पुूना International School
Shree Swaminarayan Gurukul, Zundal

# Grade – 9
# MATHS
# Specimen copy
# Year 22-23

# INDEX

**CHAPTER NO. – 1**

**CHAPTER NAME – Number Systems.**

**KEY POINTS TO REMEMBER :**

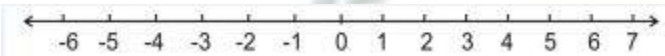
1 Rational Numbers

2 Irrational Numbers

3 Real Numbers and their Decimal Expansions

4 Operations on Real Numbers

5 Laws of Exponents for Real Numbers




- Natural numbers are : 1, 2, 3, …………….. denoted by N.
- Whole numbers are : 0, 1, 2, 3, ……………… denoted by W.
- Integers : ……. -3, -2, -1, 0, 1, 2, 3, ……………… denoted by Z.
- Rational numbers - All the numbers which can be written in the form p/q are called rational numbers where p and q are integers and $q \neq 0$.
- Every integer p is also a rational number, can be written as p/1.
- Irrational numbers - A number is called irrational, if it cannot be written in the form p/q where p and q are integers and $q \neq 0$.
- The decimal expansion of a rational number is either terminating or non terminating recurring. Thus we say that a number whose decimal expansion is either terminating or non terminating recurring is a rational number.
- Terminating decimals: The rational numbers with a finite decimal part or for which the long division terminates after a finite number of steps are known as finite or terminating decimals.
- Non-Terminating decimals: The rational numbers with an infinite decimal part or for which the long division does not terminate even after an infinite number of steps are known as infinite or non-terminating decimals
- The decimal expansion of an irrational number is non terminating non recurring.
- All the rational numbers and irrational numbers taken together make a collection of real numbers.
- A real number is either rational or irrational.
- If r is rational and s is irrational then r+s, r–s, rxs are always irrational numbers but r/s may be rational or irrational.
- If n is a natural number other than a perfect square, then $\sqrt{n}$ is a irrational number.
- Negative of an irrational number is an irrational number.
- There is a real number corresponding to every point on the number line. Also, corresponding to every real number there is a point on the number line.
- Every irrational number can be represented on a number line using Pythagoras theorem.

- For every positive real number $x$, $\sqrt{x}$ can be represented by a point on the number line by using the following steps:

1. Obtain all positive real numbers $x$ (say).
2. Draw a line and mark a point P on it.
3. Make a point Q on the line such that PQ = $x$ units.
4. From point Q mark a distance of 1 unit and mark the new point as R.
5. Find the mid-point of PR and mark the point as O.
6. Draw a circle with centre O and radius OR.
7. Draw a line perpendicular to PR passing through Q and intersecting the semi-circle at S. Length QS is equal to

# CHAPTER 1

# Number Systems

## (Ex. 1.1)

**1. Is zero a rational number? Can you write it in the form $\frac{p}{q}$, where $p$ and $q$ are integers and $q \neq 0$ ?**

**Ans.** Consider the definition of a rational number.

A rational number is the one that can be written in the form of $\frac{p}{q}$, where $p$ and $q$ are integers and $q \neq 0$.

Zero can be written as $\frac{0}{1}, \frac{0}{2}, \frac{0}{3}, \frac{0}{4}, \frac{0}{5} ......$

So, we arrive at the conclusion that 0 can be written in the form of $\frac{p}{q}$, where $q$ is any integer.

Therefore, zero is a rational number.

**2. Find six rational numbers between 3 and 4.**

**Ans.** We know that there are infinite rational numbers between any two numbers.

A rational number is the one that can be written in the form of $\frac{p}{q}$, where $p$ and $q$ are

Integers and .

We know that the numbers $3.1, 3.2, 3.3, 3.4, 3.5$ and $3.6$ all lie between 3 and 4.

We need to rewrite the numbers in $\frac{p}{q}$ form to get the rational numbers between 3 and 4.

So, after converting, we get $\frac{31}{10}, \frac{32}{10}, \frac{33}{10}, \frac{34}{10}, \frac{35}{10}$ and $\frac{36}{10}$.

We can further convert the rational numbers $\frac{32}{10}, \frac{34}{10}, \frac{35}{10}$ and $\frac{36}{10}$ into lowest fractions.

On converting the fractions into lowest fractions, we get $\frac{16}{5}, \frac{17}{5}, \frac{7}{2}$ and $\frac{18}{5}$.

Therefore, six rational numbers between 3 and 4 are $\frac{31}{10}, \frac{16}{5}, \frac{33}{10}, \frac{17}{5}, \frac{7}{2}$ and $\frac{18}{5}$.

**3. Find five rational numbers between $\frac{3}{5}$ and $\frac{4}{5}$.**

**Ans.** We know that there are infinite rational numbers between any two numbers.

A rational number is the one that can be written in the form of $\frac{p}{q}$, where *p* and *q* are Integers and $q \neq 0$.

We know that the numbers $\frac{3}{5}$ and $\frac{4}{5}$ can also be written as $0.6$ and $0.8$.

We can conclude that the numbers $0.61, 0.62, 0.63, 0.64$ and $0.65$ all lie between $0.6$ and $0.8$

We need to rewrite the numbers $0.61, 0.62, 0.63, 0.64$ and $0.65$ in $\frac{p}{q}$ form to get the rational numbers between 3 and 4.

So, after converting, we get $\frac{61}{100}, \frac{62}{100}, \frac{63}{100}, \frac{64}{100}$ and $\frac{65}{100}$.

.

We can further convert the rational numbers $\frac{62}{100}, \frac{64}{100}$ and $\frac{65}{100}$ into lowest fractions.

On converting the fractions, we get $\frac{31}{50}, \frac{16}{25}$ and $\frac{13}{20}$.

Therefore, six rational numbers between 3 and 4 are $\frac{61}{100}, \frac{31}{50}, \frac{63}{100}, \frac{16}{25}$ and $\frac{13}{50}$.

**4. State whether the following statements are true or false. Give reasons for your answers.**

**(i) Every natural number is a whole number.**

**(ii) Every integer is a whole number.**

**(iii) Every rational number is a whole number.**

**Ans. (i)** Consider the whole numbers and natural numbers separately.

We know that whole number series is $0, 1, 2, 3, 4, 5 \ldots$.

We know that natural number series is $1, 2, 3, 4, 5 \ldots$.

So, we can conclude that every number of the natural number series lie in the whole number series.

Therefore, we conclude that, yes every natural number is a whole number.

**(ii)** Consider the integers and whole numbers separately.

We know that integers are those numbers that can be written in the form of $\frac{p}{q}$, where q

Now, considering the series of integers, we have $\ldots -4, -3, -2, -1, 0, 1, 2, 3, 4 \ldots$.

We know that whole number series is $0, 1, 2, 3, 4, 5 \ldots$.

We can conclude that all the numbers of whole number series lie in the series of integers.

But every number of series of integers does not appear in the whole number series.

Therefore, we conclude that every integer is not a whole number.

**(iii)** Consider the rational numbers and whole numbers separately.

We know that rational numbers are the numbers that can be written in the form , where $q \neq 0 \, . \frac{p}{q}$

We know that whole number series is $0, 1, 2, 3, 4, 5 \ldots\ldots$ .

We know that every number of whole number series can be written in the form of $\frac{p}{q}$ as $q \neq 0 \, \frac{0}{1}, \frac{1}{1}, \frac{2}{1}, \frac{3}{1}, \frac{4}{1}, \frac{5}{1} \ldots\ldots$.

We conclude that every number of the whole number series is a rational number. But, every rational number does not appear in the whole number series.

Therefore, we conclude that every rational number is not a whole number.

# Number Systems

## (Ex. 1.2)

**5. State whether the following statements are true or false. Justify your answers.**

**(i) Every irrational number is a real number.**

**(ii) Every point on the number line is of the form $\sqrt{m}$ , where *m* is a natural number. (iii) Every real number is an irrational number.**

**Ans. (i)** Consider the irrational numbers and the real numbers separately.
We know that irrational numbers are the numbers that cannot be converted in the form $\frac{p}{q}$

wher e $p$ and $q$ are integers and $q \neq 0$

We know that a real number is the collection of rational numbers and irrational numbers.

Therefore, we conclude that, yes every irrational number is a real number.

**(ii)False,** Consider a number line. We know that on a number line, we can represent negative as well as positive numbers.

We know that we cannot get a negative number after taking square root of any number.
Therefore, we conclude that not every number point on the number line is of the form $\sqrt{m}$

where $m$ is a natural number.

**(iii)False,** Consider the irrational numbers and the real numbers separately.
We know that irrational numbers are the numbers that cannot be converted in the form $\frac{p}{q}$ ,

where $p$ and $q$ are integers and $q \neq 0$ .

We know that a real number is the collection of rational numbers and irrational numbers.

So, we can conclude that every irrational number is a real number. But every real number is not an irrational number.

Therefore, we conclude that, every real number is not a rational number.

**(iv) Are the square roots of all positive integers irrational ? If not, give an example of the square root of a number that is a rational number.**

**Ans.** We know that square root of every positive integer will not yield an integer.

We know that $\sqrt{4}$ is 2, which is an integer. But, $\sqrt{7}$ or $\sqrt{10}$ will give an irrational number.

Therefore, we conclude that square root of every positive integer is not an irrational number.

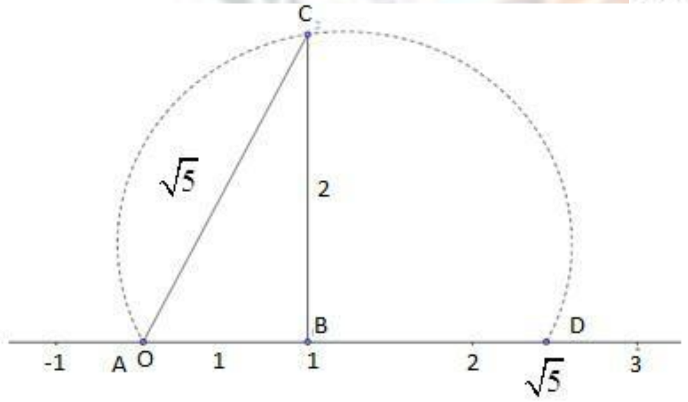
**(iii) Show how $\sqrt{5}$ can be represented on the number line. Ans.**

According to the Pythagoras theorem, we can conclude that

$$\left(\sqrt{5}\right)^2 = (2)^2 + (1)^2.$$

We need to draw a line segment *AB* of 1 unit on the number line. Then draw a straight line segment *BC* of 2 units. Then join the points *C* and *A*, to form a line segment *BC*.

Then draw the arc *ACD*, to get the number $\sqrt{5}$ on the number line.



# Number Systems

## (Ex. 1.3)

**6. Write the following in decimal form and say what kind of decimal expansion each has:**

**(i)** $\frac{36}{100}$

**(ii)** $\frac{1}{11}$

**(iii)** $4\frac{1}{8}$

**(iv)** $\frac{3}{13}$

**(v)** $\frac{2}{11}$

**(vi)** $\frac{329}{400}$

**Ans. (i)** $\frac{36}{100}$

On dividing 36 by 100, we get

$$\begin{array}{r l} & 0.36 \\ 100 \big) & 36 \\ & \underline{-0} \\ & 360 \\ & \underline{-300} \\ & 600 \\ & \underline{-600} \\ & \underline{0} \end{array}$$

Therefore, we conclude that $\frac{36}{100} = 0.36$, which is a terminating decimal.

**(ii)** $\frac{1}{11}$

On dividing 1 by 11, we get

$$
\begin{array}{r|l}
 & 0.0909.... \\
11 & 1 \\
 & \underline{-0} \\
 & 10 \\
 & \underline{-0} \\
 & 100 \\
 & \underline{-99} \\
 & 10 \\
 & \underline{-0} \\
 & 100 \\
 & \underline{-99} \\
 & \underline{1}
\end{array}
$$

We can observe that while dividing 1 by 11, we got the remainder as 1, which will continue to be 1.

Therefore, we conclude that $\frac{1}{11} = 0.0909.....$ or $\frac{1}{11} = 0.\overline{09}$, which is a non-terminating repeating decimal.

**(iii)** $4\frac{1}{8} = \frac{33}{8}$

On dividing 33 by 8, we get

$$
\begin{array}{r|l}
 & 4.125 \\
8 & 33 \\
 & \underline{-32} \\
 & 10 \\
 & \underline{-8} \\
 & 20 \\
 & \underline{-16} \\
 & 40 \\
 & \underline{-40} \\
 & \underline{0}
\end{array}
$$

We can observe that while dividing 33 by 8, we got the remainder as 0.

Therefore, we conclude that $4\frac{1}{8} = \frac{33}{8} = 4.125$, which is a terminating decimal.

**(iv)** $\frac{3}{13}$

On dividing 3 by 13, we get

$$
\begin{array}{r|r}
 & 0.230769.... \\
\hline
13 & 3 \\
 & \underline{-0} \\
 & 30 \\
 & \underline{-26} \\
 & 40 \\
 & \underline{-39} \\
 & 10 \\
 & \underline{-0} \\
 & 100 \\
 & \underline{-91} \\
 & 90 \\
 & \underline{-78} \\
 & 120 \\
 & \underline{-117} \\
 & 3
\end{array}
$$

We can observe that while dividing 3 by 13 we got the remainder as 3, which will continue to be 3 after carrying out 6 continuous divisions.

Therefore, we conclude that $\frac{3}{13} = 0.230769.....$ or $\frac{3}{13} = 0.\overline{230769}$, which is a non-terminating repeating decimal.

**(v)** $\frac{2}{11}$

On dividing 2 by 11, we get

$$
\begin{array}{r}
0.1818\ldots \\
11\overline{)\quad 2} \\
\underline{-0} \\
20 \\
\underline{-11} \\
90 \\
\underline{-88} \\
20 \\
\underline{-11} \\
90 \\
\underline{-88} \\
\underline{2}
\end{array}
$$

We can observe that while dividing 2 by 11, first we got the remainder as 2 and then 9, which will continue to be 2 and 9 alternately.

Therefore, we conclude that $\frac{2}{11} = 0.1818.....$ or $\frac{2}{11} = 0\overline{18}$, which is a non-terminating repeating decimal.

**(vi)** $\frac{329}{400}$

On dividing 329 by 400, we get

$$
\begin{array}{r}
0.8225 \\
400\overline{)\quad 329} \\
\underline{-0} \\
3290 \\
\underline{-3200} \\
900 \\
\underline{-800} \\
1000 \\
\underline{-800} \\
2000 \\
\underline{-2000} \\
\underline{0}
\end{array}
$$

We can observe that while dividing 329 by 400, we got the remainder as 0.

Therefore, we conclude that $\frac{329}{400} = 0.8225$, which is a terminating decimal.

**2. You know that $\frac{1}{7}=0.142857......$ Can you predict what the decimal expansions of $\frac{2}{7},\frac{3}{7},\frac{4}{7},\frac{5}{7},\frac{6}{7}$ are, without actually doing the long division? If so, how?**

**[Hint: Study the remainders while finding the value of $\frac{1}{7}$ carefully.]**

**Ans.** We are given that $\frac{1}{7}=0.\overline{142857}$ or $\frac{1}{7}=0.142857.....$.

We need to find the values of $\frac{2}{7},\frac{3}{7},\frac{4}{7},\frac{5}{7}$ and $\frac{6}{7}$, without performing long division.

We know that, $\frac{2}{7},\frac{3}{7},\frac{4}{7},\frac{5}{7}$ and $\frac{6}{7}$ can be rewritten as $2\times\frac{1}{7},3\times\frac{1}{7},4\times\frac{1}{7},5\times\frac{1}{7}$ and $6\times\frac{1}{7}$.

On substituting value of $\frac{1}{7}$ as $0.142857.....$, we get

$2\times\frac{1}{7}=2\times0.142857.....=0.285714.........$

$3\times\frac{1}{7}=3\times0.142857....=0.428571$---------

$4\times\frac{1}{7}=4\times0.142857...=0.571428$--------

$5\times\frac{1}{7}=5\times0.142857.....=0.714285$ -------

$6\times\frac{1}{7}=6\times0.142857.....=0.857142$ --------

Therefore, we conclude that, we can predict the values of $\frac{2}{7},\frac{3}{7},\frac{4}{7},\frac{5}{7}$ and $\frac{6}{7}$, without performing long division, to get

$$\frac{2}{7}=0.\overline{285714}, \frac{3}{7}=0.\overline{428571}, \frac{4}{7}=0.\overline{571428}, \frac{5}{7}=0.\overline{714285}, \text{ and } \frac{6}{7}=0.\overline{857142}$$

**3. Express the following in the form $\frac{p}{q}$, where *p* and *q* are integers and *q* $\neq$ 0.**

**(v)** $0.\overline{6}$

**(vi)** $0.4\overline{7}$

**(vii)** $0.\overline{001}$

**Ans.** Solution:

**(i)** $\text{Let } x=0.\overline{6} \Rightarrow x=0.6666.........(a)$

We need to multiply both sides by 10 to get

$10x=6.6666.....$ $.....(b)$

We need to subtract (*a*)from (*b*), to get

$$\begin{array}{r} 10x=6.6666..... \\ -x=0.6666..... \\ \hline 9x=6 \end{array}$$

We can also write $9x=6$ as $x=\frac{6}{9}$ or $x=\frac{2}{3}$.

Therefore, on converting $0.\overline{6}$ in the $\frac{p}{q}$ form, we get the answer as $\frac{2}{3}$.

**(ii)** $\text{Let } x=0.4\overline{7} \Rightarrow x=0.47777.......(a)$

We need to multiply both sides by 10 to get

$10x=4.7777.....(b)$

We need to subtract ($a$)from ($b$), to get

$$\begin{array}{l} 10x = 4.7777..... \\ \underline{-x = 0.4777....} \\ 9x = 4.3 \end{array}$$

We can also write $9x = 4.3$ as $x = \frac{4.3}{9}$ or $x = \frac{43}{90}$.

Therefore, on converting $0.4\bar{7}$ in the $\frac{p}{q}$ form, we get the answer as $\frac{43}{90}$.

**(iii)** $\text{Let } x = 0.\overline{001} \Rightarrow x = 0.001001........(a)$

We need to multiply both sides by 1000 to get

$1000x = 1.001001.....$ $....(b)$

We need to subtract ($a$)from ($b$), to get

$$\begin{array}{l} 1000x = 1.001001..... \\ \underline{\quad -x = 0.001001....} \\ 999x = 1 \end{array}$$

We can also write $999x = 1$ as $x = \frac{1}{999}$.

Therefore, on converting $0.\overline{001}$ in the $\frac{p}{q}$ form, we get the answer as $\frac{1}{999}$.

**4. Express $0.99999....$ in the form $\frac{p}{q}$. Are you surprised by your answer? Discuss why the answer makes sense with your teacher and classmates.**

**Ans.** $\text{Let } x = 0.99999......(a)$

We need to multiply both sides by 10 to get

$10x = 9.9999......(b)$

We need to subtract ($a$)from ($b$), to get

$$\begin{array}{l} 10x = 9.99999..... \\ \underline{-x = 0.99999....} \\ 9x = 9 \end{array}$$

We can also write $9x = 9$ as $x = \frac{9}{9}$ or $x = 1$.

Therefore, on converting $0.99999....$ in the $\frac{p}{q}$ form, we get the answer as $1$.

Yes, at a glance we are surprised at our answer.

But the answer makes sense when we observe that 0.9999……… goes on forever. SO there is not gap between 1 and 0.9999……. and hence they are equal.

**5. What can the maximum number of digits be in the recurring block of digits in the decimal expansion of $\frac{1}{17}$? Perform the division to check your answer.**

**Ans.** We need to find the number of digits in the recurring block of $\frac{1}{17}$.

Let us perform the long division to get the recurring block of $\frac{1}{17}$.

We need to divide 1 by 17, to get

We can observe that while dividing 1 by 17 we got the remainder as 1, which will continue to be 1 after carrying out 16 continuous divisions.

Therefore, we conclude that

$\frac{1}{17}=0.0588235294117647.....$ or $\frac{1}{17}=0.\overline{0588235294117647}$ , which is a non-terminating decimal and recurring decimal.

**6. Look at several examples of rational numbers in the form $\frac{p}{q}$ ($q \neq 0$), where *p* and *q* are integers with no common factors other than 1 and having terminating decimal representations (expansions). Can you guess what property *q* must satisfy?**

**Ans.** Solution:

Let us consider the examples of the form $\frac{p}{q}$ that are terminating decimals.

$\frac{5}{2}=2.5$

$\frac{5}{4}=1.25$

$\frac{2}{5}=0.4$

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

$\frac{5}{16}=0.3125$

We can observe that the denominators of the above rational numbers have powers of 2, 5 or both.

Therefore, we can conclude that the property, which *q* must satisfy in $\frac{p}{q}$ , so that the rational number $\frac{p}{q}$ is a terminating decimal is that $q$ must have powers of 2, 5 or both.

$isnotequalto$

**7. Write three numbers whose decimal expansions are non-terminating non-recurring.**

**Ans.** The three numbers that have their expansions as non-terminating on recurring decimal are given below.

0.04004000400004….

0.07007000700007….

0.013001300013000013….

**8. Find three different irrational numbers between the rational numbers** $\frac{5}{7}$ and $\frac{9}{11}$.

**Ans.** Let us convert $\frac{5}{7}$ and $\frac{9}{11}$ into decimal form, to get

$\frac{5}{7} = 0.714285....$ and $\frac{9}{11} = 0.818181....$

Three irrational numbers that lie between $0.714285....$ and $0.818181....$ are:

0.73073007300073….

0.74074007400074….

0.76076007600076….

**(iv) Classify the following numbers as rational or irrational:**

**(i)** $\sqrt{23}$

**(ii)** $\sqrt{225}$

**(iv) 0.3796**

**(v) 7.478478...**

**(vi) 1.101001000100001...**

**Ans. (i)** $\sqrt{23}$

We know that on finding the square root of 23, we will not get an integer.

Therefore, we conclude that $\sqrt{23}$ is an irrational number.

**(ii)** $\sqrt{225}$

We know that on finding the square root of 225, we get 15, which is an integer.

Therefore, we conclude that $\sqrt{225}$ is a rational number.

**(iii)** 0.3796

We know that 0.3796 can be converted into $\frac{p}{q}$.

While, converting 0.3796 into $\frac{p}{q}$ form, we get

$0.3796 = \frac{3796}{10000}$.

The rational number $\frac{3796}{10000}$ can be converted into lowest fractions, to get $\frac{949}{2500}$.

We can observe that 0.3796 can be converted into a rational number.

Therefore, we conclude that 0.3796 is a rational number.

**(iv)** 7.478478….

We know that 7.478478…. is a non-terminating recurring decimal, which can be converted into $\frac{p}{q}$ form.

While, converting 7.478478…. into $\frac{p}{q}$ form, we get

$x = 7.478478.... \qquad ....(a)$

$1000x = 7478.478478.......(b)$

While, subtracting (b) from (a), we get

$$\begin{array}{r} 1000x = 7478.478478.... \\ -x = \quad 7.478478.... \\ \hline 999x = 7471 \end{array}$$

We know that $999x = 7471$ can also be written as $x = \frac{7471}{999}$.

Therefore, we conclude that 7.478478…. is a rational number.

**(v)** 1.101001000100001....

We can observe that the number 1.101001000100001.... is a non-terminating on recurring decimal.

We know that non-terminating and non-recurring decimals cannot be converted into form. $\frac{p}{q}$

Therefore, we conclude that 1.101001000100001.... is an irrational number.

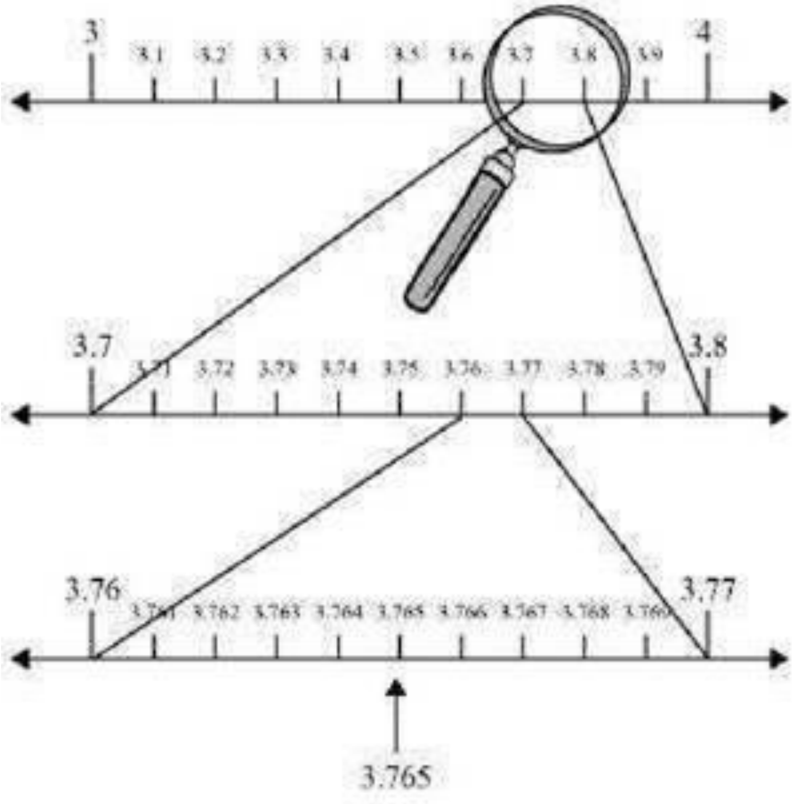
# Number Systems

## Ex. 1.4

**7. Visualize 3.765 on the number line using successive magnification. Ans.** We know that the number 3.765 will lie between 3.764 and 3.766. We know that the numbers 3.764 and 3.766 will lie between 3.76 and 3.77. We know that the numbers 3.76 and 3.77 will lie between 3.7 and 3.8.

We know that the numbers 3.7 and 3.8 will lie between 3 and 4.

Therefore, we can conclude that we need to use the successive magnification, after locating numbers 3 and 4 on the number line.



**2. Visualize $4.\overline{26}$ on the number line, up to 4 decimal places.**

**Ans.** We know that the number $4.\overline{26}$ can also be written as $4.262....$.

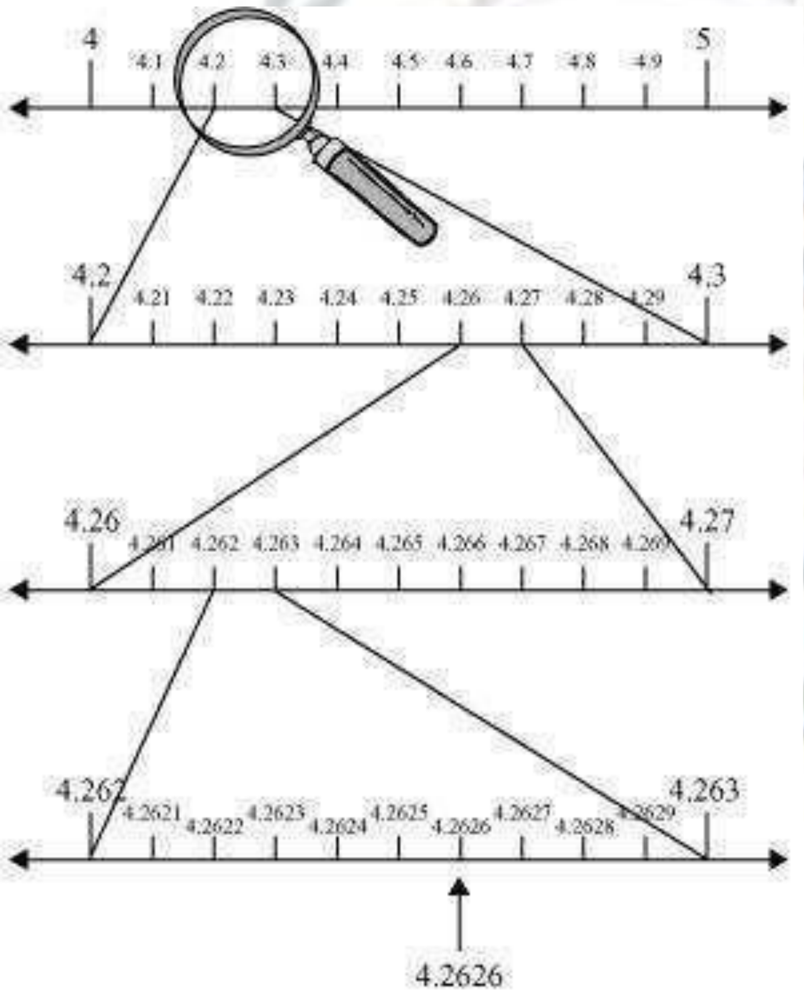
We know that the number $4.262....$ will lie between 4.261 and 4.263.

We know that the numbers 4.261 and 4.263 will lie between 4.26 and 4.27.

We know that the numbers 4.26 and 4.27 will lie between 4.2 and 4.3.

We know that the numbers 4.2 and 4.3 will lie between 4 and 5.

Therefore, we can conclude that we need to use the successive magnification, after locating numbers 4 and 5 on the number line.



# Number Systems

## Ex. 1.5

**1. Classify the following numbers as rational or irrational:**

**(i)** $2-\sqrt{5}$

**(ii)** $\left(3+\sqrt{23}\right)-\sqrt{23}$

**(iii)** $\frac{2\sqrt{7}}{7\sqrt{7}}$

**(iv)** $\frac{1}{\sqrt{2}}$

**(v)** $2\pi$

**Solutions:- (i)** $2-\sqrt{5}$

We know that $\sqrt{5}=2.236....$, which is an irrational number.

$2-\sqrt{5}=2-2.236....$

$=-0.236....$,

which is also an irrational number.

Therefore, we conclude that $2-\sqrt{5}$ is an irrational number.

**(ii)** $\left(3+\sqrt{23}\right)-\sqrt{23}$

$\left(3+\sqrt{23}\right)-\sqrt{23}=3+\sqrt{23}-\sqrt{23}$

= 3

Therefore, we conclude that $\left(3+\sqrt{23}\right)-\sqrt{23}$ is a rational number.

**(iii)** $\frac{2\sqrt{7}}{7\sqrt{7}}$

We can cancel $\sqrt{7}$ in the numerator and denominator, as $\sqrt{7}$ is the common number in numerator as well as denominator, to get

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

Therefore, we conclude that $\frac{2\sqrt{7}}{7\sqrt{7}}$ is a rational number.

**(iv)** $\frac{1}{\sqrt{2}}$

We know that $\sqrt{2} = 1.414....,$ which is an irrational number.

We can conclude that, when 1 is divided by $\sqrt{2}$, we will get an irrational number.

Therefore, we conclude that $\frac{1}{\sqrt{2}}$ is an irrational number.

**(v)** $2\pi$

We know that $\pi = 3.1415....,$ which is an irrational number.

We can conclude that $2\pi$ will also be an irrational number.

Therefore, we conclude that $2\pi$ is an irrational number.

**8. Simplify each of the following expressions:**

**(i)** $\left(3+\sqrt{3}\right)\left(2+\sqrt{2}\right)$

**(ii)** $\left(3+\sqrt{3}\right)\left(3-\sqrt{3}\right)$

**(iii)** $\left(\sqrt{5}+\sqrt{2}\right)^2$

**(iv)** $\left(5-\sqrt{2}\right)\left(5+\sqrt{2}\right)$

**Ans. (i)** $\left(3+\sqrt{3}\right)\left(2+\sqrt{2}\right)$

We need to apply distributive law to find value of $\left(3+\sqrt{3}\right)\left(2+\sqrt{2}\right)$.

$$\left(3+\sqrt{3}\right)\left(2+\sqrt{2}\right) = 3\left(2+\sqrt{2}\right)+\sqrt{3}\left(2+\sqrt{2}\right)$$

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

Therefore, on simplifying $\left(3+\sqrt{3}\right)\left(2+\sqrt{2}\right)$, we get $6+3\sqrt{2}+2\sqrt{3}+\sqrt{6}$.

**(ii)** $\left(3+\sqrt{3}\right)\left(3-\sqrt{3}\right)$

We need to apply distributive law to find value of $\left(3+\sqrt{3}\right)\left(3-\sqrt{3}\right)$.

$$\left(3+\sqrt{3}\right)\left(3-\sqrt{3}\right)=3\left(3-\sqrt{3}\right)+\sqrt{3}\left(3-\sqrt{3}\right)$$
$$=9-3\sqrt{3}+3\sqrt{3}-3$$

Therefore, on simplifying $\left(3+\sqrt{3}\right)\left(3-\sqrt{3}\right)$, we get 6.

**(iii)** $\left(\sqrt{5}+\sqrt{2}\right)^2$

We need to apply the formula $(a+b)^2=a^2+2ab+b^2$ to find value of $\left(\sqrt{5}+\sqrt{2}\right)^2$.

$$\left(\sqrt{5}+\sqrt{2}\right)^2=\left(\sqrt{5}\right)^2+2\times\sqrt{5}\times\sqrt{2}+\left(\sqrt{2}\right)^2$$
$$=5+2\sqrt{10}+2$$
$$=7+2\sqrt{10}.$$

Therefore, on simplifying $\left(\sqrt{5}+\sqrt{2}\right)^2$, we get $7+2\sqrt{10}$.

**(iv)** $\left(\sqrt{5}-\sqrt{2}\right)\left(\sqrt{5}+\sqrt{2}\right)$

We need to apply the formula $(a-b)(a+b)=a^2-b^2$ to find value of $\left(\sqrt{5}+\sqrt{2}\right)^2$.

$$\left(\sqrt{5}-\sqrt{2}\right)\left(\sqrt{5}+\sqrt{2}\right)=\left(\sqrt{5}\right)^2-\left(\sqrt{2}\right)^2$$

=5-2=3

Therefore, on simplifying $\left(\sqrt{5}-\sqrt{2}\right)\left(\sqrt{5}+\sqrt{2}\right)$, we get 3.

**3. Recall, $\pi$ is defined as the ratio of the circumference (say *c*) of a circle to its diameter (say *d*). That is, $\pi=\frac{c}{d}$. This seems to contradict the fact that $\pi$ is irrational. How will you resolve this contradiction?**

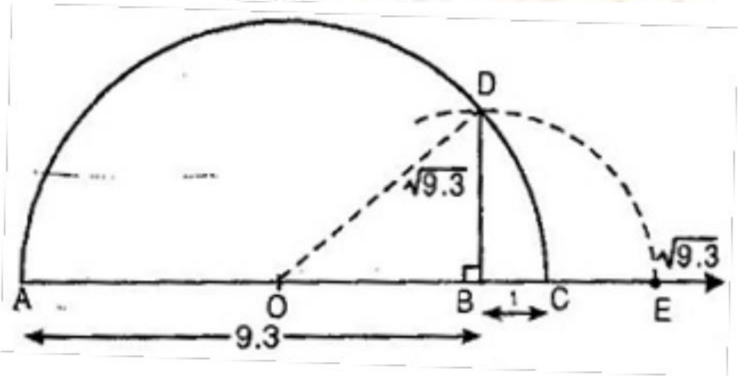
**Ans.** We know that when we measure the length of a line or a figure by using a scale or any device, we do not get an exact measurement. In fact, we get an approximate rational value. So, we are not able to realize that either circumference ($c$) or diameter($d$) of a circle is irrational.

Therefore, we can conclude that as such there is not any contradiction regarding the value of $\pi$ and we realize that the value of $\pi$ is irrational.

**4. Represent 9.3 on the number line.**

**Ans.** Mark the distance 9.3 units from a fixed point A on a given line to obtain a point B such that AB = 9.3 units. From B mark a distance of 1 unit and call the new point as C. Find the mid-point of AC and call that point as O. Draw a semi-circle with centre O and radius OC = 5.15 units. Draw a line perpendicular to AC passing through B cutting the semi-circle at D.

Then BD =BE= $\sqrt{9.3}$ where point B is zero point of number line.




**(viii) Rationalize the denominators of the following:**

**(i)** $\frac{1}{\sqrt{7}}$

**(ii)** $\frac{1}{\sqrt{7}-\sqrt{6}}$

**(iii)** $\frac{1}{\sqrt{5}+\sqrt{2}}$

**(iv)** $\frac{1}{\sqrt{7}-2}$

**Ans. (i)** $\frac{1}{\sqrt{7}}$

We need to multiply the numerator and denominator of $\frac{1}{\sqrt{7}}$ by $\sqrt{7}$, to get

$\frac{1}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = \frac{\sqrt{7}}{7}$.

Therefore, we conclude that on rationalizing the denominator of $\frac{1}{\sqrt{7}}$, we get $\frac{\sqrt{7}}{7}$.

**(ii)** $\frac{1}{\sqrt{7}-\sqrt{6}}$

We need to multiply the numerator and denominator of $\frac{1}{\sqrt{7}-\sqrt{6}}$ by $\sqrt{7}+\sqrt{6}$, to get

$\frac{1}{\sqrt{7}-\sqrt{6}} \times \frac{\sqrt{7}+\sqrt{6}}{\sqrt{7}+\sqrt{6}} = \frac{\sqrt{7}+\sqrt{6}}{\left(\sqrt{7}-\sqrt{6}\right)\left(\sqrt{7}+\sqrt{6}\right)}$.

We need to apply the formula $(a-b)(a+b) = a^2 - b^2$ in the denominator to get

$$\frac{1}{\sqrt{7}-\sqrt{6}} = \frac{\sqrt{7}+\sqrt{6}}{\left(\sqrt{7}\right)^2 - \left(\sqrt{6}\right)^2}$$

$$= \frac{\sqrt{7}+\sqrt{6}}{7-6}$$

$$= \sqrt{7}+\sqrt{6}.$$

Therefore, we conclude that on rationalizing the denominator of $\frac{1}{\sqrt{7}-\sqrt{6}}$, we get $\sqrt{7}+\sqrt{6}$

.

**(iii)** $\frac{1}{\sqrt{5}+\sqrt{2}}$

We need to multiply the numerator and denominator of $\frac{1}{\sqrt{5}+\sqrt{2}}$ by $\sqrt{5}-\sqrt{2}$, to get

$\frac{1}{\sqrt{5}+\sqrt{2}} \times \frac{\sqrt{5}-\sqrt{2}}{\sqrt{5}-\sqrt{2}} = \frac{\sqrt{5}-\sqrt{2}}{\left(\sqrt{5}+\sqrt{2}\right)\left(\sqrt{5}-\sqrt{2}\right)}$.

We need to apply the formula $(a-b)(a+b)=a^2-b^2$ in the denominator to get

$$\frac{1}{\sqrt{5}+\sqrt{2}}=\frac{\sqrt{5}-\sqrt{2}}{\left(\sqrt{5}\right)^2-\left(\sqrt{2}\right)^2}$$

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

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

Therefore, we conclude that on rationalizing the denominator of $\frac{1}{\sqrt{5}+\sqrt{2}}$, we get $\frac{\sqrt{5}-\sqrt{2}}{3}$.

**(iv)** $\frac{1}{\sqrt{7}-2}$

We need to multiply the numerator and denominator of $\frac{1}{\sqrt{7}-2}$ by $\sqrt{7}+2$, to get

$$\frac{1}{\sqrt{7}-2}\times\frac{\sqrt{7}+2}{\sqrt{7}+2}=\frac{\sqrt{7}+2}{\left(\sqrt{7}-2\right)\left(\sqrt{7}+2\right)}.$$

We need to apply the formula $(a-b)(a+b)=a^2-b^2$ in the denominator to get

$$\frac{1}{\sqrt{7}-2}=\frac{\sqrt{7}+2}{\left(\sqrt{7}\right)^2-(2)^2}$$

$$=\frac{\sqrt{7}+2}{7-4}$$

$$=\frac{\sqrt{7}+2}{3}.$$

Therefore, we conclude that on rationalizing the denominator of $\frac{1}{\sqrt{7}-2}$, we get $\frac{\sqrt{7}+2}{3}$.

# Number Systems

## Ex. 1.6

**9. Find:(i)** $64^{\frac{1}{2}}$ **(ii)** $32^{\frac{1}{5}}$ **(iii)** $125^{\frac{1}{3}}$

**Ans. (i)** $64^{\frac{1}{2}}$

We know that $a^{\frac{1}{n}} = \sqrt[n]{a}$, where $a > 0$.

We conclude that $64^{\frac{1}{2}}$ can also be written as $\sqrt[2]{64} = \sqrt[2]{8 \times 8}$

$\sqrt[2]{64} = \sqrt[2]{8 \times 8} = 8.$

Therefore, the value of $64^{\frac{1}{2}}$ will be 8.

**(ii)** $32^{\frac{1}{5}}$

We know that $a^{\frac{1}{n}} = \sqrt[n]{a}$, where $a > 0$.

We conclude that $32^{\frac{1}{5}}$ can also be written as $\sqrt[5]{32} = \sqrt[2]{2 \times 2 \times 2 \times 2 \times 2}$

$\sqrt[5]{32} = \sqrt[2]{2 \times 2 \times 2 \times 2 \times 2} = 2$

Therefore, the value of $32^{\frac{1}{5}}$ will be 2.

**(iii)** $125^{\frac{1}{3}}$

We know that $a^{\frac{1}{n}} = \sqrt[n]{a}$, where $a > 0$.

We conclude that $125^{\frac{1}{3}}$ can also be written as $\sqrt[3]{125} = \sqrt[3]{5\times5\times5}$

$\sqrt[3]{125} = \sqrt[3]{5\times5\times5} = 5$

Therefore, the value of $125^{\frac{1}{3}}$ will be 5.

**(ix)** **Find:(i)** $9^{\frac{3}{2}}$ **(ii)** $32^{\frac{2}{5}}$ **(iii)** $16^{\frac{3}{4}}$ **(iv)** $125^{\frac{-1}{3}}$ **Ans. (i)** $9^{\frac{3}{2}}$

We know that $a^{\frac{1}{n}} = \sqrt[n]{a}$, where $a > 0$.

We conclude that $9^{\frac{3}{2}}$ can also be written as $\sqrt[2]{(9)^3} = \sqrt[2]{9\times9\times9} = \sqrt[2]{3\times3\times3\times3\times3\times3}$

$\sqrt[2]{(9)^3} = \sqrt[2]{3\times3\times3\times3\times3\times3}$

$= 3\times3\times3$

=27

Therefore, the value of $9^{\frac{3}{2}}$ will be 27.

**(ii)** $32^{\frac{2}{5}}$

We know that $a^{\frac{1}{n}} = \sqrt[n]{a}$, where $a > 0$.

We conclude that $32^{\frac{2}{5}}$ can also be written as $\sqrt[5]{(32)^2}$

$= \sqrt[5]{(2\times2\times2\times2\times2)(2\times2\times2\times2\times2)} = 2\times2$

= 4

Therefore, the value of $32^{\frac{2}{5}}$ will be 4.

**(iii)** $16^{\frac{3}{4}}$

We know that $a^{\frac{1}{n}} = \sqrt[n]{a}$, where $a > 0$.

We conclude that $16^{\frac{3}{4}}$ can also be written as $\sqrt[4]{(16)^3}$

$= \sqrt[4]{(2\times2\times2\times2)(2\times2\times2\times2)(2\times2\times2\times2)}$

$= 2\times2\times2$

= 8

Therefore, the value of $16^{\frac{3}{4}}$ will be 8.

**(iv)** $125^{\frac{-1}{3}}$

We know that $a^{-n} = \frac{1}{a^n}$

We conclude that $125^{\frac{-1}{3}}$ can also be written as $\frac{1}{125^{\frac{1}{3}}}$, or $\left(\frac{1}{125}\right)^{\frac{1}{3}}$.

We know that $a^{\frac{1}{n}} = \sqrt[n]{a}$, where $a > 0$.

We know that $\left(\frac{1}{125}\right)^{\frac{1}{3}}$ can also be written as $\sqrt[3]{\left(\frac{1}{125}\right)} = \sqrt[3]{\left(\frac{1}{5}\times\frac{1}{5}\times\frac{1}{5}\right)}$

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

Therefore, the value of $125^{\frac{-1}{3}}$ will be $\frac{1}{5}$.

**(v) Simplify:**

**(i)** $2^{\frac{2}{3}} \cdot 2^{\frac{1}{5}}$

**(ii)** $\left(\frac{1}{3^3}\right)^7$

**(iii)** $\dfrac{11^{\frac{1}{2}}}{11^{\frac{1}{4}}}$

**(iv)** $7^{\frac{1}{2}} \cdot 8^{\frac{1}{2}}$

**Ans. (i)** $2^{\frac{2}{3}} \cdot 2^{\frac{1}{5}}$

We know that $a^m \cdot a^n = a^{(m+n)}$.

We can conclude that $2^{\frac{2}{3}} \cdot 2^{\frac{1}{5}} = (2)^{\frac{2}{3}+\frac{1}{5}}$.

$2^{\frac{2}{3}} \cdot 2^{\frac{1}{5}} = (2)^{\frac{10+3}{15}} \quad = (2)^{\frac{13}{15}}$

Therefore, the value of $2^{\frac{2}{3}} \cdot 2^{\frac{1}{5}}$ will be $(2)^{\frac{13}{15}}$.

**(ii)** $\left(\frac{1}{3^3}\right)^7$

We know that $(a^m)^n = a^{mn}$

$= \frac{1}{3^{3\times 7}} = \frac{1}{3^{21}} = 3^{-21}$

We conclude that $\left(\frac{1}{3^3}\right)^7$ can also be written as $3^{-21}$

**(iii)** $\dfrac{11^{\frac{1}{2}}}{11^{\frac{1}{4}}}$

We know that $\frac{a^m}{a^n} = a^{m-n}$

We conclude that $\frac{11^{\frac{1}{2}}}{11^{\frac{1}{4}}} = 11^{\frac{1}{2}-\frac{1}{4}}$.

$$\frac{11^{\frac{1}{2}}}{11^{\frac{1}{4}}} = 11^{\frac{1}{2}-\frac{1}{4}} = 11^{\frac{2-1}{4}}$$

$$= 11^{\frac{1}{4}}$$

Therefore, the value of $\frac{11^{\frac{1}{2}}}{11^{\frac{1}{4}}}$ will be $11^{\frac{1}{4}}$.

**(iv)** $7^{\frac{1}{2}} \cdot 8^{\frac{1}{2}}$

We know that $a^m \cdot b^m = (a \times b)^m$.

We can conclude that $7^{\frac{1}{2}} \cdot 8^{\frac{1}{2}} = (7 \times 8)^{\frac{1}{2}}$.

$$7^{\frac{1}{2}} \cdot 8^{\frac{1}{2}} = (7 \times 8)^{\frac{1}{2}} = (56)^{\frac{1}{2}}$$

Therefore, the value of $7^{\frac{1}{2}} \cdot 8^{\frac{1}{2}}$ will be $(56)^{\frac{1}{2}}$.

SUBJECT : MATHS

CHAP - 1

Std : $9^{th}$

WORK-SHEET

1 The absolute value of | - 23 | is

(A) - 23 (B) 23 (C) 0 (D) None

2 The smallest prime number is

(A) 0 (B) 2 (C) 1 (D) None

3 The smallest whole number is

(A) 0 (B) 2 (C) 1 (D) None

**SOLVE**

4. Find six rational numbers between 3 and 4

5 Locate $\sqrt{2}$ on the number line

6 TRUE OR FALSE

(i) Every integer is a rational number
(ii) Every rational number is a integer.
(iii) Every whole number is a Natural number
(iv) Every integer is a whole number

**SOLVE**

1. Express 3. 142678 in the form $\frac{p}{q}$
2. Visualize 3.765 on the number line, using successive magnification.

पुणा International School
Shree Swaminarayan Gurukul, Zundal

# Grade – 9
# MATHS
# Specimen copy
# Year 22-23

# INDEX

## Notes
## CHAPTER – 3
## COORDINATE GEOMETRY

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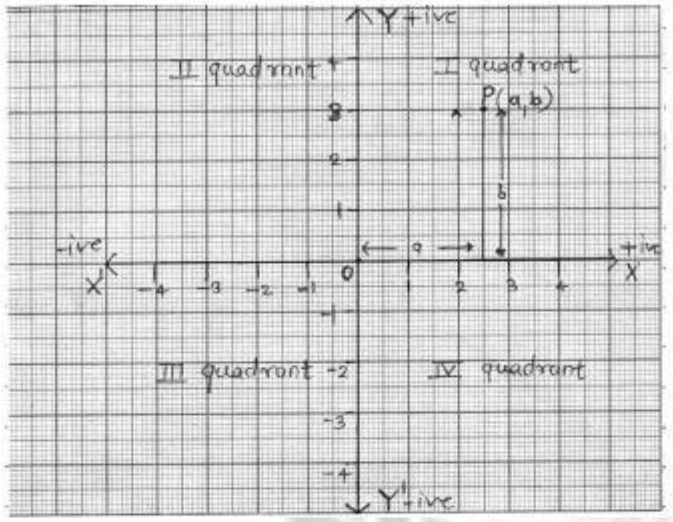
### 1. Cartesian System

### 2. Plotting a Point in the Plane with given Coordinates

**Coordinate Geometry** : The branch of mathematics in which geometric problems are solved through algebra by using the coordinate system is known as coordinate geometry.

**Coordinate System**

**Coordinate axes:** The position of a point in a plane is determined with reference to two fixed mutually perpendicular lines, called the coordinate axes.




In this system, position of a point is described by ordered pair of two numbers.

**Quadrants**: The coordinate axes divide the plane into four parts which are known as quadrants.

**Ordered pair** : A pair of numbers a and b listed in a specific order with 'a' at the first place and 'b' at the second place is called an ordered pair (a,b)

Note that $(a, b) \neq (b, a)$

Thus (2,3) is one ordered pair and (3,2) is another ordered pair.

In given figure O is called origin.

The horizontal line

XOX' is called the x-axis.

The vertical line YOY' is called the y-axis.

P(a, b) be any point in the plane. 'a' the first number denotes the distance of point from y - axis and 'b' the second number denotes the distance of point from x-axis.

a - X - coordinate | abscissa of P.

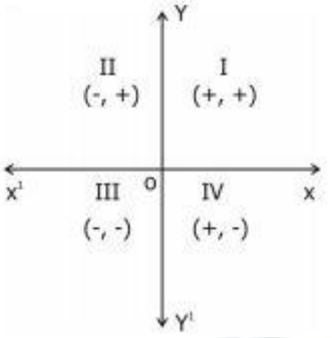
b - Y - coordinate | ordinate of P.

The point of intersection of the coordinate axes is called the **origin**.

The coordinates of origin are (0, 0)

Every point on the x-axis is at a distance o unit from the x -axis. So its ordinate is 0.

Every point on the y-axis is at a distance of unit from the y -axis. So, its abscissa is 0.




**Note :** Any point lying on x - axis or y - axis does not lie in any quadrant.

The sign of coordinates (x, y) of a point in various quadrants are as given below:

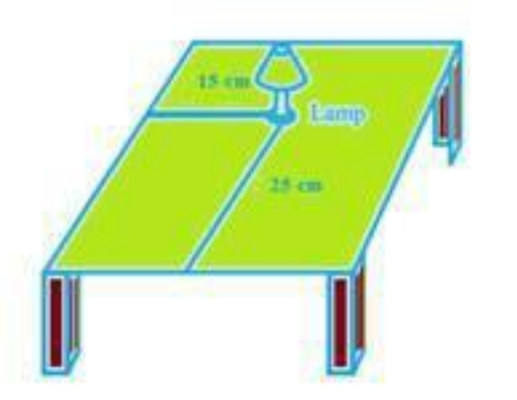
| Quadrant | Coordinates | |
|---|---|---|
| ¤ | x | y |
| I | + | + |
| II | - | + |
| III | - | - |
| IV | + | - |

## CHAPTER 3

## Coordinate Geometry (Ex. 3.1)

1. **How will you describe the position of a table lamp on your study table to another person?**

**Ans.** Let us consider the given below figure of a study stable, on which a study lamp is placed.




Let us consider the lamp on the table as a point and the table as a plane. From the figure, we can conclude that the table is rectangular in shape, when observed from the top. The table has a short edge and a long edge.

Let us measure the distance of the lamp from the shorter edge and the longer edge. Let us assume that the distance of the lamp from the shorter edge is 15 cm and from the longer edge, its 25 cm.Therefore, we can conclude that the position of the lamp on the table can be described in two ways depending on the order of the axes as $(15, 25)$ or $(25, 15)$.

2. **(Street Plan): A city has two main roads which cross each other at the centre of the city. These two roads are along the North-South direction and East-West direction.**

**All the other streets of the city run parallel to these roads and are 200 m apart. There are 5 streets in each direction. Using 1cm = 200 m, draw a model of the city on your notebook. Represent the roads/streets by single lines.**

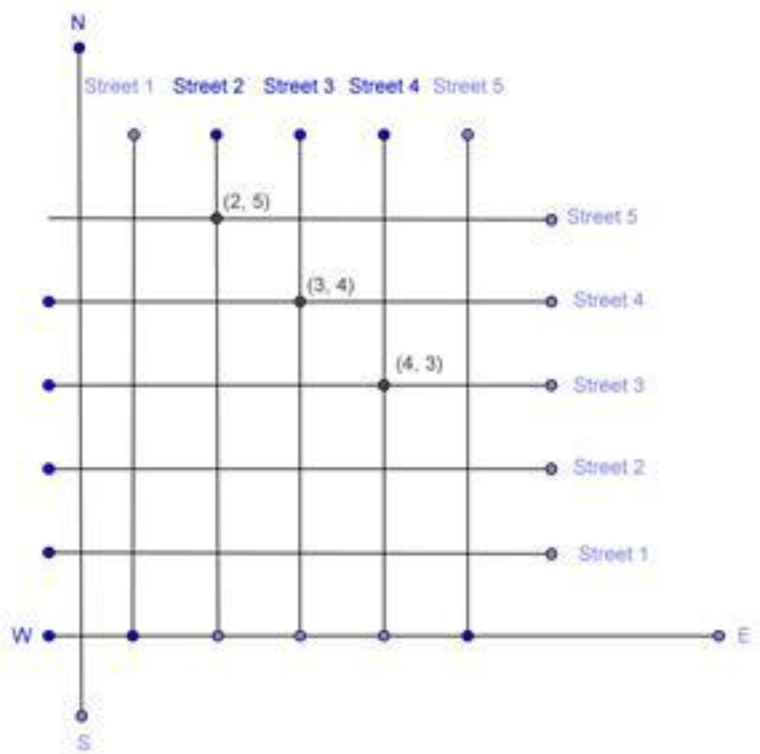
**There are many cross- streets in your model. A particular cross-street is made by two streets, one running in the North - South direction and another in the East – West direction. Each cross street is referred to in the following manner: If the 2nd street running in the North - South direction and 5th in the East - West direction meet at some crossing, then we will call this cross-street (2, 5). Using this convention, find:**

**(I) how many cross - streets can be referred to as (4, 3).**

**(II) how many cross - streets can be referred to as (3, 4).**

**Ans.** We need to draw two perpendicular lines as the two main roads of the city that cross each other at the center and let us mark it as N-S and E-W. Let us take the scale as 1 cm = 200m.

We need to draw five streets that are parallel to both the main roads, to get the given below figure.




(i) From the figure, we can conclude that only one point have the coordinates as (4, 3). Therefore, we can conclude that only one cross - street can be referred to as (4, 3).

(ii) From the figure, we can conclude that only one point have the coordinates as (3, 4). Therefore, we can conclude that only one cross - street can be referred to as (3, 4).

## Coordinate Geometry
## Ex. 3.2

**1. Write the answer of each of the following questions:**

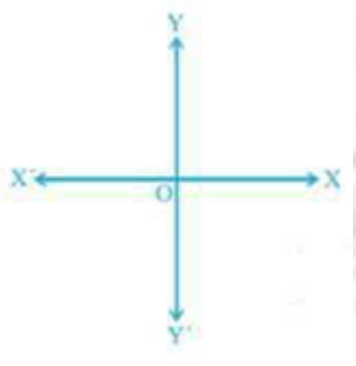
(i) **What is the name of horizontal and the vertical lines drawn to determine the position of any point in the Cartesian plane ?**

(ii) **What is the name of each part of the plane formed by these two lines ?**

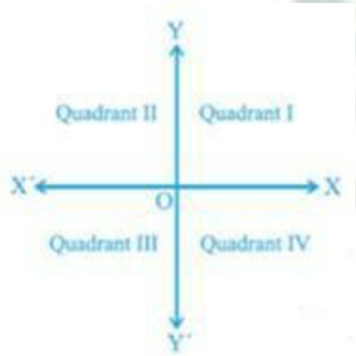
(iii) **Write the name of the point where these two lines intersect.**

**Ans. (i)** The horizontal line that is drawn to determine the position of any point in the Cartesian plane is called as ***x*-axis**.

The vertical line that is drawn to determine the position of any point in the Cartesian plane is called as ***y*-axis**.




(ii) The name of each part of the plane that is formed by *x*-axis and *y*-axis is called as **quadrant**.




(iii) The point, where the *x*-axis and the *y*-axis intersect is called as **origin**.

**2. See Fig.3.14, and write the following:**

**(i)** The coordinates of B.

**(ii)** The coordinates of C.

**(iii)** The point identified by the coordinates (–3, –5)

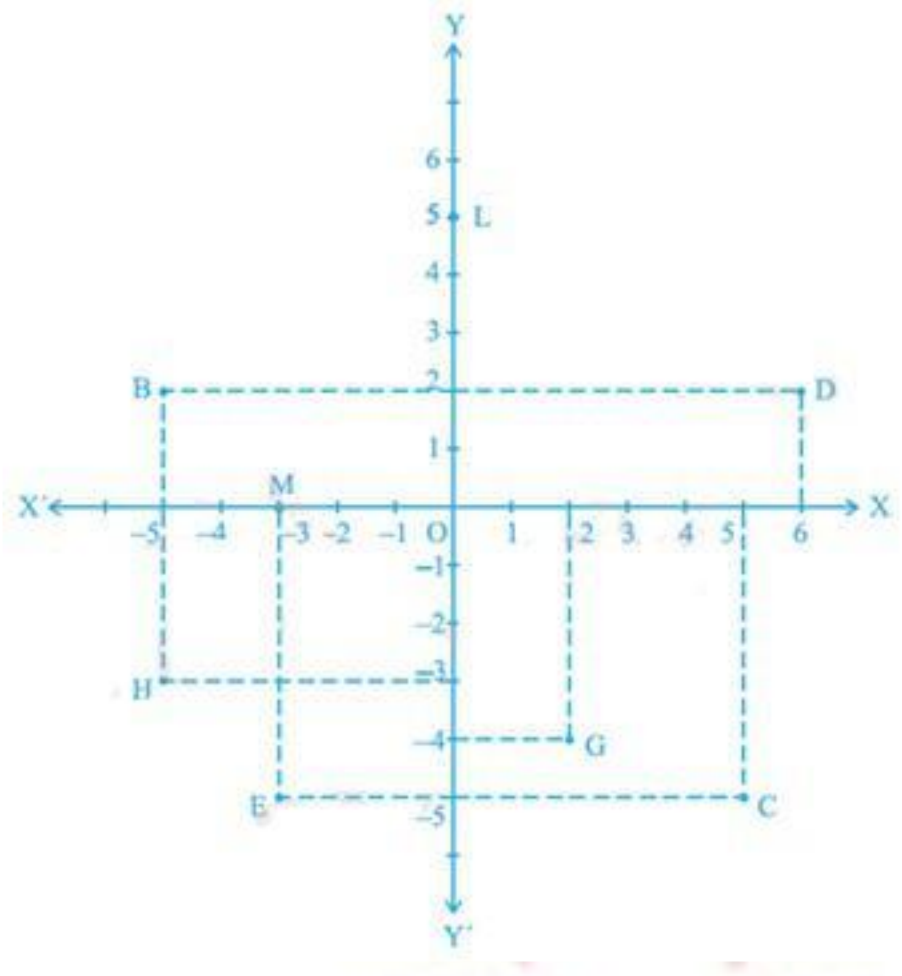
**(iv)** The point identified by the coordinates (2, – 4).

**(v)** The abscissa of the point D.

**(vi)** The ordinate of the point H.

**(vii)** The coordinates of the point L.

**(viii)** The coordinates of the point M.




**Ans.** We need to consider the given below figure to answer the following questions.

(i) The coordinates of point *B* in the above figure is the distance of point *B* from *x*-axis and *y*-axis.

Therefore, we can conclude that the coordinates of point *B* are (-5, 2).

(ii) The coordinates of point *C* in the above figure is the distance of point *C* from *x*-axis and *y*-axis.

Therefore, we can conclude that the coordinates of point *C* are (5, -5).

(iii) The point that represents the coordinates (-3, -5) is *E*.

(iv) The point that represents the coordinates (2, - 4) is *G*.

(v) The abscissa of point *D* in the above figure is the distance of point *D* from the *y*-axis. Therefore, we can conclude that the abscissa of point *D* is 6.

(vi) The ordinate of point *H* in the above figure is the distance of point *H* from the *x*-axis. Therefore, we can conclude that the abscissa of point *H* is -3.

(vii) The coordinates of point *L* in the above figure is the distance of point *L* from *x*-axis and *y*-axis. Therefore, we can conclude that the coordinates of point *L* are (0, 5).

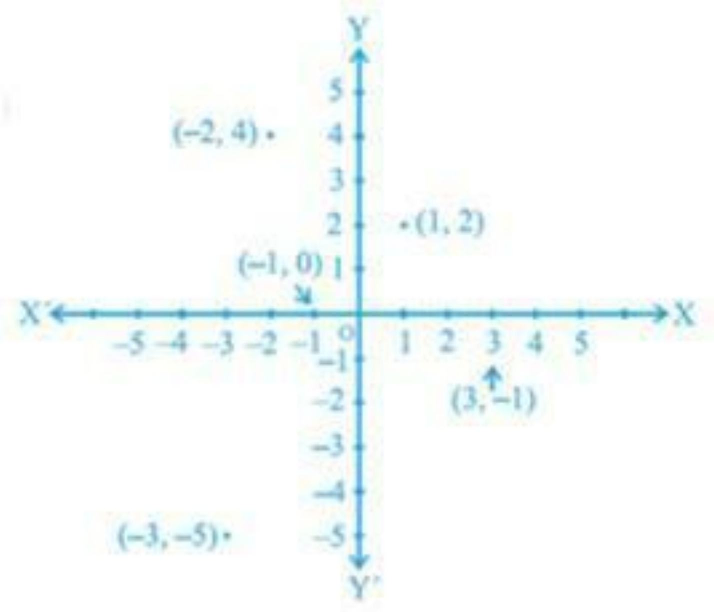
(viii) The coordinates of point *M* in the above figure is the distance of point *M* from *x*-axis and *y*-axis. Therefore, we can conclude that the coordinates of point *M* are (-3, 0).

**Coordinate Geometry**
**Ex. 3.3**

1. **In which quadrant or on which axis do each of the points (- 2, 4), (3, - 1), (- 1, 0), (1, 2) and (- 3, - 5) lie ? Verify your answer by locating them on the Cartesian plane.**

**Ans.** We need to determine the quadrant or axis of the points (- 2, 4), (3, - 1), (- 1, 0), (1, 2) and (- 3, - 5).

First, we need to plot the points (- 2, 4), (3, - 1), (- 1, 0), (1, 2) and (- 3, - 5) on the graph, to get




We need to determine the quadrant, in which the points (- 2, 4), (3, - 1), (- 1, 0), (1, 2) and (- 3, - 5) lie.

From the figure, we can conclude that the point (- 2, 4) lie in II$^{nd}$ quadrant.

From the figure, we can conclude that the point (3, - 1) lie in IV$^{th}$ quadrant.
From the figure, we can conclude that the point (-1, 0) lie on *x*-axis.

From the figure, we can conclude that the point (1, 2) lie in I$^{st}$ quadrant.

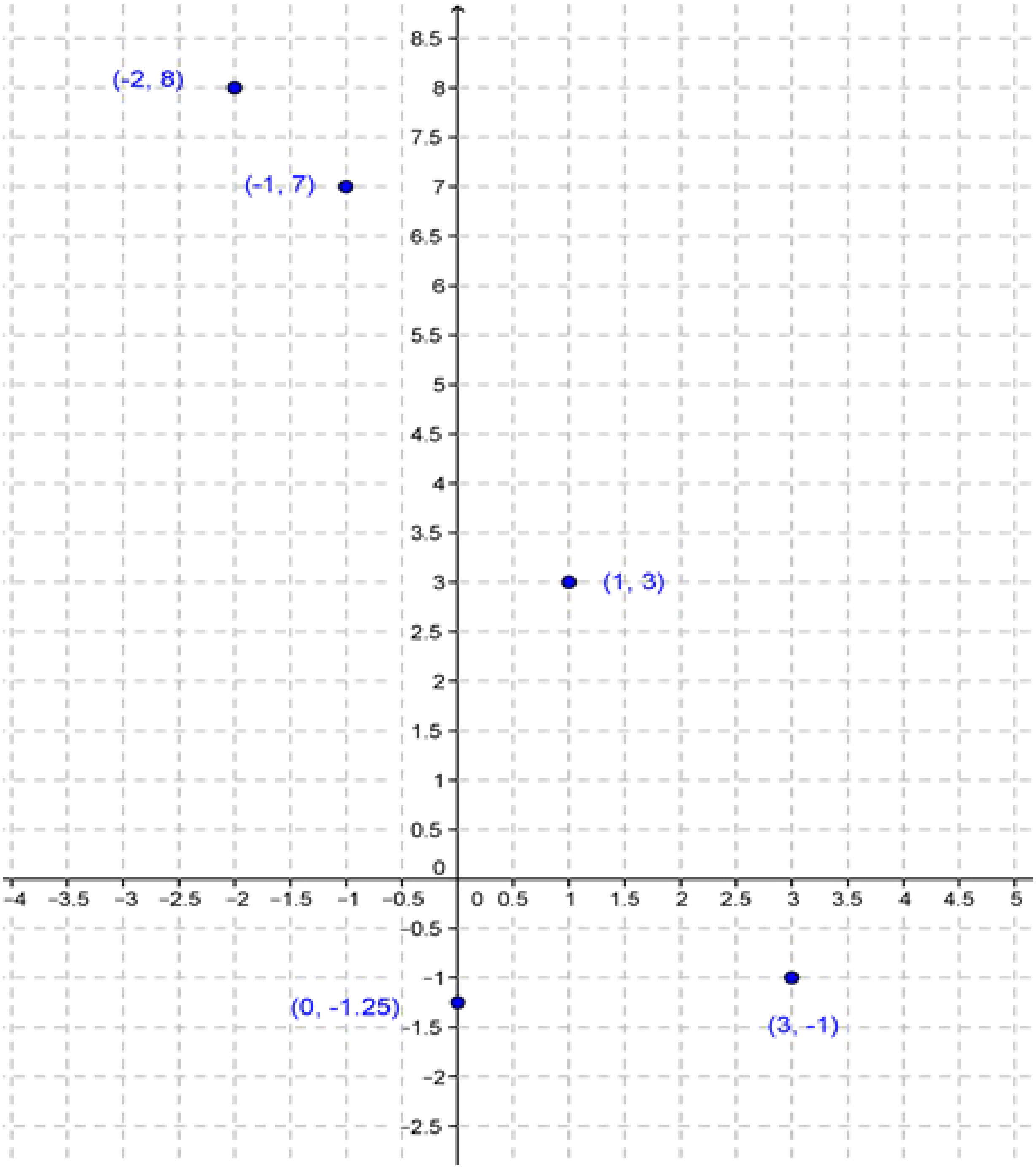
From the figure, we can conclude that the point (- 3, - 5) lie in III$^{rd}$ quadrant.

(iii) **Plot the points (*x*, *y*) given in the following table on the plane, choosing suitable units of distance on the axes.**

| | | | | | |
|---|---|---|---|---|---|
| $X$ | $-2$ | $-1$ | $0$ | $1$ | $3$ |
| $y$ | $8$ | $7$ | $-1.25$ | $3$ | $-1$ |

**Ans.** We need to plot the given below points on the graph by using a suitable scale.

| | | | | | |
|---|---|---|---|---|---|
| $X$ | $-2$ | $-1$ | $0$ | $1$ | $3$ |
| $y$ | $8$ | $7$ | $-1.25$ | $3$ | $-1$ |



## WORK-SHEET

SUBJECT: MATHS

CHAP 3

Std: $9^{th}$

1 Any point on the X axis is of the form

(A) (x, y) (B) (x, y) (C) (x, y) (D) (x, y)

2 Which of the following equation has graph parallel to Y-axis

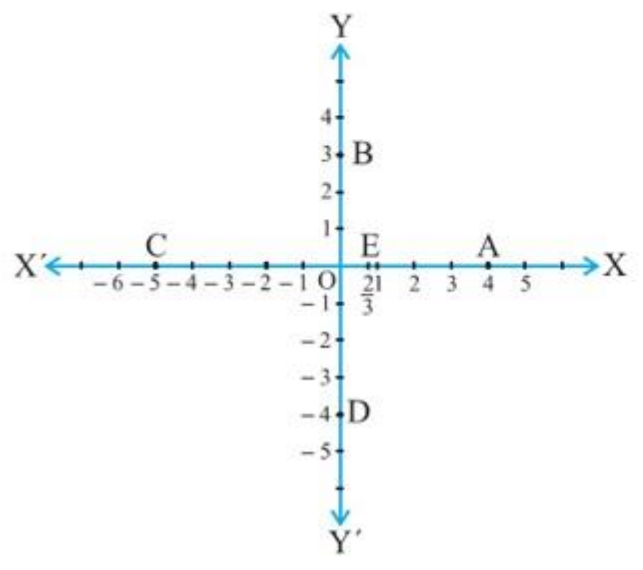
(A) y = - 2 (B) x = 1 (C) x – y = 2 (D) x + y = 2

3 If (2,0) is a solution of the linear equation 2x + 3y = k, then the value of k is

(A) 4 (B) 6 (C) 5 (D) 2

**<u>Solve:</u>**

4. Write the coordinates of the points marked on the axes in given figure




**5. See in below figure, and write the following:**

**(i)** The coordinates of B.

**(ii)** The coordinates of C.

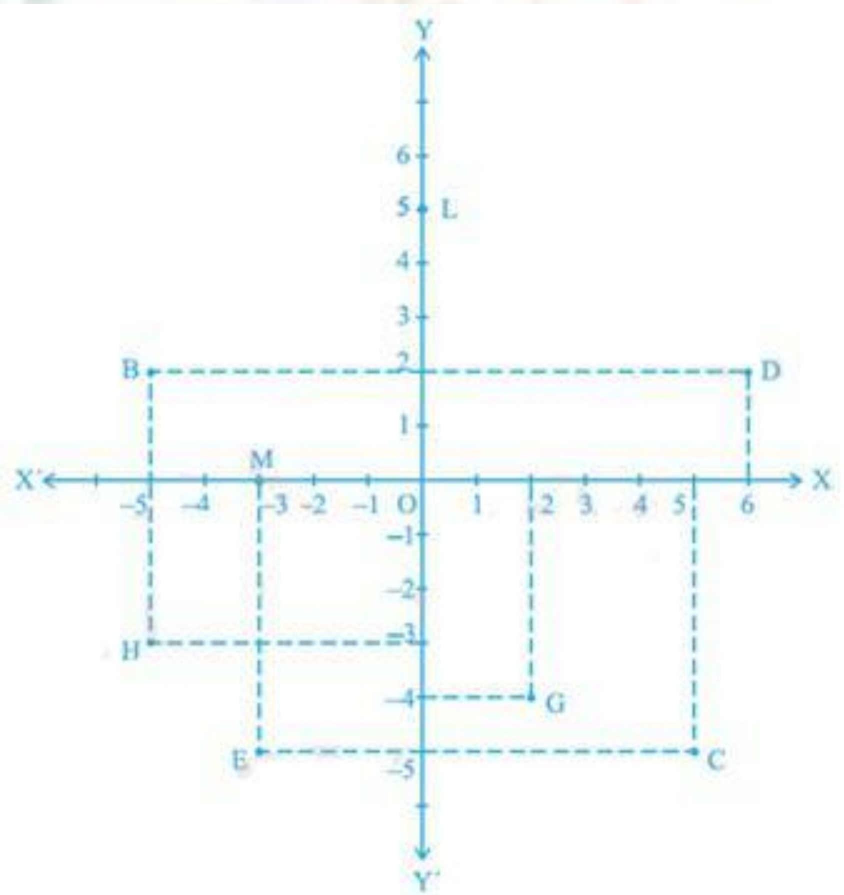
**(iii)** The point identified by the coordinates (–3, –5)

**(iv)** The point identified by the coordinates (2, – 4).

**(v)** The abscissa of the point D.

**(vi)** The ordinate of the point H.

**(vii)** The coordinates of the point L.
**(viii)** The coordinates of the point M.



पुणा International School

Shree Swaminarayan Gurukul, Zundal

# Grade – 9
# MATHS
# Specimen copy
# Year 22-23

# INDEX

# *Linear Equations in Two Variables*

## *(Ex. 4.1)*

(ii) **The cost of a notebook is twice the cost of a pen. Write a linear equation in two variables to represent this statement.**

**(Take the cost of a notebook to be Rs *x* and that of a pen to be Rs *y*).**

**Ans.** Let the cost of a notebook be $Rs.\ x$.

Let the cost of a pen be $Rs.\ y$.

We need to write a linear equation in two variables to represent the statement, "Cost of a notebook is twice the cost of a pen".

Therefore, we can conclude that the required statement will be $x = 2y$ = x -2y = 0

(i) **Express the following linear equations in the form *ax* + *by* + *c* = 0 and indicate the values of *a*, *b* and *c* in each case:**

**(i)** $2x + 3y = 9.3\overline{5}$

**(ii)** $x - \frac{y}{5} - 10 = 0$

**(iii)** $-2x + 3y = 6$

**(iv)** $x = 3y$

**(v)** $2x = -5y$

**(vi)** $3x + 2 = 0$

**(vii)** $y - 2 = 0$

**(viii)** $5 = 2x$

**Ans. (i)** $2x + 3y = 9.3\overline{5}$

We need to express the linear equation $2x + 3y = 9.3\overline{5}$ in the form *ax* + *by* + *c* = 0 and indicate the values of *a*, *b* and *c*.

$2x + 3y = 9.3\overline{5}$ can also be written as $2x + 3y - 9.3\overline{5} = 0$.

We need to compare the equation $2x + 3y - 9.3\overline{5} = 0$ with the general equation *ax* + *by* + *c* = 0, to get the values of *a*, *b* and *c*.

Therefore, we can conclude that $a = 2, b = 3 \text{ and } c = -9.3\overline{5}$ .

**(ii)** $x - \frac{y}{5} - 10 = 0$

We need to express the linear equation $x - \frac{y}{5} - 10 = 0$ in the form *ax* + *by* + *c* = 0 and indicate the values of *a*, *b* and *c*.

$x - \frac{y}{5} - 10 = 0$ can also be written as $1 \cdot x - \frac{y}{5} - 10 = 0$.

We need to compare the equation $1 \cdot x - \frac{y}{5} - 10 = 0$ with the general equation *ax* + *by* + *c* = 0, to get the values of *a*, *b* and *c*.

Therefore, we can conclude that $a = 1, b = -\frac{1}{5} \text{ and } c = -10$ .

**(iii)** $-2x + 3y = 6$

We need to express the linear equation $-2x + 3y = 6$ in the form *ax* + *by* + *c* = 0 and indicate the values of *a*, *b* and *c*.

$-2x + 3y = 6$ can also be written as $-2x + 3y - 6 = 0$.

We need to compare the equation -2x + 3y – 6 = 0 with the general equation *ax* + *by* + *c* = 0, to get the values of *a*, *b* and *c*.

Therefore, we can conclude that $a=-2, b=3 \text{ and } c=-6$ .

$$-2x+3y-6=0$$

**(iv)** $x=3y$

We need to express the linear equation $x=3y$ in the form *ax* + *by* + *c* = 0 and indicate the values of *a*, *b* and *c*.

$x=3y$ can also be written as $x-3y+0=0.$

We need to compare the equation $x-3y+0=0$ with the general equation *ax* + *by* + *c* = 0, to get the values of *a*, *b* and *c*.

Therefore, we can conclude that $a=1, b=-3 \text{ and } c=0$ .

**(v)** $2x=-5y$

We need to express the linear equation $2x=-5y$ in the form *ax* + *by* + *c* = 0 and indicate the values of *a*, *b* and *c*.

$2x=-5y$ can also be written as $2x+5y+0=0.$

We need to compare the equation $2x+5y+0=0$ with the general equation *ax* + *by* + *c* = 0, to get the values of *a*, *b* and *c*.

Therefore, we can conclude that $a=2, b=5 \text{ and } c=0$ .

**(vi)** $3x+2=0$

We need to express the linear equation $3x+2=0$ in the form *ax* + *by* + *c* = 0 and indicate the values of *a*, *b* and *c*.

$3x+2=0$ can also be written as $3x+0\cdot y+2=0.$

We need to compare the equation $3x+0\cdot y+2=0$ with the general equation *ax* + *by* + *c* = 0, to get the values of *a*, *b* and *c*.

Therefore, we can conclude that $a = 3, b = 0$ and $c = 2$ .

**(vii)** $y - 2 = 0$

We need to express the linear equation $y - 2 = 0$ in the form *ax* + *by* + *c* = 0 and indicate the values of *a*, *b* and *c*.

$y - 2 = 0$ can also be written as $0 \cdot x + 1 \cdot y - 2 = 0.$

We need to compare the equation $0 \cdot x + 1 \cdot y - 2 = 0$ with the general equation *ax* + *by* + *c* = 0, to get the values of *a*, *b* and *c*.

Therefore, we can conclude that $a = 0, b = 1$ and $c = -2$ .

**(viii)** $5 = 2x$

We need to express the linear equation $5 = 2x$ in the form *ax* + *by* + *c* = 0 and indicate the values of *a*, *b* and *c*.

$5 = 2x$ can also be written as $-2x + 0 \cdot y + 5 = 0.$

We need to compare the equation $-2x + 0 \cdot y + 5 = 0$ with the general equation *ax* + *by* + *c* = 0, to get the values of *a*, *b* and *c*.

Therefore, we can conclude that $a = -2, b = 0$ and $c = 5$ .

# CHAPTER 4
# Linear Equations in Two Variables
## (Ex. 4.2)

(ii) **Which one of the following options is true, and why?**

$y = 3x + 5$ **has**

**(i) a unique solution, (ii)**

**only two solutions,**

**(iii) infinitely many solutions**

**Ans.** We need to the number of solutions of the linear equation $y = 3x + 5$. We know

that any linear equation has infinitely many solutions. Justification:

If $x = 0$ then $y = 3 \times 0 + 5 = 5$

If $x = 1$ then $y = 3 \times 1 + 5 = 8$

If $x = -2$ then $y = 3 \times (-2) + 5$ = $-1$

Similarly, we can find infinite many solutions by putting the values of $x$ so correct answer is (iii)

(iii) **Write four solutions for each of the following equations:**

**(i)** $2x + y = 7$

**(ii)** $\pi x + y = 9$

**(iii)** $x = 4y$

**Ans.** $2x+y=7$

We know that any linear equation has infinitely many solutions.

Let us put $x=0$ in the linear equation $2x+y=7$, to get

$2(0)+y=7 \qquad \Rightarrow y=7.$

Thus, we get first pair of solution as $(0,7)$.

Let us put $x=2$ in the linear equation $2x+y=7$, to get

$2(2)+y=7 \quad \Rightarrow y+4=7 \Rightarrow y=3.$

Thus, we get second pair of solution as $(2,3)$.

Let us put $x=4$ in the linear equation $2x+y=7$, to get

$2(4)+y=7 \quad \Rightarrow y+8=7 \Rightarrow y=-1.$

Thus, we get third pair of solution as $(4,-1)$.

Let us put $x=6$ in the linear equation $2x+y=7$, to get

$2(6)+y=7 \quad \Rightarrow y+12=7 \Rightarrow y=-5.$

Thus, we get fourth pair of solution as $(6,-5)$.

Therefore, we can conclude that four solutions for the linear equation $2x+y=7$ are $(0,7),(2,3),(4,-1) \text{ and } (6,-5)$.

**(ii)** $\pi x+y=9$

We know that any linear equation has infinitely many solutions.

Let us put $x=0$ in the linear equation $\pi x+y=9$, to get

$\pi(0)+y=9 \qquad \Rightarrow y=9$

Thus, we get first pair of solution as $(0,9)$.

Let us put $y=0$ in the linear equation $\pi x+y=9$, to get

$\pi x+(0)=9 \qquad \Rightarrow x=\frac{9}{\pi}$.

Thus, we get second pair of solution as $\left(\frac{9}{\pi},0\right)$.

Let us put $x=1$ in the linear equation $\pi x+y=9$, to get

$\pi(1)+y=9 \Rightarrow y=9-\pi$

Thus, we get third pair of solution as. $(1$ Let

us put $y=2$ in the linear equation $\pi x+y=9$, to get

$\pi x+2=9 \qquad \Rightarrow \pi x=7 \Rightarrow x=\frac{7}{\pi}$

Thus, we get fourth pair of solution as $\left(\frac{7}{\pi},2\right)$ .

Therefore, we can conclude that four solutions for the linear equation $\pi x+y=9$ are

$(0,9)$, $\left(\frac{9}{\pi},0\right)$, $(1,9-\pi)$, $\left(\frac{7}{\pi},2\right)$ .

**(iii)** $x=4y$

We know that any linear equation has infinitely many solutions.

Let us put $y=0$ in the linear equation $x=4y$, to get

$x=4(0) \qquad \Rightarrow x=0$

Thus, we get first pair of solution as $(0,0)$ .

Let us put $y=2$ in the linear equation $x=4y$, to get

$x = 4(2) \qquad \Rightarrow \; x = 8$

Thus, we get second pair of solution as $(8, 2)$.

Let us put $y = 4$ in the linear equation $x = 4y$, to get

$x = 4(4) \qquad \Rightarrow \; x = 16$

Thus, we get third pair of solution as $(16, 4)$.

Let us put $y = 6$ in the linear equation $x = 4y$, to get

$x = 4(6) \qquad \Rightarrow \; x = 24$

Thus, we get fourth pair of solution as $(24, 6)$.

Therefore, we can conclude that four solutions for the linear equation $x = 4y$ are $(0, 0), (8, 2), (16, 4)$ and $(24, 6)$.

---

(iii) **Check which of the following are solutions of the equation $x - 2y = 4$ and which are not:**

**(i)** $(0, 2)$

**(ii)** $(2, 0)$

**(iii)** $(4, 0)$

**(iv)** $(\sqrt{2}, 4\sqrt{2})$

**(v)** $(1, 1)$

**Ans. (i)** $(0, 2)$

We need to put $x = 0$ and $y = 2$ in the L.H.S. of linear equation $x - 2y = 4$, to get

$(0)-2(2)=-4$

$\therefore$ L.H.S. $\neq$ R.H.S.

Therefore, we can conclude that $(0,2)$ is not a solution of the linear equation $x-2y=4$.

**(ii)** $(2,0)$

We need to put $x=2$ and $y=0$ in the L.H.S. of linear equation $x-2y=4$, to get

$(2)-2(0)=2$

$\therefore$ L.H.S. $\neq$ R.H.S.

Therefore, we can conclude that $(2,0)$ is not a solution of the linear equation $x-2y=4$.

**(iii)** $(4,0)$

We need to put $x=4$ and $y=0$ in the linear equation $x-2y=4$, to get

$(4)-2(0)=4$

$\therefore$ L.H.S. $=$ R.H.S.

Therefore, we can conclude that $(4,0)$ is a solution of the linear equation $x-2y=4$.

**(iv)** $\left(\sqrt{2},4\sqrt{2}\right)$

We need to put $x=\sqrt{2}$ and $y=4\sqrt{2}$ in the linear equation $x-2y=4$, to get

$\left(\sqrt{2}\right)-2\left(4\sqrt{2}\right)=-7\sqrt{2}$, $L.H.S=-7\sqrt{2}, R.H.S=4$

$\therefore$ L.H.S. $\neq$ R.H.S.

Therefore, we can conclude that $\left(\sqrt{2},4\sqrt{2}\right)$ is not a solution of the linear equation $x-2y=4$.

**(v)** $(1,1)$

We need to put $x=1 \text{ and } y=1$ in the linear equation $x-2y=4$, to get

$(1)-2(1)=-1$

$\therefore$ L.H.S. $\neq$ R.H.S.

Therefore, we can conclude that $(1,1)$ is not a solution of the linear equation $x-2y=4$.

**4. Find the value of *k*, if *x* = 2, *y* = 1 is a solution of the equation $2x+3y=k$.**

**Ans.** We know that, if $x=2 \text{ and } y=1$ is a solution of the linear equation $2x+3y=k$, then on substituting the respective values of *x* and *y* in the linear equation $2x+3y=k$, the LHS and RHS of the given linear equation will not be effected.

$\therefore\ 2(2)+3(1)=k \quad \Rightarrow k=4+3 \Rightarrow k=7$

Therefore, we can conclude that the value of *k*, for which the linear equation $2x+3y=k$ has $x=2 \text{ and } y=1$ as one of its solutions is 7.

# CHAPTER 4

# Linear Equations in Two Variables

## (Ex. 4.3)

**1. Draw the graph of each of the following linear equations in two variables:**

**(i)** $x + y = 4$

**(ii) x – y = 2**

**(iii) y = 3x**

**(iv) 3 = 2x + y**

**(i)** $x + y = 4$

**Ans.** We can conclude that $x = 0, y = 4; x = 1, y = 3$ and $x = 2, y = 2$ are the solutions of the linear equation $x + y = 4$.

We can optionally consider the given below table for plotting the linear equation $x + y = 4$ on the graph.

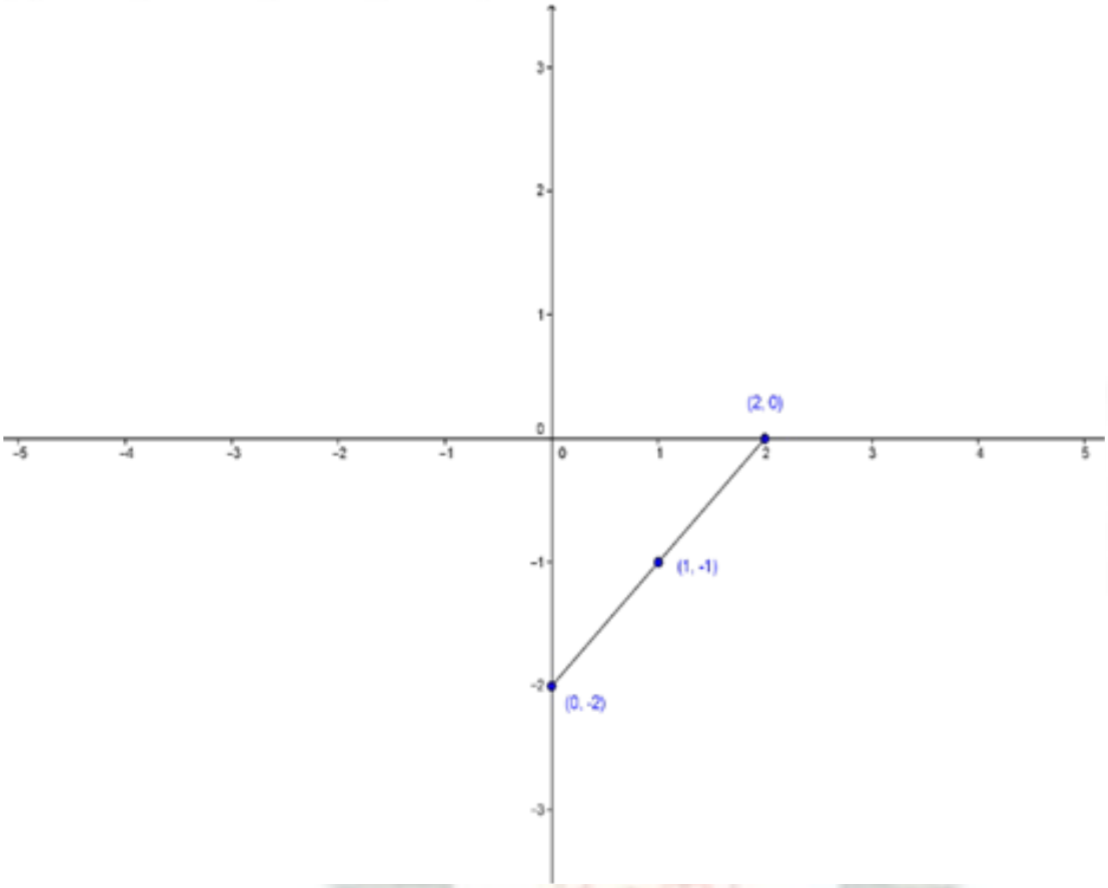
| | | | |
|---|---|---|---|
| $X$ | 0 | 1 | 2 |
| $y$ | 4 | 3 | 2 |

**(ii)** $x - y = 2$

We can conclude that $x = 0, y = -2; x = 1, y = -1$ and $x = 2, y = 0$ are the solutions of the linear equation $x - y = 2$.

We can optionally consider the given below table for plotting the linear equation $x - y = 2$ on the graph.

| | | | |
|---|---|---|---|
| $X$ | 0 | 1 | 2 |
| $y$ | $-2$ | $-1$ | 0 |




**(iii)** $y = 3x$

We can conclude that $x = 0, y = 0; x = 1, y = 3$ and $x = 2, y = 6$ are the solutions of the linear equation $y = 3x$.

We can optionally consider the given below table for plotting the linear equation $y = 3x$ on the graph.

| | | | |
|---|---|---|---|
| $X$ | 0 | 1 | 2 |
| $y$ | 0 | 3 | 6 |

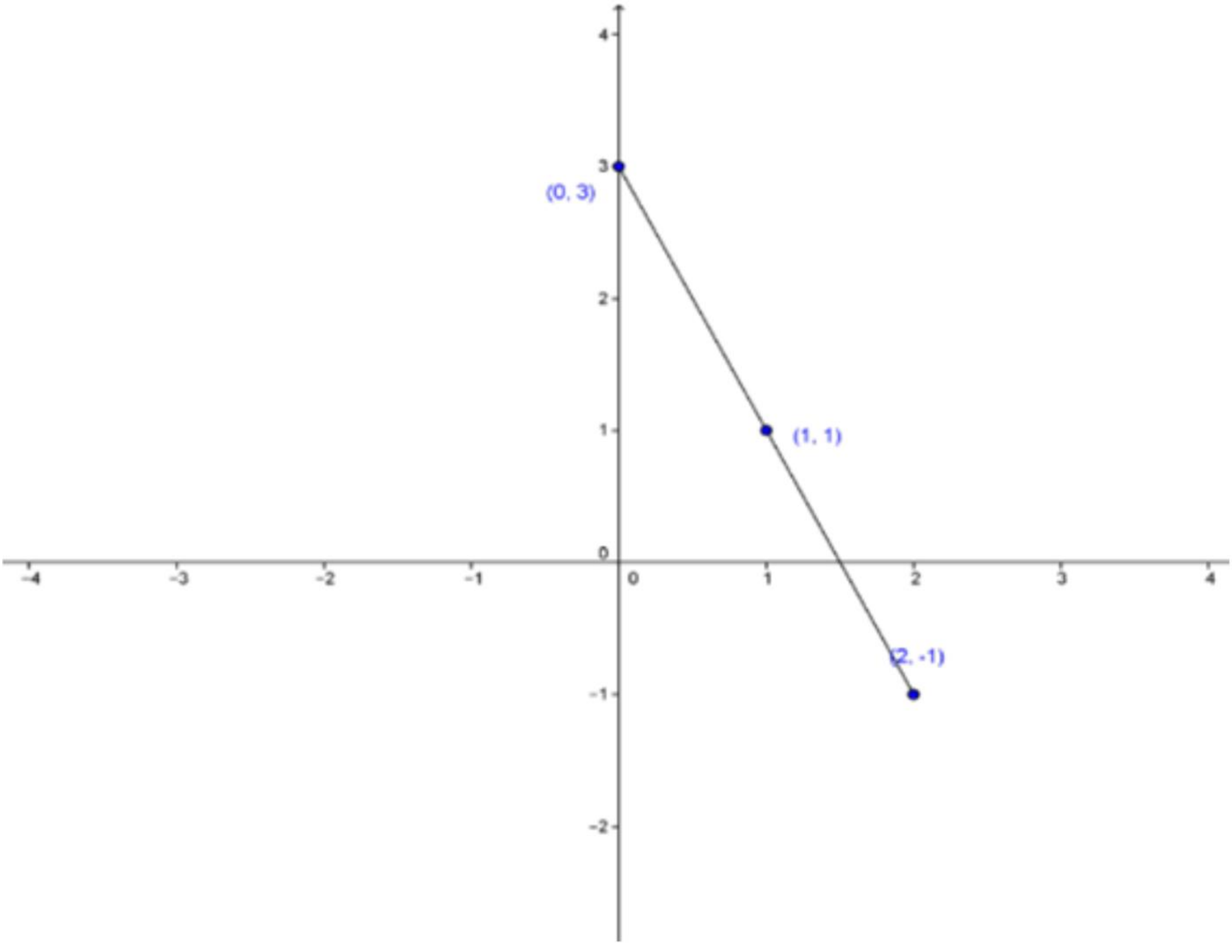
so

**(iv)** $3 = 2x + y$

We can conclude that $x = 0, y = 3; x = 1, y = 1$ and $x = 2, y = -1$ are the solutions of the linear equation $3 = 2x + y$.

We can optionally consider the given below table for plotting the linear equation $3 = 2x + y$ on the graph.

| | | | |
|---|---|---|---|
| $X$ | 0 | 1 | 2 |
| $y$ | 3 | 1 | $-1$ |




(iv) **Give the equations of two lines passing through (2, 14). How many more such lines are there, and why?**

**Ans.** We need to give the two equations of the line that passes through the point $(2,14)$.

We know that infinite number of lines can pass through any given point.

We can consider the linear equations $7x-y=0$ and $2x+y=18$.

We can conclude that on putting the values $x=2$ and $y=14$ in the above mentioned linear equations, we get LHS=RHS.

Therefore, we can conclude that the line of the linear equations $7x-y=0$ and $28x-4y=0$ will pass through the point $(2,14)$. so infinitely many lines can be drawn through (2,14)

**3. If the point (3, 4) lies on the graph of the equation $3y=ax+7$, find the value of *a*.**

**Ans.** We know that if any point lie on the graph of any linear equation, then that point is the solution of that linear equation.

We can conclude that $(3,4)$ is a solution of the linear equation $3y=ax+7$.
We need to substitute $x=3$ and $y=4$ in the linear equation $3y=ax+7$, to get

$$3(4)=a(3)+7 \Rightarrow 12=3a+7$$

$$\Rightarrow 3a=12-7 \quad \Rightarrow 3a=5 \Rightarrow a=\frac{5}{3}$$

Therefore, we can conclude that the value of *a* will be $\frac{5}{3}$.

(iv) **The taxi fare in a city is as follows: For the first kilometre, the fare is Rs 8 and for the subsequent distance it is Rs 5 per km. Taking the distance covered as *x* km and total fare as Rs *y*, write a linear equation for this information, and draw its graph.**

**Ans.** From the given situation, we can conclude that the distance covered at the rate Rs 5 per km will be $(x-1)$, as first kilometer is charged at Rs 8 per km.
We can conclude that the linear equation for the given situation will be:

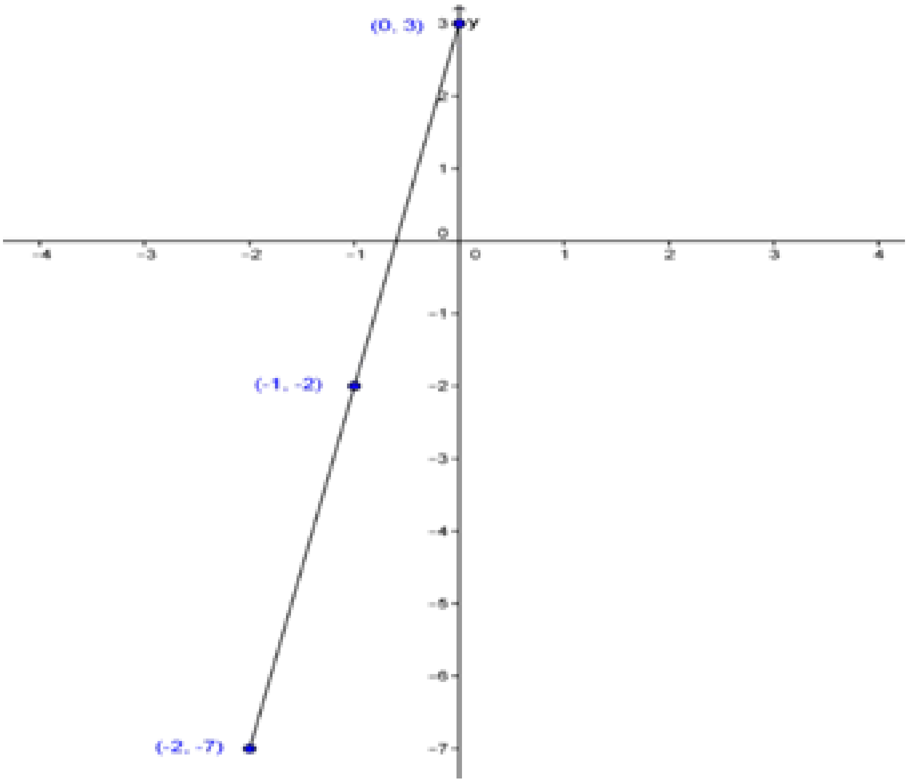
$$8+5(x-1)=y \Rightarrow 8+5x-5=y \Rightarrow 3+5x=y.$$

We need to draw the graph of the linear equation $3+5x=y$.

We can conclude that $x=0, y=3; x=1, y=1$ and $x=2, y=-1$ are the solutions of the linear equation $3+5x=y$.

We can optionally consider the given below table for plotting the linear equation $3+5x=y$ on the graph.

| | | | |
|---|---|---|---|
| $X$ | 0 | $-1$ | $-2$ |
| $y$ | 3 | $-2$ | $-7$ |




(v) **From the choices given below, choose the equation whose graphs are given in the given figures.**

**For the first figure**

**(i) y = x**

**(ii) x + y = 0**

**(iii) y = 2x**

**(iv) 2 + 3y = 7x**

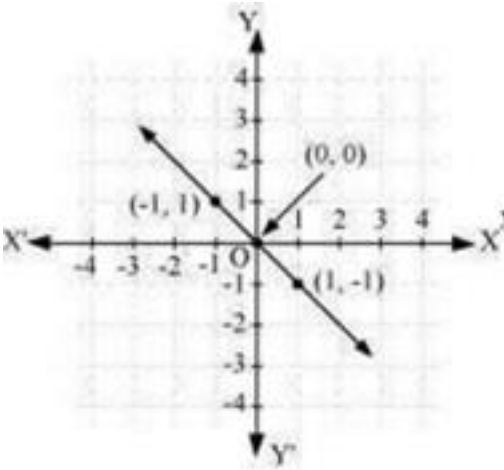
**For the second figure**

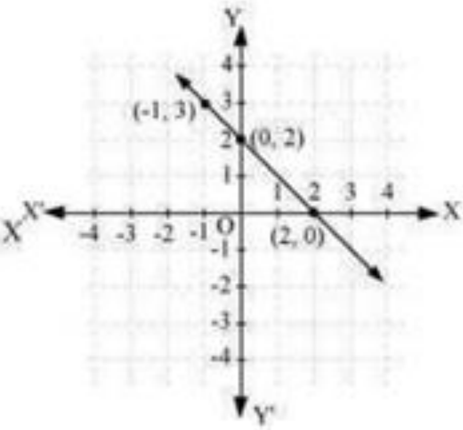
**(i) y = x +2**

**(ii) y = x – 2**

**(iii) y = – x + 2**

**(iv) x + 2y = 6**




**Ans.** For First figure

**(i)** $y = x$

We know that if any point lie on the graph of any linear equation, then that point is the solution of that linear equation.

Let us check whether $x = -1, y = 1; x = 0, y = 0$ and $x = 1, y = -1$ are the solutions of the linear equation $y = x$.

For $x = -1, y = 1$, we get

$$y = x \qquad \Rightarrow \quad -1 \neq 1$$

Therefore, the given graph does not belong to the linear equation $y = x$.

**(ii)** $x + y = 0$

We know that if any point lie on the graph of any linear equation, then that point is the solution of that linear equation.

For $x = -1, y = 1$, we get

$$-1 + 1 = 0 \qquad \Rightarrow \quad 0 = 0.$$

For $x = 0, y = 0$, we get

$$0 + 0 = 0 \qquad \Rightarrow \quad 0 = 0.$$

For $x = 1, y = -1$, we get

$$1 + (-1) = 0 \quad \Rightarrow 1 - 1 = 0 \Rightarrow 0 = 0.$$

Therefore, the given graph belongs to the linear equation $x+y=0$.

**(iii)** $y=2x$

We know that if any point lie on the graph of any linear equation, then that point is the solution of that linear equation.

For $x=-1, y=1$, we get

$y=2x \quad \Rightarrow -1=2(1) \Rightarrow -1 \neq 2.$

Therefore, the given graph does not belong to the linear equation $y=2x$.

**(iv)** $2+3y=7x$

We know that if any point lie on the graph of any linear equation, then that point is the solution of that linear equation.

For $x=-1, y=1$, we get

$2+3(1)=7(-1) \Rightarrow 2+3=-7 \quad \Rightarrow 5 \neq -7.$

Therefore, the given graph does not belong to the linear equation $2+3y=7x$.

**For Second figure**

**(i)** $y=x+2$

We know that if any point lie on the graph of any linear equation, then that point is the solution of that linear equation.

For $x=-1, y=3$, we get

$3=-1+2 \quad \Rightarrow 3 \neq 1.$

Therefore, the given graph does not belong to the linear equation $y=x+2$.

**(ii)** $y=x-2$

We know that if any point lie on the graph of any linear equation, then that point is the solution of that linear equation.

For $x=-1, y=3$, we get

$3=-1-2 \quad \Rightarrow 3 \neq -3.$

Therefore, the given graph does not belong to the linear equation $y=x-2$.

**(iii)** $y=-x+2$

We know that if any point lie on the graph of any linear equation, then that point is the solution of that linear equation.

For $x=-1, y=3$, we get

$3=-(-1)+2 \quad \Rightarrow 3=1+2 \Rightarrow 3=3.$

For $x=0, y=2$, we get

$2=-(0)+2 \quad \Rightarrow 2=2.$

For $x=2, y=0$, we get

$0=-(2)+2 \quad \Rightarrow 0=0.$

Therefore, hat the given graph belongs to the linear equation $y=-x+2$.

**(iv)** $x+2y=6$

We know that if any point lie on the graph of any linear equation, then that point is the solution of that linear equation.

For $x=-1, y=3$, we get

$(-1)+2(3)=6 \quad \Rightarrow -1+6=6 \Rightarrow 5 \neq 6.$

Therefore, the given graph does not belong to the linear equation $x+2y=6$.

**(iii) If the work done by a body on application of a constant force is directly proportional to the distance travelled by the body, express this in the form of an equation in two variables and draw the graph of the same by taking the constant force as 5 units. Also read from the graph the work done when the distance travelled by the body is:**

**(iii) 2 units**

**(iv) 0 units**

**Ans.** We are given that the work done by a body on application of a constant force is directly proportional to the distance travelled by the body.

Let the work done be *W* and let constant force be *F*.

Let distance travelled by the body be *D*.

According to the question,

$W \propto D \qquad \Rightarrow W = F \cdot D.$

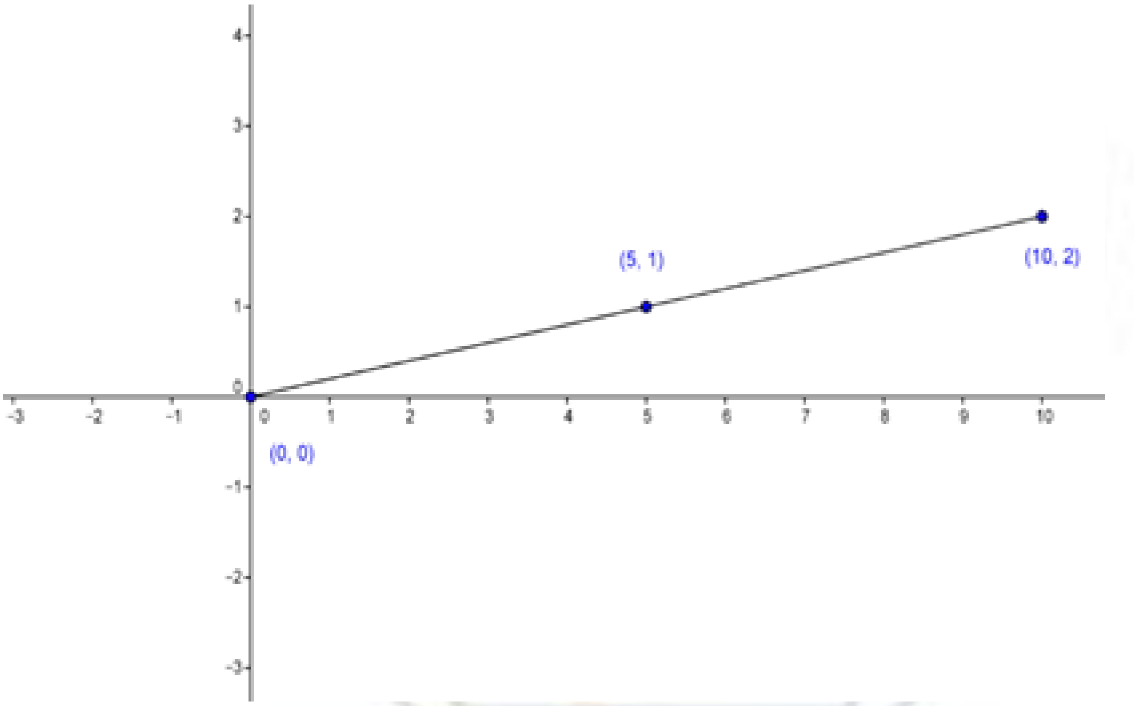
We need to draw the graph of the linear equation $W = F \cdot D$, when the force is constant as 5 units, i.e., $W = 5D$.

Work done W is along x-axis and distance D is along y-axis.

We can conclude that W=0,D=0

W=5,D=1 and W=10,D=2 are the solutions of the linear equation $W = 5D$.

| | | | |
|---|---|---|---|
| $W$ | 0 | 5 | 10 |
| $D$ | 0 | 1 | 2 |




Therefore, we can conclude from the above mentioned graph, the work done by the body, when the distance is 2 units will be 10 units and when the distance is 0 units, the work done will be 0 unit.

(i) **Yamini and Fatima, two students of Class IX of a school, together contributed Rs 100 towards the Prime Minister's Relief Fund to help the earthquake victims. Write a linear equation which satisfies this data. (You may take their contributions as Rs x and Rs y.) Draw the graph of the same.**

**Ans.** The contribution made by Yamini is Rs *x* and the contribution made by Fatime is Rs *y*.

We are given that together they both contributed Rs 100.

We get the given below linear equation from the given situation.

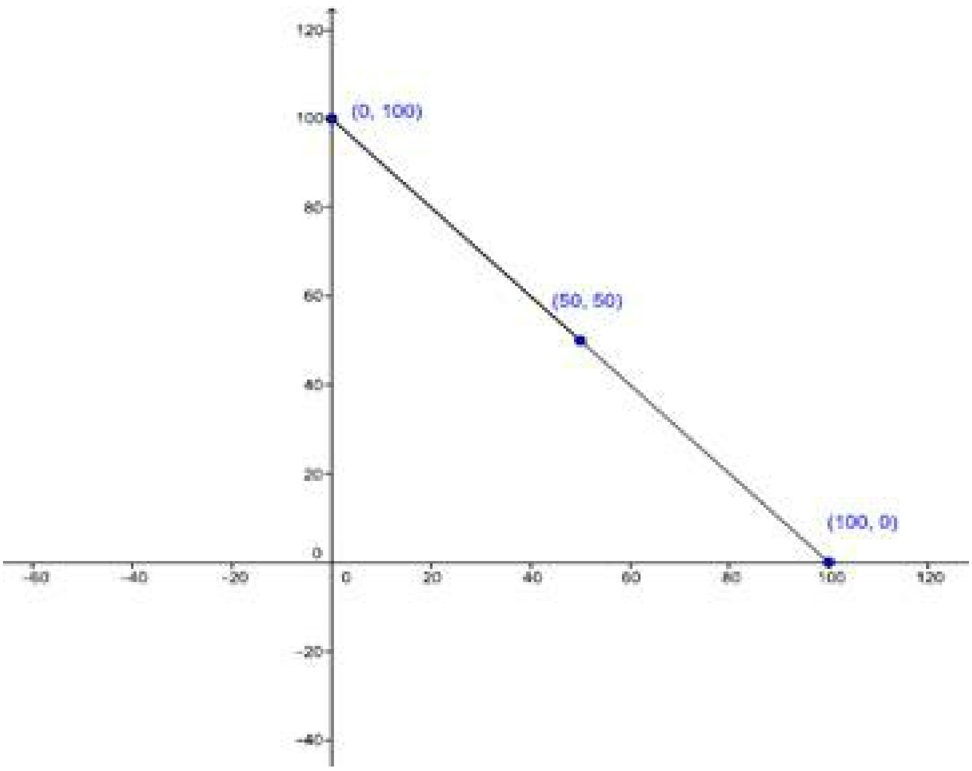
$x + y = 100$.

We need to consider any 3 solutions of the linear equation $x + y = 100$, to plot the graph of the linear equation $x + y = 100$.

We can conclude that x=0,y=100,x=50,y=50 and x=100,y=0 are the solutions of the linear equation $x + y = 100$.

We can optionally consider the given below table for plotting the linear equation $x + y = 100$ on the graph.

| | | | |
|---|---|---|---|
| $X$ | 0 | 50 | 100 |
| $y$ | 100 | 50 | 0 |



(ii) **In countries like USA and Canada, temperature is measured in Fahrenheit, whereas in countries like India, it is measured in Celsius. Here is a linear equation that converts Fahrenheit to Celsius:**

$$F = \left(\frac{9}{5}\right)C + 32$$

**(i) Draw the graph of the linear equation above using Celsius for x-axis and Fahrenheit for y-axis.**

**(ii) If the temperature is $30°C$, what is the temperature in Fahrenheit ?**

**(iii) If the temperature is $95°F$, what is the temperature in Celsius ?**

**(iv) If the temperature is $0°C$, what is the temperature in Fahrenheit and if the temperature is $0°F$, what is the temperature in Celsius ?**

**(v) Is there a temperature which is numerically the same in both Fahrenheit and Celsius? If yes, find it.**

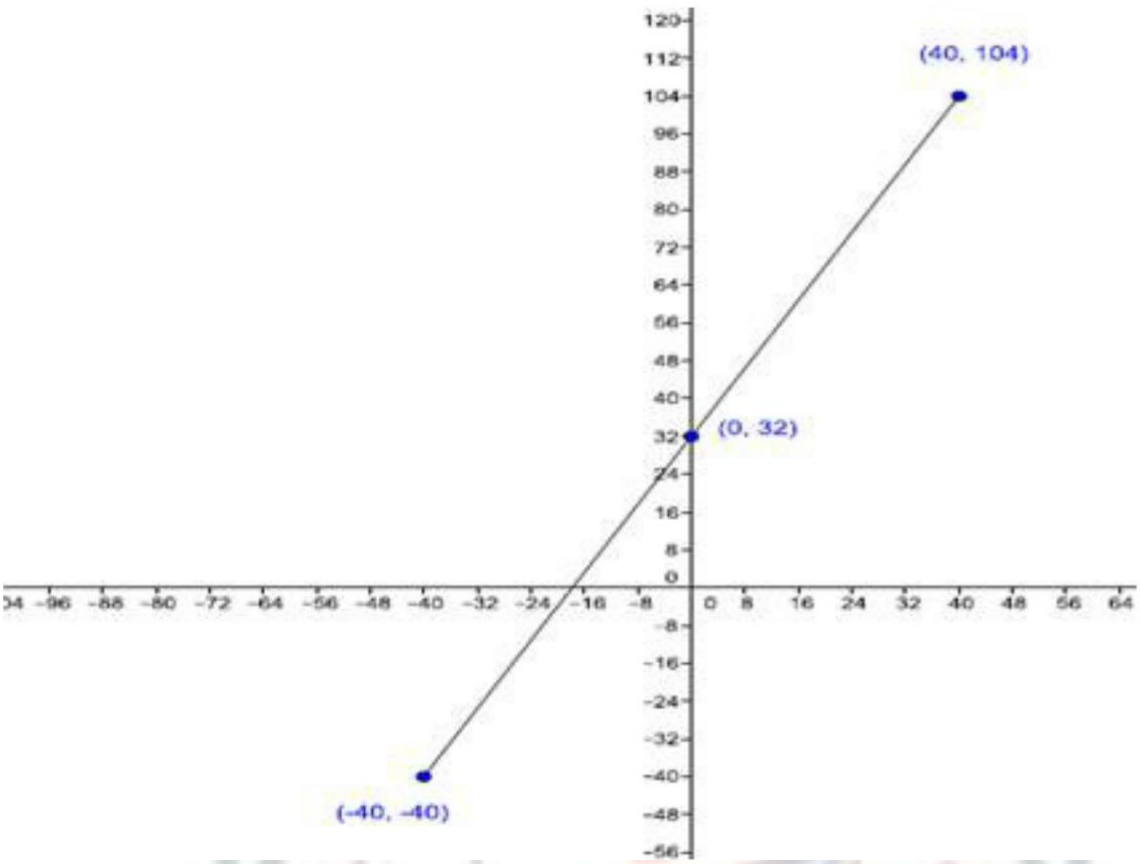
**Ans.** We are given a linear equation that converts the temperature in Fahrenheit into degree Celsius.

$$F = \left(\frac{9}{5}\right)C + 32$$

**(i)** We need to consider any 3 solutions of the linear equation $F = \left(\frac{9}{5}\right)C + 32$, to plot the graph of the linear equation $F = \left(\frac{9}{5}\right)C + 32$.

We can conclude that C=-40,F=-40,C=0,F=32 and C=40,F=104 are the solutions of the linear equation $F = \left(\frac{9}{5}\right)C + 32$.

| | | | |
|---|---|---|---|
| $C$ | $-40$ | 0 | 40 |
| $F$ | $-40$ | 32 | 104 |




**(ii)** We need to find the temperature in Fahrenheit, when the temperature in degree Celsius is $30^{\circ}$.when C= $30^{\circ}$

$$F=\left(\frac{9}{5}\right)(30)+32 \;=9\times6+32=86^{\circ}$$

Therefore, we can conclude that the temperature in Fahrenheit will be $86^{\circ}F$.

**(iii)** We need to find the temperature in degree Celsius, when the temperature in Fahrenheit is .

$95^{\circ}$

$$95=\left(\frac{9}{5}\right)C+32 \Rightarrow \frac{9}{5}C=95-32 \Rightarrow C=63\times\frac{5}{9} \;=35^{\circ}.$$

Therefore, we can conclude that the temperature in degree Celsius will be $35^{\circ}$.

**(iv)** We need to find the temperature in Fahrenheit, when the temperature in degree Celsius is .

$0^{\circ}$

$$F=\left(\frac{9}{5}\right)(0)+32=32^{\circ}$$

Therefore, we can conclude that the temperature in Fahrenheit will be $32^{\circ}$.

We need to find the temperature in degree Celsius, when the temperature in Fahrenheit is $0^{\circ}$ .

$$0=\left(\frac{9}{5}\right)C+32 \Rightarrow \frac{9}{5}C=0-32 \Rightarrow C=-32\times\frac{5}{9}=-17.77^{\circ}.$$

Therefore, we can conclude that the temperature in degree Celsius will be $-17.77^{\circ}$

**(v)** We need to find a temperature that is numerically same in both Fahrenheit and degree Celsius.So

F=C

$$F=\left(\frac{9}{5}\right)F+32 \Rightarrow F-\frac{9F}{5}=32 \Rightarrow -\frac{4F}{5}=32 \Rightarrow F=-40^{\circ}.$$

Therefore, we can conclude that the temperature that is numerically same in Fahrenheit and Degree Celsius will be $-40^{\circ}$.

# CHAPTER 4

## Linear Equations in Two Variables

## (Ex. 4.4)

(vi) **Give the geometric representations of y = 3 as an equation**

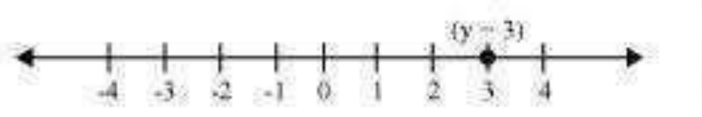
**(i) In one variable (ii)**

**In two variables**

**Ans. (i)** We need to represent the linear equation y=3 geometrically in one variable.

We can conclude that in one variable, the geometric representation of the linear equation y=3 will be same as representing the number 3 on a number line.

Given below is the representation of number 3 on the number line.



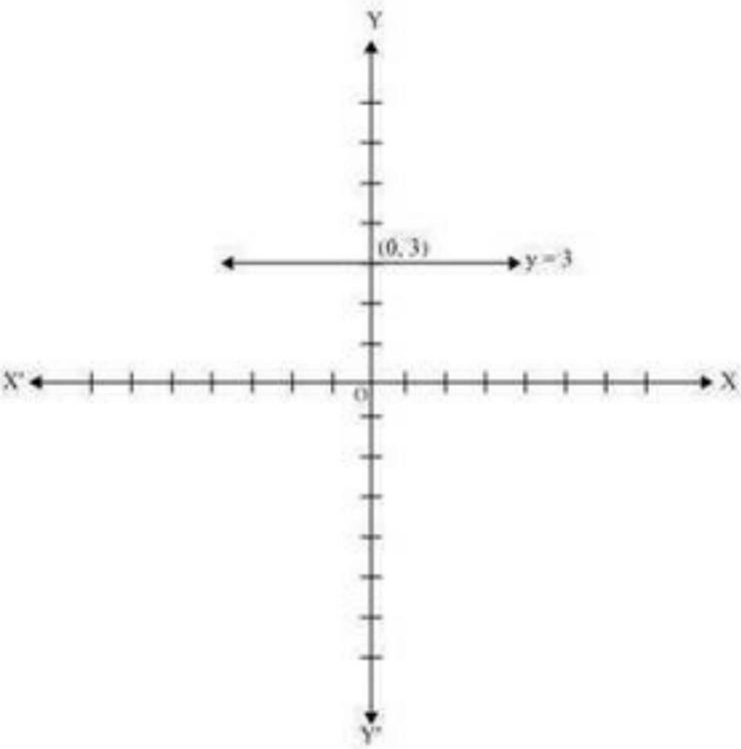

(v) We need to represent the linear equation y=3 geometrically in two variables. We know that the linear equation y=3 can also be written as 0.x + y = 3

We can conclude that in two variables, the geometric representation of the linear equation y=3 will be same as representing the graph of linear equation 0.x + y = 3

Given below is the representation of the linear equation 0.x + y = 3 on a graph.

We can optionally consider the given below table for plotting the linear equation 0.x + y = 3 on the graph.

| | | |
|---|---|---|
| *X* | 1 | 0 |
| *y* | 3 | 3 |




(vii) **Give the geometric representations of 2x + 9 = 0 as an equation**

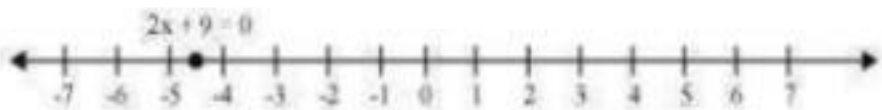
**(i) In one variable (ii)**

**In two variables**

**Ans. (i)** We need to represent the linear equation 2x + 9 = 0 geometrically in one variable.

We know that the linear equation 2x+9 = 0 can also be written as $x = -\frac{9}{2}$ or x = -4.5. We can conclude that in one variable, the geometric representation of the linear equation 2x + 9 = 0 will be same as representing the number -4.5 on a number line.

Given below is the representation of number -4.5 on the number line.




**(iv)** We need to represent the linear equation 2x+9 = 0 geometrically in two variables. We know that the linear equation 2x+9 = 0 can also be written as 2x+ 0.y + 9 = 0

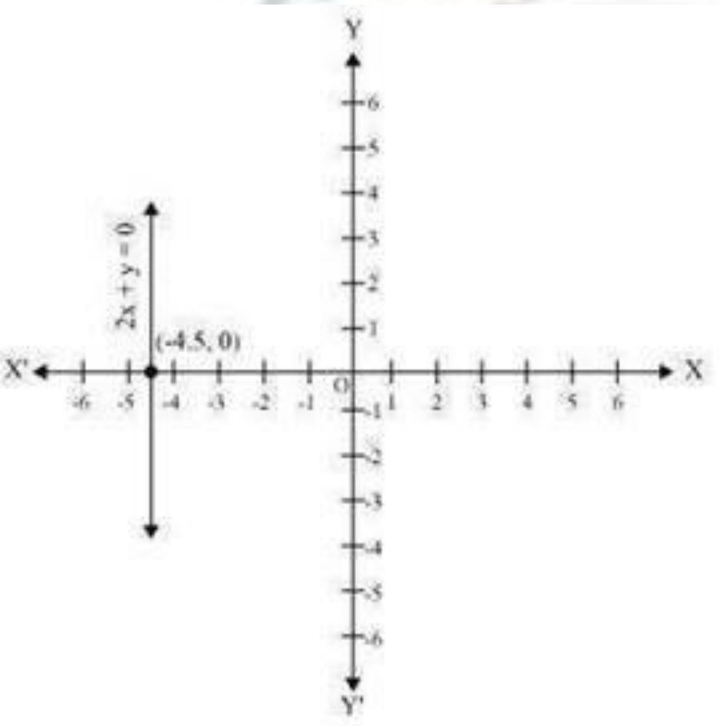
We can conclude that in two variables, the geometric representation of the linear equation 2x+9 = 0 will be same as representing the graph of linear equation 2x+ 0.y + 9 = 0.

Given below is the representation of the linear equation 2x+ 0.y + 9 = 0 on a graph.

We can optionally consider the given below table for plotting the linear equation

2x+ 0.y + 9 = 0 on the graph.

| x | -4.5 | -4.5 | -4.5 | -4.5 | -4.5 |
|---|---|---|---|---|---|
| y | 0 | 1 | 2 | -1 | -2 |



## CHAPTER – 4 Std -9th

## LINEAR EQUATION IN TWO VARIABLE

Q 1 write the equation of x=5 in the standard form of linear equation in two variables.

Q 2 write is the equation of x-axis ?

Q 3 writes an equation of a line which passes through the origin.

Q 4 At what point, the graph of linear equation2x Plus3y = 6cut the y axis.

Q 5 If a linear equation passes through the points (3,-3) and (6,-6) , then write the equation of the line.

Q 6 Write a linear equation where the point of the form (a, a) lies.

Q 7Tthe cost of a hen is 50 times the cost of its egg. Write the linear equation for the above statement, if x represent the cost of a hen and Y represent cost of an egg of it.

Q 8 In which quadrant the positive solution of the equation a x + by + c=0 always lie.

Q 9 Write two solutions of the linear equation .x + 2y = 1

Q 10 The graph of the equation y = mx + c. Does not pass through the origin, justify the statement.

Short questions for 2 marks each.

Q 1 The sum of a two digit number and the number obtained by reversing the order of the digit is 121. It unit's and ten's digit of the number are x and y respectively. Then write the linear equation representing the above statement.

Q 2 Express y in terms of x given that 2x - 5y = 7. Check whether the point (-3,-2) is on the given line.

Q 3 Draw the graph of linear equation y = x on the same Cartesian plane. What do you observe.?

Q 4 Draw the graph of the linear equation whose Solutions are represented by the points having the sum of the coordinates as 10 units

Q 5 Find the value of K, if (1,-1) is a solution of the equation 3x –k y = 8. Also, find the coordinates of the another point lying on its graph.

Q 6 Draw the graph of linear equation $2x + 5y = 13$,. Check whether (4,1) is a solution of the given equation.

Q 7 Write linear equation such that each point on its graph has ordinate 3 times its abscissa.

## Short answer question for 3 marks

Q 1Determine the point on the graph of the linear equation $2X + 5Y = 19$, whose ordinate is $1\frac{1}{2}$ times its abscissa.

Q 2 Determine the point on the graph of the linear equation $2X + 3Y= 15$, whose abscissa is3 ½ times its ordinate.

Q 3 For what value of C, the linear equation $2X + CY= 8$ has equal value of x and y for its solution?

Q 4 Find two solutions of the linear equation $5x – 4y = - 8$

Q 5 Draw the graph of the linear equation $2x + 3y = 12$. At what points the graph of the equation cuts the x – axis and the y axis

Q 6 Draw the graphs of the equations $x + y = 6$ and $2x + 3y = 16$ on the same graph paper. Find the coordinates of the points where the two lines intersect

Q 7 Draw the graph of the following equation $2( x + 1) = 3 ( y – 1) – 4$ and check whether the point (3, -1) lies on the line

Q 8 Draw the graph of $y = - 5$ and $y = 5$ on the same graph. Are the lines parallel? Find the point of intersection of two lines

Q 9 If present age of son and father are expressed by x and y respectively and after ten years father will be twice as old as his son. Write the relation between x and y

Q 10 If (2, 5) is a solution of the equation $2x + 3y = m$, find the value of m ($m = 19$)

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# Year 22-23

# INDEX

# CHAPTER 5

## Introduction to Euclid's Geometry

## (Ex. 5.1)

(ii) **Which of the following statements are true and which are false? Give reasons for your answers.**

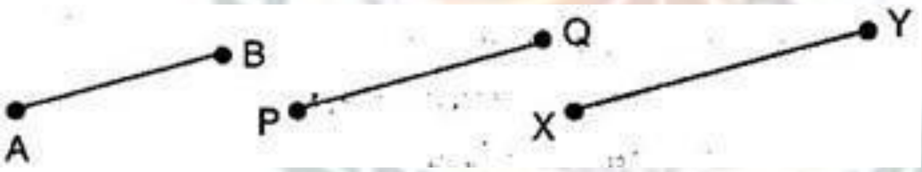
(i) **Only one line can pass through a single point.**

(ii) **There are infinite numbers of lines which pass through two distinct points.**

(iii) **A terminated line can be produced indefinitely on both the sides.**

(iv) **If two circles are equal, then their radii are equal.**

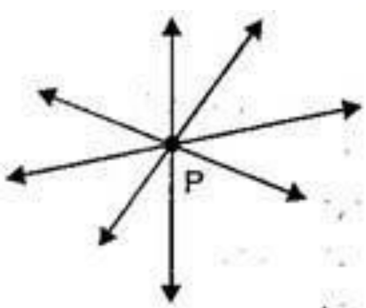
(v) **In Fig. 5.9, if AB = PQ and PQ = XY, then AB = XY**




**Ans.(i) False**

Correct statement: Infinite many lines can pass through a single point.

This is self-evident and can be seen visually by the student given below:




(iii) **False** because the given statement contradicts the postulate I of the Euclid that assures that there is a unique line that passes through two distinct points.

Through two points P and Q a unique line can be drawn.

**(iii) True**


**Reason:** We need to consider Euclid's Postulate 2: "A terminated line can be produced indefinitely."

**(iv) True**

**Reason:** Let us consider two circles with same radii.

We can conclude that, when we make the two circles overlap with each other, we will get a superimposed figure of the two circles.

Therefore, we can conclude that the radii of both the circles will also coincide and will be same.

**(v) True**

**Reason:** We are given that AB = PQ and PQ = XY.

By Euclid's axiom 1 i.e., things which are equal to the same thing are equal to one another.

Therefore, we can conclude that AB, PQ and XY are the lines with same dimensions, and hence if AB = PQ and PQ = XY, then AB = XY.

---

**(iii) Give a definition for each of the following terms. Are there other terms that need to be defined first? What are they, and how might you define them?**

**(iii) parallel lines**

**(iv) perpendicular lines**

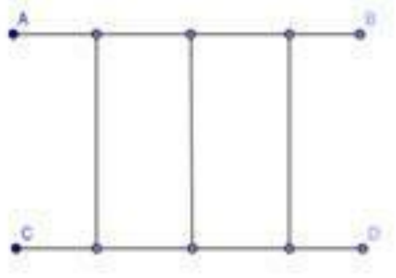
**(v) line segment**

**(vi) radius of a circle**

**(v) Square**

**Ans. (i)** Parallel lines

Two lines are said to be parallel, when the perpendicular distance between these lines is always constant or we can say that the lines that never intersect each other are called as parallel lines.




We need to define line first, in order to define parallel lines.

(i) Perpendicular lines

Two lines are said to be perpendicular lines, when angle between these two lines is $90^\circ$.


We need to define line and angle, in order to define perpendicular lines.

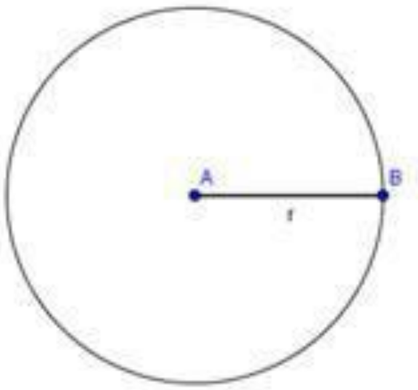
(ii) Line segment

A line of a fixed dimension between two given points is called as a line segment.


We need to define line and point, in order to define a line segment.

**(i)** Radius of a circle

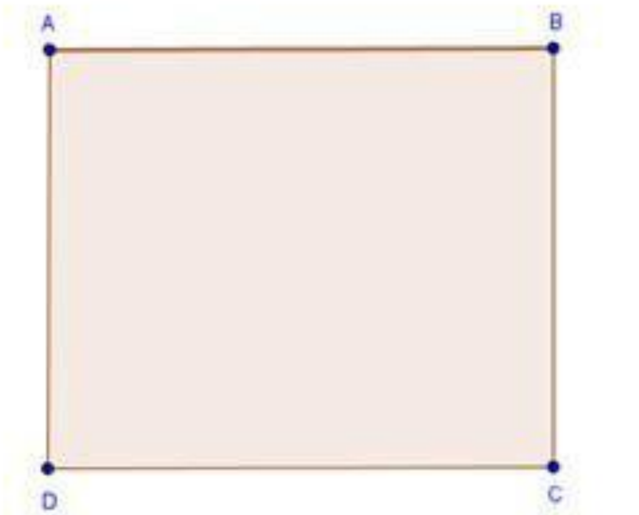
The distance of any point lying on the boundary of a circle from the center of the circle is called as radius of a circle.




We need to define circle and center of a circle, in order to define radius of a circle.

**(ii)** Square

A quadrilateral with all four sides equal and all four angles of $90^\circ$ is called as a square.




We need to define quadrilateral and angle, in order to define a square.

**3. Consider the two 'postulates' given below:**

**(iii) Given any two distinct points A and B, there exists a third point C, which is between A and B.**

**(iv) There exists at least three points that are not on the same line.**

**Do these postulates contain any undefined terms? Are these postulates consistent ? Do they follow from Euclid's postulates ? Explain.**

**Ans.** We are given with following two postulates

**(iv)** Given any two distinct points A and B, there exists a third point C, which is between A and B.

**(v)** There exists at least three points that are not on the same line.

The undefined terms in the given postulates are point and line.

The two given postulates are consistent, as they do not refer to similar situations and they refer to two different situations.

We can also conclude that, it is impossible to derive at any conclusion or any statement that contradicts any well-known axiom and postulate.

The two given postulates do not follow from the postulates given by Euclid.

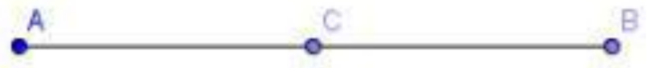
The two given postulates can be observed following from the axiom, "Given two distinct points, there is a unique line that passes through them".

**(v) If a point C lies between two points A and B such that AC = BC, then prove that** $AC = \frac{1}{2}AB$ **. Explain by drawing the figure.**

**Ans.** We are given that a point $C$ lies between two points $B$ and $C$, such that $AC = BC$.

We need to prove that $AC = \frac{1}{2}AB$.

Let us consider the given below figure.




We are given that $AC = BC$....($i$)

An axiom of the Euclid says that "If equals are added to equals, the wholes are equal." Let us add $AC$ to both sides of equation ($i$).

$AC+AC=BC+AC.$

An axiom of the Euclid says that "Things which coincide with one another are equal to one another."

We can conclude that $BC + AC$ coincide with $AB$, or $AB =$

$BC + AC$.…($ii$)

An axiom of the Euclid says that "Things which are equal to the same thing are equal to one another."

From equations ($i$) and ($ii$), we can conclude that $AC +$

$AC = AB$, or$2AC = AB$.

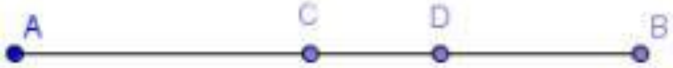
An axiom of the Euclid says that "Things which are halves of the same things are equal to one another."

Therefore, we can conclude that $AC = \frac{1}{2}AB$.

**5. In the above question, point C is called a mid-point of line segment AB, prove that every line segment has one and only one mid-point.**

**Ans.** We need to prove that every line segment has one and only one mid-point.

Let us consider the given below line segment $AB$ and assume that $C$ and $D$ are the mid-points of the line segment $AB$.




If $C$ is the mid-point of line segment $AB$, then

$AC = CB$.

An axiom of the Euclid says that "If equals are added to equals, the wholes are equal." $AC + AC =$

$CB + AC$.-----------(i)

From the figure, we can conclude that $CB + AC$ will coincide with $AB$.

An axiom of the Euclid says that “Things which coincide with one another are equal to one another.”

$AC + AC = AB$.--------------------(ii)

An axiom of the Euclid says that “Things which are equal to the same thing are equal to one another.”

Let us compare equations (i) and (ii), to get

$AC + AC = AB$, or$2AC = AB$.----------------(iii)

If $D$ is the mid-point of line segment $AB$, then

$AD = DB$.

An axiom of the Euclid says that “If equals are added to equals, the wholes are equal.”

$AD + AD = DB + AD$.----------------(iv)

From the figure, we can conclude that $DB + AD$ will coincide with $AB$.

An axiom of the Euclid says that “Things which coincide with one another are equal to one another.”

$AD + AD = AB$.--------------------(v)

An axiom of the Euclid says that “Things which are equal to the same thing are equal to one another.”

Let us compare equations (iv) and (v), to get

$AD + AD = AB$, or

$2AD = AB$.(vi)

An axiom of the Euclid says that “Things which are equal to the same thing are equal to one another.”

Let us compare equations (iii) and (vi), to get

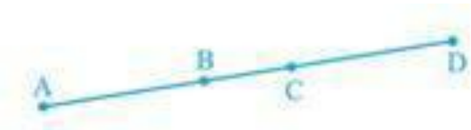
$2AC = 2AD$.

An axiom of the Euclid says that "Things which are halves of the same things are equal to one another."

$AC = AD$.

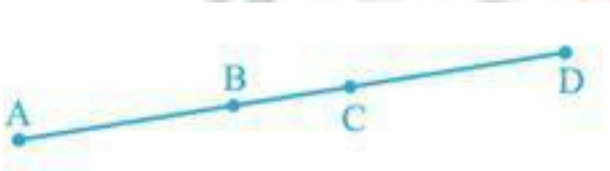
Therefore, we can conclude that the assumption that we made previously is false and a line segment has one and only one mid-point.

**6. In the following figure, if AC = BD, then prove that AB = CD.**




**Ans.** We are given that $AC = BD$.

We need to prove that $AB = CD$ in the figure given below.




From the figure, we can conclude that

$AC = AB + BC$, and

$BD=CD+BC$.

An axiom of the Euclid says that "Things which are equal to the same thing are equal to one another."

$AB + BC = CD + BC$. -------------(i)

An axiom of the Euclid says that "when equals are subtracted from equals, the remainders are also equal."

We need to subtract $BC$ from equation (i), to get

$AB+BC-BC=CD+BC-BC$ $AB = CD$.

Therefore, we can conclude that the desired result is proved.

**7. Why is axiom 5, in the list of Euclid's axioms, considered as a 'universal truth'? (Note that the question if not about fifth postulate)**

**Ans.** We need to prove that Euclid's fifth axiom is considered as a universal truth.

Euclid's fifth axiom states that "the whole is greater than the part."

The above given axiom is a universal truth. We can apply the fifth axiom not only mathematically but also universally in daily life.

**Mathematical proof:**

Let us consider a quantity $z$, which has different parts as $a$, $b$, $x$ and $y$.

$z = a + b + x + y$.

Therefore, we can conclude that $z$ will always be greater than its corresponding parts $a$, $b$, $x$ and $y$.

**Universal proof:**

We know that Mumbai is located in Maharashtra and Maharashtra is located in India.

In other words, we can conclude that Mumbai is a part of Maharashtra and Maharashtra is a part of India.

Therefore, we can conclude that whole India will be greater than Mumbai or Maharashtra or both.

Therefore, we can conclude that Euclid's fifth axiom is considered as a 'Universal truth'.

# CHAPTER 5
# Introduction to Euclid's Geometry

## (Ex. 5.2)

1. **How would you rewrite Euclid's fifth postulate so that it would be easier to understand?**

**Ans.** We need to rewrite Euclid's fifth postulate so that it is easier to understand.

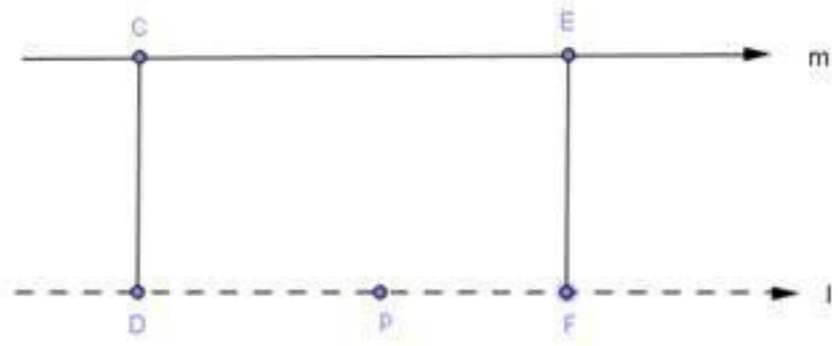
We know that Euclid's fifth postulate states that "No intersection of lines will take place when the sum of the measures of the interior angles on the same side of the falling line is exactly 180°."

We know that Play fair's axiom states that "For every line *l* and for every point *P* not lying on l, there exists a unique line m passing through *P* and parallel to *l*".

The above mentioned Play fair's axiom is easier to understand in comparison to the Euclid's fifth postulate.

Let us consider a line *l* that passes through a point *p* and another line *m*. Let these lines be at a same plane.

Let us consider the perpendicular *CD* on *l* and *FE* on *m*.




From the above figure, we can conclude that $CD = EF$.

Therefore, we can conclude that the perpendicular distance between lines *m* and *l* will be constant throughout, and the lines *m* and *l* will never meet each other or in other words, we can say that the lines *m* and *l* are equidistant from each other.

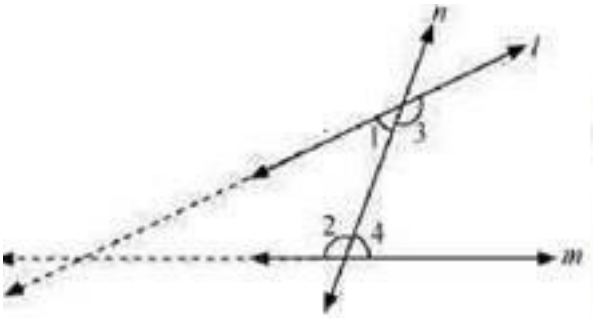
**2. Does Euclid's fifth postulate imply the existence of parallel lines ? Explain.**

**Ans.** We need to verify whether Euclid's fifth postulate imply the existence of parallel lines or not.

The answer to the above statement is Yes.

Let us consider two lines *m* and *l*.

In the figure given below, we can conclude that the lines *m* and *l* will intersect further.

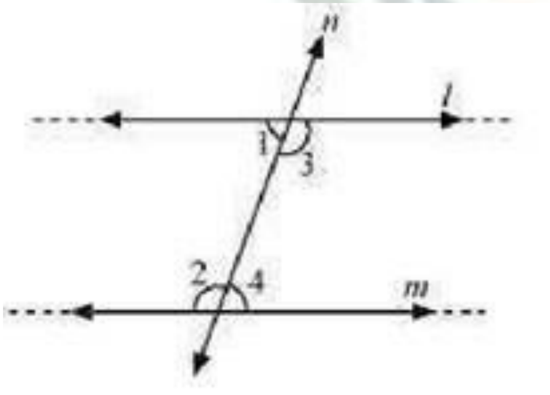



From the figure, we can conclude that

$\angle 1 + \angle 2 < 180^{\circ}$, and $\angle 3 + \angle 4 > 180^{\circ}$.

We know that Euclid's fifth postulate states that "No intersection of lines will take place when the sum of the measures of the interior angles on the same side of the falling line is exactly 180°."

Let us consider lines *l* and *m*.




From the above figure, we can conclude that lines *l* and *m* will never intersect from either side.

Therefore, we can conclude that the lines *l* and *m* are parallel.

# CHAPTER – 5 Std -9th

## Introduction to Euclid's Geometry

1.A surface is that which has

a. length and breadth b. length only c. breadth only d. length and height

2. The number of lines that can pass through a given point is

a. Two b. None c. only one d. Infinitely many

3. The number of dimensions, a solid has

a. 1 b. 2 c. 3 d. 0

4. Two plane intersect each other to form a

a. plane b. point c. straight line d. angle

5. Which of the following need a proof?

a. Axiom b. Theorem c. postulate d. Definition

6. Euclid's stated that all right angles are equal to each other in the form of:

a. an axiom b. a definition c. a postulate d. a proof

7. If the point F lies in between M and N and C is midpoint of MF then :

a. MC + FN=MN b. MF + CF=MN c. MC + CN=MN d. CF + CN=MN

8. The number of interwoven isosceles triangle in sriyantra (in the Atharvedas) is

a. 7 b. 8 c. 9 d. 11

9. If PQ is a line segment of length 12 cm and R is a point in its interior, then $PR^2 + QR^2 + 2PR.QR$ equal.

a. 12 b. 13 c. 144 d. 169

10. Greek's emphasized on.

a. inductive reasoning b. deductive reasoning

c. Both (a) and (b) d. practical use of geometry

# Solve

11. Write first postulate 1.

12 Write first postulate 2

13 Write first postulate 3

14 Write first postulate 4

15 If a point C lies between two point A and B such that AB = BC , then prove that

AC = $\frac{1}{2}$ AC. Explain by drawing the figure.

16 In figure, if AC = BD, then prove that AB = CD

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# Grade – 9 MATHS Specimen copy Year 22-23

# INDEX

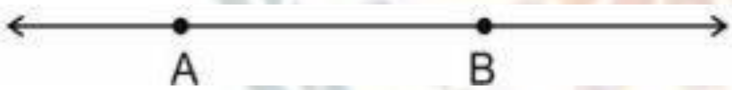
**SUBJECT: MATHS STANDARD – 9TH**

**CHAPTER – 06**

1. **Basic Terms and Definitions**
2. **Intersecting Lines and Non-intersecting Lines**
3. **Pairs of Angles**
4. **Parallel Lines and a Transversal**
5. **Lines Parallel to the same Line**
6. **Angle Sum Property of a Triangle**

(i) **Point** - We often represent a point by a fine dot made with a fine sharpened pencil on a piece of paper.

(ii) **Line** - A line is completely known if we are given any two distinct points. Line AB is represented by as $\overleftrightarrow{AB}$. A line or a straight line extends indefinitely in both the directions.




(iii) **Line segment** - A part (or portion) of a line with two end points is called a line segment.


(iv) **Ray** - A part of line with one end point is called a ray.It usually denotes the direction of line


(v) **Collinear points** - If three or more points lie on the same line, they are called collinear points, otherwise they are called non-collinear points.

(vi) **Angle** - An angle is the union of two non-collinear rays with a common initial point.

**Types of Angles -**

(1) **Acute angle** - An acute angle measure between $0^o$ and $90^o$

(2**) Right angle** - A right angle is exactly equal to $90^o$

(ii) **Obtuse angle** - An angle greater than $90^o$ but less than $180^o$

(iii) **Straight angle** - A straight angle is equal to $180^o$

(iv) **Reflex angle** - An angle which is greater than $180^o$ but less than $360^o$ is called a reflex angle.

(v) **Complementary angles** - Two angles whose sum is $90^o$ are called complementary angles. Let one angle be x, then its complementary angle be $(90^\circ - x)$.

(vi) **Supplementary angle** - Two angles whose sum is $180^o$ are called supplementary angles. Let one angle be x, then its supplementary angle be $(180^\circ - x)$.

(vii) **Adjacent angles** -Two **angles** are **Adjacent** when they have a common side and a common vertex (corner point) and don't overlap..

(9**) Linear pair** - A **linear pair** of angles is formed when two lines intersect. Two angles are said to be **linear** if they are adjacent angles formed by two intersecting lines. The measure of a straight angle is 180 degrees, so a **linear pair** of angles must add up to 180 degrees

(10**) Vertically opposite angles** - Vertically opposite angles are formed when two lines intersect each other at a point. Vertically opposite angles are always equal.

**TRANSVERSAL** - A line which intersects two or more given lines at distinct points, is called a transversal of the given line.

- **Corresponding angles**
- **Alternate interior angles**
- **Alternate exterior angles**
- **Interior angles on the same side of the transversal.**
- **If a transversal intersects two parallel lines, then**

1. Each pair of corresponding angles is equal.

2. Each pair of alternate interior angles is equal.

3. Each pair of interior angle on the same side of the transversal is supplementary.

- If a transversal interacts two lines such that, either

4. any one pair of corresponding angles is equal, or

5. any one pair of alternate interior angles is equal or

6. Any one pair of interior angles on the same side of the transversal is supplementary ,then the lines are parallel.

- Lines which are parallel to a given line are parallel to each other.
- The sum of the three angles of a triangle is $180$
- The sum of all angles round a point is equal to $360^{\circ}$.
- If a side of a triangle is produced, the exterior angle so formed is equal to the sum of the two interior opposite angles.
- If two parallel lines are intersected by a transversal, the bisectors of any pair of alternate interior angles are parallel and vice-versa.
- If two parallel lines are intersected by a transversal, then bisectors of any two corresponding angles are parallel and vice-versa.
- If a line is perpendicular to one of the given parallel lines, then it is also perpendicular to the other line.

**1. In Fig. 6.13, lines AB and CD intersect at O. If $\angle AOC + \angle BOE = 70°$ and $\angle BOD = 40°$, find $\angle BOE$ and reflex $\angle COE$.**

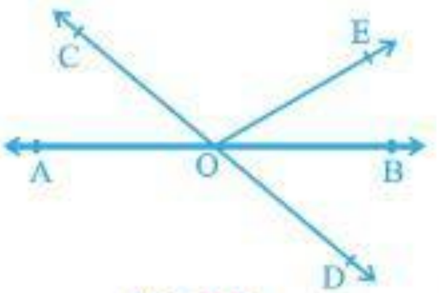



Fig. 6.13

**Ans.** We are given that $\angle AOC + \angle BOE = 70°$ and $\angle BOD = 40°$.

We need to find $\angle BOE$ and reflex $\angle COE$.

From the given figure, we can conclude that $\angle AOC, \angle COE$ and $\angle BOE$ form a linear pair.

We know that sum of the angles of a linear pair is $180°$.

$$\angle AOC + \angle COE + \angle BOE = 180°$$
$$\therefore \angle AOC + \angle BOE + \angle COE = 180°$$
$$\Rightarrow 70° + \angle COE = 180°$$
$$\Rightarrow \angle COE = 180° - 70°$$
$$= 110°.$$

Reflex $\angle COE = 360° - \angle COE$

$$= 360° - 110°$$
$$= 250°.$$

$\angle AOC = \angle BOD$ (Vertically opposite angles), or

$$\angle BOD + \angle BOE = 70°.$$

But, we are given that $\angle BOD = 40^\circ$.

$40^\circ + \angle BOE = 70^\circ$

$\angle BOE = 70^\circ - 40^\circ$

$= 30^\circ$.

Therefore, we can conclude that $\text{Reflex } \angle COE = 250^\circ$ and $\angle BOE = 30^\circ$ .

**2. In Fig. 6.14, lines XY and MN intersect at O. If $\angle \mathbf{POY} = 90^\circ$ and *a*:*b* = 2 : 3, find *c*.**

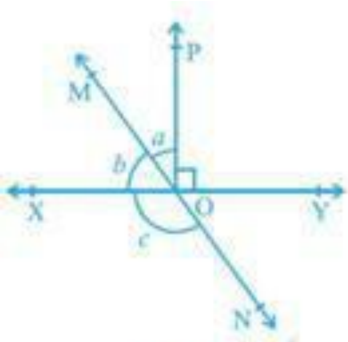


Fig. 6.14

**Ans.** We are given that $\angle POY = 90^\circ$ and $a : b = 2 : 3$.

We need find the value of *c* in the given figure.

Let *a* be equal to 2*x* and *b* be equal to *3x*.

$\because\ a + b = 90^\circ \Rightarrow 2x + 3x = 90^\circ \Rightarrow 5x = 90^\circ$

$\Rightarrow x = 18^\circ$

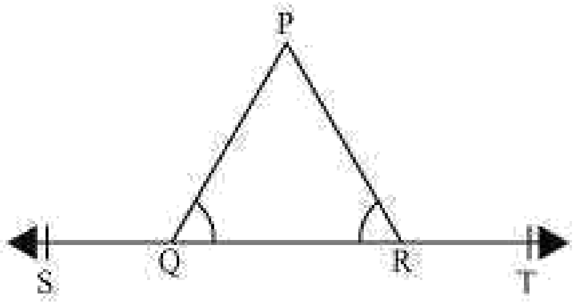
Therefore $b = 3 \times 18^\circ = 54^\circ$

Now $b + c = 180^\circ$ [Linear pair]

$\Rightarrow 54^\circ + c = 180^\circ$

$\Rightarrow c = 180^\circ - 54^\circ = 126^\circ$

**3. In the given figure, $\angle PQR = \angle PRQ$ , then prove that $\angle PQS = \angle PRT$ .**




**Ans.** We need to prove that $\angle PQS = \angle PRT$.

We are given that $\angle PQR = \angle PRQ$.

From the given figure, we can conclude that $\angle PQS$ and $\angle PQR$, and $\angle PRS$ and $\angle PRT$ form a linear pair.

We know that sum of the angles of a linear pair is $180^\circ$.

$\therefore \angle PQS + \angle PQR = 180^\circ$, and (i)

$\angle PRQ + \angle PRT = 180^\circ$. (ii)

From equations (i) and (ii), we can conclude that

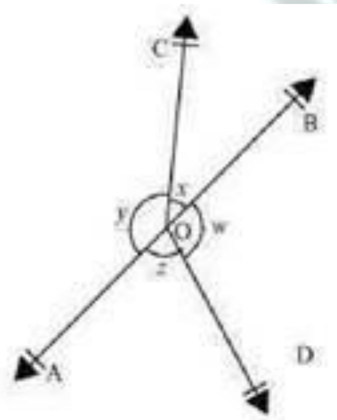
$\angle PQS + \angle PQR = \angle PRQ + \angle PRT$.

But, $\angle PQR = \angle PRQ$.

$\therefore \angle PQS = \angle PRT$.

Therefore, the desired result is proved.

**4. In Fig. 6.16, if *x* + *y* = *w* + *z*, then prove that AOB is a line.**




**Ans.** We need to prove that *AOB* is a line.

We are given that $x + y = w + z$.

We know that the sum of all the angles around a fixed point is $360^\circ$.

Thus, we can conclude that $\angle AOC + \angle BOC + \angle AOD + \angle BOD = 360^\circ$, or

$y + x + z + w = 360^\circ$.

But, $x + y = w + z$ (Given).

$2(y + x) = 360^\circ$.

$y + x = 180^\circ$.

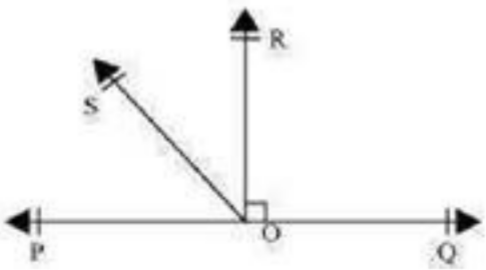
From the given figure, we can conclude that *y* and *x* form a linear pair.

We know that if a ray stands on a straight line, then the sum of the angles of linear pair formed by the ray with respect to the line is $180^\circ$.

.

Therefore, we can conclude that *AOB* is a line.

**4. In the given figure, POQ is a line. Ray OR is perpendicular to line PQ. OS is another ray lying between rays OP and OR. Prove that** $\angle ROS = \frac{1}{2}(\angle QOS - \angle POS)$.




**Ans.** We need to prove that $\angle ROS = \frac{1}{2}(\angle QOS - \angle POS)$.

We are given that *OR* is perpendicular to *PQ*, or

$\angle QOR = 90^\circ$.

From the given figure, we can conclude that $\angle POR$ and $\angle QOR$ form a linear pair.

We know that sum of the angles of a linear pair is $180^\circ$.

, or

$\angle POR = 90^\circ$.

From the figure, we can conclude that $\angle POR = \angle POS + \angle ROS$.

$\Rightarrow \angle POS + \angle ROS = 90^\circ$, or

$\angle ROS = 90^\circ - \angle POS$ .(*i*)

From the given figure, we can conclude that $\angle QOS$ and $\angle POS$ form a linear pair.

We know that sum of the angles of a linear pair is $180^\circ$.
$\angle QOS + \angle POS = 180^\circ$, or
$\frac{1}{2}(\angle QOS + \angle POS) = 90^\circ$ .(*ii*)
Substitute (*ii*) in (*i*), to get

$$\angle ROS = \frac{1}{2}(\angle QOS + \angle POS) - \angle POS$$

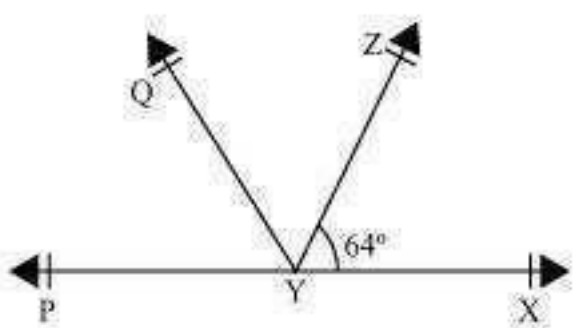
$$= \frac{1}{2}(\angle QOS - \angle POS).$$

Therefore, the desired result is proved.

**(vii) It is given that $\angle XYZ = 64^\circ$ and XY is produced to point P. Draw a figure from the given information. If ray YQ bisects $\angle ZYP$, find $\angle XYQ$ and reflex $\angle QYP$**

**Ans.** We are given that $\angle XYZ = 64^\circ$, *XY* is produced to *P* and *YQ* bisects $\angle ZYP$.

We can conclude the given below figure for the given situation:




We need to find $\angle XYQ$ and reflex $\angle QYP$.

From the given figure, we can conclude that $\angle XYZ$ and $\angle ZYP$ form a linear pair.

We know that sum of the angles of a linear pair is $180^\circ$.

.

But .

$$\Rightarrow 64^{\circ} + \angle ZYP = 180^{\circ}$$
$$\Rightarrow \angle ZYP = 116^{\circ}.$$

Ray *YQ* bisects $\angle ZYP$, or

$$\angle QYZ = \angle QYP = \frac{116^{\circ}}{2} = 58^{\circ}.$$

$$\angle XYQ = \angle QYZ + \angle XYZ$$

$$= 58^{\circ} + 64^{\circ} = 122^{\circ}.$$

Reflex $\angle QYP = 360^{\circ} - \angle QYP$

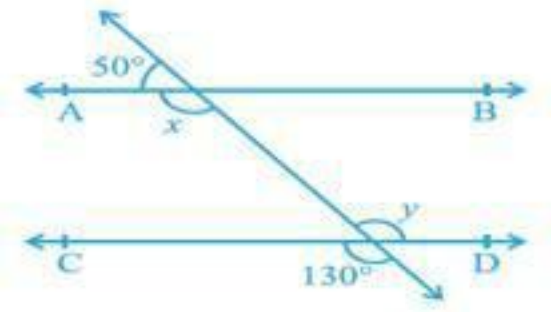
$$= 360^{\circ} - 58^{\circ}$$

$$= 302^{\circ}.$$

Therefore, we can conclude that $\angle XYQ = 122^{\circ}$ and Reflex $\angle QYP = 302^{\circ}$

## Chapter - 6
## Lines and Angles (Ex. 6.2)

**1. In the given figure, find the values of x and y and then show that AB || CD.**




**Ans.** We need to find the value of *x* and *y* in the figure given below and then prove that $AB \parallel CD$.

From the figure, we can conclude that

$y = 130^\circ$ (Vertically opposite angles), and

$x$ and $50^\circ$ form a pair of linear pair.

We know that the sum of linear pair of angles is $180^\circ$.

$x + 50^\circ = 180^\circ$

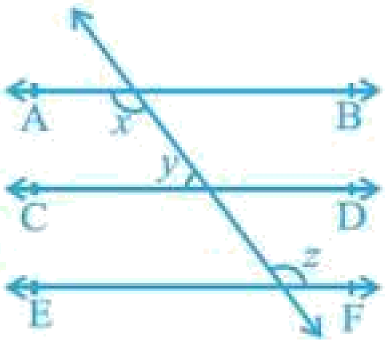
$x = 130^\circ$.

$x = y = 130^\circ$.

From the figure, we can conclude that x and y form a pair of alternate interior angles corresponding to the lines *AB* and *CD*.

Therefore, we can conclude that $x = 130^\circ,\ y = 130^\circ$ and $AB \parallel CD$.

**2. In the given figure, if AB || CD, CD || EF and y : z = 3: 7, find x.**




**Ans.** We are given that $AB \parallel CD$, $CD \parallel EF$ and $y : z = 3 : 7$.

We need to find the value of *x* in the figure given below.

We know that lines parallel to the same line are also parallel to each other.

We can conclude that $AB \parallel CD \parallel EF$.

Let Angles be $y = 3a$ and $z = 7a$.

We know that angles on same side of a transversal are supplementary.

.

$x = z$ (Alternate interior angles)

$z + y = 180^\circ$, or

$7a + 3a = 180^\circ$

$\Rightarrow 10a = 180^\circ$

$a = 18^\circ$.

$z = 7a = 126^\circ$

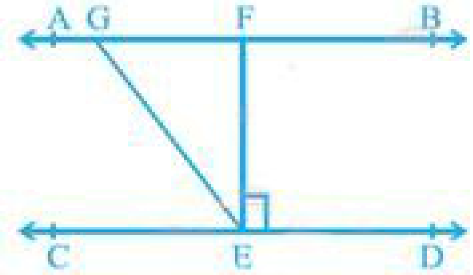
$y = 3a = 54^\circ$.

Now $x + 54^\circ = 180^\circ$

$x = 126^\circ$.

Therefore, we can conclude that $x = 126^\circ$.

3. **In the given figure, If AB || CD, $EF \perp CD$ and $\angle GED = 126^\circ$, find** $\angle AGE, \angle GEF$ and $\angle FGE$.




**Ans.** We are given that $AB \parallel CD$, $EF \perp CD$ and $\angle GED = 126^\circ$.

We need to find the value of $\angle AGE, \angle GEF$ and $\angle FGE$ in the figure given below.

$\angle GED = 126^\circ$

$\angle GED = \angle FED + \angle GEF$.

But, $\angle FED = 90^\circ$.

$126^\circ = 90^\circ + \angle GEF$

$\Rightarrow \angle GEF = 36^\circ$.

$\because \angle AGE = \angle GED$ (Alternate angles)

$\therefore \angle AGE = 126^\circ$.

From the given figure, we can conclude that $\angle FED$ and $\angle FEC$ form a linear pair.

We know that sum of the angles of a linear pair is $180^\circ$.

$\angle FED + \angle FEC = 180^\circ$

$\Rightarrow 90^\circ + \angle FEC = 180^\circ$

$\Rightarrow \angle FEC = 90^\circ$

$\angle FEC = \angle GEF + \angle GEC$

$\therefore 90^\circ = 36^\circ + \angle GEC$

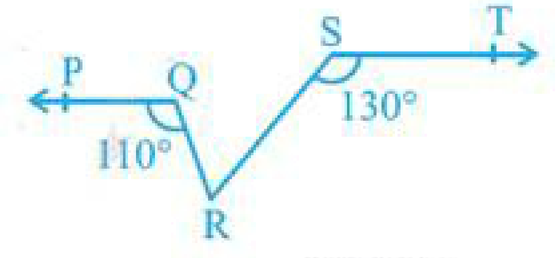
$\Rightarrow \angle GEC = 54^\circ$.

$\angle GEC = \angle FGE = 54^\circ$ (Alternate interior angles)

Therefore, we can conclude that $\angle AGE = 126^\circ, \angle GEF = 36^\circ$ and $\angle FGE = 54^\circ$.

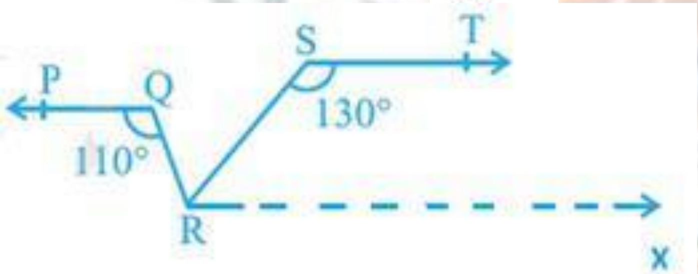
4. **In the given figure, if PQ || ST, $\angle PQR = 110^\circ$ and $\angle RST = 130^\circ$, find $\angle QRS$.**

   **[Hint: Draw a line parallel to ST through point R.]**




**Ans.** We are given that $PQ \parallel ST$, $\angle PQR = 110^\circ$ and $\angle RST = 130^\circ$.

We need to find the value of $\angle QRS$ in the figure.




We need to draw a line *RX* that is parallel to the line *ST*, to get

Thus, we have $ST \parallel RX$.

We know that lines parallel to the same line are also parallel to each other.

We can conclude that $PQ \parallel ST \parallel RX$.

(Alternate interior angles)

S0 $\angle QRX = 110^\circ$.

We know that angles on same side of a transversal are supplementary.

$\angle RST + \angle SRX = 180^\circ \Rightarrow 130^\circ + \angle SRX = 180^\circ$

$\Rightarrow \angle SRX = 180^\circ - 130^\circ = 50^\circ$.

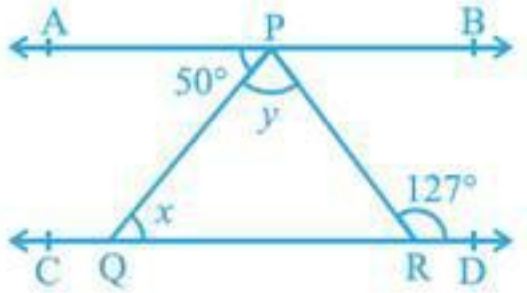
From the figure, we can conclude that

$\angle QRX = \angle SRX + \angle QRS \Rightarrow 110^\circ = 50^\circ + \angle QRS$

$\Rightarrow \angle QRS = 60^\circ$.

Therefore, we can conclude that $\angle QRS = 60^\circ$.

**5. In the given figure, if AB || CD, $\angle APQ = 50^\circ$ and $\angle PRD = 127^\circ$, find x and y.**




**Ans.** We are given that $AB \parallel CD$, $\angle APQ = 50^\circ$ and $\angle PRD = 127^\circ$.

We need to find the value of *x* and *y* in the figure.

$\angle APQ = x = 50^\circ$. (Alternate interior angles)

(Alternate interior angles)

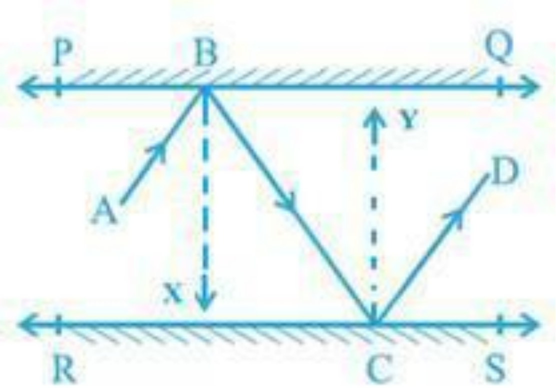
$\angle APR = \angle QPR + \angle APQ$.

$127^\circ = y + 50^\circ \quad \Rightarrow y = 77^\circ$.

Therefore, we can conclude that $x = 50^\circ$ and $y = 77^\circ$.

**(viii) In the given figure, PQ and RS are two mirrors placed parallel to each other. An incident ray AB strikes the mirror PQ at B, the reflected ray moves along the path BC and strikes the mirror RS at C and again reflects back along CD. Prove that AB || CD.**

**Ans.** We are given that *PQ* and *RS* are two mirrors that are parallel to each other.




We need to prove that $AB \parallel CD$ in the figure.

Let us draw lines *BX* and *CY* that are parallel to each other, to get $AB \parallel CD$ We know that according to the laws of reflection

$\angle ABX = \angle CBX$ and $\angle BCY = \angle DCY$.

$\angle BCY = \angle CBX$ (Alternate interior angles)

We can conclude that $\angle ABX = \angle CBX = \angle BCY = \angle DCY$.

From the figure, we can conclude that

and

Therefore, we can conclude that $\angle ABC = \angle DCB$.

From the figure, we can conclude that $\angle ABC$ and $\angle DCB$ form a pair of alternate interior angles corresponding to the lines *AB* and *CD*, and transversal *BC*.

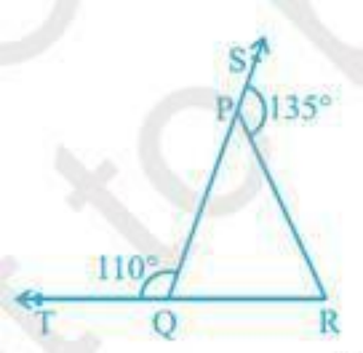
Therefore, we can conclude that $AB \parallel CD$.

## CHAPTER 6

## Lines and Angles

## (Ex. 6.3)

1. **In the given figure, sides QP and RQ of ΔPQR are produced to points S and T respectively. If $\angle$SPR = 135º and $\angle$PQT = 110º, find $\angle$PRQ.**




**Ans.** We are given that $\angle SPR = 135^\circ$ and $\angle PQT = 110^\circ$.

We know that the sum of angles of a linear pair is $180^\circ$.

$\angle SPR + \angle RPQ = 180^\circ$. (Linear Pair axiom)

and $\angle PQT + \angle PQR = 180^\circ$. (Linear Pair axiom)

$135^\circ + \angle RPQ = 180^\circ$, and $110^\circ + \angle PQR = 180^\circ$.

Or, $\angle RPQ = 45^\circ$, and $\angle PQR = 70^\circ$.

From the figure, we can conclude that

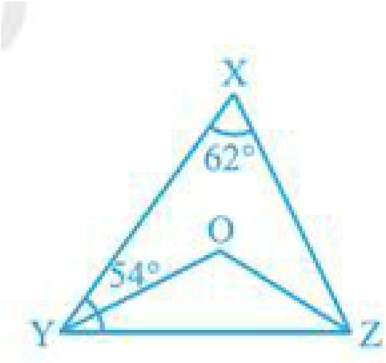
$\angle PQR + \angle RPQ + \angle PRQ = 180^\circ$. (Angle sum property)

$\Rightarrow 70^\circ + 45^\circ + \angle PRQ = 180^\circ \Rightarrow 115^\circ + \angle PRQ = 180^\circ$

$\Rightarrow \angle PRQ = 65^\circ$.

Therefore, we can conclude that $\angle PRQ = 65^\circ$.

2. **In the given figure, $\angle X = 62^\circ$, $\angle XYZ = 54^\circ$. If YO and ZO are the bisectors of $\angle XYZ$ and $\angle XZY$ respectively of $\Delta XYZ$, find $\angle OZY$ and $\angle YOZ$.**




**Ans.** We are given that $\angle X = 62^\circ$, $\angle XYZ = 54^\circ$ and *YO* and *ZO* are bisectors of $\angle XYZ$ and $\angle XZY$, respectively.

We need to find $\angle OZY$ and $\angle YOZ$ in the figure.

From the figure, we can conclude that in $\Delta XYZ$

$\angle X + \angle XYZ + \angle XZY = 180^\circ$. (Angle sum property)

$\Rightarrow 62^\circ + 54^\circ + \angle XZY = 180^\circ \Rightarrow 116^\circ + \angle XZY = 180^\circ$

$\Rightarrow \angle XZY = 64^\circ$.

We are given that *OY* and *OZ* are the bisectors of $\angle XYZ$ and $\angle XZY$, respectively. $\angle XYO = \angle ZYO = \frac{54}{2} = 27^\circ$ and $\angle OZY = \angle XZO = \frac{64}{2} = 32^\circ$

From the figure, we can conclude that in $\Delta OYZ$

$\angle OYZ + \angle OZY + \angle YOZ = 180^\circ$ (Angle sum property)

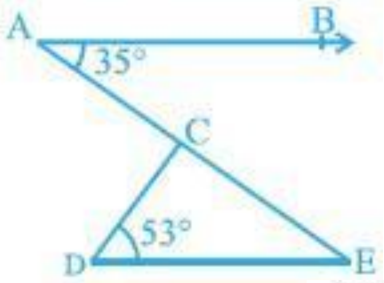
$27^\circ + 32^\circ + \angle YOZ = 180^\circ$

$\Rightarrow 59^\circ + \angle YOZ = 180^\circ$

$\Rightarrow \angle YOZ = 121^\circ$.

Therefore, we can conclude that $\angle YOZ = 121^\circ$ and $\angle OZY = 32^\circ$.

**3. In the given figure, if AB || DE, ∠ BAC = 35º and ∠ CDE = 53º, find ∠ DCE.**




**Ans.** We are given that $AB \parallel DE$, $\angle BAC = 35^\circ$ and $\angle CDE = 53^\circ$.

We need to find the value of $\angle DCE$ in the figure given below.

From the figure, we can conclude that

$\angle BAC = \angle CED = 35^\circ$ (Alternate interior)

From the figure, we can conclude that in $\Delta DCE$

$\angle DCE + \angle CED + \angle CDE = 180^\circ$ (Angle sum property)

$\angle DCE + 35^\circ + 53^\circ = 180$

$\Rightarrow \angle DCE + 88^\circ = 180^\circ$

$\Rightarrow \angle DCE = 92^\circ$.

Therefore, we can conclude that $\angle DCE = 92^\circ$.

4. **In the given figure, if lines PQ and RS intersect at point T, such that ∠ PRT = 40º, ∠ RPT = 95º and ∠ TSQ = 75º, find ∠ SQT.**

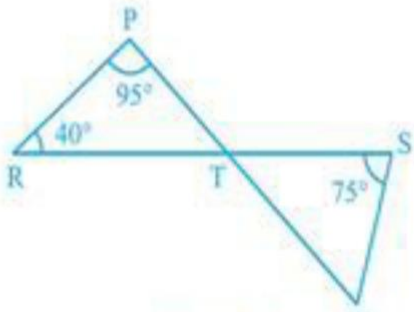



Fig. 6.42

**Ans.** We are given that $\angle PRT = 40^\circ$, $\angle RPT = 95^\circ$ and $\angle TSQ = 75^\circ$.

We need to find the value of $\angle SQT$ in the figure.

From the figure, we can conclude that in $\Delta RTP$

$\angle PRT + \angle RTP + \angle RPT = 180^\circ$ (Angle sum property)

$40^\circ + \angle RTP + 95^\circ = 180^\circ$

$\Rightarrow \angle RTP + 135^\circ = 180^\circ$

$\Rightarrow \angle RTP = 45^\circ.$

From the figure, we can conclude that

$\angle RTP = \angle STQ = 45^\circ$ (Vertically opposite angles)

From the figure, we can conclude that in $\Delta STQ$

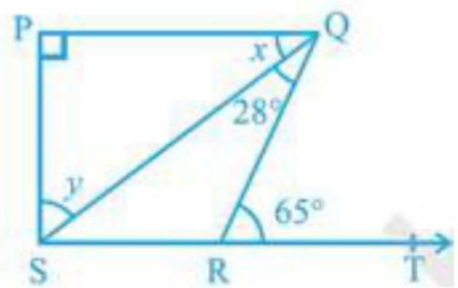
$\angle SQT + \angle STQ + \angle TSQ = 180^\circ$ (Angle sum property)

$\angle SQT + 45^\circ + 75^\circ = 180^\circ \Rightarrow \angle SQT + 120^\circ = 180^\circ$

$\Rightarrow \angle SQT = 60^\circ.$

Therefore, we can conclude that $\angle SQT = 60^\circ$.

**(iii) In the given figure, if $PQ \perp PS$, PQ || SR, $\angle SQR = 28^\circ$ and $\angle QRT = 65^\circ$, then find the values of x and y.**




**Ans.** We are given that $PQ \perp PS, PQ \parallel SR, \angle SQR = 28^\circ$ and $\angle QRT = 65^\circ$.

We need to find the values of *x* and *y* in the figure.

We know that "If a side of a triangle is produced, then the exterior angle so formed is equal to the sum of the two interior opposite angles."

From the figure, we can conclude that

$\angle SQR + \angle QSR = \angle QRT$, or

$28^\circ + \angle QSR = 65^\circ$

$\Rightarrow \angle QSR = 37^\circ$

From the figure, we can conclude that

$x = \angle QSR = 37^\circ$ (Alternate interior angles) From

the figure, we can conclude that $\Delta PQS$

$\angle PQS + \angle QSP + \angle QPS = 180^\circ$ (Angle sum property)

$\angle QPS = 90^\circ \quad (PQ \perp PS)$

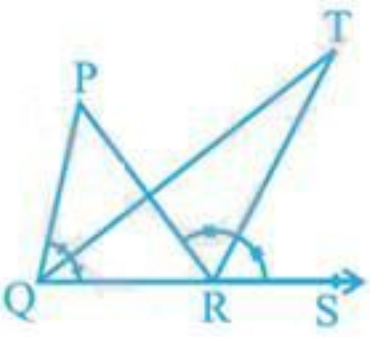
$x + y + 90^\circ = 180^\circ$

$\Rightarrow y + 37^\circ + 90^\circ = 180^\circ$

$\Rightarrow y + 127^\circ = 180^\circ \Rightarrow y = 53^\circ$

Therefore, we can conclude that $x = 37^\circ$, $y = 53^\circ$

**6. In the given figure, the side QR of ΔPQR is produced to a point S. If the bisectors of $\angle PQR$ and $\angle PRS$ meet at point T, then prove that $\angle QTR = \frac{1}{2}\angle QPR$.**




**Ans.** We need to prove that $\angle QTR = \frac{1}{2}\angle QPR$ in the figure given below.

We know that "If a side of a triangle is produced, then the exterior angle so formed is equal to the sum of the two interior opposite angles."

From the figure, we can conclude that in $\Delta QTR$, $\angle TRS$ is an exterior angle

$\angle QTR + \angle TQR = \angle TRS$, or

$\angle QTR = \angle TRS - \angle TQR$ …(i)

From the figure, we can conclude that in $\Delta PQR$, $\angle PRS$ is an exterior angle

$\angle QPR + \angle PQR = \angle PRS.$

We are given that $QT$ and $RT$ are angle bisectors of $\angle PQR$ and $\angle PRS.$

$\angle QPR + 2\angle TQR = 2\angle TRS$

$\angle QPR = 2(\angle TRS - \angle TQR).$

We need to substitute equation (*i*) in the above equation, to get

$\angle QPR = 2\angle QTR$, or

$\angle QTR = \frac{1}{2}\angle QPR.$

Therefore, we can conclude that the desired result is proved.

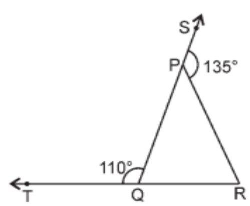
# WORK - SHEET

## CHAPTER – 6                                        STD -9th

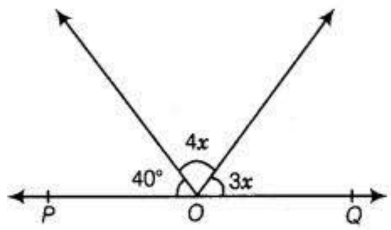
## LINES AND ANGLE

***SOLVE                                        (EACH CARRY 1 MARK)**

1. If angle is such that six times its compliment is 12° less than twice its supplement, then the value of angle is
   a. 38°   b. 48°   c. 58°   d. 68°
2. If angles measures X and Y form a complimentary pair , then which of the following measures of angle will form a supplementary pair?
   a. (x + 47°), (y + 43°)
   b. (x - 23°), (y + 23°)
   c. (x - 47°), (y - 43°)
   d. No such pair is possible.
3. If one angle of a triangle is equal to the sum of the other two angles, then the triangle is.
   a. An isosceles triangle
   b. An obtuse triangle
   c. An equilateral triangle
   d. A right triangle
4. An exterior angle of a triangle is 105° and its two interior opposite angles are equal. Each of these equal angles is.
   a. 37 ½°   b. 52½°   c.72½° d.75°
5. Sides QP and RQ of triangle PQR are produced to point S and T respectively if angle SPR= 135° and angle PQT =110 ° find angle PRQ




   a. 35°
   b. 45°
   c. 55°
   d. 65°
6. In the figure, POQ is a line. The value of x is.



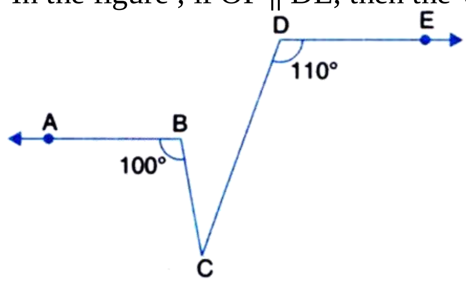

a. 20°

b. 25°

c. 30°

d. 35°

7. In the figure , if OP || DE, then the value of ∠BCD is



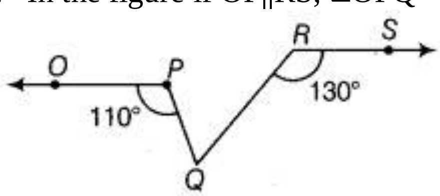

a. 30°

b. 45°

c. 55°

d. 65°

8. In the figure if OP||RS, ∠OPQ = 110° and ∠QRS = 130°, then ∠PQR is equal to.




a. 40° b. 50° c.60° d.70°

9. If one of a triangle is equal to the sum of the other two, then triangle is a / an

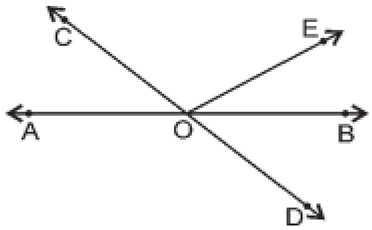
a. Acute angle triangle

b. Obtuse angle triangle

c. Right angle triangle

d. None of these

10. In the given figure, lines AB and CD intersect at O. If ∠AOC + ∠BOE = 80° and ∠BOD = 30°, then ∠BOE equals to

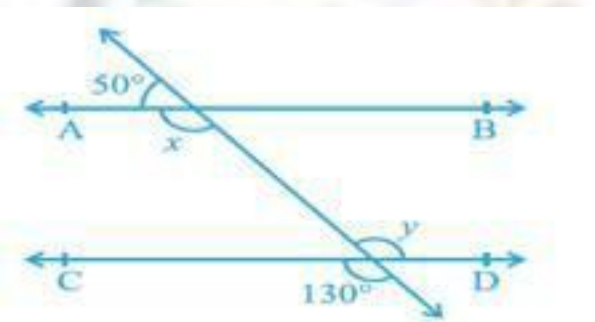



a. 30° b.40° c.50° d.60°

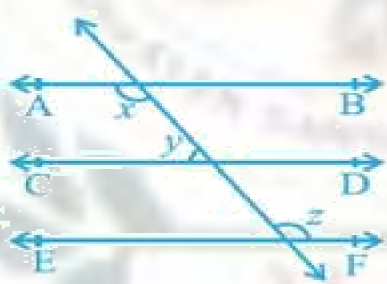
b.

**<u>*SOLVE</u>** **<u>(EACH CARRY 2 MARK)</u>**

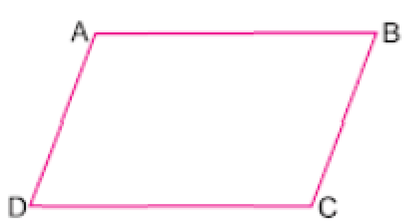
**11. . In the given figure, find the values of x and y and then show that AB || CD.**



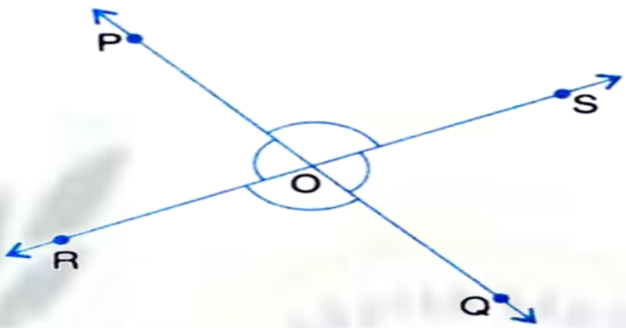

12. **In the given figure, if AB || CD, CD || EF and y : z = 3: 7, find x.**




13.As per given figure, AB∥DC and AD∥BC. Prove that ∠DAB = ∠DCB.



14. In given figure, lines PQ and RS intersect each other at point O. If ∠POR : ∠ROQ = 5 : 7, find all the angles.



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# Grade – 9 MATHS Specimen copy Year 22-23

# INDEX



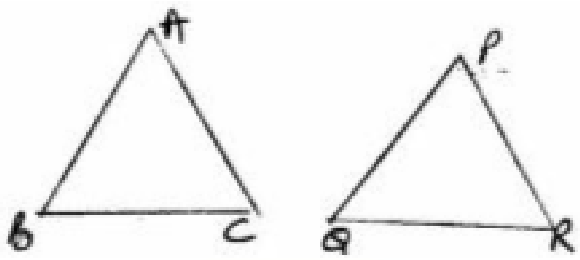
**Notes**

# CHAPTER – 7

# TRIANGLES

1. **Congruence of Triangles**
2. **Criteria for Congruence of Triangles**
3. **Some Properties of a Triangle**
4. **Inequalities in a Triangle**

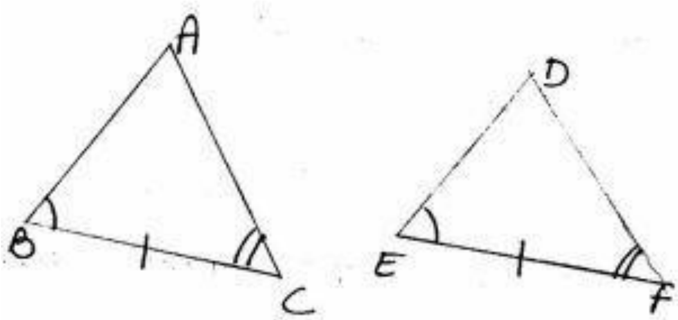
- **Triangle** - A closed figure formed by three intersecting lines is called a triangle. A triangle has three sides, three angles and three vertices.
- **Congruent figures** - Congruent means equal in all respects or figures whose shapes and sizes both are same. For example, two circles of the same radii are congruent. Also two squares of the same sides are congruent.
- **Congruent Triangles** - Two triangles are congruent if and only if one of them can be made to superimpose on the other, so as to cover it completely
- If two triangles ABC and PQR are congruent under the correspondence $A \leftrightarrow P$ $B \leftrightarrow Q$ $and$ $C \leftrightarrow R$ then symbolically, it is expressed as $\Delta ABC \cong \Delta PQR$



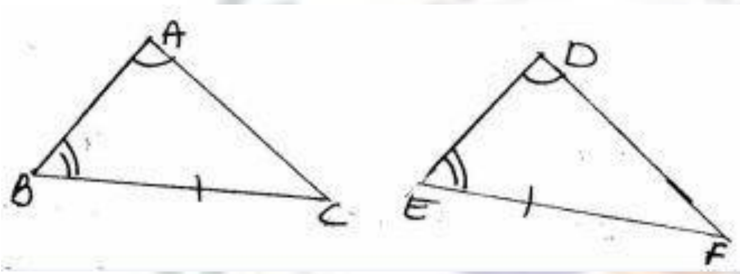
- In congruent triangles, corresponding parts are equal and we write 'CPCT' for corresponding parts of congruent triangles.
- **SAS congruency rule** - Two triangles are congruent if two sides and the included angle between two sides of one triangle are equal to the two sides and the included angle between two sides of the other triangle. For example $\Delta ABC$ and $\Delta PQR$ as shown in the figure satisfy SAS congruence criterion.

**ASA Congruence Rule** - Two triangles are congruent if two angles and the included side of one

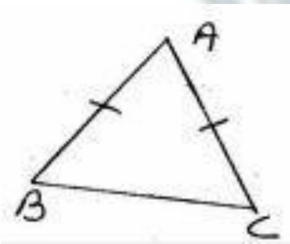
- triangle are equal to two angles and the included side of other triangle. For examples $\Delta ABC$ and $\Delta DEF$ shown below satisfy ASA congruence criterion.




- **AAS Congruence Rule** - Two triangle are congruent if any two pairs of angles and one pair of corresponding sides are equal. For example $\Delta ABC$ and $\Delta DEF$ shown below satisfy AAS congruence criterion.




- **AAS criterion for congruence of triangles is a particular case of ASA criterion**
- **Isosceles Triangle** - A triangle in which two sides are equal is called an isosceles triangle. For example $\Delta ABC$ shown below is an isosceles triangle with AB=AC.




- **Scalene Triangle** - A triangle, no two of whose sides are equal, is called scalene triangle.
- **Equilateral Triangle** - A triangle whose all sides are equal, is called an equilateral triangle.

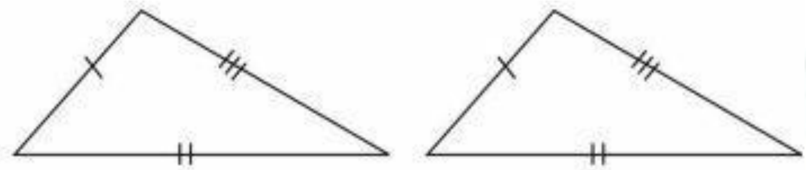
**Right angled triangle** - A triangle with one right angle is called a right angled triangle.

- The sum of all the angles of a triangle is 180°.
- If a side of a triangle is produced, the exterior angle so formed is equal to the sum of two interior opposite angles.

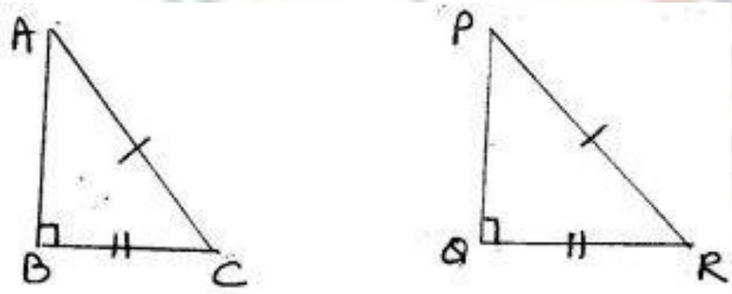
Angle opposite to equal sides of a triangle are equal.

- 

  Sides opposite to equal angles of a triangle are equal.
- 
- Each angle of an equilateral triangle is $60^o$.
- If the altitude from one vertex of a triangle bisects the base, then the triangle is isosceles triangle.
- **(i)** **congruence Rule** - If three sides of one triangle are equal to the three sides of another triangle then the two triangles are congruent for example $\Delta ABC\ and\ \Delta DEF$ as shown in the figure satisfy SSS congruence criterion.



- **RHS Congruence Rule** - If in two right triangles the hypotenuse and one side of one triangle are equal to the hypotenuse and one side of the other triangle then the two triangle are congruent. For example $\Delta ABC\ and\ \Delta PQR$ shown below satisfy RHS congruence criterion.

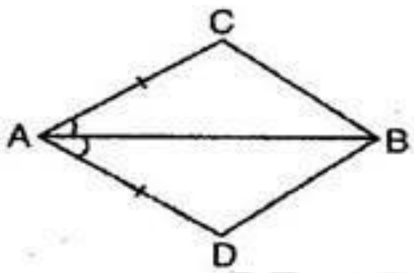



RHS stands for Right angle - Hypotenuse side.

- A point equidistant from two given points lies on the perpendicular bisector of the line segment joining the two points and vice-versa.
- A point equidistant from two intersecting lines lies on the bisectors of the angles formed by the two lines.
- In a triangle, angle opposite to the longer side is larger (greater)
- In a triangle, side opposite to the larger (greater) angle is longer.
- Sum of any two sides of a triangle is greater than the third side.

# CHAPTER 7
# Triangles
## (Ex. 7.1)

1. In quadrilateral ABCD (See figure). AC = AD and AB bisects $\angle$A. Show that $\Delta$ABC $\cong$ $\Delta$ABD. What can you say about BC and BD?




**Ans. Given**: In quadrilateral ABCD, AC = AD and AB bisects $\angle$A.

**To prove**: $\Delta$ABC $\cong$ $\Delta$ABD

**Proof**: In $\Delta$ABC and $\Delta$ABD,

AC = AD [Given]

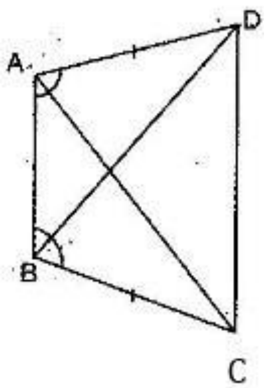
$\angle$BAC = $\angle$BAD [$\because$ AB bisects $\angle$A]

AB = AB [Common]

$\therefore$ $\Delta$ABC $\cong$ $\Delta$ABD [By SAS congruency]

Thus **BC = BD** [By C.P.C.T.]

2. ABCD is a quadrilateral in which AD = BC and $\angle$DAB = $\angle$CBA. (See figure). Prove that:




**(i) $\Delta$ABD $\cong$ $\Delta$BAC**

**(ii) BD=AC**

**(iii) $\angle$ ABD = $\angle$ BAC**

**Ans. (i)** In $\Delta$ABC and $\Delta$BAD,

BC = AD [Given]

$\angle$DAB = $\angle$CBA [Given]

AB = AB [Common]

$\therefore$ $\Delta$ABC $\cong \Delta$ ABD [By SAS congruency]

Thus AC = BD [By C.P.C.T.]

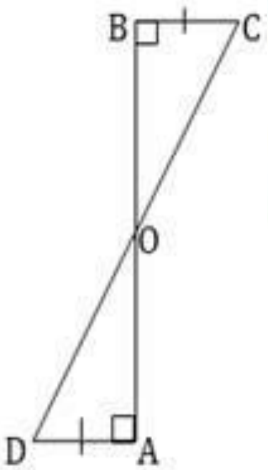
**(iii)** Since $\Delta$ABC $\cong \Delta$ ABD

$\therefore$ **AC = BD** [By C.P.C.T.]

**(iii)** Since $\Delta$ABC $\cong \Delta$ ABD

$\therefore$ $\angle$ **ABD** = $\angle$**BAC** [By C.P.C.T.]

3. AD and BC are equal perpendiculars to a line segment AB. Show that CD bisects AB (See figure)




**Ans.** In $\Delta$BOC and $\Delta$AOD,

$\angle$OBC = $\angle$OAD = $90^\circ$ [Given]

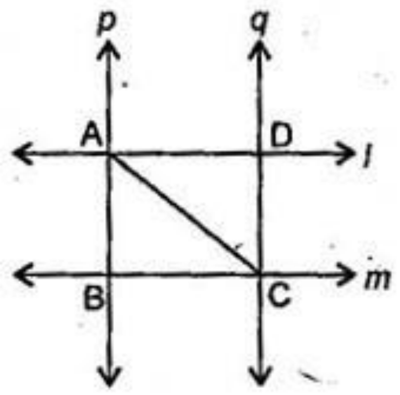
$\angle$BOC = $\angle$AOD [Vertically Opposite angles]

BC = AD [Given]

$\therefore$ $\Delta$BOC $\cong$ $\Delta$AOD [By AAS congruency]

$\Rightarrow$ **OB = OA** [By C.P.C.T., Also, OC = OD again by C.P.C.T.]

**4**. l and m are two parallel lines intersected by another pair of parallel lines p and q (See figure). Show that $\Delta$ABC $\cong$ $\Delta$CDA.




**Ans.** AC being a transversal. [Given]

Therefore ∠DAC = ∠ACB [Alternate angles]

Now p ‖ q [Given]

And AC being a transversal. [Given]

Therefore $\angle$BAC = $\angle$ACD [Alternate angles]

Now In $\Delta$ABC and $\Delta$ADC,

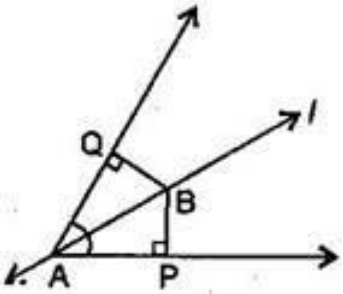
$\angle$ACB = $\angle$DAC [Proved above]

$\angle$BAC = $\angle$ACD [Proved above]

AC = AC [Common]

$\therefore$ $\Delta$**ABC** $\cong$ $\Delta$ **CDA** [By ASA congruency]

**5**. Line l is the bisector of the angle A and B is any point on BP and BQ are perpendiculars from B to the arms of ∠A. Show that:




(v) △APB ≅ △AQB

(vi) BP = BQ or B is equidistant from the arms of ∠A (See figure). Ans. Given:

Line $l$ bisects ∠A.

∴ ∠BAP = ∠BAQ

**(i)** In $\Delta$ABP and $\Delta$ABQ,

∠BAP = ∠BAQ [Given]

∠BPA = ∠BQA = $90^\circ$

[Given] AB = AB [Common]

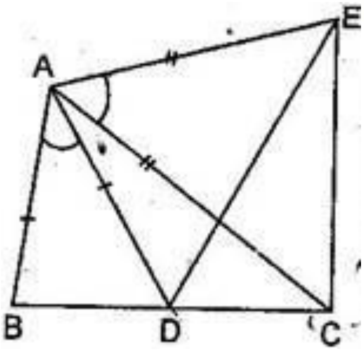
∴ $\Delta$APB ≅ $\Delta$AQB [By AAS congruency]

**(ii)** Since $\Delta$APB ≅ $\Delta$AQB

∴ BP = BQ [By C.P.C.T.]

⇒ B is equidistant from the arms of ∠A.

**6.** In figure, AC = AE, AB = AD and ∠BAD = ∠EAC. Show that BC = DE.



Ans. Given that $\angle$BAD = $\angle$EAC

Adding $\angle$DAC on both sides, we get

$\angle$BAD + $\angle$DAC = $\angle$EAC + $\angle$DAC

$\Rightarrow$ $\angle$BAC = $\angle$EAD ……….(i)

Now in $\Delta$ABC and $\Delta$ADE,

AB = AD [Given]

AC = AE [Given]

$\angle$BAC = $\angle$DAE [From eq. (i)]

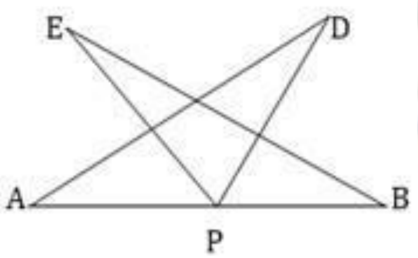
$\therefore$ $\Delta$ABC $\cong$ $\Delta$ADE [By SAS congruency]

$\Rightarrow$ BC = DE [By C.P.C.T.]

7. AB is a line segment and P is the mid-point. D and E are points on the same side of AB such that $\angle$BAD = $\angle$ABE and $\angle$EPA = $\angle$DPB. Show that:

(iii) $\Delta$DAP $\cong$ $\Delta$EBP

(iv) AD = BE (See figure)




**Ans.** Given that $\angle$EPA = $\angle$DPB

Adding $\angle$EPD on both sides, we get

$\angle$EPA + $\angle$EPD = $\angle$DPB + $\angle$EPD

$\Rightarrow$ $\angle$ APD = $\angle$BPE ……….(i)

Now in $\Delta$APD and $\Delta$BPE,

$\angle$PAD = $\angle$PBE [ $\because$ $\angle$BAD = $\angle$ABE (given),

$\therefore$ $\angle$PAD = $\angle$PBE]

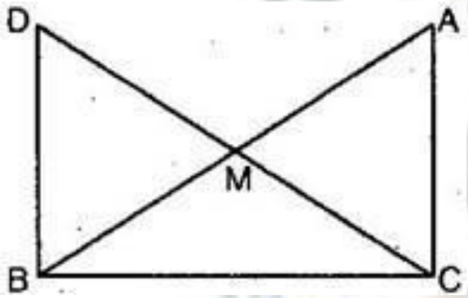
AP = PB [P is the mid-point of AB]

$\angle$APD = $\angle$BPE [From eq. (i)]

$\therefore$ $\Delta$DAP $\cong$ $\Delta$EBP [By ASA congruency]

$\Rightarrow$ AD = BE [ By C.P.C.T.]

(iv) In right triangle ABC, right angled at C, M is the mid-point of hypotenuse AB. C is joined to M and produced to a point D such that DM = CM. Point D is joined to point B. (See figure)




Show that:

(v) $\Delta$AMC $\cong$ $\Delta$BMD

(vi) $\angle$DBC is a right angle.

(vii) $\Delta$DBC $\cong$ $\Delta$ACB

(iv) CM = $\frac{1}{2}$ AB

Ans. (i) In $\Delta$AMC and $\Delta$BMD,
AM = BM [M is the mid-point of AB]

$\angle$AMC = $\angle$BMD [Vertically opposite angles]
CM = DM [Given]

$\therefore$ $\Delta$AMC $\cong$ $\Delta$BMD [By SAS congruency]
$\therefore$ $\angle$ACM = $\angle$BDM ……….(i)

$\angle$CAM = $\angle$DBM and AC = BD [By C.P.C.T.]

5. For two lines AC and DB and transversal DC, we have,

$\angle$ACD = $\angle$BDC [Alternate angles]

$\therefore$ AC $\parallel$ DB

Now for parallel lines AC and DB and for transversal BC. $\angle D$
$BC + \angle ACB = 180^0$[cointerior angles].....(ii)

But $\Delta$ABC is a right angled triangle, right angled at C. $\therefore$
$\angle$ACB = $90^0$ ……….(iii)

Therefore $\angle$DBC = $90^0$ [Using eq. (ii) and (iii)]

$\Rightarrow$ $\angle$DBC is a right angle.

6. Now in $\Delta$DBC and $\Delta$ABC,

DB = AC [Proved in part (i)]

$\angle$DBC = $\angle$ACB = $90^0$ [Proved in part (ii)]

BC = BC [Common]

$\therefore$ $\Delta$DBC $\cong$ $\Delta$ACB [By SAS congruency]

7. Since $\Delta$DBC $\cong$ $\Delta$ACB [Proved above]

$\therefore$ DC=AB

$\Rightarrow$ DM+CM=AB

$\Rightarrow$ CM+CM=AB[ $\because$ DM=CM]

$\Rightarrow$ 2CM = AB

$\Rightarrow$ CM= $\frac{1}{2}$AB

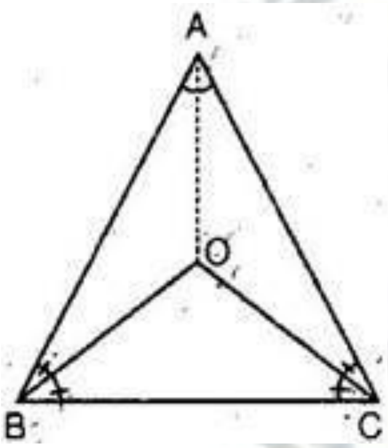
# Ex. 7.2

1. In an isosceles triangle ABC, with AB = AC, the bisectors of $\angle$B and $\angle$C intersect each other at O. Join A to O. Show that:

(i) OB=OC

(ii) AO bisects $\angle$A.

Ans. (i) ABC is an isosceles triangle in which AB = AC.




$\therefore \angle C = \angle B$ [Angles opposite to equal sides]

$\Rightarrow \angle OCA + \angle OCB = \angle OBA + \angle OBC$

$\because$ OB bisects $\angle$B and OC bisects $\angle$C

$\therefore \angle OBA = \angle OBC$ and $\angle OCA = \angle OCB$

$\Rightarrow \angle OCB + \angle OCB = \angle OBC + \angle OBC$

$\Rightarrow 2\angle OCB = 2\angle OBC$

$\Rightarrow \angle OCB = \angle OBC$

Now in $\Delta$OBC,

$\angle$OCB = $\angle$OBC [Proved above]

$\therefore$ OB = OC [Sides opposite to equal angles]

(iv) In $\Delta$AOB and $\Delta$AOC,

AB = AC [Given]

OA = OA [ Common ]

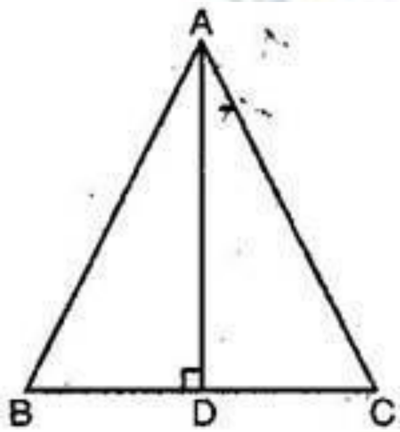
OB = OC [Prove above]

$\therefore$ $\Delta$AOB $\cong$ $\Delta$ AOC [By SSS congruency]

$\Rightarrow$ $\angle$OAB = $\angle$OAC [By C.P.C.T.]

Hence AO bisects $\angle$A.

(iv) In $\Delta$ABC, AD is the perpendicular bisector of BC (See figure). Show that $\Delta$ABC is an isosceles triangle in which AB = AC.




Ans. In $\Delta$ADB and $\Delta$ADC,

BD = CD [AD bisects BC]

$\angle$ADB = $\angle$ADC = $90^\circ$ [AD $\perp$ BC]

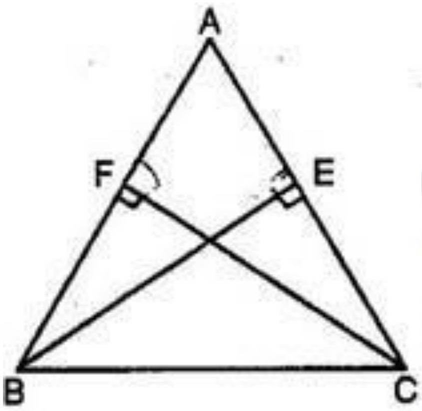
AD = AD [Common]

$\therefore$ $\Delta$ABD $\cong$ $\Delta$ ACD [By SAS congruency]

$\Rightarrow$ AB = AC [By C.P.C.T.]

Therefore, ABC is an isosceles triangle with AB = AC. Hence, proved.

(iv) ABC is an isosceles triangle in which altitudes BE and CF are drawn to equal sides AC and AB respectively (See the given figure). Show that these altitudes are equal.




**Ans.** In $\Delta$ ABE and $\Delta$ ACF,

$\angle$A= $\angle$A [Common]

$\angle$AEB = $\angle$AFC = $90^\circ$ [Given]

AB = AC [Given]

$\therefore$ $\Delta$ABE $\cong$ $\Delta$ ACF [By AAS congruency]

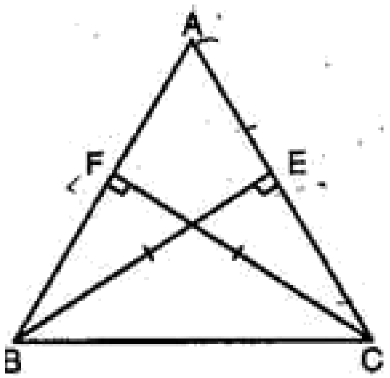
$\Rightarrow$ BE = CF [By C.P.C.T.]

$\Rightarrow$ **Altitudes are equal.**

8. ABC is a triangle in which altitudes BE and CF to sides AC and AB are equal (See figure). Show that:

(vii) $\Delta$ABE $\cong$ $\Delta$ ACF

(viii) AB = AC or $\Delta$ABC is an isosceles triangle.




Ans. (i) In $\Delta$ABE and $\Delta$ACF,

$\angle$A= $\angle$A [Common]

$\angle$AEB = $\angle$AFC = $90^\circ$ [Given]

BE = CF [Given]

$\therefore$ $\Delta$ABE $\cong$ $\Delta$ACF [By AAS congruency]

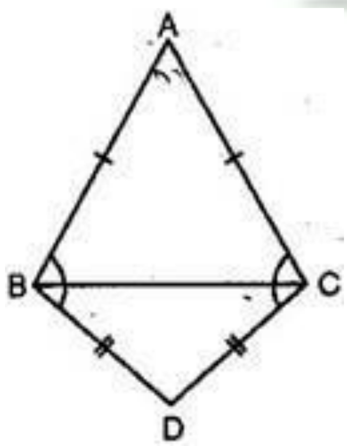
(iii) Since $\Delta$ABE $\cong$ $\Delta$

ACF $\Rightarrow$ BE = CF [By

C.P.C.T.]

$\Rightarrow$ ABC is an isosceles triangle.

(ii) ABC and DBC are two isosceles triangles on the same base BC (See figure). Show that $\angle$ABD = $\angle$ACD.




**Ans.** In isosceles triangle ABC,

AB = AC [Given]

$\angle$ACB = $\angle$ABC …….(i) [Angles opposite to equal sides]

Also in Isosceles triangle BCD.

BD=DC

$\therefore$ $\angle$BCD = $\angle$CBD ……….(ii) [Angles opposite to equal sides]

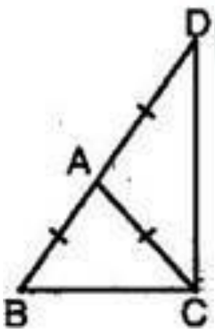
Adding eq. (i) and (ii),

$\angle$ACB + $\angle$BCD = $\angle$ABC + $\angle$CBD

$\Rightarrow$ $\angle$ACD = $\angle$ABD

Or $\angle$ABD = $\angle$ACD

(v) $\Delta$ ABC is an isosceles triangle in which AB = AC. Side BA is produced to D such that AD = AB. Show that $\angle$BCD is a right angle (See figure).




Ans. In isosceles triangle ABC,

AB = AC [Given]

$\angle$ACB = $\angle$ABC …….(i) [Angles opposite to equal sides]

Now AD = AB [By construction]

But AB = AC [Given]

$\therefore$ AD=AB=AC

$\Rightarrow$ AD=AC

Now in triangle ADC,

AD=AC

$\Rightarrow \angle$ADC = $\angle$ACD ………(ii) [Angles opposite to equal sides]

In triangle BCD,

$\Rightarrow \angle ABC + \angle BCD + \angle CDA = 180^0$ [ Angle sum property ]

$\Rightarrow \angle ACB + \angle BCD + \angle CDA = 180^0$ [ Because $\angle$ACB = $\angle$ABC, see (i) ]

$\Rightarrow \angle ACB + \angle ACB + \angle ACD + \angle CDA = 180^0$ [Because $\angle BCD = \angle ACB + \angle ACD$ ]

$\Rightarrow 2\angle ACB + \angle ACD + \angle CDA = 180^0$

$\Rightarrow 2\angle ACB + \angle ACD + \angle ACD = 180^0$ [ Because $\angle$ADC = $\angle$ACD, see (ii) ]

$\Rightarrow 2\angle ACB + 2\angle ACD = 180^0$

$\Rightarrow 2(\angle ACB + \angle ACD) = 180^0$ [ Taking out 2 common ]

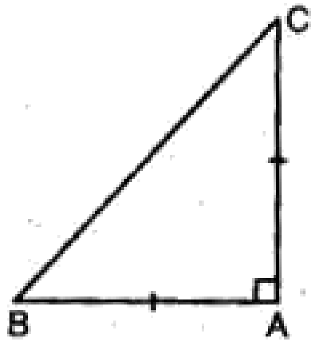
$\Rightarrow 2\angle BCD = 180^0$ [ Because, $\angle ACD + \angle ACB = \angle BCD$ ]

$\Rightarrow \angle$BCD = $90^\circ$

Hence $\angle$BCD is a right angle.

(v) ABC is a right angled triangle in which $\angle$A = $90^\circ$ and AB = AC. Find $\angle$B and $\angle$C. Ans.

ABC is a right triangle in which,



$\angle A = 90^\circ$ And AB = AC

In $\Delta$ABC,

AB=AC

$\Rightarrow \angle C = \angle B$ ……….(i)

We know that, in $\Delta$ABC,

$\angle A + \angle B + \angle C = 180^\circ$ [Angle sum property]

$\Rightarrow 90^\circ + \angle B + \angle B =$

[$\angle A = 90^\circ$ (given) and $\angle B = \angle C$ (from eq. (i)]

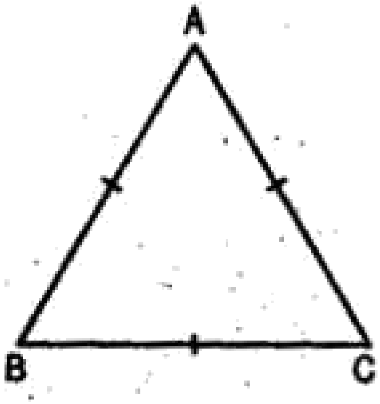
$\Rightarrow 2\angle B = 90^\circ$

$\Rightarrow \angle B = 45^\circ$

Also $\angle C = 45^\circ$ [$\angle B = \angle C$]

(viii) Show that the angles of an equilateral triangle are $60^\circ$ each.

Ans. Let ABC be an equilateral triangle.




$\therefore$ AB=BC=AC

$\Rightarrow$ AB=BC

$\Rightarrow \angle C = \angle A$ ……….(i)

Similarly, AB = AC

$\Rightarrow \angle C = \angle B$ ……….(ii)

From eq. (i) and (ii),

$\angle A = \angle B = \angle C$ ……….(iii)

Now in $\Delta$ ABC

$\angle A + \angle B + \angle C = 180^\circ$ ……….(iv)

$\Rightarrow \angle A + \angle A + \angle A = 180^\circ$

$\Rightarrow 3\angle A = 180^\circ$

$\Rightarrow \angle A = 60^\circ$

Since $\angle A = \angle B = \angle C$ [From eq. (iii)]

$\therefore \angle A = \angle B = \angle C =$

Hence each angle of equilateral triangle is $60^\circ$.

पुणा International School
Shree Swaminarayan Gurukul, Zundal

# Grade – 9
# MATHS
# Specimen copy
# Year 21-22

# *INDEX*

***S A 1***

# Notes
# CHAPTER 12
# HERON'S FORMULA

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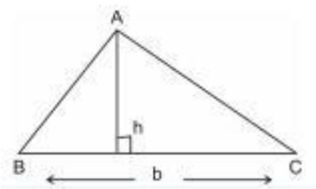
**1. Area of a Triangle – by Heron's Formula**

**2. Application of Heron's Formula in finding Areas of Quadrilaterals**

- Triangle with base 'b' and altitude 'h' is

  Area = 1/ 2× b×h

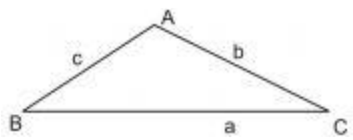



- Area of an isosceles triangle whose equal side is a = $a^2$ / 2 square units

- Triangle with sides a, b and c

(i) Semi perimeter of triangle s = a + b + c / 2

(ii) Area = $\sqrt{s(s-a)(s-b)(s-c)}$ sq. unit

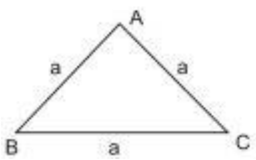



- Equilateral triangle with side 'a'

  Perimeter = 3a units

  Altitude = √ 3 / 2 a units

  Area = √3 / 4 $a^2$ square units




- Rectangle with length l, breadth b

  Perimeter = 2 ( l + b)

Area = $l \times b$

- Square with side a

  Perimeter = 4a units

  Area = $a^2$ sq. units

Area = $(\text{Diagonal})^2$ sq. units

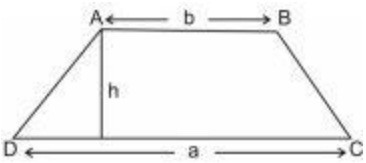
- Parallelogra with length l, breadth b and height h

  Perimeter = 2 ( l + b )

  Area = $b \times h$

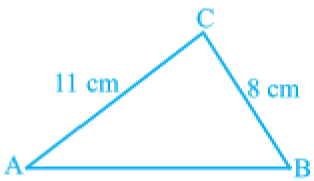
- Trapezium with parallel sides 'a' & 'b' and the distance between two parallel sides as 'h'.

  Area = ½ (a + b) h square units



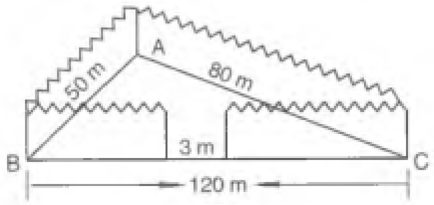

**Example 1 .** Find the area of a triangle, two sides of which are 8 cm and 11 cm and the perimeter is 32 cm.

**Sol.**




Let a, b, c be the sides of the given triangle and 2s be its perimeter such that
a = 8 cm, b = 11 cm and 2s = 32 cm i.e. s = 16 cm
Now,
$a + b + c = 2s$
$\Rightarrow 8 + 11 + c = 32$
$\Rightarrow c = 13$
$\therefore$ s - a = 16 - 8 = 8, s - b = 16 - 11 = 5 and s - c = 16 - 13 = 3
Hence, Area of given triangle = $\sqrt{s(s-a)(s-b)(s-c)}$
= 16×8×5×3 = 830 $cm^2$

**2.** A triangular park ABC has sides 120 m, 80 m and 50 m. (in a given figure). A gardener Dhania has to put a fence all around it and also plant grass inside. How much area does she need to plant? Find the cost of fencing it with barbed wire at the rate of ₹ 20 per metre leaving a space 3m wide for a gate on one side.




**Sol.** Computation of area: Clearly, the park is trianglar with sides

a = BC = 120 m, b = CA = 80 m and c = AB = 50 m

Ifs denotes the semi-perimeter of the park, then

$2s = a + b + c \Rightarrow 2s = 120 + 80 + 50 \Rightarrow s = 125$

$\therefore$ s - a = 125 - 120 = 5, s - b = 125 - 80 = 45 and s - c = 125 - 50 = 75

Hence, Area of the park = $\sqrt{s(s-a)(s-b)(s-c)} = 125\times5\times45\times75 m^2 = 37515\ m^2$

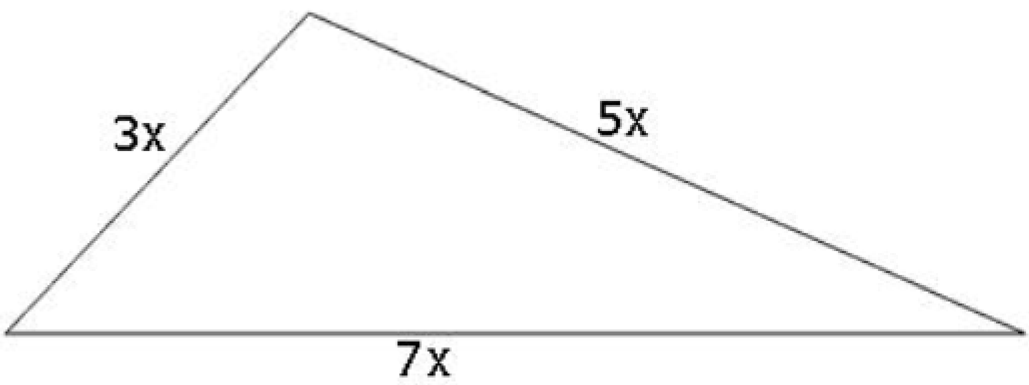
Length of the wire needed for fencing = perimeter of the park - width of the gate

= 250m - 3m = 247 m

Cost of fencing = Rs.(20 × 247) = Rs.4940

**3.** The sides of a triangular plot are in the ratio of 3 : 5 : 7 and its perimeter is 300 m. Find its area.

**Sol.**




Suppose that the sides in metres are 3x, 5x and 7x.

Then, we know that 3x + 5x + 7x = 300 (Perimeter of the triangle)

Therefore, 15x = 300, which gives x = 20.

So the sides of the triangles are 3 × 20 m, 5 × 20 m and 7 × 20 m

i.e., 60m, 100m and 140m.

We have s = 60+100+1402 = 150 m

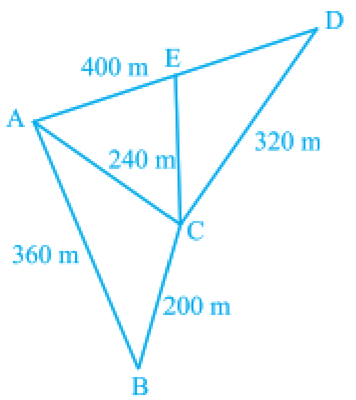
and area will be = $\sqrt{150(150-60)(150-100)(150-140)}$

= 150×90×50×10

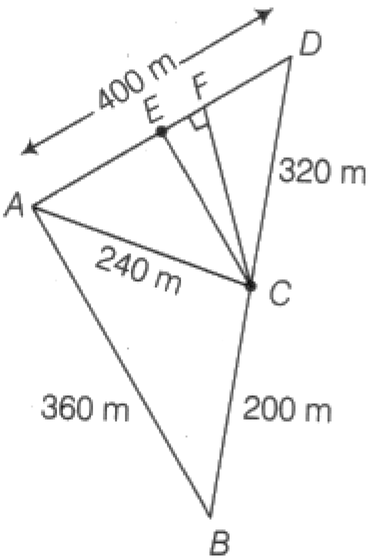
= 1500 $\sqrt{3}\ m^2$

**4.** Kamla has a triangular field with sides 240 m, 200 m, 360 m, where she grew wheat. In another triangular field with sides 240 m, 320 m, 400 m adjacent to the previous field, she wanted to grow potatoes and onions.

She divided the field in two parts by joining the mid-point of the longest side to the opposite vertex and grew potatoes in one part and onions in the other part. How much area (in hectares) has been used for wheat, potatoes and onions? [1 hectare = 1000 $m^2$, 2 = 1.41]




**Sol.** Let ABC be the field, where wheat is grown. Also, let ACD be the field which has been divided into two parts by joining C to the mid-point E of AD. For the area of △ABC, we have
a = 200m, b = 240 m, c = 360m

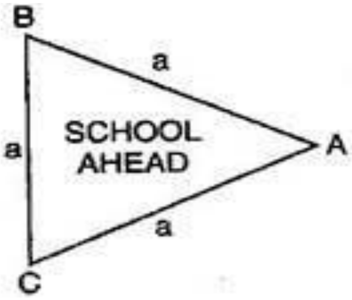



Therefore, s = 200+240+3602 = 400 m
So, area of growing wheat = s(s−a)(s−b)(s−c)
= 400(400−200)(400−240)(400−360)
= 1.6 × 2 hec = 1.6 × 1.41 [ ∵ 1.6 hec = 16000 $m^2$]
= 2.26 hec(approx.)
Now, we calculate the area of △ACD.
Here, s = 240+320+4002 = 480 m
So, area of △ACD
= 480(480−240)(480−320)(480−400)
= 480×240×160×80= 38400 $m^2$
= 3.84 hec [∵ 1 $m^2$ = 110000hec]
Now, let CF ⊥ AD. Then,
ar(△AEC) = 12 × AE × CF = 12 × ED × CF [∵ AE = ED, as E is mid-point of AD]
= ar(△EDC) [∵ CF is also a height of ∵EDC corresponding to base ED]
∴ Area for growing potatoes = Area for growing onions
= (3.84 ÷ 2) = 1.92 hec
Hence, area has been used for growing wheat, potatoes and onion are 2.26 hec, 1.92 hec and 19.2 hec, respectively.

# Ex. 12.1

1. **A traffic signal board, indicating 'SCHOOL AHEAD' is an equilateral triangle with side**

$'a'$. **Find the area of the signal board, using Heron's formula. If its perimeter is 180 cm, what will be the area of the signal board?**




**Ans.** Let the Traffic signal board is $\Delta$ABC.

According to question, Semi-perimeter of $\Delta$ABC $(s)$ = $\frac{a+a+a}{2}=\frac{3a}{2}$

Using Heron's Formula, Area of triangle ABC = $\sqrt{s(s-a)(s-b)(s-c)}$

= $\sqrt{\frac{3a}{2}\left(\frac{3a}{2}-a\right)\left(\frac{3a}{2}-a\right)\left(\frac{3a}{2}-a\right)}$

= $\sqrt{\frac{3a}{2}\times\frac{a}{2}\times\frac{a}{2}\times\frac{a}{2}}$ = $\sqrt{3\left(\frac{a}{2}\right)^4}$

= $\frac{\sqrt{3}a^2}{4}$ square units

Now, Perimeter of this triangle = 180 cm

$\Rightarrow$ 3 x Side of triangle $(a)$ = 180 cm

$\Rightarrow$ Side of triangle $(a) = \frac{180}{3}$ = 60 cm

$\Rightarrow$ Semi-perimeter of this triangle = $\frac{180}{2}$ = 90 cm

Using Heron's Formula, Area of this triangle = $\sqrt{s(s-a)(s-b)(s-c)}$

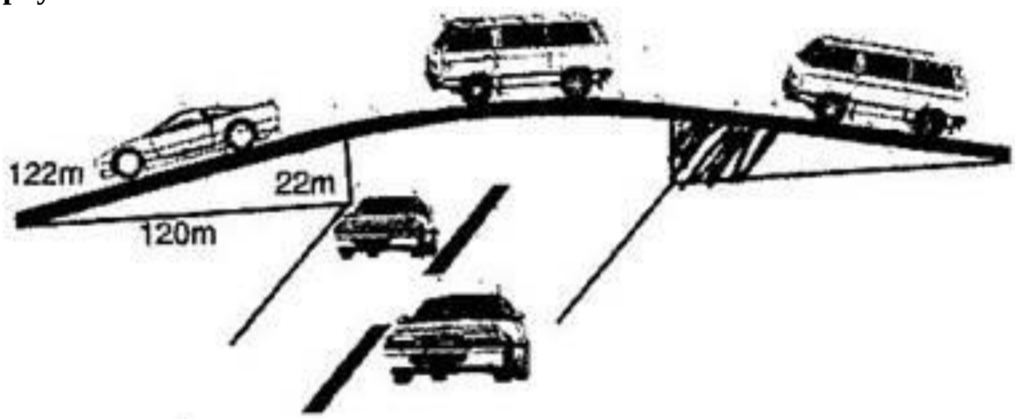
$= \sqrt{90(90-60)(90-60)(90-60)}$

$= \sqrt{90 \times 30 \times 30 \times 30}$

= √ 3 X 30 X 30 X 30 X 30

= 900 √3 $cm^2$

2. **The triangular side walls of a flyover has been used for advertisements. The sides of the walls are 122 m, 22 m and 120 m (see figure). The advertisement yield an earning of Rs. 5000 per $m^2$ per year. A company hired one of its walls for 3 months, how much rent did it pay?**




**Ans.** Given: $a$ = 122 m, $b$ = 22 m and $c$ = 120 m

Semi-perimeter of triangle $(s) = \frac{122+22+120}{2} = \frac{264}{2}$ = 132 m

Using Heron's Formula,

Area of triangle = $\sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{132(132-122)(132-22)(132-120)}$

$=\sqrt{132 \times 10 \times 110 \times 12}$

$=\sqrt{11 \times 12 \times 10 \times 11 \times 10 \times 12}$

$= 10 \times 11 \times 12$

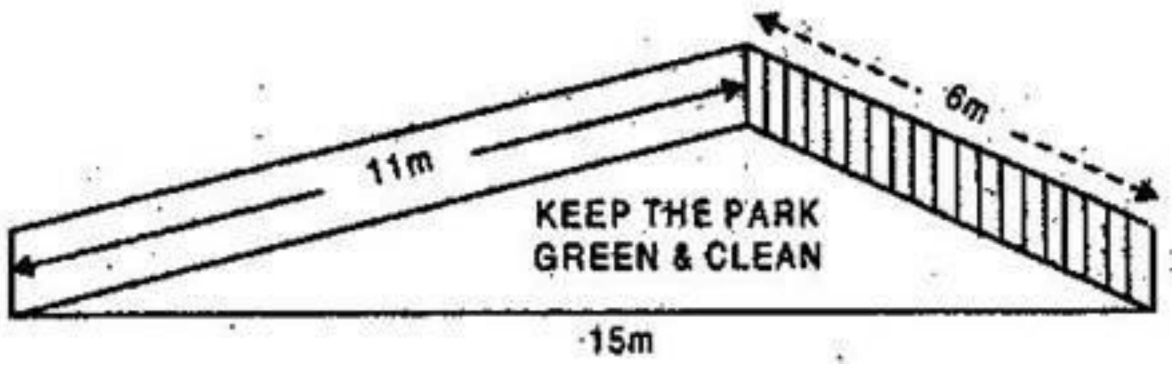
$= 1320\, m^2$

$\because$ Rent for advertisement on wall for 1 year = Rs. 5000 per $m^2$ $\therefore$ Rent for advertisement on wall for 3 months for 1320 $m^2$ = $\frac{5000}{12} \times 3 \times 1320$

= Rs. 1650000

Hence rent paid by company = Rs. 16,50,000

3. **There is slide in a park. One of its side walls has been painted in some colour with a message "KEEP THE PARK GREEN AND CLEAN", (see figure). If the sides of the wall are 15m, 11 m and 6 m, find the area painted in colour.**




**Ans.** Since, sides of coloured triangular wall are 15 m, 11 m and 6 m.

$\therefore$ Semi-perimeter of coloured triangular wall = $\frac{15+11+6}{2} = \frac{32}{2}$ = 16 m

Now, Using Heron's formula,

Area of coloured triangular wall = $\sqrt{s(s-a)(s-b)(s-c)}$ =

$\sqrt{16(16-15)(16-11)(16-6)}$

= $\sqrt{16\times1\times5\times10}$ = $20\sqrt{2}m^2$

Hence area painted in blue colour = $20\sqrt{2}m^2$

4. **Find the area of a triangle two sides of which are 18 cm and 10 cm and the perimeter is 42 cm.**

**Ans.** Given: $a$ = 18 cm, $b$ = 10 cm.

Since Perimeter = 42 cm

$\Rightarrow a+b+c$ =42

$\Rightarrow$ 18+10+ $c$ =42

$\Rightarrow c$ = 42 – 28 = 14 cm

$\therefore$ Semi-perimeter of triangle = $\frac{18+10+14}{2}$ = $\frac{42}{2}$ = 21 cm

$\therefore$ Area of triangle = $\sqrt{s(s-a)(s-b)(s-c)}$

= $\sqrt{21(21-18)(21-10)(21-14)}$

= $\sqrt{21\times3\times11\times7}$ = $\sqrt{7\times3\times3\times11\times7}$

= $21\sqrt{11}$ = 21 x 3.3 = 69.3 cm$^2$

5. **Sides of a triangle are in the ratio of 12: 17: 25 and its perimeter is 540 cm. Find its area.**

**Ans.** Let the sides of the triangle be $12x, 17x$ and $25x$ .

Therefore, $12x+17x+15x$ = 540

$\Rightarrow 54x=540$

$\Rightarrow x$ = 10

$\therefore$ The sides are 120 cm, 170 cm and 250 cm.

Semi-perimeter of triangle $(s)=\dfrac{120+170+250}{2}$ = 270 cm

Now, Area of triangle = $\sqrt{s(s-a)(s-b)(s-c)}$ =

$\sqrt{270(270-120)(270-170)(270-250)}$

= $\sqrt{270\times150\times100\times20}$ = $9000\ cm^2$

6. **An isosceles triangle has perimeter 30 cm and each of the equal sides is 12 cm. Find the area of the triangle.**

**Ans.** Given: $a$ = 12 cm, $b$ = 12 cm

Since Perimeter = 30 cm

$\Rightarrow a+b+c$ =30

$\Rightarrow$ 12+12+ $c$ =30

$\Rightarrow c$ = 30 – 24 = 6 cm

$\therefore$ Semi-perimeter of triangle = $\dfrac{12+12+6}{2}$ = 15 cm

$\therefore$ Area of triangle = $\sqrt{s(s-a)(s-b)(s-c)}$

= $\sqrt{15(15-12)(15-12)(15-6)}$

= $\sqrt{15\times3\times3\times9}$ = $\sqrt{5\times3\times3\times3\times3\times3}$

$9\sqrt{15}cm^2$