VATSALYA INTERNATIONAL SCHOOL (2021-22)
CLASS 11th Straight line (Board MCQ)
KEY CONCEPTS

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. $3x + 4y = 5$, $\quad -4x + 9y = 3$ 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 $\Rightarrow m = \tan\theta$

eg. A line which is making an angle of 45º with the x-axis then its slope is $m = \tan 45º = 1$.

Note :

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

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

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

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

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 :

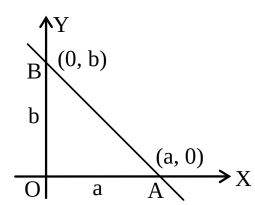
The equation of a line passing through two given points (x_1, y_1) and (x_2, y_2) is -

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

4.4 Intercept Form :

The equation of a line which makes intercept a and b on the x-axis and y-axis respectively is $\frac{x}{a} + \frac{y}{b} = 1$.

Here, the length of intercept between the co-ordinates axis $= \sqrt{a^2 + b^2}$



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

4.5 Normal (Perpendicular) Form of a Line :

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

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

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

$y = -\frac{a}{b}x - \frac{c}{b}$, here slope $m = -\frac{a}{b}$, Intercept $C = \frac{c}{b}$

(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 $\cos\alpha = \frac{a}{\sqrt{a^2+b^2}}$, $\sin\alpha = \frac{b}{\sqrt{a^2+b^2}}$ 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

$\Rightarrow \dfrac{m_1 - m_2}{1 + m_1 m_2} = \tan 90º = \infty$

$\Rightarrow m_1 m_2 = -1$

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

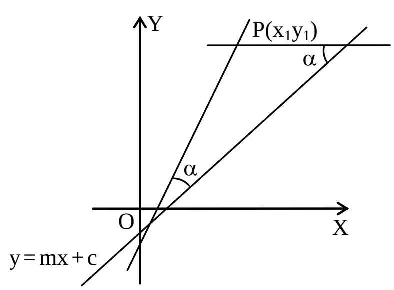
8. Equation of Parallel & Perpendicular lines

(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 a with = 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 -

$x_1\cos\alpha + y_1\sin\alpha = p$

10.1 Distance between Two Parallel Lines :

The distance between two parallel lines $ax + by + c_1 = 0$ and $ax + by + c_2 = 0$ is

$$\frac{|c_1 - c_2|}{\sqrt{a^2 + b^2}}$$

Note :

(i) Distance between two parallel lines $ax + by + c_1 = 0$ and $kax + kby + c_2 = 0$ is

$$\frac{\left|c_1 - \frac{c_2}{k}\right|}{\sqrt{a^2 + b^2}}$$

(ii) Distance between two non parallel lines is always zero.

11. Condition of Concurrency

Three lines $a_1x + b_1y + c_1 = 0$, $a_2x + b_2y + c_2 = 0$ and $a_3x + b_3y + c_3 = 0$ are said to be concurrent, if they passes through a same point. The condition for their concurrency is

$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = 0$$

Again, to test the concurrency of three lines, first find out the point of intersection of any two of the three lines. If this point lies on the remaining lines then the three lines are concurrent.

Note : If P = 0, Q = 0, R = 0 the equation of any three line and P + Q + R = 0 the line are concurrent. But its converse is not true i.e. if the line are concurrent then it is not necessary that P + Q + R = 0

12. Bisector of Angle between two Straight line

(i) Equation of the bisector of angles between the lines $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are

$$\frac{a_1x + b_1y + c_1}{\sqrt{a_1^2 + b_1^2}} = \pm \frac{a_2x + b_2y + c_2}{\sqrt{a_2^2 + b_2^2}}$$

(ii) To discriminate between the acute angle bisector and the obtuse angle bisector : If θ be the angle between one of the lines and one of the bisector, find $\tan\theta$. If $|\tan\theta| < 1$ then $2\theta < 90^\circ$ so that this bisector is the acute angle bisector, If $|\tan\theta| > 1$, then we get the bisector to be the obtuse angle bisector.

(iii) First write the equation of the lines so that the constant terms are positive. Then

(a) If $a_1a_2 + b_1b_2 > 0$ then on taking positive sign in the above bisectors equation we shall get the obtuse angle bisector and on taking negative sign we shall get the acute angle bisector.

(b) If $a_1a_2 + b_1b_2 < 0$, the positive sign give the acute angle and negative sign gives the obtuse angle bisector.

(c) On taking positive sign we shall get equation of the bisector of the angle which contains the origin and negative sign gives the equation of the bisector which does not contain origin.

Note : This is also the bisector of the angle in which origin lies (since c_1, c_2 are positive and it has been obtained by taking positive sign)

13. Lines passing through the point of intersection of two lines

If equation of two lines $P = a_1x + b_1y + c_1 = 0$ and $Q = a_2x + b_2y + c_2 = 0$, then the equation of the lines passing through the point of intersection of these lines is $P + \lambda Q = 0$ or $(a_1x + b_1y + c = 0) + \lambda(a_2x + b_2y + c_2 = 0) = 0$; Value of λ is obtained with the help of the additional information given in the problem.

LEVEL-1

Question based on **Slope of a Line & Different forms of Equation of Straight Line**

Q.1 The angle made by the line joining the points (1, 0) and (–2, $\sqrt{3}$) with x axis is -
(A) 120º (B) 60º (C) 150º (D) 135º

Q.2 If A(2,3), B(3,1) and C(5,3) are three points, then the slope of the line passing through A and bisecting BC is -
(A) 1/2 (B) –2 (C) –1/2 (D) 2

Q.3 If the vertices of a triangle have integral coordinates, then the triangle is -
(A) Isosceles (B) Never equilateral
(C) Equilateral (D) None of these

Q.4 The equation of a line passing through the point (–3, 2) and parallel to x-axis is -
(A) $x - 3 = 0$ (B) $x + 3 = 0$
(C) $y - 2 = 0$ (D) $y + 2 = 0$

Q.5 If the slope of a line is 2 and it cuts an intercept – 4 on y-axis, then its equation will be -
(A) $y - 2x = 4$ (B) $x = 2y - 4$
(C) $y = 2x - 4$ (D) None of these

Q.6 The equation of the line cutting of an intercept –3 from the y-axis and inclined at an angle $\tan^{-1} 3/5$ to the x axis is -
(A) $5y - 3x + 15 = 0$ (B) $5y - 3x = 15$
(C) $3y - 5x + 15 = 0$ (D) None of these

Q.7 If the line $y = mx + c$ passes through the points (2, 4) and (3, –5), then -
(A) m = –9, c = –22 (B) m = 9, c = 22
(C) m = –9, c = 22 (D) m = 9, c = –22

Q.8 The equation of the line inclined at an angle of 60º with x-axis and cutting y-axis at the point (0, –2) is -
(A) $\sqrt{3}\,y = x - 2\sqrt{3}$ (B) $y = \sqrt{3}\,x - 2$
(C) $\sqrt{3}\,y = x + 2\sqrt{3}$ (D) $y = \sqrt{3}\,x + 2$

Q.9 The equation of a line passing through the origin and the point (a cosθ, a sin θ) is-
(A) $y = x \sin\theta$ (B) $y = x \tan\theta$
(C) $y = x \cos\theta$ (D) $y = x \cot\theta$

Q.10 Slope of a line which cuts intercepts of equal lengths on the axes is -
(A) –1 (B) 2 (C) 0 (D) $\sqrt{3}$

Q.11 The intercept made by line $x \cos\alpha + y \sin\alpha = a$ on y axis is -
(A) a (B) a cosecα
(C) a secα (D) a sinα

Q.12 The equation of the straight line which passes through the point (1, –2) and cuts off equal intercepts from axes will be-
(A) $x + y = 1$ (B) $x - y = 1$
(C) $x + y + 1 = 0$ (D) $x - y - 2 = 0$

Q.13 The intercept made by a line on y-axis is double to the intercept made by it on x-axis. If it passes through (1, 2) then its equation-
(A) $2x + y = 4$ (B) $2x + y + 4 = 0$
(C) $2x - y = 4$ (D) $2x - y + 4 = 0$

Q.14 If the point (5, 2) bisects the intercept of a line between the axes, then its equation is-
(A) $5x + 2y = 20$ (B) $2x + 5y = 20$
(C) $5x - 2y = 20$ (D) $2x - 5y = 20$

Q.15 If the point (3,–4) divides the line between the x-axis and y-axis in the ratio 2 : 3 then the equation of the line will be -
(A) $2x + y = 10$ (B) $2x - y = 10$
(C) $x + 2y = 10$ (D) $x - 2y = 10$

Q.16 The equation to a line passing through the point (2, –3) and sum of whose intercept on the axes is equal to –2 is -
(A) $x + y + 2 = 0$ or $3x + 3y = 7$

(B) $x + y + 1 = 0$ or $3x - 2y = 12$
(C) $x + y + 3 = 0$ or $3x - 3y = 5$
(D) $x - y + 2 = 0$ or $3x + 2y = 12$

Q.17 The line $bx + ay = 3ab$ cuts the coordinate axes at A and B, then centroid of ΔOAB is-
(A) (b, a) (B) (a, b)
(C) (a/3, b/3) (D) (3a, 3b)

Q.18 The area of the triangle formed by the lines $x = 0$, $y = 0$ and $x/a + y/b = 1$ is-
(A) ab (B) ab/2
(C) 2ab (D) ab/3

Q.19 The equations of the lines on which the perpendiculars from the origin make 30º angle with x-axis and which form a triangle of area $\frac{50}{\sqrt{3}}$ with axes, are -
(A) $x \pm \sqrt{3}\, y - 10 = 0$
(B) $\sqrt{3}\, x + y - 10 = 0$
(C) $x + \sqrt{3}\, y \pm 10 = 0$
(D) None of these

Q.20 If a perpendicular drawn from the origin on any line makes an angle 60º with x axis. If the line makes a triangle with axes whose area is $54\sqrt{3}$ square units, then its equation is -
(A) $x + \sqrt{3}\, y = 18$
(B) $\sqrt{3}\, x + y + 18 = 0$
(C) $\sqrt{3}\, x + y = 18$
(D) None of these

Q.21 For a variable line $x/a + y/b = 1$, $a + b = 10$, the locus of mid point of the intercept of this line between coordinate axes is -
(A) $10x + 5y = 1$ (B) $x + y = 10$
(C) $x + y = 5$ (D) $5x + 10 y = 1$

Q.22 If a line passes through the point P(1,2) makes an angle of 45º with the x-axis and meets the line $x + 2y - 7 = 0$ in Q, then PQ equals -
(A) $\frac{2\sqrt{2}}{3}$ (B) $\frac{3\sqrt{2}}{2}$
(C) $\sqrt{3}$ (D) $\sqrt{2}$

Q.23 A line passes through the point (1, 2) and makes 60º angle with x axis. A point on this line at a distance 3 from the point (1, 2) is -
(A) $(-5/2,\ 2 - 3\sqrt{3}/2)$ (B) $(3/2,\ 2 + 3\sqrt{3}/2)$
(C) $(5/2,\ 2 + 3\sqrt{3}/2)$ (D) None of these

Q.24 If the points (1, 3) and (5, 1) are two opposite vertices of a rectangle and the other two vertices lie on the line $y = 2x + c$, then the value of c is -
(A) 4 (B) – 4
(C) 2 (D) None of these

Question based on Angle between two Straight Lines

Q.25 The angle between the lines $y - x + 5 = 0$ and $\sqrt{3}\, x - y + 7 = 0$ is -
(A) 15º (B) 60º
(C) 45º (D) 75º

Q.26 The angle between the lines $2x + 3y = 5$ and $3x - 2y = 7$ is -
(A) 45º (B) 30º
(C) 60º (D) 90º

Q.27 The angle between the lines $2x - y + 5 = 0$ and $3x + y + 4 = 0$ is-
(A) 30º (B) 90º
(C) 45º (D) 60º

Q.28 The obtuse angle between the line $y = -2$ and $y = x + 2$ is -
(A) 120º (B) 135º
(C) 150º (D) 160º

Q.29 The acute angle between the lines $y = 3$ and $y = \sqrt{3}\, x + 9$ is -
(A) 30º (B) 60º
(C) 45º (D) 90º

Q.30 Orthocenter of the triangle whose sides are given by $4x - 7y + 10 = 0$, $x + y - 5 = 0$ & $7x + 4y - 15 = 0$ is -
(A) (–1, –2) (B) (1, –2)
(C) (–1, 2) (D) (1, 2)

Q.31 The angle between the lines $x - \sqrt{3}\, y + 5 = 0$ and y-axis is -
(A) 90º (B) 60º
(C) 30º (D) 45º

Q.32 If the lines $mx + 2y + 1 = 0$ and $2x + 3y + 5 = 0$ are perpendicular then the value of m is -
(A) –3 (B) 3 (C) –1/3 (D) 1/3

Q.33 If the line passing through the points (4, 3) and (2, λ) is perpendicular to the line $y = 2x + 3$, then λ is equal to -

(A) 4 (B) –4

(C) 1 (D) –1

Q.34 The equation of line passing through (2, 3) and perpendicular to the line adjoining the points (–5, 6) and (–6, 5) is -

(A) $x + y + 5 = 0$ (B) $x – y + 5 = 0$

(C) $x – y – 5 = 0$ (D) $x + y – 5 = 0$

Q.35 The equation of perpendicular bisector of the line segment joining the points (1, 2) and (–2, 0) is -

(A) $5x + 2y =1$ (B) $4x + 6y = 1$

(C) $6x + 4y =1$ (D) None of these

Q.36 If the foot of the perpendicular from the origin to a straight line is at the point (3, –4). Then the equation of the line is -

(A) $3x – 4y = 25$ (B) $3x – 4y + 25 = 0$

(C) $4x + 3y –25 = 0$ (D) $4x – 3y + 25 = 0$

Question based on Equation of Parallel and Perpendicular lines

Q.37 Equation of the line passing through the point (1, –1) and perpendicular to the line $2x – 3y = 5$ is -

(A) $3x + 2y – 1 = 0$ (B) $2x + 3y + 1 = 0$

(C) $3x + 2y – 3 = 0$ (D) $3x + 2y + 5 = 0$

Q.38 The equation of the line passing through the point (c, d) and parallel to the line $ax + by + c = 0$ is -

(A) $a(x + c) + b(y + d) = 0$

(B) $a(x + c) – b(y + d) = 0$

(C) $a(x – c) + b(y – d) = 0$

(D) None of these

Q.39 The equation of a line passing through the point (a, b) and perpendicular to the line $ax + by + c = 0$ is -

(A) $bx – ay + (a^2 – b^2) = 0$

(B) $bx – ay – (a^2 – b^2) = 0$

(C) $bx – ay = 0$

(D) None of these

Q.40 The line passes through (1, –2) and perpendicular to y-axis is -

(A) $x + 1 = 0$ (B) $x – 1 = 0$

(C) $y – 2 = 0$ (D) $y + 2 = 0$

Q.41 The equation of a line passing through (a, b) and parallel to the line $x/a + y/b = 1$ is -

(A) $x/a + y/b = 0$ (B) $x/a + y/b = 2$

(C) $x/a + y/b = 3$ (D) $x/a + y/b + 2 = 0$

Q.42 A line is perpendicular to $3x + y = 3$ and passes through a point (2, 2). Its y intercept is -

(A) 2/3 (B) 1/3

(C) 1 (D) 4/3

Q.43 The equation of a line parallel to $2x – 3y = 4$ which makes with the axes a triangle of area 12 units, is -

(A) $3x + 2y = 12$ (B) $2x – 3y = 12$

(C) $2x – 3y = 6$ (D) $3x + 2y = 6$

Q.44 The equation of a line parallel to $x + 2y = 1$ and passing through the point of intersection of the lines $x – y = 4$ and $3x + y = 7$ is -

(A) $x + 2y = 5$ (B) $4x + 8y – 1 = 0$

(C) $4x + 8y + 1 = 0$ (D) None of these

Q.45 The straight line L is perpendicular to the line $5x – y = 1$. The area of the triangle formed by the line L and coordinate axes is 5. Then the equation of the line will be -

(A) $x + 5y = 5\sqrt{2}$ or $x + 5y = –5\sqrt{2}$

(B) $x – 5y = 5\sqrt{2}$ or $x – 5y = 5\sqrt{2}$

(C) $x + 4y = 5\sqrt{2}$ or $x– 2y = 5\sqrt{2}$

(D) $2x + 5y = 5\sqrt{2}$ or $x + 5y = 5\sqrt{2}$

Q.46 If (0, 0), (–2, 1) and (5, 2) are the vertices of a triangle, Then equation of line passing through its centroid and parallel to the line $x – 2y = 6$ is-

(A) $x – 2y = 1$ (B) $x + 2y + 1 = 0$

(C) $x – 2y = 0$ (D) $x – 2y + 1 = 0$

Q.47 The equation of the line which passes through ($a\cos^3\theta$, $a\sin^3\theta$) and perpendicular to the line $x\sec\theta + y\operatorname{cosec}\theta = a$ is -

(A) $x\cos\theta + y\sin\theta = 2a\cos2\theta$

(B) $x\sin\theta – y\cos\theta = 2a\sin2\theta$

(C) $x\sin\theta + y\cos\theta = 2a\cos2\theta$

(D) $x\cos\theta – y\sin\theta = a\cos2\theta$

Question based on

Equation of straight lines through (x_1, y_1) making an angle α with y = mx + c

Q.48 The equation of the lines which passes through the point (3,–2) and are inclined at 60º to the line $\sqrt{3}\,x + y = 1$.

(A) $y + 2 = 0,\ \sqrt{3}\,x - y - 2 - 3\sqrt{3} = 0$

(B) $\sqrt{3}\,x - y - 2 - 3\sqrt{3} = 0$

(C) $x - 2 = 0,\ \sqrt{3}\,x - y + 2 + 3\sqrt{3} = 0$

(D) None of these

Q.49 (1, 2) is vertex of a square whose one diagonal is along the x – axis. The equations of sides passing through the given vertex are -

(A) 2x – y = 0, x + 2y + 5 = 0

(B) x – 2y + 3 = 0, 2x + y – 4 = 0

(C) x – y + 1 = 0, x + y – 3 = 0

(D) None of these

Q.50 The equation of the lines which pass through the origin and are inclined at an angle $\tan^{-1} m$ to the line y = mx + c, are-

(A) $y = 0,\ 2mx + (1 - m^2)y = 0$

(B) $y = 0,\ 2mx + (m^2 - 1)y = 0$

(C) $x = 0,\ 2mx + (m^2 - 1)y = 0$

(D) None of these

Question based on

Length of Perpendicular, foot of the perpendicular & image of the point with respect to line

Q.51 The length of the perpendicular from the origin on the line $\sqrt{3}\,x - y + 2 = 0$ is -

(A) 3 (B) 1

(C) 2 (D) 2.5

Q.52 The length of perpendicular from (2, 1) on line 3x – 4y + 8 = 0 is-

(A) 5 (B) 4 (C) 3 (D) 2

Q.53 The length of perpendicular from the origin on the line x/a + y/b = 1 is -

(A) $\frac{b}{\sqrt{a^2 + b^2}}$ (B) $\frac{a}{\sqrt{a^2 + b^2}}$

(C) $\frac{ab}{\sqrt{a^2 + b^2}}$ (D) None of these

Q.54 The distance between the lines 5x + 12y + 13 = 0 and 5x + 12y = 9 is -

(A) 11/13 (B) 22/17

(C) 22/13 (D) 13/22

Q.55 The distance between the parallel lines y = 2x + 4 and 6x = 3y + 5 is -

(A) $17/\sqrt{3}$ (B) 1

(C) $3/\sqrt{5}$ (D) $17\sqrt{5}/15$

Q.56 The foot of the perpendicular drawn from the point (7, 8) to the line 2x + 3y – 4 = 0 is -

(A) $\left(\frac{23}{13}, \frac{2}{13}\right)$ (B) $\left(13, \frac{23}{13}\right)$

(C) $\left(-\frac{23}{13}, -\frac{2}{13}\right)$ (D) $\left(-\frac{2}{13}, \frac{23}{13}\right)$

Q.57 The coordinates of the point Q symmetric to the point P(–5, 13) with respect to the line 2x – 3y – 3 = 0 are -

(A) (11, –11) (B) (5, –13)

(C) (7, –9) (D) (6, –3)

Question based on

Lines passing through the Point of Intersection of two lines

Q.58 The line passing through the point of intersection of lines x + y – 2 = 0 and 2x – y + 1 = 0 and origin is -

(A) 5x – y = 0 (B) 5x + y = 0

(C) x + 5y = 0 (D) x – 5y = 0

Q.59 The equation of the line through the point of intersection of the line y = 3 and x + y = 0 and parallel to the line 2x – y = 4 is -

(A) 2x – y + 9 = 0 (B) 2x – y – 9 = 0

(C) 2x – y + 1 = 0 (D) None of these

Q.60 The equation of the line passing through the point of intersection of the line 4x – 3y – 1 = 0 and 5x – 2y – 3 = 0 and parallel to the line 2x – 3y + 2 = 0 is -

(A) x – 3y = 1 (B) 3x – 2y = 1

(C) 2x – 3y + 1 = 0 (D) 2x – y = 1

Q.61 The equation of a line perpendicular to the line 5x – 2y + 7 = 0 and passing through the point of

intersection of lines $y = x + 7$ and $x + 2y + 1 = 0$, is -
(A) $2x + 5y = 0$ (B) $2x + 5y = 20$
(C) $2x + 5y = 10$ (D) None of these

Q.62 The equation of straight line passing through the point of intersection of the lines $x - y + 1 = 0$ and $3x + y - 5 = 0$ and perpendicular to one of them is -
(A) $x + y - 3 = 0$ or $x - 3y + 5 = 0$
(B) $x - y + 3 = 0$ or $x + 3y + 5 = 0$
(C) $x - y - 3 = 0$ or $x + 3y - 5 = 0$
(D) $x + y + 3 = 0$ or $x + 3y + 5 = 0$

Question based on
Condition of concurrency

Q.63 If a, b, c are in A.P., then $ax + by + c = 0$ will always pass through a fixed point whose coordinates are -
(A) (1, –2) (B) (–1, 2)
(C) (1, 2) (D) (–1, –2)

Q.64 The straight lines $ax + by + c = 0$ where $3a + 2b + 4c = 0$ are concurrent at the point
(A) (1/2, 3/4) (B) (3/4, 1/2)
(C) (–3/4, –1/2) (D) (–3/4, 1/2)

Q.65 If the lines $ax + 2y + 1 = 0$, $bx + 3y + 1 = 0$, $cx + 4y + 1 = 0$ are concurrent, then a, b, c are in -
(A) AP (B) GP
(C) HP (D) None

Q.66 Find the fix point through which the line $x(a + 2b) + y(a + 3b) = a + b$ always passes for all values of a and b -
(A) (2, 1) (B) (1, 2)
(C) (2, –1) (D) (1, –2)

Question based on
Bisector of Angle between two Lines

Q.67 The equation of the bisector of the angle between the lines $3x - 4y + 7 = 0$ and $12x - 5y - 8 = 0$ is -
(A) $99x - 77y + 51 = 0$, $21x + 27y - 131 = 0$
(B) $99x - 77y + 51 = 0$, $21x + 27y + 131 = 0$
(C) $99x - 77y + 131 = 0$, $21x + 27y - 51 = 0$
(D) None of these

Q.68 The equation of the bisector of the acute angle between the lines $3x - 4y + 7 = 0$ and $12x + 5y - 2 = 0$ is-
(A) $11x - 3y - 9 = 0$
(B) $11x - 3y + 9 = 0$
(C) $21x + 77y - 101 = 0$
(D) None of these

ANSWER KEY

LEVEL-1

Qus.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Ans.	C	C	B	C	C	A	C	B	B	A	B	C	A	B	B	B	B	B	B	A
Qus.	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
Ans.	C	A	C	B	A	D	C	B	B	D	B	B	A	D	C	A	A	C	C	D
Qus.	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
Ans.	B	D	B	B	A	D	D	A	C	B	B	D	C	C	D	A	A	A	A	C
Qus.	**61**	**62**	**63**	**64**	**65**	**66**	**67**	**68**												
Ans.	A	A	A	B	A	C	A	B												

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Straight Line and Pair of Straight Lines

Topic 1 Various Forms of Straight Line

Objective Questions I (Only one correct option)

1. A straight line L at a distance of 4 units from the origin makes positive intercepts on the coordinate axes and the perpendicular from the origin to this line makes an angle of 60° with the line $x + y = 0$. Then, an equation of the line L is **(2019 Main, 12 April II)**

(a) $x + \sqrt{3}y = 8$
(b) $(\sqrt{3} + 1)x + (\sqrt{3} - 1)y = 8\sqrt{2}$
(c) $\sqrt{3}x + y = 8$
(d) $(\sqrt{3} - 1)x + (\sqrt{3} + 1)y = 8\sqrt{2}$

2. The equation $y = \sin x \sin(x+2) - \sin^2(x+1)$ represents a straight line lying in **(2019 Main, 12 April I)**

(a) second and third quadrants only
(b) first, second and fourth quadrants
(c) first, third and fourth quadrants
(d) third and fourth quadrants only

3. Lines are drawn parallel to the line $4x - 3y + 2 = 0$, at a distance $\frac{3}{5}$ from the origin. Then which one of the following points lies on any of these lines? **(2019 Main, 10 April I)**

(a) $\left(-\frac{1}{4}, -\frac{2}{3}\right)$ (b) $\left(-\frac{1}{4}, \frac{2}{3}\right)$
(c) $\left(\frac{1}{4}, -\frac{1}{3}\right)$ (d) $\left(\frac{1}{4}, \frac{1}{3}\right)$

4. The region represented by $|x - y| \le 2$ and $|x + y| \le 2$ is bounded by a **(2019 Main, 10 April I)**

(a) rhombus of side length 2 units
(b) rhombus of area $8\sqrt{2}$ sq units
(c) square of side length $2\sqrt{2}$ units
(d) square of area 16 sq units

5. If the two lines $x + (a-1)y = 1$ and $2x + a^2y = 1$, $(a \in R - \{0, 1\})$ are perpendicular, then the distance of their point of intersection from the origin is **(2019 Main, 9 April II)**

(a) $\frac{2}{5}$ (b) $\frac{\sqrt{2}}{5}$
(c) $\frac{2}{\sqrt{5}}$ (d) $\sqrt{\frac{2}{5}}$

6. Slope of a line passing through P (2, 3) and intersecting the line, $x + y = 7$ at a distance of 4 units from P, is **(2019 Main, 9 April I)**

(a) $\frac{1-\sqrt{5}}{1+\sqrt{5}}$ (b) $\frac{\sqrt{7}-1}{\sqrt{7}+1}$
(c) $\frac{1-\sqrt{7}}{1+\sqrt{7}}$ (d) $\frac{\sqrt{5}-1}{\sqrt{5}+1}$

7. If a point $R(4, y, z)$ lies on the line segment joining the points $P(2, -3, 4)$ and $Q(8, 0, 10)$, then the distance of R from the origin is **(2019 Main, 8 April II)**

(a) $2\sqrt{21}$ (b) $\sqrt{53}$
(c) $2\sqrt{14}$ (d) 6

8. Suppose that the points (h, k), $(1, 2)$ and $(-3, 4)$ lie on the line L_1. If a line L_2 passing through the points (h, k) and $(4, 3)$ is perpendicular to L_1, then k/h equals **(2019 Main, 8 April II)**

(a) $-\frac{1}{7}$ (b) $\frac{1}{3}$
(c) 3 (d) 0

9. A point on the straight line, $3x + 5y = 15$ which is equidistant from the coordinate axes will lie only in **(2019 Main, 8 April I)**

(a) IV quadrant (b) I quadrant
(c) I and II quadrants (d) I, II and IV quadrants

10. If a straight line passing through the point $P(-3, 4)$ is such that its intercepted portion between the coordinate axes is bisected at P, then its equation is **(2019 Main, 12 Jan II)**

(a) $x - y + 7 = 0$
(b) $4x - 3y + 24 = 0$
(c) $3x - 4y + 25 = 0$
(d) $4x + 3y = 0$

11. If the straight line, $2x - 3y + 17 = 0$ is perpendicular to the line passing through the points (7, 17) and (15, β), then β equals **(2019 Main, 12 Jan I)**

(a) $\frac{35}{3}$ (b) -5 (c) $-\frac{35}{3}$ (d) 5

12. If in a parallelogram $ABDC$, the coordinates of A, B and C are respectively (1, 2), (3, 4) and (2, 5), then the equation of the diagonal AD is **(2019 Main, 11 Jan II)**

(a) $3x + 5y - 13 = 0$
(b) $3x - 5y + 7 = 0$
(c) $5x - 3y + 1 = 0$
(d) $5x + 3y - 11 = 0$

13. The tangent to the curve, $y = xe^{x^2}$ passing through the point $(1, e)$ also passes through the point **(2019 Main, 10 Jan II)**

(a) $\left(\frac{4}{3}, 2e\right)$ (b) $(3, 6e)$
(c) $(2, 3e)$ (d) $\left(\frac{5}{3}, 2e\right)$

14. Two sides of a parallelogram are along the lines, $x + y = 3$ and $x - y + 3 = 0$. If its diagonals intersect at (2, 4), then one of its vertex is **(2019 Main, 10 Jan II)**

(a) (3, 6) (b) (2, 6)
(c) (2, 1) (d) (3, 5)

15. The shortest distance between the point $\left(\frac{3}{2}, 0\right)$ and the curve $y = \sqrt{x}$, $(x > 0)$, is **(2019 Main, 10 Jan I)**

(a) $\frac{3}{2}$ (b) $\frac{5}{4}$ (c) $\frac{\sqrt{3}}{2}$ (d) $\frac{\sqrt{5}}{2}$

16. If the line $3x + 4y - 24 = 0$ intersects the X-axis at the point A and the Y-axis at the point B, then the incentre of the triangle OAB, where O is the origin, is **(2019 Main, 10 Jan I)**

(a) (4, 3) (b) (3, 4)
(c) (4, 4) (d) (2, 2)

17. A point P moves on the line $2x - 3y + 4 = 0$. If $Q(1, 4)$ and $R(3, -2)$ are fixed points, then the locus of the centroid of ΔPQR is a line **(2019 Main, 10 Jan I)**

(a) with slope $\frac{2}{3}$ (b) with slope $\frac{3}{2}$
(c) parallel to Y-axis (d) parallel to X-axis

18. A straight line through a fixed point (2, 3) intersects the coordinate axes at distinct points P and Q. If O is the origin and the rectangle $OPRQ$ is completed, then the locus of R is **(2018 Main)**

(a) $3x + 2y = 6$ (b) $2x + 3y = xy$
(c) $3x + 2y = xy$ (d) $3x + 2y = 6xy$

19. Let k be an integer such that the triangle with vertices $(k, -3k)$, $(5, k)$ and $(-k, 2)$ has area 28 sq units. Then, the orthocentre of this triangle is at the point **(2017 Main)**

(a) $\left(2, -\frac{1}{2}\right)$ (b) $\left(1, \frac{3}{4}\right)$ (c) $\left(1, -\frac{3}{4}\right)$ (d) $\left(2, \frac{1}{2}\right)$

20. Let a, b, c and d be non-zero numbers. If the point of intersection of the lines $4ax + 2ay + c = 0$ and $5bx + 2by + d = 0$ lies in the fourth quadrant and is equidistant from the two axes, then **(2014 Main)**

(a) $2bc - 3ad = 0$ (b) $2bc + 3ad = 0$
(c) $2ad - 3bc = 0$ (d) $3bc + 2ad = 0$

21. If PS is the median of the triangle with vertices $P(2,2)$, $Q(6,-1)$ and $R(7,3)$, then equation of the line passing through $(1,-1)$ and parallel to PS is **(2014 Main, 2000)**

(a) $4x - 7y - 11 = 0$ (b) $2x + 9y + 7 = 0$
(c) $4x + 7y + 3 = 0$ (d) $2x - 9y - 11 = 0$

22. The x-coordinate of the incentre of the triangle that has the coordinates of mid-points of its sides as (0, 1), (1, 1) and (1, 0) is **(2013 Main)**

(a) $2 + \sqrt{2}$ (b) $2 - \sqrt{2}$ (c) $1 + \sqrt{2}$ (d) $1 - \sqrt{2}$

23. A straight line L through the point (3, –2) is inclined at an angle 60° to the line $\sqrt{3}x + y = 1$. If L also intersects the X-axis, then the equation of L is **(2011)**

(a) $y + \sqrt{3}x + 2 - 3\sqrt{3} = 0$ (b) $y - \sqrt{3}x + 2 + 3\sqrt{3} = 0$
(c) $\sqrt{3}y - x + 3 + 2\sqrt{3} = 0$ (d) $\sqrt{3}y + x - 3 + 2\sqrt{3} = 0$

24. The locus of the orthocentre of the triangle formed by the lines $(1 + p)x - py + p(1 + p) = 0$, $(1 + q)x - qy + q(1 + q) = 0$ and $y = 0$, where $p \neq q$, is **(2009)**

(a) a hyperbola (b) a parabola
(c) an ellipse (d) a straight line

25. Let $O(0, 0)$, $P(3, 4)$ and $Q(6, 0)$ be the vertices of a ΔOPQ. The point R inside the ΔOPQ is such that the triangles OPR, PQR and OQR are of equal area. The coordinates of R are **(2007, 3M)**

(a) $\left(\frac{4}{3}, 3\right)$ (b) $\left(3, \frac{2}{3}\right)$ (c) $\left(3, \frac{4}{3}\right)$ (d) $\left(\frac{4}{3}, \frac{2}{3}\right)$

26. Orthocentre of triangle with vertices (0, 0), (3, 4) and (4, 0) is **(2003, 2M)**

(a) $\left(3, \frac{5}{4}\right)$ (b) (3, 12) (c) $\left(3, \frac{3}{4}\right)$ (d) (3, 9)

27. The number of integer values of m, for which the x-coordinate of the point of intersection of the lines $3x + 4y = 9$ and $y = mx + 1$ is also an integer, is **(2001, 1M)**

(a) 2 (b) 0 (c) 4 (d) 1

28. A straight line through the origin O meets the parallel lines $4x + 2y = 9$ and $2x + y + 6 = 0$ at points P and Q respectively. Then, the point O divides the segment PQ in the ratio **(2000, 1M)**

(a) 1 : 2 (b) 3 : 4 (c) 2 : 1 (d) 4 : 3

29. The incentre of the triangle with vertices $(1, \sqrt{3})$, $(0, 0)$ and $(2, 0)$ is **(2000, 2M)**

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

30. If A_0, A_1, A_2, A_3, A_4 and A_5 be a regular hexagon inscribed in a circle of unit radius. Then, the product of the lengths of the line segments A_0A_1, A_0A_2 and A_0A_4 is **(1998, 2M)**

(a) $3/4$ (b) $3\sqrt{3}$
(c) 3 (d) $\frac{3\sqrt{3}}{2}$

31. If the vertices P, Q, R of a ΔPQR are rational points, which of the following points of the ΔPQR is/are always rational point(s) **(1998, 2M)**

(a) centroid (b) incentre
(c) circumcentre (d) orthocentre

(A rational point is a point both of whose coordinates are rational numbers)

32. If $P(1,2)$, $Q(4,6)$, $R(5,7)$ and $S(a, b)$ are the vertices of a parallelogram $PQRS$, then **(1998, 2M)**

(a) $a = 2, b = 4$ (b) $a = 3, b = 4$
(c) $a = 2, b = 3$ (d) $a = 3, b = 5$

33. The diagonals of a parallelogram $PQRS$ are along the lines $x + 3y = 4$ and $6x - 2y = 7$. Then, $PQRS$ must be a **(1998, 2M)**

(a) rectangle (b) square
(c) cyclic quadrilateral (d) rhombus

34. The graph of the function $\cos x \cos(x+2) - \cos^2(x+1)$ is **(1997, 2M)**

(a) a straight line passing through $(0, -\sin^2 1)$ with slope 2
(b) a straight line passing through (0, 0)
(c) a parabola with vertex $(1, -\sin^2 1)$
(d) a straight line passing through the point $\left(\frac{\pi}{2}, -\sin^2 1\right)$ and parallel to the X-axis

35. The orthocentre of the triangle formed by the lines $xy = 0$ and $x + y = 1$, is **(1995, 2M)**

(a) $\left(\frac{1}{2}, \frac{1}{2}\right)$ (b) $\left(\frac{1}{3}, \frac{1}{3}\right)$
(c) (0, 0) (d) $\left(\frac{1}{4}, \frac{1}{4}\right)$

36. If the sum of the distance of a point from two perpendicular lines in a plane is 1, then its locus is **(1992, 2M)**

(a) square (b) circle
(c) straight line (d) two intersecting lines

37. Line L has intercepts a and b on the coordinate axes. When, the axes are rotated through a given angle, keeping the origin fixed, the same line L has intercepts p and q, then **(1990, 2M)**

(a) $a^2 + b^2 = p^2 + q^2$ (b) $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{p^2} + \frac{1}{q^2}$
(c) $a^2 + p^2 = b^2 + q^2$ (d) $\frac{1}{a^2} + \frac{1}{p^2} = \frac{1}{b^2} + \frac{1}{q^2}$

38. If $P = (1, 0)$, $Q = (-1, 0)$ and $R = (2, 0)$ are three given points, then locus of the points satisfying the relation $SQ^2 + SR^2 = 2SP^2$, is **(1988, 2M)**

(a) a straight line parallel to X-axis
(b) a circle passing through the origin
(c) a circle with the centre at the origin
(d) a straight line parallel to Y-axis

39. The point (4, 1) undergoes the following three transformations successively

I. Reflection about the line $y = x$.
II. Transformation through a distance 2 units along the positive direction of X-axis.
III. Rotation through an angle $\frac{\pi}{4}$ about the origin in the counter clockwise direction.

Then, the final position of the point is given by the coordinates **(1980, 1M)**

(a) $\left(\frac{1}{\sqrt{2}}, \frac{7}{\sqrt{2}}\right)$ (b) $(-\sqrt{2}, 7\sqrt{2})$
(c) $\left(-\frac{1}{\sqrt{2}}, \frac{7}{\sqrt{2}}\right)$ (d) $(\sqrt{2}, 7\sqrt{2})$

40. The points $(-a, -b)$, $(0, 0)$, (a, b) and (a^2, a^3) are **(1979, 2M)**

(a) collinear
(b) vertices of a rectangle
(c) vertices of a parallelogram
(d) None of the above

Objective Questions II

(One or more than one correct option)

41. Let $a, \lambda, \mu \in R$. Consider the system of linear equations $ax + 2y = \lambda$ and $3x - 2y = \mu$.

Which of the following statement(s) is/are correct? **(2016 Adv.)**

(a) If $a = -3$, then the system has infinitely many solutions for all values of λ and μ
(b) If $a \neq -3$, then the system has a unique solution for all values of λ and μ
(c) If $\lambda + \mu = 0$, then the system has infinitely many solutions for $a = -3$
(d) If $\lambda + \mu \neq 0$, then the system has no solution for $a = -3$

42. For $a > b > c > 0$, the distance between (1, 1) and the point of intersection of the lines $ax + by + c = 0$ and $bx + ay + c = 0$ is less than $2\sqrt{2}$. Then, **(2014 Adv.)**

(a) $a + b - c > 0$ (b) $a - b + c < 0$
(c) $a - b + c > 0$ (d) $a + b - c < 0$

43. All points lying inside the triangle formed by the points (1, 3), (5, 0) and (– 1, 2) satisfy **(1986, 2M)**

(a) $3x + 2y \geq 0$ (b) $2x + y - 13 \geq 0$
(c) $2x - 3y - 12 \leq 0$ (d) $-2x + y \geq 0$

Fill in the Blanks

44. Let the algebraic sum of the perpendicular distance from the points (2, 0), (0, 2) and (1, 1) to a variable straight line be zero, then the line passes through a fixed point whose coordinates are… . **(1991, 2M)**

45. The orthocentre of the triangle formed by the lines $x + y = 1$, $2x + 3y = 6$ and $4x - y + 4 = 0$ lies in quadrant number… . **(1985, 2M)**

46. If a, b and c are in AP, then the straight line $ax + by + c = 0$ will always pass through a fixed point whose coordinates are (…) . **(1984, 2M)**