STRAIGHT LINE

1. EQUATION OF STRAIGHT LINE

A relation between x and y which is satisfied by co-ordinates of every point lying on a line is called the equation of Straight Line. Every linear equation in two variable x and y always represents a straight line.

eg. $3x + 4y = 5$, $-4x + 9y = 3$ etc.

General form of straight line is given by

$ax + by + c = 0$.

2. EQUATION OF STRAIGHT LINE PARALLEL TO AXES

(i) Equation of x axis $\Rightarrow y = 0$.

Equation a line parallel to x axis (or perpendicular to y axis) at a distance 'a' from it $\Rightarrow y = a$.

(ii) Equation of y axis $\Rightarrow x = 0$.

Equation of a line parallel to y axis (or perpendicular to x axis) at a distance 'a' from it $\Rightarrow x = a$.

eg. Equation of a line which is parallel to x-axis and at a distance of 4 units in the negative direction is $y = -4$.

3. SLOPE OF A LINE

If θ is the angle made by a line with the positive direction of x axis in anticlockwise sense, then the value of $\tan\theta$ is called the Slope (also called gradient) of the line and is denoted by m or slope $= \tan\theta$

eg. A line which is making an angle of 45º with the x-axis then its slope is

$m = \tan 45^\circ = 1$.

Note :

(i) Slope of x axis or a line parallel to x axis is $\tan 0^\circ = 0$.

(ii) Slope of y axis or a line parallel to y axis is $\tan 90^\circ = \infty$.

(iii) The slope of a line joining two points (x_1, y_1) and (x_2, y_2) is given by $m = \dfrac{y_2 - y_1}{x_2 - x_1}$.

eg. Slope of a line joining two points (3, 5) and (7, 9) is $= \dfrac{9-5}{7-3} = \dfrac{4}{4} = 1$.

4. DIFFERENT FORMS OF THE EQUATION OF STRAIGHT LINE

4.1 Slope - Intercept Form :

The equation of a line with slope m and making an intercept c on y–axis is $y = mx + c$. If the line passes through the origin, then $c = 0$. Thus the equation of a line with slope m and passing through the origin $y = mx$.

4.2 Slope Point Form :

The equation of a line with slope m and passing through a point (x_1, y_1) is

$y - y_1 = m(x - x_1)$

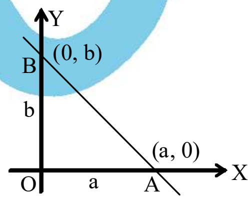
4.3 Two Point Form :

The equation of a line passing through two given points (x_1, y_1) and (x_2, y_2) is –

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

4.4 Intercept Form :

The equation of a line which makes intercept a and b on the x axis and y axis respectively is $\dfrac{x}{a} + \dfrac{y}{b} = 1$. Here, the length of intercept between the co-ordinates axis $= \sqrt{a^2 + b^2}$



Area of $\Delta OAB = \dfrac{1}{2} OA.\ OB = \dfrac{1}{2}$ a.b.

4.5 Normal (Perpendicular) Form of a Line :

If p is the length of perpendicular on a line from the origin and θ is the inclination of perpendicular with x- axis then equation on this line is

$x\cos\theta + y\sin\theta = p$

4.6 Parametric Form (Distance Form) :

If θ be the angle made by a straight line with x-axis which is passing through the point (x_1, y_1) and r be the distance of any point (x, y) on the line from the point (x_1, y_1) then its equation.

$$\frac{x - x_1}{\cos\theta} = \frac{y - y_1}{\sin\theta} = r$$

5. REDUCTION OF GENERAL FORM OF EQUATIONS INTO STANDARD FORMS

General Form of equation $ax + by + c = 0$ then its -

(i) Slope Intercept Form is $y = -\dfrac{a}{b}x - \dfrac{c}{b}$, here slope $m = -\dfrac{a}{b}$, Intercept $C = \dfrac{c}{b}$

(ii) Intercept Form is $\frac{x}{-c/a} + \frac{y}{-c/b} = 1$, here

x intercept is $= -c/a$, y intercept is $= -c/b$

(iii) Normal Form is

To change the general form of a line into normal form, first take c to right hand side and make it positive, then divide the whole equation by $\sqrt{a^2+b^2}$ like $-\frac{ax}{\sqrt{a^2+b^2}} - \frac{by}{\sqrt{a^2+b^2}} = \frac{c}{\sqrt{a^2+b^2}}$,

here $\cos\theta = -\frac{a}{\sqrt{a^2+b^2}}$, $\sin\theta = -\frac{b}{\sqrt{a^2+b^2}}$

and $p = \frac{c}{\sqrt{a^2+b^2}}$

6. POSITION OF A POINT RELATIVE TO A LINE

(i) The point (x_1, y_1) lies on the line $ax + by + c = 0$ if, $ax_1 + by_1 + c = 0$

(ii) If $P(x_1, y_1)$ and $Q(x_2, y_2)$ do not lie on the line $ax + by + c = 0$ then they are on the same side of the line, if $ax_1 + by_1 + c$ and $ax_2 + by_2 + c$ are of the same sign and they lie on the opposite sides of line if $ax_1 + by_1 + c$ and $ax_2 + by_2 + c$ are of the opposite sign.

(iii) (x_1, y_1) is on origin or non origin sides of the line $ax + by + c = 0$ if $ax_1 + by_1 + c = 0$ and c are of the same or opposite signs.

7. ANGLE BETWEEN TWO STRAIGHT LINES

The angle between two straight lines $y = m_1x + c_1$ and $y = m_2x + c_2$ is given by

$$\tan\theta = \left|\frac{m_1 - m_2}{1 + m_1m_2}\right|$$

Note :

(i) If any one line is parallel to y axis then the angle between two straight line is given by $\tan\theta = \pm\frac{1}{m}$

Where m is the slope of other straight line

(ii) If the equation of lines are $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ then above formula would be $\tan\theta = \left|\frac{a_1b_2 - b_1a_2}{a_1a_2 + b_1b_2}\right|$

(iii) Here two angles between two lines, but generally we consider the acute angle as the angle between them, so in all the above formula we take only positive value of $\tan\theta$.

7.1 Parallel Lines :

Two lines are parallel, then angle between them is 0

$\Rightarrow \frac{m_1 - m_2}{1 + m_1m_2} = \tan 0^\circ = 0$

$\Rightarrow m_1 = m_2$

Note : Lines $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are parallel $\Leftrightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2}$

7.2 Perpendicular Lines :

Two lines are perpendicular, then angle between them is 90º

$\Rightarrow \frac{m_1 - m_2}{1 + m_1m_2} = \tan 90^\circ = \infty \Rightarrow m_1m_2 = -1$

Note : Lines $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are perpendicular then $a_1a_2 + b_1b_2 = 0$

7.3 Coincident Lines :

Two lines $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are coincident only and only if

$\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

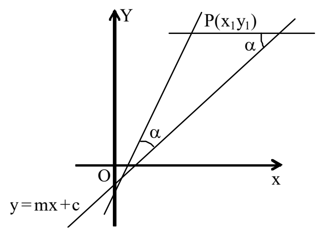
8. EQUATION OF PARALLEL & PERPENDICULAR LINES :

(i) Equation of a line which is parallel to $ax + by + c = 0$ is $ax + by + k = 0$

(ii) Equation of a line which is perpendicular to $ax + by + c = 0$ is $bx - ay + k = 0$

The value of k in both cases is obtained with the help of additional information given in the problem.

9. EQUATION OF STRAIGHT LINES THROUGH (X_1, Y_1) MAKING AN ANGLE α WITH $y = mx + c$



$$y - y_1 = \frac{m \mp \tan\alpha}{1 \pm m\tan\alpha}(x - x_1)$$

10. LENGTH OF PERPENDICULAR

The length P of the perpendicular from the point (x_1, y_1) on the line $ax + by + c = 0$ is given by

$$P = \frac{|ax_1 + by_1 + c|}{\sqrt{a^2+b^2}}$$

Note :

(i) Length of perpendicular from origin on the line $ax + by + c = 0$ is $c\sqrt{a^2+b^2}$

(ii) Length of perpendicular from the point (x_1, y_1) on the line $x\cos\alpha + y\sin\alpha = p$ is $x_1\cos\alpha + y_1\sin\alpha = p$

SOLVED PROBLEMS

Ex.1 Find the equation of a line which is making an angle of 60º with the x axis and an intercept of 5 unit length in negative direction of y axis

Sol. Let line is y = mx + c

Here m = tan60º = $\sqrt{3}$, c = – 5

equation is y = $\sqrt{3}$ x – 5

Ex.2 Find the equation of a line which is passing through origin and making an angle of 45º with x-axis

Sol. Here m = tan45º = 1 so the equation is y = x or x – y = 0

Ex.3 Find the equation of a line which is passing through (3, – 4) and making an angle of 45º with x-axis

Sol. y – (–4) = tan45º(x – 3)

$\Rightarrow$ y + 4 = x – 3 $\Rightarrow$ x – y – 7 = 0

Ex.4 Find the equation of a line passing through (3, –4) and (4, 3)

Sol. y + 4 = $\frac{3+4}{4-3}$ (x–3) or y = 7x – 25

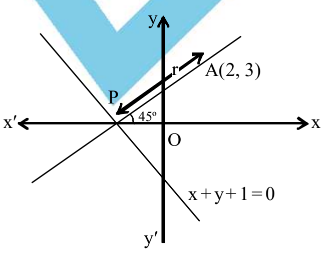
Ex.5 Find the equation of a line which makes intercepts 3 and 4 on x-axis and y-axis

Sol. $\frac{x}{3}+\frac{y}{4}$ = 1 $\Rightarrow$ 4x + 3y = 12

Ex.6 Find the equation of a line which passes through point A(2,3) and makes an angle of 45º with x-axis. If this line meet the line x + y + 1 = 0 at point P then distance AP

Sol. Here x_1 = 2, y_1 = 3 and θ = 45º

hence $\frac{x-2}{\cos 45^o} = \frac{y-3}{\sin 45^o}$ = r



from first two parts $\Rightarrow$ x – 2 = y – 3

$\Rightarrow$ x – y + 1 = 0

Co-ordinate of point P on this line is

$$\left(2+\frac{r}{\sqrt{2}}, 3+\frac{r}{\sqrt{2}}\right)$$

if this point is on line x + y + 1 = 0 then

$$\left(2+\frac{r}{\sqrt{2}}\right)+\left(3+\frac{r}{\sqrt{2}}\right) + 1 = 0$$

$\Rightarrow$ r = – $3\sqrt{2}$ $\Rightarrow$ | r | = $3\sqrt{2}$

Ex.7 Find the equation of a line which passes through (1, –2) and makes equal intercept on axes

Sol. Let the equation is $\frac{x}{a}+\frac{y}{b}$ = 1, given

a = b Θ Line passes through (1, 2)

$\therefore$ $\frac{1}{a}+\frac{-2}{a}$ = 1 $\Rightarrow$ a = –1

equation is $\frac{x}{-1}+\frac{y}{-1}$ = 1

x + y + 1 = 0

Ex.8 Find the slope of a Line which is made by joining the point (1, 0) and (–2, $\sqrt{3}$)

Sol. m = $\frac{\sqrt{3}-0}{-2-1}$ = – $\frac{1}{\sqrt{3}}$

tanθ = – $\frac{1}{\sqrt{3}}$ $\Rightarrow \theta$ = 150º

Ex.9 If the intercept made by the line between the axes is bisected at the point (5, 2) then find its equation

Sol. Let the equation of the line be $\frac{x}{a}+\frac{y}{b}$ = 1 then the co–ordinates of point of intersection of this line and x axis and y axis are (a, 0) and (0, b) respectively (by putting x = 0 and y = 0)

hence mid point of the intercept is (a/2, b/2)

Θ a/2 = 5, b/2 = 2 $\Rightarrow$ a = 10, b = 4

hence required equation of the line is

$\Rightarrow$ 2x + 5y = 20

Ex.10 Find the Length of perpendicular from the origin to the line 3x + 4y = 10

Sol. Converting the given equation into normal form by dividing $\sqrt{3^2+4^2}$ = 5 is

$$\frac{3x}{5}+\frac{4y}{5}=\frac{10}{5} \qquad \Rightarrow \frac{3x}{5}+\frac{4y}{5}=2$$

comparing with x cos α + y sin α = p

$\Rightarrow$ p = 2

Ex.11 Find the coordinates of a point which is at 3 distance from points (1,–3) of line 2x+3y+7=0

Sol. Slope of given line is = $-\frac{2}{3}$

$\therefore$ $\tan\theta = -\frac{2}{3}$

Hence $90^o < \theta < 180^o$

$\therefore$ $\sin\theta = \frac{2}{\sqrt{13}}$, $\cos\theta = -\frac{3}{\sqrt{13}}$

Distance from of line 2x + 3y + 7 = 0 is

$$\frac{x-1}{\left(\frac{3}{\sqrt{13}}\right)} = \frac{y+3}{\left(\frac{2}{\sqrt{13}}\right)} = r$$

Putting r = 3 we get the co-ordinates of desired point as

$x - 1 = -\frac{9}{\sqrt{13}}$, $y + 3 = \frac{6}{\sqrt{13}}$

or $x = 1 - \frac{9}{\sqrt{13}}$, $y = -3 + \frac{6}{\sqrt{13}}$

Ex.12 Find the Normal form of line $x + \sqrt{3}\,y - 4 = 0$

Sol. Given line $x + \sqrt{3}\,y = 4$

dividing both side by $\sqrt{(\sqrt{3})^2 + 1^2} = 2$

we get $\frac{x}{2} + \frac{\sqrt{3}y}{2} = 2$

or $x \cos\pi/3 + y \sin \pi/3 = 2$

Ex.13 Find the Angle between y = x+ 6 and $y = \sqrt{3}\,x + 7$

Sol. Here $m_1 = 1$ $m_2 = \sqrt{3}$

$\tan\theta = \left|\frac{1-\sqrt{3}}{1+\sqrt{3}}\right| \Rightarrow \theta = \tan^{-1}\frac{1-\sqrt{3}}{1+\sqrt{3}} = 15^o$

Ex.14 If A(1, 2), B(–1, 3) and C(3, –5) be vertices of a triangle then find $\angle B$

Sol. Slope of AB = $m_1 = -1/2$

Slope of BC = $m_2 = -2$

$\therefore$ $\angle B = \tan^{-1}\left|\frac{-1/2+2}{1+(-1/2)(-2)}\right|$

$= \tan^{-1}(3/4)$

Ex.15 If 3x + 4y –5 = 0 and 4x + ky – 8 = 0 are two perpendicular lines then k is -

(A) 3 (B) 4 (C) – 3 (D) – 4

Sol. $m_1 = -\frac{3}{4}$ $m_2 = -\frac{4}{k}$

Two lines are perpendicular if $m_1m_2 = -1$

$\Rightarrow (-\frac{3}{4}) \times (-\frac{4}{k}) = -1$ $\Rightarrow k = -3$

Ex.16 If 7x + 3y + 9 = 0 and y = kx + 7 are two parallel lines then find k

Sol. $m_1 = -\frac{7}{3}$ $m_2 = k$ Two lines are parallel if $m_1 = m_2$

k = – 7/3

Ex.17 Find the equation of straight lines which passes through (3,4) and making an angle of 45º with line x – y – 2 = 0

Sol. Here m = 1 and $\tan\alpha = \tan 45^o = 1$

equation is y – 4 = (x – 3)

i.e y – 4 = 0, x – 3 = 0

Ex.18 One vertex of an equilateral triangle is (2,3) and the equation of line opposite to the vertex is x + y =2, then find the equation of remaining two sides

Sol. Since the two sides make an angle of 60º each with side x + y = 2. Therefore equations of these sides will be

$y - 3 = \frac{-1 \pm \tan 60^o}{1 \mp (-1)\tan 60^o}(x - 2)$

$= \frac{-1 \pm \sqrt{3}}{1 \pm \sqrt{3}}(x - 2)$

$\Rightarrow$ $y - 3 = (2 \pm \sqrt{3})(x - 2)$

EXERCISE

Q.1 Find the distance between the points: A(2, –3) and B(–6, 3)

Q.2 Find the distance of the point P(6, –6) from the origin.

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

Q.4 Find a point on the y-axis which is equidistance from A(–4, 3) and B(5, 2).

Q.5 Using the distance formula, show that the points A(3, –2) B(5, 2) and C(8, 8) are collinear.

Q.6 Show that the points A(7, 10), B(–2, 5) and C(3, –4) are the vertices of an isosceles right-angled triangle.

Q.7 If the points A(-2, -1), B(1, 0), C(x, 3) and D(1, y) are the vertices of a parallelogram, find the values of x and y.

Q.8 Find the area of ΔABC whose vertices are A(–3, –5), B(5, 2), and C(–9, –3).

Q.9 Show that the points A(–5, 1), B(5, 5) and C(10, 7) are collinear.

Q.10 Find the value of k for which the points A(-2, 3), B(1, 2), C(k, 0) are collinear.

Q.11 Find the area of the quadrilateral whose vertices are A(–4,5),B(0,7),C(5,–5) and D(–4,–2).

Q.12 Find the coordinates of the point which divides the join of A(–5, 11) and B(4, –7) in the ratio 2 : 7.

Q.13 Find the ratio in which the x-axis cuts the join of the points A(4, 5) and B(–10, 2). Also, find the point of intersection.

Q.14 Find the slope of a line whose inclination is 30°

Q.15 Find the inclination of a line whose slope is $\sqrt{3}$

Q.16 Find the slope of a line which passes through the points (0, 0) and (4, –2)

Q.17 If the slope of the line joining the points A(x, 2) and B(6, -8) is $\frac{-5}{4}$, find the value of x.

Q.18 Show that the line through the points (5, 6) and (2, 3) is parallel to the line through the points (9, –2) and (6, –5).

Q.19 Find the angle between the line whose slope are $\sqrt{3}$ and $\frac{1}{\sqrt{3}}$.

Q.20 Find the angle between the lines whose slopes are $(2-\sqrt{3})$ and $(2+\sqrt{3})$.

Q.21 If A(1, 2), B(–3, 2) and C(3, –2) be the vertices of a ΔABC, show that

(i) tan A = 2 **(ii)** tan B = $\frac{2}{3}$ **(iii)** tan C = $\frac{4}{7}$

Q.22 If θ is the angle between the lines joining the points A(0, 0) and B(2, 3), and the points C(2, -2), D(3, 5), show that tanθ = $\frac{11}{23}$

Q.23 If θ is the angle between the diagonals of a parallelogram ABCD whose vertices are A(0, 2), B(2, –1), C(4, 0) and D(2, 3). Show that tan θ = 2.

Q.24 Show that the points A(0,6),B(2,1)and C(7,3) are three corners of a square ABCD. Find
(i) the slope of the diagonals BD and
(ii) the coordinates of the fourth vertex.

Q.25 A(1, 1), B(7, 3) and C(3, 6) are the vertices of a ΔABC. If D is the midpoint of BC and AL ⊥ BC, find the slope of
(i) AD and **(ii)** AL.

Q.26 Find the angle which the line joining the points $(1, \sqrt{3})$ and $(\sqrt{2}, \sqrt{6})$ makes with the x-axis.

Q.27 Prove that the points A(1, 4), B(3, –2) and C(4, –5) are collinear. Also find the equations of line on which these points lie.

Q.28 If A(0, 0), B(2, 4) and C(6, 4) are the vertices of a ΔABC, find the equations of its side.

Q.29 If A(-1, 6), B(-3, -9) and C(5, -8) are the vertices of a ΔABC, find the equation of its medians.

Q.30 Find the equation of the perpendicular bisector of the line segment whose end points are A(10, 4) and B(–4, 9).

Q.31 Find the equations of the altitudes of a ΔABC, whose vertices are A(2, –2), B(1, 1) and C(–1, 0).

Q.32 If A(4, 3), B(0, 0) and C(2, 3) are the vertices of a ΔABC, find the equation of the bisector of $\angle A$.

Q.33 The midpoints of the sides BC, CA and AB of a ΔABC are D(2, 1), E(–5, 7) and F(–5, –5) respectively. Find the equations of the sides of ΔABC.

Q.34 If A(1, 4), B(2, –3) and C(–1, –2) are the vertices of a ΔABC, find the equation of
(i) the median through A
(ii) the altitude through A
(iii) the perpendicular bisector of BC.

Q.35 Find the equation of the bisectors of the angles between the coordinate axes.

Q.36 Find the equation of the line through the point (–1, 5) and making an intercept of –2 on the y-axis.

Q.37 Find the equation of the line which is parallel to the line 2x – 3y = 8 and whose y-intercept is 5 units.

Q.38 Find the equation of the line passing through the point (0, 3) and perpendicular to the line x – 2y + 5 = 0.

Q.39 Find the equation of the line which is perpendicular to the line 3x + 2y = 8 and passes through the midpoint of the line joining the points (6, 4) and (4, –2).

Q.40 Find the equation of the line whose y-intercept is -3 and which is perpendicular to the line joining the points (–2,3) and (4,–5).

Q.41 Find the equation of the line passing through (–3, 5) and perpendicular to the line through the points (2, 5), and (–3, 6).

Q.42 A line perpendicular to the line segment joining the points (1, 0) and (2, 3) divides it in the ratio 1 : 2. Find the equation of the line.

Q.43 Find the equation of the line passing through the point (2, 2) and cutting off intercepts on the axes, whose sum is 9.

Q.44 Find the equation of the line which passes through the point (22, -6) and whose intercept on the x-axis exceeds the intercept on the y-axis by 5.

Q.45 Find the equation of the line whose portion between the axes is bisected at the point (3, –2).

Q.46 Find the equation of the line whose portion intercepted between the coordinate axes is divided at the point (5, 6) in the ratio 3 : 1.

Q.47 A straight line passes through the point (-5,2) and portion of the line intercepted between the axes is divided at this point the ratio 2 : 3. Find the equation of the line.

Q.48 If the straight line $\frac{x}{a}+\frac{y}{b}=1$ passes through the points (8, -9) and (12, -15), find the value of a and b.

Q.49 Find the equation of the line for which p = 3 and $\alpha = 45^{\circ}$

Q.50 The length of the perpendicular segment from the origin to a line is 2 units and the inclination of this perpendicular is α such that $\sin\alpha = \frac{1}{3}$ and α is acute. Find the equation of the line.

Q.51 Find the equation of the line which is at a distance of 3 units from the origin such that $\tan\alpha = \frac{5}{12}$, where α is the acute angle which this perpendicular makes with the positive direction of the x-axis.

Q.52 Reduce the equation y + 5 = 0 to slope-intercept form, and hence find the slope and y-intercept of the line.

Q.53 Reduce the equation 3x – 4y + 12 = 0 to intercepts form. Hence, find length of the portion of the line intercepts between the axes.

Q.54 Reduce the equation $x + y - \sqrt{2} = 0$ to the normal form $x\cos\alpha + y\sin\alpha = p$, and hence find the values of α and p.

Q.55 Find the values of k for which the length of perpendicular from the point (4, 1) on the line 3x – 4y + k = 0 is 2 units.

Q.56 Show that the length of perpendicular from the point (7, 0) to the line 5x + 12y–9 = 0 is double the length of perpendicular to it from the point (2, 1).

Q.57 The points A(2, 3), B(4, -1) and C(-1, 2) are the vertices of ΔABC. Find the length of perpendicular form C on AB and hence find the area of ΔABC.

Q.58 What are the points on the x-axis whose perpendicular distance from the line $\frac{x}{3}+\frac{y}{4}=1$ is 4 units?

Q.59 Find all the points on the line x + y = 4 that lie at a unit distance from the line 4x + 3y = 10.

Q.60 A vertex of a square is at the origin and its one side lies along the line 3x – 4y – 10 = 0. Find the area of the square.

Q.61 Find the distance between the parallel lines 4x – 3y + 5 = 0 and 4x – 3y + 7 = 0.

Q.62 Prove that the line 12x – 5y – 3 = 0 is mid-parallel to the line 12x – 5y + 7 = 0 and 12x – 5y – 13 = 0.

Q.63 The perpendicular distance of a line from the origin is 5 units and its slope is -1. Find the equation of the line.

Q.64 Find the value of k so that the lines 3x – y – 2 = 0, 5x + ky – 3 = 0 and 2x + y – 3 = 0 are concurrent.

Q.65 Find the image of the point P(1, 2) in the line x – 3y + 4 = 0.

Q.66 Find the area of the triangle formed by the lines x + y = 6, x – 3y = 2 and 5x – 3y + 2 = 0.

Q.67 Find the area of the triangle formed by the lines x = 0, y = 1 and 2x + y = 2.

Q.68 Find the area of the triangle, the equations of whose sides are y = x, y = 2x and y – 3x = 4.

Q.69 Find the equation of the perpendicular drawn from the origin to the line 4x – 3y + 5 = 0. Also, find the coordinates of the foot of the perpendicular.

Q.70 Find the equation of the perpendicular drawn from the point P(–2, 3) to the line x – 4y + 7 = 0. Also, find the coordinates of the foot of the perpendicular.

ANSWER KEY

1. 10 units **2.** $6\sqrt{2}$ units **3.** P(3, 0)
4. P(0, –2) **7.** x=4, y=2 **8.** 29 sq units
10. k=7 **11.** 60.5 sq units **12.** P(–3, 7)
13. (5 : 2), P(–6, 0) **14.** $\frac{1}{\sqrt{3}}$ **15.** 60°
16. $-\frac{1}{2}$ **17.** x=–2 **19.** 30° **20.** 60°
24. **(i)** $\frac{7}{3}$ **(ii)** (5,8) **25. (i)** $\frac{7}{8}$ **(ii)** $\frac{4}{3}$
26. 60° **27.** 3x+y–7=0 **28.** y=4, 2x–3y= 0, 2x–y=0
29. 29x+4y+5=0, 8x–5y–21=0, 13x+14y+47=0
30. 28x –10y–19= 0
31. 2x + y – 2 = 0, 3x – 2y – 1 = 0, x – 3y + 1 = 0
32. x–3y+5=0
33. x – 2 = 0, 6x – 7y + 79 = 0, 6x + 7y + 65 = 0
34. **(i)** 13x – y – 9 = 0 **(ii)** 3x – y + 1 = 0 **(iii)** 3x – y – 4 = 0
35. x–y=0 or x + y =0 **36.** 7x + y + 2 = 0
37. 2x – 2y + 15 = 0 **38.** 2x + y – 3 = 0
39. 2x– 3y – 7 = 0 **40.** 3x – 4y –12 = 0
41. 5x – y + 20 = 0 **42.** 3x + 9y –13 =0
43. x + 2y – 6 = 0 or 2x + y – 6 = 0
44. 6x + 11y – 66 = 0 or x + 2y – 10 = 0
45. 2x – 3y – 12 = 0 **46.** 2x + 5y – 40 = 0
47. 3x – 5y + 25 = 0 **48.** a = 2, b = 3
49. $x + y - 3\sqrt{2} = 0$ **50.** $2\sqrt{2}x + y - 6 = 0$
51. 12x + 5y –39 = 0
52. y = 0 · x – 5, m = 0 and c = –5
53. $\frac{x}{-4}+\frac{y}{3}=1$, 5 units
54. xcos45° + ysin 45° = 1; α = 45°, p = 1
55. k = 2 or k = –18 **57.** $\frac{7}{\sqrt{5}}$ units, 7 sq units
58. (8, 0) and (–2, 0) **59.** (3, 1) and (–7, 11)
60. 4 sq units **61.** $\frac{2}{5}$ units
63. $x + y + 5\sqrt{2} = 0$ or $x + y - 5\sqrt{2} = 0$
64. k = –2 **65.** $\left(\frac{6}{5}, \frac{7}{5}\right)$ **66.** 12 sq units
67. 1 sq units **68.** 4 sq units **69.** 3x + 4y = 0, $\left(-\frac{4}{5}, \frac{3}{5}\right)$
70. 4x + y + 5 = 0, $\left(\frac{-27}{17}, \frac{23}{17}\right)$