— STRAIGHT LINE —

AIEEE Syllabus

1. *Equation of Straight line*
2. *Equation of Straight line parallel to axes*
3. *Slope of a line*
4. *Different forms of the equation of Straight line*
5. *Reduction of general form of equation into standard forms*
6. *Position of a point relative to a line*
7. *Angle between two straight lines*
8. *Equation of parallel & perpendicular lines*
9. *Equation of Straight lines through* (x_1, y_1) *making an angle* α *with* $y = mx + c$
10. *Length of perpendicular*
11. *Condition of concurrency*
12. *Bisectors of angles between two lines*
13. *Line passing through the point of intersection of two lines*

Total No. of questions in **Straight line** are:

Solved examples……….....…………………..…21

Level # 1 ……………………………………… 68

Level # 2 ……………………………………….30

Level # 3 ……………………………………….30

Level # 4 ……………………………………..…22

Total No. of questions…..………..171

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1. Students are advised to solve the questions of exercises (Levels # 1, 2, 3, 4) in the same sequence or as directed by the faculty members.
2. Level #3 is not for foundation course students, it will be discussed in fresher and target courses.

Index : Preparing your own list of Important/Difficult Questions

Instruction to fill

(A) Write down the Question Number you are unable to solve in **column A** below, by Pen.

(B) After discussing the Questions written in **column A** with faculties, strike off them in the manner so that you can see at the time of Revision also, to solve these questions again.

(C) Write down the Question Number you feel are important or good in the **column B**.

EXERCISE NO.	COLUMN :A Questions I am unable to solve in first attempt	COLUMN :B Good/Important questions
Level # 1		
Level # 2		
Level # 3		
Level # 4		

Advantages

1. It is advised to the students that they should prepare a question bank for the revision as it is very difficult to solve all the questions at the time of revision.

2. Using above index you can prepare and maintain the questions for your revision.

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. $3x + 4y = 5$, $-4x + 9y = 3$ 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 $m = \tan 45^\circ = 1$.

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 :

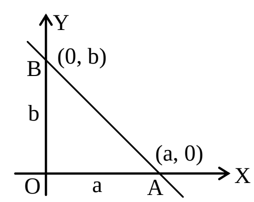
The equation of a line passing through two given points (x_1, y_1) and (x_2, y_2) is -

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

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 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 tanθ.

7.1 Parallel Lines :

Two lines are parallel, then angle between them is 0

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

$$\Rightarrow m_1 = m_2$$

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

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

$$\Rightarrow m_1m_2 = -1$$

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

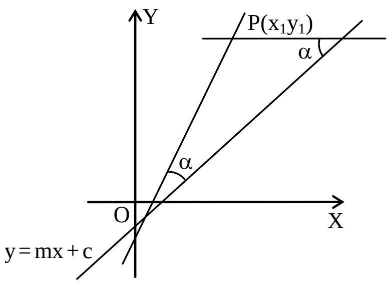
8. Equation of Parallel & Perpendicular lines

(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 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 tanθ. If |tanθ| < 1 then 2θ < 90º so that this bisector is the acute angle bisector, If |tanθ| > 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.

SOLVED EXAMPLES

Ex.1 The equation of the line which passes through the point (3, 4) and the sum of its intercept on the axes is 14, is -

(A) $4x - 3y = 24,\ x - y = 7$

(B) $4x + 3y = 24,\ x + y = 7$

(C) $4x + 3y + 24 = 0,\ x + y + 7 = 0$

(D) $4x - 3y + 24 = 0,\ x - y + 7 = 0$

Sol. Let the equation of the line be $\frac{x}{a} + \frac{y}{b} = 1$ ...(1)

This passes through (3, 4), therefore

$$\frac{3}{a} + \frac{4}{b} = 1 \qquad ...(2)$$

It is given that $a + b = 14 \Rightarrow b = 14 - a$. Putting $b = 14 - a$ in (2), we get

$$\frac{3}{a} + \frac{4}{b} = 1 \quad \Rightarrow a^2 - 13a + 42 = 0$$

$\Rightarrow (a - 7)(a - 6) = 0 \ \Rightarrow a = 7, 6$

For $a = 7$, $b = 14 - 7 = 7$ and for $a = 6$, $b = 14 - 6 = 8$.

Putting the values of a and b in (1), we get the equations of the lines

$$\frac{x}{7} + \frac{y}{7} = 1 \quad \text{and} \quad \frac{x}{6} + \frac{y}{8} = 1$$

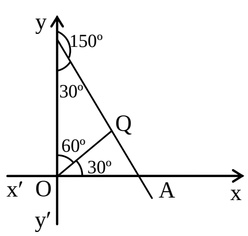
or $x + y = 7$ and $4x + 3y = 24$ **Ans. [B]**

Ex.2 The length of the perpendicular from the origin to a line is 7 and the line makes an angle of 150º with the positive direction of y-axis. The equation of the line is –

(A) $\sqrt{3}\,x + y = 14$ (B) $\sqrt{3}\,x - y = 14$

(C) $\sqrt{3}\,x + y + 14 = 0$ (D) $\sqrt{3}\,x - y + 14 = 0$

Sol. Here $p = 7$ and $\alpha = 30º$



$\therefore$ Equation of the required line is

$x \cos 30º + y \sin 30º = 7$

or $x\frac{\sqrt{3}}{2} + y \times \frac{1}{2} = 7$

or $\sqrt{3}\,x + y = 14$ **Ans. [A]**

Ex.3 If the intercept made by the line between the axes is bisected at the point (x_1, y_1), then its equation is -

(A) $\frac{x}{x_1} + \frac{y}{y_1} = 2$ (B) $\frac{x}{x_1} + \frac{y}{y_1} = 1$

(C) $\frac{x}{x_1} + \frac{y}{y_1} = \frac{1}{2}$ (D) None of these

Sol. Let the equations of the line be $\frac{x}{a} + \frac{y}{b} = 1$, then the coordinates of point of intersection of this line and x-axis and y-axis are respectively (a, 0). (0, b). Hence mid point of the intercept is (a/2, b/2).

$\therefore$ $a/2 = x_1 \Rightarrow a = 2x_1$ and $b/2 = y_1$

$\Rightarrow b = 2y_1$

Hence required equation of the line is

$$\frac{x}{2x_1} + \frac{y}{2y_1} = 1$$

$\Rightarrow \frac{x}{x_1} + \frac{y}{y_1} = 2$ **Ans. [A]**

Ex.4 The distance of the point (2, 3) from the line $2x - 3y + 9 = 0$ measured along a line $x - y + 1 = 0$, is -

(A) $\sqrt{2}$ (B) $4\sqrt{2}$

(C) $\sqrt{8}$ (D) $3\sqrt{2}$

Sol. The slope of the line $x - y + 1 = 0$ is 1. So it makes an angle of 45º with x-axis.

The equation of a line passing through (2, 3) and making an angle of 45º is

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

$$\left[\text{Using } \frac{x - x_1}{\cos\theta} = \frac{y - y_1}{\sin\theta} = r\right]$$

co-ordinats of any point on this line are

$(2 + r\cos 45º,\ 3 + r\sin 45º)$ or $\left(2 + \frac{r}{\sqrt{2}}, 3 + \frac{r}{\sqrt{2}}\right)$

If this point lies on the line $2x - 3y + 9 = 0$,

then $4 + r\sqrt{2} - 9 - \frac{3r}{\sqrt{2}} + 9 = 0$

$\Rightarrow r = 4\sqrt{2}$.

So the required distance = $4\sqrt{2}$. **Ans. [B]**

Ex.5 If x + 2y = 3 is a line and A(–1, 3); B(2, –3); C(4, 9) are three points, then -

(A) A is on one side and B, C are on other side of the line

(B) A, B are on one side and C is on other side of the line

(C) A, C on one side and B is no other side of the line

(D) All three points are on one side of the line

Sol. Substituting the coordinates of points A, B and C in the expression x + 2y – 3, we get

The value of expression for A is

$= -1 + 6 - 3 = 2 > 0$

The value of expression for B is

$= 2 - 6 - 3 = -7 < 0$

The value of expression for C is

$= 4 + 18 - 3 = 19 > 0$

$\because$ Signs of expressions for A, C are same while for B, the sign of expression is different

$\therefore$ A, C are on one side and B is on other side of the line

Ans. [C]

Ex.6 The equation of two equal sides of an isosceles triangle are 7x – y + 3 = 0 and x + y – 3 = 0 and its third side is passes through the point (1, –10). The equation of the third side is

(A) x – 3y – 31 = 0 but not 3x + y + 7 = 0

(B) neither 3x + y + 7 = 0 nor x – 3y – 31 = 0

(C) 3x = y + 7 = 0 or x – 3y – 31 = 0

(D) 3x + y + 7 = 0 but not x – 3y – 31 = 0

Sol. Third side passes through (1, –10) so let its equation be y + 10 = m(x –1)

If it makes equal angle, say θ with given two sides, then

$\tan\theta = \frac{m-7}{1+7m} = \frac{m-(-1)}{1+m(-1)} \Rightarrow m = -3 \text{ or } 1/3$

Hence possible equations of third side are

$y + 10 = -3(x-1)$ and $y + 10 = \frac{1}{3}(x - 1)$

or $3x + y + 7 = 0$ and $x - 3y - 31 = 0$

Ans.[C]

Ex.7 Triangle formed by lines x + y = 0, 3x + y = 4 and x + 3y = 4 is -

(A) equilateral (B) right angled

(C) isosceles (D) None of these

Sol. Slope of the given lines are –1, –3, $-\frac{1}{3}$ respectively

Let $m_1 = -\frac{1}{3}$, $m_2 = -1$, $m_3 = -3$

$\therefore \tan A = \frac{-\frac{1}{3}+1}{1+\frac{1}{3}.1} \Rightarrow A = \tan^{-1}\left(\frac{1}{2}\right)$

$\tan B = \frac{-1+3}{1+1.3} \Rightarrow B = \tan^{-1}\left(\frac{1}{2}\right)$

and $\tan C = \frac{-\frac{1}{3}+1}{1+3.\frac{1}{3}} \Rightarrow C = \tan^{-1}\left(-\frac{4}{3}\right)$

$\because \angle A = \angle B$, Hence triangle is isosceles triangle.

Ans.[C]

Ex.8 If A(–2,1), B(2,3) and C(–2,–4) are three points, then the angle between BA and BC is -

(A) $\tan^{-1}\left(\frac{3}{2}\right)$ (B) $\tan^{-1}\left(\frac{2}{3}\right)$

(C) $\tan^{-1}\left(\frac{7}{4}\right)$ (D) None of these

Sol. Let m_1 and m_2 be the slopes of BA and BC respectively. Then

$m_1 = \frac{3-1}{2-(-2)} = \frac{2}{4} = \frac{1}{2}$ and $m_2 = \frac{-4-3}{-2-2} = \frac{7}{4}$

Let θ be the angle between BA and BC. Then

$\tan\theta = \left|\frac{m_2 - m_1}{1+m_1m_2}\right| = \left|\frac{\frac{7}{4}-\frac{1}{2}}{1+\frac{7}{4}\times\frac{1}{2}}\right| = \left|\frac{\frac{10}{8}}{\frac{15}{8}}\right| = \pm\frac{2}{3}$

$\Rightarrow \theta = \tan^{-1}\left(\frac{2}{3}\right)$

Ans. [B]

Ex.9 The area of the parallelogram formed by the lines 4y – 3x = 1, 4y – 3x – 3 = 0, 3y – 4x + 1 = 0, 3y – 4x + 2 = 0 is -

(A) 3/8 (B) 2/7

(C) 1/6 (D) None of these

Sol. Let the equation of sides AB, BC, CD and DA of parallelogram ABCD are respectively

$y = \frac{3}{4}x + \frac{1}{4}$ ...(1); $y = \frac{3}{4}x + \frac{3}{4}$ ...(2)

$y = \frac{4}{3}x - \frac{1}{3}$ ...(3); $y = \frac{4}{3}x - \frac{2}{3}$ ...(4)

Here $m = \frac{3}{4}$, $n = \frac{4}{3}$, $a = \frac{1}{4}$, $b = \frac{3}{4}$,

$c = -\frac{1}{3}$, $d = -\frac{2}{3}$

$\therefore$ Area of parallelogram ABCD

$$= \left|\frac{(a-b)(c-d)}{m-n}\right| = \left|\frac{\left(\frac{1}{4}-\frac{3}{4}\right)\left(-\frac{1}{3}+\frac{2}{3}\right)}{\frac{3}{4}-\frac{4}{3}}\right|$$

$$= \left|\frac{-\frac{1}{2}\times\frac{1}{3}}{-\frac{7}{12}}\right| = \frac{2}{7}$$ **Ans. [B]**

Ex.10 The equation of a line parallel to $ax + by + c' = 0$ and passing through the point (c, d) 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

Sol. Equation of a line parallel to ax + by + c = 0 is written as

ax + by + k = 0 ...(1)

f it passes through (c, d), then

ac + bd + k = 0 ...(2)

Subtracting (2) and (1), we get

a(x – c) + b(y – d) = 0

Which is the required equation of the line.

Ans.[C]

Ex.11 A straight line L perpendicular to the line 5x – y = 1. The area of the triangle formed by the line L and co-ordinates axes is 5, then the equation of line, is -

(A) x + 5y = ± 5 (B) $x + 5y = \pm\sqrt{2}$

(C) $x + 5y = \pm 5\sqrt{2}$ (D) None of these

Sol. Let the line L cut the axes at A and B say. OA = a, OB = b

$\therefore$ Area Δ OAB $= \frac{1}{2}ab = 5$ ...(1)

Now equation of line perpendicular to lines 5x – y = 1 is x + 5y = k

Putting x = 0, y = = b, y = 0, x = k = a

$\therefore$ $\frac{1}{2}$ k. k/5 = 5 from ... (1)

$k^2 = 50 \Rightarrow k = 5\sqrt{2}$

Hence the required line is $x + 5y = \pm 5\sqrt{2}$

Ans.[C]

Note : Trace the line approximately and try to make use of given material as per the question.

Ex.12 The sides AB, BC, CD and DA of a quadrilateral have the equations x + 2y = 3, x = 1, x – 3y = 4, 5x + y + 12 = 0 respectively, then the angle between the diagonals AC and BD is -

(A) 60º (B) 45º

(C) 90º (D) None of these

Sol. Solving for A,

x + 2y – 3 = 0

5x + y + 12 = 0

$$\Rightarrow \frac{x}{+24+3} = \frac{y}{-15-12} = \frac{1}{-9}$$

$\therefore$ A (–3, 3)

Similarly B(1,1), C(1, –1), D(–2, –2)

Now m_1 = slope of AC = – 1

m_2 = slope of BD = 1

$m_1m_2 = -1$ $\therefore$ the angle required is 90º

Ans. [C]

Ex.13 If the lines ax + by + c = 0, bx + cy + a = 0 and cx + ay + b = 0 are concurrent, then -

(A) a – b – c = 0 (B) a + b + c = 0

(C) b + c – a = 0 (D) a + b – c = 0

Sol. If the lines are concurrent, then $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 0$

$\Rightarrow$ $3abc - a^3 - b^3 - c^3 = 0$

$\Rightarrow$ $(a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca) = 0$

$\Rightarrow$ $(a + b + c)[(a - b)^2 + (b - c)^2 + (c - a)^2] = 0$

$\Rightarrow$ a + b + c = 0

$[\therefore (a - b)^2 + (b - c)^2 + (c - a)^2 \neq 0]$ **Ans. [B]**

Ex.14 The vertices of ΔOBC are respectively (0, 0), (–3, –1) and (–1, –3). The equation of line parallel to BC and at a distance 1/2 from O which intersects OB and OC is -

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

(C) $2x + 2y - \sqrt{2} = 0$ (D) None of these

Sol. Slope of BC = $\frac{-3+1}{-1+3} = -1$

Now equation of line parallel to BC is

$y = -x + k \Rightarrow y + x = k$

Now length of perpendicular from O on this line

$= \pm \frac{k}{\sqrt{2}} = \frac{1}{2} \Rightarrow k = -\frac{\sqrt{2}}{2}$

$\therefore$ Equation of required line is

$2x + 2y + \sqrt{2} = 0$ **Ans. [A]**

Ex.15 The equation of a line through the point of intersection of the lines $x - 3y + 1 = 0$ and $2x + 5y - 9 = 0$ and whose distance from the origin is $\sqrt{5}$, is -

(A) $2x + y - 5 = 0$ (B) $2x - y + 5 = 0$

(C) $2x + y - 10 = 0$ (D) $2x - y - 10 = 0$

Sol. Let the required line by method $P + \lambda Q = 0$ be

$(x - 3y + 1) + \lambda(2x + 5y - 9) = 0$

$\therefore$ perpendicular from (0, 0) = $\sqrt{5}$ gives

$\frac{1-9\lambda}{\sqrt{(1-2\lambda)^2 + (5-3\lambda)^2}} = \sqrt{5}$,

squaring and simplifying $(8\lambda - 7)^2 = 0$

$\Rightarrow \lambda = 7/8$

Hence the line required is

$(x - 3y + 1) + 7/8\,(2x + 5y - 9) = 0$

or $22x + 11y - 55 = 0 \Rightarrow 2x + y - 5 = 0$

Ans.[A]

Note: Here to find the point of intersection is not necessary.

Ex.16 A variable line passes through the fixed point P. If the algebraic sum of perpendicular distances of the points (2, 0); (0, 2) and (1, 1) from the line is zero, then P is -

(A) (1,1) (B) (1, –1)

(C) (2, 2) (D) None of these

Sol. Let equation of variable line is

$ax + by + c = 0$ ...(1)

Now sum of perpendicular distance

$\frac{2a+c}{\sqrt{a^2+b^2}} + \frac{2b+c}{\sqrt{a^2+b^2}} + \frac{a+b+c}{\sqrt{a^2+b^2}} = 0$

$\Rightarrow a + b + c = 0$ … (2)

on subtracting (2) from (1), we get

$a(x - 1) + b(y - 1) = 0$

Which obviously passes through a fixed point P(1, 1). **Ans. [A]**

Ex.17 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) $21x + 77y - 101 = 0$

(C) $11x - 3y + 9 = 0$

(D) None of these

Sol. Here equation of bisectors

$\frac{3x-4y+7}{5} = \pm \frac{12x+5y-2}{13}$

Which give, $11x - 3y + 9 = 0$ and

$21x + 77y - 101 = 0$

Now angle between the line $3x - 4y + 7 = 0$ and one bisector $11x - 3y + 9 = 0$ is

$|\tan\theta| = \left|\frac{-9+44}{33+12}\right| = \left|\frac{35}{45}\right| < 1$

Hence the bisector is the required.

$11x - 3y + 9 = 0$ **Ans.[C]**

Ex.18 The equation of two straight lines through (7, 9) and making an angle of 60º with the line $x - \sqrt{3}\,y - 2\sqrt{3} = 0$ is -

(A) $x = 7,\ x + \sqrt{3}\,y = 7 + 9\sqrt{3}$

(B) $x = \sqrt{3},\ x + \sqrt{3}\,y = 7 + 9\sqrt{3}$

(C) $x = 7,\ x - \sqrt{3}\,y = 7 + 9\sqrt{3}$

(D) $x = \sqrt{3},\ x - \sqrt{3}\,y = 7 + 9\sqrt{3}$

Sol. We know that the equations of two straight lines which pass through a point (x_1, y_1) and make a given angle α with the given straight line $y = mx + c$ are

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

Here $x_1 = 7$, $y_1 = 9$, $\alpha = 60^o$ and m = slope of the line $x - \sqrt{3}y - 2\sqrt{3} = 0$

So, $m = \frac{1}{\sqrt{3}}$

So, the equation of the required lines are

$$y - 9 = \frac{\frac{1}{\sqrt{3}} + \tan 60^o}{1 - \frac{1}{\sqrt{3}}\tan 60^o}(x - 7)$$

and $$y - 9 = \frac{\frac{1}{\sqrt{3}} - \tan 60^o}{1 + \frac{1}{\sqrt{3}}\tan 60^o}(x - 7)$$

or $$(y - 9)\left(1 - \frac{1}{\sqrt{3}}\tan 60^o\right) = \left(\frac{1}{\sqrt{3}} + \tan 60^o\right)(x - 7)$$

and $$(y - 9)\left(1 + \frac{1}{\sqrt{3}}\tan 60^o\right) = \left(\frac{1}{\sqrt{3}} - \tan 60^o\right)(x - 7)$$

or $$0 = \left(\frac{1}{\sqrt{3}} + \sqrt{3}\right)(x - 7) \Rightarrow x - 7 = 0$$

and $$(y - 9)2 = \left(\frac{1}{\sqrt{3}} - \sqrt{3}\right)(x - 7) \Rightarrow x + \sqrt{3}y = 7 + 9\sqrt{3}$$

Hence the required lines are $x = 7$ and $x + \sqrt{3}y = 7 + 9\sqrt{3}$ **Ans. [A]**

Ex.19 If the lines $x + 2ay + a = 0$, $x + 3by + b = 0$ and $x + 4cy + c = 0$ are concurrent, then a, b and c are in

(A) A.P. (B) G.P.

(C) H.P. (D) None of these

Sol. Given lines will be concurrent if

$$\begin{vmatrix} 1 & 2a & a \\ 1 & 3b & b \\ 1 & 4c & c \end{vmatrix} = 0 \Rightarrow -bc + 2ac - ab = 0$$

$$\Rightarrow b = \frac{2ac}{a + c}$$

$\Rightarrow$ a,b,c are in H.P. **Ans.[C]**

Ex.20 If the sides of triangle are $x + y - 5 = 0$, $x - y + 1 = 0$ and $y - 1 = 0$, then its circumcentre is -

(A) (2, 1) (B) (2, –2)

(C) (1, 2) (D) (1, –2)

Sol. Here the sides $x + y - 5 = 0$ and $x - y + 1$ are perpendicular to each other, therefore $y = 1$ will be hypotenuse of the triangle. Now its middle point will be the circumcentre.

Now solving the pair of equations

$x + y - 5 = 0$, $y - 1 = 0$

and $x - y + 1 = 0$, $y - 1 = 0$, we get

$P \equiv (4, 1)$, $Q \equiv (0, 1)$

Mid point of PQ or circumcentre = (2, 1)

Ans. [A]

Ex.21 If P_1 and P_2 be perpendicular from the origin upon the straight lines $x\sec\theta + y\,\text{cosec}\theta = a$ and $x\cos\theta - y\sin\theta = a\cos2\theta$ respectively, then the value of $4P_1^2 + P_2^2$ is -

(A) a^2 (B) $2a^2$

(C) $3a^2$ (D) $4a^2$

Sol. We have P_1 = length of perpendicular from (0, 0) on $x \sec \theta + y \text{ cosec } \theta = a$

i.e. $$P_1 = \frac{a}{\sqrt{\sec^2\theta + \text{cosec}^2\alpha}} = a \sin\theta \cos\theta$$

$$= \frac{a}{2}\sin 2\theta \text{ or } 2P_1 = a \sin 2\theta$$

P_2 = Length of the perpendicular from (0, 0) on $x \cos \theta - y \sin \theta = a \cos 2\theta$

$$P_2 = \frac{a\cos 2\theta}{\sqrt{\cos^2\theta + \sin^2\theta}} = a \cos 2\theta$$

$$4P_1^2 + P_2^2 = a^2 \sin^2 2\theta + a^2 \cos^2 2\theta = a^2$$

Ans.[A]

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 θ (B) y = x tan θ
(C) y = x cos θ (D) y = x cot θ

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 cosα + y sinα = 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) $5x + 10y = 1$

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 $x\sec\theta + y\,\mathrm{cosec}\theta = a$ 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

LEVEL-2

Q.1 The area of the parallelogram formed by the lines $4y - 3x = 1$, $4y - 3x - 3 = 0$, $3y - 4x + 1 = 0$, $3y - 4x + 2 = 0$ is -

(A) 3/8 (B) 2/7
(C) 1/6 (D) None of these

Q.2 If the intercept of a line between coordinate axes is bisected at the point (2, 2), then its equation is –

(A) $x + y = 4$ (B) $2x + y = 6$
(C) $x + 2y = 6$ (D) $3x - y = 4$

Q.3 If sides of a triangle are $y = mx + a$, $y = nx + b$ and $x = 0$, then its area is -

(A) $\frac{1(a-b)^2}{2(m-n)}$ (B) $\frac{1}{2}\frac{(a-b)^2}{m+n}$

(C) $\frac{1(a+b)^2}{2(m-n)}$ (D) None of these

Q.4 A variable line passes through a fixed point (a, b) and meets the co-ordinates axes in A and B. The locus of the point of intersection of lines through A, B parallel to coordinate axes is -

(A) $x/a + y/b = 2$ (B) $a/x + b/y = 1$
(C) $x/a + y/b = 1$ (D) $x/a + y/b = 3$

Q.5 The straight line $x = a$ and $x^2 - 3y^2 = 0$ encloses a triangle which is -

(A) isosceles (B) Right angled
(C) equilateral (D) None of these

Q.6 A straight line cuts intercepts from the coordinate axes sum of whose reciprocals is1/p. It passes through a fixed point -

(A) (1/p,p) (B) (p,1/p)
(C) (1/p,1/p) (D) (p, p)

Q.7 The diagonal of the parallelogram whose sides are $\ell x + my + n = 0$, $\ell x + my + n' = 0$, $mx + \ell y + n = 0$, $mx + \ell y + n' = 0$ include an angle -

(A) $\tan^{-1}\left(\frac{2\ell m}{\ell^2 + m^2}\right)$ (B) $\tan^{-1}\left(\frac{\ell^2 - m^2}{\ell^2 + m^2}\right)$

(C) $\pi/2$ (D) $\pi/3$

Q.8 In the equation $y - y_1 = m(x - x_1)$ if m and x_1 are fixed and different lines are drawn for different values of y_1, then; (where $m \neq \infty$) –

(A) There will be one line only
(B) There will be a set of parallel lines
(C) The lines will pass through the single point
(D) None of these

Q.9 If the coordinates of the points A, B, C be (–1, 5), (0, 0) and (2,2) respectively and D be the middle point of BC, then the equation of the perpendicular drawn from B to the line AD is -

(A) $2x + y = 0$ (B) $x + 2y = 0$
(C) $x - 2y = 0$ (D) $2x - y = 0$

Q.10 If p and q are length of the perpendiculars from the origin on the lines $x \sec\theta + y \operatorname{cosec}\theta = a$ and $x \cos\theta - y \sin\theta = a \cos 2\theta$, then $4p^2 + q^2$ equals -

(A) $2a^2$ (B) a^2 (C) $3a^2$ (D) $4a^2$

Q.11 The lines PQ whose equation is $x - y = 2$ cuts the x axis at P and Q is (4, 2). The line PQ is rotated about P through 45º in the anticlockwise direction. The equation of the line PQ in the new position is -

(A) $y = -\sqrt{2}$ (B) $y = 2$
(C) $x = 2$ (D) $x = -2$

Q.12 If one diagonal of a rhombus is $x - 2y = 1$, then other diagonal will be -

(A) $x + 2y = 1$ (B) $2x - y = 3$
(C) $2x + y = 3$ (D) $x - 2y = 4$

Q.13 If the three lines $p_1x + q_1y = 1$, $p_2x + q_2y = 1$ and $p_3x + q_3y = 1$ are concurrent, then the points (p_1, q_1), (p_2, q_2) and (p_3, q_3) are -

(A) vertices of right angle triangle
(B) vertices of an equilateral triangle
(C) vertices of isosceles triangle
(D) collinear

Q.14 The points on the line $x + y = 4$ which lie at a unit distance from the line $4x + 3y = 10$, are -

(A) (3, 1), (–7, 11) (B) (–3, 1), (–7, 11)
(C) (3, 1), (7, 11) (D) (1, 3), (–7, 11)

Q.15 If the lines $ax + by + c = 0$, $bx + cy + a = 0$ and $cx + ay + b = 0$ be concurrent, then -

(A) $a^3 + b^3 + c^3 - abc = 0$
(B) $a^3 + b^3 + c^3 + 3abc = 0$
(C) $a^3 + b^3 + c^3 - 3abc = 0$
(D) None of these

Q.16 The equation to a pair of opposite sides of a parallelogram are $x^2 - 5x + 6 = 0$ and $y^2 - 6y + 5 = 0$. The equations to its diagonals are -

(A) $4x + y = 13$ and $4y = x - 7$
(B) $x + 4y = 13$ and $y = 4x - 7$
(C) $4x + y = 13$ and $y = 4x - 7$
(D) $y - 4x = 13$ and $y + 4x = 7$

Q.17 Find the fix point through which the line $(2\cos\theta + 3\sin\theta)\, x + (3\cos\theta - 5\sin\theta)\, y - (5\cos\theta - 2\sin\theta) = 0$ passes for all values of θ -

(A) (0, 0) (B) (1, 1)
(C) (2, 1) (D) None of these

Q.18 Variable line $ax + by + c = 0$ passes a fixed point if a, b and c are three consecutive odd natural number, the fixed point is –

(A) (1, 1) (B) (2, –1)
(C) (1, –2) (D) None of these

Q.19 The point P (a, b) lies on the straight line $3x + 2y = 13$ and the point Q (b, a) lies on the straight line $4x - y = 5$, then the equation of line PQ is-

(A) $x - y = 5$ (B) $x + y = 5$
(C) $x + y = -5$ (D) $x - y = -5$

Q.20 If $a + b + c = 0$ and $p \neq 0$, the lines $ax + (b + c)\, y = p$, $bx + (c + a)\, y = p$ and $cx + (a + b)\, y = p$

(A) Do not intersect (B) Intersect
(C) Are concurrent (D) None of these

Q.21 The equation of the line joining the point (3, 5) to the point of intersection of the lines $4x + y - 1 = 0$ and $7x - 3y - 35 = 0$ is equidistant from the points (0, 0) and (8, 34)

(A) True
(B) False
(C) Nothing can be said
(D) None of these

Q.22 A straight line passes through a fixed point (h, k). The locus of the foot of perpendicular on it drawn from the origin is-

(A) $x^2 + y^2 - hx - ky = 0$
(B) $x^2 + y^2 + hx + ky = 0$
(C) $3x^2 + 3y^2 + hx - ky = 0$
(D) None of these

Q.23 The area bounded by the curves $y = |x| - 1$ and $y = -|x| + 1$ is -

(A) 1 (B) 2
(C) $2\sqrt{2}$ (D) 4

Q.24 The point $(a^2, a + 1)$ lies in the angle between the lines $3x - y + 1 = 0$ and $x + 2y - 5 = 0$ containing the origin, then -

(A) $a \in (0, 1)$ (B) $a \geq 1$ or $a \leq -3$
(C) $a \in (-3, 0) \cup \left(\frac{1}{3}, 1\right)$ (D) None of these

Q.25 In an isosceles triangle ABC, the coordinates of the points B and C on the base BC are respectively (2, 1) and (1, 2). If the equation of the line AB is $y = \frac{1}{2}x$, then the equation of the line AC is -

(A) $2y = x + 3$ (B) $y = 2x$

(C) $y = \frac{1}{2}(x - 1)$ (D) $y = x - 1$

Q.26 The number of lines that are parallel to $2x + 6y - 7 = 0$ and have an intercept 10 between the co-ordinate axis is

(A) 1 (B) 2

(C) 4 (D) Infinitely many

Q.27 The locus of the point of intersection of the lines $\sqrt{3}\,x - y - 4\sqrt{3}\,k = 0$ and $\sqrt{3}\,kx + ky - 4\sqrt{3} = 0$ for different value of k is

(A) Circle (B) Parabola

(C) Hyperbola (D) Ellipse

Q.28 The lines $x + (a - 1)y + 1 = 0$ and $2x + a^2y - 1 = 0$ are perpendicular if

(A) $|a| = 2$ (B) $0 < a < 1$

(C) $-1 < a < 0$ (D) $a = -1$

Q.29 Let α be the distance between the lines $-x + y = 2$ and $x - y = 2$, and β be the distance between the lines $4x - 3y = 5$ and $6y - 8x = 1$, then

(A) $20\sqrt{2}\,\beta = 11\alpha$ (B) $20\sqrt{2}\,\alpha = 11\beta$

(C) $11\sqrt{2}\,\beta = 20\alpha$ (D) None of these

Q.30 Given vertices A(1,1), B(4, –2) and C(5,5) of a triangle, then the equation of the perpendicular dropped from C to the interior bisector of the angle A is

(A) $y - 5 = 0$ (B) $x - 5 = 0$

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

LEVEL-3

Q.1 The incentre of the triangle formed by the axes and the line $\frac{x}{a}+\frac{y}{b}=1$ is -

(A) $\left(\frac{a}{2},\frac{b}{2}\right)$

(B) $\left(\frac{ab}{a+b+\sqrt{ab}},\frac{ab}{a+b+\sqrt{ab}}\right)$

(C) $\left(\frac{a}{3},\frac{b}{3}\right)$

(D) $\left(\frac{ab}{a+b+\sqrt{a^2+b^2}},\frac{ab}{a+b+\sqrt{a^2+b^2}}\right)$

Q.2 A straight line through the point (2, 2) intersects the lines $\sqrt{3}x+y=0$ and $\sqrt{3}x-y=0$ at the point A & B. The equation to the line AB so that triangle OAB is equilateral -

(A) $x-2=0$ (B) $x+y-4=0$

(C) $y-2=0$ (D) None of these

Q.3 $\frac{x}{a}+\frac{y}{b}=1$ is a variable line such that $\frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{k^2}$. The locus of the foot of perpendicular from origin to the line is-

(A) $x^2+y^2-ax-by=0$

(B) $x^2+y^2+ax+by=a^2+b^2$

(C) $x^2+y^2=k^2$

(D) $x^2-y^2=2k^2$

Q.4 If a ray traveling along the line x = 1 gets reflected from the line x + y = 1 then the equation of the line along which the reflected ray travels is -

(A) y = 0 (B) x – y = 1

(C) x = 0 (D) none of these

Q.5 The sides of a triangle are x = 2, y + 1 = 0 and x + 2y = 4. Its circumcentre is-

(A) (4, 0) (B) (2, – 1)

(C) (0, 4) (D) (2, 3)

Q.6 If r is the geometric mean of p and q, then the line px + qy + r = 0 -

(A) has a fixed direction

(B) passes through a fixed point

(C) forms with the axes a triangle of constant area

(D) sum of its intercepts on the axes is constant

Q.7 If $16a^2-40ab+25b^2-c^2=0$, then the line ax + by + c = 0 passes through the points -

(A) (4, – 5) and (– 4, 5)

(B) (5, – 4) and (– 5, 4)

(C) (1, – 1) and (– 1, 1)

(D) None of these

Q.8 The equations of two sides of a square whose area is 25 square units are 3x – 4y = 0 and 4x + 3y = 0. The equations of the other two sides of the square are-

(A) $3x-4y\pm 25=0,\ 4x+3y\pm 25=0$

(B) $3x-4y\pm 5=0,\ 4x+3y\pm 5=0$

(C) $3x-4y\pm 5=0,\ 4x+3y\pm 25=0$

(D) none of these

Q.9 The equation of base of an equilateral triangle is x + y = 2. The vertex is (2, –1) then area of triangle is-

(A) $2\sqrt{3}$ (B) $\frac{\sqrt{3}}{6}$ (C) $\frac{1}{\sqrt{3}}$ (D) $\frac{2}{\sqrt{3}}$

Q. 10 ABCD is a square A ≡ (1, 2), B ≡ (3, –4). If line CD passes through (3, 8), then mid-point of CD is

(A) (2, 6) (B) (6, 2)

(C) (2, 5) (D) $\left(\frac{28}{5},\frac{1}{5}\right)$

Q. 11 The line L has intercepts a and b on the coordinate axes. When keeping the origin fixed, the coordinate axes are rotated through a fixed angle, then the same line has intercepts p and q on the rotated axes. Then

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

Q. 12 A variable line drawn through the point (1, 3) meets the x- axis at A and y- axis at B. It the rectangle OAPB is completed, where 'O' is the origin, then locus of 'P' is-

(A) $\frac{1}{y} + \frac{3}{x} = 1$ (B) $x + 3y = 1$

(C) $\frac{1}{x} + \frac{3}{y} = 1$ (D) $3x + y = 1$

Q. 13 If we reduce $3x + 3y + 7 = 0$ to the form $x \cos \alpha + y \sin \alpha = p$, then the value of p is

(A) $\frac{7}{2\sqrt{3}}$ (B) $\frac{7}{3}$

(C) $\frac{3\sqrt{7}}{2}$ (D) $\frac{7}{3\sqrt{2}}$

Q. 14 $ax - by - a^2 = 0$, where a, b are non-zero, is the equation to the straight line perpendicular to a line ℓ and passing through the point where ℓ crosses the x- axis. Then equation to the line ℓ is

(A) $\frac{x}{b} - \frac{y}{a} = 1$ (B) $\frac{x}{a} + \frac{y}{b} = 1$

(C) $\frac{x}{b} + \frac{y}{a} = ab$ (D) $\frac{x}{a} - \frac{y}{b} = ab$

Direction: **Assertion/Reason type Question.**

The following questions (Q. 15 to 24) given below consist of an "Assertion" (1) and "Reason "(2) Type questions. Use the following key to choose the appropriate answer.

(A) Both (1) and (2) are true and (2) is the correct explanation of (1)

(B) Both (1) and (2) are true but (2) is not the correct explanation of (1)

(C) (1) is true but (2) is false

(D) (1) is false but (2) is true

Q.15 **Statement (1) :** The st. lines $3x + 4y = 9$ and $6x + 8y + 15 = 0$ are parallel.
Statement (2) : They are on the opposite side of the origin.

Q.16 **Statement (1) :** Equation of the bisector of acute angle between the lines $4x - 3y + 7 = 0$ and $3x - 4y + 3 = 0$ is $x - y + 2 = 0$.
Statement (2): Any point on the bisector of the two lines always equidistant from the given lines.

Q.17 Three (or more) lines are said to be concurrent lines if all the lines pass through the same point.
Statement (1): If $3a - 2b + 5c = 0$ then the family of lines $ax + by + c = 0$ are concurrent.
Statement (2): If $L_1 = 0$ and $L_2 = 0$ are any two non-parallel lines then $L_1 + \lambda L_2 = 0$ represents a set of lines through the intersection of $L_1 = 0$ and $L_2 = 0$, where λ is a non-zero real number.

Q.18 The line joining two points A(–3, 2) and B(1, –2) make angle α with positive direction of x- axis. Then
Statement (1): $\sin 2\alpha \neq \cos 2\alpha = 1$
Statement (2): If a line makes angle θ with positive direction of x- axis then slope of line $= \tan \theta$

Q.19 **Statement (1)**: Area of triangle formed by line $3x + 4y + 12 = 0$ and coordinate axis is 6.
Statement (2): Area of triangle formed by line $Ax + By + C = 0$ and coordinate axis is $\frac{2C^2}{|AB|}$

Q.20 Sides of a triangle are $2x - 3y - 1 = 0$, $3x + 2y - 5 = 0$ and $x + y - 1 = 0$ then
Statement (1): Orthocentre of the triangle is (1, 1)
Statement (2) : Orthocentre of a right angled triangle is the vertex at which angle is right angle.

Q.21 **Statement (1)** : If p is length of perpendicular from origin to the line $\frac{x}{a} + \frac{y}{b} = 1$ then a^2, $2p^2$ and b^2 are in H.P.

Statement (2) : If p is the perpendicular distance of line $\frac{x}{a} + \frac{y}{b} = 1$ from (0, 0), then $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$

Q.22 A pair of straight line drawn through the origin form with the line 2x + 3y = 6 an isosceles, right angled triangle then

Statement (1): Area of the triangle is $\frac{36}{13}$

Statement (2): If ABC is a right angled isosceles triangle right angled at A, and AD is perpendicular from A to BC, then area of $\Delta ABC = (AD)^2$

Q.23 **Statement (1)** : Area enclosed by the lines represented by $\pm 2x \pm 3y + 6 = 0$ is 6..

Statement (2): Area enclosed by the lines represented by equation $\pm ax \pm by + c = 0$ is $\frac{2c^2}{|ab|}$

Q.24 **Statement (1)**: Point (–1, –1) and (3, 7) lies on the same side of line 3x – 8y – 7 = 0

Statement (2): If (x_1, y_1) and (x_2, y_2) lies on same side of line ax + by + c = 0 then $\frac{ax_1 + by_1 + c}{ax_2 + by_2 + c} > 0$.

Passage -1

A(0, 3), B (–2, 0) and C(6, 1) be the vertices of a triangle and M(β, β + 1) be a moving point then

Q.25 M lies on the curve

(A) y = x + 1 (B) $y = x^2$

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

Q.26 If M and A lie on same side of BC then

(A) β > 2 (B) β < 2

(C) $\beta > -\frac{6}{7}$ (D) $\beta < \frac{3}{4}$

Q.27 M lies within ΔABC if

(A) $-\frac{6}{7} < \beta < 4$ (B) $-4 < \beta < -\frac{6}{7}$

(C) $-\frac{6}{7} < \beta < \frac{3}{2}$ (D) None of these

Passage-2

Given the equations of two sides of a square as 5x + 12y – 10 = 0, 5x + 12y + 29 = 0. Also given is a point M(–3, 5) lying on one of its sides. Answer the following questions

Q.28 The number of possible squares must be

(A) one (B) two

(C) four (D) None of these

Q.29 The area of the square must be

(A) 9 units (B) 6 units

(C) 5 units (D) None of these

Q.30 If the possible equations of the remaining sides is 12 x – 5y + λ = 0 then λ cannot be-

(A) 61 (B) 22

(C) 100 (D) 36

LEVEL-4

(Question asked in previous AIEEE and IIT-JEE)

SECTION –A

Q.1 A square of side a lies above the x- axis and has one vertex at the origin. The side passing through the origin makes an angle α $(0 < \alpha < \frac{\pi}{4})$ with the positive direction of x- axis. The equation of its diagonal not passing through the origin is- **[AIEEE 2003]**

(A) $y(\cos\alpha + \sin\alpha) + x(\cos\alpha - \sin\alpha) = a$

(B) $y(\cos\alpha - \sin\alpha) - x(\sin\alpha - \cos\alpha) = a$

(C) $y(\cos\alpha + \sin\alpha) + x(\sin\alpha - \cos\alpha) = a$

(D) $y(\cos\alpha + \sin\alpha) + x(\sin\alpha + \cos\alpha) = a$

Q.2 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- **[AIEEE 2003]**

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

Q.3 The equation of the straight line passing through the point (4, 3) and making intercepts on the coordinate axes whose sum is – 1 is- **[AIEEE 2004]**

(A) $\frac{x}{2} + \frac{y}{3} = -1$ and $\frac{x}{-2} + \frac{y}{1} = -1$

(B) $\frac{x}{2} - \frac{y}{3} = -1$ and $\frac{x}{-2} + \frac{y}{1} = -1$

(C) $\frac{x}{2} + \frac{y}{3} = 1$ and $\frac{x}{2} + \frac{y}{1} = 1$

(D) $\frac{x}{2} - \frac{y}{3} = 1$ and $\frac{x}{-2} + \frac{y}{1} = 1$

Q.4 The line parallel to the x-axis and passing through the intersection of the lines ax + 2by + 3b = 0 and bx – 2ay – 3a = 0, where (a, b) ≠ (0, 0) is - **[AIEEE-2005]**

(A) below the x-axis at a distance of 3/2 from it

(B) below the x-axis at a distance of 2/3 from it

(C) above the x-axis at a distance of 3/2 from it

(D) above the x-axis at a distance of 2/3 from it

Q.5 If non-zero numbers a, b, c are in H.P., then the straight line $\frac{x}{a} + \frac{y}{b} + \frac{1}{c} = 0$ always passes through a fixed point that point is – **[AIEEE-2005]**

(A) (–1, 2) (B) (–1, –2)

(C) (1, – 2) (D) $\left(1, -\frac{1}{2}\right)$

Q.6 A straight line through the point A(3, 4) is such that its intercept between the axes is bisected at A. Its equation is – **[AIEEE 2006]**

(A) 3x – 4y + 7 = 0 (B) 4x + 3y = 24

(C) 3x + 4y = 25 (D) x + y = 7

Q.7 If (a, a^2) falls inside the angle made by the lines $y = \frac{x}{2}$, x > 0 and y = 3x, x > 0, then a belongs to **[AIEEE 2006]**

(A) $(3, \infty)$ (B) $\left(\frac{1}{2}, 3\right)$

(C) $\left(-3, -\frac{1}{2}\right)$ (D) $\left(0, \frac{1}{2}\right)$

Q.8 The perpendicular bisector of the line segment joining P(1, 4) and Q(k, 3) has y-intercept-4. Then a possible value of k is -**[AIEEE 2008]**

(A) 2 (B) –2
(C) –4 (D) 1

Q.9 The line $p(p^2 + 1)x - y + q = 0$ and $(p^2 + 1)^2 x + (p^2 + 1)y + 2q = 0$ are perpendicular to a common line for **[AIEEE- 2009]**
(A) Exactly one value of p
(B) Exactly two values of p
(C) More than two values of p
(D) No value of p

Q.10 The line L given by $\frac{x}{5}+\frac{y}{b}=1$ passes through the point (13, 32). The line K is parallel to L and has the equation $\frac{x}{c}+\frac{y}{3}=1$. Then the distance between L and K is - **[AIEEE- 2010]**
(A) $\frac{23}{\sqrt{15}}$ (B) $\sqrt{17}$
(C) $\frac{17}{\sqrt{15}}$ (D) $\frac{23}{\sqrt{17}}$

Q.11 The lines $x + y = |a|$ and $ax - y = 1$ intersect each other in the first quadrant. Then the set of all possible values of a is the interval – **[AIEEE- 2011]**
(A) $(0, \infty)$ (B) $[1, \infty)$
(C) $(-1, \infty)$ (D) $(-1, 1]$

SECTION –B

Q.1 The orthocentre of the triangle formed by the lines xy = 0 and x + y = 1 is **[IIT 1995]**
(A) $\left(\frac{1}{2},\frac{1}{2}\right)$ (B) $\left(\frac{1}{3},\frac{1}{3}\right)$
(C) (0, 0) (D) $\left(\frac{1}{4},\frac{1}{4}\right)$

Q.2 The diagonals of parallelogram PQRS are along the lines x + 3y = 4 and 6x – 2y = 7. Then PQRS must be a **[IIT 1998]**
(A) rectangle (B) square
(C) cyclic quadrilateral (D) rhombus

Q.3 Orthocentre of the triangle whose vertices are A (0, 0), B (3, 4) & C (4, 0) is : **[IIT Scr. 2003]**
(A) $\left(3,\frac{3}{4}\right)$ (B) $\left(3,\frac{5}{4}\right)$
(C) (3, 12) (D) (2, 0)

Q.4 Let PS be the median of the triangle with vertices P(2, 2), Q(6, –1) and R(7, 3). The equation of the line passing through (1,–1) and parallel to PS is - **[IIT-Scr.-2000]**
(A) 2x – 9y – 7 = 0 (B) 2x – 9y – 11 = 0
(C) 2x + 9y – 11 = 0 (D) 2x + 9y + 7 = 0

Q.5 Find the number of integer value of m which makes the x coordinates of point of intersection of lines. 3x + 4y = 9 and y = mx + 1 integer. **[IIT-Scr.-2001]**
(A) 2 (B) 0 (C) 4 (D) 1

Q.6 Area of the parallelogram formed by the lines y = mx, y = mx + 1, y = nx, y = nx + 1 is **[IIT-Scr.-2001]**
(A) $|m + n| / (m - n)^2$ (B) $2 / |m + n|$
(C) $1 / |m + n|$ (D) $1 / |m - n|$

Q.7 A straight line through the origin O meets the parallel lines 4x + 2y = 9 and 2x + y + 6 = 0 at the points P and Q respectively. Then the point O divides the segment PQ in the ratio- **[IIT-Scr.-2002]**
(A) 1 : 2 (B) 3 : 4
(C) 2 : 1 (D) 4: 3

Q.8 Let P = (–1, 0), Q = (0, 0) and R = $(3, 3\sqrt{3})$ be three points. Then the equation of the bisector of the angle PQR is-**[IIT-Scr.-2002/AIEEE-07]**
(A) $(\sqrt{3}/2)x + y = 0$ (B) $x + \sqrt{3}y = 0$
(C) $\sqrt{3}x + y = 0$ (D) $x + (\sqrt{3}/2)y = 0$

Q.9 Lines $L_1 : y - x = 0$ and $L_2 : 2x + y = 0$ intersect the line $L_3 : y + 2 = 0$ at P and Q, respectively.

The bisector of the acute angle between L_1 and L_2 intersects L_3 at R. **[IIT-2007/AIEEE-11]**

STATEMENT–1 : The ratio PR : RQ equals $2\sqrt{2} : \sqrt{5}$

because

STATEMENT–2 : In any triangle, bisector of an angle divides the triangle into two similar triangles.

(A) Statement–1 is True, Statement–2 is True; Statement–2 is a correct explanation for Statement–1.

(B) Statement–1 is True, Statement–2 is True; Statement–2 is NOT a correct explanation for Statement–1

(C) Statement–1 is True, Statement–2 is False

(D) Statement–1 is False, Statement–2 is True

Q.10 The locus of the orthocenter of the triangle formed by the lines **[IIT- 2009]**

$(1 + p) x – py + p (1 + p) = 0$,

$(1 + q) x – qy + q (1 + q) = 0$,

and $y = 0$, where $p \neq q$, is

(A) a hyperbola (B) a parabola

(C) an ellipse (D) a straight line

Q.11 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 **-** **[IIT- 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) $\sqrt{3}\,y + x - 3 + 2\sqrt{3} = 0$

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												

LEVEL-2

Qus.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	B	A	A	B	C	D	C	B	C	B	C	C	D	A	C	C	B	C	B	A
Qus.	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**										
Ans.	A	A	B	C	B	B	C	D	A	B										

LEVEL-3

Qus.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	D	C	C	A	A	C	A	A	B	D	B	C	D	B	B	D	A	D	C	D
Qus.	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**										
Ans.	A	A	D	A	A	C	C	B	A	D										

LEVEL-4

SECTION-A

Q.No.	1	2	3	4	5	6	7	8	9	10	11
Ans.	A	C	D	A	C	B	B	C	A	D	B

SECTION-B

Q.No.	1	2	3	4	5	6	7	8	9	10	11
Ans.	C	D	A	D	A	D	B	C	C	D	B