COORDINATE GEOMETRY

INTRODUCTION

In the previous class, you have learnt to locate the position of a point in a coordinate plane of two dimensions, in terms of two coordinates. You have learnt that a linear equation in two variables, of the form ax + by + c = 0 (either $a \neq 0$ or $b \neq 0$) can be represented graphically as a straight line in the coordinate plane of x and y coordinates. In chapter 4, you have learnt that graph of a quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$ is an upward parabola if $a > 0$ and a downward parabola if $a < 0$.

In this chapter, you will learn to find the distance between two given points in terms of their coordinates and also, the coordinates of the point which divides the line segment joining the two given points internally in the given ratio.

HISTORICAL FACTS

Rene Descartes (1596-1650), the 17th century French-Mathematician, was a thinker and a philosopher. He is called the father of Co-ordinate Geometry because he unified Algebra and Geometry which were earlier two distinct branches of Mathematics. Descartes explained that two numbers called co-ordinates are used to locate the position of a point in a plane.


Rene Descartes,
(1596-1650), France

He was the first Mathematician who unified Algebra and Geometry, so Analytical Geometry is also called Algebraic Geometry. Cartesian plane and Cartesian Product of sets have been named after the great Mathematician.

REVIEW

1. Rectangular co-ordinate system –

(a) Distance between two points; The distance between the points P (x_1, y_1) and Q (x_2, y_2) is given by $PQ = \sqrt{(x_2 - x_1)^2 + y_2 - y_1)^2}$

(b) Section formula

(i) If P (x, y) divides the join of A (x_1, y_1) and B (x_2, y_2) internally in the ratio m : n then

$$x = \left(\frac{mx_2 + nx_1}{m+n}\right), y = \left(\frac{my_2 + ny_1}{m+n}\right)$$

(ii) If If P (x, y) divides the join of A (x_1, y_1) and B (x_2, y_2) externally in the ratio m : n then

$$x = \left(\frac{mx_2 - nx_1}{m-n}\right), y = \left(\frac{my_2 - ny_1}{m-n}\right)$$

(iii) If A (x_1, y_1) and B (x_2, y_2) be two given points then the co-ordinate of p mid point of AB are

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

SUMMARY OF THE CHAPTER

BASIC CONCEPTS AND IMPORTANT RESULTS

* **Coordinate system**

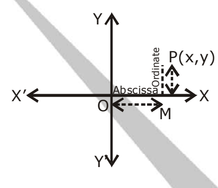
When two numbered lines perpendicular to each other (usually horizontal and vertical) are placed together so that the two origins (the points corresponding to zero) coincide the resulting configuration is called a **cartesian coordinate system** or simply a **coordinate system** or a **coordinate plane.**

Let X'OX and Y'OY, two number lines perpendicular to each other, meet at the point O (shown in the adjoining figure), then

(i) X'OX is called x-axis.
(ii) Y'OY is called y-axis.
(iii) X'OX and Y'OY taken together are called coordinate axes
(iv) the point O is called the **origin.**

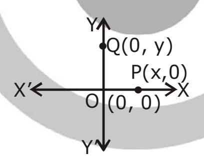
* **Coordinates of a point**

Let P be any point in the coordinate plane. From P, draw PM perpendicular to X'OX, then
(i) OM is called x-coordinate or abscissa of P and is usually denoted by x.
(ii) MP is called y-coordinate or ordinate of P and is usually denoted by
(iii) x and y taken together are called cartesian coordinates or simply coordinates of P and are written as by (x, y)



REMARKS

1. The coordinates of the origin O are (0, 0).
2. For any point on x-axis, its ordinate is always zero and so the coordinate of any ponit P on x-axis are (x, 0).
3. For any point on y-axis, its abscissa is always zero and so the coordinates of any point Q on y-axis are (0, y)



* **Coordinate Geometry**

Coordinate geometry is that branch of mathematics which deals with the study of geometry by mean of algebra. In coordinate geometry, we represent a point in a plane by an ordered pair of real numbers called coordinates of the point; and a straight line or a curve by an algebraic equation with real coefficients. We have seen earlier that a linear equation in two variables of the from ax + by + c = 0 (a, b not simultaneously zero) represents a straight line and the equation $y = ax^2 + bx + c$ $(a \neq 0)$ represents a parabola (upwards or downwards). In fact, coordinate geometry has been developed as an algebraic tool for studying geometry of figures. Thus, we use algebra advantageously to the study of straight lines and geometric curves.

* **Distance formula**

The distance between the points P (x_1, y_1) and Q(x_2, y_2) = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

The distance of the point P(x, y) from the origin O(0, 0) is given by OP = $\sqrt{x^2 + y^2}$.

* **Section formula**

The coordinates of the point which divides (internally) the line segment joining the points P(x_1, y_1) and Q(x_2, y_2) in the ratio

$m_1 : m_2$ are $\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$.

* **Mid-point formula**

The coordinates of the mid-point of the line segment joining the points P (x_1, y_1) and Q(x_2, y_2) are

$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$.

REMARK. In problems where it is required to find the ratio when a given point divides the join of two given points, it is convenient to take the ratio as k : 1, for, in this way two unknowns (m_1 and m_2) are reduced to one unknown and the section formula becomes

$x = \dfrac{kx_2 + x_1}{k+1}$ and $y = \dfrac{ky_2 + y_1}{k+1}$.

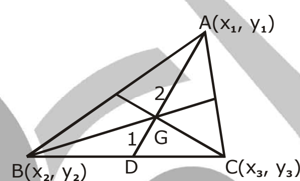
Then equate the abscissa or the ordinate of the point so obtained with that of the given point, and find the value of unknown k.

* **Centroid of a triangle**

The point where the medians of a triangle meet is called the ***centroid of the triangle.***

If AD is a medina of the triangle ABC and G is its centroid, then $\dfrac{AG}{GD} = \dfrac{2}{1}$. The coordinates of the point G are

$$\left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right).$$



REMARK. To prove that a quadrilateral is a

(i) ***Parallelogram*** **:** Show that opposite side are equal

Or

Show that diagonals bisect each other.

(ii) ***Rectangle*** **:** Show that opposite sides are equal and diagonals are also equal

Or

Show that opposite sides are equal and one angle is 90º

Or

Show that diagonals bisects each other and are equal.

(iii) ***Rhombus*** **:** Show that all sides are equal

Or

Show that diagonal bisect each other two adjacent sides are equal.

(iv) ***Square*** **:** Show that all sides are equal and diagonals are also equal

Or

Show that all sides are equal and one angle is 90º

Or

Show that diagonals bisect each other and two adjacent sides are equal and diagonals are also equal.

* **Area of a triangle**

The area of the triangle whose vertices are $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ is the absolute value (numerical value) of the expression

$$\frac{1}{2}\{x_1 (y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)\}.$$

* **Condition of collinearity of three points**

The points $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ are collinear if and only if the area of $\Delta ABC = 0$

i.e., if and only if

$x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) = 0$.

SOLVED PROBLEMS

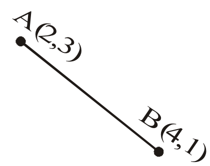
Ex.1 Find the distance between the following pairs of points : **[NCERT]**

(a) (2,3), (4, 1) (b) (–5, 7), (–1,3) (c) (a, b), (– a, – b)

Sol. (a) The given points are : A (2, 3), B (4, 1).

Required distance = AB = BA =

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

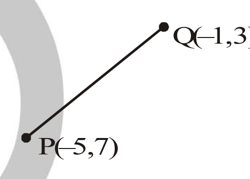


AB = $\sqrt{(4-2)^2 + (1-3)^2} = \sqrt{(2)^2 + (-2)^2}$

= $\sqrt{4+4}$ = $\sqrt{8}$ = $2\sqrt{2}$ units

(b) Distance between P (–5, 7) and Q (– 1, 3) is given by

PQ = QP = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$



= $\sqrt{(-1+5)^2 + (3-7)^2} = \sqrt{16+16}$ = $\sqrt{32}$

Required distance = PQ = QP = $4\sqrt{2}$ units

(c) Distance LM between L (a,b) and M (–a, –b) is given by

LM = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

= $\sqrt{(-a-a)^2 + (-b-b)^2} = \sqrt{(-2a)^2 + (-2b)^2}$

= $\sqrt{4a^2 + 4b^2}$

= $\sqrt{4(a^2 + b^2)} = 2\sqrt{a^2 + b^2}$ units

Ex.2 Find points on x-axis which are at a distance of 5 units from the point A(–1, 4).

Sol. Let the point on x-axis be P(x, 0).

Distance = PA = 5 units

$\Rightarrow$ $PA^2 = 25$ $\Rightarrow$ $(x+1)^2+(0-4)^2 = 25$

$\Rightarrow$ $x^2 + 2x + 1 + 16 = 25$ $\Rightarrow x^2 + 2x + 17 = 25$ $\Rightarrow$ $x^2 + 2x - 8 = 0$

$$x = \frac{-2 \pm \sqrt{(2)^2 + 4(8)}}{2} = \frac{-2 \pm \sqrt{36}}{2} = \frac{-2 \pm 6}{2}$$

= $\frac{-2+6}{2}$, $\frac{-2-6}{2}$ = $\frac{4}{2}$, $-\frac{8}{2}$ = 2, –4

Required point on x-axis are (2, 0) and (–4, 0)

Verification : PA

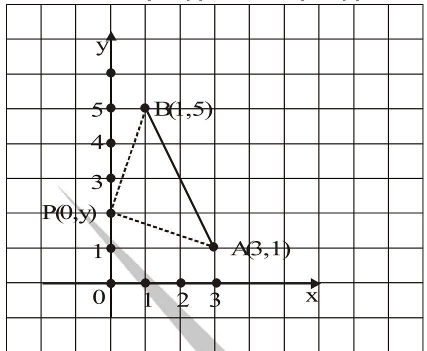
= $\sqrt{(2+1)^2 + (0-4)^2} = \sqrt{9+16} = \sqrt{25}$ = 5

PA = $\sqrt{(-4+1)^2 + (0-4)^2} = \sqrt{9+16} = \sqrt{25}$ = 5

Ex.3 What point on y-axis is equidistant from the points (3, 1) and (1, 5) ?

Sol. Since the required point P(say) is on the y-axis, its abscissa (x-co-ordinate) will be zero. Let the ordinate (y-co-ordinate) of the point be y.

Therefore co-ordinates of the point P are : (0, y) i.e., P(0, y)



Let A and B denote the points (3, 1) and (1, 5) respectively.

PA = PB ...(given) Squaring we get :

$PA^2 = PB^2$

$\Rightarrow (0-3)^2 + (y-1)^2 = (0-1)^2 + (y-5)^2$

$\Rightarrow 9 + y^2 + 1 - 2y = 1 + y^2 + 25 - 10y$

$\Rightarrow y^2 - 2y + 10 = y^2 - 10y + 26$

$\Rightarrow -2y + 10y = 26 - 10 \Rightarrow 8y = 16 \Rightarrow y = 2$

The required point on y-axis equidistant from A(3, 1) and B(1, 5) is P(0, 2).

Ex.4 If Q(2, 1) and R(–3, 2) and P(x, y) lies on the right bisector of QR then show that 5x – y + 4 = 0.

Sol. Let P(x, y) be a point on the right bisector of QR : Q(2, 1) and R(–3, 2) are equidistant from P(x, y), then we must have :

PQ = PR

$\Rightarrow PQ^2 = PR^2$

$\Rightarrow (x-2)^2 + (y-1)^2 = (x+3)^2 + (y-2)^2$

$\Rightarrow (x^2 - 4x + 4) + (y^2 - 2y + 1)$

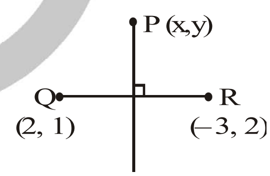
$= (x^2 + 6x + 9) + (y^2 - 4y + 4)$

$\Rightarrow -4x-2y+5 = 6x-4y+13$

$\Rightarrow 10x-2y+8=0$

$\Rightarrow 2(5x-y+4) = 0$

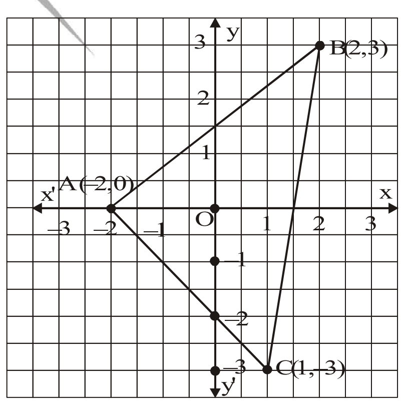
$\Rightarrow 5x - y + 4 = 0$



Ex.5 The vertices of a triangle are (–2, 0), (2, 3) and (1, –3). Is the triangle equilateral : isosceles or scalene?

Sol. We denote the given point (–2, 0), (2, 3) and (1, –3) by A, B and C respectively then :

A(–2, 0), B(2, 3), C(1, –3)



AB $= \sqrt{(2+2)^2 + (3-0)^2} = \sqrt{(4)^2 + (3)^2} = 5$

BC $= \sqrt{(1-2)^2 + (-3-3)^2} = \sqrt{(-1)^2 + (-6)^2} = \sqrt{37}$

CA $= \sqrt{(-2-1)^2 + (0+3)^2} = \sqrt{(-3)^2 + (3)^2} = 3\sqrt{2}$

Thus we have AB ≠ BC ≠ CA

$\Rightarrow$ ABC is a scalene triangle

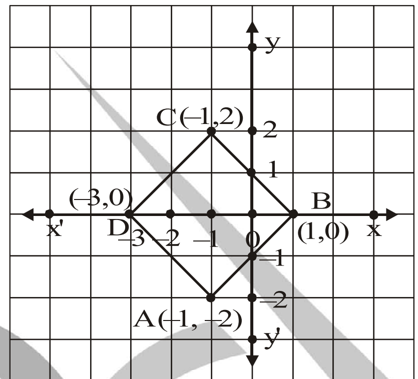
Ex.6 Name the quadrilateral formed, if any, by the following points, and give reasons for your answer.
(–1, –2), (1, 0), (–1, 2), (– 3, 0) **[NCERT]**

Sol. A(–1, –2), B(1, 0), C(–1, 2), D(–3, 0)

Determine distances : AB, BC, CD, DA, AC and BD.

AB $= \sqrt{(1+1)^2+(0+2)^2} = \sqrt{4+4} = \sqrt{8} = 2\sqrt{2}$

BC $= \sqrt{(-1-1)^2+(2-0)^2} = \sqrt{4+4} = \sqrt{8} = 2\sqrt{2}$



CD $= \sqrt{(-3+1)^2+(0-2)^2} = \sqrt{4+4} = \sqrt{8} = 2\sqrt{2}$

DA $= \sqrt{(-1+3)^2+(-2-0)^2} = \sqrt{4+4} = \sqrt{8} = 2\sqrt{2}$

AB = BC = CD = DA

The sides of the quadrilateral are equal .... (1)

AC $= \sqrt{(-1+1)^2+(2+2)^2} = \sqrt{0+16} = 4$

BD $= \sqrt{(-3-1)^2+(0-0)^2} = \sqrt{16+0} = 4$

The diagonals of quadrilateral are equal .... (2)

From (1) and (2) we conclude that ABCD is a square.

Ex.7 Determine whether the points (1, 5), (2, 3) and (–2, –11) are collinear. **[NCERT]**

Sol. The given points are : A(1, 5), B(2, 3) and C(–2, –11).

Let us calculate the distance : AB, BC and CA by using distance formula.

AB $= \sqrt{(2-1)^2+(3-5)^2} = \sqrt{(1)^2+(-2)^2} = \sqrt{1+4} = \sqrt{5}$

BC $= \sqrt{(-2-2)^2+(-11-3)^2} = \sqrt{(-4)^2+(-14)^2} = \sqrt{16+196} = \sqrt{212} = 2\sqrt{53}$

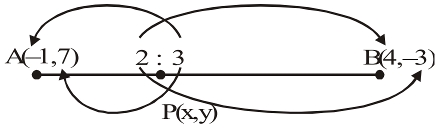
CA $= \sqrt{(-2-1)^2+(-11-5)^2} = \sqrt{(-3)^2+(-16)^2} = \sqrt{9+256} = \sqrt{265}$

From the above we see that : AB + BC $\neq$ CA

Hence the above stated points A(1, 5), B(2, 3) and C(–2, –11) are not collinear.

Ex.8 Find the co-ordinates of the point which divides the join of (–1, 7) and (4, –3) in the ratio 2 : 3.

Sol. Let P(x, y) divides the line segment AB joining A(–1, 7) and B(4, –3) in the ratio 2 : 3. Then by using section formula the co-ordinates of P are given by : **[NCERT]**



$\left(\dfrac{2\times 4\times 3\times(-1)}{2+3}, \dfrac{2\times(-3)+3\times 7}{2+3}\right) = P\left(\dfrac{8-3}{5}, \dfrac{-6+21}{5}\right) = P\left(\dfrac{5}{5}, \dfrac{15}{5}\right) = P(1, 3)$

Hence the required point of division which divides the join of (–1, 7) and (4, – 3) in the ratio 2 : 3 is P(1, 3).

Ex.9 Find the co-ordinates of the points which divide the line segment joining A(–2, 2) and B(2, 8) into four equal parts. **[NCERT]**

Sol.

It is given that AB is divided into four equal parts : AP = PQ = QR = RB

Q is the mid-point of AB, then co-ordinates of Q are : $\left(\frac{-2+2}{2}, \frac{2+8}{2}\right) = \left(\frac{0}{2}, \frac{10}{2}\right)$ = (0, 5)

P is the mid-point of AQ, then co-ordinates of P are: $\left(\frac{-2+0}{2}, \frac{2+5}{2}\right) = \left(\frac{-2}{2}, \frac{7}{2}\right) = \left(-1, \frac{7}{2}\right)$

Also, R is the mid-point of QB, then co-ordinates of R are: $\left(\frac{0+2}{2}, \frac{5+8}{2}\right) = \left(\frac{2}{2}, \frac{13}{2}\right) = \left(1, \frac{13}{2}\right)$

Hence, required co-ordinates of the points are:

P$\left(-1, \frac{7}{2}\right)$, Q(0, 5), R$\left(1, \frac{13}{2}\right)$

Ex.10 If the point C(–1,2) divides the lines segment AB in the ratio 3 : 4, where the co-ordinates of A are (2, 5), find the coordinates of B.

Sol. Let C (–1, 2) divides the line joining A (2, 5) and B (x, y) in the ratio 3 : 4. Then,

C $\left(\frac{3x+8}{7}, \frac{3y+20}{7}\right)$ = C (–1, 2)

$\Rightarrow \frac{3x+8}{7} = -1$ & $\frac{3y+20}{7} = 2$

$\Rightarrow$ 3x + 8 = – 7 & 3y + 20 = 14

$\Rightarrow$ x = – 5 & y = – 2

The coordinates of B are : B (–5, – 2)

Ex.11 Find the ratio in which the line segment joining the points (1, – 7) and (6, 4) is divided by x-axis.

Sol. Let C (x, 0) divides AB in the ratio k : 1.

By section formula, the coordinates of C are given by :

C$\left(\frac{6k+1}{k+1}, \frac{4k-7}{k+1}\right)$

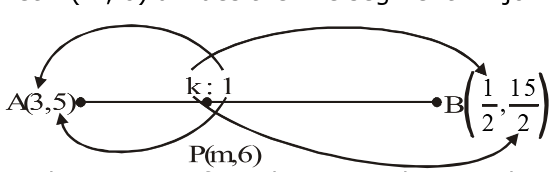
But C (x, 0) = C $\left(\frac{6k+1}{k+1}, \frac{4k-7}{k+1}\right)$

$\Rightarrow \frac{4k-7}{k+1} = 0 \Rightarrow 4k - 7 = 0 \Rightarrow k = \frac{7}{4}$

i.e., the x-axis divides AB in the ratio 7 : 4.

Ex.12 Find the value of m for which coordinates (3,5), (m,6) and $\left(\frac{1}{2}, \frac{15}{2}\right)$ are collinear.

Sol. Let P (m, 6) divides the line segment AB joining A (3,5), B $\left(\frac{1}{2}, \frac{15}{2}\right)$ in the ratio k : 1.



Applying section formula, we get the co-ordinates of P :

$$\left(\frac{\frac{1}{2}k+3\times 1}{k+1},\frac{\frac{15}{2}k+5\times 1}{k+1}\right)=\left(\frac{k+6}{2(k+1)},\frac{15k+10}{2(k+1)}\right)$$

But P (m, 6) = $P\left(\frac{k+6}{2(k+1)},\frac{15k+10}{2(k+1)}\right)$

$\Rightarrow$ m = $\frac{k+6}{2(k+1)}$ and also $\frac{15k+10}{2(k+1)}$ = 6

$\Rightarrow$ $\frac{15k+10}{2(k+1)}$ = 6 $\Rightarrow$ 15k + 10 = 12(k + 1)

$\Rightarrow$ 15k + 10 = 12k + 12 $\Rightarrow$ 15k – 12k = 12 – 10

$\Rightarrow$ 3k = 2 $\Rightarrow$ k = $\frac{2}{3}$

Putting k = $\frac{2}{3}$ in the equation m = $\frac{k+6}{2(k+1)}$ we get :

$$m = \frac{\left(\frac{2}{3}+6\right)}{2\left(\frac{2}{3}+1\right)}=\frac{\left(\frac{2+18}{3}\right)}{2\left(\frac{2+3}{3}\right)}$$

$$= \frac{20}{3}\times\frac{3}{10}=\frac{20}{10} \quad \left(\because k=\frac{2}{3}\right) \quad m = \frac{10\times 2}{10} = 2$$

Required value of m is 2 $\Rightarrow$ m = 2

Ex.13 The two opposite vertices of a square are (–1, 2) and (3, 2). Find the co-ordinates of the other two vertices.

Sol. Let ABCD be a square and two opposite vertices of it are A(–1, 2) and C(3, 2). ABCD is a square.

$\Rightarrow$ AB = BC $\Rightarrow$ $AB^2 = BC^2$

$\Rightarrow$ $(x + 1)^2 + (y - 2)^2 = (x - 3)^2 + (y - 2)^2$

$\Rightarrow$ $x^2 + 2x + 1 = x^2 - 6x + 9$

$\Rightarrow$ 2x + 6x = 9 – 1 = 8 $\Rightarrow$ 8x = 8 $\Rightarrow$ x = 1

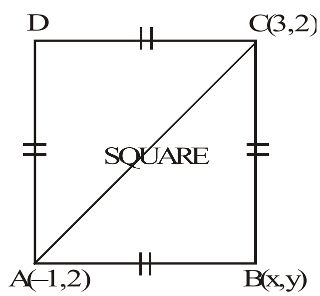
ABC is right Δ at B, then

$AC^2 = AB^2 + BC^2$ (Pythagoras theorem)

$\Rightarrow$ $(3 + 1)^2 + (2 - 2)^2$

$= (x + 1)^2 + (y - 2)^2 + (x - 3)^2 + (y - 2)^2$

$\Rightarrow$ $16 = 2(y - 2)^2 + (1 + 1)^2 + (1 - 3)^2$



$\Rightarrow$ $16=2(y-2)^2+4+4$ $\Rightarrow$ $2(y-2)^2=16-8=8$

$\Rightarrow$ $(y - 2)^2 = 4$ $\Rightarrow$ y – 2 = $\pm$2 $\Rightarrow$ y = 4 and 0

i.e. when x = 1 then y = 4 and 0

Co-ordinates of the opposite vertices are : B(1, 0) or D(1, 4)

Ex.14 The co-ordinates of the vertices of ΔABC are A(4, 1), B(−3, 2) and C(0, k). Given that the area of ΔABC is 12 unit^2. Find the value of k.

Sol. Area of ΔABC formed by the given-points A(4, 1), B(−3, 2) and C(0, k) is

$= \frac{1}{2} | 4 (2 - k) + (-3) (k - 1) + 0 (1 - 2)|$

$= \frac{1}{2} |8 - 4k - 3k + 3| = \frac{1}{2} (11 - 7k)$

But area of ΔABC = 12 unit^2 .... (given)

$\frac{1}{2} |11 - 7k| = 12$

$\Rightarrow |11 - 7k| = 24 \pm (11 - 7k) = 24$ $\Rightarrow$ $11 - 7k = 24$ or $-(11 - 7k) = 24$

$-7k = 24 - 11 = 13$

$\Rightarrow$ $k = -\frac{13}{7}$ or $-(11 - 7k) = 24$ $\Rightarrow$ $-11 + 7k = 24 \Rightarrow 7k = 24 + 11 = 35$

$\Rightarrow$ $k = \frac{35}{7} = 5$

Hence the values of k are : 5, $\frac{-13}{7}$.

Ex.15 Find the area of the quadrilateral whose vertices taken in order are (−4, −2), (−3, −5), (3, −2) and (2, 3).

Sol. Join A and C. **[NCERT]**

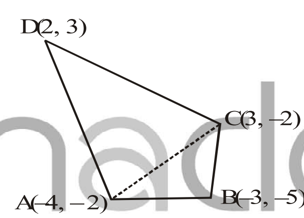
The given points are A(−4, −2), B(−3, −5), C(3, −2) and D(2, 3)

Area of ΔABC

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

$= \frac{1}{2} | 20 - 8 - 6 + 15|$

$= \frac{21}{2} = 10.5$ sq. units



Area of ΔACD

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

$= \frac{1}{2} | 20 + 15| = \frac{35}{2} = 17.5$ sq. units.

Area of quadrilateral ABCD = ar. (ΔABC) + ar. (ΔACD) = (10.5 + 17.5) sq. units = 28 sq. units

Ex.16 Find the value of p for which the points (−1, 3), (2, p), (5, −1) are collinear.

Sol. The given points A (−1, 3), B (2, p), C (5, − 1) are collinear.

$\Rightarrow$ Area ΔABC formed by these points should be zero.

$\Rightarrow$ The area of $\Delta ABC = 0$

$\Rightarrow$ $\frac{1}{2} |x_1 (y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)| = 0$

$\Rightarrow$ $-1(p+1) + 2(-1 - 3) + 5(3 - p) = 0$

$\Rightarrow$ $-p - 1 - 8 + 15 - 5p = 0$

$\Rightarrow$ $-6p + 15 - 9 = 0 \Rightarrow -6p = -6 \Rightarrow p = 1$

Hence the value of p is 1.

EXERCISE – 1

• Distance Formula

1. Find the points on the line through A(5, –4) and B(–3, 2) that are twice as far from A as from B.
2. Show that the points A (a, a), B (– a, – a) and C (– a$\sqrt{3}$, a$\sqrt{3}$) form an equilateral triangle.
3. Find the value of x such that PQ = QR, where P, Q and R are (6, – 1), (1, 3) and (x, 8) respectively.
4. Show that the points (1, 7), (4, 2) (–1, – 1) and (–4, 4) are the vertices of a square.
5. Show that the points A(2, –2), B(14, 10), C(11, 13) and D(–1, 1) are the vertices of a rectangle.
6. Name the type of quadrilateral formed by the following points and give reasons for your answer
   (i) (–1, –2), (1, 0), (–1, 2), (–3, 0)
   (ii) (4, 5), (7, 6), (4, 3), (1, 2)
7. If two vertices of an equilateral triangle are (0, 0) and (3, 0), find the third vertex.
8. The centre of a circle is C(2α – 1, 3α + 1) and it passes through the point A(–3, –1). If a diameter of the circle of length 20 units, find the value (s) of α.
9. (i) Find the centre of a circle passing through the points (6, –6), (3, –7) and (3, 3). Also find its radius
   (ii) Find the coordinates of the point equidistant from the three given points A(5, 1), B(–3, –7) and C(7, –1).
10. (i) If the points A(6, 1), B(8, 2), C(9, 4) and D(p, 3), taken in order, are the vertices of a parallelogram, find the values of p.
    (ii) If A(1, 2), B(4, q), C(p, 6) and D(3, 5), taken in order, are the vertices of parallelogram, find the values of p and q.
11. Find the distance the points
    (i) R (a + b, a – b) and S (a – b, – a – b)
    (ii) A $\left(at_1^2, 2at_1\right)$ and B $\left(at_2^2, 2at_2\right)$
12. Find the equation of the perpendicular bisector of AB, where A and B are the points (3, 6) and (-3, 4) respectively. Also, find its point of intersection with (i) x – axis (ii) y – axis
13. If P and Q are two points whose coordinates are $\left(at^2, 2at\right)$ and $\left(\frac{a}{t^2}, \frac{2a}{t}\right)$ respectively and S is the point (a, 0).

    Show that $\frac{1}{SP} + \frac{1}{SQ}$ is independent of t.
14. Prove that the points (-2, 5) (0, 1) and (2, -3) are collinear.
15. Find a point which is equidistant from the points A (-5, 4) and B(-1, 6). How many such points are there?
16. The centre of a circle is (2a, a – 7). Find the values of a if the circle passes through the point (11, - 9) and has diameter $10\sqrt{2}$ units.
17. If (-4, 3) and (4, 3) are two vertices of an equilateral triangle, find the coordinates of the third vertex, given that the origin lies in the (i) interior, (ii) exterior of the triangle.
18. Find the centre of the circle passing through (5, - 8) (2, - 9) and (2, 1).
19. If two opposite vertices of a square are (5, 4) and (1, - 6), find the coordinates of its remaining two vertices.

• Section Formula

20. Find the ratio in which that line segment joining (2, –3) and (5, 6) is divides by x-axis.
21. Find the vertices of a triangle, the mid- point of whose sides are (3, 1), (5, 6) and (–3, 2).
22. Find the ratio in which the point (2, y) divides the join (– 4 , 3) and (6, 3) and hence find the value of y.

23. Find the ratio in which the y-axis divides the line segment joining the points (5,–6) and (–1, –4). Also find the coordinates of the point of intersection.
24. (i) Determine the ratio in which the point (–6, a) divides the join of A(–3, –1)and B(–8, 9). Also find the value of a.

    (ii) Find the ratio in which the point P whose ordinate is –3 divides the join of A(–2, 3) and B$\left(5,-\frac{15}{2}\right)$. Hence find the coordinates of P.
25. Determine the ratio in which the line 3x + y – 9 = 0 divides the segment joining the points (1, 3) and (2, 7).
26. Find the ratio in which the point (-3, p) divides the line segment joining the points (-5, -4) and (-2, 3). Hence, find the value of p.
27. If A (-2, -1), B (a, 0), C (4, b) and D (1, 2) are the vertices of a parallelogram, find the values of a and b.
28. Find the lengths of the medians of a Δ ABC whose vertices are A (7, - 3), B (5, 3) and C (3, - 1).
29. Point p divides the line segment joining the points A (2, 1) and B (5, - 8) such that $\frac{AP}{AB} = \frac{1}{3}$. If p lies on the line 2x – y + k = 0, find the value of k.
30. Find the coordinates of the points which divide the line segment joining the points (-4, 0) and (0, 6) in four parts.
31. Three vertices of a parallelogram are (a + b, a – b), (2a + b, 2a – b), (a – b, a + b). Find the fourth vertex.
32. If two vertices of a parallelogram are (3, 2), (-1, 0) and the diagonals cut at (2, - 5), find the other vertices of the parallelogram.
33. Use analytical geometry to prove that the mid – point of the hypotenuse of a right angled triangle is equidistant from its vertices.
34. A (3, 2) and B(-2, 1) are two vertices of a triangle ABC whose centroid G has the coordinates (5/3, - 1/3). Find the coordinates of the third vertex C of the triangle.
35. If (-2, 3), (4, - 3) and (4, 5) are the mid – points of the sides of a triangle, find the coordinates of its centroid.
36. Prove analytically that the line segment joining the middle points of two sides of a triangle is equal to half of the third side.

- **Area of a Triangle**

37. Show that the points P$\left(\frac{-3}{2}, 3\right)$, Q(6, –2) and R(–3, 4) are collinear.
38. P(2, 1), Q(4, 2), R(5, 4) and S(3, 3) are vertices of a quadrilateral, find the area of quadrilateral PQRS.
39. If A(4, –6), B(3, –2) and C(5, 2) are the vertices of a triangle and D is mid-point of BC, find the coordinates of the point D. Also find the areas of Δs ABD and ACD. Hence verify that the median AD divides the triangle ABC two triangles of equal areas.
40. A, B and C are the points (0, –1), (2, 1) and (0, 3) respectively, and D, E and F are mid- points of the sides BC, CA and AB respectively. Prove analytically that the area of ΔABC is 4 times the area of ΔDEF.
41. If A(–5, 7), B(–4, –5), C(–1, –6) and D(4, 5) are the vertices of a quadrilateral, find the area of the quadrilateral ABCD.
42. Let A(4, 2), B(6, 5) and C(1, 4) be the vertices of ΔABC.

    (i) The median from A meets BC at D. Find the coordinates of the point D.

    (ii) Find the coordinates of the point G on AD such that AG : GD = 2 : 1

    (iii) Find the areas of Δs GBC and ABC and verify that the area of ΔABC is 3 times the area of ΔGBC.

43. Find the condition that the point (x, y) may lie on the line joining (3, 4) and (-5, -6).
44. If the points (p, q), (m, n) and (p – m, q – n) are collinear, show that pn = qm.
45. If the area of ΔABC formed by A (x, y), B (1, 2) and C (2, 1) is 6 square units, then prove that x + y = 15 or, x + y + 9 = 0.
46. If the vertices of a triangle have integral coordinates, prove that the triangle cannot be equilateral.

47. The coordinates of A, B, C are (6, 3), (-3, 5) and (4, - 2) respectively and P is any point (x, y). Show the ratio of the areas of triangles PBC and ABC is $\left|\frac{x+y-2}{7}\right|$.
48. Prove that the points (a, b), (a_1, b_1) and $(a - a_1, b - b_1)$ are collinear if $ab_1 = a_1b$
49. If the vertices of a triangle are (1, - 3), (4, p) and (-9, 7) and its area is 15 aq. units, find the value (s) of p.

50. If $a \neq b \neq c$, prove that the points (a, a^2), (b, b^2), (c, c^2) can never be collinear.
51. If three points $(x_1, y_1), (x_2, y_2), (x_3, y_3)$ lie on the same line, prove that $\frac{y_2-y_3}{x_2x_3} + \frac{y_3-y_1}{x_3x_1} + \frac{y_1-y_2}{x_1x_2} = 0$.
52. If the points A (1, - 2), B (2, 3), C (a, 2) and D (-4, -3) form a parallelogram, find the value of a and height of the parallelogram taking AB as base.
53. A (6, 1), B (8, 2) and C (9, 4) are three vertices of a parallelogram ABCD. If E is the mid – point of DC, find the area of ΔADE.

EXERCISE – 2

1. Show that the point A(5, 6), B(1, 5) C(2, 1) and D(6, 2) are the vertices of a square.

2. Determine the ratio in which the point P(m, 6) divides the join of A(–4, 3) and B(2, 8). Also find the value of m.

3. A(3, 2) and B(–2, 1) are two vertices of a triangle ABC, whose centroid G has coordinates $\left(\frac{5}{3},-\frac{1}{3}\right)$. Find the coordinates of the third vertex C of the triangle.

4. Show that the points A(2, –2), B(14, 10), C(11, 13) and D(–1, 1) are the vertices of a rectangle.

5. Prove that the coordinates of the centroid of a ΔABC, with vertices. A(x_1, y_1), B(x_2,y_2) and C(x_3,y_3) are given by $\left(\frac{x_1+x_2+x_3}{3},\frac{y_1+y_2+y_3}{3}\right)$.

6. Determine the ratio in which the point (–6, a) divides the join of A(–3, –1) and B(–8, 9). Also find the value of a.

7. Find the point on the x-axis which is equidistant from the points (–2, 5) and (2, –3)

8. Prove that the points A(0, 1), B(1, 4), C(4, 3) and D(3, 0) are the vertices of a square.

9. Find the value of K, if the points A(8, 1), B(3, –4) and C(2, K) are collinear.

10. Point P divides the line segment joining the points A(–1, 3) and B(9, 8) such that $\frac{AP}{PB}=\frac{K}{1}$. If P lies on the line x – y + 2 = 0, find the value of K.

11. If the points (p, q), (m, n) and (p – m, q – n) are collinear, show that pn = qm.

12. The coordinates of the mid-point of the line joining the points (3p, 4) and (– 2, 2q) are (5, p). Find the values of p and q.

13. Two vertices of a triangle are (1, 2) and (3, 5). If the centroid of the triangle is at the origin, find the coordinates of the third vertex.

14. If 'a' is the length of one of the sides of an equilateral triangle ABC, base BC lies on x-axis and vertex B is at the origin, find the coordinates of the vertices of the triangle ABC

15. Find the ratio in which the line-segment joining the points (6, 4) and (1, –7) is divided by x-axis.

16. The coordinates of two vertices A and B of a triangle An are (1, 4) and (5, 3) respectively. lf the coordinates of the centroid of DABC are (3, 3), find the coordinates of the third vertex C.

17. Find the value of m for which the points with coordinates (3, 5), (m, 6) and $\left(\frac{1}{2},\frac{15}{2}\right)$ are collinear.

18. Find the value of x such that PQ = QR where the coordinates of P, Q and R are (6, –1); (1,3) and (x, 8) respectively.

19. Find a point on x-axis which is equidistant from the points (7, 6) and (–3, 4).

20. The line-segment joining the points (3, –4) and (1, 2) is trisected at the points P and Q. If the coordinates of P and Q are (p, –2) and $\left(\frac{5}{3},q\right)$ respectively, find the values of p and q.

21. Prove that the points (0, 0), (5, 5) and (–5, 5) are vertices of a right isosceles triangle.

22. If the point P(x, y) is equidistant from the point A(5,1) and B(–1, 5), prove that 3x=2y.

23. The line joining the points (2, 1) and (5, –8) is trisected at the points P and Q. If point P lies on the line 2x – y + k = 0, find the value of k.

24. Show that the points (0, –1); (2, 1); (0, 3) and (–2, 1) are the vertices of a square.

25. Find the value of K such that the point (0, 2) is equidistant from the points (3, K) and (K, 5).

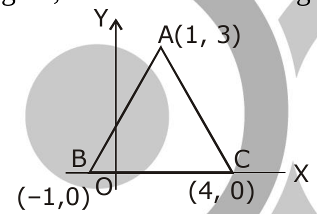
26. The base BC of an equilateral ΔABC lies on y-axis. The coordinates of point C are (0, –3). lf the origin is the mid-point of the base BC, find the coordinates of the points A and B.
27. Find the coordinates of the point equidistant from the points A(1, 2), B(3, – 4) and C(5,–6).
28. Prove that the points A (–4, –1), B (–2, – 4), C (4, 0) and D (2, 3) are the vertices of a rectangle.
29. Find the coordinates of the points which divide the line-segment joining the points (– 4,0) and (0, 6) in three equal parts. $\left(\frac{-8}{3},2\right),\left(\frac{-4}{3},4\right)$
30. Two vertices of ΔABC are given by A (2, 3) and B (–2, 1) and its centroid is $G\left(1,\frac{2}{3}\right)$. Find the coordinates of the third vertex C of the ΔABC.
31. Show that the points A(1, 2), B(5, 4), C(3, 8) and D (–1, 6) are the vertices of a square.
32. Find the co-ordinates of the point equidistant from three given points A (5, 1), B(–3, –7) and C(7,–1).
33. Find the value of p for which the points (–1,3), (2, p) and (5,–1) are collinear.
34. If the points (10, 5), (8,4) and (6,6) are the mid· points of the sides of a triangle, find its vertices.
35. In what ratio is the line segment joining the points (–2, – 3) and (3, 7) divided by the y-axis? Also, find the coordinates of the point of division.
36. If A (5, – 1), B (– 3, – 2) and C (–1, 8) are the vertices of triangle ABC, find the length of median through A and the coordinates of the centroid.
37. If (–2, –1); (a, 0); (4, b) and (1,2) are the vertices of a parallelogram, find the values of a and b.
38. Show that the points (7, 10), (–2, 5) and (3, –4) are the vertices of an isosceles right triangle.
39. In what ratio does the lines x – y – 2 = 0 divides the line segment joining (3, –1) and (8, 9)?
40. Three consecutive vertices of a parallelogram are (–2, 1); (1, 0) and (4, 3). Find the coordinates of the fourth vertex.
41. If the point C (– 1, 2) divides the line segment AB in the ratio 3 : 4, where the coordinates of A are (2, 5), find the coordinates of B.
42. For what value of p, are the points (2, 1), (p, –1) and (–1, 3) collinear?
43. Determine the ratio in which the line 3x + 4y – 9 = 0 divides the line segment joining the points (1, 3) and (2, 7).
44. If the distances of P(x, y) from the points A(3, 6) and B(– 3, 4) are equal, prove that 3x + y = 5.
45. For what value of p, the points (– 5, 1), (1, p) and (4, –2) are collinear?
46. For what value of k are the points (1, 1), (3, k) and (–1, 4) are collinear?
47. Find the area of the ΔABC with vertices A(– 5, 7), B(– 4, – 5) and C(4, 5)
48. If the point P(x, y) is equidistant from the points A(3, 6) and B(–3, 4) prove that 3x + y – 5 = 0.
49. The point R divides the line segment AB, where A(–4, 0) and B(0, 6) such that AR = . Find the co-ordinates of R.
50. The co-ordinates of A and B are (1, 2) and (2, 3) respectively. If P lies on AB find co-ordinates of P such that $\frac{AP}{PB}=\frac{4}{3}$.
51. If A(4, – 8), B(3, 6) and C(5, –4) are the vertices of a ΔABC, D is the mid point of BC and P is a point on AD joined such that $\frac{AP}{PD}=2,$ find the co-ordinates of P.
52. Find the value of k if the points (k, 3), (6, – 2) and (– 3, 4) are collinear.
53. If P divides the join of A(– 2, – 2) and B(2, – 4) such that $\frac{AP}{AB}=\frac{3}{7},$ find the co-ordinates of P.
54. The mid points of the sides of a triangle are (3, 4), (4, 6) and (5, 7). Find the co-ordinates of the vertices of the triangle.

55. Show that A(–3, 2), B(–5, – 5), C(2, – 3) and D(4, 4) are the vertices of a rhombus.
56. Find the ratio in which the line 3x + y – 9 = 0 divides the line-segment joining the points (1, 3) and (2, 7).
57. Find the distance between the points $\left(\frac{-8}{5},2\right)$ and $\left(\frac{2}{5},2\right)$.
58. Find the point on y-axis which is equidistant from the points (5, – 2) and (– 3, 2).
59. The line segment joining the points A(2, 1) and B(5, – 8) is trisected at the points P and Q such that P is nearer to A. If P also lies on the line given by 2x – y + k = 0, find the value of k.
60. If P(x, y) is any point on the line joining the points A(a, 0) and B(0, b), then show that $\frac{x}{a}+\frac{y}{b}=1$.
61. Find the point on x-axis which is equidistant from the points (2, – 5) and (– 2, 9)
62. The line segment joining the points P(3, 3), Q(6, – 6) is trisected at the points A and B such that A is nearer to P. If A also lies on the line given by 2x + y + k = 0, find the value of k.
63. If the points A(4, 3) and B(x, 5) are on the circle with the centre O(2, 3), find the value of x.
64. Find the ratio in which the point (2, y) divides the line segment joining the points A(–2, 2) and B(3, 7). Also find the value of y.
65. Find the area of the quadrilateral ABCD whose vertices are A(–4,–2), B(–3,–5),C(3,–2) and D(2, 3).
66. Find the area of the triangle formed by joining the mid-points of the sides of the triangle whose vertices are (0, – 1), (2, 1) and (0, 3).
67. If the mid-point of the line segment joining the points P(6, b – 2) and Q(– 2, 4) is (2, – 3), find the value of b.
68. Show that the points (–2, 5), (3, – 4) and (7, 10) are the vertices of a right angled isosceles triangle.
69. The centre of a circle is (2α – 1, 7) and it passes through the point (– 3, – 1). If the diameter of the circle is 20 units, then find the value(s) of α.
70. If C is a point lying on the line segment AB joining A(1, 1) and B(2, – 3) such that 3AC = CB, then find the co-ordinates of C.
71. Find a relation between x and y if the points (x, y), (1, 2) and (7, 0) are collinear.
72. If the points (–2, 1), (a, b) and (4, – 1) are collinear and a – b = 1, then find the values of a and b.
73. Find the value of K, if the points A(7, – 2), B(5, 1) and C(3, 2K) are collinear.

EXERCISE – 3

1. If the distance between the points (x, 2) and (3, –6) is 10 units, then positive value of x is
   (a) 3 (b) 9 (c) 6 (d) 1
2. The values of y for which the distance between the points (2, –3) and (10, y) is 10 units, are
   (a) –3, 9 (b) 5, 1 (c) –5, 1 (d) –9, 3
3. The distance between the points (a cos θ + b sin θ, 0) and (0, asin θ – b cos θ) is
   (a) $a^2 + b^2$ (b) $\sqrt{a^2+b^2}$ (c) a + b (d) $a^2 - b^2$
4. If A and B are the points (–6, 7) and (–1, –5), then 2AB is equal to
   (a) 238 (b) 13 (c) 169 (d) 26
5. The coordinates of the point on y-axis which is equidistant from the points, (4,–3) and (5, 2) are
   (a) (0, 20) (b) (0, –23) (c) $\left(0,\frac{2}{5}\right)$ (d) $\left(0,\frac{4}{5}\right)$
6. If the distance between the points (4, y) and (1, 0) is 5 units, then y is equal to
   (a) ±4 (b) 4 (c) –4 (d) 0
7. If P (2, 2), Q(–4, –4) and R(5, –8) are the vertices of a ΔPQR, then length of median through R is
   (a) $\sqrt{117}$ units (b) $\sqrt{85}$ units (c) $\sqrt{113}$ units (d) $\sqrt{65}$ units
8. The points (a, b + c), (b, c + a) and (c, a + b) are
   (a) vertices of an equilateral triangle
   (b) vertices of an isosceles triangle
   (c) vertices of a right triangle
   (d) collinear
9. If the points (k, 2k), (3k, 3k) and (3, 1) are collinear, then value of k is
   (a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $-\frac{1}{3}$ (d) $-\frac{2}{3}$
10. If A (5, 3), B(11, –5) and C(12, y) are the vertices of a right angled triangle, right angled at C, then values of y are
    (a) 2, 4 (b) –2, 4 (c) 2, –4 (d) –4, –2
11. If the points A(x, 2), B(–3, –4) and C(7, –5) are collinear, then x is
    (a) –63 (b) 63 (c) 60 (d) –60
12. If the points (x, 2x), (–2, 6) and (3, 1) are collinear, then value of x is
    (a) $\frac{3}{4}$ (b) $\frac{3}{5}$ (c) $\frac{5}{3}$ (d) $\frac{4}{3}$
13. The area of the triangle formed by the points (a, b + c), (b, c + a), and (c, a + b) is
    (a) 0 (b) a + b + c (c) abc (d) $(a + b + c)^2$
14. If the area of the triangle formed by the points $\left(x,\frac{4}{3}\right)$, (–2, 6) and (3, 1) is 5 sq units, then x is
    (a) 3 (b) 5 (c) $\frac{2}{3}$ (d) $\frac{3}{5}$
15. The coordinates of the centroid of the triangle whose vertices are (1, 3), (–2, 7) and (5, –3), are
    (a) (4, 7) (b) $\left(\frac{4}{3},\frac{7}{3}\right)$ (c) $\left(2,\frac{7}{2}\right)$ (d) $\left(\frac{8}{3},\frac{7}{3}\right)$
16. The coordinates of the consecutive vertices of a parallelogram are (1, 3), (–1, 2) and (2, 5). The coordinates of the fourth vertex are
    (a) (6, 4) (b) (4, 6) (c) (–2, 0) (d) (–4, –6)
17. The centroid of a triangle is the point (1, 4), If its two vertices are (4, –3) and (–9, 7), then the third vertex is
    (a) (–3, 4) (b) (7, 4) (c) (4, 7) (d) (8, 8)

18. The mid-point of segment AB is the point (4, 0). If the coordinates of A are (3, –2), then the coordinates of the point B are
(a) (5, 2) (b) (11, –2) (c) (9, 2) (d) (9, –2)
19. The line segment joining the points (–3, –4) and (1, –2) is divided by the y-axis in the ratio
(a) 1 : 3 (b) 2 : 3 (c) 3 : 1 (d) 3 : 2
20. The ratio in which the point (1, 3) divides the line segment joining the points (–1, 7) and (4, –3) is
(a) 3 : 2 (b) 2 : 3 (c) –2 : 3 (d) 3 : –2
21. The distance of the point (–3, 4) from the origin is
(a) 5 units (b) 7 units (c) 25 units (d) 1 unit
22. The distance between the points P(–1, -5) and Q(–6, 7) is
(a) 12 units (b) 13 units (c) 15 units (d) 169 units
23. The distance between the points (a,b) and (–a,–b) is
(a) $2\sqrt{a^2+b^2}$ (b) $\sqrt{2}\,a$ (c) 2 b (d) 2 | a |
24. If the distance between the points (p, – 5) and (2, 7) is 13 units, then the values of p are
(a) 3, 7 (b) –3, 7 (c) 3, – 7 (d) –3, –7
25. The area of a square whose vertices are A(0, –2, B(3, 1), C(0, 4) and D(–3, 1) is
(a) 18 sq. units (b) 15 sq. units (c) $\sqrt{18}$ sq. units (d) $\sqrt{15}$ sq. units
26. In the adjoining figure, the area of the triangle ABC is



(a) 15 sq. units (b) 10 sq. units (c) 7.5 sq. units (d) 2.5 sq. units
27. The point on the x-axis which is equidistant from the points A(–2, 3) and B(5, 4) is
(a) (0, 2) (b) (2, 0) (c) (3, 0) (d) –2, 0)
28. If A is an point on the y-axis whose ordinate is 5 and B is the point (–3, 1), then the length of AB is
(a) 8 units (b) 5 units (c) 3 units (d) 25 units
29. The coordinates of the mid-point of the line segment joining the points A(–4, –3) and B(2, 7) are
(a) (–2, –4) (b) (–2, 4) (c) (2, 4) (d) (–1, 2)
30. If the end points of a diameter of a circle are A(–2, 3) and B(4,–5), then the coordinates of its centre are
(a) (2, –2) (b) (1, –1) (c) (–1, 1) (d) (–2, 2)
31. If one end of a diameter of a circle is (2, 3) and the centre is (–2, 5) then the other end is
(a) (–6, 7) (b) (6, –7) (c) (0, 8) (d) (0, 4)
32. If the mid-point of the line segment joining the points P(a, b–2) and Q(–2, 4) is R(2, –3), then the values of a and b are
(a) a = 4, b= –5 (b) a = 6, b = 8 (c) a = 6, b = –8 (d) a = –6, b = 8
33. The coordinates of the point which divides the join of(–1, 7) and (4, –3) in the ratio 2 : 3 internally are
(a) (1, –3) (b) (–1, 3) (c) (–1, –3) (d) (1, 3)
34. The ratio in which the point C(–4, 6) divides the line segment joining the points A(–6, 10) and B(3, –8) is
(a) 2 : 7 (b) 7 : 2 (c) 2 : 5 (d) 5 : 2
35. The ratio in which the line segment joining the points (4, 6) and (–7, –1) is divided by the x-axis is
(a) 1 : 6 (b) 4 : 7 (c) 7 : 4 (d) 6 : 1
36. The centroid of the triangle whose vertices are (3, –7), (–8,6) and (5, 10) is
(a) (0, 9) (b) (0, 3) (c) (1, 3) (d) (3, 3)
37. If the points A(2, 3), B(4,k) and C(6, –3) are collinear, then the value of k is
(a) 1 (b) –1 (c) 0 (d) 3
38. The area (in sq. units) of the triangle formed by the points A(5, 2), B(4, 7) and C(7, –4) is
(a) –4 (b) 4 (c) –2 (d) 2

39. What point on x-axis is equidistant from the points A(7, 6) and B(–3, 4) ?
(a) (0, 4) (b) (–4, 0) (c) (3, 0) (d) (0, 3)

40. A point P divides the join of A(5, –2) and B(9, 6) in the ratio 3 : 1. The coordinates of P are
(a) (4, 7) (b) (8, 4) (c) (12, 8) (d) $\left(\frac{11}{2}, 5\right)$

41. In what ratio does the point P(1, 2) divide the join of A(–2, 1) and B(7, 4) ?
(a) 1 :2 (b) 2 :1 (c) 3 :2 (d) 2 :3

42. The point which divides the line segment joining the points A(7, –6) and B(3, 4) in the ratio 1 :2 lies in
(a) I quadrant (b) II quadrant (c) III quadrant (d) IV quadrant

43. In what ratio does the x-axis divide the join of A(2 –3) and B(5, 6) ?
(a) 2 :3 (b) 3 :5 (c) 1 :2 (d) 2 : 1

44. In what ratio does the y-axis divide the join of P(–4, 2) and Q(8, 3) ?
(a) 3 : 1 (b) 1 :3 (c) 2 : 1 (d) 1 :2

45. If P(–1, 1) is the midpoint of the line segment joining A(–3, 6) and B(1, b+ 4), then b = ?
(a) 1 (b) –1 (c) 2 (d) 0

46. If P $\left(\frac{a}{3}, 4\right)$ is the midpoint of the line segment joining A(–6, 5) and B(–2, 3), then a = ?
(a) –4 (b) –12 (c) 12 (d) –6

47. If the distance between the points A(2, –2) and B(–1, x) is 5, then
(a) x = –3 or x = 4 (b) x = 3 or x = –4 (c) x = –6 or x = 2 (d) x = 6 or x = –2

48. The line 2x + y – 4 = 0 divides the line segment joining A(2, –2) and B(3, 7) in the ratio
(a) 2 : 5 (b) 2 : 9 (c) 2 : 7 (d) 2 : 3

49. If A(4, 2), B(6, 5) and C(1, 4) be the vertices of ΔABC and AD is the median, then the coordinates of D are
(a) $\left(\frac{5}{2}, 3\right)$ (b) $\left(5, \frac{7}{2}\right)$ (c) $\left(\frac{7}{2}, \frac{9}{2}\right)$ (d) none of these

50. Two vertices of ΔABC are A(–1, 4) and B(5, 2) and its centroid is G(0, –3). Then, the coordinates of C are
(a) (4, 3) (b) (4, 15) (c) (–4, –15) (d) (–15, –4)

51. The three vertices of a parallelogram ABCD are A(–2, 3), B(6, 7) and C(8, 3). The fourth vertex D is
(a) (1, 0) (b) (0, 1) (c) (–1 ,0) (d) (0, –1)

52. The points A(–4, 0), B (4, 0) and C(0, 3) are the vertices of a triangle. which is
(a) isosceles (b) equilateral (c) scalene (d) right-angled

53. The points P(0, 6), Q(–5, 3) and R(3, 1) are the vertices of a triangle, which is
(a) equilateral (b) isosceles (c) scalene (d) right -angled

54. The points (a, a), (–a, –a) and $\left(-\sqrt{3}\,a, \sqrt{3}\,a\right)$ form the vertices of
(a) an equilateral triangle (b) a scalene triangle
(c) an isosceles triangle (d) a right triangle

55. Three points A(1 – 2), B(3, 4) and C(4, 7) form
(a) a straight line
(b) an equilateral triangle
(c) a right-angled triangle
(d) none of these

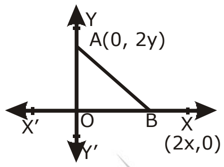
56. If the points A(2, 3), B(5, k) and C(6, 7) are collinear, then
(a) k = 4 (b) k = 6 (c) $k = \frac{-3}{2}$ (d) k = $\frac{11}{4}$

57. If the points A(1, 2), O(0, 0) and C(a, b) are collinear, then
(a) a = b (b) a = 2b (c) 2a = b (d) a + b = 0

58. The area of ΔABC with vertices A(a, b + c), B(b, c + a) and C(c, a + b) is
(a) $(a + b + c)^2$ (b) a + b + c (c) abc (d) 0

59. The point which lies on the perpendicular bisector of the line segment joining the points A(–2, –5) and B(2, 5) is
(a) (0, 0) (b) (0, 2) (c) (2, 0) (d) (–2, 0)

60. In the given figure A(0, 2y) and B(2x, 0) are the end points of line segment AB. The coordinates of point C which is equidistant from the three vertices of triangle AOB are



(a) (x, y) (b) (y, x) (c) $\left(\frac{x}{2}, \frac{y}{2}\right)$ (d) $\left(\frac{y}{2}, \frac{x}{2}\right)$

61. The points A(9, 0), B(9, 6), C(–9, 6) and D(–9, 0) are the vertices of a
(a) square (b) rectangle (c) rhombus (d) trapezium

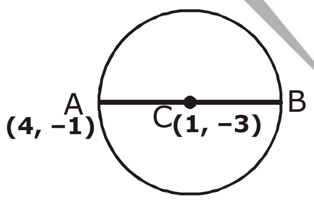
62. The area of ΔABC with vertices A(3, 0), B(7, 0) and C(8, 4) is
(a) 14 sq units (b) 28 sq units (c) 8 sq units (d) 6 sq units

63. AOBC is a rectangle whose three vertices are A(0,3), O(0, 0) and B(5, 0). Length of each of its disgonals is
(a) 5 units (b) 3 units (c) $\sqrt{34}$ units (d) 4 units

64. A line intersects the y-axis and x-axis at the points P and Q respectively. If (2, –5) is the midpoint of PQ, then the coordinates of P and Q are respectively
(a) (0, –5) and (2, 0)
(b) (0, –10) and (4, 0)
(c) (0, 10) and (–4, 0)
(d) (0, 4) and (–10 ,0)

65. A circle drawn with origin as the centre passes through the point $A\left(\frac{13}{2}, 0\right)$. Which of the following points does not lie in the interior of the circle ?
(a) $\left(\frac{-3}{4}, 1\right)$ (b) $\left(2, \frac{7}{3}\right)$ (c) $\left(5, \frac{-1}{2}\right)$ (d) $\left(-6, \frac{5}{2}\right)$

66. The coordinates of one end point of a diameter AB of a circle are A(4, –1) and the coordinates of the centre of the circle are C(1, –3). Then, the coordinates of B are



(a) (2, –5) (b) (–2, 5) (c) (–2, –5) (d) (2, 5)

67. The point on the x-axis which is equidistant from the points (5, 4) and (–2, 3) is
(a) (–2, 0) (b) (2, 0) (c) (0, 2) (d) (2, 2)

68. If the distances of p(x, y) from A(–1, 5) and B(5, 1) are equal, then
(a) 2x = y (b) 3x = 2y (c) 3x = y (d) 2x = 3y

69. If the point (x, y) is equidistant from the point (a + b, b – a) and (a – b, a + b), then which of the following is correct?
(a) ax = by (b) $ax^2 = by$ (c) ay = bx (d) $ay^2 = bx$

70. Which of the following points are the vertices of an equilateral triangle?
(a) (a, a), (–a, –a), (2a, a) (b) (a, a) (–a, –a), $(-a\sqrt{3}, a\sqrt{3})$
(c) $(\sqrt{2}a, -a), (a, \sqrt{2}a), (a, -a)$ (d) (0, 0), (a, a), $(a, \sqrt{2}a)$

71. If the points (–1, 3), (2, p) and (5, –1) are collinear, the value of p is
(a) 1 (b) –1 (c) 0 (d) $\sqrt{2}$
72. The co-ordinates of the point which divides the line joining (1, –2) and (4, 7) internally in the ratio 1 : 2 are
(a) (1, 2) (b) (–1, –1) (c) (–1, 2) (d) (2, 1)
73. In what ratio is the line joining the points A(4, 4) and B(7, 7) divided by p(–1, –1)?
(a) 8 : 5 (b) 5 : 8 (c) 5 : 7 (d) 7 : 4
74. If x – axis divides the line joining (3, 4) and (5, 6) in the ratio λ : 1 then λ is –
(a) $-\frac{3}{2}$ (b) $-\frac{2}{3}$ (c) $\frac{3}{4}$ (d) $\frac{1}{3}$
75. A triangle with vertices (4, 0), (-1 , - 1), (3, 5) is –
(a) Isosceles and right angled
(b) Isosceles but not right angled
(c) Right angled but not isosceles
(d) Neither right angled nor isosceles
76. Line formed by joining (-1, 1) and (5, 7) is divided by a line x + y = 4 in the ratio of
(a) 1 : 2 (b) 1 : 3 (c) 3 : 4 (d) 1 : 4
77. The area of triangle formed by the points (p, 2 – 2 p), (1 – p, 2p) is 70 sq. units. How many integral value of p are possible?
(a) 2 (b) 3 (c) 4 (d) None of these
78. The points (22, 23) divide the join of P (7, 5) and Q externally in the ratio 3 : 5, the Q =
(a) (3, 7) (b) (-3, 7) (c) (3, - 7) (d) (-3, - 7)
79. The third vertex of an equilateral triangle whose two vertices are (2, 4), (2, 6) is:
(a) $(\sqrt{3}, 5)$ (b) $(2\sqrt{3}, 5)$ (c) $(2+\sqrt{3}, 5)$ (d) (2, 5)
80. The point which divides the line segment joining the points (7, - 6) and (3, 4) in the ratio 1 : 2 internally lies in the :
(a) I quadrant (b) II quadrant (c) III quadrant (d) IV quadrant
81. If points (x, 0), (0, y) and (1, 1) are collinear then the relation is: **(NTSE Stage – 1 = 2013)**
(a) x + y = 1 (b) x+ y = xy (c) x + y + 1 = 0 (d) x + y + xy = 0
82. ΔABC has vertices A(- 4, 1), B (2, - 1), C (1, k). The number of possible values for k such that the triangle is isosceles is : **(NTSE Stage – 1 = 2014)**
(a) 1 (b) 3 (c) 5 (d) 4
83. The centre of a circle passing through the points (7, - 5), (3, - 7) and (3, 3) is **(NTSE Stage – 1 2014)**
(a) (5, - 6) (b) (5, - 1) (c) (3, 2) (d) (3, - 2)
84. P = (1, - 9), Q = (2, 5) and R = (6, 7) are the co-ordinates of the centroid from the following alternatives given – **(NTSE Stage – 1 = 2017)**
(a) $\frac{41}{7}$ (b) (1, 3) (c) (3, 1) (d) (- 3, 1)
85. If a point P $\left(\frac{23}{5}, \frac{33}{5}\right)$, divides line AB joining two points A(3, 5) and B(x, y) internally in ratio of 2 :3, then the values of x and y will be – **(NTSE Stage – 1 = 2018)**
(a) x = 4 , y = 7 (b) x = 5, y = 9 (c) x = 7, y = 9 (d) x = 7, y = 8
86. The sum of distances from x – axis and y – axis measured from the point (3, 5) will be **(NTSE Stage – 1 = 2019)**
(a) – 1 (b) 0 (c) 2 (d) 8
87. The foot of the perpendicular from P(-3, 2) to the Y – axis is M. co – ordinates of M are _____. **(NTSE Stage – 1 = 2019)**

(a) (3, 0) (b) (0, 2) (c) $\left(\frac{3}{2}, -1\right)$ (d) $(-3, 2)$

88. In right angled triangle ABC, m <B = 90°. ΔABC is in the first and second quadrant on the graph paper. The coordinates of the points A and C are (2, 5) and (-2, 3) respectively. Find the possible pairs of coordinates of point B from the following alternatives **(NTSE Stage – 1 = 2019)**
(a) (2, 5) or (2, 3) (b) (5, 2) or (3, 2) (c) (-2, 2) or (5, 3) (d) (2, - 2), or)5, 3)

89. Co – ordinates of a point on y – axis which is equidistant from the points (6, 4) and (- 4, 3) are] **(NTSE Stage – 1 = 2019)**
(a) (9, 0) (b) (0, 9) (c) (3, 2) (d) (0, 0)

EXERCISE – 4

1. Find the area of quadrilateral formed by joining the points (- 4, 2), (1, - 1), (4, 1) and (2, 5) in order.
(a) 25, 4 (b) 20, 5 (c) 24, 5 (d) None of these
2. Three points A (1, 2), B (3, 4) and C (4, 7) form:
(a) A straight line (c) An equilateral triangle
(c) A right angled triangle (d) None of these
3. The quadrilateral formed by the points (a, - b) (0, 0), (- a , b) and (ab, - b^2) is a:
(a) Rectangle (b) Parallelogram (c) Square (d) None of these
4. If (3, - 4) and (-6, 5) are the extremities of the diagonal of a parallelogram and (- 2, 1) is tis third vertex, then its fourth vertex is –
(a) (- 1, 0) (b) (-1, 1) (c) (0, -1) (d) None of these
5. The area of the triangle formed by the mid points of sides of the triangle whose vertices are (2, 1), (-2, 3), (4, - 3) is –
(a) 1.5 sq. units (b) 3 sq. units (c) 6 sq. units (d) 12 sq. units
6. Circumcenter of a triangle whose vertices are (0, 0), (4, 0) and (0, 6) is –
(a) $\left(\frac{4}{3}, 2\right)$ (b) (0, 0) (c) (2, 3) (d) (4, 6)
7. If a vertex of a triangle is (1, 1) and the mid – points of two sides through this vertex are (-2, 2) and (3, 2), then the centroid of the triangle is :
(a) $\left(\frac{1}{3}, \frac{7}{3}\right)$ (b) $\left(1, \frac{7}{3}\right)$ (c) $\left(-\frac{1}{3}, \frac{7}{3}\right)$ (d) $\left(-1, \frac{7}{3}\right)$
8. Find the coordinates of the circumcentre of the triangle whose vertices are (8, 6), (8, - 2) and (2, - 2) :
(a) (2, 3) (b) (5, 2) (c) (5, 3) (d) (7, 2)
9. If A(4, 2), B(6, 5) and C(1, 4) be the vertices of ABC and AD is the median, then the coordinates of D are
(a) $\left(\frac{5}{2}, 3\right)$ (b) $\left(5, \frac{7}{2}\right)$ (c) $\left(\frac{7}{2}, \frac{9}{2}\right)$ (d) None of these
10. The area of the triangle formed by the points (k, 2 – 2k), (- k + 1, 2k) and (- 4 – k, 6 – 2k) is 70 units. For
(a) Four real values of k
(b) No integral value of k
(c) Two integral values of k
(d) Only one integral value of k
11. The triangle with vertices A (2, 7) and D (4, y) and C (- 2, 6) is right angled at A if
(a) Y = - 1 (b) Y = 0 (c) Y = 1 (d) None
12. The join of the points (- 3, - 4) and (1, - 2) is divided by y – axis in the ratio.
(a) 1 : 3 (b) 2 : 3 (c) 3 : 1 (d) 3 : 2

13. If the vertices of a triangle ABC are A (- 4, - 1), B)(1, 2) and C (4, - 3), then the coordinates of the circumcentre of the triangle are
(a) (1/3, - 2/3) (b) (0, - 4) (c) (0, -2) (d) (-3/2, ½)

14. The extremities of a diagonal of a parallelogram are the point (3, - 4) and (-6, 5). If third vertex is (-2, 1) then the coordinates of the fourth vertex are
(a) (1, 0) (b) (0, 0) (c) (1, 1) (d) None

15. The area of a triangle, two of whose vertices are (2, 1) and (3, - 2) is 5. The coordinates of the third vertex can not be
(a) (6, - 1) (b) (4, 5) (c) (-1, 20) (d) (2, 9)

16. The centroid of a triangle lies at the origin and the coordinates of its two vertices are (-8, 0) and (9, 11), the area of the triangle in sq. unit is
(a) 11/8 (b) 8/11 (c) 88 (d) None

17. The line 3x + 2y = 24 meets the y – axis at A and the x – axis at B ; C is a point on the perpendicular bisector of AB such that the area of the triangle ABC is 91 sq. units. The coordinates of C can be
(a) (29/2, - 1) (b) (29/2, 13) (c) (- 13/2, 1) (d) (-13/2, 13)

18. The midpoints of sides of a triangle are (3, 4), (4, 1) and (2, 0). Which of the following does not denote the coordinates of its vertices?
(a) 1, 3 (b) 5, 3 (c) 5, 5 (d) 3, - 3

19. If points (a, 0), (0, b) and (1, 1) are collinear, then $\left(\frac{a+b}{ab}\right)$ equals : -
(a) 1 (b) – 1 (c) 2 (d) $\sqrt{2}$

20. Mid – points of the sides AB and AC of ΔABC are (3, 5) and (-3, -3) respectively, then the length of BC =
(a) 10 (b) 15 (c) 20 (d) 30

21. The ratio in which the line segment joining p (x, - y), and Q (x_2, y_2) is divided by x – axis is:
(a) $Y_1 : y_2$ (b) $– y_1 : y_2$ (c) $x_1 : x_2$ (d) $– x_1 : x_2$

22. If the line segment joining the points (3, - 4) and (1, 2) is trisected at points P (a, - 2) and Q $\left(\frac{5}{3}, b\right)$,then
(a) $a = \frac{8}{3}, b = \frac{2}{3}$ (b) $a = \frac{7}{3}, b = 0$ (c) $a = \frac{1}{3}, b = 1$ (d) $a = \frac{2}{3}, b = \frac{1}{3}$

23. If the coordinates of two point A and B are (3, 4) and (5, - 2) respectively. Find the coordinates of any point P, PA = PB and area of ΔPAB = 10.
(a) (7, 1) or (0, 1) (b) (7, 2) or (1, 0) (c) (2, 7) or (1, 0) (d) (2, 7) or (0, 1)

24. The area of a triangle is 5. Two of its vertices are (2, 1) and (3, - 2). The third vertex is (x, y) where y = x + 3. Find the coordinates of the third vertex.
(a) $\left(\frac{13}{2}, \frac{7}{2}\right)$ or $\left(\frac{-3}{2}, \frac{3}{2}\right)$ (b) $\left(\frac{7}{2}, \frac{13}{2}\right)$ or $\left(\frac{3}{2}, \frac{-3}{2}\right)$ (c) $\left(\frac{2}{7}, \frac{2}{13}\right)$ or $\left(\frac{2}{3}, \frac{-2}{3}\right)$ (d) $\left(\frac{7}{2}, \frac{13}{2}\right)$ or $\left(\frac{-3}{2}, \frac{3}{2}\right)$

25. Find the area of a rhombus, if its vertices are (3, 0) (4, 5), (-1, 4) and (-2, -1), taken is order.
(a) 21 (b) 22 (c) 24 (d) 23

26. Point P divides the line segment joining the points A (2, 1) and (5, - 8) such that $\frac{AP}{AB} = \frac{1}{3}$. If P lies on the line 2x – y + k = 0, find the value of k.
(a) 2 (b) – 2 (c) 4 (d) – 4

27. What type of triangle is formed by the points p $(\sqrt{2}, \sqrt{2})$, Q $(-\sqrt{2}, -\sqrt{2})$ and R $(-\sqrt{6}, \sqrt{6})$?
(a) Scalene triangle (b) Equilateral triangle
(c) Isosceles triangle (d) None of these

28. If (-2, 1) is centroid of the triangle having its vertices at (x, 0), (5, -2), (-8, y), then x, y satisfy the relation
(a) 5x + 3y = 0 (b) 3x – 8y = 0 (c) 8x + 3y = 0 (d) 8x = 3y

29.Four points (x_1, y_4), (x_2, y_1), (x_2, y_2), (x_3, y_3) and (x_4, y_4) are such $\sum_{i=1}^{4}(x_1^2 + y_1^2) \leq 2\,(x_1x_4 + x_2x_3 + y_1y_2 + y_3y_4)$. Then these points are vertices of:

(a) Parallelogram (b) Rectangle (c) Square (d) Rhombus

30.Let A (h, k), B (1, 1) and C (2, 1) be the Vertices of a right angled triangle with AC as its hypotenuse. If the area of triangle is 1, then the set of values which 'k' can take is given by –

(a) {1, 3} (b) {0, 2} (c) {-1, 3} (d) {-3, -2)

31.The orthocentre of a triangle whose vertices are (0, 0), (4, 0) and (0, 6) is –

(a) (2a, 2b) (b) $\left(\frac{a}{2}, \frac{b}{2}\right)$ (c) $\left(\sqrt{a^2+b^2}, 0\right)$ (d) None of these

32.A triangle ABC with vertices A (-1, 0), B (-2, 3/4) & C (- 3, - 7/6) has its orthocentre H. Then the orthocentre of triangle BCH will be:

(a) (-3, - 2) (b) (1, 3) (c) (-1, 2) (d) None of these

33.If the equation of the locus of a point equidistant from the points (a_1, b_1) and (a_2, b_2) is $(a_1 - a_2)\,x + (b_1 - b_2)\,y + c = 0$, then the value of 'c' is –

(a) $\frac{1}{2}(a_2^2 + b_2^2 - a_1^2 - b_1^2)$ (b) $a_1^2 - a_2^2 + b_1^2 + b_2^2$

(c) $\frac{1}{2}(a_1^2 + a_2^2 + b_1^2 + b_2^2)$ (d) $\sqrt{a_1^2 + b_1^2 - a_2^2 - b_2^2}$

34.Locus of centroid of the triangle whose vertices are (a cos t, a sin t), (b sin t, - b cos t) and (1, 0), where t is a parameter is:

(a) $(3x-1)^2 + (3y)^2 = a^2 - b^2$ (b) $(3x-1)^2 + (3y)^2 = a^2 + b^2$

(c) $(3x+1)^2 + (3y)^2 = a^2 + b^2$ (d) $(3x+1)^2 + (3y)^2 = a^2 - b^2$

35.Let A (2, - 3) and B (- 2, 1) be vertices of a triangle ABC. If the centroid of this triangle moves on the line 2x + 3y = 1, then the locus of the vertex C is the line:

(a) 3y = 9 (b) 2x – 3y = 7 (c) 3x + 2y = 5 (d) 3x – 2y = 3

36.A variable straight line passes through a fixed point (a, b) intersecting the coordinates axes at A & B. If 'O' is the origin, then the locus of the centroid of the triangle OAB is –

(a) bx + ay – 3xy = 0 (b) bx + ay - 2xy = 0

(c) ax + by – 3xy = 0 (d) ax + by – 2xy = 0

37.One diagonal of a square is the portion of the 3x + 2y = 12 intercepted between the axes. The coordinates of the extremity of the other diagonals no lying in the first quadrant are

(a) (1, - 1) (b) (-1, - 1) (c) (-1, 1) (d) None of these

38.ABCD is a rhombus. Its diagonals AC and BD intersect at the point M and satisfy BD = 2AC. If the coordinates of D and M are (1, 1) and (2, - 1) respectivley, the coordinates of A are

(a) (-3, - 1/2) (b) (1, - 3/2) (c) (3/2, - 1) (d) (1/2, - 3)

39.Area of the rhombus enclosed by the lines ax $\pm$ by $\pm$ c = 0 is

(a) $2a^2/bc$ (b) ab^2/ca (c) ac^2/ab (d) None

40.A ray of light coming from the point (1, 2) is reflected at a point A on the axis of x and then passes through the point (5, 3). The coordinates of the point A are

(a) (5/13, 0) (b) (-7, 0) (c) (13/5, 0) (d) (15,0)

41.If the straight lines x + 2y – 9 = 0, 3x + 5y – 5 = 0 and ax + by + 1 = 0 are concurrent, then the straight line 35x – 22y – 1 = 0 passes through

(a) (a, b) (b) (b, a) (c) (a, - b) (d) (-a, b)

42.The centre of the circle passing through the points (6, - 6), (3, 3) is – **(NTSE Stage – 2 = 2016)**

(a) (3, 2) (b) (-3, -2) (c) (3, -2) (d) (-3, 2)

43. If the line segment joining (2, 3) and (-1, 2) is divided internally in the ratio 3 : 4 by the graph of the equation x + 2 y = k, the value of k is – **(NTSE Stage – 2 = 2016)**

(a) $\frac{5}{7}$ (b) $\frac{31}{7}$ (c) $\frac{36}{7}$ (d) $\frac{41}{7}$

ANSWER KEY

EXERCISE – 1

1. (–11, 8)
3. X = 5, – 3
6. (i) Square (ii) Parallelogram
7. $\left(\frac{3}{2}, \frac{3\sqrt{3}}{2}\right)$ or $\left(\frac{3}{2}, \frac{-3\sqrt{3}}{2}\right)$
8. $2, \frac{-46}{13}$
9. (i) (3,–2); 5 units (ii) (2, –4)
10. (i) 7 (ii) p = 6; q = 3
11. (i) $2\sqrt{a^2+b^2}$ (ii) AB $(t_2-t_1)\sqrt{(t_2+t_1)^2+4}$
12. (i) $x = \frac{5}{3}$ (ii) y = 5
13. $\frac{1}{a}$, which is independent of t.
15. (-3, 5). Infinite number of points. infact all the points which are solutions of the equation 2x + y + 1 = 0
16. a = 5, 3
17. (i) $(0, 3 - 4\sqrt{3})$ (ii) $(0, 3 + 4\sqrt{3})$
18. (2, - 4)
19. (8, - 3) and (- 2, 1)
20. 2 : 1
21. A(–1, 7), B(–5, –3) and C (11, 5).
22. 3:2, Y = 3
23. $5:1; \left(0, \frac{-13}{3}\right)$
24. (i) 3:2; 5 (ii) 4 : 3; (2, –3)
25. 3 : 4
26. 2/3
27. a = 1 and b = 3
28. $\sqrt{10}$ units
29. – 4

30. (-3, 1.5), (-2, 3), (-1, 4.5)
31. (-b, b)
32. (1, - 12), (5, - 10)
33. DA = DB = DC ie., D is equidistant from the vertices of triangle ABC.
34. (4, - 4)
35. $\left(2, \frac{5}{3}\right)$
38. sq. units.
39. (4, 0) ; 3 sq. unit, 3sq. unit
40. D(1, 2), E (0, 1), F(1, 0)
41. 72 sq. units
42. (i) $\left(\frac{7}{2}, \frac{9}{2}\right)$ (ii) $\left(\frac{11}{3}, \frac{11}{3}\right)$ (iii) $\frac{13}{6}$ sq. units; $\frac{13}{2}$ sq. units
43. 0
45. 0
46. irrational number
49. p = - 3, - 9
50. p = - 3, - 9
52. a = - 3, h = $\frac{12\sqrt{2}}{\sqrt{13}}$
53. $\frac{3}{4}$ sq. units

EXERCISE – 2

2. 3 : 2, −2/5
3. (4, −4)
6. 3 : 2, 5
7. (−2, 0)
9. −5
10. $\frac{2}{3}$
12. p = 4, q = 2
13. (−4, −7)
14. A(a/2, $\sqrt{3}a/2$) , B(0, 0), C(a,0)
15. 4 : 7
16. (3, 2)
17. 2
18. 5 or −3
19. (3, 0)
20. p = $\frac{7}{3}$, q = 0
23. k = −8
25. k = 1
26. ($\pm 3\sqrt{3}, 0$) and (0, 3)
27. (11, 2)
29. (3, −2)
30. (2, −4)
33. p = 1
34. (4, 5), (8, 7), (12, 3)
35. 2 : 3, (0, 1)
36. $\sqrt{65}, \left(\frac{1}{3}, \frac{5}{3}\right)$
37. a = 1, b = 3
39. 2 : 3
39. (1, 2)
40. (−5, −2)
41. p = 5
42. 6 : 25
45. −1
46. −2
47. 53 sq. units
49. $\left(-1, \frac{9}{2}\right)$
50. $\left(\frac{11}{7}, \frac{18}{7}\right)$
51. (4, −2)
52. k = $-\frac{3}{2}$
53. $\left(\frac{-2}{7}, \frac{-20}{7}\right)$
54. (4, 5), (2, 3), (6, 9)
56. 3 : 4
57. 2
58. (0, −2)
59. −8
61. (−7, 0)
62. − 8
63. 2
64. 4 : 1, 6
65. 28 sq. unit
66. 1 sq. unit
67. −8
69. −4 or 2
70. $\left(\frac{5}{4}, 0\right)$
71. x + 3y = 7
72. a = 1, b = 0
73. 2

EXERCISE – 3

Ques.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Ans.	b	d	b	d	c	a	b	d	c	c
Ques.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
Ans.	a	d	a	c	b	b	d	a	c	b
Ques.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
Ans.	a	b	d	b	a	c	b	b	d	b
Ques.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.
Ans.	a	c	d	a	d	b	c	d	c	b
Ques.	41.	42.	43.	44.	45.	46.	47.	48.	49.	50.
Ans.	a	d	c	d	b	b	c	b	c	c
Ques.	51.	52.	53.	54.	55.	56.	57.	58.	59.	60.
Ans.	d	a	d	a	a	b	c	d	a	a
Ques.	61.	62.	63.	64.	65.	66.	67.	68.	69.	70.
Ans.	b	c	c	b	d	c	b	b	c	b
Ques.	71.	72.	73.	74.	75.	76.	77.	78.	79.	80.
Ans.	a	d	b	b	a	a	d	d	c	d
Ques.	81.	82.	83.	84.	85.	86.	87.	88.	89.	
Ans.	b	c	d	c	c	d	b	a	b	

EXERCISE – 4

Ques.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Ans.	c	d	d	a	a	c	b	b	c	d
Ques.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
Ans.	a	c	c	d	d	d	b	b	a	c
Ques.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
Ans.	b	b	b	d	c	d	b	a	b	c
Ques.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.
Ans.	a	b	a	b	a	d	c	b	c	c
Ques.	41.	42.	43.							
Ans.	a	c	d							