{3}p - 4 = \frac{1}{2}p + 6$

5) $\frac{2}{5}p - p = 6$

6) $\frac{3}{7}x - x = 12$

7) $\frac{3}{7}y - 2y = 34$

8) $5x + 5 - \frac{2}{3}x = 18$

9) $3x - 3 - \frac{4}{7}x = 12$

10) $\frac{3}{5}y + y = 8$

11) $7m - 13 - \frac{3}{13}m = 81$

12) $\frac{m+5}{4} + \frac{m}{5} = 2$

13) $\frac{x+3}{3} = \frac{5x+1}{9}$

14) $\frac{3x-1}{2} = \frac{7x+1}{6}$

15) $\frac{y-5}{2} + \frac{y}{8} = 13$

**SUB TOPIC: APPLICATION (WORD PROBLEMS) ON EQUATIONS**

Examples:

1. Baker bought 2kg of sugar at sh.3p and 1kg of salt at sh (p + 200). Find p if Baker paid sh. 3,700 altogether.

2kg of sugar = sh.(2 x 3p) = sh.6p.
1kg of salt = sh. (p + 200)
Total cost = sh.3,700
6p + p + 200 = 3,700
7p + 200 = 3,700
7p + 200 – 200 = 3,700 – 200
7p = 3,500

$\frac{7p}{7} = \frac{3,500}{7}$

P = sh. 500

2. Okiru had shs4,000 less than Obbo and Oketch had twice as much as Obbo. If they had sh.12,000 altogether, how much did each boy have?

Let Obbo's amount be k
Obbo had sh.k
Okiru had sh.(k – 4,000)
Oketch had sh.(2 x k) = sh.2k
Total amount = sh.12,000
K + 2k + k – 4,000 = 12,000
4k + 4,000 = 12,000
4k + 4,000 – 4000 = 12,000 – 4,000
4k = 8,000

$\frac{4k}{4} = \frac{8,000}{4}$

K = 2,000

**ACTIVITY:**

1. At Mama Joan's shop, an exercise book costs three times as much as a pen. Aguti bought 6 pens and 3 books from the shop. If she used sh.7,200 altogether.

a) Find the cost of a pen.
b) How much money did she spend on books?

2. In a market, the cost of a pawpaw is sh.800 more than the cost of a mango. A mango costs two- thirds of the cost of a pineapple. The total cost of the three fruits is sh.4,300. Calculate the cost of the pineapple.
3. A book costs shs(x +300) and a pen costs shs(x +100). If Timothy paid sh.2,100 for 3 books and 2 pens.
a) Find the value of x. b) How much money did he pay for all the books?
4. Peter got 4 pens more than Sarah and Jane got twice as many as Peter. If they both shared 20 pens, how many pens did Jane get?
5. Katabira had (3m + n) goats and later sold off (m – 2n) goats. How many goats did she remain with?
6. Akol walks 2 km more than Akello when going to school. If they walk 8 km altogether, what distance does each girl walk?
7. Kalema bought 2 kg of sugar at sh. 3p per kg and 1kg of salt at sh.(p + 200). If Kalema paid sh.3,700, find the value of p.
8. Nyakato went to the market to sell eggs. She sold them in trays. Each tray cost shs.p. If she sold 30 trays of eggs for shs.2,400, what was the cost of each tray?
9. Mr. Walimbwa bought two items; a plate and a spoon. The cost of the plate was four times that of a spoon. If the cost of the two items was sh.12,000; what was the cost of the spoon?
10. A cow costs shs.200,000 more than that of a goat. If the total cost of a cow and a goat is shs.320,000. Find the cost of each of them.
11. Sh. 7,000 is shared among A, B and C such that B gets sh. 600 less than A and C gets twice as much as A gets. How much does each get?

## SUB TOPIC: MORE ABOUT FORMING AND SOLVING EQUATIONS

- Words for addition include: sum, older, greater, more, total, altogether, increase.
- Words for subtraction are: difference, younger, less, range, and decrease.
- Words that refer to multiplication include: product, of, double, times.

Examples:

1. John is 12 years older than Mary. If their total age is 78 years, how old is Mary?

Let Mary's age be x.

| Mary's age | John's age | Total ages |
|---|---|---|
| (x) years | (x + 12) years | 78 years |

(x) + (x + 12) = 78
X + x + 12 = 78
2x + 12 = 78
2x + 12 – 12 = 78 – 12
2x = 66
$\frac{2x}{2} = \frac{66}{2}$
X = 33

Mary's age = (x) years
= 33 years
Mary is 33 years old.

2. A man is 15 years older than his son. In 5 years' time, he will be twice as old as his son. How old is each now?

Let n be the son's age now.

| | Son | Father |
|---|---|---|
| Now | ( n) yrs | (n + 15)yrs |
| In 5 years' time | 2(n + 5) yrs | (n + 15 + 5)yrs |

2(n + 5) = (n + 15 + 5)
2n + 10 = n + 20
2n + 10 – 10 = n + 20 – 10
2n - n = n – n + 10
∴ n = 10

(i) The son's age is 10 years.

(ii) Father's age now = (n + 15)yrs
= 10 + 15
= 25 yrs

**ACTIVITY:**

1. Samuel is 12 years older than Doreen. If their total age is 45 years, how old is Doreen?
2. Peter is 5 years younger than Timothy. If their total age is 39 years, how old is each of them?
3. Bosco is twice as old as Tinah. If their total age is 33 years, how old is Tinah?
4. Mercy is thrice as old as Victor. In 14 years' time, Mercy will be twice as old as Victor. How old is each of them now?
5. Felix is 10 years older than Divine. In 5 years' time, Felix will be twice as old as Divine. How old is each of them now?
6. Jane is 27 years old and Joshua is 7 years old. In how many years' time will Jane be twice as old as Joshua?
7. A mother is 15 years older than her daughter. Six years ago, their total age was 53 years. How old was the mother six years ago?
8. A father is 10 years older than the son. In five years' time, the sum of their ages will be 50 years.

a) How old is the son now?
b) How old will the father be in five years' time?

9. Hillary is four times as old as his daughter. After six years, the difference in their ages will be 30 years. How old is Hillary now?

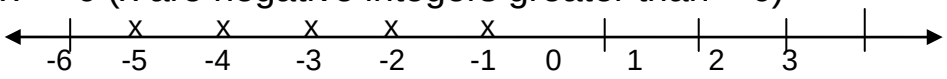
**SUB TOPIC: SOLUTION SETS**

- A solution set is a set of all possible values to the unknown in an inequality.
- List the first 5 or 6 then put 3 dots to show that they continue (infinity).
- For inequalities with $<$ and $>$ exclude the given number(s) in the solution set
- For inequalities with $\leq$ and $\geq$ include the given number (s) in the solution set.

Examples

1. If X is a negative integer, find the solution set for x > - 6.

x > ⁻6 (x are negative integers greater than – 6)

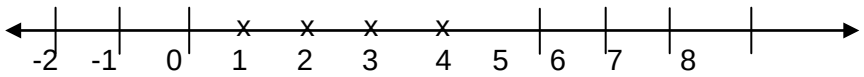



∴ X = {-5, -4, -3, -2, -1}

The solution set for x > - 5 is $\{-5, -4, -3, -2, -1\}$

2. If y is a positive integer, find the solution set for y < 5.

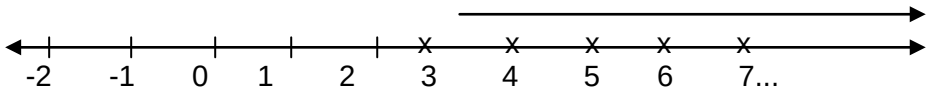
y < 5 (integers less than 5)




:. The solution set for $y < 5$ is $\{1, 2, 3, 4\}$

3. Find the solution set for X ≥ 3. If X is a whole number

X ≥ 3 (greater than and equal to 3) or are integers from 3 and above.

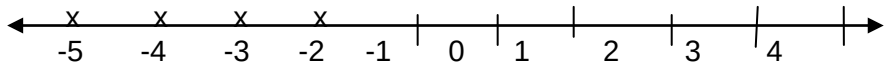



:. The solution set for X ≥ 3 is {3, 4, 5, 6, 7,...}

4. Find the solution set for y ≤ ⁻2. If y is a negative integer

Solution

Y ≤ -2 {less than and equal to ⁻2}




:. The solution set for Y is {….., -5, -4, -3, -2}

**ACTIVITY:**

Find the solution set for:

1) x>6 where x is a whole number. 2) x≤5 where x is a square number.
3) y ≥ 0 where y is an even number
4) k ≥ ⁻6, where k is a negative integer.
5) m ≥ ⁻2 where m is a negative integer.
6) x < 3 where x are negative integers .
7) k ≥ 0 where k is an even number less than 10.
8) x ≤ ⁻10 where x are negative integers less than 15.
9) x ≤ 8 where x is a positive integer.
10) x ≤ 1 where x are whole numbers.

**SUB TOPIC: MORE ABOUT SOLUTION SETS**

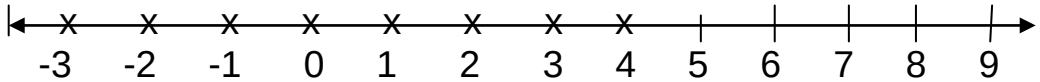
- Read from the middle, leftwards then later read rightwards.
- Here, the integers can be determined i.e is a finite set.

Examples

1. Find the solution set for ⁻3< x < 5

⁻3 < x < 5 Here, x are {integers greater than ⁻3 but less than 5}

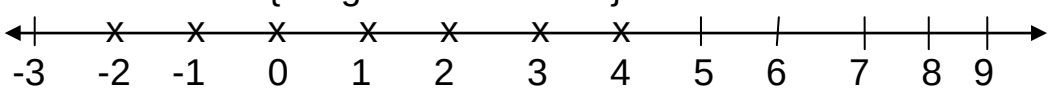
Or = {integers between ⁻3 and 5}




:. X = {⁻2, ⁻1, 0, 1, 2, 3, 4}

2. What is the solution set for: ⁻2 ≤ x ≤ 4?

⁻2 ≤ x ≤ 4 = {integers from ⁻2 to 4}




:. X = {⁻2, ⁻1, 0, 1, 2, 3, 4}

**ACTIVITY:**

Find the solution set for each of:

1) $^{-}1 < y < 3$ 2) $-2 \leq y \leq 2$ 3) $^{-}3 < y < 4$

4) $3 > x > {}^{-}3$ 5) $2 > x > -4$ 6) $3 \geq x \geq {}^{-}3$

**SUB TOPIC: SOLVING INEQUALITIES**

The signs change when you divide by a –ve or the terms are reverse.

Examples:

1. Find the solution set from $3x - 3 < 12$

Solution

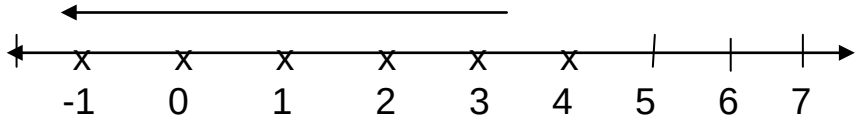
$3x - 3 < 12$

$3x - 3 + 3 < 12 + 3$

$3x < 15$

$\frac{3x}{3} < \frac{15}{3}$

$\therefore X < 5$ (integers less than 5)




$\therefore$ The solution set for $X = \{\ldots -1, 0, 1, 2, 3, 4\}$

2. Solve and find the solution set for $2x < 3$

Solution

$2x < 3$

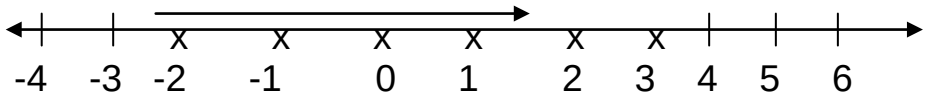
$\frac{}{-2}$

$^{-}2 \times \frac{2x}{-2} > 3 \times {}^{-}2$

$2x > {}^{-}6$

$\frac{2x}{2} > \frac{{}^{-}6}{2}$

$\therefore X > -3$ (integers greater than -3)




$\therefore X = \{-2, -1, 0, 1, 2, 3\ldots\}$

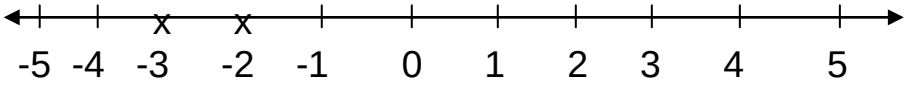
3. Find the solution set for $8 > {}^{-}2x > 2$

Solution

$8 > -2x > 2$

$\frac{8}{-2} < \frac{2x}{-2} < \frac{2}{-2}$

$-4 < x < -1$ (integers greater than -4 but less than -1)




$\therefore X = \{-3, -2\}$

**ACTIVITY:**

Solve and give the solution set for each of:

1) $x + 3 > 3$ 2) $y - 5 \geq 7$ 3) $-9p \geq 45$ 4) $3x + 3 \leq -6$

5) $3m \leq 3$ 6) $3(x - 12) \leq 15$ 7) $16 \geq -4x \geq 12$ 8) $6+1 < n + 3$

## SUB TOPIC: WORD PROBLEMS IN INEQUALITIES

- Re-name the solution set with any letter.

Examples

1. The H/M's car can accommodate maximally 5 people. Put this information in an inequality form.

Let y be inequality

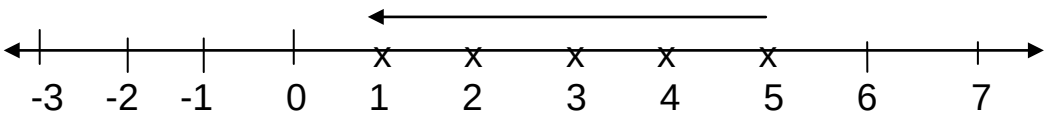
Maximally 5 people = less than and equal to 5

:. $Y \leq 5$

Give the solution set for the above inequality.

Solution

$Y \leq 5$ = (integers less than and equal to 5)




:. Y = {… 1, 2, 3, 4, (5)} – infinite solution set

2. The interview panel can interview more than six people but less than thirteen people a day. What possible number of people can the panel interview?

Let k be the inequality more than six but less than 13

:. $6 < k < 13$

Solution set for K = {7, 8, 9, 10, 11, 12} – finite solution set

3. What number can be added to seven to give a number greater than15?

Let n be the number

$n + 7 > 15$

$n + 7 - 7 > 15 - 7$

$n + 0 > 8$

:. $n > 8$

Solution set for n = {9, 10, 11, 12, …} – infinite solution set

## ACTIVITY:

1. What counting digit can be added to 4 to give a number less than 5?

2. Okullo is 8 years, Make is 6yrs, and Nakato is 3 years old. A school admits pupils from the age of 5 to 11. Which of these pupils will not be accepted?

3. A ticket states that for children 8 years and below enter freely. Which of these will gain entry? Kato 8yrs, Sarah 7yrs, Asio 10yrs and Abbey 4yrs

4. A doctor prescribed a dosage for children, she said for children above 8yrs but not more than 17yrs take 2 spoons a day. Write an inequality using d.

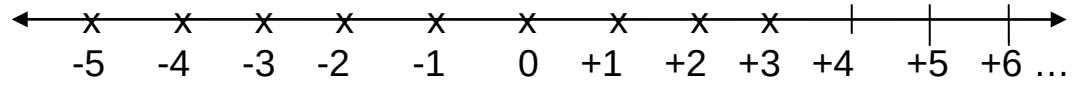
## SUB TOPIC: WRITING INEQUALITIES FOR GIVEN SOLUTION SETS

**Concepts:**

- Re-name the solution with any letter.
- Describe the solution set (arrangement of integers on the number line).

Examples

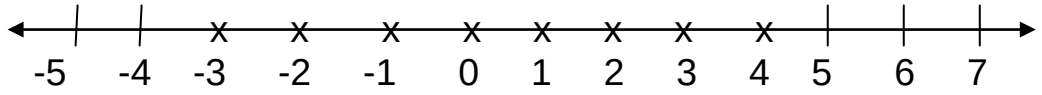
1. Write an inequality for the solution sets given below.



Let x be the inequality

X = {integers from $^{-}4$ to 4} Or X = {integers between $^{-}5$ and 5}

∴ The inequality for the solution set is $^{-}5 < x < 5$

2. 

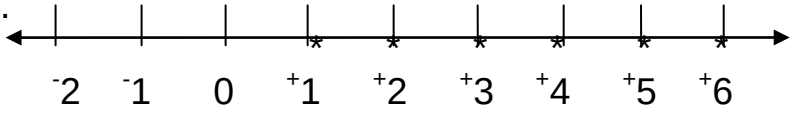

Let y be the inequality

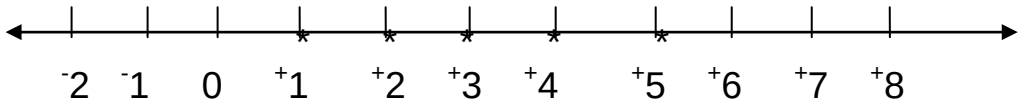
Y = {integers between $^{-}4$ and 5} OR y are {integers from $^{-}3$ to 4}

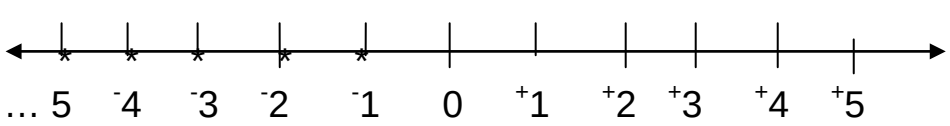
The inequality for the solution set is $-3 \leq y \leq 4$

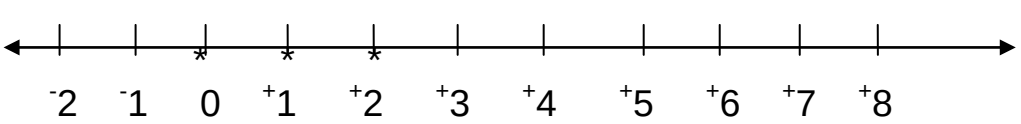
**ACTIVITY:**

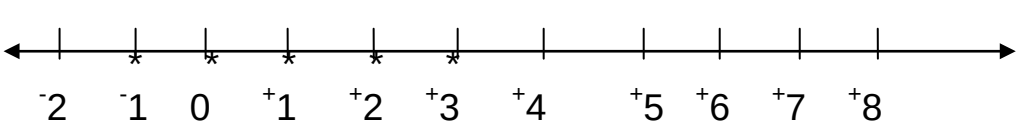
The number lines below show possible values of x. List the members of each set.

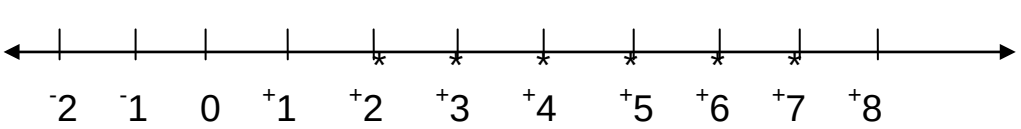
1. 


2. 


3. 


4. 


5. 


6.