

STUDY NOTES

BASIC MATHEMATICS FORM ONE

CHAPTER 1: NUMBERS

What is numbers?

Numbers are symbols or words which represent quantity of something for example in form 1B there are forty four students.

i.e. 44 students

The numbers are represented by symbols called numerals.

Each symbol in a numeral is called a digit.

E.g. In 256 there are three digits 2, 5, and 6.

There are ten digits which are 0, 1, 2, 3, 5, 6, 7, 8, and 9

Each digit in a numeral has a value called place value.

Example in 316, 6 is called ones and can be written as 6×1 , 1 is called tens and is written as 1×10 and 3 is called hundreds written as 3×100 .

Therefore 316 can be written as $3 \times 100 + 1 \times 10 + 6 \times 1$ this form is called expanded form.

The system where numbers are in groups of ten is called base ten numerations or decimal system numeration. The place value of every digit in decimal system numeration is ten times the place value of the next to the right.

Table of place values:-

Billion	Hundred million	Ten Million	Million	Hundred thousand	Ten thousand	Thousand	Hundred	Tens	Ones
4	8	9	6	0	1	2	6	5	2

Exercise 1.1

1. Write each of the following numbers in expanded form:-

- 94 =
- 7019 =
- 50 =
- 303 =
- 5003 =
- 500 =
- 999 =
- 5 =
- 5000 =

2. Find the place value of the following:-

- 513 (1)
The place value of 1 is
- 357999 (5)

The place value of 5 is

(c) 50149 (5)

The place value of 5 is

(d) 8665 (8)

The place value of 8 is

(e) 227 (7)

The place value of 7 is

(f) 900412 (4)

The place value of 4 is

3) Write the numerals for each of the following:-

(a) $9 \times 100 + 0 \times 10 + 1 \times 1$

(b) $5 \times 10000 + 5 \times 1000 + 5 \times 100 + 5 \times 10 + 5 \times 1$

(c) $6 \times 100000 + 8 \times 10000 + 0 \times 1000 + 1 \times 100 + 7 \times 10 + 0 \times 1$

(d) $5 \times 100 + 0 \times 10 + 1 \times 1$

1:2 NATURAL AND WHOLE NUMBERS

Natural numbers

Natural numbers are the ones that begin with 1,2, 3 to infinity.

They are counting number, they are denoted by N

Number line of natural numbers.



Whole numbers

Are the ones that begin by 0, 1, 2, 3, to infinity? They are denoted by W, in a number line.



Even, odd and prime numbers:-

Even: are natural numbers which are divisible by 2 without remainder.

Example: - 2, 4, 6, 8, 10, 12.

Odd:-

Odd numbers are natural numbers which are not divisible by 2, when they are divided by 2 they give remainder, so the answer is not a natural numbers.

E.g: 1, 3, 5, 7, 9, 11.....

Prime numbers:-

Prime numbers are natural numbers which are divisible by one and by themselves.

They are the ones with only two factors.

E.g. 2, 3, 5, 7, 11, 13

Numbers up to one billion:

Ten	10
Hundred	100
Thousand	1,000
Ten thousand	10,000
Hundred thousand	100,000
One million	1,000,000
Ten million	10,000,000
Hundred million	100,000,000
One billion	1,000,000,000

EXERCISE 1:2

1. For the given numbers below, write down which are:-

(a) Even (b) Prime (c) Odd

9, 12, 15, 17, 25, 36, 37, 38, 39, 40, 41, 42, 43, 44, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71.

2. Write down the prime numbers between 70 and 90.

3. Write down a number which is even and prime

4. Among the numbers 3, 5, 7, 9, 11,

13. What is not a prime number?

5. Show even, odd, and prime numbers less than 10 on separate number

6. (a) Given any point as a number on a number line for N or W.

Can you always name another one to the right of it?

7. Given any two points as numbers one after another on a number line for N or W. Can you find the whole numbers between them?

8. Do the points representing N and W on a number line completely fill the number line?

9. How does N differ from W.

More examples

1. Write the following numerals in words:-

(a) 72 - Seventy two

(b) 10368 - Ten thousand three hundred and sixty eight.

(c) 1152 - One thousand one hundred and fifty two.

(d) 144 - One hundred and forty four.

(e) 573921 - Five hundred and seventy three thousand nine hundred and twenty one

(f) 952675 - Nine hundred and fifty two thousand six hundred and seventy five

(g) 105, 451, 225 - One hundred and five million, four hundred and fifty one Thousand, two hundred and twenty five

2. Express the statement in numerals:-
Nine billion eight hundred million

and two hundred = 9,800,000,200.

3. Write down the largest four digit number = 9,999.

4. Write down the largest four digit number when the digits are not repeating = 9876.

5. Write down the smallest three – digit number without using a zero = 111

6. Change the order of the digits in 47986 to make:

(a) The largest possible number = 98764

(b) The smallest possible number = 46789

7. Write down the number with 6 in the hundred place, 9 in the tens place, 0 in the thousands place, 4 in the units place and 3 in the ten thousands place. 30,694

8. Write down next three counting numbers after 6999.

7000, 7001, 7002

9. Write the numbers in words:-

(a) 6054 - Six thousand and fifty four

(b) 3,250,000 - Three million two hundred and fifty thousand.

(c) 106,000 - One hundred and six thousand

(d) 100,600 - One hundred thousand and six hundred.

(e) 100,006 - One hundred thousand and six.

(f) 205,020 - Two hundred and five thousand and twenty.

(g) 2,415,982,728 - Two billion, four hundred and fifteen million, nine hundred and eighty two thousand, seven hundred and twenty eight.

10. Write in numerals:-

(a) Six hundred seventy five - 675

(b) Four hundred and five - 405

(c) Three thousand and sixteen - 316

(d) Eight thousand and sixteen - 8016

(e) One hundred thirty seven thousand two hundred and fourteen - 137214

(f) One million five hundred thousand - 1,500,000

(g) Two million twenty three - 2,000,023

(h) Nineteen thousand and forty five - 19,045

(i) One billion fourteen million two hundred and fifteen thousand - 1,014,215,000

Operations with whole numbers:-

There are four operations which are addition, subtraction , multiplication and division.

ADDITION (PLUS) (+):-

i) Horizontal addition

E.g. $254 + 369 = 623$

$14796 + 230 + 14 = 15030$

ii) Vertical addition:-

E.g.
$$\begin{array}{r} 34567 \\ + 81259 \\ \hline 115826 \end{array}$$

$$\begin{array}{r} 243 \\ + 46897 \\ \hline 47140 \end{array}$$

The answer obtained after adding is called sum.

SUBTRACTION (-) (MINUS):-

i) Horizontal subtraction

E.g. $2349610 - 1396789 = 952821$

$129 - 98 = 31$

The answer obtained after subtracting numbers is called Difference.

ii) Vertical subtraction:-

$$\begin{array}{r} \text{E.g.} \quad 24987 \\ - \quad 19898 \\ \hline \quad 5089 \\ \hline \end{array}$$

E.g.

DIVISION ($\div$)

$$a \div b = c$$

a = dividend

b = divisor

c = quotient

Short division

$$\begin{array}{r} 9 \overline{) 8573913} \\ \underline{952657} \end{array}$$

$$7 \overline{)$$

Multiplication /Times (x)

$$a \times b = c$$

a = Multiplicand

b = Multiplier

c = Product

There are two types of Multiplication

Horizontal multiplication

$$\text{E.g. } 2486 \times 7 = 17402$$

$$\text{E.g. } 126 \times 8 = 1008$$

Vertical – multiplication:-

$$\begin{array}{r} \quad 4569 \\ \times 4561 \\ \hline \quad 4569 \\ 27414 \\ 22845 \\ 18276 \\ \hline 20839209 \\ \hline \end{array}$$

The number that multiplies is called Multiplier

The number to be multiplied is called multiplicand

The answer obtained after multiplication is called product.

Long or vertical division

$$\begin{array}{r} 735 \\ 15 \overline{) 11029} \\ \underline{105} \\ 52 \\ - 45 \\ \hline 79 \\ \underline{75} \\ 4 \end{array}$$

Q = 735 remainder 4

The number that divides is called **divisor**

The number to be divided is called **dividend**.

The answer obtained after division is called **Quotient**.

The left over upon division is

called **Remainder**.

e.g. $29 \div 6 =$

$$\begin{array}{r} 4 \\ 6 \overline{) 29} \\ \underline{- 24} \\ 5 \end{array}$$

- Quo
- Nun
- Rer

$N = Q \times D + R$

$$29 = 4 \times 6 + 5$$

Word problems on whole numbers

1. E.g In a school garden there are four rows of cabbage with 12 in each row, six rows of tomatoes with eight in each row.

How many plants of each kind are there?

Solution:-

1 row = 12 cabbage

4 rows = x

x = 12 cabbages x 4 rows

x = 48 cabbages

1 row = 8 tomatoes

6 row = x

X = 8 tomatoes x 6 rows

X = 48 tomatoes

There are 48 cabbages plants

48 tomatoes plants

2. Two thousand four hundred shillings are deposited by a teacher each month, How much is this after two years?

Solution:-

2400shs = 1 month

1 year = 12 months

2 yrs = 24 months

2400shs x 24 months

$\therefore = 576000/=$

More examples

1. $324 + 1984$

Solution:-

$$\begin{array}{r} 324 \\ + 1984 \\ \hline 2308 \end{array}$$

2. $28782 - 2784 + 294$.

Solution:-

$$\begin{array}{r} 28782 \\ - 2784 \\ \hline 25998 \\ + 294 \\ \hline 26292 \end{array}$$

3. $\begin{array}{r} 2745 \\ + 1948 \\ \hline 4693 \end{array}$

4. $\begin{array}{r} 2479249872 \\ - 944129872 \\ \hline 1535120000 \end{array}$

Will the sums of the following be even or odd:-

5. Two numbers which are Odd.

The answer must be even.

6. Two numbers which are even.

Even numbers

7. An odd and even number

Odd numbers

8. Any two odd numbers.

Even numbers

9. Use horizontal way to find products in questions:-

1. $128 \times 5 = 640$

2. $195 \times 9 = 1755$

3. $17289 \times 2 = 34578$

10. Use long multiplication method to evaluate:-

249752×8921

Solution:-

$$\begin{array}{r}
 249752 \\
 \times 8921 \\
 \hline
 249752 \\
 499504 \\
 2247768 \\
 1989016 \\
 \hline
 2219037592
 \end{array}
 \quad \therefore = \underline{221}$$

11. Find the product and quotient of the following

(a) 247×100

Soln:-

$$\begin{array}{r}
 247 \\
 \times 100 \\
 \hline
 000 \\
 000 \\
 247 \\
 \hline
 \therefore \underline{\underline{24700}}
 \end{array}$$

(b) $4000 \div 100$

Soln:-

$$\begin{array}{r}
 40 \\
 100 \overline{) 4000} \\
 \underline{400} \\
 0 \quad \therefore = \underline{40} \\
 \underline{0} \\
 -
 \end{array}$$

Revision exercise

1. In a school garden there are 4 rows of carrots with 10 in each row.

How many plants are there?

2. Six students were given 96,000 shillings to share equally. How many shillings did each student get?

3. The cost of one kilogram of sugar is 700 shillings and Juma buys 8 kgs of sugar.

How much did cost him?

4. Richard sold 240 copies of the daily news paper for 300 shillings each, 198 pieces of the Uhuru news paper for 200 shillings and 6 sports magazine for 500 shillings each. How much did he collect in all?

5. There are 17 streams in a school, each stream has 35 pupils. How many pupils are there in the school.

6. A page of a book has 36 lines. If each line contains 14 words, how many words are these if the book has

250 pages?

7. Jim's school is 13 km from his home. If he goes to school daily how many kilometers does he travel in 196 days.

8. Each day a school shop collects sh. 75000 from the customers. If the collection was made for eight days and sh. 275000 of the collected money was used to make a fence for the school. How much money was left?

9. A school collects 140 eggs from its poultry farm each day. Each egg costs 80shillings. How much money per day does the school earn in selling the eggs?

10. A school of 900 students has decided to make uniforms for each student. If a shirt and a pair of trousers need 2 m and 1.5 m respective, How much of each material of cloth will the school need so as to give uniforms to all students.

SOLUTIONS

Qn 1.

4 rows @ 10 plants

$4 \times 10 = \text{Total plants}$

40

There are 40 carrot plants.

Qn 2.

6 students = 96000 shillings

$$\begin{array}{r} 16000 \\ 6 \overline{) 96000} \\ \underline{6} \\ 36000 \\ \underline{36000} \end{array}$$

Each student got 16000shs

Qn 3.

1kg=700shs.

Juma buys 8 kgs

$700 \times 8 = 5600$

It cost him 5600/=

Qn 4.

$240 \times 300 = 72000$

$198 \times 200 = 39600$

$6 \times 500 = 3000$

1146000.

: - He

Qn 5.

17 streams $\times$ 35 pupils

$17 \times 35 = 595$

Therefore the total number of pupils in t

Qn 6.

36 lines $\times$ 14 words

$$36 \times 14 = 504 \times 250 \text{ pages}$$

126,000 Words

Qn 7.

$$1 \text{ day} = 26 \text{ km}$$

$$196 \text{ days} = x \text{ km}$$

$$196 \times 26 = x =$$

$$5096 \text{ km}$$

He travel 5096 km

Qn 8.

$$8 \text{ days} = 75000 \times 8$$

$$600,000 / =$$

$$600,000$$

$$- \quad \underline{275,000}$$

$$\underline{325,000}$$

$$\therefore \underline{325,000 / = \text{ was left}}$$

Qn 9.

Qn

10.

Each egg costs = 80 shillings

Each day 140 eggs

We multiply 140×80

$$= 112000$$

The School earns 112000 each day.

$$900 \times 2\text{m} = 1800\text{m}$$

$$900 \times 1.5 = 1350\text{m}$$

The school will need 1800m and 1350 m

ORDER OF OPERATIONS

The order of priority is often given by the word BODMAS to mean

B rackets

O rders

D ivision

M ultiplication

A ddition

S ubtraction

so first perform any operation in brackets, Then any use of orders division or multiplication followed by Addition or subtraction

Example : evaluate the following

$$(a) \quad 12 + 4 \times 2 = 12 + (4 \times 2)$$

$$= 12 + 8$$

$$\underline{12 + 4 \times 2 = 20}$$

$$(b) 20 \div 2 + 3 = (20 \div 2) + 3 \\ = 10 + 3$$

$$(c) 4 \times 3 + 7 \times 2 = (4 \times 3) + (7 \times 2) \\ = 12 + 14 \\ = 26$$

1:4 FACTORS AND MULTIPLES OF NUMBERS

When a number divides exactly into another number, it is called a factor of a second number.

The second number is called a multiple of the first numbers.

e.g $16 \div 8 = 2$ So 2 is the factor of 16 and 16 is the multiple of 2. Other factors of 16 are 8, 4, 1 and 16.

In general one (1) is a factor of every number and each number is a factor of itself.

- Factors of a number are numbers less than the given number.

- Factors are finite, and divisors of the given number.

- Multiple are number greater than the given number.

-They are infinite and dividend of a particular number.

E.g Factors of 36 = 1, 2, 3, 4, 5, 6, 9, 12, 18, and 36

Multiple of 3=3,6,9,12,15,18,21,24,27,30.....

PRIME FACTORIZATION

Is the process of writing numbers using their prime factors we use the short division in writing / factorization. E.g Write the following as the product of their prime factors.

1

2	24
2	12
2	6
3	3
	1

$$\therefore 24 = 2 \times 2 \times 2 \times 3$$

2

2	48
2	24
2	12
2	6
3	3
	1

$$\therefore 48 = 2 \times 2 \times 2 \times 2 \times 3$$

3

2	420
2	210
3	105
5	35
7	7
	1

$$\therefore 420 = 2 \times 2 \times 3 \times 5 \times 7$$

4

2	360
2	180
2	90
3	45
3	15
5	5
	1

$$\therefore 360 = 2 \times 2 \times 2 \times 3 \times 3 \times 5$$

THE LOWEST COMMON MULTIPLES (LCM)

LCM is the short form of lowest or least common multiple .

E.g 2 = 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24-.....

3 = 3, 6, 9, 12, 15, 18, 21, 24
27, ...

Common multiples are = (6, 12, 18, and 24)

LCM = 6

E.g Find the lowest common multiples of 9, 18, 24

Soln

9 = 9, 18, 27, 36, 45, 54, 63, 72, 81, 90, 99, 108, 117, 126.....

18 = 18, 36, 54, 72, 90, 108, 126, 144, 162, 180, 198.....

27 = 27, 54, 81, 108, 135, 162, 189.....

Common multiples are={54,108....}

The least common multiples=54

Exercise 1:5

1. Match the property in left column and right column then name the property

Left hand column	Right hand column
(a) $2 + (3 + 5) + 5$	(h) $(2 + 3)$
(b) $1 + (2 + 3) + 1$	(i) $(2 + 2)$
(c) $2 + (2 + 1) + 4$	(j) $(8 + 4)$
(d) $4 + (3 + 5) + 2 + 3$	(k) $(1 + 2) + 3$
(e) $1 + (1 + 3) + 5 + 4$	(l) $(3 + 5) + 4$
(f) $8 + (4 + 4) + 1 + 3$	(m) $(1 + 1) + 3$
(g) $(1 + 3) + 1 + (1 + 3)$	(n) $1 + 1 + (1 + 3)$

solution

- a and h have Associative property
b and k have Commutative property
c and l have Associative property
e and m have Commutative property
f and j have Associative property

g and n have Commutative property.

2. By using properties of whole numbers give reasons why each of the following two expressions are equal.

(a) $5 + (6 + 7) = (7 + 6) + 5$

- The answer to the two expressions will be the same because they numbers have commuted.

(b) $(8 + 3) + 4 = 8 + (4 + 3)$

- When you solve this you will get the same answer because of the exchange of the numbers.

(c) $5 + (2 + 1) = 1 + (3 + 2)$

- In this expression, we have seen that they are two different expressions so you cannot get the same answer from the two.

(d) $(5 + 3) + 2 = 3 + (2 + 5)$

- In this two expression you can get the same answer because only the position of numbers and brackets as the one that has changed.

3. Telling / writing equal expressions:-

(a) $2 \times (5 \times 3) = (2 \times 5) \times 3$ -

Associative property

(b) $4 \times (3 \times 5) = (4 \times 3) \times 4$ -

Associative property

(c) $2 \times (4 \times 7) = 7 \times (2 \times 4)$ -

Associative property

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

Commutative property

(e) $(3 \times 2) \times 6 = 16 \times (2 \times 2)$ -

Commutative property

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

Commutative property

4. Why is it permitted to write $3 \times 2 \times 5 \times 9$ without any brackets?

Because even if they are written without brackets they don't destroy the meaning of the question / statement.

5. Express each of the following in the form of $(a \times b) + (a \times c)$

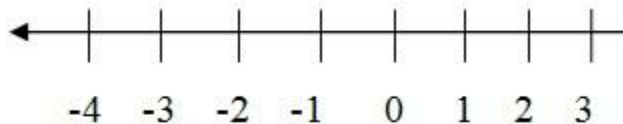
(a) $2 \times (3 + 5)$

$$\begin{aligned}
 &= (2 \times 3) + 2 \times 5 \\
 \text{(b)} \quad &4 \times (3 + 10) \\
 &= (4 \times 3) + 4 \times 10 \\
 \text{(c)} \quad &2 \times (3 + 7) \\
 &= (2 \times 3) + 2 \times 7 \\
 \text{(d)} \quad &4 \times (3 + 1) \\
 &= (4 \times 3) + 4 \times 1
 \end{aligned}$$

6. Express each of the following in the form $a \times (b + c)$

$$\begin{aligned}
 \text{(a)} \quad &(2 \times 5) + 2 \times 3 \\
 &= 2 \times (5 + 3) \\
 \text{(b)} \quad &(5 \times 3) + 5 \times 7 \\
 &= 5 \times (3 + 7) \\
 \text{(c)} \quad &(2 \times 1) + (2 \times 3) \\
 &= 2 \times (1 + 3)
 \end{aligned}$$

Starting from 0 to the right and other numbers from 0 to the left
Number line for Z



If we want to know which number is larger than the other we have to consider which one is to the right or left

Consider the following

$$\begin{aligned}
 \text{(d)} \quad &(7 \times 3) + (7 \times 1) \\
 &= 7 \times (3 + 1)
 \end{aligned}$$

7. Calculate the following:-

$$\begin{aligned}
 \text{(a)} \quad &14 \times 5 + 16 - 4 = 82 \\
 \text{(b)} \quad &36 \times 72 \div 4 = 648 \\
 \text{(c)} \quad &(144 + 20) \times 48 + 4 \div 2 = 7872 \\
 \text{(d)} \quad &24 \times (10 + 54) + 8 = 192.
 \end{aligned}$$

1:5 INTEGERS

The integers are whole numbers from negative infinity to positive infinity. They are denoted by Z.

The order of the size of the number 1, 2, 3, 4..... Can be represented as points on a number line



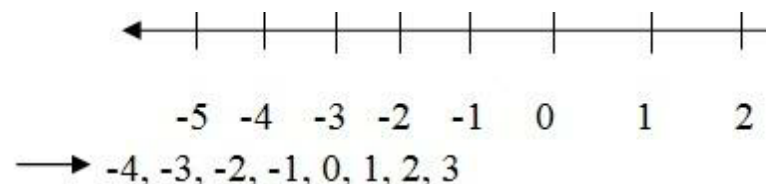
Here $a < b$ or $b > a$, $b < c$ or $c > b$, and $c < d$ or $d > c$

Summary:

$<$	= Less or smaller than	}	
$>$	= Greater or bigger than		
$\leq$	= Less or equal	}	inclu
$\geq$	= Greater or equal		
$=$	= Equal		

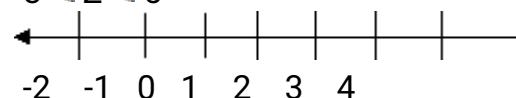
e.g. write down all the integers between -5 and 4

Solution

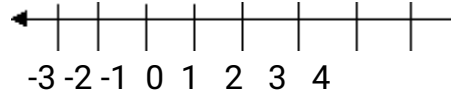


Example: present on a number line

$$-3 < Z < 5$$



$$-3 \leq Z < 5$$



OR

Operation with integers

Integers can be operated using number lines except for division

Addition

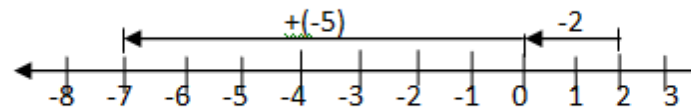
Addition of integers

RULE1: To add a negative integer you move to the left on the number line.

Example

$$-2 + (-5) = -7$$

Start at -2 move 5 steps to the left or
Start at 0 move 2 steps to the left then
5 steps to the left

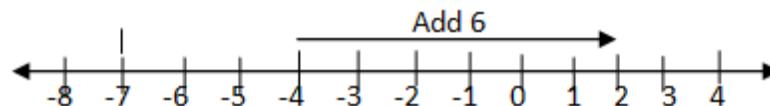
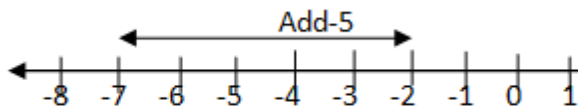


RULE2: To add a positive integer you move to the right on number line.

Example

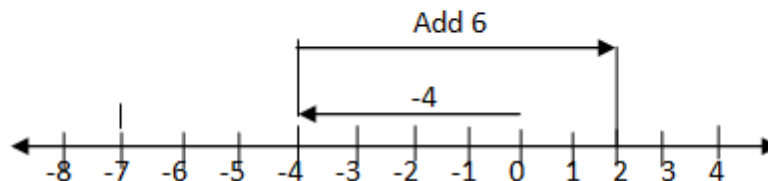
$$-4 + (+6) = +2$$

Start at -4 move 6 steps to the right



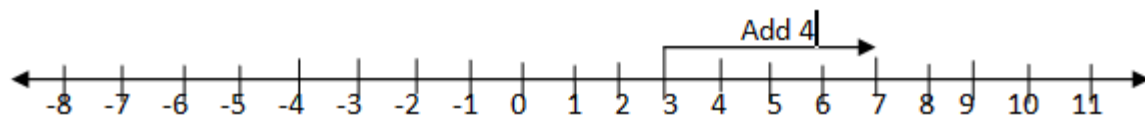
OR

Start at 0 move 4 steps to the left then 6 steps to the right



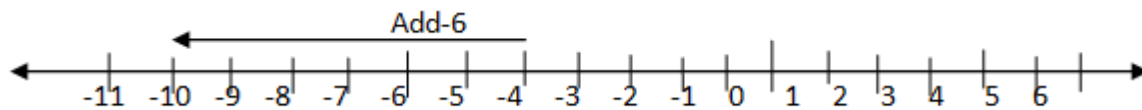
$$+3 + (+4) = 7$$

Start at +3 move 4 steps to the right



$$-4 + -6 = -10$$

Start at -4 move 6 steps to the left



Subtraction of integers

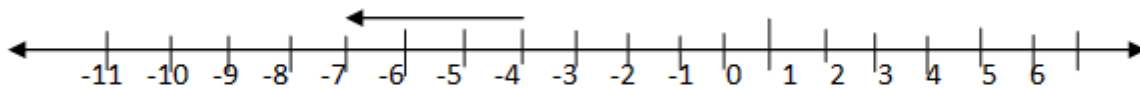
Subtraction of positive integers gives the same result as addition of integers

RULE 1

To subtract a positive integer you move to the left on the number line.

Example $-4 - (+3) = -7$

start at -4 move 3 steps to the left



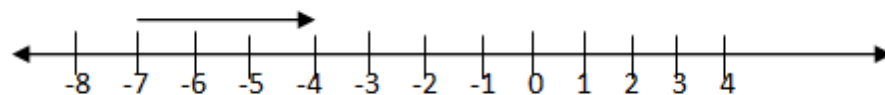
RULE2

To subtract a negative integer you move to the right on the number line

Example

$$-7 - (-3) = -4$$

Start at -7 move 3 steps to the right



Multiplication

The rules for multiplying are as follows

x	positive	negative
positive	+	-
negative	-	+

$$+ \times + = +$$

$$+ \times - = -$$

$$- \times + = -$$

$$- \times - = +$$

Division

The rules for division are as follows

$\div$	positive
positive	+
negative	-

$$+ \div + = +$$

$$+ \div - = -$$

$$- \div + = -$$

$$- \div - = +$$

NOTE: The result are similar to the rules of multiplication.

Example:

$$-36 \div 6 = -6$$

$$24 \div 6 = +4$$

$$24 \div -6 = -4$$

$$-24 \div 6 = -4$$

$$-24 \div -6 = 4$$

CHAPTER 2: FRACTIONS

A fraction is a number that can be

written in the form of $\frac{a}{b}$

Where a and b are intergers and $b \neq 0$

$\frac{a}{b}$ is read as "a over b"

The number which is written on top of fraction is called Numerator and the bottom is called denominator e.g

$$\frac{2}{3}, \frac{4}{9}, \frac{5}{2}$$

Type of fraction

(i) Proper fractions

- A proper fraction is the one in

which the numerator is less than denominator

e.g. $\frac{4}{8}, \frac{6}{3}, \frac{7}{6}$ etc

(ii) Improper fractions

- These are the ones which the numerators are greater than the denominator

$\frac{8}{4}, \frac{6}{3}, \frac{7}{6}$ etc

(iii) Mixed fractions or mixed numbers

- These are the ones formed after improper fractions are divided complete

e.g. $\frac{5}{2} = 2\frac{1}{2}$, $6\frac{3}{4}$, $9\frac{15}{16}$

(iv) Equivalent fractions

These are two or more fractions that can be simplified to equal lowest fraction.

$$(i) \quad \frac{2}{4} \equiv \frac{6}{12} \equiv \frac{5}{10} \equiv \frac{500}{1000}$$

$$(ii) \quad \frac{2}{8} \equiv \frac{4}{16}$$

Example: Change the following into mixed numbers

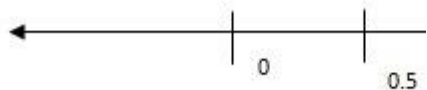
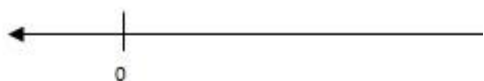
$$1. \quad \frac{15}{2} = 7\frac{1}{2}$$

$$2. \quad \frac{21}{7} = 3$$

$$3. \quad \frac{45}{7} = 6\frac{3}{7}$$

Fractions can be represented on number lines

e.g. represent $\frac{1}{2}$ on a number line.

SolutionRepresent: $\frac{5}{2}$ Represent: $\frac{9}{7}$ **Exercise 1**

1. (i) Which of the following are: -

- (a) Proper fractions
 (b) Mixed fractions
 (c) Improper fractions

(ii) List four equivalent fractions

- (i) $\frac{5}{7}$
 (ii) $\frac{13}{17}$
 (iii) $\frac{4}{5}$
 (iv) $\frac{4}{3}$
 (v) $\frac{6}{5}$
 (vi) $\frac{2}{6}$
 (vii) $\frac{8}{24}$
 (viii) $\frac{3}{4}$
 (ix) $\frac{4}{12}$
 (x) $\frac{16}{48}$
 (xi) $\frac{15}{19}$
 (xii) $\frac{153}{75}$
 (xiii) $\frac{14}{5}$

- (xiv) $\frac{15}{6}$
 (xv) $\frac{57}{93}$
 (xvi) $3\frac{1}{2}$

Solution

(a) Proper fraction

 $\frac{5}{7}, \frac{13}{17}, \frac{4}{5}, \frac{2}{6}, \frac{8}{24}, \frac{3}{4}, \frac{4}{12},$
 $\frac{16}{48}, \frac{15}{19}, \frac{57}{93}$

(b) Improper fraction

 $\frac{4}{2}, \frac{6}{5}, \frac{153}{75}, \frac{14}{5}, \frac{15}{6}$

(c) Mixed fraction

 $1\frac{5}{6}, 3\frac{1}{2}$

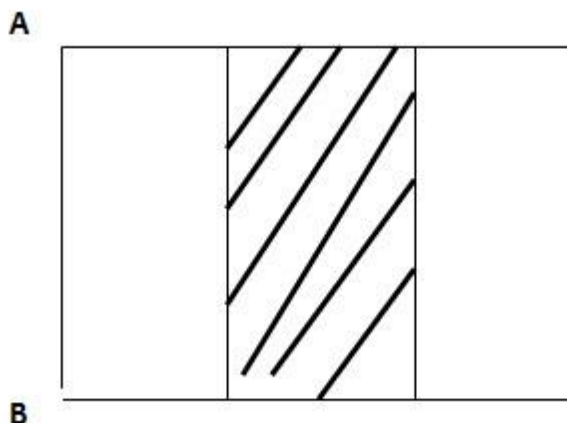
Four equivalent fractions are:-

- $\rightarrow \frac{1}{3} \equiv \frac{10}{30}, \frac{1}{3} \equiv \frac{5}{15}$
- $\rightarrow \frac{2}{5} \equiv \frac{4}{10}, \frac{2}{5} \equiv \frac{8}{20}$
- $\rightarrow \frac{3}{7} \equiv \frac{9}{21}, \frac{3}{7} \equiv \frac{21}{49}$
- $\rightarrow \frac{100}{200} \equiv \frac{10000}{20000}, \frac{100}{200} \equiv \frac{200}{400}$

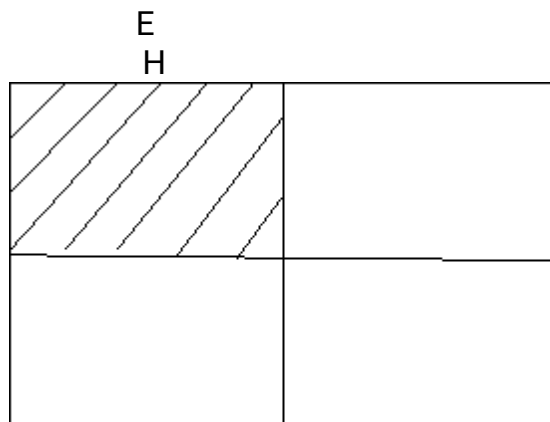
2. Write the following fractions in words

- (a) $\frac{3}{4}$
 $\Rightarrow$ three quarters
 (b) $\frac{1}{2}$
 $\Rightarrow$ A half
 (c) $\frac{1}{3}$
 $\Rightarrow$ A third
 (d) $\frac{5}{6}$
 $\Rightarrow$ Five over six
 (e) $\frac{9}{10}$
 $\Rightarrow$ Nine over Ten
 (f) $\frac{1}{4}$
 $\Rightarrow$ A quarter

2. Write the name of the fraction of the shaded part in figures ABCD and EFGH



$\therefore \frac{1}{3}$ = one over three (A third)
Which is a proper fraction



F

G

$\therefore \frac{1}{4}$ = one over four (A quarter)
Which is a proper fraction

Comparison of fraction

Fraction can be compared by using two methods

- (i) Number line
- (ii) L.C.M of the denominators

(I) Number line

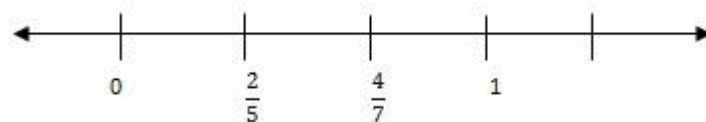
Example 1. show $\frac{1}{3}$ and $\frac{1}{2}$ on a number line and then find which is greater than the other



$$\therefore \frac{1}{2} > \frac{1}{3}$$

Example 2. Which is greater between $\frac{2}{5}$ and $\frac{4}{7}$?

Solution:



$$\therefore \frac{4}{7} > \frac{2}{5}$$

(II) L.C.M of the denominators

Determine which fraction is greater between $\frac{2}{5}$ and $\frac{4}{7}$

Solution

1st find the L.C.M of 5 and 7

$\Rightarrow$ L. C. M of 5 and 7 = 35

2nd multiply by that L. C. M each fraction

$$\Rightarrow \frac{2}{5} \times 35 = 14$$

$$\Rightarrow \frac{4}{7} \times 35 = 20$$

Conclusion, check the one which has given us bigger number after multiplication with L.C.M

$$\frac{4}{7} > \frac{2}{5}$$

Example: which is greater $\frac{9}{4}$ or $\frac{3}{11}$?

Solution:

L.C.M = 44

$$\Rightarrow \frac{9}{4} \times 44$$

$$\begin{aligned}
 &= 99 \\
 \Rightarrow &\frac{3}{11} \times 44 \\
 &= 12 \\
 \therefore &\frac{9}{4} > \frac{3}{11}
 \end{aligned}$$

Operations on Fractions

Addition and Subtraction of Fraction

NOTE:

1. Add the numerator together if each fraction has the same denominator.

2. If the fraction has different denominator, you must find the smallest number that each denominator divides into exactly. (LCM)

3. When adding fractions, do not add the denominator.

Example:

Evaluate the following fractions

$$\begin{aligned}
 \text{(i)} \quad \frac{1}{5} + \frac{3}{5} &= \frac{1+3}{5} \\
 &= \frac{4}{5}
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii)} \quad \frac{2}{5} + \frac{1}{4} &= \frac{8+5}{20} \\
 &= \frac{13}{20}
 \end{aligned}$$

$$\begin{aligned}
 \text{(iii)} \quad \frac{3}{4} + \frac{2}{3} &= \frac{9+8}{12} \\
 &= \frac{17}{12}
 \end{aligned}$$

$$\begin{aligned}
 &= 1\frac{5}{12} \\
 \text{(iv)} \quad \frac{3}{4} - \frac{1}{5} &= \frac{15-4}{20} \\
 &= \frac{11}{20}
 \end{aligned}$$

$$(v) \quad 2\frac{3}{5} + 3\frac{3}{4} = \frac{13}{5} + \frac{15}{4}$$

$$= \frac{52+75}{20}$$

$$= \frac{127}{20}$$

$$= 6\frac{7}{20}$$

$$(vi) \quad 9\frac{1}{2} - 4\frac{4}{8} = \frac{19}{2} - \frac{37}{8}$$

$$= \frac{76-37}{8}$$

$$4\frac{7}{8}$$

$$\text{Evaluate (i) } \frac{2}{3} \times \frac{3}{4} = \frac{2 \times 3}{3 \times 4}$$

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

On simplifying gives $\frac{1}{2}$

$$(ii) \quad \frac{4}{7} \times \frac{5}{6} = \frac{20}{42}$$

$$= \frac{10}{21}$$

$$(iii) \quad 5 \times \frac{5}{8} = \frac{5 \times 5}{1 \times 8}$$

$$= \frac{25}{8}$$

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

$$(iv) \quad \frac{3}{4} \times 8 = \frac{3 \times 8}{4 \times 1}$$

$$= \frac{24}{4}$$

$$= 6$$

Multiplication

NOTE: 1. Before multiplying a number convert mixed number into improper fractions

2. Multiply the numerators and multiply the denominator.

Examples:

Dividing Fractions

1. When dividing fractions invert the second fraction then multiply the first fraction by the inverted fraction.

Example

(i) Evaluate: $\frac{3}{5} \div \frac{2}{3}$

Solution

$$\frac{3}{5} \div \frac{2}{3} = \frac{3}{5} \times \frac{3}{2}$$

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

$$\text{Therefore} = \frac{9}{10}$$

2. Before dividing number convert mixed numbers into improper fraction.

Example

$$4\frac{1}{4} \div 5\frac{1}{5} = \frac{17}{4} \div \frac{26}{5}$$

$$= \frac{17}{4} \times \frac{5}{26}$$

$$= \frac{85}{104}$$

CHAPTER 3: DECIMALS AND PERCENTAGES

Are fractions of tenth, they are written using a point which is a result of division of a normal fraction

E.g. 0.34, 0.5, 0.333-----

In the fraction 0.2546 the place values are

On es	Te nth	Hundre dths	Thousa ndths	Ten Thousa ndths
0	2	5	4	6

Decimals can be converted into fractions and vice versa

E.g. Change $\frac{3}{4}$ in to decimals

Solution:

$$4 \div 3 = 0.75$$

This fraction which ends after dividing is called terminating fraction. Other fractions do not end, these ones are called recurring or repeating decimals.

E.g. $\frac{1}{3}$

This can be written in short as $0.\dot{3}$ Other examples are: -

Conversion of Repeating decimal into fractions

Example: (i) change $0.\dot{3}$ into fractions

Solution:

$$0.3 = 0.333\ldots$$

$$\text{Let } t = 0.\dot{3} \quad \text{..... (i)}$$

$$10t = 3.\dot{3} \quad \text{..... (ii)}$$

Subtract (i) from (ii)

$$10t = 3.\dot{3}$$

$$-t = 0.\dot{3}$$

$$9t = 3.0$$

$$\frac{9t}{9} = \frac{3}{9}$$

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

Exercise 1

Insert $>$ or $<$ between each pair of fractions questions 4 to 12

1. $\frac{2}{3}$, $\frac{1}{3}$

Solution

$$\text{L.C.M} = 3$$

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

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

$$\therefore \frac{2}{3} > \frac{1}{3}$$

2. $\frac{1}{9}$, $\frac{1}{7}$

Solution

$$\text{L.C.M} = 63$$

$$\frac{1}{9} \times 63 = 7$$

$$\frac{1}{7} \times 63 = 9$$

$$\therefore \frac{1}{7} > \frac{1}{9}$$

$$3. \frac{5}{6} \quad \frac{3}{4}$$

Solution

$$\frac{5}{6} \times 12 = 10$$

$$\frac{3}{4} \times 12 = 9$$

$$\therefore \frac{5}{6} > \frac{3}{4}$$

$$4. \frac{4}{5} \quad \frac{3}{4}$$

Solution

$$\frac{4}{5} \times 20 = 16$$

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

$$\therefore \frac{4}{5} > \frac{3}{4}$$

$$5. \frac{15}{20} \quad \frac{7}{4}$$

Solution

$$\text{L.C.M of } 20 \text{ and } 4 = 80$$

$$\frac{15}{20} \times 80 = 60$$

$$\frac{7}{4} \times 80 = 140$$

$$\therefore \frac{7}{4} > \frac{15}{20}$$

$$6. \frac{1}{4} \quad \frac{3}{4}$$

Solution

$$\text{L. C. M of } 4 \text{ and } 4 = 4$$

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

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

$$\therefore \frac{3}{4} > \frac{1}{4}$$

$$7. \frac{2}{5} \quad \frac{1}{6}$$

Solution

$$\text{L. C. M of } 5 \text{ and } 6 = 30$$

$$\frac{2}{5} \times 30 = 12$$

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

$$\therefore \frac{2}{5} > \frac{1}{6}$$

$$8. \frac{8}{9} \quad \frac{5}{6}$$

Solution

$$\text{L. C. M of } 9 \text{ and } 6 = 18$$

$$\frac{8}{9} \times 18 = 16$$

$$\frac{5}{6} \times 18 = 15$$

$$\therefore \frac{8}{9} > \frac{5}{6}$$

9. Which numbers are denominators in each of the following fractions?

(a) $\frac{3}{16}$ 16 is the denominator.

(b) $\frac{25}{93}$ 93 is the denominator

(c) $\frac{4}{35}$ 5 is the denominator

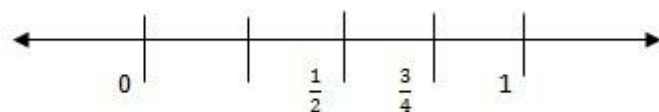
10. Which numbers are numerators in each of the following fractions?

(a) $\frac{3}{5}$ Numerators is 3

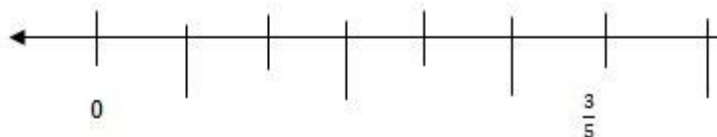
(b) $\frac{4}{39}$ Numerators is 4

(c) $\frac{12}{13}$ Numerators is 12

Draw a number line and show $\frac{1}{2}$ and $\frac{3}{4}$ on it



11. Draw a number line and show on it $\frac{9}{10}$ and $\frac{3}{5}$



12. Which is greater

(a) $\frac{3}{5}$ or $\frac{3}{4}$

Solution

Find the L.C.M of 5 and 4 = 20

$$\frac{3}{5} \times 20 = 12$$

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

$$\therefore \frac{3}{4} > \frac{3}{5}$$

$$(b) \frac{2}{3} \text{ or } \frac{1}{2}$$

Solution

Find the L.C.M of 3 and 2 = 6

$$\frac{2}{3} \times 6 = 4$$

$$\frac{1}{2} \times 6 = 3$$

$$\therefore \frac{2}{3} > \frac{1}{2}$$

13. What is the condition for a fraction to be called improper?

The numerator is bigger than the denominator.

14. Change the following improper fractions into mixed numbers

$$(a) \frac{2}{3} = 1 \frac{1}{2}$$

$$(b) \frac{35}{8} = 4 \frac{3}{8}$$

$$(c) \frac{53}{15} = 3 \frac{8}{15}$$

$$(d) \frac{64}{33} = 1 \frac{31}{33}$$

16 15. Change the following mixed numbers into improper fractions

$$(a) 3 \frac{4}{5}$$

Solution

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

$$\therefore = \frac{19}{5}$$

$$(b) 15 \frac{3}{7}$$

Solution

$$15 \times \frac{3}{7} = \frac{105+3}{7}$$

$$\therefore = \frac{108}{7}$$

$$(c) 24 \frac{15+15}{23}$$

Solution

$$24 \frac{15}{23} = \frac{567+15}{23}$$

$$\therefore = \frac{582}{23}$$

3.3 PERCENTAGES

Percentages are fractions expressed out of 100. That is – are the ones whose denominator is one hundred, they are denoted by (%) called percent

Example: 12% means $12 \times \frac{1}{100} = \frac{12}{100}$
 $70\% = \frac{70}{100}$ etc.

Examples: 1. convert the following percentage into fraction

(i) 65%

(ii) 75%

(iii) $12 \frac{1}{2}\%$

Solution

$$(i) \quad 65\% = 65 \times \frac{1}{100} = \frac{65}{100} = \frac{13}{20}$$

$$(ii) \quad 75\% = 75 \times \frac{1}{100} = \frac{75}{100} = \frac{3}{4}$$

$$(iii) \quad 12 \frac{1}{2}\% = 12 \frac{1}{2} \times \frac{1}{100} = \frac{25}{2} \times \frac{1}{100} = \frac{25}{200}$$

$$\therefore 12 \frac{1}{2}\% = \frac{1}{8}$$

2. Change

- (i) 40% into decimal
 (ii) 35% into fractions
 (iii) 0.125 into percentage

Solution

$$(i) 40\% = \frac{40}{100} = \frac{4}{10}$$

$$\therefore = 0.4$$

- (ii) 35%

$$35 \times \frac{1}{100} = \frac{35}{100}$$

$$\therefore = \frac{35}{100}$$

- (iii) 0.125

Solution

$$0.125 = \frac{125}{1000} \times 100\%$$

$$\therefore = 12.5\%$$

3. Change the recurring decimals into fractions

- (i) $0.\dot{2}\dot{1}$

Solution

$$\text{Let } x = 0.\dot{2}\dot{1} \dots\dots\dots (i)$$

$$100x = 21.\dot{2}\dot{1} \dots\dots\dots (ii)$$

Take away equation (i) from (ii)

$$100x = 21.\dot{2}\dot{1}$$

$$\begin{array}{r} x \\ 99x = 21.00 \\ 99x \quad 21 \\ \hline 99 \quad 21 \end{array}$$

$$\therefore x = \frac{21}{99}$$

- (ii) $0.9\dot{3}$

Solution

$$\text{Let } x = 0.9\dot{3} \dots\dots\dots (i)$$

$$10x = 9.\dot{3} \dots\dots\dots (ii)$$

$$100x = 93.3 \dots\dots\dots (iii)$$

Take equation (ii) away from equation (iii)

$$100x = 93.3$$

$$\begin{array}{r} 100x \quad 9.3 \\ 10x \quad 9.3 \\ \hline 90x \quad 84 \quad 42 \\ 90 \quad 84 \quad 42 \end{array}$$

$$\therefore x = \frac{42}{45}$$

- (iii) $0.\dot{5}6\dot{7}$

Solution

$$\text{Let } x = 0.\dot{5}6\dot{7} \dots\dots\dots (i)$$

$$1000x = 567.567 \dots\dots\dots (ii)$$

Take away equation (i) from (ii)

$$1000x = 567.567$$

$$X = 0.567$$

$$\begin{array}{r} 999x \quad 567.000 \\ 999 \quad 567 \end{array}$$

$$\therefore x = \frac{281}{495}$$

- (iv) $0.\dot{1}35\dot{2}$

Solution

$$\text{Let } x = 0.\dot{1}35\dot{2} \dots\dots\dots (i)$$

$$10000x = 1352.1352 \dots\dots\dots (ii)$$

Take (ii) - (i)

$$10000x = 1352.1352$$

$$\begin{array}{r} x \\ 9999x = 1352.0000 \\ 9999x \quad 1352 \\ \hline 9999 \quad 1352 \end{array}$$

$$\therefore x = \frac{1352}{9999}$$

- (v) $0.\dot{2}1\dot{9}$

Solution

$$\text{Let } x = 0.\dot{2}1\dot{9} \dots\dots\dots (i)$$

$$1000x = 219.219 \dots\dots\dots (ii)$$

Take away equation (i) from (ii)

$$1000x = 219.219$$

$$\begin{array}{r} x \\ 999x = 219.000 \\ 999x \quad 219 \\ \hline 999 \quad 219 \end{array}$$

$$\therefore x = \frac{219}{999}$$

- (vi) $0.\dot{1}8\dot{6}$

Solution

$$\text{Let } x = 0.\dot{1}8\dot{6} \dots\dots\dots (i)$$

$$1000x = 186.186 \dots\dots\dots (ii)$$

Take away equation (i) from (ii)

$$1000x = 186.186$$

$$\begin{array}{r} x \\ 999x = 186.000 \\ 999x \quad 186 \\ \hline 999 \quad 186 \end{array}$$

$$\begin{array}{r} 62 \\ \therefore x = \frac{62}{333} \\ \text{(vii) } 0.\dot{8}63\dot{4} \end{array}$$

Solution

$$\begin{aligned} \text{Let } n &= 0.\dot{8}63\dot{4} \dots\dots\dots (i) \\ 10000n &= 8634.8634 \dots\dots\dots (ii) \\ \text{Take away equation (i) from (ii)} \\ 10000n &= 8634.8634 \end{aligned}$$

$$\begin{array}{r} n \quad 0.8634 \\ 9999n = 8634.0000 \\ 9999n \quad 8634 \\ \hline 9999 = 9999 \\ \hline 8634 \\ \therefore n = \frac{8634}{9999} \end{array}$$

$$\text{(viii) } 0.7\dot{9}\dot{2}$$

Solution

$$\begin{aligned} \text{Let } x &= 0.7\dot{9}\dot{2} \dots\dots\dots (i) \\ 10x &= 7.\dot{9}\dot{2} \dots\dots\dots (ii) \\ 1000x &= 792.\dot{9}\dot{2} \dots\dots\dots (iii) \\ \text{Take away equation (ii) from} \\ \text{equation (iii)} \\ 100x &= 792.\dot{9}\dot{2} \\ 1000x - 10x &= 792.\dot{9}\dot{2} - 7.\dot{9}\dot{2} \\ 990x &= 785 \end{aligned}$$

$$\begin{array}{r} X = \frac{785}{990} \\ \therefore x = \frac{157}{198} \end{array}$$

$$\text{(ix) } 0.\dot{6}4\dot{5}$$

Solution

$$\begin{aligned} \text{Let } y &= 0.\dot{6}4\dot{5} \dots\dots\dots (i) \\ 1000y &= 645.\dot{6}4\dot{5} \dots\dots\dots (ii) \\ \text{Take away equation (i) from (ii)} \\ 1000y - y &= 645.\dot{6}4\dot{5} \\ 999y &= 645 \\ \begin{array}{r} 999y \quad 645 \\ 999 = 999 \\ \hline 215 \\ \therefore y = \frac{215}{333} \end{array} \end{aligned}$$

$$\text{(x) } 0.\dot{6}\dot{4}$$

Solution

$$\begin{aligned} \text{Let } b &= 0.\dot{6}\dot{4} \dots\dots\dots (i) \\ 100b &= 64.\dot{6}\dot{4} \dots\dots\dots (ii) \end{aligned}$$

Take away equation (i) from (ii)

$$100b - b = 64.\dot{6}\dot{4} - 0.\dot{6}\dot{4}$$

$$99b = 64$$

$$\begin{array}{r} 99b \quad 64 \\ 99 = 99 \end{array}$$

$$\therefore b = \frac{64}{99}$$

$$\text{(xi) } 0.\dot{6}2\dot{7}$$

Solution

$$\text{Let } m = 0.\dot{6}2\dot{7} \dots\dots\dots (i)$$

$$1000m = 627.\dot{6}2\dot{7} \dots\dots\dots (ii)$$

Take away equation (i) from (ii)

$$1000m - m = 627.\dot{6}2\dot{7} - 0.\dot{6}2\dot{7}$$

$$999m = 627$$

$$\begin{array}{r} 999m \quad 627 \\ 999 = 999 \end{array}$$

$$\therefore m = \frac{627}{999}$$

4. In question (i) to (v) change the fractions into decimals.

$$\text{i. } \frac{1}{3}$$

Solution

$$1 \div 3 =$$

$$\therefore = 0.33$$

$$\text{ii. } \frac{5}{6}$$

Solution

$$5 \div 6 =$$

$$\therefore = 0.833$$

$$\text{iii. } \frac{4}{11}$$

Solution

$$4 \div 11 =$$

$$\therefore = 0.3636$$

$$\text{iv. } \frac{1}{9}$$

Solution

$$1 \div 9 =$$

$$\therefore = 0.111$$

$$\text{v. } \frac{7}{13}$$

Solution

$$7 \div 13 =$$

$$\therefore = 0.538461$$

5. Convert into fraction $0.\dot{1}2\dot{3}$

Solution

Let $b = 0.\dot{1}2\dot{3}$ (i)

$1000b = 123.\dot{1}2\dot{3}$ (ii)

Take equation (i) away from equation (ii)

$$1000b - b = 123.\dot{1}2\dot{3} - 0.\dot{1}2\dot{3}$$

$$999b = 123$$

$$\begin{array}{r} 999b \quad 123 \\ 999 - 999 \\ \hline 41 \end{array}$$

$$b = \frac{41}{333}$$

Operations on Decimals

Operations with decimals are similar to operations with whole numbers:

Addition

Note: The decimal points must be in line, put zeros at the end to give the same number of decimal places in each number.

Examples

(i) Find $28.3 + 4.96 + 110.9$

Solution

$$\begin{array}{r} 28.30 \\ 4.96 \\ + 110.90 \\ \hline 144.16 \end{array}$$

144.16 The answer

Subtraction

Example: i) Evaluate (a) $81.5 - 19.4$ (b) $16.8 - 7.49$ (c) $8.5 - 9.41$

Solution:

$$(a) \quad 81.5 - 19.4 = 81.5$$

$$\underline{-19.4}$$

$$\underline{62.1}$$

The answer is 62.1

$$(b) \quad 16.8 - 7.49 = 16.80$$

$$\underline{7.49}$$

9.31 The answer

$$(c) \quad 8.5 - 9.41$$

Here the answer is negative; you must reverse the subtraction.

$$\therefore 8.5 - 9.41 = 9.41$$

$$\underline{-8.50}$$

$$\underline{-0.91}$$

$$\therefore 8.5 - 9.41 = -0.91$$

Multiplication

Note:

1. When multiplying decimals the

answer must have the same number of decimal places as the total number of decimal places in the number being multiplied.

2. First carry out the multiplication in the usual way, without any decimal points, then put the point to the total decimal places.

Example:

$$1. \text{ Evaluate } 4.8 \times 2.001 = 48 \times 2001 \\ = 96048$$

There are $1 + 3 = 4$ decimal places

$$\therefore 4.8 \times 2.001 = 9.6048$$

Division

Note:

It is not easy to divide by a decimal, so you multiply each number by a power of 10 in order that you are dividing by a whole number.

Example:- (i) Find (a) $68.32 \div 1.4$

$$(b) 9.66 \div 0.23$$

Solution

$$(a) 68.32 \div 1.4 = 68.32 \times 10 \div 1.4 \times 10$$

$$682.2 \div 14$$

By long division

$$\begin{array}{r} 48.8 \\ 14 \overline{) 683.2} \end{array}$$

$$- \underline{56}$$

$$123$$

$$- \underline{112}$$

$$112$$

$$- \underline{112}$$

Therefore $68.32 \div 1.4 = 48.8$

(b)

$$\begin{array}{r} 42 \\ 23 \overline{) 966} \end{array}$$

$$- \underline{92}$$

$$46$$

$$- \underline{46}$$

Therefore $9.66 \div 0.23 = 42$

Exercise

1. Evaluate (a) $4.22 + 5.47$ (b) $8 - 17.2$ (c) $7.32 \div 1.2$ (d) 1

Solution

$$(a) 4.22 + 5.47 = 4.22$$

$$+ \underline{5.47}$$

$$\underline{9.69}$$

$$(b) 8 - 17.2 = 17.20$$

$$- \underline{8.00}$$

$$\underline{9.20}$$

$$\therefore 8 - 17.2 = -9.2$$

$$(c) 7.32 \div 1.2 = 7.32 \times 10 \div 1.2 \times 10$$

$$73.2$$

$$\begin{array}{r}
 \text{(c)} \quad 6.1 \\
 12 \overline{) 73.2} \\
 \underline{- 72} \\
 12 \\
 \underline{- 12} \\
 0
 \end{array}$$

t

Therefore $7.32 \div 1.2 = 6.1$

$$\text{(d)} \quad 1.237 \times 1.7 = 1237 \times 17$$

$$= 21029$$

$$\therefore 1.237 \times 1.7 = 2.1029$$

Mariam was given 20,000 shillings by her father, she spent 48% of it to buy shoes. How much money remained.

Solution

$$\frac{48}{100} \times 20,000$$

$$= 9,600$$

$$20,000$$

$$- 9,600$$

$$11,600$$

$\therefore$ The remained money was 11,600/=

Note:

1. Change a fraction or decimal to a percentage, multiply by 100%

Eg (i) Change $\frac{3}{5}$ to a percentage

$$\begin{aligned}
 \text{Solution: } \frac{3}{5} \times 100\% &= \frac{300\%}{5} \\
 &= 60\%
 \end{aligned}$$

- (ii) Change $\frac{1}{6}$ to a percentage

$$\begin{aligned}
 \text{Solution: } \frac{1}{6} \times 100\% &= \frac{100\%}{6} \\
 &= 16.67\% \text{ or } 16\frac{2}{3}\% \\
 &= 16\frac{2}{3}\% \text{ or } \frac{100}{6}\%
 \end{aligned}$$

- (iii) Change 0.125 into percentage

$$\text{Solution: } 0.125 \times 100\% = 12.5\%$$

2. To change a percentage to a fraction or decimal, divide by 100

Example: (i) Write 70% as a fraction and as a decimal

Solution

Divide by 100

$$70\% = \frac{70}{100}$$

$$= \frac{7}{10} \text{ as fraction}$$

$$\underline{\text{As decimal} = 0.7}$$

PERCENTAGES APPLIED TO REAL LIFE PROBLEMS

The examples below show the wide range of application

Examples:-

1. In one week, Flora earned 48,000/=, she spent 4,000/= on travel to and from work. What percentage of her money was left?

Solution:

$$\begin{aligned}
 \text{Percentage spent } 4,000 &= \text{out of } 48,000 / = \frac{4000}{48000} \\
 &= \frac{4000}{48000} \\
 &= 8\frac{160000}{48000}\% = 8.33\% \\
 8\frac{1}{3}\% &= 8.33\%
 \end{aligned}$$

$$\text{Percentage left: } - 100\% - 8.33\% = \underline{91.67\%}$$

Percentage of a quantity

When finding a percentage of a quantity, it is often helps to change the percentage to a decimal and multiply it by the quantity.

Example:- Find (a) 20% of 840,000

(b) $17\frac{1}{2}\%$ of 20 meters.

Solution:

$$(a) \ 20\% = \frac{20}{100}$$

$$= 0.2$$

$$\text{So } 20\% \text{ of } 840,000/- = 0.2 \times 840,000/-$$

$$= \underline{168,000}$$

$$(b) \ 17\frac{1}{2}\% \text{ of } 20 \text{ meters} = \frac{17.5}{100} \times 20\text{m}$$

$$= 0.175 \times 20\text{m}$$

$$= \underline{3.5\text{m}}$$

percentage increase (or decrease)

Example: In 1975 the population of a village was 90. It increased by 30% the following year. What was the population in the year 1976?

Solution:

$$\text{Method A: } 30\% \text{ out of } 900 = \frac{30}{100} \times 900 = 270$$

$$\text{The population in the year 1976 was } 900 + 270 = 1170$$

Method B: The increase of 30% gives a final total equal to

$$\text{Now } 130\% = \frac{130}{100} = 1.3$$

$$\text{The new population} = 1.3 \times 900$$

$$= \underline{1170}$$

The value 1.3 is called a multiplier

The method for decreases is similar

Percentage increase and Decrease

There are two steps to calculate

CHAPTER 4: APPROXIMATIONS

Is the process of rounding off a number in the given places in rounding makes numbers easier to deal with but at the same time reduces their accuracy. The methods used for approximation or rounding off numbers are decimal places and significant figures.

ROUNDING OFF PROCEDURES

- i) If the first neglected digit is greater or equal to 5 the digit occupying the place value will increase by 1 unit
- ii) If the first neglected number is less than five, then the number occupying the required place value will remain unchanged.

ROUNDING OFF NUMBERS

Examples

1. Round off the following numbers to the nearest whole number.

- a) 3425
- b) 7.283
- c) 6.674
- d) 0.625
- e) 36.12
- f) 5446

Solutions

- a) $3425 \approx 3000$
- b) $7.283 \approx 7$
- c) $6.674 \approx 7$
- d) $0.625 \approx 1$
- e) $36.12 \approx 36$
- f) $5446 \approx 5000$

2. Round off the following to

- a) 1 decimal place.
- b) 2 decimal places.
- c) 3 decimal places.
- a) 23.7016
- b) 0.0094

Solution

- 1. $23.7016 \approx 23.7$ to 1 decimal place.
- 2. $23.7016 \approx 23.70$ to 2 decimal place.

- 1. $23.7016 \approx 23.702$ to 3 decimal places.

b) 0.0094

- a) $0.0094 \approx 0.0$ to 1 decimal place.
- b) $0.0094 \approx 0.001$ to 2 decimal place.
- c) $0.0094 \approx 0.009$ to 3 decimal places.

3. Round off the following number to the nearest

- a) Whole number
- b) Tenth
- c) Hundredth

- i. 0.625
- ii. 8.385

Solution

- i. 0.625

- a) $0.625 \approx 1$ to whole numbers
- b) $0.625 \approx 0.6$ to tenth
- c) $0.625 \approx 0.63$ to hundredths

ii. 8.385

- a) $8.385 \approx 8$ to whole numbers

b) $8.385 \approx 8.4$ to tenth

c) $8.385 \approx 8.39$ to hundredths

Example: Round off 84678 to

i) Tens

Solution

$$84678 = 84700$$

ii) Hundreds

Solution

$$84678 = 85000$$

iii) Thousands

Solution

$$84678 = 80000$$

Example: Round off 179999 correct to i) hundreds ii) Thousand iii) Tens iv) Ten thousands

Solution

i) $179999 \approx 180000$

ii) 180000

iii) 180000

iv) 180000

Significant Figures

They are the total number of digits in the given number including zero's which are in between non-zero digits.

Note

i) Zero is a significant figure when it is in between two non-zero digits

ii) When zero is an outcome of approximation (rounding off) where a 9 receives 1 and becomes ten, then zero of ten is a significant figure.

Examples: determine the number of significant figures in the following

i) 20896100

= There are six significant figures

ii) 0.00025060

= There are four significant figures

iii) 2.00008453

= There are nine significant figures

Examples: Re write following numbers correcting to the required of significant figures.

a. 0.23678 to 3 significant figures

Solution

$$0.23678$$

$$\therefore = 0.24$$

b. 2.09478 to 3 significant figures

Solution

$$2.09478$$

$$\therefore = 2.09$$

c. 0.009994 to 2 significant figures

Solution

$$0.009994$$

$$\therefore = 0.010$$

d. 0.00931225697 to 7 significant figures

Solutions

$$0.00931225697$$

$$\therefore = 0.0093123$$

Exercise

Re write the following numbers correctly to

a. 10.999009 to three significant figures

Solution

$$10.999009$$

$$\therefore = 11.0$$

b. 705.4005 to six significant figures

Solution

$$705.4005$$

$$= 705.401$$

c. 847910 to three significant figures

Solution

$$847910$$

$$\therefore = 848000$$

Approximations in operations

When you want to check approximation whether a calculation is correct or not. Round each number in the calculation to 1 significant figure. Do the calculation

mentally.

Example:

A group of 42 people go to the cinema, which cost 680/- each. What is the approximation total cost?

Solution

Round 42 to 40 and 680 to 700

Therefore $40 \times 700 = 28,000/-$

Note: The exact cost is 28,560 The approximation is 28,000 which is close.

referred to as variables.

Algebraic expression

An expression – is a mathematical statement which consists of several variables. An expression can only be simplified, that is we cannot find values of the variables (s) on it.

Examples

1. $a + 2$

2. $x + 3y + 9z$

3. $16p - qp$

4. $a + b + c + d$

5. 40

An equation

An equation is formed when two expression are joined by an equal sign

E.g

i) $2x - y = 16$

ii) $x + 2 = 6 - 5$

iii) $3y + xy = 9$

Each member of an equation or expression is called Term

Coefficient

When a number is multiplied by a variable (s) that number is called coefficient of that variable

Example

What is the coefficient of the variables in the following?

a) $6x - 8p + y$

b) $y^2 - k + 3d$

c) $2a + 3b - c$

Solutions

Coefficients of a) x is 6
 y is 1

CHAPTER 5: ALGEBRA

Algebra is a study which deals with situations whereby some values unknown. Normally these unknown are represented by letters. Those letters are also

$$\begin{aligned}
 P &= -8 \\
 \text{b) } K &= -1 \\
 d &= 3, \\
 y^2 &= 1 \\
 \text{c) } a &= 2 \\
 b &= 3 \\
 c &= -1
 \end{aligned}$$

Addition and subtraction of algebraic expression

Addition and subtraction of algebraic expression can be done by adding or subtracting like term. Like terms are those terms which has identical (same) variables

Examples

- $2a + 4a = 6a$
- $5a + 16a = 21a$
- $2x + 10x - 3x = 9x$

Examples: simplify the expression

$$3n - 7n + 12n$$

Solution

$$-4n + 12n$$

$$12n - 4n$$

$$\therefore = 8n$$

Examples: simplify

$$6m - 4 - 2m + 15$$

Soln

$$6m - 2m - 4n + 15$$

$$= 4m + 11$$

Example: simplify $4x + 6y - 3x + 5y$

Solution

$$4x - 3x + 6y + 5y$$

$$= x + 11y$$

$$\text{Coefficient: } y = 11$$

$$x = 1$$

Number of terms = two

Exercise 7.1

1. Simplify each of the following expressions and after simplifying state

- the number of terms
- the coefficient of each of the terms

$$\begin{aligned}
 &\text{i) } n + n + n + n + n + k + k + \\
 &k + x + x = 5n + 3k + 2x
 \end{aligned}$$

Solution

(a) There are 3 terms

(b) Coefficient of "n" is 5

Coefficients of "y" is 3

Coefficients of "x" is 2

$$\text{ii) } 3x + 4y - 7z + 3x - 7y + 2z$$

Solution

a) There are 3 terms

$$6x - 3y - 5z$$

b) coefficients of x is 6

Coefficients of y is -3

Coefficients of z is -5

$$\text{iii) } 3\frac{1}{2}x + 7x - \frac{1}{4}x =$$

Solution

$$\begin{aligned}
 \frac{7}{2}x + \frac{7}{1}x &= \frac{7x+14x}{2} = \frac{21x}{2} - \frac{1}{4}x = \frac{84x-2x}{8} = \frac{82x}{8} = \\
 &= 10\frac{1}{4}x
 \end{aligned}$$

a) There is 1 term

b) Coefficient of x is $10\frac{1}{4}$

Simplify each of the expressions in numbers 2 – 6

$$2. 12m + 13m$$

- $$\begin{aligned}
 &12m \\
 &+ 13m \\
 &25m = 25m \\
 3. \quad &5y + 7y - 4y \\
 &12y - 4y \\
 &= 8y \\
 4. \quad &24w - 28w \\
 &\quad \quad -28w \quad + \\
 &24w \\
 &= -4w \\
 5. \quad &15n - 9n \\
 &15n - 9n \\
 &= 6n \\
 6. \quad &4k - k + 3k \\
 &3k + 3k \\
 &= 6k \\
 7. \quad &8y - 3 - 7y + 4 \\
 &8y - 7y - 3 + 4 \\
 &\quad y + 4 - 3 \\
 &\quad y + 1 \\
 &\quad = y + 1 \\
 8. \quad &14x + 8 - 3x + 2 \\
 &14x - 3x + 8 + 2 \\
 &= 11x + 10 \\
 9. \quad &3a - 5b - 7a + 6c + 7a + 8b \\
 &3a - 7a + 7a - 5b + 8b + 6c \\
 &= 3a + 3b + 6c \\
 10. \quad &4x - 6y + 7x + 2y \\
 &4x + 7x - 6y + 2y \\
 &= 11x - 4y \\
 11. \quad &3x + 4 + 8x - 4 - 11x \\
 &3x + 8x - 11x + 4 - 4 \\
 &11x - 11x + 4 - 4 \\
 &0 + 0 \\
 &= 0 \\
 12. \quad &8m + 0.4m - 2 - 6m + 8 \\
 &8m + 0.4m - 6m - 2 + 8 \\
 &8.4m - 6m + 6
 \end{aligned}$$

$$= 2.4m + 6$$

Multiplication and division of algebraic expression

Example:1) Multiply $a - 2b + 6ab$ by $12xy$

Solution

$$\begin{aligned}
 &(a - 2b + 6ab) \times 12xy \\
 &= 12axy - 24bxy + 72abxy
 \end{aligned}$$

Examples:2) Re - write without brackets

$$- 16a (-2mn + 9xb - 3kbc)$$

Solution

$$\begin{aligned}
 &-16a (-2mn + 9xb - 3kbc) = (- \\
 &16a \times -2mn) + (-16a \times 9xb) + (-16a \times \\
 &-3kbc)
 \end{aligned}$$

$$= 32amn$$

$$+ -144axb + 48abck$$

$$= 32amn$$

$$- 144axb + 48abck$$

Example:3) divide $36xyz - 48xwz - 24xz$ by $12z$

Solution

$$(36xyz - 48xwz - 24xz) \div 12z$$

$$= \frac{36xyz - 48xwz - 24xz}{12z}$$

$$= \frac{36xyz}{12z} - \frac{48xwz}{12z} - \frac{24xz}{12z}$$

$$\begin{array}{ccc}
 \downarrow & \downarrow & \downarrow \\
 = 3x & - & 4xw & - & 2x
 \end{array}$$

$$\therefore = 3xy - 4xw - 2x$$

Exercise 7.2

1. Complete the following

$$60xy - 30y + 90z = 30 (\quad)$$

Solution

$$60xy - 30y + 90z = 30 (2xy - y + 3x)$$

2. Simplify i) $xy + yz + 2xy - 3zy$

ii) $8m \div 2 + 3mn \div n$

Solution

i) $xy + yz + 2xy - zy \Rightarrow xy + yz + 2xy - zy = xy + 2xy + yz - 3zy$

$$= 3xy - 2yz$$

ii) $8m \div 2 + 3mn \div n$

$$4m + 3m$$

$$(4 + 3) m$$

$$= 7m$$

3. Simplify the following

i) $5mn - 3mn$

$$= 2mn$$

ii) $xyz + 3xy + 4zx - zyx$

$$= xyz - zyx + 3xy + 4zx$$

$$= 0 + 3xy + 4zx$$

$$= 3xy + 4zx$$

iii) $3(2n + 3) + 4(5n - 3)$

Solution

$$6n + 9 + 20n - 12$$

$$6n + 20n + 9 - 12$$

$$= 26n - 3$$

iv) $abc + bac - cab$

Solution

$$abc + abc - abc$$

$$abc - abc + abc$$

$$abc + 0$$

$$= abc$$

v) $2(5x + 3y) + 3(3x + 2y)$

Solution

$$10x + 6y + 9x + 6y$$

$$10x + 9x + 6y + 6y$$

$$= 19x + 12y$$

vi) $m(2n + 3) + n(3m + 4)$

Solution

$$2nm + 3m + 3mn + 4n$$

$$2nm + 3mn + 3m + 4n$$

$$= 5mn + 3m + 4n$$

vii) $x(y - 5) + y(x + 2)$

Solution

$$xy - 5x + yx + 2y$$

$$xy + yx - 5x + 2y$$

$$= 2xy - 5x + 2y$$

viii. $\frac{20m}{5} + \frac{25n}{5}$

$$= 4m + 5n$$

ix) $Pq - 2qp + 3pq - 2qp$

Solution

$$Pq + 3pq - 2qp - 2qp$$

$$4pq - 4pq$$

$$= 0$$

x) $(4x + 8y) \div 2 + (9xw + 4xy) \div w$

solution

$$= \frac{4x+8y}{2} + \frac{9xw+4xy}{w}$$

$$= \frac{4x}{2} + \frac{8y}{2} + \frac{9xw}{w} + \frac{4xy}{w}$$

$$= 2x + 4y + 9x + \frac{4xy}{w}$$

$$= 2x + 9x + 4y + \frac{4xy}{w}$$

$$= 11x + 4y + \frac{4xy}{w}$$

xi) Multiply $6a - 5b$ by $3x$

Solution

$$3x(6a - 5b) = 3x \times 6a - 3x$$

$$\times 5b$$

$$= 18ax - 15bx$$

$$\therefore = 18ax -$$

15bx

Equations

An equation is a mathematical statement which involves two expressions connected or joined by an equal sign

So we define an equation also as a statement of equality e.g. $2y - 6 = 3x + 12$

The values of variables can be found in an equation if the number of equations is equal to the number of unknowns.

FORMULATION OF AN EQUATION

There are three steps to follow when formulating an equation which are;

- i) Understand the problem/question, what it is asking for
- ii) Let the unknown be represented by a variable
- iii) Formulate the equation using the given information

Signs, words or phrase used when formulating an equation:-

+	Addition, sum of, increase by, greater than, plus, taller than, more than
-	Difference, subtract, decrease, less than, shorter than.
×	Multiplication, times, products.
÷	Division, divided, Quotient.
=	Equals, is, given, result.

Example 01

1. The age of the father is equal to the sum of the ages of his son and daughter. If the son's age is thrice the age of his sister, formulate an equation.

Solution

Let y be the father's age

And x be the age of the daughter

The age of son = $3x$

$$y = 3x + x$$

$$y = 4x$$

2. The sum of two numbers is 20. If one of the numbers is 8, formulate an equation.

Solution

Let one of the numbers be x

And the other number = 8

$$x + 8 = 20$$

3. A girl is 14 years old, how old will she be in x years time

Solution

A girl = 14 years

Let " y " be a girl's age in x years time.

In years time = $+x$

$$\therefore y = 14 + x$$

4. The difference between 24 and another number is 16, form an equation

Soln

Let another number = x

$$\therefore 24 - x = 16$$

Exercise 7.3

Formulate equations for each of the following

1. Five times a number gives twenty

Soln

$$5 \times x = 20$$

$$5x = 20$$

2. The difference between 123 and another number is 150

Solution

let another number = x

$$\text{Then } x - 123 = 150$$

$$\therefore x - 123 = 150$$

3. The sum of 21 and another number is 125

solution

let another number = y

Sum means (+)

$$21 + y = 125$$

$$\therefore 21 + y = 125$$

4. When a certain number is increased by 15, the result is 88

solution

Let the number be x

$$\text{Then } x + 15 = 88$$

$$x + 15 = 88$$

5. When 99 is increased by a certain number the result is 63

Solution

Let the number = y

$$\text{Then } 99 + y = 63$$

$$\therefore 99 + y = 63$$

6. The product of 12 and another

number is the same as two times the sum of 12 and the number

Solution

Let the number be x

$$\text{Then } 12 \times x = 2 \times (12 + x)$$

$$\therefore 12x = 24 + 2x$$

7. A number is such that when it is double and 8 added to it, the result is the same as multiplying the number by 3 and subtracting 7.

solution

Let the number be x

$$\text{Then } x + x + 8 = x \times 3 - 7$$

$$2x + 8 = 3x - 7$$

8. When 36 is added to a certain number, the result is the same as multiplying the number by 5.

solution

Let x be the number

$$\text{Then } x + 36 = x \times 5$$

$$\therefore x + 36 = 5x$$

9. If John is n years old and is 6 years older than James, write an expression of the sum of their ages.

Solution

Let "J" be John, and "Q" be James and "N" be the year

Let $Q = q$ years

$$J = n + 6 \text{ years}$$

The sum of their age = $q + n + 6$

$$\therefore = q + n + 6$$

10. When the sum of n and $(n + 3)$ is multiplied by 5 the result half the product of the two numbers.

Write the expression of this statement:-

Solution

$$(n + (n + 3)) \times 5 = \frac{1}{2} (n + (n + 3))$$

$$(2n + 3) \times 5 = \frac{1}{2}(2n + 3)$$

$$\therefore 10n + 15 = n + \frac{3}{2}$$

SOLVING FOR EQUATIONS

Solving means finding the value of the unknown in the equation

Example 1

1. $x + 5 = 8$

Solution

$$x + 5 = 8$$

$$x + 5 - 5 = 8 - 5$$

$$x + 0 = 3$$

$$x = 3$$

2. $x - 8 = 15$

$$x - 8 + 8 = 15 + 8$$

$$x = 23$$

3. $3x - 5 = 7$

$$3x - 5 + 5 = 7 + 5$$

$$3x = 12$$

$$\frac{3x}{3} = \frac{12}{3}$$

$$x = 4$$

4. $\frac{3x}{2} + 3 = 12$

solution;

multiply 2 both side

$$X(2) \times \left(\frac{3x}{2} + 3\right) = 12 \times (2)$$

$$3x + 3 = 24$$

$$3x = 24 - 3$$

$$3x = 21$$

$$\frac{3x}{3} = \frac{21}{3}$$

$$x = 7$$

5. $\frac{5}{3}(3x - 2) = 10$

Solution

$$3 \times \frac{5}{3}(3x - 2) = 10 \times 3$$

$$5(3x - 2) = 30$$

$$\frac{5(3x - 2)}{5} = \frac{30}{5}$$

$$3x - 2 = 6$$

$$3x = 6 + 2$$

$$3x = 8$$

$$\frac{3x}{3} = \frac{8}{3}$$

$$x = \frac{8}{3}$$

$$6. \frac{8}{3x-2} = 2$$

Solution

$$\frac{8}{3x-2} = \frac{2}{1}$$

$$8 \times 1 = (3x - 2) \times 2$$

$$8 = 6x - 4$$

$$8 + 4 = 6x - 4 + 4$$

$$\frac{12}{6} = \frac{6x}{6}$$

$$x = 2$$

$$7. \frac{4m}{5} - \frac{2m}{3} = 4$$

Solution

$$\frac{12m - 10m}{15} = 4$$

$$2m = 4 \times 15$$

$$2m = 60$$

$$\frac{2m}{2} = \frac{60}{2}$$

$$\frac{m}{1} = \frac{30}{1}$$

$$8. \frac{x}{2} + \frac{3x}{4} = 5$$

Solution

$$\frac{4x+6x}{8} = \frac{5}{1}$$

$$10x = 5 \times 8$$

$$10x = 40$$

$$\frac{10x}{10} = \frac{40}{10}$$

$$x = 4$$

$$9. 2x - 5 = 3x - 8$$

Solution

$$3x - 8 = 2x - 5$$

$$3x - 2x = 8 - 5$$

$$x = 3$$

$$10. 4 - 3t = 0.3t - 5.9$$

Solution

$$4 + 5.9 = 0.3t + 3t$$

$$9.9 = 3.3t$$

$$9.9 = 3.3t$$

$$\frac{9.9}{3.3} = \frac{3.3t}{3.3}$$

$$t = 3$$

$$11. \frac{4x-3}{2} = \frac{9x-6}{8} + 2\frac{3}{4}$$

Solution

$$\frac{4x-3}{2} = \frac{9x-6}{8} + \frac{11}{4}$$

Multiply by 8 both side

$$8 \times \frac{4x-3}{2} = \left(\frac{9x+6}{8} + \frac{11}{4}\right) \times 8$$

$$4 \times (4x-3) = \frac{9x+6}{8} \times 8 + \frac{11}{4} \times 8$$

$$16x - 12 = 9x + 6 + 22$$

$$16x - 12 = 9x + 28$$

$$16x - 9x = 28 + 12$$

$$7x = 40$$

$$\frac{7x}{7} = \frac{40}{7}$$

$$x = 5\frac{5}{7}$$

12. $\frac{3x}{7} = \frac{2x}{3} - \frac{1}{3}$ solve for x

Solution

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

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

$$7(2x-1) = 3(3x)$$

$$14x-7 = 9x$$

$$14x-9x=7$$

$$5x = 7$$

$$\frac{5x}{5} = \frac{7}{5}$$

$$x = \frac{7}{5}$$

EXERCISE 7.4

Solve the following equations

1. $x + 12 = 25$

Solution

$$x = 25 - 12$$

$$x = 13$$

2. $\frac{3x}{3} = \frac{15}{3}$

$$x = 5$$

3. $2x + 12 = 25$

Solution

$$2x + 12 - 12 = 25 - 12$$

$$2x + 0 = 13$$

$$\frac{2x}{2} = \frac{13}{2}$$

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

4. $x - 8 = 8$

Solution

$$x - 8 + 8 = 8 + 8$$

$$x = 16$$

5. $\frac{x}{5} = \frac{5}{5} \times$

Solution

$$x = 5 \times 5$$

$$x = 25$$

6. $2x - 8 = 8$

Solution

$$2x = 8 + 8$$

$$2x = 16$$

$$\frac{2x}{2} = \frac{16}{2}$$

$$x = 8$$

7. $3x - 3 = 15$

Solution

$$3x - 3 + 3 = 15 + 3$$

$$\frac{3x}{3} = \frac{18}{3}$$

$$\therefore x = 6$$

8. $\frac{x}{5} - 3 =$

5

Solution

$$\frac{x}{5} - 3 + 3 = 5 + 3$$

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

$$5 \times \frac{x}{5} = 8 \times 5$$

$$\therefore x = 40$$

$$9. \quad 0.2x + 7 = 9$$

Solution

$$0.2x + 7 - 7 = 9 - 7$$

$$\frac{0.2x}{0.2} = \frac{2}{0.2} \times \frac{10}{10} = \frac{20}{2}$$

$$\therefore x = 10$$

$$10. \quad 0.6x - 5 = 7$$

Solution

$$0.6x - 5 + 5 = 7 + 5$$

$$\frac{0.6x}{0.6} = \frac{12}{0.6} \times \frac{10}{10}$$

$$\therefore x = 20$$

$$11. \quad \frac{x}{5} + 3 = 5$$

Solution

$$\frac{x}{5} + 3 - 3 = 5 - 3$$

$$\frac{x}{5} = 2$$

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

$$\underline{x = 10}$$

$$12. \quad 4x - 7 = 7$$

Solution

$$4x = 7 + 7$$

$$4x = 14$$

$$\frac{4x}{4} = \frac{14}{4}$$

$$x = \frac{7}{2}$$

$$13.$$

$$14$$

$$\frac{7x-1}{2} =$$

Solution

$$2 \times \frac{7x-1}{2} = 14 \times 2$$

$$7x - 1 = 28$$

$$7x - 1 + 1 = 28 + 1$$

$$7x = 29$$

$$\frac{7x}{7} = \frac{29}{7}$$

$$\therefore x = 4\frac{1}{7}$$

$$14.$$

$$\frac{3x+2}{5} = 4$$

Solution

$$5 \times \frac{3x+2}{5} = 4 \times 5$$

$$3x + 2 = 20$$

$$3x + 2 - 2 = 20 - 2$$

$$3x = 18$$

$$\frac{3x}{3} = \frac{18}{3}$$

$$\therefore x = 6$$

10

$$\frac{5}{x} \times \frac{10}{1}$$

$$5 = 10x$$

$$\frac{5}{10} = \frac{10x}{10}$$

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

15.
6

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

=

2.

18.

$$\frac{5}{x+1} = 10$$

Solution

$$\times 5 \frac{3x}{5} = 6 \times$$

5

$$\frac{3x}{3} = \frac{30}{3}$$

=

$$\therefore x = 10$$

16.

$$\frac{3x-1}{5} = 5$$

Solution

$$\times 5 \frac{3x-1}{5} = 5 \times 5$$

$$3x = 25 + 1$$

$$\frac{3x}{3} = \frac{26}{3}$$

=

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

17.

$$\frac{5}{x}$$

=

Solution

$$\frac{5}{x+1} = \frac{10}{1}$$

$$5 \times 1 = 10(x + 1)$$

$$5 = 10x + 10$$

$$5 - 10 = 10x$$

$$-\frac{10x}{10} = -\frac{5}{10}$$

19.

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

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

solution

$$1(x + 5) = 3(x - 1)$$

$$x + 5 = 3x - 3$$

$$3 + 5 = 3x - x$$

$$\frac{8}{2} = \frac{2x}{2}$$

$$\therefore x = 4$$

$$20. \frac{(x+5)}{(x-1)} = 5$$

Solution

$$\frac{x+5}{x-1} = \frac{5}{1}$$

$$1(x+5) = 5(x-1)$$

$$x+5 = 5x-5$$

$$5+5 = 5x-x$$

$$\frac{10}{4} = \frac{4x}{4}$$

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

Solving word problems

E.g. 1

If John has hundred shillings, how many oranges can be buy if orange costs 50 shillings?

Solution

Let k be the number of oranges John can buy but one orange costs 50shs.

$$50 \times k = 200$$

$$\frac{50k}{50} = \frac{200}{50}$$

$$K = 4$$

$\therefore$ John can buy 4 oranges

Example 2:

A father age is 4 times the age of his son. If the sum of there is fifty years Find the age of the son.

Solution

Let the age of father be y
Let the age of the son be x
Therefore the age of the father is $y = 4x$

$$\text{Their sum} = 4x + x = 50$$

$$5x = 50$$

$$\frac{5x}{5} = \frac{50}{5}$$

$\therefore$ The son's age is 10years old

Example 3:

The sum of 2 consecutive numbers is 31. Find the smaller numbers

Solution

Let the smaller number be x

Let the bigger number be x

+ 1

$$x + x + 1 = 31$$

$$2x + 1 = 31$$

$$2x = 31 - 1$$

$$2x = 30$$

$$\frac{2x}{2} = \frac{30}{2}$$

$\therefore$ The smaller number is 15

Exercise 7.5

1. If 4 is added to a number and the sum is multiplied by 3 the result is 27. Find the number.

Solution

Let the number be 'b'

$$(b + 4) \times 3 = 27$$

$$12 + 3b = 27$$

$$3b = 15$$

$$b = 5$$

2. Okwi's age is six times Uli's age. 15 years hence Okwi will be three times as old as Uli. Find their ages.

Solution

Let the age of Uli be x

$$\text{Okwi} = 6x$$

Okwi	Uli
$6x$	x
$6x + 15$	$x + 5$
$6x + 15 =$	$3x + 45$

fifteen years to come

$$6x + 15 \qquad 15 + x$$

$$\text{Then } 6x + 15 = 3(x + 15)$$

$$6x + 15 = 3x + 45$$

$$6x - 3x = 45 - 15$$

$$3x = 30$$

$$\frac{3x}{3} = \frac{30}{3}$$

$$x = 10$$

$$\text{Okwi} = 60 \text{ years}$$

$$\text{Uli} = 10 \text{ years}$$

3. The sum of two consecutive odd numbers is 88. Find the numbers

Solution

Let the number be n

$$n + 2, n + 4$$

$$n + 2 + n + 4 = 88$$

$$2n + 6 = 88$$

$$\frac{2n}{2} = \frac{82}{2}$$

$$n = 41$$

$$\text{The smaller number} = 41 +$$

$$2 = 43$$

$$\text{The bigger number} = 41 + 4 = 45$$

4. Obi's age is twice Oba's age. 4 years ago Obi was three times as old as Oba. Find their ages.

Solution

Oba's age let it be x

Obi	Oba
$2x$	x
$2x - 4$	$x - 4$

$$2x - 4 = (x - 4) 3$$

$$2x - 4 = 3x - 12$$

$$8 = x$$

$$\text{Obi} = 16 \text{ years old.}$$

$$\text{Oba} = 8 \text{ years old.}$$

Inequalities in one unknown

The following rules are useful when solving inequalities

i) Adding or subtracting equal amounts from each side does not change the inequalities sign

$$\text{Example : solve } x - 2 \leq 4$$

Solution

$$x - 2 + 2 \leq 4 + 2$$

$$x \leq 6$$

$$\text{Example 2: } 2x + 4 \geq 16$$

Solution

$$2x + 4 - 4 \geq 16 - 4$$

$$\frac{2x}{2} \geq \frac{12}{2}$$

$$x \geq 6$$

ii) Multiplying or dividing by same

positive number each side change the inequality sign

Example: solve $3y + 16 < 50$

Solution

$$3y + 16 - 16 < 50 - 16$$

$$\frac{3y}{3} < \frac{34}{3}$$

Example 2: $\frac{1}{3}(2x - 4) \geq 9$

$$\frac{1}{3}(2x - 4) \geq 9 \times 3$$

$$2x - 4 + 4 \geq 29 \times 3$$

$$\frac{2x}{2} \geq \frac{31}{2}$$

$$x \geq 3\frac{1}{2}$$

iii) Multiplying or dividing each side by negative number CHANGES the inequality sign.

Example. Solve the inequality

$$\left(\frac{2}{3}(4 - 3x) < 4\right)$$

Solution

$$2(4 - 3x) < 4 \times 3$$

$$2\left(\frac{4 - 3x}{2}\right) < \frac{12}{2}$$

$$4 - 3x < 6$$

$$-3x < 6 - 4$$

$$\frac{-3x}{-3} < \frac{2}{-3}$$

The sign changes

$$x > -\frac{2}{3}$$

Examples 1: Solve $-4x + 3 \geq \frac{1}{2}$

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

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

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

$$\frac{-4x}{-4} \geq -\frac{5}{2} \div -4$$

$$x \leq -\frac{5}{2} \times -\frac{1}{4}$$

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

Examples 2. solve $\frac{2x-6}{4} > \frac{3-2x}{3}$

L.C.M

$$\times 4$$

$$- 2x)$$

$$8x$$

$$18$$

$$\frac{14x}{14} > \frac{30}{14}$$

Find their

$$3\left(\frac{2x-6}{4}\right) > \left(\frac{3-2x}{3}\right)$$

$$3(2x - 6) > 4(3$$

$$6x - 18 > 12 -$$

$$6x + 8x > 12 +$$

$$x > \frac{30}{14}$$

BINARY OPERATIONS

Is an operation denoted by $*$, which describe the formula of a given variables.

if $P * q = 5pq - p$: Find

i) $2 * 3 =$

$$p = 2 \text{ and } q = 3$$

$$2 * 3 = 5(2)(3) - 2$$

$$= 30 - 2 = 28$$

$$2 * 3 = 28$$

ii) $(1 * 2) * 3$

Solution

$$(1 * 2) = p = 1 \text{ and } q = 2$$

$$\text{In } (1 * 2) = 5(1)(2) - 1 = 9$$

$$= 10 - 1$$

$$= 9$$

$$\therefore 1 * 2 = 9$$

$$9 * 3 = p * q$$

$$9 * 3 = 5(9)(3) - 9$$

$$= 135 - 9$$

$$= 126$$

$$(1 * 2) * 3 = 126$$

iv) $(2 * 1) * (3 * 2)$

Solution

$$2 * 1 = p = 2 \text{ and } q = 1$$

$$5(2)(1) - 2$$

$$2 * 1 = 10 - 2$$

$$= 8$$

$$3 * 2 = p = 3 \text{ and } q = 2$$

$$5(3)(2) - 3$$

$$15 \times 2 - 3$$

$$3 * 2 = 30 - 3$$

$$3 * 2 = 27$$

$$2 * 1 = 8$$

$$3 * 2 = 27$$

$$8 * 27$$

$$8 * 27 = p = 8 \text{ and } q = 27$$

$$5(8)(27) - 8$$

$$40 \times 27 - 8$$

$$1080 - 8$$

$$\text{Then: } 8 * 27 = 1072$$

$$(2 * 1) * (3 * 2) = 1072$$

iv. if $(t * 5) = 50$ find t

Solution

$$t * 5 = p = t \text{ and } q = 5$$

$$t * 5 = 5(t)(5) - t$$

$$15t - t$$

$$24t = 50$$

$$t * 5 = 24t$$

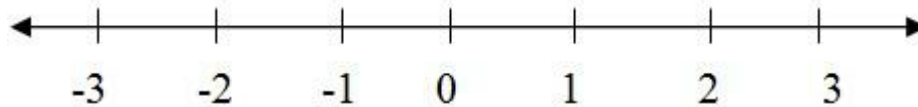
$$= \frac{24t}{24} = \frac{50}{24}$$

$$t = \frac{25}{12}$$

CHAPTER 6: COORDINATE GEOMETRY

Introduction

The position of points on a line found by using a number line, that is



When two number lines one vertical and another one horizontal are considered one kept at 90° and intersecting at their zero marks, The result is called xy – plane or Cartesian plane. The horizontal one is called x – axis and the vertical is called y – axis.

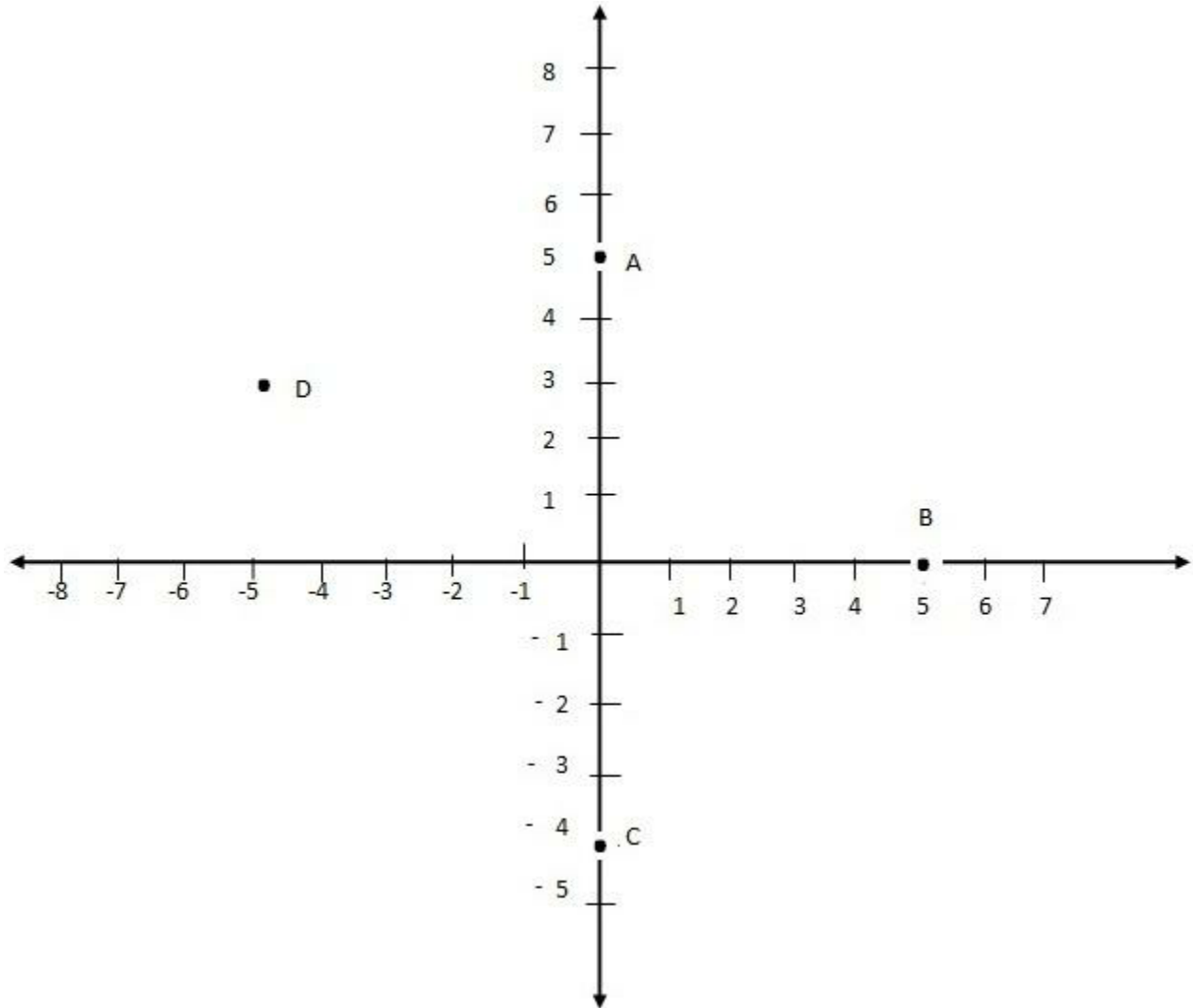
Origin is the where the two axes that is x – axis and y axis (intersect)

Coordinates of a point

The position of a point in the xy – plane is given by a pair of in the form of ordered pair. Thus ordered pair is called coordinate. The coordinate of the point is therefore written in the form of (a, b), Where the first number “a” is the value in the horizontal axis i.e x – axis b is the value in the y – axis

The value in the x – axis is also referred to as abscissa and y – axis is called ordinate. All distance in the xy – plane are measured the origin.

Examples write the coordinates of the following point A, B, C, D, E, F



Solutions

The coordinates of the points are

$$A = (0, 5)$$

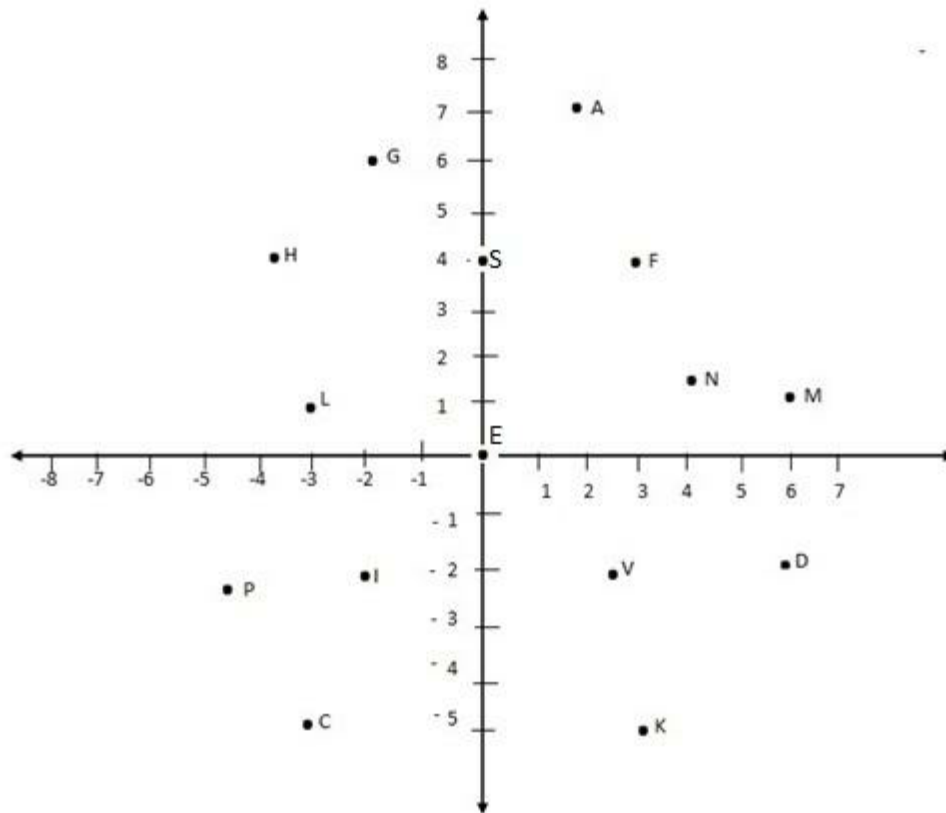
$$B = (5, 0)$$

$$C = (0, -4)$$

$$D = (-5, 5)$$

Exercise 10.1

- a) Write down the coordinates of each of the labeled points in figure 9.2
b) State the quadrant in which each of these points F, H, V and I belong



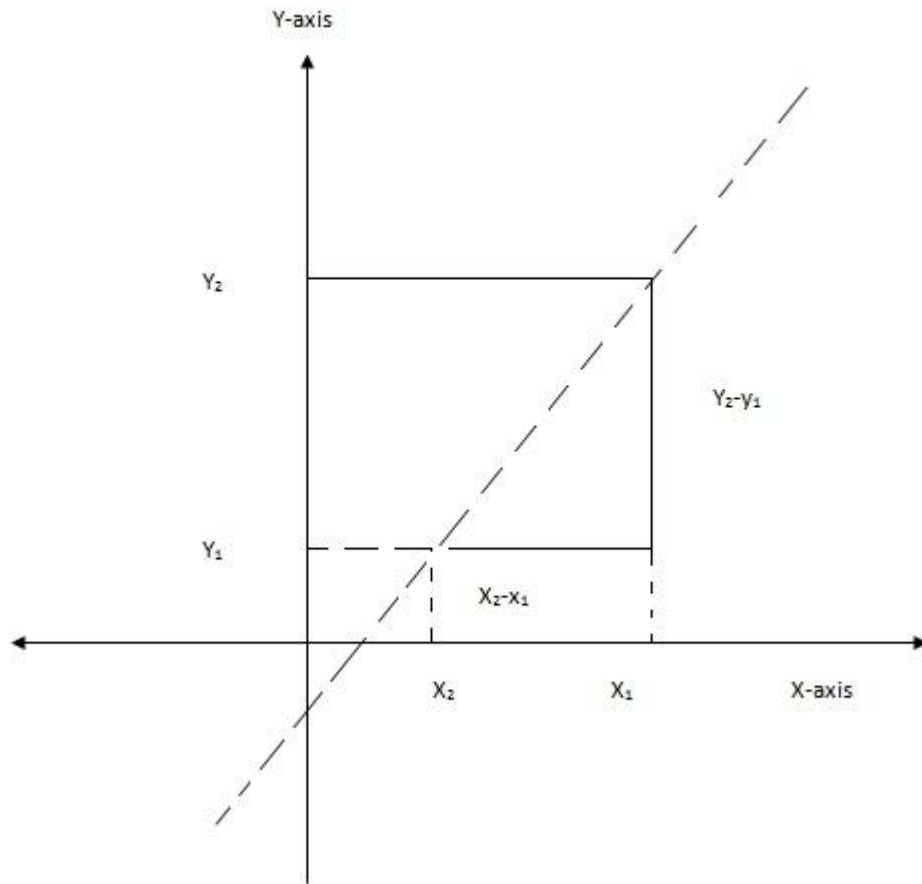
2. Draw axes on a graph paper and plot the points given below. Join in the order given with straight lines forming polygonal figures shape have you drawn in each case.

- (1, 1), (3, 1), (3, 3), (1, 3)
- (-2, 1), (2, 5), (2, -2)
- (3, 1), (5.4, 1), (4.3, 2), (3.3, 2)
- (5.5, 3.4), (6.5, 3.4), (6.8, 4.3), (6.0, 4.9), (5.2, 4.3)
- (1.5, -3), (6, 3), (1.5, 3), (-6, -3)
- (-1, 0), (-2, 2), (0, 1), (2, 2), (1, 0), (2, -2), (0, -1)

SLOPE/GRADIENT OF A LINE

Slope / gradient is the change in the vertical axis to the change in the horizontal axis.

$$\text{Slope} = \frac{\text{change in } y\text{-axis}}{\text{change in } x\text{-axis}}$$



$$\text{Gradient} = \frac{\text{change in } y}{\text{change in } x}$$

$$\text{Gradient (M)} = \frac{y_2 - y_1}{x_2 - x_1}$$

Example: Find the gradients of the lines joining

- (a) A (2, 4) and B (-2, 6)
- (b) A (-2, -2) and B (2, -4)
- (c) A (0, -1) and B (2, 3)

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\frac{6-4}{-2-2} = \frac{2}{-4}$$

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

Solution

- a. Let (x_1, y_1) be (2, 4) and
 (x_2, y_2) be (-2, 6)

- b. let (x_1, y_1) be (-2, -2)

(x₂, y₂) be (2, -4)

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\begin{aligned} M &= \frac{-4 - (-2)}{2 - (-2)} \\ &= \frac{-2}{4} \\ m &= -\frac{1}{2} \end{aligned}$$

c. A (0, -1) and B (2, 3)

Solution

Let (x₁, y₁) be (0, -1)

(x₂, y₂) be (2, 3)

$$\begin{aligned} M &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{3 - (-1)}{2 - 0} = 2 \end{aligned}$$

$$M = 2$$

Exercise 10.2

1. Plot pair of the following points on a graph paper and join them by straight line. For each pair, calculate the gradient of the line and state whether it is positive, negative, zero or undefined.

- (0,3), (2,5)
- (5,8), (4,1)
- (1,5), (4,7)
- (2,6), (5,3)
- (1,6), (3,-1)
- (3,6), (-2,-1)
- (0,2), (6,2)
- (2,3), (-1,-3)
- (2,10), (2,0)
- ($3\frac{1}{2}$, $-\frac{1}{2}$), ($7\frac{1}{2}$, 2)
- (-2,1), (4,3)
- (-4,4), (-3,3)
- (0,0), (-3,4)
- (99,6), (119,1)
- (0.64, -1.62), (1.36, -0.62))

EQUATION OF A LINE

We have already discussed how to find the gradient of a line for example the gradient of the line joining points (2, -4) and (5,0) is given as.

$$m = \frac{-4 - 0}{2 - 5} = \frac{-4}{-3} = \frac{4}{3}$$

Since the two points are collinear, we can find the equation of the line having any point on a line say (x,y) and any point, then from

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

let (x₁, y₁) = (x, y), and (x₂, y₂) = (5, 0)

$$\frac{4}{3} = \frac{0 - y}{5 - x}$$

$$\frac{4}{3} = \frac{y}{5 - x}$$

$$4(5 - x) = 3x - y$$

$$20 - 4x = -3y$$

$$\frac{-2}{3}y = \frac{20}{-3} - \frac{4}{-3}$$

$$\therefore y = \frac{4x}{3} - \frac{20}{3}$$

In general the equation of a straight line is written as $y = mx + c$. Where m - Is the slope of the line and c is ordinate of the y. called y- intercept

The point on the line (x,y) is called arbitrary point

Example: - find the equation of line passing through the points.

(12,-6) and (2, 6)

Solution

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\text{let } (x, y) = (12, -6), \\ (x_2, y_2) = (2, 6)$$

$$M = \frac{6 - -6}{2 - 12} \\ = \frac{12}{-10} \\ = -\frac{6}{5}$$

$$\text{Use } (x, y), \text{ and } (2, 6) \text{ and } m = -\frac{6}{5}$$

$$\frac{y - 6}{x - 2} = \frac{-6}{5} \\ 5(y - 6) = -6(x - 2) \\ 5y - 30 = -6x + 12 \\ 5y = -6x + 12 + 30 \\ 5y = -6x + 42 \\ \frac{5y}{5} = \frac{42 - 6x}{5}$$

$$y = \frac{42 - 6x}{5}$$

(2) Give that $y = -\frac{3}{7}x + 6$ find the gradient of this line

The gradient is $\frac{3}{7}x$

Example: find the equation of the line passing through the point (4, 6) and having a slope -1/2

Solution

$$(x, y), (4, 6), M = \frac{1}{2} \\ \frac{y - 6}{x - 4} = \frac{1}{2}$$

$$2(y - 6) = x - 4 \\ 2y - 12 = x - 4 \\ 2y = x + 8$$

$$y = 0.5x \text{ or } \frac{1}{2}x + 4$$

X-intercept and y - intercept.

X-intercept is the point where a line meets (cuts) the x-axis, at the value of y (ordinate) is equal to zero.

That is to say the x-intercept is found by substituting $y = 0$ in the equation. Therefore for the equation $y = mx + c$.

$$Y = 0, 0 = mx + c$$

$$Mx + c = 0$$

$$Mx = -c$$

$$x = -c/m.$$

Therefore the coordinate of x-intercept is $(-c/m, 0)$.

y- Intercept is the point where the line and the y- axis meet. All this point the abscissa is normally equal to zero. The x- intercept is found by setting $x=0$

$$\text{i.e } y = mx + c$$

$$x=0$$

$$y = m(0) + c$$

$$y = c$$

The intercept (0,c)

The coordinate of the Y-intercept is (0,c)

Example : - a line L is passing through the points A(5 - 2) and B(1,4).

Find

i. The equation of the line in the form of

$$Y = mx + c \text{ and } ax + by + c = 0$$

ii. The x and y intercept.

Solution:

i.

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{4 - -2}{1 - 5}$$

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

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

$$(x, y) = (1, 4)$$

$$\frac{4-y}{1-x} = -\frac{3}{2}$$

$$-3 + 3x = 8 - 2y$$

$$2y = 11 - 3x$$

$$Y = \frac{11}{2} - \frac{3x}{2}$$

$$Y = -\frac{3x}{2} + \frac{11}{2}$$

$$\text{From } \frac{4-y}{1-x} = -\frac{3}{2}$$

$$\text{then } -3 + 3x = 8 - 2y$$

$$-3 + 3x = 8 - 2y$$

$$-3 + 3x - 8 + 2y = 0$$

$$3x - 11 + 2y = 0$$

$$3x + 2y - 11 = 0$$

(ii) Y – intercept

Let $x = 0$

$$3x + 2y - 11 = 0$$

$$\frac{2y}{2} = \frac{11}{2}$$

$$y = \frac{11}{2}$$

$$Y - \text{Intercept} = 0, \frac{11}{2}$$

The coordinate of Y-intercept is $(0, 11/2)$

∴ find the x-intercept

Let $y=0$

$$mx + c = y$$

$$0 = -\frac{3x}{2} + 11$$

$$x = \frac{22}{3}$$

The coordinate of X-intercept is $(22/3, 0)$

(iii) If $ax + by = 12$ goes through points $(1, -2)$ and $(4, 1)$ find the value a and b -

solution

$$M = \frac{y_2 - y_1}{x_2 - x_1} +$$

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

$$M = \frac{3}{3}$$

$$M = 1$$

let the two collinear point be $(x, y), (4, 1)$
and gradient 1
then from

$$M = \frac{Y_2 - Y_1}{X_2 - X_1}$$

$$M = \frac{y - 1}{x - 4}$$

$$x - 4 = y - 1$$

$$x - y = -1 + 4$$

$$x - y = 3$$

if the equation is multiple by 4 both side
we have

$$4(x - y) = 4 \times 3$$

$$4x - 4y = 12$$

compare the equations.

$$x - y = 3 \text{ and } ax + by = 12$$

$$ax + by = 4(3)$$

$$\frac{a}{4}x + \frac{b}{4}y = 3$$

$$x - y = 3$$

$$\frac{a}{4}x + \frac{b}{4}y = 3$$

then

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

$$a = 4$$

$$\frac{b}{4} = -1$$

$$b = -4$$

The value of $a=4$ and $b=-4$

EXERCISE 10.3

3. Find the equations of lines through

points

- a) (2,1) with gradient 2.
- b) (0,5) with gradient -2
- c) (1,-3) with gradient -3
- d) (-2, -4) with gradient $\frac{3}{2}$
- e) (0, 0) with gradient -3
- f) (-3, -3) and y- intercept $\frac{1}{2}$
- g) (6, 2) and y intercept -2
- h) (-1 , -1) and y - intercept - $\frac{1}{3}$
- i) (1 , 2) and y- intercept = 2
- j) (5 , 5) and y intercept 0

2. Find the equations of the following lines

- a. (i) y – intercept - 2 , gradient 1
- b. (ii) y – intercept 7, gradient $\frac{3}{4}$

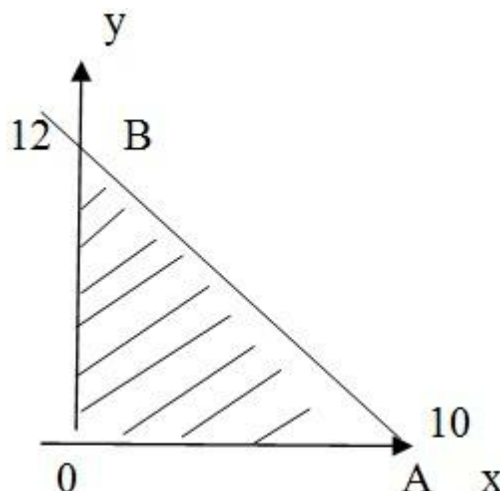
(iii) y- intercept -16, gradient 4

- d. (iv) y -intercept 2, gradient - 10
- e. (v) y- intercept 0.4, gradient -0.7

(3) Rewrite the following equations in the form $y = mx + c$, and then determine the gradient and the y- intercept of each.

- a) (i) $7x + 4y = 11$
- (ii) $14x + 3y = 12$
- c) (iii) $2x = 5 + y$
- d) (iv) $4x + 5y = 40$
- (v) $8x - (\frac{1}{3})y = 0$
- (vi) $6x = 5 - 2y$
- (vii) $\frac{2}{3}x + \frac{4y}{3} = 9$

Qn. 4. Find the area of the shaded region in the following figure. If the equation line AB is $5x + 6y - 60 = 0$



SIMULTANEOUS EQUATIONS

Are equations of more than one variable which can be solved at the same time. There are two ways of solving simultaneous equations.

1. (i) Elimination method
- (ii) Substitution method.
- (iii) Graphical Method

The principle of solving equations is that the number of equations should be equal to the number of unknowns

Example of simultaneous equation

$$\begin{aligned} \text{(a)} &= \begin{cases} a + b = 3 \\ a - b = 1 \end{cases} \\ \text{(b)} &= \begin{cases} 2x + y = 9 \\ x + y = 5 \end{cases} \end{aligned}$$

These are examples of simultaneous equations with two unknowns.

1. Elimination method

Is the method of omitting one variable and solve the remaining variables.

How to eliminate

- i. Check if there are equal coefficients
- ii. If there are equal coefficients of same variables in the both equations subtract.
- iii. If there are equal and opposite to coefficients of same variable in both

equations, add.

2. If all coefficients are different modify the equations

Example 1. $2x + 3y = 6$

$$3x + 2y = 4$$

Modification

Omitting: x

$$\begin{array}{r} \times 3 \{ 2x + 3y = 6 \\ \times 2 \{ 3x - 2y = 4 \end{array}$$

here we can now omit x by subtracting.

$$\begin{array}{r} 6x + 9y = 18 \\ - \{ 6x - 4y = 8 \end{array}$$

$$13y = 10$$

$$y = \frac{10}{13}$$

Omitting y

$$\begin{array}{r} \times 2 \{ 2x + 3y = 6 \\ \times 3 \{ 3x - 2y = 4 \\ \hline 4x + 6y = 12 \\ + \{ 9x - 6y = 12 \end{array}$$

$$13x = 24$$

$$\frac{13x}{13} = \frac{24}{13}$$

$$x = \frac{24}{13}$$

Let find the value of y by take one equation

$$2x + 3y = 6$$

$$\text{but } x = \frac{24}{13}$$

$$\text{Then } 2\left(\frac{24}{13}\right) + 3y = 6$$

$$3y = 6 - \frac{48}{13}$$

$$\frac{1}{3} \times 3y = \frac{30}{13} - \frac{1}{3}$$

$$y = \frac{10}{13}$$

Example 2:

$$\begin{cases} 6x + y = 15 \\ 3x + y = 9 \end{cases}$$

Solution

$$\begin{cases} 6x + y = 15 \\ - \{ 3x + y = 9 \end{cases}$$

$$3x = 6$$

$$\frac{3x}{3} = \frac{6}{3}$$

$$x = 2$$

Let find the value of y by take one equation

$$6x + y = 15$$

$$6 \times 2 + y = 15$$

$$12 + y = 15$$

$$y = 15 - 12$$

$$y = 3$$

$$\therefore x = 2 \text{ and } y = 3$$

Example 03:

$$2x + y = 10$$

$$3x - 2y = 1$$

Solution. by Eliminate

$$\begin{array}{r} \times 2 \{ 2x + y = 10 \\ \times 1 \{ 3x - 2y = 1 \end{array}$$

$$+ \begin{cases} 4x + 2y = 20 \\ 3x - 2y = 1 \end{cases}$$

$$7x = 21$$

$$\frac{7x}{7} = \frac{21}{7}$$

$$x = 3$$

Let find the value of y by taken one equation

$$3x - 2y = 1$$

$$3 \times 3 - 2y = 1$$

$$9 - 2y = 1$$

$$-2y = 1 - 9$$

$$= \frac{-2y}{-2} = \frac{-8}{-2}$$

$$y = 4$$

$$y = 4 \text{ and } x = 3$$

Solve the following simultaneous equations by elimination method

$$1. \quad x + y = 7$$

$$5x + 12y = 7$$

Solution**Modify**

$$\begin{aligned} &\times \begin{cases} x + y = 7 \\ 5x + 12y = 7 \end{cases} \\ &\times \begin{cases} 5x + 5y = 35 \\ 5x + 12y = 7 \end{cases} \end{aligned}$$

$$\begin{aligned} -7y &= -28 \\ \frac{-7Y}{-7} &= \frac{-28}{-7} \end{aligned}$$

$$y = 4$$

Let find the value of x by taken one equation

$$x + y = 7$$

$$x + 4 = 7$$

$$x = 7 - 4$$

$$x = 3$$

Therefore: $x=3$ and $y = 4$

$$2. \quad x + 8y = 19$$

$$2x + 11y = 28$$

Solution

$$\begin{aligned} &\times \begin{cases} x + 8y = 19 \\ 2x + 11y = 28 \end{cases} \\ &\times \begin{cases} 2x + 16y = 38 \\ 2x + 11y = 28 \end{cases} \end{aligned}$$

$$\begin{aligned} 5y &= 10 \\ \frac{5y}{5} &= \frac{10}{5} \end{aligned}$$

$$y = 2$$

Let find the value of x by take one equation

$$x + 8y = 19$$

$$x + 8 \times 2 = 19$$

$$x = 19 - 16$$

$$x = 3$$

Therefore: $x=3$ and $y = 2$

$$3. \quad 8x + 5y = 9$$

$$3x + 2y = 4$$

Solution

$$\begin{aligned} &\times \begin{cases} 8x + 5y = 9 \\ 3x + 2y = 4 \end{cases} \\ &\times \begin{cases} 8x + 5y = 9 \\ 3x + 2y = 4 \end{cases} \end{aligned}$$

$$\begin{aligned} &\begin{cases} 24x + 15y = 27 \\ 24x + 16y = 32 \end{cases} \\ &= \frac{-y}{-} = \frac{-5}{-} \\ &y = 5 \end{aligned}$$

Let find the value of x by taken one equation

$$8x + 5y = 9$$

$$8x + 5(5) = 9$$

$$8x + 25 = 9$$

$$8x = 9 - 25$$

$$8x = -16$$

$$= \frac{8x}{8} = \frac{-16}{8}$$

$$x = -2$$

Therefore: $x = -2$ and $y = 5$

$$4. \quad 2x - 3y = 7$$

$$15x + y = 9$$

Solution

$$\times \begin{cases} 2x - 3y = 7 \\ 15x + y = 9 \end{cases}$$

$$+ \begin{cases} 2X - 3Y = 7 \\ 15X + 3Y = 27 \end{cases}$$

$$\begin{aligned} 17x &= 34 \\ \frac{17x}{17} &= \frac{34}{17} \end{aligned}$$

$$x = 2$$

Let find the value of y by taken one equation

$$2y - 3y = 7$$

$$2(2) - 3y = 7$$

$$-3y = 7 - 4, \quad -3y = 3$$

$$4 - 3y = 7$$

$$= \frac{-3y}{-3} = \frac{3}{-3}$$

$$y = -1$$

Therefore: $x = 2, y = -1$

$$5. \quad 2x + 3y = 8$$

$$2x = 2 + 3y$$

solution

$$2x + 3y = 8$$

$$2x - 3y = 2$$

$$\begin{cases} 2x + 3y = 8 \\ 2x - 3y = 2 \end{cases}$$

$$\begin{aligned} 6y &= 6 \\ \frac{6y}{6} &= \frac{6}{6} \end{aligned}$$

$$y = 1$$

Let find the value of x by taken one equation

$$2x + 3y = 8$$

$$2x + 3(1) = 8$$

$$2x = 8 - 3$$

$$\begin{aligned} x &= 5 \\ \frac{2x}{2} &= \frac{5}{2} \\ x &= \frac{5}{2} \end{aligned}$$

Therefore: $x = \frac{5}{2}$ and $y = 1$

$$6. \quad 3x - 4y = 20$$

$$x + 2y = 5$$

Solution

$$\begin{aligned} 2 \begin{cases} 3x - 4y = 20 \\ x + 2y = 5 \end{cases} \\ 4 \begin{cases} 6x - 8y = 40 \\ 4x + 8y = 20 \end{cases} \\ - \end{aligned}$$

$$\begin{aligned} 2x &= 20 \\ \frac{2x}{2} &= \frac{20}{2} \end{aligned}$$

$$x = 10$$

Let find the value of y by taken the one equation

$$x + 2y = 5$$

$$10 + 2y = 5$$

$$2y = 5 - 10$$

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

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

Therefore: $y = \frac{-5}{2}$ and $x = 10$

$$7. \quad 6x = 7y + 7$$

$$7y - x = 8$$

Solution

$$\begin{cases} 6x - 7y = 7 \\ -x + 7y = 8 \end{cases}$$

$$\begin{aligned} 5x &= 15 \\ \frac{5x}{5} &= \frac{15}{5} \end{aligned}$$

$$x = 3$$

Let find the value of y by taken one equation

$$6x - 7y = 7$$

$$6(3) - 7y = 7$$

$$-7y = -11$$

$$\frac{-7y}{-7} = \frac{-11}{-7}$$

$$y = \frac{11}{7}$$

$$y = \frac{11}{7}, x = 3$$

Therefore :

$$8. \quad y = 4x - 7$$

$$16x - 5y = 25$$

solution

$$-4x + y = -7$$

$$16x - 5y = 25$$

$$\begin{aligned} 5 \begin{cases} -4x + y = -7 \\ 16x - 5y = 25 \end{cases} \\ 1 \end{aligned}$$

$$\begin{aligned} \begin{cases} -20x + 5y = -35 \\ 16x - 5y = 25 \end{cases} \\ + \end{aligned}$$

$$-4x = -10$$

$$\frac{-4x}{4} = \frac{-10}{4}$$

$$x = 2.5 \text{ or } 5/2$$

Let find the value of y by taken equation one

$$y - 4x = -7$$

$$y = -4(2.5) = -7$$

$$y = -7 + 10$$

$$y = 3$$

Therefore $x = 2.5$ and $y = 3$

$$9. \quad 2x + 7y = 39$$

$$3x + 5y = 31$$

solution

$$\begin{array}{r} 3 \{ 2x + 7y = 39 \\ 2 \{ 3x + 5y = 31 \\ \hline 6x + 21y = 117 \\ - \{ 6x + 10y = 62 \\ \hline 11y = 55 \\ \hline 11 \quad 11 \end{array}$$

$$y = 5$$

Let find the value of x by taken one equation

$$3x + 5y = 31$$

$$3x + 5(5) = 31$$

$$3x = 31 - 25$$

$$\frac{3x}{3} = \frac{6}{3}$$

$$x = 2$$

Therefore: $x = 2$ and $y = 5$

$$\begin{array}{l} 10. \quad 15x - 8y = 29 \\ \quad 17x + 12y = 75 \end{array}$$

Solution

$$\begin{array}{r} 12 \{ 15x - 8y = 29 \\ 8 \{ 17x + 12y = 75 \\ \hline 180x - 96y = 348 \\ + \{ 136x + 96y = 600 \\ \hline 316x = 948 \\ \hline 316 \quad 316 \end{array}$$

$$x = 3$$

Let find the value of y by taken one equation

$$15x - 8y = 29$$

$$15(3) - 8y = 29$$

$$\frac{-8y}{-8} = \frac{-16}{-8}$$

Therefore: $y = 2$ and $x = 3$

2: SUBSTITUTION

Example: 01 solve

$$6x + y = 15$$

$$3x + y = 9 \text{ by substitution method.}$$

solution

$$6x + y = 15 \quad \text{..... (i)}$$

$$3x + y = 9 \quad \text{..... (ii)}$$

from equation 1

$$6x + y = 15$$

$$y = 15 - 6x \quad \text{.....(iii)}$$

Substitute equation (iii) into (ii)

$$3x + y = 9$$

$$3x + 15 - 6x = 9$$

$$3x - 6x + 15 = 9$$

$$-3x = 9 - 15$$

$$-3x = -6$$

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

$$x = 2$$

$$y = 15 - 6x$$

$$y = 15 - 6 \times 2$$

$$y = 15 - 12 = 3$$

$$x = 2 \text{ and } y = 3$$

Example 02

$$2x + y = 10 \quad \text{.....(i)}$$

$$3x - 2y = 1 \quad \text{.....(ii)}$$

From (i)

$$2x + y = 10$$

$$2x - 2x + y = 10 - 2x$$

$$y = 10 - 2x \quad \text{.....(iii)}$$

Put (iii) into (ii)

$$3x - 2(10 - 2x) = 1$$

$$3x - 20 + 4x = 1$$

$$3x + 4x - 20 = 1$$

$$\frac{7x}{7} = \frac{21}{7}$$

$$\therefore x = 3$$

$$y = 10 - 2x$$

$$y = 10 - 2(3)$$

$$y = 10 - 6$$

$$y = 4$$

$$\therefore x = 3 \text{ and } y = 4$$

Solve:

$$3x + 2y = 8 \quad \text{..... (i)}$$

$$2x + 3y = 12 \quad \text{..... (ii)}$$

solution

from (i)

$$3x + 2y = 8$$

$$2y = 8 - 3x$$

$$\frac{2y}{2} = \frac{8-3x}{2}$$

$$Y = \frac{8-3x}{2} \dots\dots (iii)$$

Put (iii) into (ii)

$$2x+3y=12$$

$$2x+3\left(\frac{8-3x}{2}\right)=12$$

$$2x+\frac{24-9x}{2}=12$$

$$4x+24-9x=24$$

$$-5x=24-24$$

$$-5x=0$$

$$\frac{-5x}{-5} = \frac{0}{-5}$$

$$x=0$$

$$3x + 2y = 8$$

$$3(0) + 2y = 8$$

$$2y=8$$

$$\frac{2y}{2} = \frac{8}{2}$$

$$\therefore Y = 4$$

$$X = 0 \text{ and } y = 4$$

Exercise 10.4

1. Solve the simultaneous equations by using elimination method.

(i). $2x + y = 5$

$$4x - y = 7$$

(ii) $3x + y = 6$

$$5x + y = 8$$

(iii) $5x - 2y = 16$

$$x + 2y = 8$$

(iv) $8x+5y=40$

$$9x + 5y = 5$$

(v) $7x - 4y = 17$

$$5x - 4y = 11$$

(vi) $0.7x - 0.5y = 2.5$

$$0.7x - 0.3y = 2.9$$

2. Solve the following simultaneous equations by using substitution method

(i). $3x - 2y =$

$$2x + y = 8$$

(ii) $5x + y = 23$

$$3x - 2y = 6$$

(iii) $x - 3y = 2$

$$4x + 2y = 36$$

(iv) $7x - y = 14$

$$8x - 2y = 16$$

(v) $7x + y = 14$

$$8x - 2y = 16$$

(vi) $2y + \frac{1}{2}x = 9$

$$Y + \frac{1}{5}x = 9$$

3. Solve the following by using any method

(i) $3y - x =$

$$y + 2x = 6$$

(ii) $8m - n = 38$

$$m - 3n = -1$$

(iii) $5x - 2y = 10$

$$-x + 3y = 24$$

1. 4.Solve the following simultaneous equations by substitution method

(i) $x - y = -3$

$$2x - y = -5$$

(ii) $X - 2y = 6$

$$X + 2y = 2$$

3. (iii) $3x - 4y = -11$

$$2x + 3y = 1$$

4. (iv) $2x - 3y = 32$

$$3x - 4y = 30$$

(v) $5a - 5b = 7$

$$2a - 4b = 2$$

5. Solve the following system of simultaneous equations by elimination.

6. (i) $10u + 3v - 4 = 0$
 $6u + 2v - 2 = 0$

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

(iii) $3x + 3y = 15$
 $2x + 5y = 14$

(iv) $7x - 3y = 15$
 $5x - 2y = 19$

(v) $x + y = 5$
 $x - y = 1$

6. Solve the following by any method

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

$$\frac{1}{4}x + \frac{1}{2}y = 6$$

Solving word problems leading to simultaneous equations.

1. A father's age is four times the age of his son. If the sum of their ages is 60 years. Find the age of the son and that of the father.

Solution.

Let x be the age of the son

Let y be the age of father

$$y = 4x \dots\dots\dots (i)$$

$$x + y = 60 \dots\dots\dots (ii)$$

By substitution method

$$x + y = 60, \text{ but } y = 4x$$

then

$$x + 4x = 60$$

$$5x = 60$$

$$\frac{5x}{5} = \frac{60}{5}$$

$$x = 12$$

By solve value of y you can take one equation

$$y = 4x$$

$$y = 4(12) = 48$$

The age of the father is 48 years and

that of the son is 12 years

2. The sum of two number is 12 and their difference is 2 find the number

Solution

Let the first number be $= x$

Let the second number be $= y$

$$\begin{aligned} & \begin{cases} x + y = 12 \\ x - y = 2 \end{cases} \\ & \text{---} + \end{aligned}$$

$$2x + 0 = 14$$

$$2x = 14$$

$$\frac{2x}{2} = \frac{14}{2}$$

$$x = 7$$

Let find the value of y

$$7 + y = 12$$

$$y = 12 - 7$$

$$y = 5$$

The numbers are 5 and 7

Example 03. If the numerator of a fraction is decreased by 1 its value become $\frac{2}{3}$ but if its denominator is increased by 5 its value becomes $\frac{1}{2}$, what the fraction?

solution

let the fraction be $\frac{a}{b}$

$$\frac{a-1}{b} = \frac{2}{3} \dots\dots\dots (i)$$

$$\frac{a}{b+5} = \frac{1}{2} \dots\dots\dots (ii)$$

from (i)

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

$$3(a-1) = 2b$$

$$3a - 3 = 2b$$

$$3a - 2b = 3 \dots\dots\dots (iii)$$

from (ii)

$$\frac{a-1}{b} = \frac{2}{3} \dots\dots\dots (i)$$

$$\frac{a}{b+5} = \frac{1}{2} \dots\dots\dots (ii)$$

$$2a = b + 5$$

$$2a - b = 5 \dots\dots\dots (iv)$$

Solve (iii) and (iv) simultaneously,

$$\begin{array}{l} 2 \{ 3a - 2b = 3 \\ 3 \{ 2a - b = 5 \end{array}$$

$$\begin{array}{l} \{ 6a - 4b = 6 \\ \{ 6a - 3b = 15 \end{array}$$

$$0 - b = -9$$

$$\underline{-b = -9}$$

$$b = 9 - \text{denominator}$$

From (iii) $3a - 2b = 3$, but $b = 9$

$$3a - 2(9) = 3$$

$$3a - 18 = 3$$

$$3a = 3 + 18$$

$$3a = 21$$

$$a = \frac{21}{3}$$

$$a = 7 \text{ , numerator}$$

$$\therefore \text{the fraction} = \frac{7}{9}$$

Example 4

The sum of the digits of a two digit number is 7. If the digits are reversed, the new number is increased by 3. Equal to 4 times the original number

Find the original number

Let the number be x and y

$$x + y = 7 \dots\dots\dots (i)$$

The meaning of $x, y = 10x + y$

Similarly $y, x = 10y + x$

$$y, x + 3 = 4(x, y)$$

$$10y + x + 3 = 4(10x + y)$$

$$10y + x + 3 = 40x + 4y$$

$$6y + 3 = 39x$$

$$\frac{39x - 6y}{3} = \frac{3}{3}$$

$$13x - 2y = 1 \dots\dots (2)$$

$$\begin{array}{l} \{ x + y = 7 \\ \{ 13x - 2y = 1 \end{array}$$

$$\begin{array}{l} \{ 2x + 2y = 14 \\ \{ 13x - 2y = 1 \end{array}$$

$$\begin{array}{l} \{ 13x - 2y = 1 \\ \{ 13x - 2y = 1 \end{array}$$

$$15x + 0 = 15$$

$$15x = 15$$

$$\frac{15x}{15} = \frac{15}{15}$$

$$x = 1$$

Let find the value of y

$$x + y = 7$$

$1 + y = 7$ the number was x, y is 1, 6

$$y = 6$$

The original number is 16

Exercise 10.5

1. The sum of two number is 109 and the difference of the same numbers 29. find the numbers

2. Two number are such that the first number plus three times the second number is 1. And the first minus three times the second is $\frac{1}{7}$. Find the two numbers

3. The sum of the number of boys and

girls in a class is 36. If twice the number of girls exceeds the number of boys by 12, find the number of girls and that of boys in the class.

4. Twice the length of a rectangle exceeds three times the width of the rectangle by one centimeter and if one – third of the difference of the length and the width is one centimeter find the dimensions of the rectangle.

5. The cost of 4 pencils and five pens together is 6000 shillings while the cost of 6 pencils and 8 pens is 940 shillings,

EXERCISE 10.1

1. (a) Their coordinates are

A (2, 7)

J (0, 4)

F (3, 4)

N (4, 1.5)

M (6, 1)

V (2.5, -2)

D (6, -2)

K (3, -5)

C (-3, -5)

I (-2, -2)

P (-4.5, -2.5)

H (-4, 4)

G (-2, 6)

L (-3, 1)

E (0, 0)

calculate the cost of one pencil and one pen

6. Half of Paul's money plus one – fifth of John's money is 1400 shilling John's money is 2650 shillings. How much has each?

7. A farmer buys 3 sheep and 4 goats for shs 290, Another buys sheep and goats from the same market for shs 170. What price did they pay for (a) 1 goat (b) 1 sheep

SOLUTIONS.

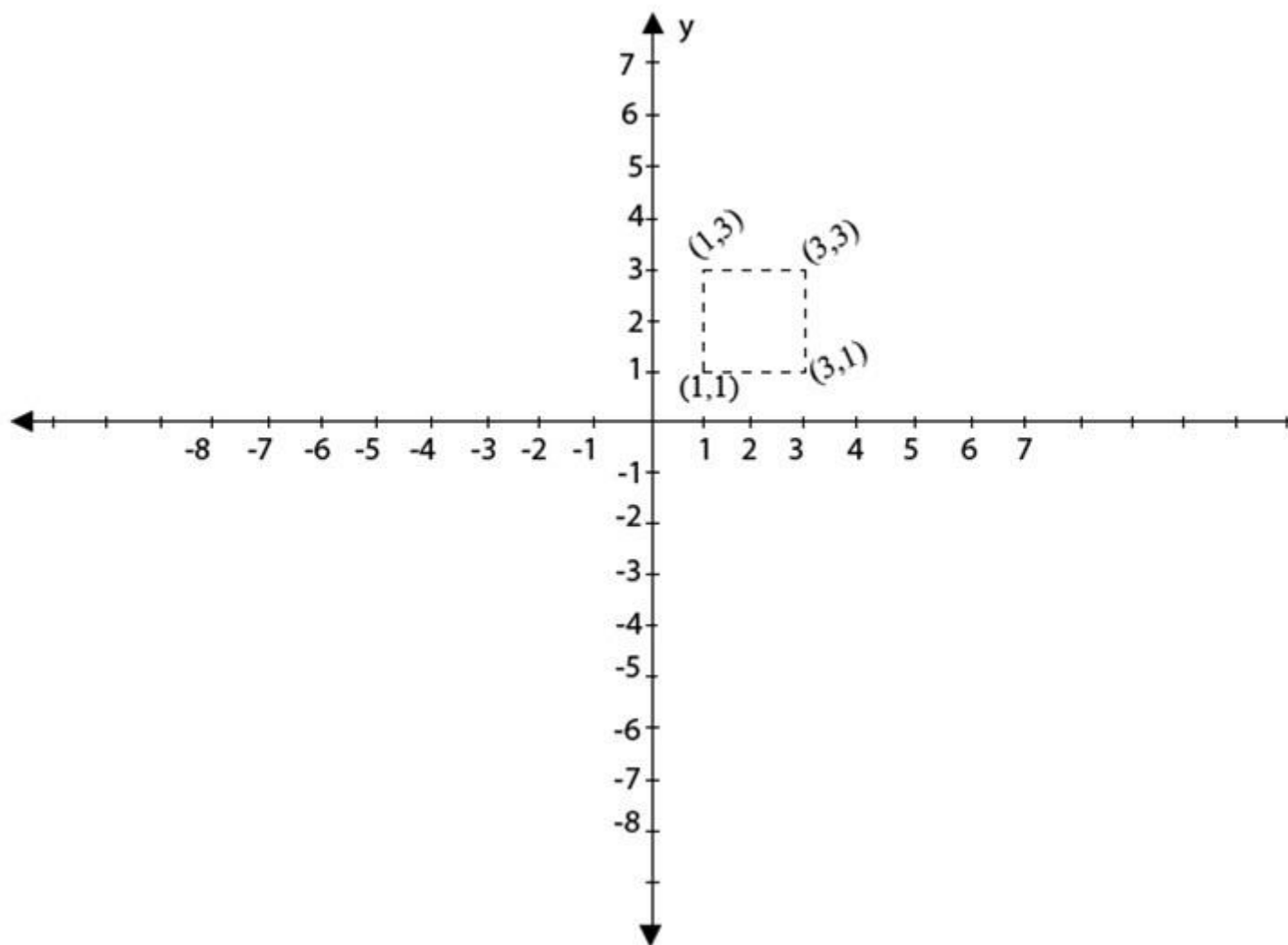
(b) F belongs to quadrant I

H belongs to quadrant II

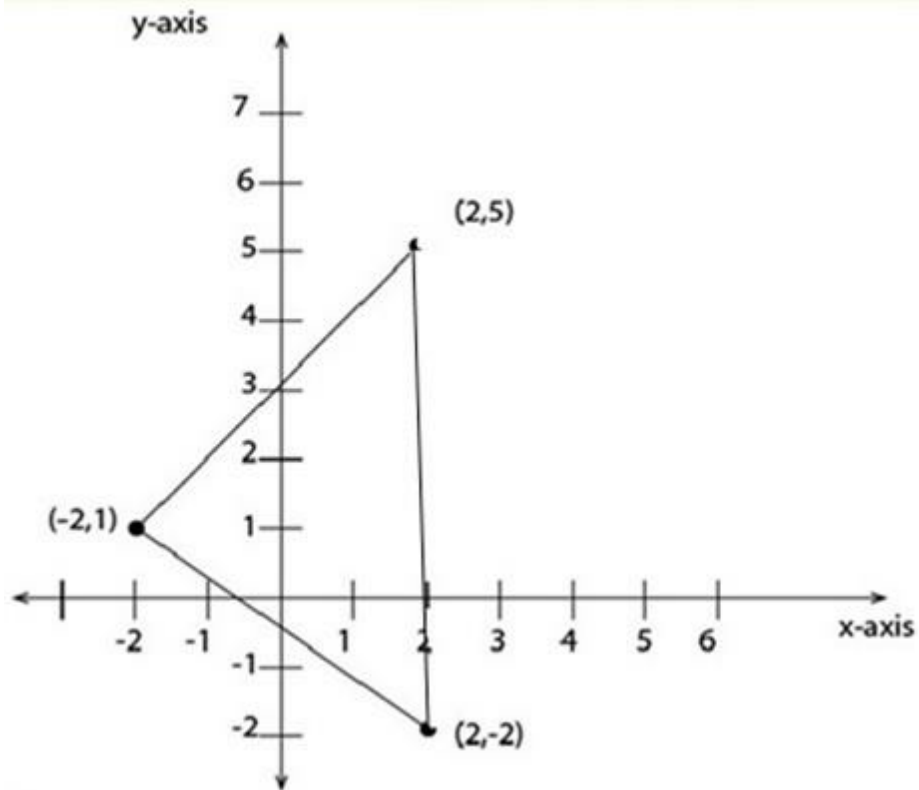
V belongs to quadrant IV

I belong to quadrant III

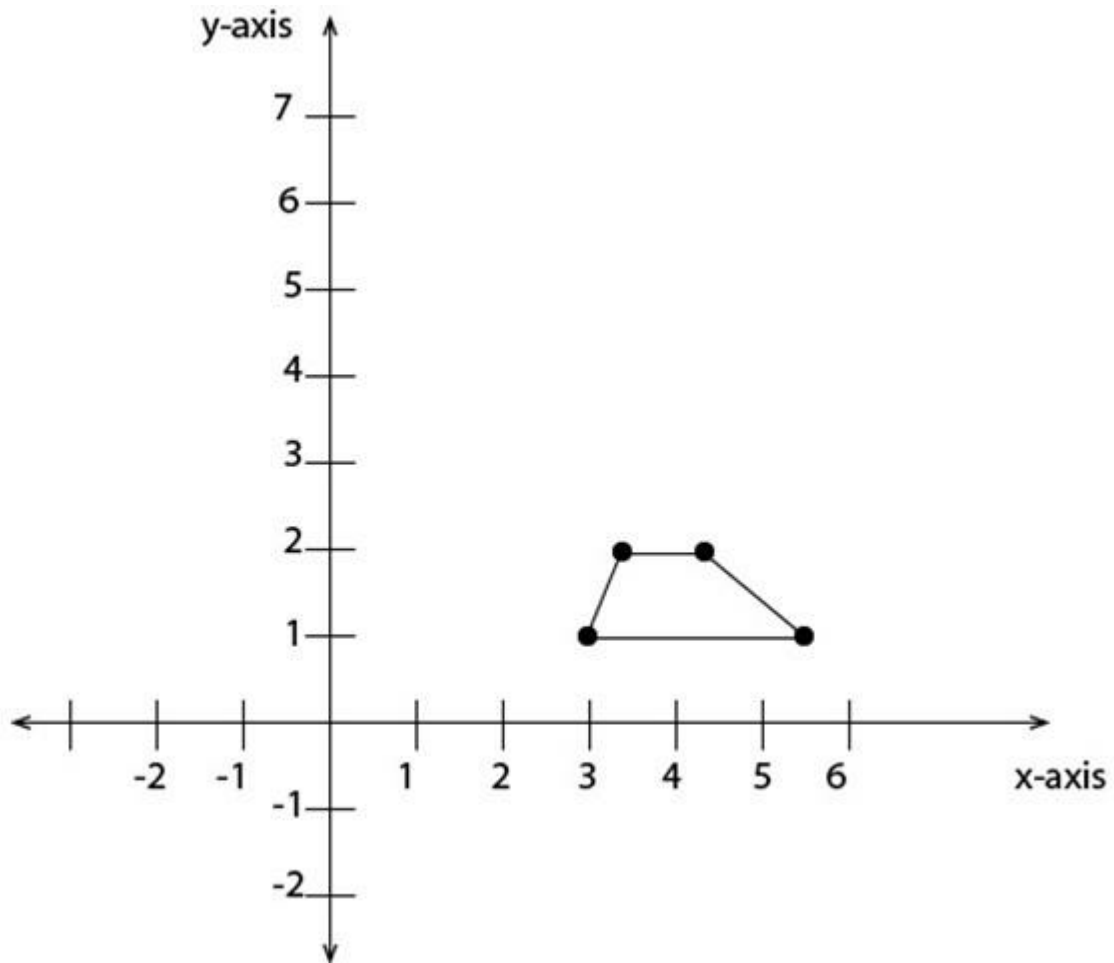
2 (a) **Square**



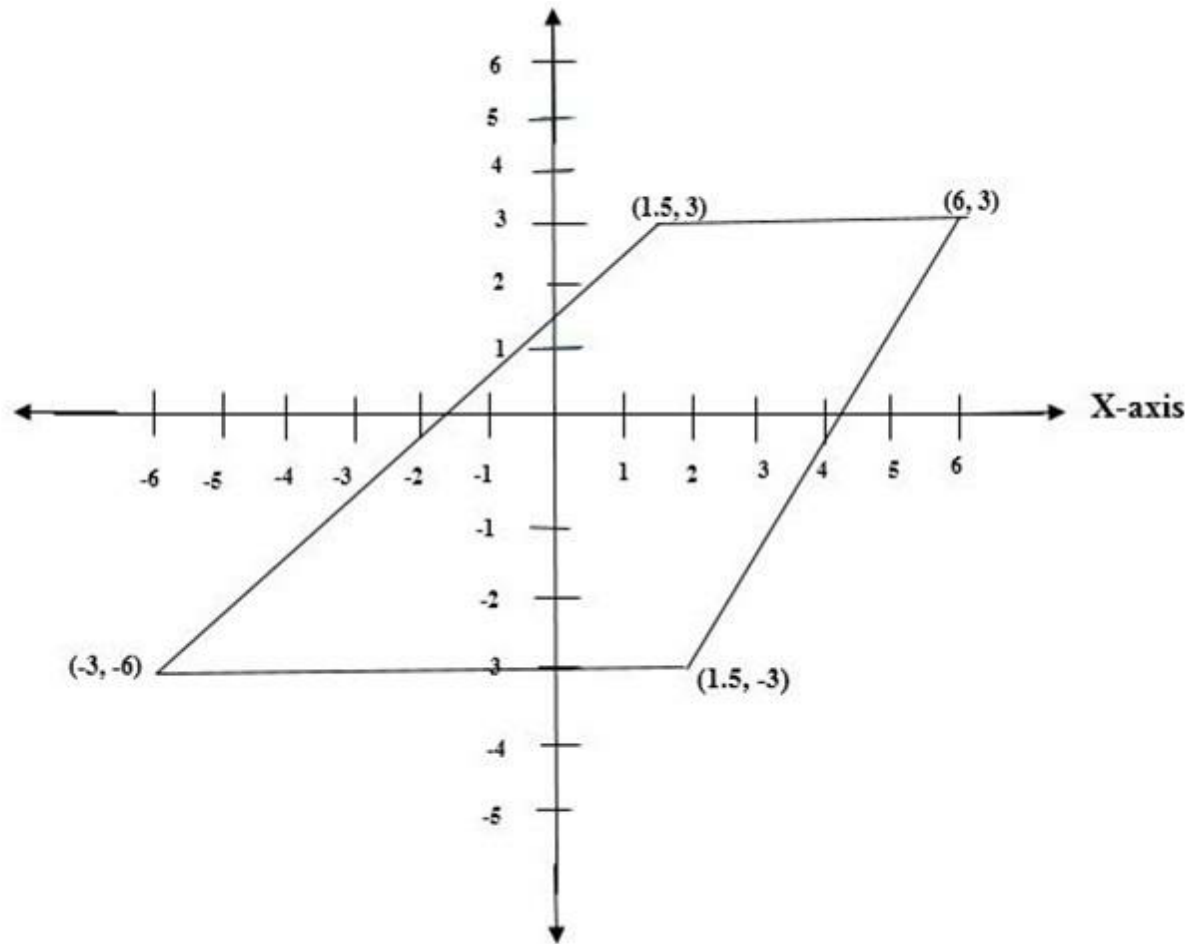
(b) **Triangle**



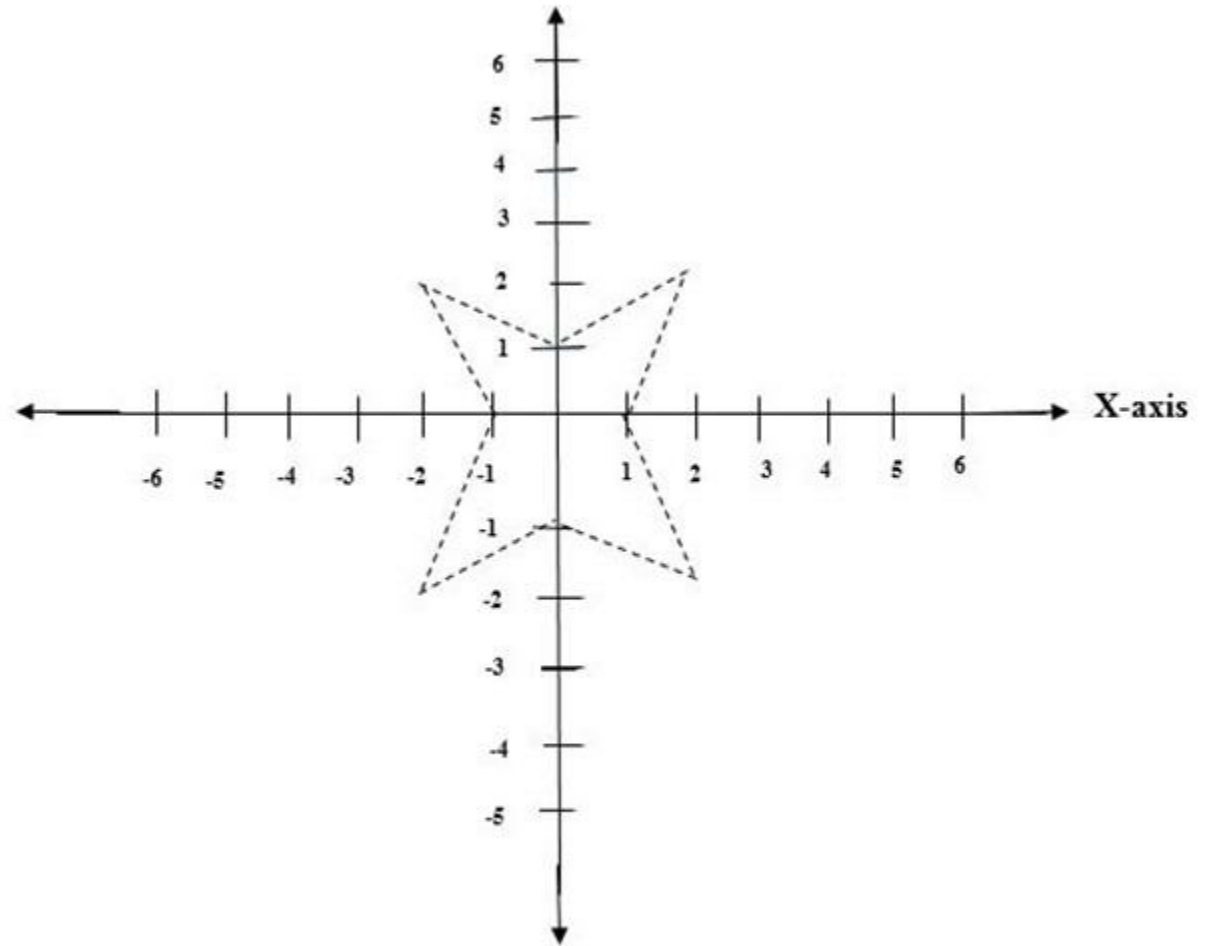
(c) Trapezium



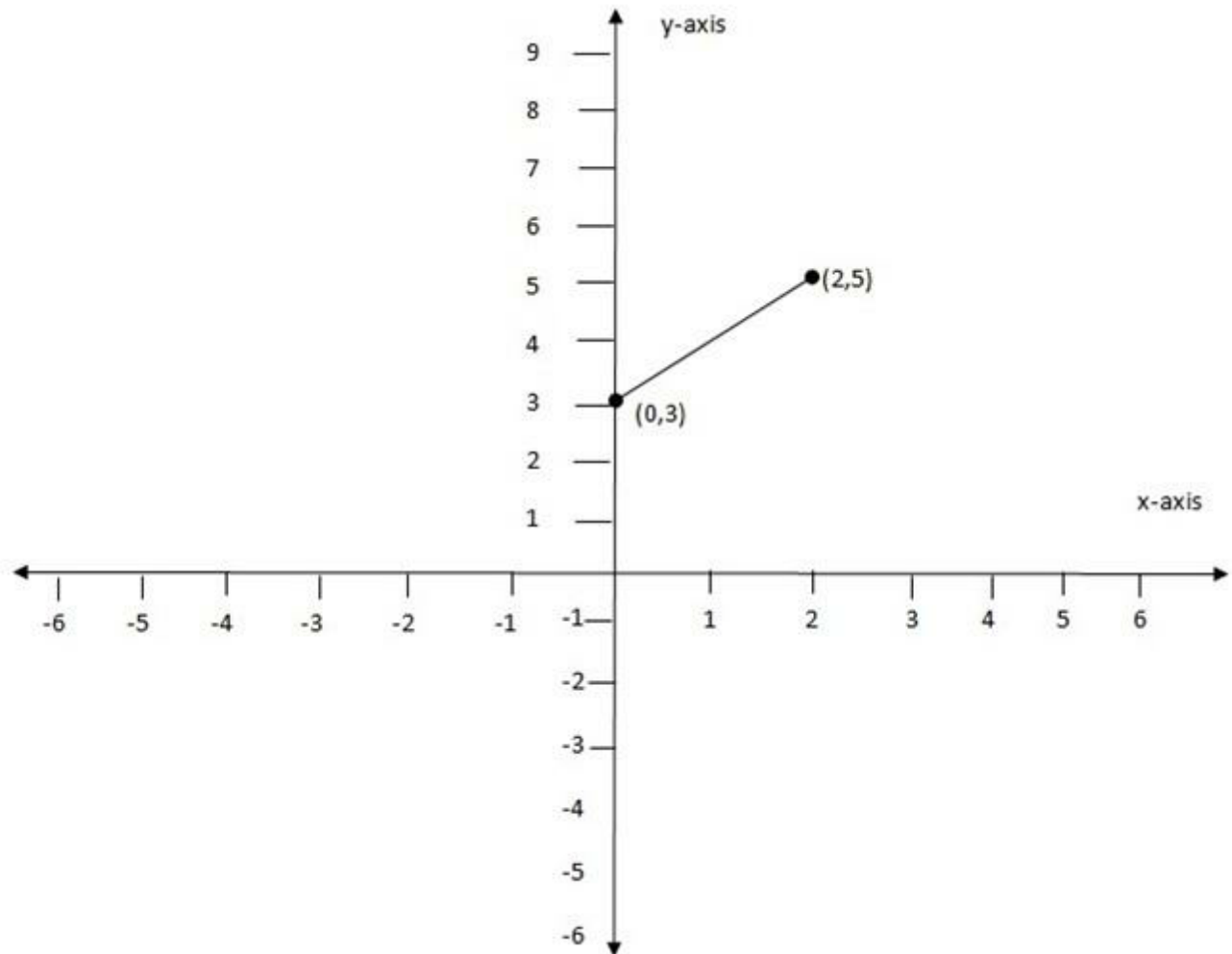
(d) **Parallelogram**



(e) Octagon

EXERCISE 10.2

1. a) $(0, 3), (2, 5)$



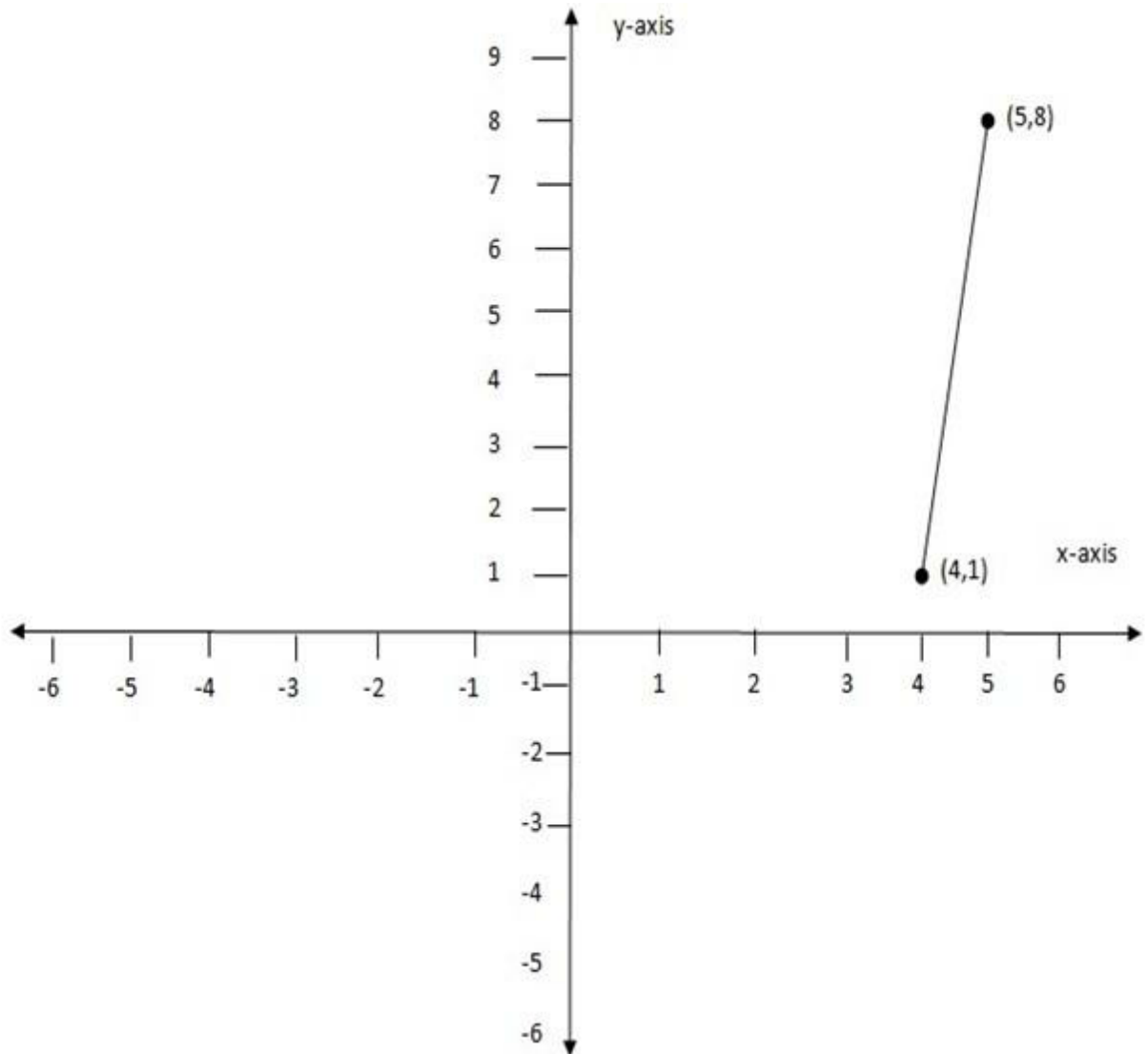
let (x_1, y_1) be $(0, 3)$
 (x_2, y_2) be $(2, 5)$

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$M = \frac{5 - 3}{2 - 0} = \frac{2}{2}$$

$M = 1$ it is positive gradient.

(b) $(5, 8), (4, 1)$



Let (x_1, y_1) be $(5, 8)$

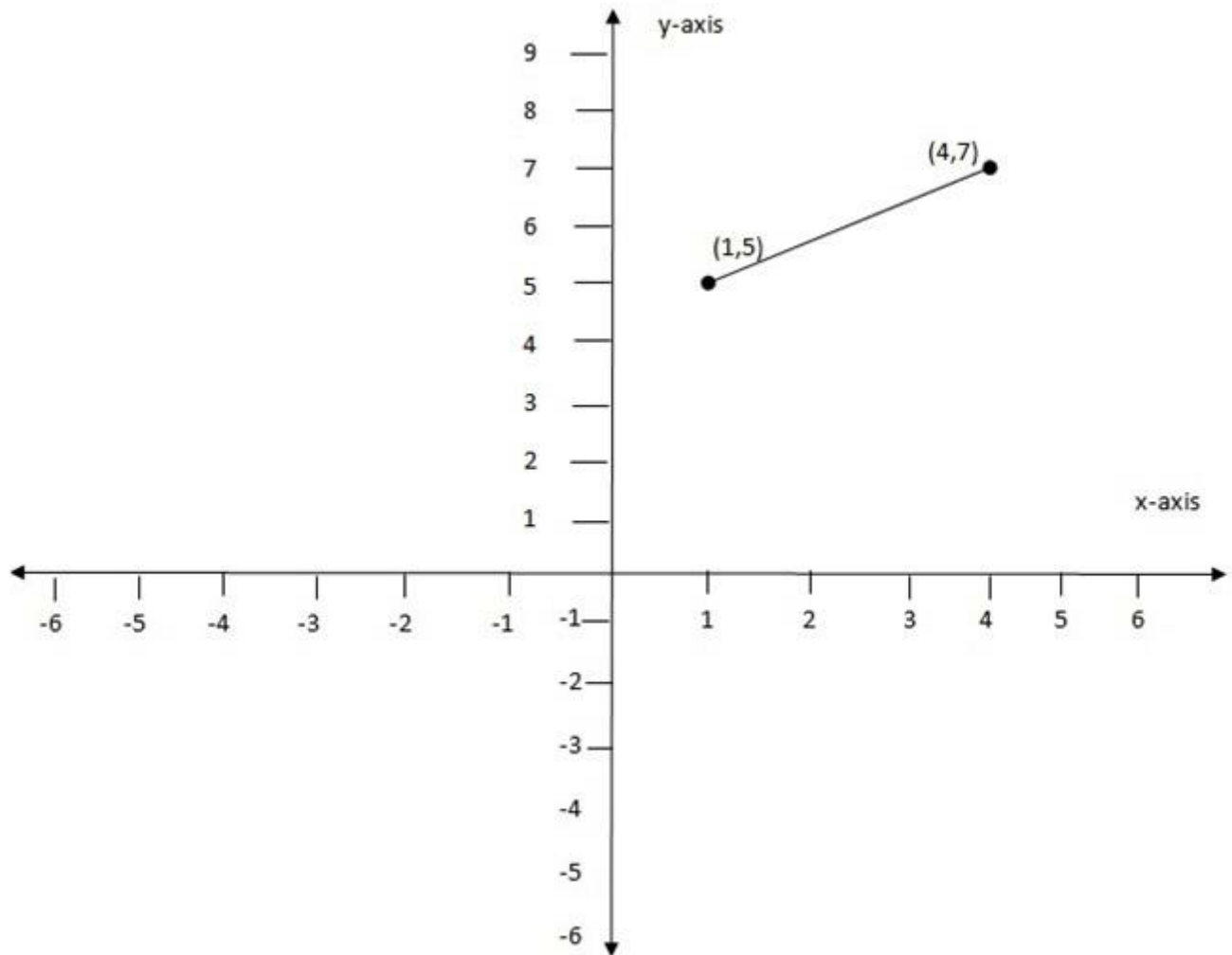
(x_2, y_2) be $(4, 1)$

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\frac{1 - 8}{4 - 5} = \frac{-7}{-1}$$

$m = 7$ Slope is positive

(c) $(1, 5), (4, 7)$



Let (x_1, y_1) be $(1, 5)$
 (x_2, y_2) be $(4, 7)$

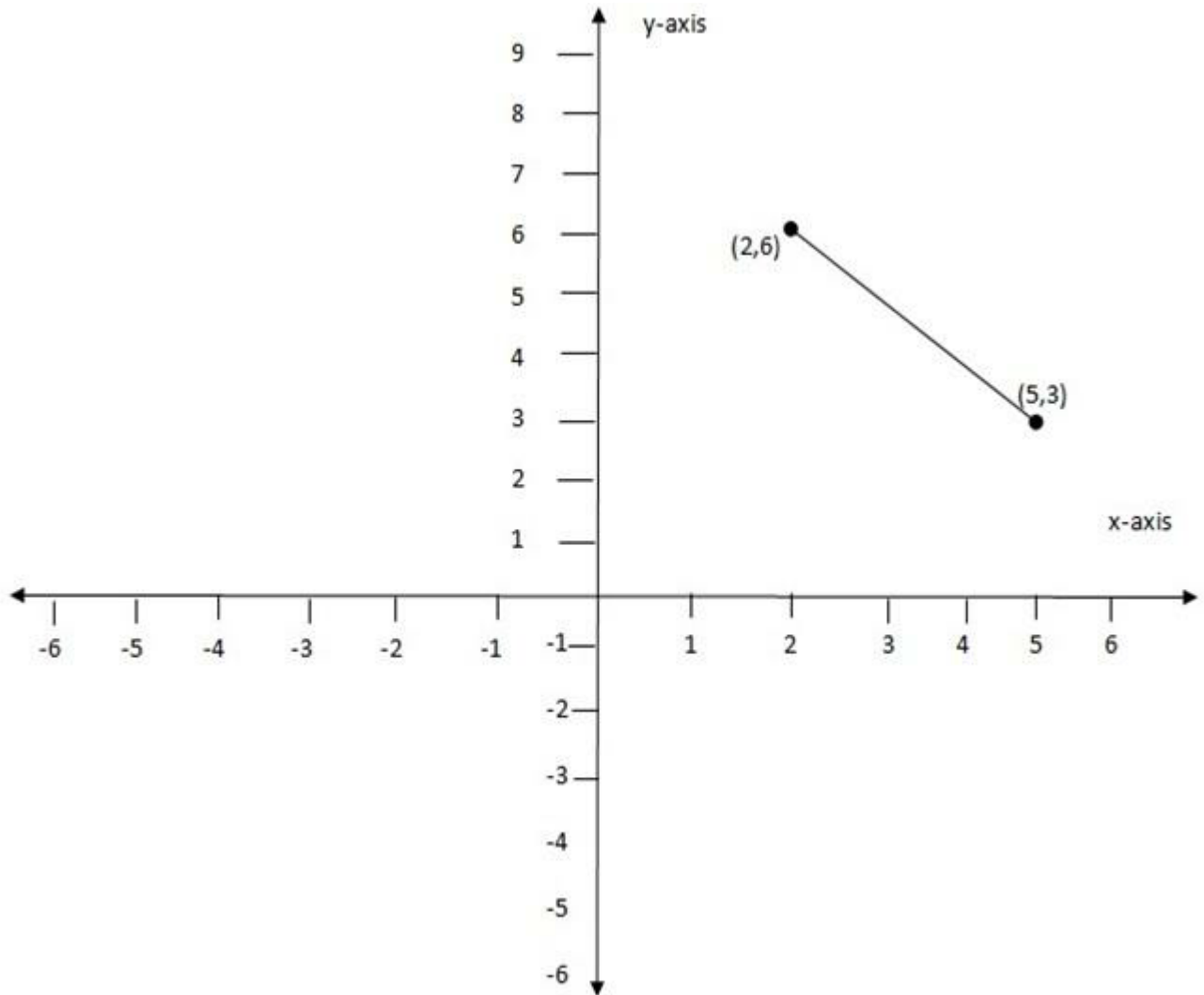
$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{7 - 5}{4 - 1} = \frac{2}{3}$$

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

The gradient is positive

(d) $(2, 6), (5, 3)$



Let $(x_1, y_1) = (2, 6)$

$(x_2, y_2) = (5, 3)$

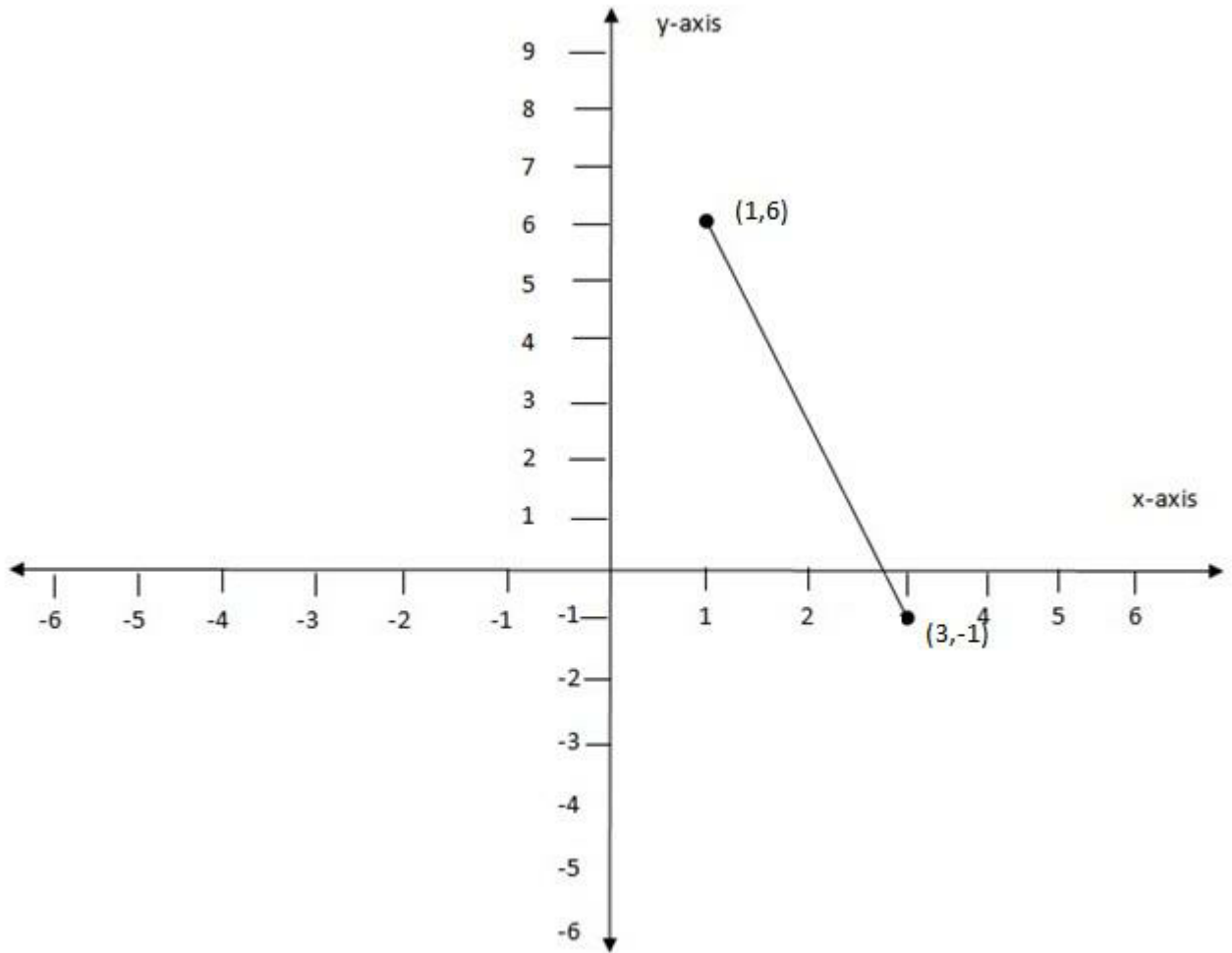
Then $m = \frac{y_2 - y_1}{x_2 - x_1}$

$$= \frac{3 - 6}{5 - 2} = \frac{-3}{3}$$

$$m = -1$$

It has a negative gradient

(e) $(1, 6), (3, -1)$



Let (x_1, y_1) be $(1, 6)$
 (x_2, y_2) be $(3, -1)$

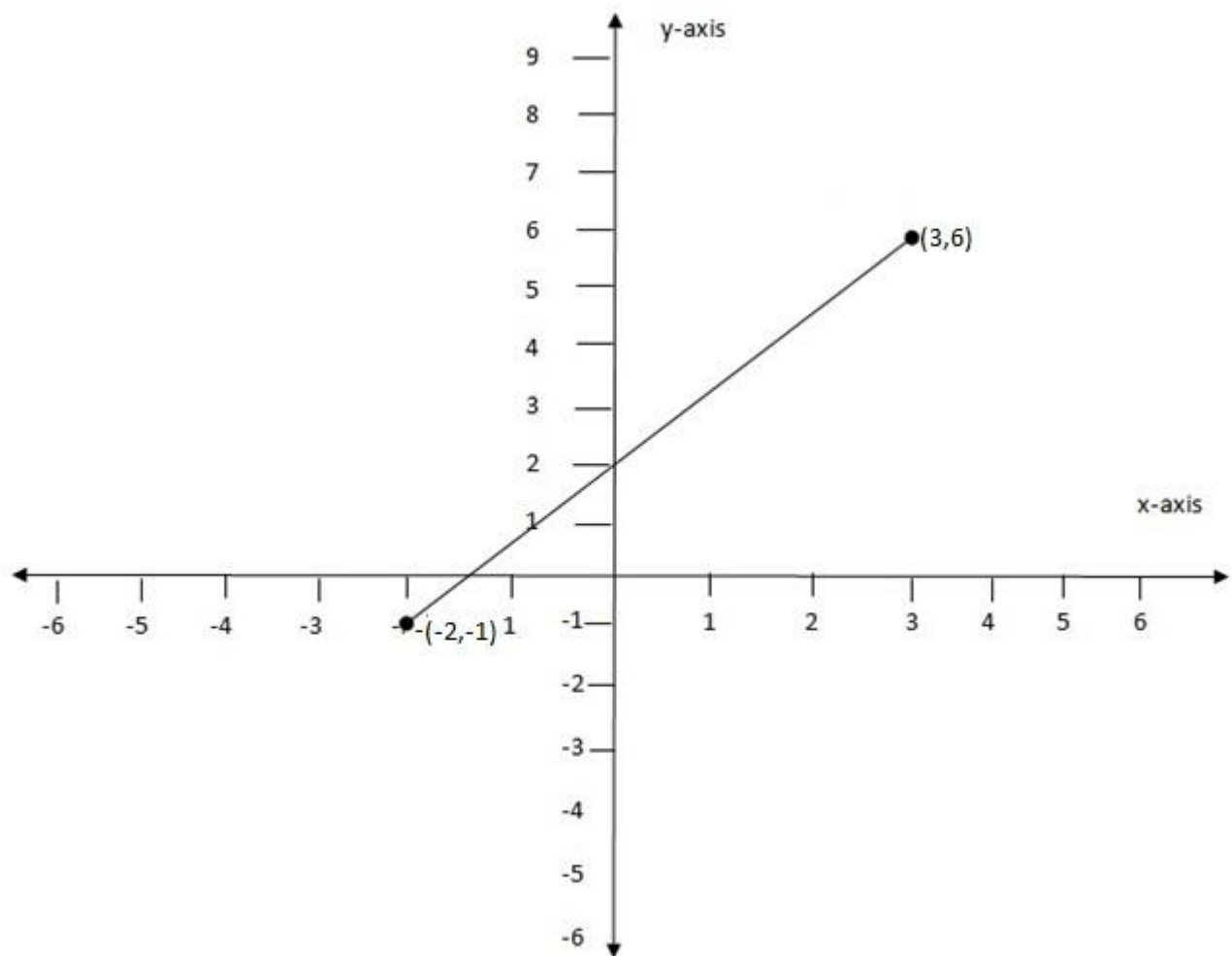
$$\text{Then } m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{-1 - 6}{3 - 1} = \frac{-7}{2}$$

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

The gradient is negative

(f) $(3, 6), (-2, -1)$



Let (x_1, y_1) be $(3, 6)$

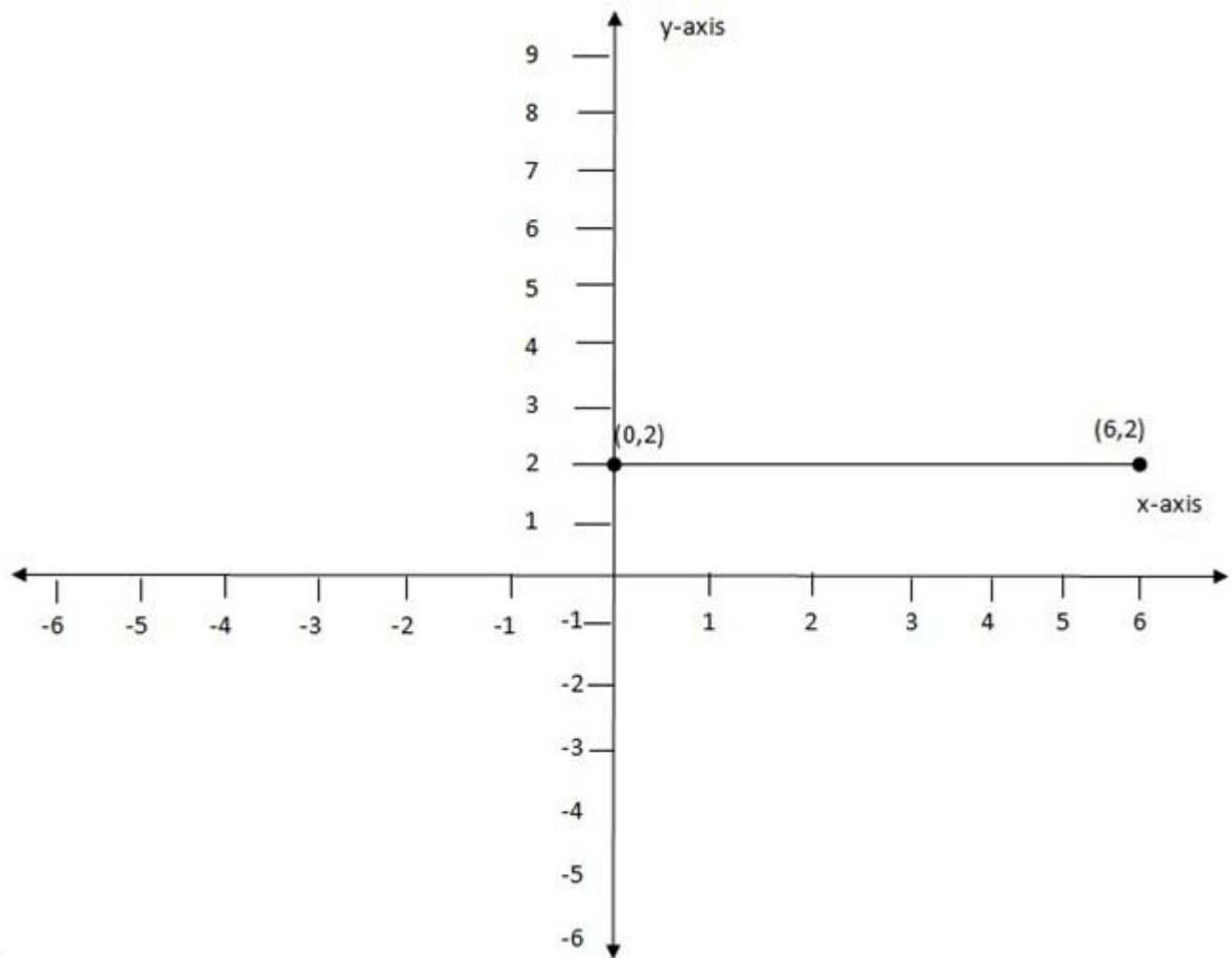
(x_2, y_2) be $(-2, -1)$

$$\begin{aligned}
 m &= \frac{y_2 - y_1}{x_2 - x_1} \\
 &= \frac{-1 - 6}{-2 - 3} \\
 &= \frac{-7}{-5} \\
 &= \frac{7}{5}
 \end{aligned}$$

$$m = \frac{7}{5}$$

The gradient is positive

(g) $(0, 2), (6, 2)$



Let (x_1, y_1) be $(0, 2)$

(x_2, y_2) be $(6, 2)$

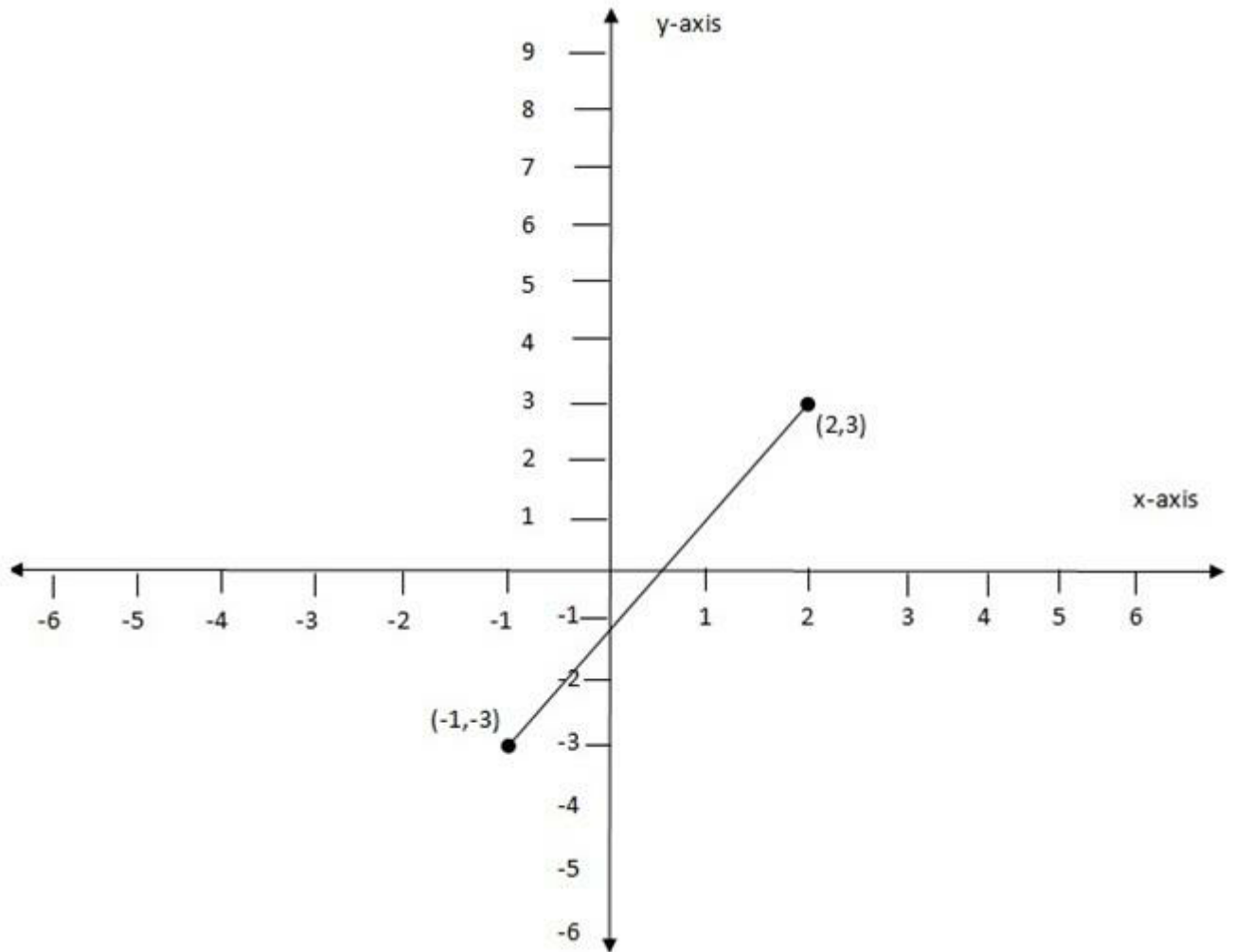
$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{2 - 2}{6 - 0} = \frac{0}{6}$$

$$= 0$$

$M = 0$ The gradient is zero

(h) $(2, 3), (-1, -3)$



Let (x_1, y_1) be $(2, 3)$
 (x_2, y_2) be $(-1, -3)$

$$M = \frac{Y_2 - Y_1}{X_2 - X_1}$$

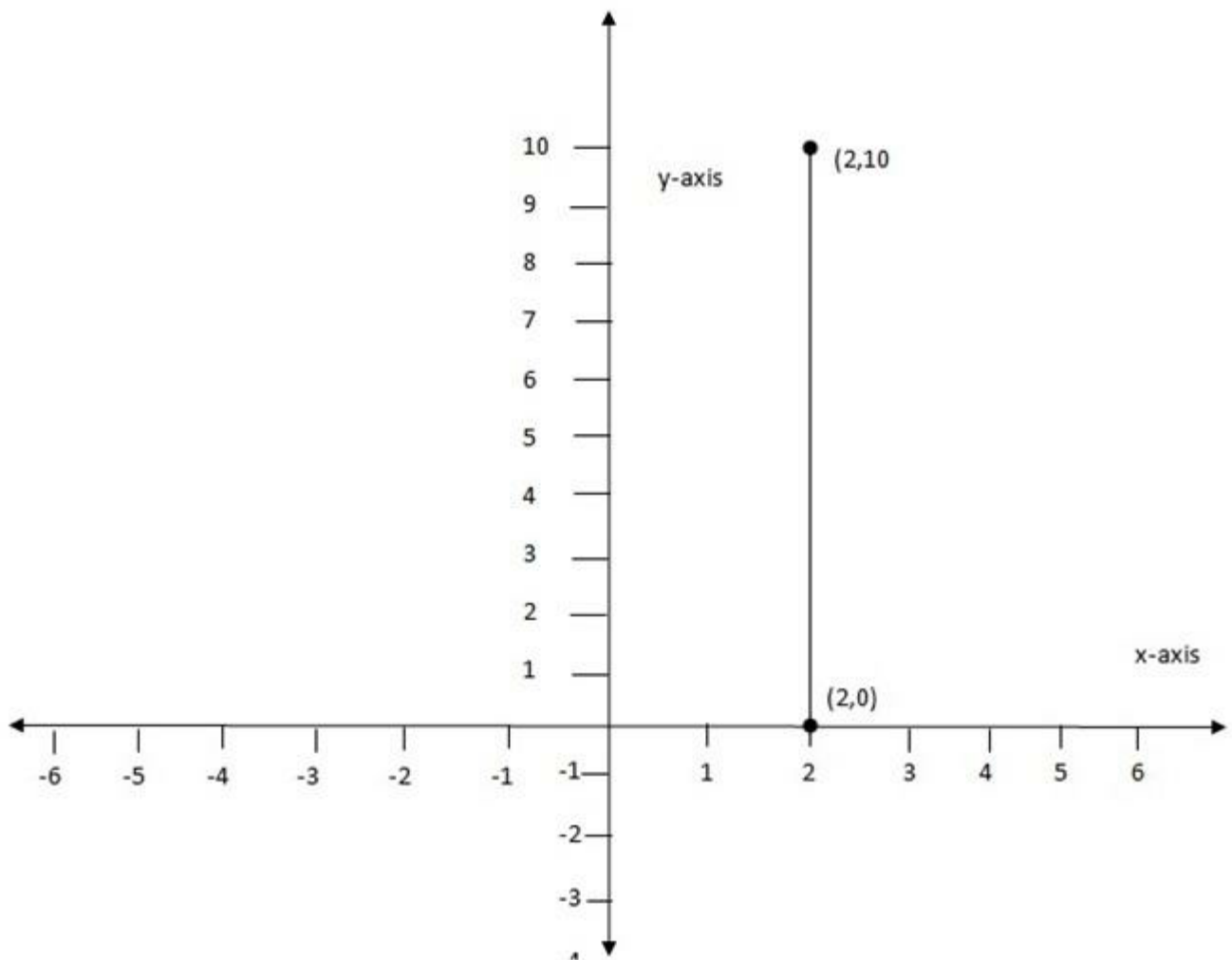
$$= \frac{-3 - 3}{-1 - 2}$$

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

$$m = 2$$

The gradient is positive

(i) (2,10), (2,0)



Let (x_1, y_1) be (2, 10)

(x_2, y_2) be (2, 0)

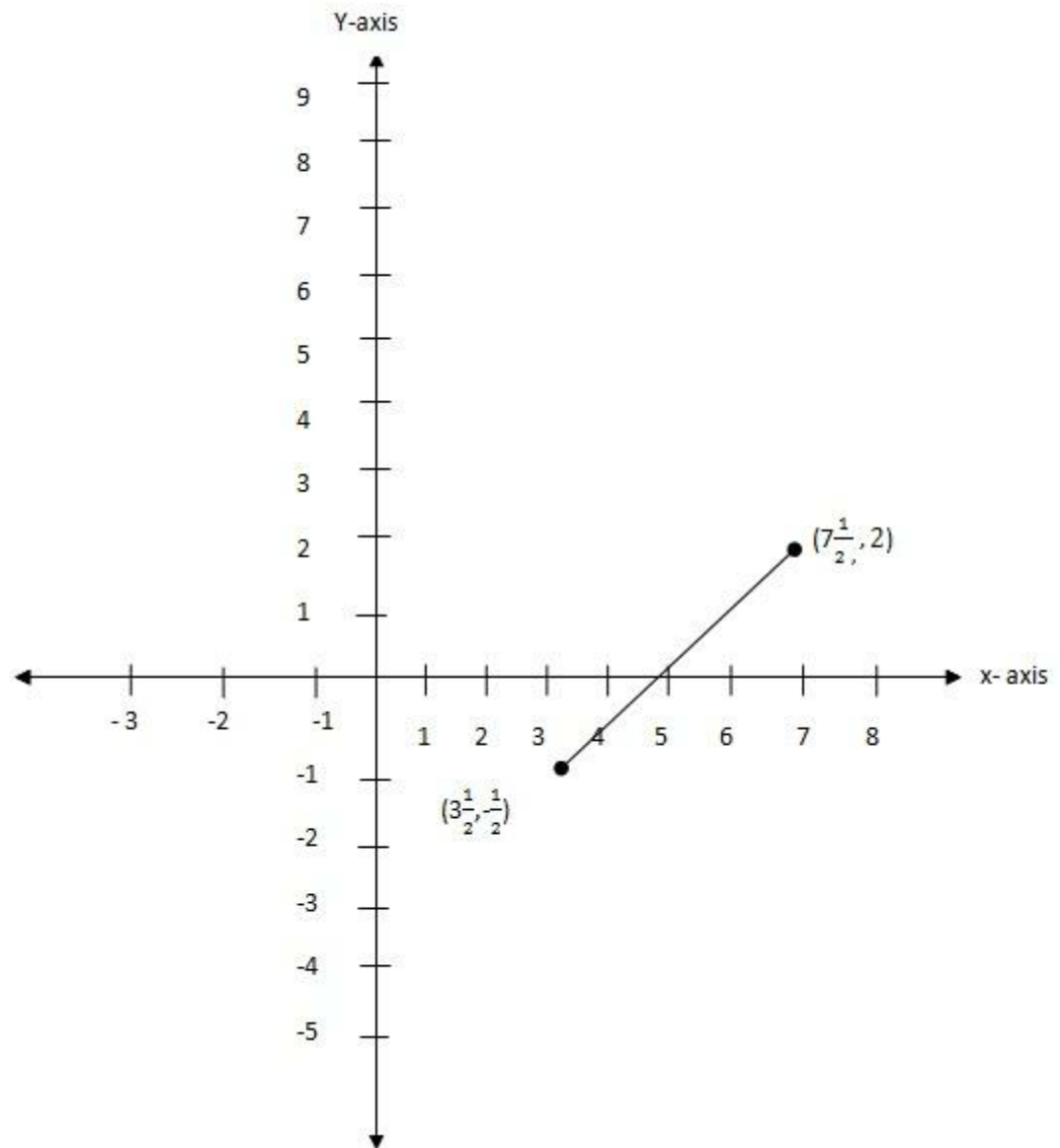
$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{0 - 10}{2 - 2}$$

$$\frac{-10}{0}$$

M is undefined
The gradient is undefined

(j) $(3\frac{1}{2}, -\frac{1}{2}), (7\frac{1}{2}, 2)$



Let (x_1, y_1) be $(3\frac{1}{2}, \frac{1}{2})$

(x_2, y_2) be $(7\frac{1}{2}, 2)$

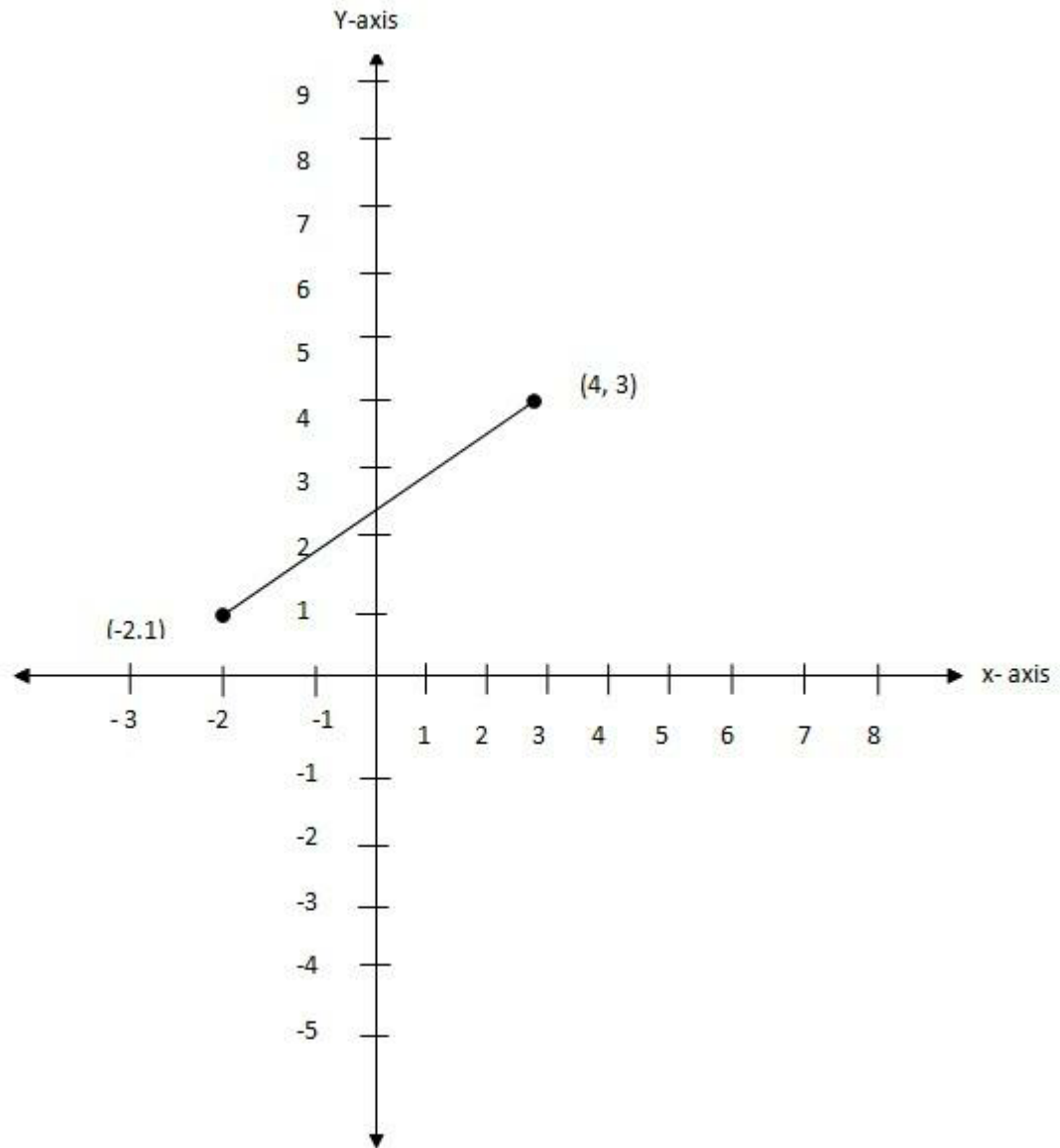
$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{2 - \frac{1}{2}}{7 - 3\frac{1}{2}} = \frac{2 + \frac{1}{2}}{4} = \frac{2\frac{1}{2}}{4} = \frac{\frac{5}{2}}{4} = \frac{5}{2} \times \frac{1}{4}$$

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

The gradient is positive

(k) $(-2, 1), (4, 3)$



let (x_1, y_1) be $(-2, 1)$
 (x_2, y_2) be $(4, 3)$

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

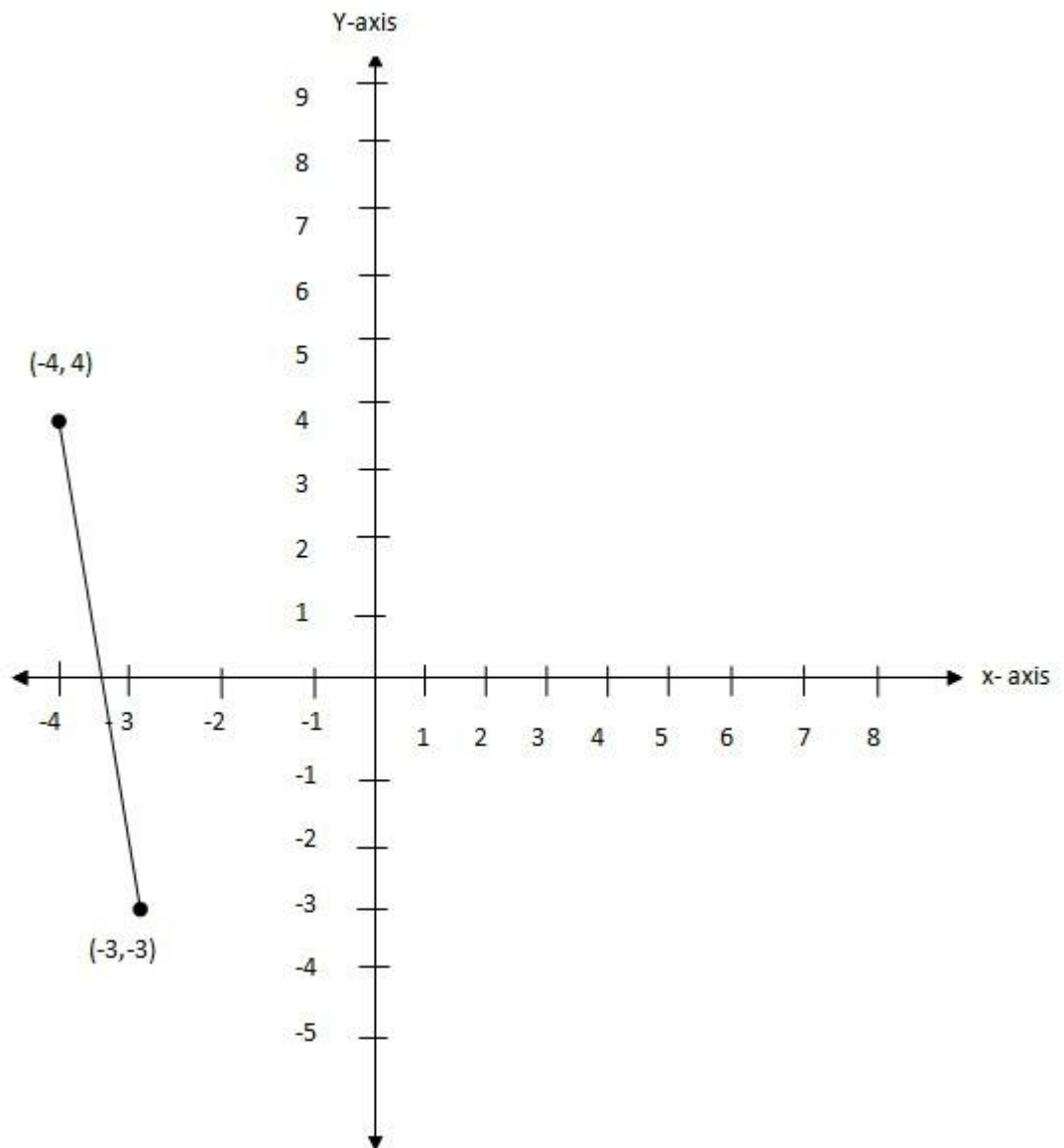
$$= \frac{3-1}{4--2}$$

$$m = \frac{2}{6}$$

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

The gradient is positive

(i) $(-4,4)$, $(-3,-3)$



let (x_1, y_1) be $(-4, -4)$

(x_2, y_2) be $(-3, -3)$

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{Y_2 - Y_1}{X_2 - X_1}$$

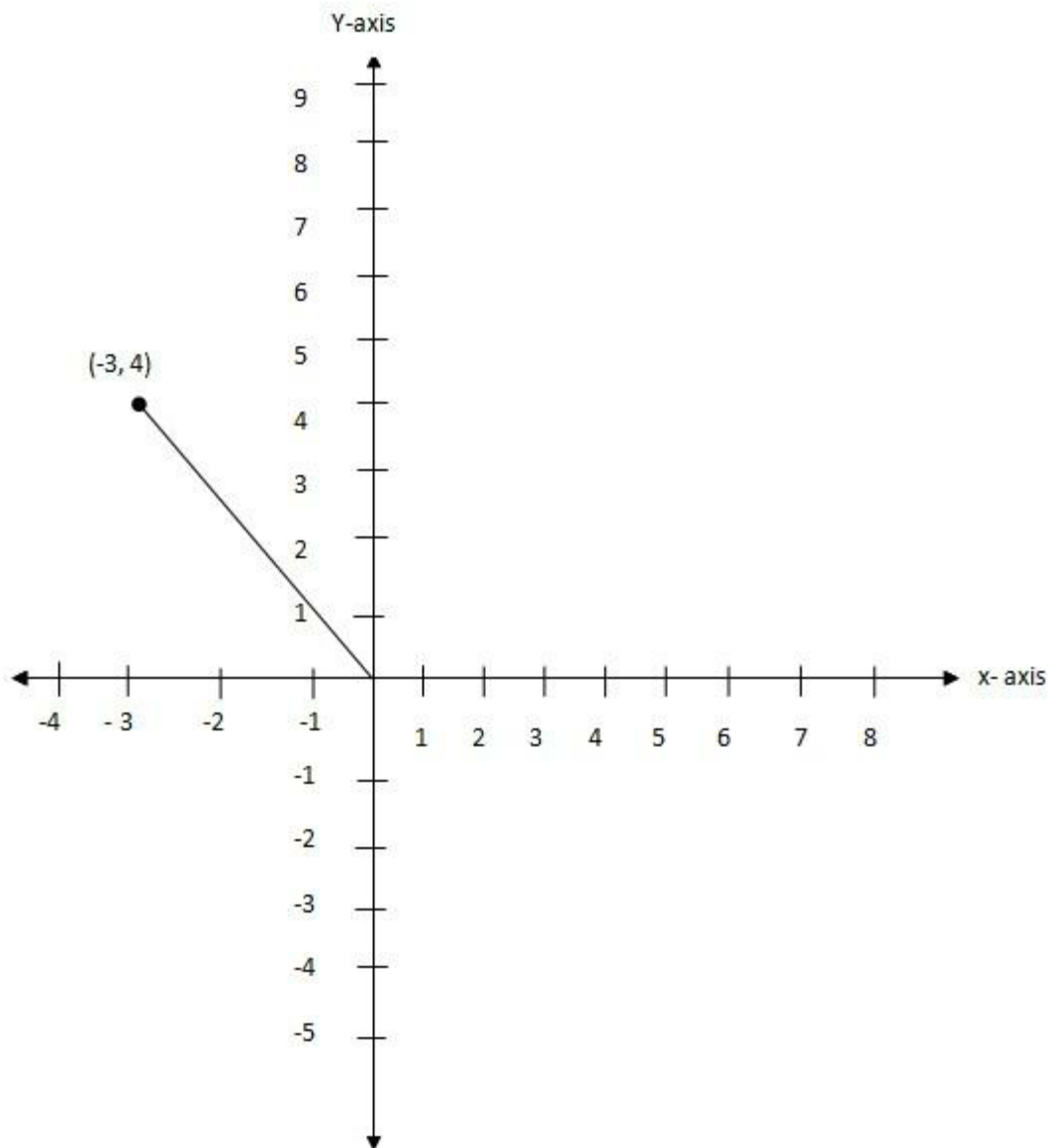
$$= \frac{-3 - 4}{-3 - -4}$$

$$m = \frac{-7}{1}$$

$$m = -7$$

The gradient is negative

(m) $(0, 0), (-3, 4)$



let (x_1, y_1) be $(0, 0)$
 (x_2, y_2) be $(-3, 4)$

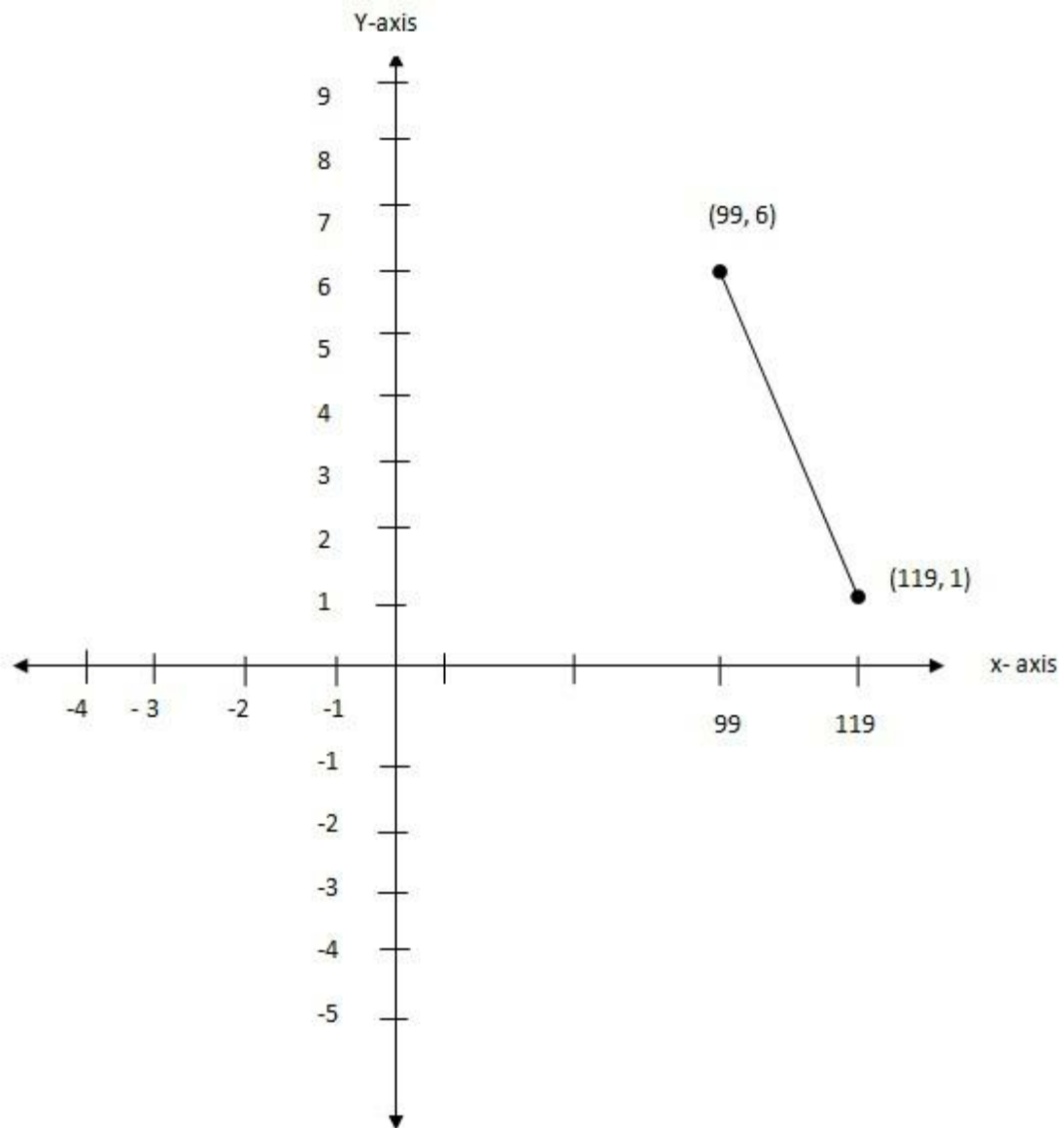
$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{4 - 0}{-3 - 0} = -\frac{4}{3}$$

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

The gradient is negative

(n) (99,6), (119,1)



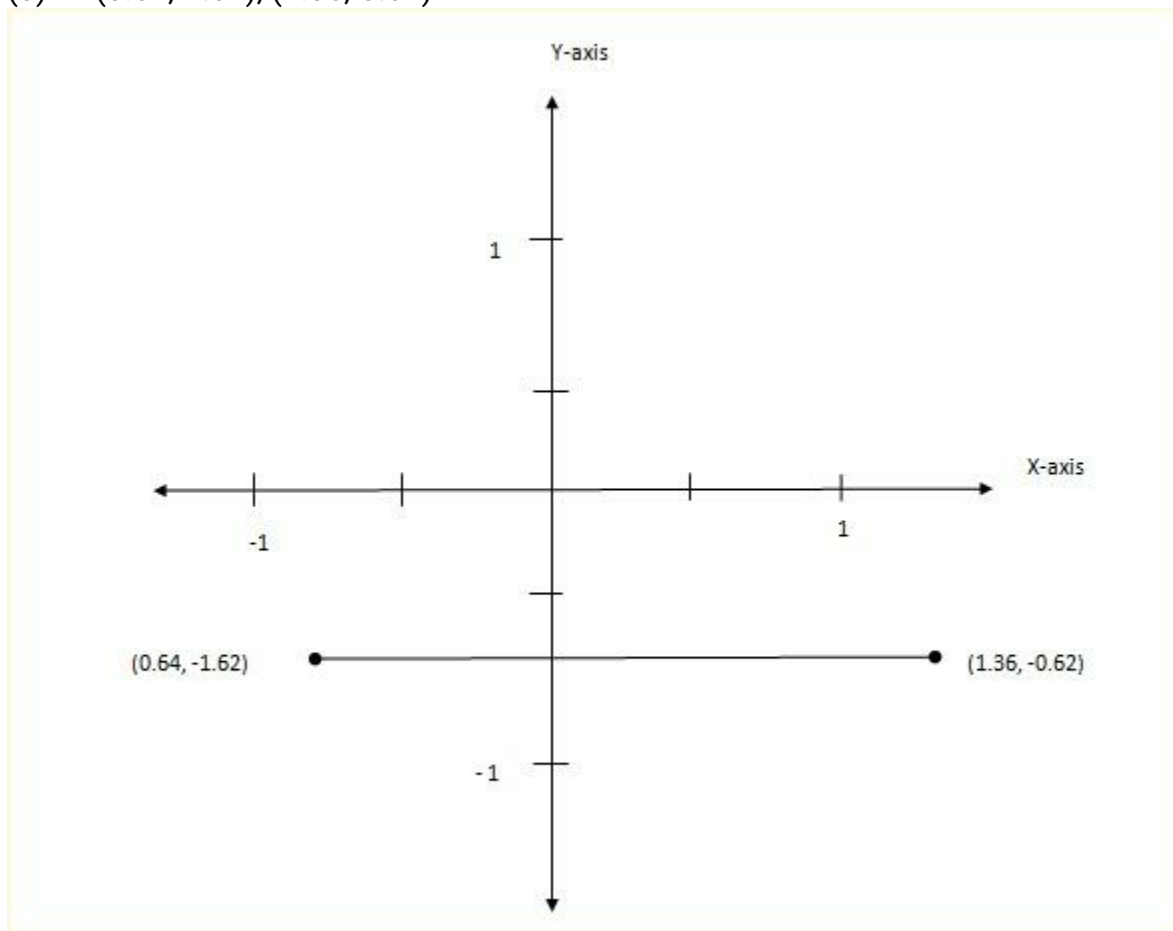
let (x_1, y_1) be (99,0)
 (x_2, y_2) be (119,1)
$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{1-6}{119-99} = \frac{5}{20}$$

$$m = -\frac{1}{4}$$

The gradient is negative

(o) (0.64,-1.62), (1.36,-0.62)



let (x_1, y_1) be $(0.64, -1.62)$
 (x_2, y_2) be $(1.36, -0.62)$

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{-0.62 - (-1.62)}{1.36 - 0.64} = \frac{1}{0.72}$$

$m=0$
The gradient
is zero

EXERCISE 10.3**1. a) (2,1) with gradient 2.** $(x, y), (2, 1) m = 2$

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{1 - y}{2 - x} = \frac{2}{1}$$

$$\begin{aligned} 2(2 - x) &= 1(1 - y) \\ 4 - 2x &= 1 - y \\ 4 - 2x &= 1 - y \\ y &= 1 - 4 + 2x \\ y &= -3 + 2x \\ \therefore y &= 2x - 3. \end{aligned}$$

b) (0,5) with gradient -2 $(x, y), (0, 5) m = -2$

$$M = \frac{Y_2 - Y_1}{X_2 - X_1}$$

$$m = \frac{5 - y}{0 - x} = \frac{-2}{1}$$

$$\begin{aligned} -2(0 - x) &= 1(5 - y) \\ 0 + 2x &= 5 - y \\ y &= 5 - 2x \\ \therefore y &= -2x + 5 \end{aligned}$$

c) (1,-3) with gradient -3 $(x, y), (1, -3) m = -3$

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$-3 = \frac{-3 - y}{1 - x}$$

$$\begin{aligned} -3 - y &= 3 - 3x \\ -y &= -3 + 3x + 3 \\ -y &= 3x = \frac{-y}{-} = \frac{3x}{-} \\ y &= -3x \end{aligned}$$

d) (-2, -4) with gradient $\frac{3}{2}$ $(x, y) (-2, -4) m = \frac{3}{2}$

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{-4 - y}{-2 - x} = \frac{3}{2}$$

$$3(-2 - x) = 2(-4 - y)$$

$$-6 - 3x = -8 - 2y$$

$$2y = 6 + 3x - 8$$

$$\frac{2y}{2} = \frac{6}{2} + \frac{3x}{2}$$

$$y = 1 + \frac{3x}{2}$$

$$y = \frac{3x}{2} + 1$$

e) (0, 0) with gradient -3 $(x, y) (0, 0) m = -3$

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - y}{0 - x} = \frac{-3}{1}$$

$$-3(0 - x) = 1(0 - y)$$

$$0 + 3x = 0 - y$$

$$y = 0 - 3x$$

$$y = -3x$$

f) (-3, -3) and y-intercept $\frac{1}{2}$ **Solution** $(-3, -3)(x, y)$ y-intercept = $\frac{1}{2}$

$$Y = mx + c$$

 $(-3, -3)(x, y)$ substitute $(-3, -3)$ to $y = mx + c$

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

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

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

$$\frac{1}{3} \times 3m = \frac{7}{2} \times \frac{1}{3} = \frac{7}{6}$$

$$M = \frac{7}{6}$$

$$Y = \frac{7}{6}x + \frac{1}{2}$$

g) (6, 2) and y intercept -2 $(6, 2), (0, -2)$

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$M = \frac{-2 - 2}{0 - 6} = \frac{-4}{-6} = \frac{2}{3}$$

Gradient = 2/3
Arbitrary

(x,y), (6,2)

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

$$\begin{aligned} 3(2-y) &= (6-x) \\ 6-3y &= 12-2x \\ -3y &= 12-6-2x \\ -3y &= 6-2x \end{aligned}$$

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

$$Y = -2 + \frac{2x}{3}$$

$$Y = \frac{2x}{3} - 2$$

h) (-1, -1) and y - intercept - 1/3

(-1, -1) and (0, -1/3)

$$M = \frac{Y_2 - Y_1}{X_2 - X_1}$$

$$\frac{\frac{-1}{3} + 1}{0 + 1}$$

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

Arbitrary point = (x,y)
(x,y), (-1,-1)

$$M = \frac{Y_2 - Y_1}{X_2 - X_1}$$

$$\frac{-1+y}{-1-x} = \frac{2}{3}$$

$$2(-1-x) = 3(-1-y)$$

$$\begin{aligned} -2-2x &= -3-3y \\ 3y &= -3+2+2x \\ 3y &= -1+2x \end{aligned}$$

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

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

i) (1,2) and y-intercept = 2

(1,2), (0,2)

$$\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2-2}{0-1} = \frac{0}{-1} = 0$$

$$\frac{2-y}{1-x} = 0$$

$$\begin{aligned} 0 &= 2-y \\ y &= 2 \end{aligned}$$

j) (5,5) and y-intercept 0

(5,5) (0,0)

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$M = \frac{0-5}{0-5} = \frac{-5}{-5}$$

Arbitrary point (x, y), (5, 5)

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\frac{5-y}{5-x} = \frac{1}{1}$$

$$\begin{aligned} y &= 5-5+x \\ y &= x \end{aligned}$$

(2) (i) y - intercept -2 , gradient 1
(0, -2) gradient 1
Arbitrary (x, y)

$$\frac{y-2}{x-0} = \frac{1}{1}$$

$$y - 0 = y + 2$$

$$x = y + 2$$

$$y = -2 + x$$

(ii) y-intercept 7, gradient 3/4

(0,7), (x,y), gradient 3/4

$$\frac{y-7}{x-0} = \frac{3}{4}$$

$$4y - 28 = 3x - 0$$

$$4y = 28 + 3x$$

$$\frac{4y}{4} = \frac{28+3x}{4}$$

$$y = 7 + \frac{3x}{4}$$

$$y = \frac{3}{4}x + 7$$

iii) y-intercept -16, gradient 4

(0,-16), (x,y) m = 4

$$\frac{y - (-16)}{x - 0} = \frac{4}{1}$$

$$4x - 0 = y + 16$$

$$-y = -4x + 16$$

$$y = 4x - 16$$

$$y = 4x - 16$$

iv) y-intercept 2, gradient is -10

$$(0, \frac{-7}{10}) (X, y), m = \frac{-7}{10}$$

$$\frac{y - \frac{-7}{10}}{x - 0} = \frac{-7}{10}$$

$$7x + 0 = -10y + 4$$

$$10y = \frac{-7x + 4}{10}$$

$$y = \frac{-7}{10}x + \frac{4}{10}$$

$$y = \frac{-7}{10}x + \frac{2}{5}$$

3 (i) $7x + 4y = 11$

$$7x + 4y = 11$$

$$y = \frac{-7}{4}x + \frac{11}{4}$$

$$y = \frac{-7x + 11}{4}$$

$$\text{Gradient} = \frac{-7}{4}$$

$$y\text{-intercept} = (0, \frac{11}{4})$$

Alternatively

$$7x + 4y = 11$$

$$4y = -7x + 11$$

$$\frac{4y}{4} = \frac{-7x}{4} + \frac{11}{4}$$

$$y = \frac{-7}{4}x + \frac{11}{4}$$

$$\text{Gradient} = \frac{-7}{4}$$

$$y\text{-intercept} = (0, \frac{11}{4})$$

ii) $14x + 3y = 12$

$$x = 0$$

$$y = \frac{12 - 14x}{3}$$

$$y = \frac{-14}{3}x + 4$$

$$y = \frac{-14}{3}x + 4, \text{Gradient} = \frac{14}{3}, y\text{-intercept} = (0, 4)$$

iii) $2x = 5 + y$

$$x = 0$$

$$2x = 5 + y, y = 0 - 5, y = -5$$

$$y = 2x - 5$$

$$y = 2x - 5$$

$$\text{Gradient} = 2$$

$$y\text{-intercept} = (0, -5)$$

iv) $4x + 5y = 40$

$$x=0$$

$$y = \frac{40}{5} - \frac{4(0)}{5}$$

$$5y = -4x + 40$$

$$y = \frac{40}{5} - \frac{4(0)}{5}$$

$$5y = -4x + 40$$

$$y = -\frac{4}{5}x + 8$$

$$y = -\frac{4}{5}x + 8$$

$$\text{Gradient} = -\frac{4}{5}$$

$$y\text{-intercept} = (0, 8)$$

$$v) = 8x \left(-\frac{1}{3}\right)y = 0$$

$$\left(-\frac{1}{3}\right)y = -8x$$

$$y = 24x$$

$$y = 24(0)$$

$$y = 0$$

$$y = -8x \times -3 = 24x$$

$$y = 24x + 0$$

$$\text{Gradient} = 24$$

$$y\text{-intercept} = (0,0)$$

$$\text{vi) } 6x = 5 - 2y$$

$$x=0$$

$$y = \frac{6x-5}{-2}$$

$$y = 0 + \frac{5}{2}$$

$$y = -3x + \frac{5}{2}$$

$$\text{Gradient} = -3$$

$$y\text{-intercept} = \left(0, \frac{5}{2}\right)$$

$$\text{vii) } \frac{2}{3}x + \frac{4y}{3} = 9$$

$$x = 0$$

$$\frac{4y}{3} = 9 - \frac{2x}{3}$$

$$Y = \frac{1}{2}x + \left(\frac{27}{4}\right)$$

$$= \left(\frac{27}{4}\right) - \left(\frac{x}{2}\right)$$

$$Y = \frac{27}{4}$$

$$Y = -\frac{x}{2} + \frac{27}{4}$$

$$\text{Gradient} = -\frac{1}{2}$$

$$y\text{-intercept} = \left(0, \frac{27}{4}\right)$$

4. x-intercept, y=0

$$5x + 6(0) - 60 = 0$$

$$5x - 60 = 0 + 60$$

$$x = \frac{60}{5}$$

$$x = 12$$

$$X\text{-intercept} = (12,0)$$

$$Y\text{-intercept, } x=0$$

$$5(0) + 6y - 60 = 0$$

$$5x - 60 = 60$$

$$\frac{6y}{6} = \frac{60}{6}$$

$$y = 10$$

$$y\text{-intercept} = (0,10)$$

$$\text{Area} = \frac{1}{2}bh$$

$$\text{Area} = \frac{1}{2}bh$$

$$\frac{1}{2} \overline{OA} \times \overline{OB}$$

$$\frac{1}{2} \times 12 \times 10$$

$$\text{Area} = 60 \text{ square units}$$

EXERCISE 10.4

1. (i) $2x + y = 5$
 $4x - y = 7$

$$+ \begin{cases} 2x + y = 5 \\ 4x - y = 7 \end{cases}$$

$$6x = 12$$

$$\frac{6x}{6} = \frac{12}{6}$$

$$x = 2$$

$$2x + y = 5$$

$$2(2) + y = 5$$

$$4 + y = 5$$

$$y = 5 - 4$$

$$y = 1$$

$$x = 2 \text{ and } y = 1$$

(ii). $3x + y = 6$

$$5x + y = 6$$

$$+ \begin{cases} 3x + y = 6 \\ 5x + y = 8 \end{cases}$$

$$2x = 2$$

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

$$x = 1$$

from $3x + y = 6$

$$3 \times 1 + y = 6$$

$$3 + y = 6$$

$$y = 6 - 3$$

$$y = 3$$

$$x = 1 \text{ and } y = 3$$

(iii) $5x - 2y = 16$
 $x + 2 = 8$

$$+ \begin{cases} 5x - 2y = 16 \\ x + 2y = 8 \end{cases}$$

$$6x + 0 = 24$$

$$\frac{6x}{6} = \frac{24}{6}$$

$$x = 4$$

Let find the value of y by taken equation one

$$5x - 2y = 16$$

$$5 \times 4 - 2y = 16$$

$$20 - 2y = 16$$

$$-2y = 16 - 20$$

$$\frac{-2}{-2}y = \frac{-4}{-2}$$

$$y = 2$$

$$x = 4 \text{ and } y = 2$$

(iv) $8x + 5y = 40$

$$9x + 5y = 5$$

$$- \begin{cases} 8x + 5y = 40 \\ 9x + 5y = 2 \end{cases}$$

$$x + 0 = 35$$

$$x = 35$$

let find the value of y by taken one equation

$$8 \times 35 + 5y = 40$$

$$280 + 5y = 40$$

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

$$y = -48$$

$$x = 35 \text{ and } y = -48$$

(v). $7x - 4y = 17$

$$5x - 4y = 11$$

$$\begin{cases} 7x + 4y = y = 17 \\ 5x + 4y = 11 \end{cases}$$

$$12x + 0 = 28$$

$$\frac{12x}{12} = \frac{28}{12} = 2\frac{1}{2}$$

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

Let find the value of y taken one equation $7x - 4y = 17$

$$7 \times \frac{7}{2} - 4y = 17$$

$$\frac{49}{2} - 4y = 17$$

$$-4y = \frac{17}{1} - \frac{49}{2} = \frac{51-49}{2} = \frac{2}{2}$$

$$-4y = \frac{2}{2}$$

$$\frac{-4y}{4} = \frac{2}{2} \div 4$$

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

$$x = 2\frac{1}{2} \text{ and } y = \frac{1}{6}$$

$$\begin{aligned} \text{(vi)} \quad 0.7x - 0.5y &= 2.5 \\ 0.7x - 0.3y &= 2.9 \end{aligned}$$

$$\begin{cases} 0.7x + 0.5y = 2.5 \\ 0.7x + 0.3y = 2.9 \end{cases}$$

$$0 - 0.2 = -0.5$$

$$0.2y = -10.4$$

$$0.2 = -10.4$$

$$y = 2$$

Let find the value of x by taken one equation

$$0.7x - 0.5y = 2.5$$

$$0.7x - 0.5(2) = 2.5$$

$$0.7x = 2.5 + 1$$

$$\frac{0.7}{0.7}x = \frac{0.35}{0.7}$$

$$x = 5$$

$$y = 2 \text{ and } x = 5$$

$$\begin{aligned} 2. \text{ (i)} \quad 3x - 2y &= 5 \\ 2x + y &= 8 \end{aligned}$$

$$3x - 2y = 5 \dots\dots\dots \text{(i)}$$

$$2x + y = 8 \dots\dots\dots \text{(ii)}$$

$$y = 8 - 2x \dots\dots\dots \text{(iii)}$$

put eqn (iii) into (iv)

$$3x - 2x(8 - 2x) = 5$$

$$3x - 16 + 4x = 5$$

$$3x + 4x - 16 = 5$$

$$7x = 5 + 16$$

$$\frac{7}{7}x = \frac{21}{7}$$

$$x = 3$$

$$y = 8 - 2 \times 3$$

$$y = 8 - 6$$

$$y = 2$$

$$x = 3 \text{ and } y = 2$$

$$\begin{aligned} \text{(ii)} \quad 5x + y &= 23 \\ 3x - 2y &= 6 \end{aligned}$$

$$5x - y = 23 \dots\dots\dots \text{(i)}$$

$$3x - 2y = 6 \dots\dots\dots \text{(ii)}$$

$$5x - y + y = 23 + y.$$

$$5x = 23 + y$$

$$5x - 23 = y \dots\dots\dots \text{(iii)}$$

put eqn (iii) in (ii)

$$3x - 2(5x - 23) = 6$$

$$3x - 10x + 46 = 6$$

$$-7x + 46 = 6$$

$$7x = 6 - 46$$

$$\frac{7}{7}x = \frac{40}{7}$$

$$x = 5\frac{5}{7}$$

Let find the value of y by taken one equation

$$5(5\frac{5}{7}) - 23 = y$$

$$(5 \times \frac{40}{7}) - 23 = y$$

$$\frac{200}{7} - \frac{22}{7} = \frac{200-116}{7} = \frac{39}{7}$$

$$y = 5\frac{4}{7}$$

$$x = 5\frac{5}{7} \text{ and } y = 5\frac{4}{7}$$

$$(iii). \quad x - 3y = 2$$

$$4x + 2y = 36$$

$$x - 3y = 2 \dots\dots\dots(i)$$

$$4x + 2y = 36 \dots\dots\dots(ii)$$

$$x = 2 + 3y \dots\dots\dots(iii)$$

put eqn (iii) in (ii)

$$4(2 + 3y) + 2y = 36$$

$$8 + 12y + 2y = 36$$

$$8 + 14y = 36$$

$$14y = 36 - 8$$

$$\frac{14y}{14} = \frac{28}{14}$$

$$y = 2$$

Let find the value of x by taken one equation

$$x = 2 + 3y$$

$$x = 2 + 3(2)$$

$$x = 2 + 6$$

$$x = 8$$

$$y = 2 \text{ and } x = 8$$

$$(iv) \quad 7x - y = 14$$

$$8x - 2y = 16$$

$$7x - y = 11 \dots\dots\dots(i)$$

$$8x - 2y = 16 \dots\dots\dots(ii)$$

$$7x - 14 = y \dots\dots\dots(iii)$$

put eqn (iii) into eqn (ii)

$$8x - 2x(7x - 14) = 16$$

$$8x - 14 + 28 = 16$$

$$-6x + 28 = 16$$

$$\frac{-6x}{-6} = \frac{-12}{-6}$$

$$x = 2$$

Let find the value of y by taken one equation

$$y = 7x - 14$$

$$y = 14 - 14 = 0$$

$$y = 0$$

$$x = 2 \text{ and } y = 0$$

$$(v) \quad 7x + y = 14$$

$$8x - 2y = 6$$

$$7x + y = 14 \dots\dots\dots(i)$$

$$8x - 2y = 6 \dots\dots\dots(ii)$$

$$y = 14 - 7x \dots\dots\dots(iii)$$

put eqn (iii) in (ii)

$$8x - 2(14 - 7x) = 6$$

$$8x - 28 + 14x = 6$$

$$22x - 28 = 6$$

$$x = \frac{11}{6} \text{ and } y = \frac{17}{11}$$

$$(vi) \quad 2y + \frac{1}{2}x = 9$$

$$y + \frac{1}{5}x = 9$$

$$2y + \frac{1}{2}x = 9 \dots\dots\dots (i)$$

$$y + \frac{1}{5}x = 9 \dots\dots\dots (ii)$$

$$y = 9 - \frac{1}{5}x \dots\dots\dots (iii)$$

Put (iii) into (i)

$$2(9 - \frac{1}{5}x) + \frac{1}{2}x = 9$$

$$18 - \frac{2x}{5} + \frac{1}{2}x = 9$$

$$18 + \frac{1}{10}x = 9$$

$$\frac{1}{10}x = 9 - 18$$

$$= 9 - \frac{10}{1}$$

$$x = -90$$

Let find the value of y by taken one equation

$$y = 9 - \frac{1}{5}x$$

$$9 - \frac{1}{5}x \times -90$$

$$9 + 18$$

$$y = 27$$

$$x = -90 \text{ and } y = 27$$

$$3. (i) \quad \begin{aligned} 3y - x &= 4 \\ y + 2x &= 6 \end{aligned}$$

$$= \begin{cases} 3y - x = 4 \\ y + 2x = 6 \end{cases}$$

$$= - \begin{cases} 3y - x = 4 \\ 3y + 6x = 18 \end{cases}$$

$$\frac{7x}{7} = \frac{14}{7}$$

$$x = 2$$

Let find the value of y by taken one equation

$$y + 2x = 6$$

$$y + 2 \times 2 = 6$$

$$y + 4 = 6$$

$$y = 6 - 4$$

$$y = 2$$

$$x = 2 \text{ and } y = 2$$

$$(ii) \quad \begin{aligned} 8m - n &= 38 \\ m - 3n &= -1 \end{aligned}$$

$$\begin{cases} 8m - n = 38 \\ m - 3n = -1 \end{cases}$$

$$= - \begin{cases} 8m - n = 38 \\ 8m - 24n = -8 \end{cases}$$

$$\frac{23n}{23} = \frac{46}{23}$$

$$n = 2$$

Let find the value of m by taken one equation

$$m - 3 = -1$$

$$m - 3 \times 2 = -1$$

$$m - 6 = -1$$

$$m = -1 + 6$$

$$m = 6 - 1$$

$$m = 5$$

$$n = 2 \text{ and } m = 5$$

(iii) $5x - 2y = 10$

$-x + 3y = 24$

$$= \begin{matrix} 3 \\ 2 \end{matrix} \begin{cases} 5x - 2y = 10 \\ -x + 3y = 24 \end{cases}$$

$$= + \begin{cases} 15 - 2y = 30 \\ -2x + 6y = 24 \end{cases}$$

$13x + 0 = 78$

$$\frac{13x}{13} = \frac{78}{13}$$

$x = 6$

Let find the value of y by taken one equation

$5 \times 6 - 2y = 10$

$30 - 2y = 10$

$-2y = 10 - 30$

$$\frac{-2y}{2} = + \frac{20}{2}$$

$y = 10$

$x = 6 \text{ and } y = 10$

4. (i) $x - y = -3$
 $2x - y = -5$

$x - y = -3 \dots\dots\dots(i)$

$2x - y = -5 \dots\dots\dots(ii)$

$x = -3 + y \dots\dots\dots(iii)$

put eqn (iii) into eqn (ii)

$2(-3 + y) - y = -5$

$-6 + 2y - y = -5$

$y - 6 = -5$

$y = -5 + 6$

$y = 1$

$x = -3 + y$

$= -3 + 1$

$x = -2$

$x = -2 \text{ and } y = 1$

(ii). $x - 2y = 6$
 $x + 2y = 2$

$x - 2y = 6 \dots\dots\dots(i)$

$x + 2y = 2 \dots\dots\dots(ii)$

$x = 6 + 2y \dots\dots\dots(iii)$

put eqn 3 into eqn 2

$6 + 2y + 2y = 2$

$6 + 4y = 2$

$4y = 2 - 6$

$$\frac{4y}{4} = \frac{-4}{4}$$

$y = -1$

$x = 6 + 2x - 1$

$x = 6 + -2$

$x = 4$

$x = 4 \text{ and } y = -1$

(iii) $3x - 4y = -11$
 $2x + 3y = 16$

$$= \begin{matrix} 2 \\ 3 \end{matrix} \begin{cases} 3x - 4y = -11 \\ 2x + 3y = 16 \end{cases}$$

$6x - 4y = -11 \dots\dots\dots(i)$

$6x + 3y = 16 \dots\dots\dots(ii)$

$6x = -11 + 4y \dots\dots\dots(iii)$

put eqn (iii) into (ii)

$$\begin{aligned}-11 + 4y + 3y &= 16 \\ -11 + 7y &= 16 \\ 7y &= 16 + 11\end{aligned}$$

$$\frac{7y}{7} = \frac{27}{7}$$

$$y = 3\frac{6}{7}$$

$$6x = -11 + 4 \times \frac{27}{7}$$

$$6x = -11 + \frac{108}{7}$$

$$6x = \frac{108}{7} - \frac{11}{1} = \frac{108}{7} - 77 = \frac{31}{7}$$

$$\frac{6x}{6} = \frac{31}{6}$$

$$x = \frac{31}{7} \times \frac{1}{6} = \frac{31}{42}$$

$$x = \frac{31}{42}$$

$$y = 3\frac{6}{7} \text{ and } x = \frac{31}{42}$$

$$\begin{aligned}\text{(iv)} \quad 2x - 3y &= 32 \\ 3x - 4y &= 30\end{aligned}$$

$$= \begin{cases} 2x - 3y = 32 \\ 3x - 4y = 30 \end{cases}$$

$$\begin{aligned}6x - 9y &= 96 \dots\dots\dots\text{(i)} \\ 6x - 8y &= 60 \dots\dots\dots\text{(ii)} \\ 6x &= 96 + 9y \dots\dots\dots\text{(iii)}\end{aligned}$$

put eqn (iii) into eqn (ii)

$$\begin{aligned}96 + 9y - 8y &= 60 \\ 96 + y &= 60 \\ y &= 60 - 96 \\ y &= -36\end{aligned}$$

$$6x = 96 + 9x - 36$$

$$6x = 96 - 324$$

$$\frac{6x}{6} = \frac{-228}{6} \quad x = -38$$

$$x = -38 \text{ and } y = -36$$

$$\begin{aligned}\text{(v)} \quad 5a - 5b &= 7 \\ 2a - 4b &= 2\end{aligned}$$

$$= \begin{cases} 5a - 5b = 7 \\ 2a - 4b = 2 \end{cases}$$

$$\begin{aligned}10a - 5b &= 7 \dots\dots\dots\text{(i)} \\ 10a - 4b &= 2 \dots\dots\dots\text{(ii)} \\ 10a &= 7 + 5b \dots\dots\dots\text{(iii)}\end{aligned}$$

put eqn (iii) into eqn (ii)

$$\begin{aligned}7 + 5b - 4b &= 2 \\ 7 + b &= 2 \\ b &= 2 - 7 \\ b &= -5\end{aligned}$$

$$\begin{aligned}10a &= 7 + 5(-5) \\ 10a &= 7 - 25 \\ 10a &= -18\end{aligned}$$

$$\frac{10a}{10} = \frac{-18}{10}$$

$$a = \frac{-18}{10}$$

$$b = -5 \text{ and } a = \frac{-18}{10}$$

$$\begin{aligned}\text{5. (i)} \quad 10u + 3v - 4 &= 0 \\ 6u + 2v - 2 &= 0\end{aligned}$$

$$\begin{aligned}10u + 3v &= 4 \\ 6u + 2v &= 2\end{aligned}$$

$$= \frac{6}{10} \begin{cases} 10u + 3v = 4 \\ 6u + 2v = 2 \end{cases}$$

$$= \begin{cases} 60u + 18v = 4 \\ 60u + 20v = 20 \end{cases}$$

$$0 - 2v - 4 = 4$$

$$\frac{-2v}{-2} = \frac{4}{-2}$$

$$V = -2$$

let find the value of u by taken equation

$$10u + 3v = 4$$

$$10u + 3(-2) = 4$$

$$10u - 6 = 4$$

$$10u = 4 + 6$$

$$10u = 10$$

$$\frac{10u}{10} = \frac{10}{10}$$

$$v = -2 \text{ and } u = 1$$

$$(ii) \quad x - y = 1$$

$$4x + 3y = \frac{1}{2}$$

$$= \frac{4}{1} \begin{cases} x - y = 1 \\ 4x + 3y = \frac{1}{2} \end{cases}$$

$$= \begin{cases} 4x - 4y = 4 \\ 4x + 3y = \frac{1}{2} \end{cases}$$

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

$$\frac{-7}{-7} = \frac{\frac{7}{2}}{-7}$$

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

let find the value of x by taken one equation

$$x - y = 1$$

$$x - \left(\frac{-1}{2}\right) = 1$$

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

$$x = \frac{1}{2} \text{ and } y = -\frac{1}{2}$$

$$(iii) \quad \begin{aligned} 3x + 3y &= 15 \\ 2x + 5y &= 14 \end{aligned}$$

$$= \frac{2}{3} \begin{cases} 3x + 3y = 15 \\ 2x + 5y = 14 \end{cases}$$

$$= - \begin{cases} 6x + 6y = 30 \\ 6x + 15y = 42 \end{cases}$$

$$= \frac{-9y}{9} = \frac{-12}{9}$$

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

Let find the value of x by taken one equation

$$3x + 3y = 15$$

$$3x + 3\left(1\frac{1}{3}\right) = 15$$

$$3x + 4 = 15$$

$$= \frac{3x}{3} = \frac{11}{3}$$

$$x = 3\frac{2}{3} \text{ and } y = 1\frac{1}{3}$$

$$(iv) \quad 7x - 3y = 15$$

$$5x - 2y = 19$$

$$= \begin{cases} 7x - 3y = 15 \\ 5x - 2y = 19 \end{cases}$$

$$= - \begin{cases} 35x - 15y = 75 \\ 35x - 14y = 133 \end{cases}$$

$$y = 58$$

Let find the value of x taken one equation

$$7x - 3y = 15$$

$$7x - 3 \times 58 = 15$$

$$7x - 204 = 15$$

$$\frac{7x}{7} = \frac{219}{7}$$

$$x = 31\frac{2}{7} \text{ and } y = 58$$

(v). $x + y = 5$
 $x - y = 1$

$$= - \begin{cases} x + y = 5 \\ x - y = 1 \end{cases}$$

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

$$y = 2$$

Let find the value of x by taken one equation

$$x + y = 5$$

$$x + 2 = 5$$

$$x = 5 - 2$$

$$x = 3$$

$$x = 3 \text{ and } y = 2$$

(vi) $\frac{1}{2}x - \frac{2}{3}y = 2$

$$\frac{1}{4}x + \frac{1}{2}y = 6$$

$$\frac{1}{2}x \times 2 - \frac{2}{3}y \times 2 = 2 \times 2$$

$$x - \frac{4}{3}y = 4$$

$$3x - 4y = 12 \dots\dots\dots (i)$$

$$\frac{1}{4}x + \frac{1}{2}y = 6$$

$$\frac{1}{4}x \times 4 + \frac{1}{2}y \times 4 = 6 \times 4$$

$$x + 2y = 24$$

$$x + 2 + \frac{4}{2}y \times 2 = 24 \times 2$$

$$2x + 4y = 48 \dots\dots\dots (ii)$$

Now you can take equation (i) and (ii) to solve the equation

$$3x - 4y = 12$$

$$2x + 4y = 48$$

$$= - \begin{cases} 3x - 4y = 12 \\ 2x + 4y = 48 \end{cases}$$

$$x = -9$$

Let find the value of y by taken one equation

$$3x - 4y = 12$$

$$3(-9) - 4y = 12$$

$$-27 - 4y = 12$$

$$-4y = 12 + 27$$

$$\frac{-4y}{-4} = \frac{39}{-4}$$

$$y = -9.75 \text{ and } x = -9$$

EXERCISE 10.5**1. Let the numbers be x and y**

$$\begin{cases} x + y = 109 \\ x - y = 29 \end{cases}$$

$$-\begin{cases} x + y = 109 \\ x - y = 29 \end{cases}$$

$$2y = 80$$

$$\frac{2y}{2} = \frac{80}{2}$$

$$y = 40$$

let find the value of x

$$x + y = 109$$

$$x + 40 = 109$$

$$x = 109 - 40$$

$$x = 69$$

The two numbers are 69 and 40

**2. let the first number be x
let the second number be y**

$$x + 3y = 1 \dots\dots\dots(i)$$

$$x - 3y = \frac{1}{7} \dots\dots\dots(ii)$$

$$= + \begin{cases} x + 3y = 1 \\ x - 3y = \frac{1}{7} \end{cases}$$

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

$$\frac{2x}{2} = \frac{8}{7}$$

$$= \frac{14x}{14} = \frac{8}{14}$$

$$x = \frac{4}{7}$$

Let find the value of y

$$x + 3y = 1$$

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

$$3y = 1 - \frac{4}{7}$$

$$3y = \frac{3}{7}$$

$$y = \frac{1}{7}$$

The number are $\frac{1}{7}$ and $\frac{4}{7}$

**3. Let the girls number be x and the
boys be y**

$$+ \begin{cases} x + y = 36 \\ 2x - y = 12 \end{cases}$$

$$\frac{3x}{3} = \frac{48}{3}$$

$$x = 16$$

let find the value of x

$$x + y = 36$$

$$16 + y = 36$$

$$y = 20$$

The girls are 16 and boys are 20

4. let the length be x and the width be y

$$\begin{cases} 2x - 3y = 1 \\ x - y = 3 \end{cases}$$

$$+ \begin{cases} 2x - 3y = 1 \\ x - y = 3 \end{cases}$$

$$\frac{5x}{5} = \frac{10}{5}$$

Let find the value of y

$$2x - 3y = 1$$

$$2x - 3y = 1$$

$$4 - 3y = 1$$

$$\frac{-3y}{-3} = \frac{-3}{-3}$$

$$y = 1$$

The length = 2cm and width = 1cm

5. Let the pencils be x and pen be y

$$\begin{cases} 4x + 5y = 600 \\ 6x + 8y = 940 \end{cases}$$

$$\begin{cases} 32x + 40y = 4800 \\ 30x + 40y = 4700 \end{cases}$$

$$\frac{2x}{2} = \frac{100}{2}$$

$$x = 50$$

Let the value of x

$$4x + 5y = 600$$

$$4 \times 50 + 5y = 600$$

$$200 + 5y = 600$$

$$5y = 600 - 200$$

$$\frac{5y}{5} = \frac{400}{5}$$

$$y = 80$$

The pencils are 50 and pens are 80

6. let paul's money be x

let john's money be y

$$\begin{cases} \frac{1}{2}x + \frac{1}{5}y = 1400 \\ \frac{3}{4}x + \frac{2}{3}y = 2650 \end{cases}$$

$$= \frac{3x}{8} + \frac{3y}{20} = \frac{4200}{4}$$

$$= \frac{3x}{8} + \frac{2y}{20} = \frac{2650}{2}$$

$$\begin{cases} \frac{3}{8}x + \frac{3}{20}y = 1050 \\ \frac{3}{8}x + \frac{2}{20}y = 1325 \end{cases}$$

$$\frac{11}{60}y = 275$$

$$\frac{11y}{60} \times \frac{60}{11} = 275 \times \frac{60}{11}$$

$$y = 1500$$

Let find the value of x

$$= \frac{1}{2}x + \frac{1}{5} \times 1500 = 1400$$

$$\frac{1}{2}x + 300 = 1400$$

$$2 \times \frac{1}{2}x = 1100 \times 2$$

$$x = 2200$$

Paul's money = 2200 shs and John's money = 1500 shs

7. let the price of the sheep be a
Let the price of goat be = b

$$\begin{cases} 3a + 4b = 290 \\ 2a + 2b = 170 \end{cases}$$

$$\begin{cases} 6a + 8a = 580 \\ 8a + 8b = 680 \end{cases}$$

$$2a = 100$$

$$\frac{2a}{2} = \frac{100}{2}$$

$$a = 50$$

let find the value of b

$$3a + 4b = 290$$

$$3 \times 50 + 4b = 290$$

$$150 + 4b = 290$$

$$4b = 290 - 150$$

$$\frac{4b}{4} = \frac{140}{4}$$

$$b = 35$$

The price of sheep = a

The price of goat = b

They bought 1 goat at 35 shs and 1 sheep at 50shs

CHAPTER 7: PERIMETERS AND AREA

PERIMETER:

The perimeter is the length of a closed curve. It is measured in centimeters, meter, kilometer etc

To find the perimeter of a shape, add the length of the sides which enclose it.

Example:

1. Find the perimeter of rectangle which is 6m by 9m

solution

Consider the diagram below



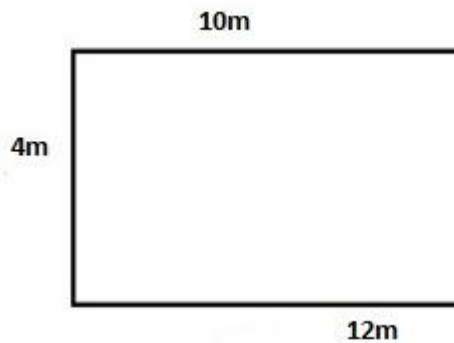
There are two lengths of 6m, and two of 9m

Add these $6m + 6m + 9m + 9m = 30m$

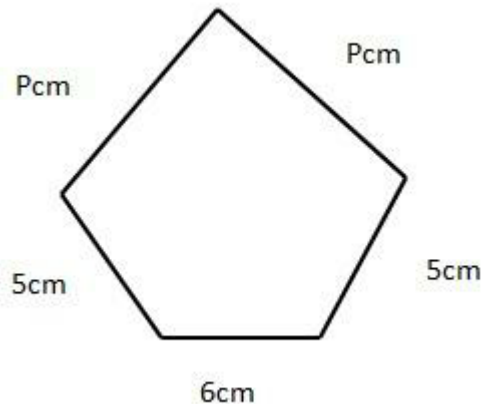
∴ The perimeter is 30m

2. find the perimeter of the following shapes

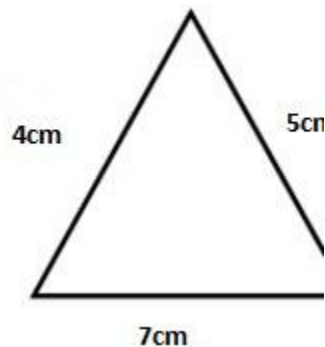
(a)



p if the perimeter is 24cm



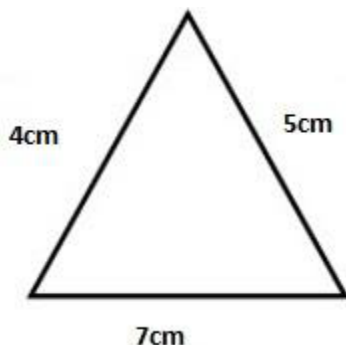
(b)

Solution

(a) The Perimeter = $4\text{m} + 6\text{m} + 10\text{m} + 12\text{m}$
 $= 32\text{m}$

∴ The perimeter is 32m

(b) For the triangle



The perimeter = $4\text{cm} + 5\text{cm} + 7\text{cm}$
 $= 16\text{cm}$

∴ The perimeter = 16cm

(a) In the figure below find the value of

solution.

The perimeter = $5\text{cm} + 6\text{cm} + P\text{cm} + P\text{cm}$

$$24 = 16\text{cm} + 2P\text{cm}$$

$$2P\text{cm} = 24\text{cm} - 16\text{cm}$$

$$2P\text{cm} = 8\text{cm}$$

$$\frac{2P\text{cm}}{2\text{cm}} = \frac{8\text{cm}}{2\text{cm}}$$

$$P = 4$$

Circumference of circles:

The perimeter of a circle is the length of its circumference.

The ratio of the perimeter to the diameter is the same for all circles, abbreviated as π

If c is the circumference, d is the diameter, then the result is

$$\frac{\text{circumference}}{\text{diameter}} = \frac{c}{d}$$

$$\frac{c}{d} = \pi$$

Multiplying across by d , it becomes

$$\pi \times d = c$$

If radius r is given, then

$$\text{Circumference} = 2\pi r$$

NOTE:

The value of π is 3.141592651

$$\text{i.e.} = 3.14, \text{ or } \frac{22}{7}$$

Example

1) A Circular running track has radius 6cm. What is the length of the track?

Solution

$$\text{Circumference} = \pi d$$

Given radius $r = 6\text{cm}$

$$\text{Then circumference} = 2\pi r$$

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

Take

$$C = 2 \times 3.14 \times 6$$

$$C = 37.68\text{cm}$$

2) Find the diameters of the circles with the
as a fraction or a whole number

(a) Circumference 88m

(b) Circumference 210m

Solution:

$$\text{(a) Circumference } C = \pi d$$

$$d = \frac{c}{\pi}, \text{ where } c = 88\text{m}$$

$$d = \frac{88}{\frac{22}{7}} \text{ m}$$

$$d = 88 \times \frac{7}{22} \text{ m}$$

$$28\text{m}$$

$$\therefore \text{The diameter } d = 28\text{m}$$

$$\text{(b) Circumference } c = \pi d$$

$$d = \frac{c}{\pi}, \text{ where } c = 210$$

$$d = \frac{210 \text{ m}}{\frac{22}{7}}$$

$$d = 210 \times \frac{7}{22} \text{ m}$$

$$\frac{735}{11} \text{ m}$$

$$\text{The diameter } d = \frac{735}{11} \text{ m}$$

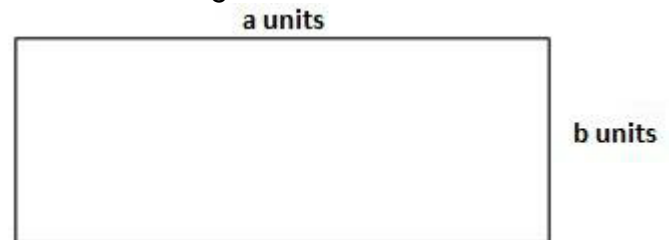
AREA:-

The area of a shape is the one that gives how much surface it covers.

Area is measured in square centimeters (cm) 2, square meters (m) 2, and square kilometer (km) 2.....

Rectangle:-

consider the figure below



$$\text{Area} = \text{length} \times \text{width}$$

$$= a \text{ units} \times b \text{ units}$$

$$= ab \text{ units square}$$

Example:

1. The length of a rectangle is 55cm, and the width is 8cm. What is the area?

Solution:



$$\begin{aligned}\text{Area} &= \text{length} \times \text{width} \\ &= 55\text{cm} \times 8\text{cm} \\ &= 440\text{cm}^2\end{aligned}$$

The area of a rectangle = 440cm²

2. The area of a rectangle is 2470m², and the length is 65m, what is the width.

Solution

$$\begin{aligned}\text{Given Area} \\ &= 2470\text{m}^2\end{aligned}$$

$$\text{Length} = 65\text{m}$$

$$\text{length} \times \text{width}$$

$$\times \text{width}$$

$$\text{Width} = \frac{2470\text{m}^2}{65\text{m}}$$

$$\text{Width} = 38\text{m}$$

The width of the rectangle is 38m.

Parallelogram

The area of a parallelogram = base x height

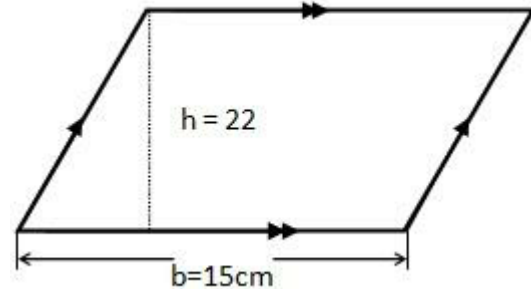
If base is b and height is h

$$\text{Then Area} = bh$$

The height of parallelogram is the perpendicular height.

Example

The parallelogram has base 15cm and height 22mm. What is its area? give your answer in cm



$$\text{Height} = 22\text{mm}$$

$$10\text{cm} = 10\text{mm}$$

$$? = 22\text{mm}$$

$$= \frac{1\text{cm} \times 22\text{mm}}{10\text{mm}}$$

$$= 2.2\text{ cm}$$

$$\begin{aligned}\text{But Area} &= \text{base} \times \text{height} \\ &= 15\text{cm} \times 2.2\text{ cm} \\ &= 33\text{cm}^2\end{aligned}$$

∴ The area of a parallelogram = 33cm²

2. A rhombus has side 1.2m and height 0.8m. What are its areas?

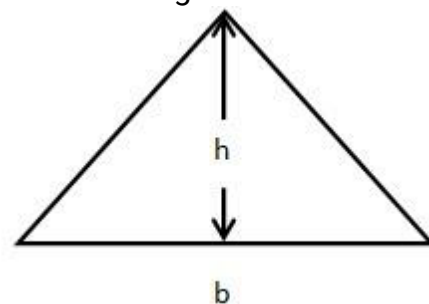
Solution

$$\begin{aligned}\text{But Area} &= \text{base} \times \text{height} \\ &= 1.2\text{m} \times 0.8\text{m} \\ &= 0.96\text{m}^2\end{aligned}$$

∴ The area of a rhombus = 0.96m²

Triangle:-

Consider the triangle below:-

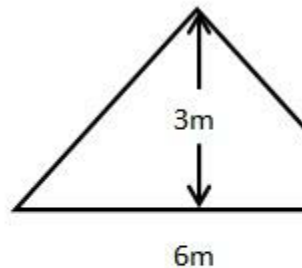


Then the area is $\frac{1}{2} \times b \times h = \frac{1}{2}bh$

$$\therefore \text{Area of triangle} = \frac{1}{2}bh$$

Example:

find area of triangle of below



$$\text{Area} = \frac{1}{2} b h$$

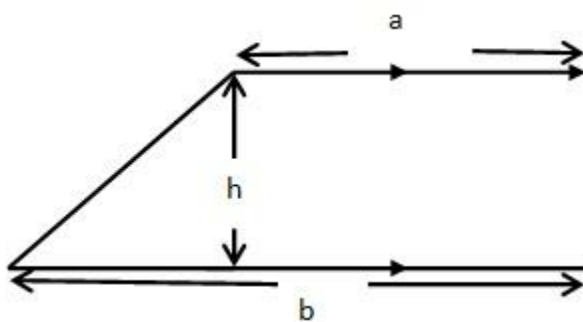
$$= \frac{1}{2} \times 6m \times 3m$$

$$9m^2$$

The area = 9m²

TRAPEZIUM

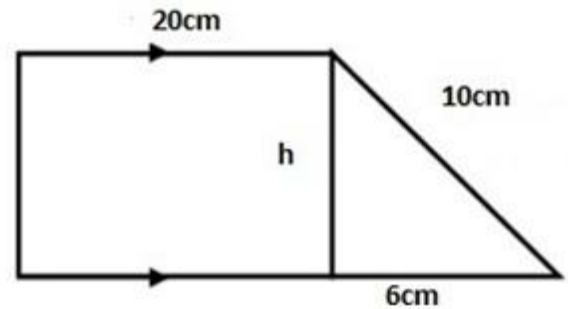
consider the parallel side of a trapezium are a and b as shown below



Then

$$\text{The Area} = \frac{1}{2} h (b + a) \text{ square units}$$

Example; Find the area of the Trapezium below



Solution

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

Where $b = 20cm + 6cm$

$$b = 26cm$$

$$a = 20cm$$

$h = \text{unknown}$

$$\text{But } 10^2 - 6^2 = h^2$$

$$100 - 36 = h^2$$

$$h^2 = 64$$

$$\sqrt{h^2} = \sqrt{64}$$

$$h = 8$$

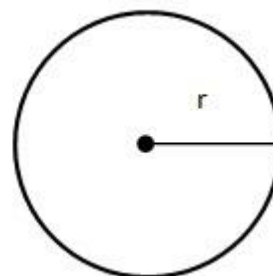
$$\text{the area} = \frac{1}{2} \times 8(20 + 26)cm^2$$

$$\frac{1}{2} \times 8 \times 46cm$$

$$\text{Area} = 184cm^2$$

Area of a circle:-

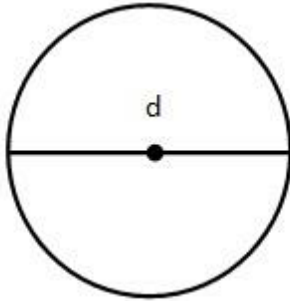
Consider a circle with radius r shown below



Then Area = $r \times \pi \times r$

$$\text{Area} = \pi r^2$$

If the circle has the diameter d as shown below



Then its area is

$$\text{Area} = \pi r^2$$

Since, $d = r \times 2$

$$d = 2r$$

$$\text{Then } r = \frac{d}{2}$$

$$\text{Area} = \pi \left(\frac{d}{2}\right)^2$$

$$= \frac{\pi d^2}{4}$$

$$\text{Area} = \frac{\pi d^2}{4} \quad \text{for diameter "d"}$$

Example:-

Find the area of the circle with the following measurement

$$\text{Take } \pi = \frac{22}{7}$$

(a) Diameter 8m

(b) Radius 3cm

(c) Diameter 0.2km

Solution

$$\begin{aligned} \text{(a) Area} &= \frac{\pi d^2}{4}, d = 8\text{m}, \pi = \frac{22}{7} \\ \text{Area} &= \frac{22 \times 8 \times 8}{4} \text{ m}^2 \\ &= 32\text{m}^2 \end{aligned}$$

$$\underline{\text{The Area of a circle} = 32\text{m}^2}$$

(b) Radius = 3cm

$$\begin{aligned} \text{Area} &= \pi r^2 \\ &= \frac{22}{7} \times 3 \times 3\text{cm}^2 \\ &= \frac{198}{7}\text{cm}^2 \end{aligned}$$

$$\underline{\text{The Area} = 28\frac{2}{7}\text{cm}^2}$$

(c) Diameter 0.2km

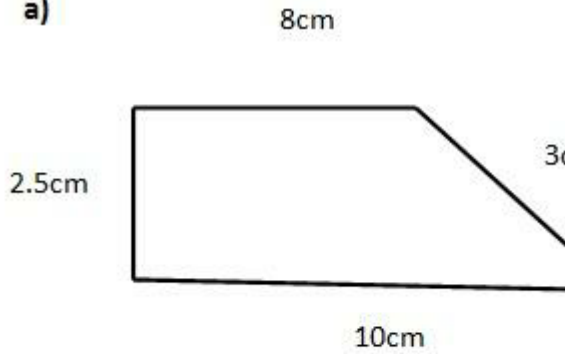
$$\begin{aligned} \text{Area} &= \frac{\pi d^2}{4} \\ &= \frac{22}{7} \times \frac{0.2 \times 0.2}{4} \text{ km}^2 \\ &= \frac{22}{7} \times \frac{0.4}{4} \text{ km}^2 \\ &= \frac{22}{7} \times 0.1 \text{ km}^2 \\ &= \frac{2.2}{7} \text{ km}^2 \\ &= \frac{22}{70} \text{ km}^2 \\ &= \frac{11}{35} \text{ km}^2 \end{aligned}$$

$$\underline{\text{The area} = \frac{11}{35} \text{ km}^2}$$

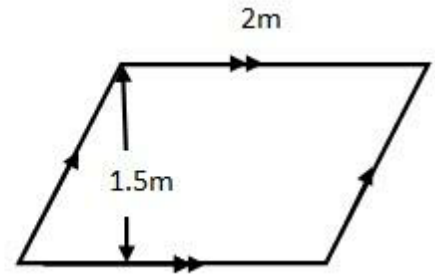
EXERCISE

1. find the perimeter of the shapes

a)

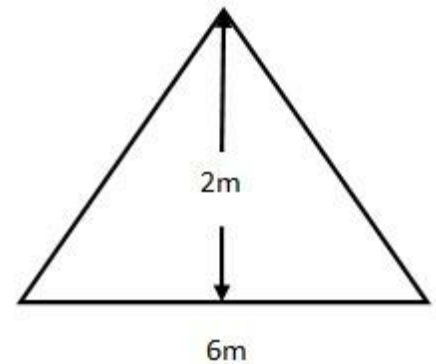
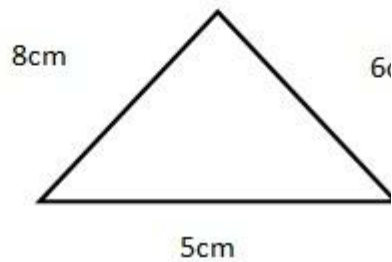


a)

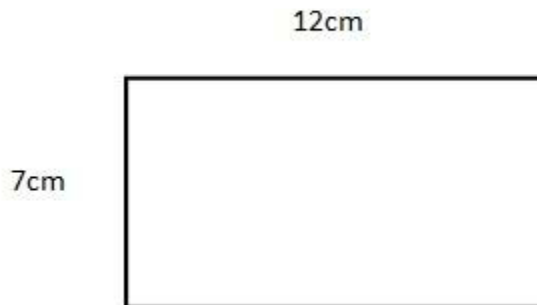


b)

b)



c)



3. A ball of radius 5m rolls along the ground 100 times ,

a) How far has it traveled?

b) How many times must the ball roll for it to cover 157m?

(Take $\pi = 3.14$)

SOLUTIONS TO EXERCISE 1

1. a) Perimeter = $2.5\text{cm} + 8\text{cm} + 10\text{cm} + 3\text{cm}$

Perimeter =

23.5cm

b) Perimeter of triangle = $8\text{cm} + 6\text{cm} + 5\text{cm}$

Perimeter =

19cm

c) Perimeter = $2(12\text{cm} + 7\text{cm})$
 $= 2 \times 19\text{cm}$

Perimeter = 38cm

2. a) Area = base $\times$ height
 Base = 2m, height = 1.5m

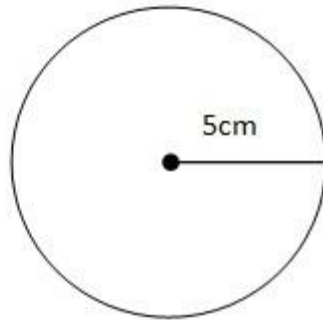
2. find the area of these shapes

$$\begin{aligned}\text{Area} &= 2\text{m} \times 1.5\text{m} \\ &= 3.0\text{m}^2 \\ \underline{\text{Area} &= 3\text{m}^2}\end{aligned}$$

b) $\text{Area} = \frac{1}{2} \text{base} \times \text{height}$, where base 6m, height

$$\begin{aligned}&= \frac{1}{2} \times 6\text{m} \times 2\text{m} \\ \underline{\text{Area} &= 6\text{m}^2}\end{aligned}$$

3.



Circumference of a circle (c) = $2\pi r$

$$\text{Then } C = 2 \times 3.14 \times 5\text{m}$$

$$C = 31.4\text{m}$$

a) It Rolls 100 times.
Rolling 1 time cover 31.4m
Rolling 100 times it will cover $31.4\text{m} \times 100$
 $= 3140\text{m}$
It will cover 3140m

b) For the ball to cover 157m, it will roll x times

$$\begin{array}{rcl} 1\text{time} & = & 31.4\text{m} \\ \times & = & 157\text{m} \\ \hline \frac{1 \times 157\text{m}}{31.4\text{m}} & = & x \end{array}$$

$$x = 5$$

∴ The ball will rolls 5

times.

CHAPTER 8: RATIO, PROFIT AND LOSS

Ratio:- the ratio of number p and q is p:q or $p \div q$ or p/q

Examples:

1. Joha and Siwenza shared 4,000 shillings between them. It Joha received 15,000 shillings and Siwenza got 25,000 shillings,

Find the ratio of the amounts they received:

Solution:

Joha : Siwenza
15,000: 25,000

or

$$15,000 = 15 = 3$$

$$25,000 = 25 = 5$$

$$3:5$$

The ratio of the amount they received is 3:5

2. Express 6:4 in lowest terms

Solution

6 : 4 it can be written as

$$6/4 = 3/2$$

6:4 in its lowest term is 3:2

3. Complete the following ratio

(a) $9 : 24 = 3$

(b) $15 : 39 = 15$

Solution

(a) $9 : 24 = 3$

Solutions

$$(a) \begin{array}{l} 9 = 3 \\ 24 = x \end{array}$$

$$x = \frac{24 \times 3}{9}$$

$$x = 8$$

Therefore $9:24 = 3:8$

$$15:39 = \underline{\quad} : 13$$

$$\begin{array}{l} 15 = x \\ 39 = 13 \end{array}$$

$$\begin{array}{l} 15 \times 13 \\ 39 \\ = 5 \end{array}$$

Therefore $15:39 = 5:13$

Question:

1. complete the following

(a) $12 : \underline{\quad} = 3 : 7$

(b) $4 : 9 = \underline{\quad} : 63$

solution

(a) $12 : \underline{\quad} = 3 : 7$

$$\begin{array}{l} 12 = \underline{\quad} \\ x = 7 \end{array}$$

$$\begin{array}{l} 12 \times 7 \\ 3 \\ = 4 \times 7 \\ = 28 \end{array}$$

Therefore $12:28 = 3:7$

(b) $4 : 9 = \underline{\quad} : 63$

solution

$$4 : 9 = \underline{\quad} : 63$$

Solutions

$$\begin{array}{l} 4 = 3 \\ 9 = 63 \end{array}$$

$$x = \frac{4 \times 63}{9}$$

$$x = 28$$

Therefore $4:9 = 28:63$

Proportions

1. Divide 120 shillings the ratio 3 : 7

Solution

$$3 + 7 = 10$$

$$\begin{array}{l} 3 \times 120 = 36 \text{ shs} \\ 10 \end{array}$$

$$\begin{array}{l} 7 \times 120 = 84 \text{ shs} \\ 10 \end{array}$$

Therefore $\frac{3}{10}$ of 120 is 36 shs

$\frac{7}{10}$ of 120 is 84 shs

2. divide 156 in the ratio of 3 : 4 : 5

solution

$$3 : 4 : 5$$

$$3 + 4 + 5 = 12$$

$$\begin{array}{r}
 + 7 = 10 \\
 3 \times 156 = 39 \\
 12
 \end{array}$$

$$\begin{array}{r}
 3 \text{ of } 156 \text{ is } 39 \\
 12
 \end{array}$$

$$\begin{array}{r}
 4 \times 156 = 52 \\
 12
 \end{array}$$

$$\begin{array}{r}
 4 \text{ of } 156 \text{ is } 52 \\
 12
 \end{array}$$

$$\begin{array}{r}
 5 \times 156 = 65 \\
 12
 \end{array}$$

$$\begin{array}{r}
 5 \text{ of } 156 \text{ is } 65 \\
 12
 \end{array}$$

Question

1. Juma, Ali, Mary and Kalo have 300, 100, 500 and 600 shaves in a cooperative shop respectively. Divide 150,000 shs among them in the ratio of their shaves

Solution

$$\begin{array}{l}
 300, 100, 500 \text{ and } 600 \\
 = 300 + : 100 + : 500 + : 600 \\
 = 3: 1: 5: 6 \\
 = 3: 1: 5: 6 \\
 = 3 + 1 + 5 + 6 = 15 \\
 = 3 \times 150,000 \div 30,000 \\
 15 \\
 = \text{Juma got } 30,000 \text{ shs}
 \end{array}$$

$$\begin{array}{l}
 1/15 \times 150,000 = 10,000 \\
 \text{Ally got } 10,000 \text{ shs}
 \end{array}$$

$$\begin{array}{l}
 5/15 \times 150,000 = 30,000 \\
 \text{Mary got } 50,000 \text{ shs}
 \end{array}$$

$$\begin{array}{l}
 6/15 \times 150,000 = 60,000 \\
 \text{Kalo got } 60,000 \text{ shs}
 \end{array}$$

Profit and loss

Profit = Selling price - buying price

Loss = Buying price - selling price

Percentage profit = $\frac{\text{profit made}}{\text{buying price}} \times 100\%$

Percentage loss = $\frac{\text{loss made}}{\text{buying price}} \times 100\%$

Example:-

1. A ration is bought for 24,000 shs and sold for 36,000 shs. Find

(a) The profit made

(b) The percent profit

Solution

$$\begin{array}{l}
 \text{(a) Buying price} = 24,000/= \\
 \text{Selling price} = 36,000/= \\
 \text{The profit made} \\
 = \text{Selling price} - \text{buying price} \\
 = 36,000/- - 24,000/- \\
 = 12,000/=
 \end{array}$$

(b) The percentage profit
 $= \frac{\text{profit made}}{\text{buying price}} \times 100\%$

$$\begin{array}{l}
 \text{Buying price} \\
 = 12,000 \times 100\% \\
 24,000 \\
 = \frac{1}{2} \times 100\% \\
 = 50\%
 \end{array}$$

2. A dealer paid 800,000/= for a machine and sold it the following year for 600,000/=

Find: (a) the loss made

(b) the percentage loss

(a) Solution

$$\begin{array}{l}
 \text{The loss made} \\
 = \text{Buying price} - \text{selling price} \\
 \text{Buying price} = 800,000/= \\
 \text{Selling price} = 600,000/=
 \end{array}$$

$$800,000 - 600,000$$

$$= 200,000/=$$

$$= 180000000$$

$$75$$

$$= 2,400,000/=$$

(b) **Solution**

$$\text{Loss made} = 200,000/=$$

$$\text{Buying price} = 800,000/=$$

The percentage loss

$$= \text{loss made} \times 100\%$$

$$\text{Buying price}$$

$$= 200,000 \times 100\%$$

$$800,000$$

$$= \frac{1}{4} \times 100\%$$

$$4$$

$$= 25\%$$

Question

1. A house was sold a profit of 900,000. If its late of the profit is $37 \frac{1}{2}$. Find the lost (buying price) of the house

Solution

$$\text{Profit made} = 900,000$$

$$\text{The percentage profit} = 37 \frac{1}{2}$$

$$\text{Buying price} = ?$$

$$\text{profit made} \times 100\%$$

$$\text{Buying price}$$

$$37 \frac{1}{2} = \frac{900,000}{\text{buying price}} \times 100\%$$

$$1 \quad \text{buying price}$$

$$B = \frac{900,000 \times 100\%}{37 \frac{1}{2}}$$

$$= \frac{900,00 \times 100}{75/2}$$

$$= \frac{900,000 \times 2}{1 \quad 75}$$

2. A dealer paid sh. 20,000 for 10 books. He sold $\frac{2}{5}$ of them at 3000 each and the remaining at 2500 each. What was his percentage profit?

Solution

$$\frac{2}{5} \times 10 = 4$$

$$4 \times 3,000 = 12,000 \text{ shs.}$$

$$\frac{1}{3} - \frac{2}{5} = \frac{3}{5}$$

$$\frac{3}{5} \times 10 = 6$$

$$6 \times 2500 = 15,000 \text{ shs}$$

$$12,000 \text{ shs} + 15,000 \text{ shs}$$

$$= 27,000 \text{ shs}$$

$$\text{Profit} = \text{Selling} - \text{Buying piece}$$

$$= 27,000 \text{ shs} - 20,000 \text{ shs}$$

$$= 7,000 \text{ shs.}$$

$$\text{Percentage profit} = \frac{\text{Profit made}}{\text{Buying price}}$$

$$7,000 \times 100\%$$

$$20,000$$

$$= 7000$$

$$200$$

$$= 35\%$$

Percentage is 35%

Question

1. Find the profit or loss when an article bought for

(a) 4000 sh and sold at 48000/=

(b) Sh. 1250 and sold at 1500/=

Solutions

(a) The profit made = Selling price - buying price

buying price = sh 4000
 selling price = sh 4800
 profit = selling - buying

$$= \text{sh } 4800 - 4000 \\ = \text{sh } 800$$

(b) buying price = 1250sh
 selling price = sh 1500
 profit = selling - buying
 profit = sh 1500 - sh 1250
 = 250 sh

(c) buying price = 2000sh
 selling price = 1400sh
 loss = buying - selling
 = 2000sh - 1400sh
 = 600sh

2. Find the buying price of an article which is sold at:-

(a) 98000sh at a profit of 40%
 (b) 30,000 sh at profit of 16%

(c) 108,500 sh at profit of 7%

(a) Solution

Buying price = ?

Selling price = 98000 sh

Percentage profit = 40%

But percentage profit

= Profit made $\times$ 100%

Buying price

40% = Profit made $\times$ 100%

Buying price

40% = profit made

100 Buying price

But profit made = S. P - B .P

2/5 = Selling - Buying

Business price

2/5 = 98000 - B

B

2 X B = 5 (98000 - B)

2B = 490000 - 5B

2B + 5B = 490,000

7B = 490,000

7

7B

$$B = 70,000 \text{ sh}$$

Therefore Buying price = 70,000sh

(b) Solution

Buying price (BP)

Selling price (SP) = 30,000/=

Percentage profit (PP) = 16%

PP = PM $\times$ 100%

BP

PM = SP - BP

$$16\% = \frac{(SP - BP)}{BP} \times 100\%$$

BP

$$BP \times 16\% = \frac{(30,000 - BP \times 100\%)BP}{BP}$$

BP

$$16\%BP = \frac{(30,000 - BP) 100\%}{100\%}$$

$$\frac{16BP}{100} = \frac{30000 - BP}{1}$$

$$4BP = 25(30,000 - BP)$$

$$4BP = 750,000 - 25BP$$

$$4BP + 25BP = 750,000$$

$$29BP = 750,000$$

$$\frac{29}{29} = \frac{750,000}{29}$$

$$BP = \frac{750,000}{29}$$

29

$$BP = 25862.7$$

Therefore the buying price of an article is 25862.07shs

(c) 108,500 sh at profit of 7%

Data given :

selling price = 108,500sh
 profit percentage = 7%
 buying price = ?
 But the percentage profit = profit made x
 100%

$$\frac{7\%}{100\%} = \frac{\text{profit made}}{\text{buying price}}$$

But the profit made
 = selling price - buying price
 $\frac{7}{100} = \frac{\text{selling price} - \text{buying price}}{\text{buying price}}$

$$\frac{7}{100} = \frac{108,000 - B}{B}$$

$$7 \times B = 100(108,500 - B)$$

$$7B = 108,500 - 100B$$

$$100B + 7B = 108,500$$

$$\frac{107B}{107} = \frac{108,500}{107}$$

$$B = 10140.19\text{sh}$$

Therefore The buying price of an article is 10140.19sh

3. find the article which is bought for 25,000 sh and sold at profit of 24%

solution

Data given ;
 Buying price = 25,000sh
 profit percentage = 24%
 selling price = ?
 but profit percentage

$$\frac{\text{profit made}}{\text{buying price}} \times 100\%$$

$$24\% = \frac{\text{profit made}}{\text{buying price}} \times 100\%$$

$$\frac{24}{100\%} = \frac{\text{profit made}}{\text{buying price}}$$

But profit made

$$= \text{selling price} - \text{buying}$$

$$\frac{6}{25} = \frac{\text{selling price} - \text{buying price}}{\text{buying price}}$$

$$\frac{6}{25} = \frac{\text{S.P} - 25,000}{25,000}$$

$$6 \times 25,000 = 25 (\text{S.P} - 25,000)$$

$$150,000 = 25\text{S.P} - 625,000$$

$$625,000 + 150,000 = 25\text{S.P}$$

$$\frac{775,000}{25} = \frac{25\text{S.P}}{25}$$

$$31,000 = \text{S.P}$$

Therefore Selling price of the article is 31,000 sh

4. A machine losing 18000/= is sold at profit of 40%. What is the selling price?

solution

Data given :

buying price = 180,000
 profit percentage = 40%
 selling price = ?

$$40 \times 180,000$$

100

$$= 40 \times 1,800$$

$$= 72,000 \text{ sh}$$

$$\text{Then } 180,000 \text{ sh} + 72,000 \text{ sh}$$

$$= 252,000 \text{ sh}$$

Therefore Selling price of machine is 252,000 sh

5. At a clearance sale boots which are cost 30,000 sh each were sold at a loss of 25%. Calculate the loss and clearance price

Solution

Data given :

$$\text{buying price} = 30,000$$

$$\text{loss} = 25\%$$

$$\text{loss made} = 25\% \times 30,000 \text{ sh}$$

$$= \frac{25}{100} \times 30,000 \text{ sh}$$

$$= 7,500 \text{ sh}$$

The loss made of boots is 7,500 sh

Clearance price (selling price)

$$\text{loss made} = \text{buying} - \text{selling price}$$

$$7,500 \text{ sh} = 30,000 \text{ sh} - S$$

$$7,500 - 30,000 = -S$$

$$-22,500 = -S$$

$$-1 \quad -1$$

Therefore Clearance price is 22,500sh

SIMPLE INTEREST

1. Simple interest (I): Is the amount of money paid as a profit.

2. Principle (P): The money borrowed or deposited or lent.

3. Rate (R) : Is the principle change per year.

4. Time (T): Period I year

5. Amount (A): The sum of principle and interest

$$\text{Interest} = \frac{\text{Principle} \times \text{Rate} \times \text{Time}}{100}$$

$$I = \frac{PRT}{100}$$

Examples:

1. Find the simple interest on 18,000 sh for 2 year at rate of 6%

Solution

Data given:

$$\text{Principle} = 18,000 \text{ sh}$$

$$\text{Rate} = 6\%$$

$$\text{Time} = 2 \text{ years}$$

$$\text{Interest} = ?$$

$$I = \frac{PRT}{100}$$

$$I = \frac{18,000 \times 6 \times 2}{100}$$

$$I = \frac{180 \times 12}{100} = 2,160$$

Therefore the simple interest is 2,160 sh

Solution:

Data given:

$$\text{Simple interest} = 90,000 \text{ sh}$$

$$\text{Rate} = 4\%$$

$$\text{Time} = 5 \text{ years}$$

Principle =?

$$I = \frac{PRT}{100}$$

$$90,000 = \frac{P \times 4 \times 5}{100}$$

$$90,000 = \frac{20P}{100}$$

$$20P \times \frac{1}{20} = \frac{90,000 \times 100}{20}$$

$$P = 450,000 \text{ SH}$$

The principle is 450,000 sh.

EXERCISE

1. Find the percentage rate at which interest on :

(a) 20,000 /= for 4 years is 2000/=

Solution

Data given:

$$\text{Interest} = 2000/=$$

$$\text{Principle} = 20,000/=$$

$$\text{Time} = 4 \text{ years}$$

$$\text{Rate} = ?$$

$$I = \frac{PRT}{100}$$

$$20,000 = \frac{200 \times R \times 4}{100}$$

$$20,000 = \frac{800R}{800}$$

$$25\% = R$$

∴ Rate is 25%

(b) 16,000 /= for 3 years is 9600/=

Solution

Data given

$$\text{Interest} = 96,00/=$$

$$\text{Principle} = 160,000/=$$

$$\text{Time} = 3 \text{ years}$$

$$\text{Rate} = ?$$

$$I = \frac{PRT}{100}$$

$$9600 = \frac{160,000 \times R \times 3}{100}$$

$$9600 = 4800R$$

$$4800 \quad 4800$$

$$2\% = R$$

∴ The rate is 2%

2. Find the principle that would earn

54,000 /= in 10 years at rate of 5%

Solution

Data given

$$\text{Interest} = 54,000/=$$

$$\text{Rate} = 5\%$$

$$\text{Time} = 10 \text{ years}$$

$$\text{Principle} = ?$$

$$I = \frac{PRT}{100}$$

$$54,000 = \frac{P \times R \times 10}{100}$$

$$54000 = \frac{P \times 2}{2}$$

$$108000 = P$$

∴ The rate principle is 108,000/=

1. Find the simple interest on 54,000/= inverted for 18 months at the rate of 12% per annum

Solution

Data given

$$\text{Interest} = ?$$

$$\text{Principle} = 54,000/=$$

$$\text{Rate} = 12$$

$$\begin{aligned} \text{Time} &= 18 \text{ months} \\ &= 1 \text{ years and 6 months} \\ &= 1 \text{ years and half} \end{aligned}$$

$$I = \frac{PRT}{100}$$

$$54,000 \times 12 \times 1 \frac{1}{2}$$

$$\frac{540 \times 6 \times}{100} = 3,240 =$$

∴ The simple interest is 3.240 /=

EXERCISE 2

1. Find the simple interest on

(a) 80,000 sh for 1 year at rate of 20% per annum

Solution

Data given:

$$\text{Principle} = 80,000/=$$

$$\text{Rate} = 20\%$$

$$\text{Time} = 1 \text{ year}$$

$$\text{Interest} = ?$$

$$\text{But, } I = \frac{PRT}{100}$$

$$I = 80,000 \times \frac{20 \times 1}{100}$$

$$= 800 \times 20$$

$$= 16,000$$

The simple interest is 1,600/=

(a) 14,000/= for 1 year at rate of 3% per annum

Solution:-

Data given:

$$\text{Principle} = 14,000/=$$

$$\text{Rate} = 3\%$$

$$\text{Interest} = 1 \text{ year}$$

$$\text{But, } I = \frac{PRT}{100}$$

$$I = 14,000 \times \frac{3 \times 1}{100}$$

$$= 140 \times 3$$

$$= 420/=$$

The simple interest is 420/=

2. Find the number of year (time in year) in which the interest on:

(a) 20,000/= at the rate of 4% is 4,800/=

Solution:

Data given:

$$\text{Principle} = 20,000/=$$

$$\text{Rate} = 4\%$$

$$\text{Interest} = 4,800/=$$

$$\text{But, } I = \frac{PRT}{100}$$

$$4,800 = 20,000 \times \frac{4 \times T}{100}$$

$$4,800 = 800T$$

$$800 = 800T$$

$$6 = T$$

The time is 6 years

(b) 50,000/= at the rate of 1% in 30,000/=

Solution:

Data given:

$$\text{Principle} = 60,000/=$$

$$\text{Rate} = 1\%$$

$$\text{Interest} = 30,000$$

$$\text{But, } I = \frac{PRT}{100}$$

$$30,000 = 60,000 \times \frac{1 \times T}{100}$$

$$30,000 = 600T$$

$$600 = 600T$$

$$50 = T$$

Therefore The time is 50 years

CHAPTER 9: UNITS

UNITS OF LENGTH

Basic unit of length is meter.

Other unit are such as :-

Unit	Symbol
Millimeter	mm
Centimeter	cm
Decimeter	dm
Meter	m
Decameter	dam
Hectametre	hm
Kilometer	km

Km hm dam m dm cm mm

1 0 0 0 0 0 0

1 0 0 0 0 0

1 0 0 0 0

1 0 0 0

1 0 0

1 0

1

EXAMPLES

1. Convert 9.17m into km

Solution

$$\begin{array}{rcl}
 1\text{km} & = & 1000\text{m} \\
 ? & = & 9.17\text{m} \\
 \hline
 1\text{km} \times 9.17\text{m} & & \\
 1000 & &
 \end{array}$$

$$\begin{array}{r}
 9.17\text{km} \\
 1000 \\
 \hline
 = 0.00917\text{km}
 \end{array}$$

2. Convert 2/51km into :-

(a) dm (b) mm (c) hm(A)

(a)

Solution

$$\begin{array}{rcl}
 1\text{km} & = & 10,000\text{dm} \\
 2.51\text{km} & = & ? \\
 \hline
 2.51 \times 10,000\text{dm} & & \\
 1\text{km} & &
 \end{array}$$

$$25100\text{dm}$$

$$\underline{\underline{2.51\text{km} = 25100\text{dm}}}$$

(b)

$$\begin{array}{rcl}
 1\text{km} & = & 10\text{hm} \\
 2.51\text{km} & = & ? \\
 \hline
 2.51 \times 10\text{hm} & & \\
 1\text{km} & &
 \end{array}$$

$$25.1\text{hm}$$

$$\underline{\underline{2.51\text{km} = 25.1\text{hm}}}$$

$$\begin{array}{rcl}
 1\text{km} & = & 1,000,000\text{mm} \\
 2.51\text{km} & = & ? \\
 \hline
 2.51 \times 1,000,000\text{mm} & & \\
 1\text{km} & &
 \end{array}$$

$$250,000\text{mm}$$

$$\underline{\underline{2.51\text{km} = 251000\text{mm}}}$$

OPERATIONS ON UNIT OF LENGTH**1. Addition**

Example Add the following:-

$$\begin{array}{r}
 \text{(a)} \quad \begin{array}{ccc} \text{m} & \text{dm} & \text{cm} \\ 6 & 7 & 8 \\ 2 & 5 & 7 \\ + 3 & 9 & 7 \\ \hline 13 & 3 & 4 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{b)} \quad \begin{array}{ccc} \text{m} & \text{dm} & \text{cm} \\ 9 & 6 & 9 \\ 8 & 8 & 8 \\ + 6 & 9 & 9 \\ \hline 23 & 23 & 26 \end{array}
 \end{array}$$

Question

1. Add together the following length (a) 785m, 97m, 605m, (b) 8dam, 9m, 2cm (Give your answer in metre.

Solution

(a) $785\text{m} + 97\text{m} + 605\text{m}$
 $= 1487\text{m}$

(b) 2 dam 9 m 2 cm

Solution

Dam 1 = m10

Dam 8 = m?

Dam 8 x 10m

1 dam

= 80m

1m = 100cm

2m = 2 cm

1m x 2cm = 2

100cm 100

0.01m

80.00m

09.00m

+ 00.02m

89.02m

Add

dm	cm	mm
7	8	9
8	8	7
+ 9	7	8
26	6	4

SUBSTRATION EXAMPLE

perform the following

(a)

km	dm	cm
5	4	3
- 2	9	8
2	9	8

(b)

hm	dm	mm
10	72	84
- 8	92	87
1	979	92

MULTIPLICATION EXAMPLES

(a)

km	hm	dam
6	8	9
x		5
30	44	45

(a)

km	hm	dam
6	8	4
x		28
168+23	224+11	112
191	23/5	2
<u>km 191</u>	<u>hm 5</u>	<u>dam 2</u>

QUESTION

To give answer of this:-

m	dm	cm
22	9	9
x		14
308	126	12/6
+ 13	+ 12	
321	13/8	6
m321	dmm8	cm6

DIVISION

Perform the following meter.

EXAMPLE1. $5\text{km} \div 10 =$ (Give answer in metre)

Solution:

Change 5km in m

$$\begin{array}{l} 1\text{km} = 1000\text{m} \\ 5\text{km} = ? \end{array}$$

$$\underline{1000\text{m} \times 5\text{km}}$$

$$1\text{km}$$

$$5000 \div 10$$

$$\begin{array}{r} 10 \overline{) 5000} \\ \underline{50} \\ 0 \\ 0 \end{array}$$

2. Evaluate $38\text{m} \div 50 =$ (Give your answer in centimeter).**Change 38m into cm:-**

$$\begin{array}{l} 1 = 100\text{cm} \\ 38\text{m} = ? \end{array}$$

$$\underline{38\text{m} \times 100\text{cm}}$$

$$1\text{m}$$

$$3800\text{cm}$$

$$3800 \div 50$$

$$76$$

$$\begin{array}{r} 50 \overline{) 3800} \\ \underline{- 350} \\ 300 \end{array}$$

$$\underline{300}$$

$$= \underline{76\text{ cm}}$$

3. Find the following in meter

(a) $(50\text{m} \quad 5\text{dm}) = 5$

Solution

Change 5dm into m

$$\begin{array}{l} 1\text{m} = 10\text{dm} \\ ? = 5\text{dm} \end{array}$$

$$\underline{5\text{dm} \times 1\text{m}} = \underline{\frac{5}{10}}$$

$$0.5\text{m}$$

$$50\text{m} + 0.5\text{m} = 50.5\text{m}$$

$$50.5\text{m} \div 5 =$$

$$\underline{\frac{50.5}{5} \times \frac{10}{10}} = \underline{\frac{505}{5}}$$

$$\begin{array}{r} 10.1 \\ 50 \overline{) 505} \\ \underline{- 50} \end{array}$$

$$- 50$$

$$\underline{- 50}$$

$$= \underline{10.1\text{m}}$$

(b) $78\text{m } 9\text{cm}) \div 9$

Solution

Change 9cm into m:-

$$1\text{m} = 100\text{cm}$$

$$\begin{array}{c} \diagup \quad \diagdown \\ ? \quad = \quad 9\text{cm} \end{array}$$

$$\underline{9\text{cm} \times 1\text{m}} = \underline{9}$$

100 100

0.09m

$$0.09m + 18m =$$

$$18.09\text{m} \div 9$$

$$\underline{18.09} \times \underline{100} = \underline{1809}$$

9 100 900

$$\begin{array}{r} 20.01 \\ 900 \overline{)1809} \\ \underline{-180} \\ 900 \\ \underline{900} \\ - - - \\ = 20.01\text{m} \end{array}$$

EXERCISE

2. A roll of string is 8.3 metres long. Pieces of string of length 2.30m, 78cm, 2.37m and 0.95m are cut off. The remaining part is divided into equal pieces of length 32cm. How many equal pieces are there?

Solution

$$0.9\text{mt } 2.30 + 1.8\text{m} + 2.37 = 7.42$$

73.50m - 7.42m

6.08m

$$1\text{m} = 100\text{cm}$$

$$?m = 32cm$$

$$\underline{1\text{m}} \times \underline{32} = \underline{32\text{m}}$$

<u>100cm</u>	<u>100</u>
--------------	------------

0.32m

$$6.08 \times 100 = \underline{608}$$

$$0.32 \times 100 = \frac{32}{100} \times 100$$

19

32 | 608

-32

288

288

— — —

There are 19 pieces.

EXAMPLES

1. Find k 4m

Solution

$$\begin{array}{r}
 \overline{) \text{ H hm } \quad 4\text{m}} \\
 - 8 \\
 \underline{3} \quad \quad 3004 \\
 - \underline{24} \\
 \quad 60 \\
 - \underline{56} \\
 \quad \quad 44 \\
 - \underline{40} \\
 \quad \quad \quad 40 \\
 - \underline{40} \\
 \quad \quad \quad \quad -- \\
 \quad \quad \quad \quad 1 \text{ km } 375.5\text{m}
 \end{array}$$

2. Find the following:-

(a) $(18\text{km} \quad 5\text{hm}) \div 5$

(b) $(50\text{m} \quad 5\text{dm}) \div 5$

Solution

(a) $(18\text{km} \quad 5\text{hm}) \div 5$

3km 7hm

(b) $(50\text{m} \quad 5\text{dm}) \div 5$

10m 1dm

UNITS OF MASS

The basic unit of mass is kilogram (kg)

Other units are such as:-

Units	Symbols
Tonne	T
Kilogram	kg
Hectogram	Hg
Decagram	dg
Gram	g
Decigram	dag
Centigram	cg
Milligram	mg

1. Change 3075g into kg

Solution

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

$3 = 3075$

$1\text{kg} \times 3075\text{g} = 3075\text{kg}$

$1000\text{g} \quad 1000$

3075g = 3.075kg

2. How many grams are there in 0.086 kg

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

$0.086\text{kg} = ?$

$0.086 \times 1000\text{g} = 86\text{g}$

$1\text{kg} \quad 1$

In 0.086kg there 86g

$1\text{m} = 100\text{cm}$

$? \text{m} = 2\text{cm}$

$1\text{m} \times 2\text{cm} = 2$

$100\text{cm} \quad 100$

0.01m

80.00m

09.00m

$+ 00.02\text{m}$

89.02m

$18,000$

37.8991 tonne

QUIZ

Convert 378997kg into tonne.

Solution

1 tonne = 1000kg but

1 kg = 10 hg

1000kg = 1000 hg

1,000kg x 10 hg = 10,000hg

1kg

1 tonne = 10,000 hg

? = 378991hg

1tonne x 378991hg

10,000hg

378991 tonne

$$\begin{array}{r} \text{(c)} \quad \text{t} \quad \text{g} \\ 3 \quad 85 \\ \times \quad 50 \\ \hline 150 \quad 450 \end{array}$$

$$\begin{array}{r} \text{(d)} \quad (4\text{kg} \quad 200\text{g}) \div 4 \\ \hline 1\text{kg} \quad 50\text{g} \end{array}$$

QUESTIONS

Find $(28\text{hg} \quad 1\text{dg}) \div 10$

Solution

$(28 \text{ hg} \quad 1\text{dg}) \div 10$

2 hg 8.1 dag

**OPERATION ON UNITS OF MASS
EXAMPLE**

Answer the following questions:-

$$\begin{array}{r} \text{(a)} \quad \text{kg} \quad \text{hg} \quad \text{g} \\ 60 \quad 9 \quad 960 \\ + \quad 11 \quad 45 \\ \hline 63 \quad 00 \quad 05 \end{array}$$

$$\begin{array}{r} \text{(b)} \quad \text{kg} \quad \text{hg} \quad \text{dg} \\ 2 \quad 9 \quad 8 \\ + 1 \quad 9 \quad 9 \\ \hline 0 \quad 9 \quad 9 \end{array}$$

The basic unit of time is second (s). other units are:-

Units	Symbols
Second	s
Minutes	min
Hour	h
Day	d
Week	W
Month	m
Year	y

60 seconds = 1 minutes

60 minutes = 1 hour

24 hour = 1 day

7 days = 1 week

4 week = 1 month

28, 29, 30 or 31 days = 1 month

12 month = 1 year

365 or 366 days = 1 year

365 or 36 days = 1 year

Time can be measured by using a **clock**.

There are two ways of reading time clock :-

- (i) By reading time in 12 hours
- (ii) By reading time in 24 hours.

<u>12 hours clock</u>	<u>24 hours clock</u>
12 midnight	2400
1	0100
2	0200
3	0300
4	0400
*	*
*	*
*	*
12 noon	1200
1	1300
2	1400
3	1500
4	1600
*	*
*	*
*	*
12 midnight	2400

EXAMPLES

1. Change 25 minutes past 10 in the following using :-

- (a) 12 hours clock
- (b) 24 hours clock

Solution:

- (a) 12 hours clock

10:25am

- (b) 24 hours clock

10:25 hours

2. Write the following times using a 24 - hours clock :

- (a) 6: 30 am
- (b) 9: 45 p.m

. Solution:

(a) 6:30 a.m it will be in 24 hours is **0630 hours**

(b) 9:45 p.m it will be in 24 hours is **2145 hours.**

3. Write the following times in words using 12 hours clock :-

- (a) 2040
- (b) 2349

Solution :

- (a) 08:40 p.m

It is forty minutes past eight. Twenty minutes to nine.

- (b) 11:49 pm

It is four nine minutes past eleven .

Eleven minutes to twelve

QUESTIONS

1. How many hours are there in a week?

$$1 \text{ day} = 24 \text{ hours}$$

$$7 \text{ days} = ?$$

$$7 \times 24 = 168 \text{ hours}$$

2. Convert 70 years into second:-

Solution:

$$1 \text{ year} = 365 \text{ days}$$

$$1 \text{ day} = 24 \text{ hours}$$

$$1 \text{ hour} = 60 \text{ minutes}$$

$$1 \text{ min} = 60 \text{ second}$$

$$= 70 \times 365 \times 24 \times 60 \times 60 =$$

$$= \underline{\underline{2,207,520,000 \text{ seconds}}}$$

3. Write the following times using a 24 hours clock.

(a) 3:20p.m

(b) 5:37 p.m

(c) 70:53 a.m

Solution

(a) 1520 hours

(b) 1737 hours

(c) 0453 hours

UNIT OF CAPACITY

The basic unit is litre (l)

Other unit are:

Unit	Symbol
Kilolitre	kl
Litre	l
Milliliter	ml

NOTE:

$$1\text{l} = 1000\text{cm}^3$$

$$1\text{k} = 1000\text{l}$$

$$1\text{?} = 1000\text{ml}$$

**Conversion of unit of capacity
EXAMPLES**Change the following into cm^3 :-

(a) 6.5 litre

(b) 35 litre

Solution

$$(a) \quad 1\text{litre} = 1000\text{cm}^3$$

$$6.5\text{litre} = ?$$

$$\underline{6.5\text{litre} \times 1000\text{cm}^3}$$

$$1\text{litre}$$

$$\underline{\underline{6500\text{cm}^3}}$$

$$(b) \quad 1\text{litre} = 1000\text{cm}^3$$

$$35 \text{ litre} = ?$$

$$\underline{35\text{litre} \times 1000\text{cm}^3}$$

$$1 \text{ litre}$$

$$\underline{\underline{35,000\text{cm}^3}}$$

2. Change the following quantities into litre

- (a) 5600cm³
 (b) 24000cm³
 (c) 4.2 kl

Solution:

(a)
$$\begin{array}{l} 1 \text{ litre} = 1000\text{cm}^3 \\ ? = 5600\text{cm}^3 \\ \hline 1 \text{ litre} \times 5600\text{cm}^3 \\ 1000\text{cm}^3 \end{array}$$

5.6litres

(b)
$$\begin{array}{l} 1 \text{ litre} = 1000\text{cm}^3 \\ ? = 24000\text{cm}^3 \\ \hline 1 \text{ litre} \times 24000\text{cm}^3 \end{array}$$

(c)
$$\begin{array}{l} 1 \text{ kl} = 1000\text{l} \\ 4.2 = ? \\ \hline 4.2\text{kl} = 1000\text{l} \\ 1\text{kl} \\ \hline \mathbf{4200\text{l}} \end{array}$$

Solution

1 litre cost sh. 100

$$34800 \div 100$$

$$\begin{array}{r} 348 \\ 100 \overline{) 34800} \\ \underline{- 30} \\ 48 \\ \underline{40} \\ 800 \\ \underline{800} \\ --- \end{array}$$

3. Write the amount of water Kurwa bought in litre.

Solution

$$350 \text{ ml} \times 60$$

$$= 21000\text{ml}$$

$$1 \text{ litre} = 1000\text{ml}$$

$$? = 21000\text{ml}$$

$$1 \text{ litre} \times 21000\text{ml} = \mathbf{21 \text{ litres}}$$

$$1000\text{ml}$$

$$= \mathbf{21 \text{ litres}}$$

EXERCISE

1. One litre of cooking oil cost sh. 700.

Find the cost of 15 litres

Solution:

$$\text{Sh. } 700 \times 15 \text{ litres}$$

$$= \mathbf{\text{Tsh } 10,500}$$

2. Doto sells 1 litre of milk for sh. 100.

How many litres of milk should Doto sell to get sh. 34,800?

LATEST HIGH SCHOOL NOTES

***0714497530* (Mr Isaboke)**

Maths form 1-4

English form 1-4

kiswahili form 1-4

chemistry form 1--4

Biology form 1-4

Physics form 1--4

Agriculture form 1--4

Business form 1--4

Cre form 1--4

History form 1--4

Computer form 1--4

Geography form 1--4

Homescience f1--4

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