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Class: 9
Subject: Mathematics
Topic: Coordinate Geometry
No. of Questions: 20

Q1. What is coordinate geometry?

Sol. The use of algebra to study geometric properties is called coordinate geometry. Points, lines, shapes and surfaces are represented by algebraic expression in coordinate geometry.

It is the system of geometry where the position of points on the plane is described using an ordered pair of numbers. In coordinate geometry, points are placed on the coordinate plane. It has two scales: one running across the plane called the x – axis and y-axis. The coordinate of any point (x, y) shows that this point is located at a distance x from x-axis and a distance y from y-axis.

Q2. Find the equation of a line parallel to x-axis at a distance of 2 units below x axis?

Sol. Equation of the straight line parallel to x-axis is given by y = k, where is constant. The required line is parallel to the x-axis and at a distance 2 unit below x-axis.

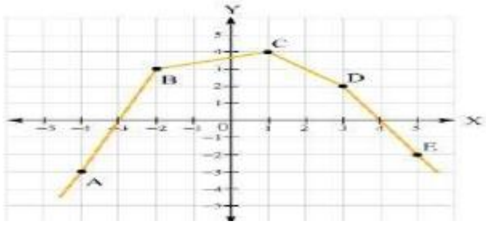
$\therefore$ k = -2 , Thus, the equation of required line is $y = -2$ i.e., $y+2 = 0$

Q3. What is Cartesian system?

Sol. The Cartesian coordinate system is used to determine each point uniquely in a plane through two numbers, usually called the x – coordinate and the y – coordinate of the point

It is a system in which the location of a point is given by coordinates that represent its distances from perpendicular lines that intersect at a point called the origin. A Cartesian coordinate system in a plane has two perpendicular lines i.e., the x-axis and y-axis.

Q4. See graph and Find what the values of x are when the value of y is zero?



What do you mean by collinear and non collinear points?

Sol. At x=4 and -3, the value of y is zero. Points that lie on the same line are called collinear points. If there is no line on which all of the points lie, then they are non collinear points.

Q5. In which quadrant can a point have?

(a) Abscissa = its ordinate
(b) Ordinate = in magnitude to abscissa

Sol. Let P (x, y) be the point in the coordinate plane.

(a) Abscissa of the point is equal to its ordinate in first and third quadrant.
(b) Ordinate of the point is equal in magnitude to abscissa in all the quadrants.

Q6. What is quadrant?

Sol. A Cartesian system consists of two perpendicular lines: one of them is horizontal and the other is vertical. The horizontal line is called the x- axis and the vertical line is called the y-axis. These are known as the coordinate axes. The x- coordinate of the point P is called the abscissa and the y-axis. These are known as the coordinate axis. The x-coordinate of the point P is called the abscissa the y-coordinate of the point P is called the ordinate.

The distance of the point from the Y-axis is called it x-coordinate, or abscissa. The distance of the point form the x-axis is called it y-coordinate, or ordinate. Let the point P(4, -3) on the coordinate plane. Abscissa of P(4, -3) = 4 Ordinate P(4, -3) = -3

Coordinate axis divide the Cartesian plane into four parts which are known as quadrants.

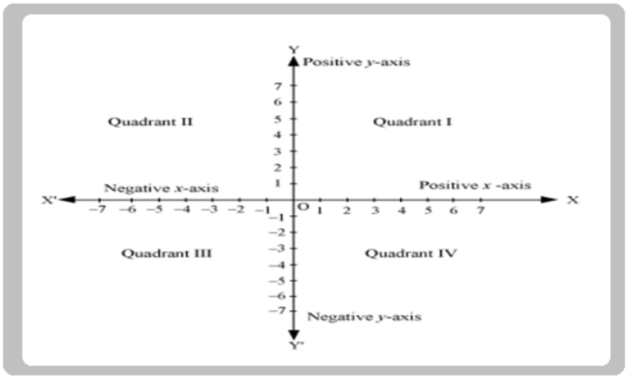
Suppose a point P(x, y) lies in the Cartesian plane.

In the Quadrant 1, x is positive and Y is positive.

In the Quadrant 2, x is negative and Y is positive.

In the Quadrant 3, x is negative and y is negative.

In the quadrant 4, x is positive and y is negative.



Q7. Determine the point on graph of the linear equation 4x-5y = 7 whose

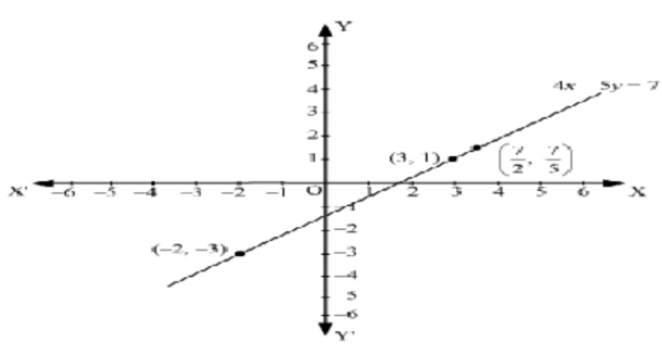
(a) Abscissa is thrice the ordinate

Sol. The given equation is 4x-5y = 7.

(a) It is given that abscissa is thrice the ordinate
Let (3a, a) be the required point.
If the point (3a, a) lies on the graph of the given equation, then it will satisfy the equation.

$$4x - 5y = 7 \Rightarrow 4(3a) - 5(a) = 7 \Rightarrow 12a - 5a = 7 \Rightarrow 7a = 7 \Rightarrow a = 1$$

Thus, the required point is (3, 1)



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Q8. Determine the point on graph of the linear equation 4x-5y = 7 whose

(a) Ordinate is 2/5 times of abscissa

Sol. It is given that ordinate is 2/5 times of abscissa.

Let $\left(b\,,\frac{2}{5}\,b\right)$ be the required point. $4x-5y=7\ \Rightarrow 4b-5\left(\frac{2}{5}\,b\right)=7\Rightarrow 4b-2b=7$

$\Rightarrow 2b=7\ \Rightarrow b=\frac{7}{2}\ required\ point\ is\ \left(\frac{7}{2},\frac{7}{5}\right)$

Q9. In which quadrant can a point have?

(a) Ordinate = and opposite of abscissa
(b) Abscissa twice that of the ordinate

Sol. Let P (x, y) be the point in the coordinate plane.

(a) Ordinate of the point is equal and opposite to abscissa in second and fourth quadrant.
(b) Abscissa of the point is equal to twice the ordinate in first and third quadrant.

Q10. The area of a triangle is 5. Two of its vertices are (2, 1) and (3, -2). The third vertex lies on y = x+3 find the third vertex.

Sol. Let the third vertex be (x_3, y_3), area of triangle $=\frac{1}{2}\,[x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)]$

As $x_1=2, y_1=1,\ x_2=3,\ y_2=2.\ Area\ of\ \Delta=5$

$\Rightarrow\ \ 5=\frac{1}{2}[2(-2-y_1)+3(y_3-1)+x_3(1+2)]$

$\Rightarrow 10=\ |3x_3+y_3-7|\ \Rightarrow 3x_3+y_3=\ \pm 19$

Taking positive sign,

$3x_3+y_3-7=10\Rightarrow 3x_3+y_3=17$____________(1)

Taking negative sign,

$3x_3+y_3-7=10\ \Rightarrow 3x_3+y_3=$ -3___________(2)

Given that $(x_3,-y_3)$ lies on Y = x+3

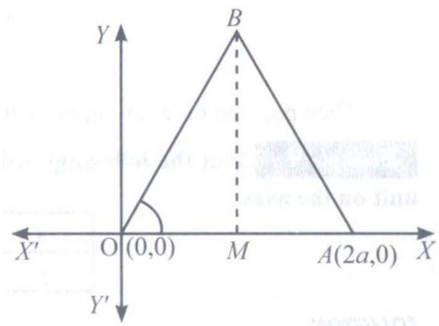
So, $-x_3 + y_3 = 3$____________________(3)

Solving equations (1) and (3), $x_3 = \frac{-3}{2}, y_3 = \frac{13}{2}$

Solving equation (2) and (3), $x_3 = \frac{-3}{2}, y_3 = \frac{3}{2.}$

So the third vertexes are $\left(\frac{7}{2}, \frac{13}{2}\right)$ *or* $\left(\frac{-3}{2}, \frac{3}{2}\right)$

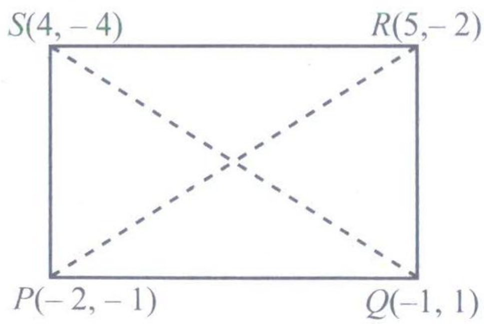
Q11. In the figure OAB is an equilateral triangle. Find the co-ordinate of vertex B.



Sol. In figure,
OAB is an equilateral triangle of 2a.
∴ OA = AB = OB = 2a
Now, from the point B, draw BM perpendicular on OA.
∴ OM = MA = a
Therefore from right triangle OMB,
$(OB)^2 = OM^2 + MB^2$
Or , $(2a)^2 = (a)^2 + MB^2$
Or, $MB^2 = 3a^2$
∴ $MB = \sqrt{3}\,a$
Since OM = a and $MB = \sqrt{3}a$
Hence, co-ordinates of vertex B are $(a, \sqrt{3}a)$

Q12. Prove that the points (-2, -1), (-1, 1), (5, -2) and (4, -4) are the vertices of a rectangle.

Sol. Let P (-2, 1), Q(-1, 1), R(5, -2) and S(4,-4) be the given points.



Now, $PQ = \sqrt{[-2-(-1)]^2 + [-1-1]^2} = \sqrt{(-1)^2 + (-2)^2} = \sqrt{5}$

$QR = \sqrt{[5-(-1)]^2 + [-2-1]^2} = \sqrt{(6)^2 + (-3)^2} = \sqrt{45}$

$RS = \sqrt{[4-5]^2 + [-4-(-2)]^2} = \sqrt{(-1)^2 + (-2)^2} = \sqrt{5}$

$SP = \sqrt{[4-(-2)]^2 + [-4-(-1)]^2} = \sqrt{(6)^2 + (-3)^2} = \sqrt{45}$

$\therefore$ PQ = RS and QR = SP

Hence, the opposite sides are equal

Again, diagonal

$PR = \sqrt{[5-(-2)]^2 + [-2-(-1)]^2} = \sqrt{(7)^2 + (-1)^2} = \sqrt{50}$

$QS = \sqrt{[4-(-1)]^2 + [-4-1]^2} = \sqrt{(5)^2 + (-5)^2} = \sqrt{50}$

Hence the diagonal are equal.

Hence, the given point P, Q, R, S are the vertices of rectangle.

Q13. Find the ratio in which the point $\left(\frac{1}{2}, 6\right)$ divides the line segment joining the points (3, 5) and (-7, 9)

Sol. Let $\left(\frac{1}{2}, 6\right)$ divide the line segment joining the points (3, 5) and (-7, 9) in the ratio of K : 1. Using section formula, the x-coordinate of the point is given as

$X = \frac{kx_{2+X_1}}{k+1}$

$\Rightarrow \frac{1}{2} = \frac{k(-7)+3}{k+1} \Rightarrow \frac{1}{2} = \frac{-7k+3}{k+1} \Rightarrow k+1 = -14k+6 \Rightarrow 15k = 5 \Rightarrow k = \frac{1}{3}$

$\therefore$ Ratio is 1 : 3

Q14. Find the values of x for which the distance between the points A(x, 5) and B(0, -3) is $4\sqrt{5}$ units.

Sol. Using distance formula,

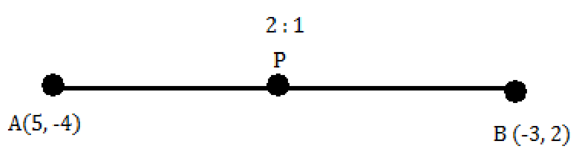
$\text{AB} = \sqrt{(0-x)^2 + (-3-5)^2} \Rightarrow 4\sqrt{5} \Rightarrow \sqrt{x^2+64}$

Squaring both sides, we get

$80 = x^2 + 64 \Rightarrow x^2 = 16 \; or \; x = \pm 4.$

Q15. Find the point on the line joining A(5, -4) and B(-3, 2) so that it is twice as far from A as from B.

Sol. $\text{X} = \frac{2\,(-3)+1\times 5}{2+1} = -\frac{1}{3}$



$\text{Y} = \frac{2\times 2+(1)(-4)}{2+1} = 0$

$\therefore$ Point is $\left(-\frac{1}{3}, 0\right)$

Q16. Find the coordinate of the point whose abscissa is 5 and which lies on x-axis.

Sol. (5, 0)

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Q17. Find the area of the triangle formed by the mid-points of the sides of ΔABC Where A (3, 2) B(-5, 6) and C(8, 3).

Sol. Area of $\Delta ABC = \frac{1}{2}\begin{vmatrix} 3-(-5) & 2-6 \\ -5-8 & 6-3 \end{vmatrix} = \frac{1}{2}\begin{vmatrix} 8 & -4 \\ -13 & 3 \end{vmatrix}$

$$= \frac{1}{2}\,|8(3) - 4(3)| = \frac{1}{2}\,|24 - 52|$$

$$= \frac{1}{2}\,|-28| = 14\ sq.units$$

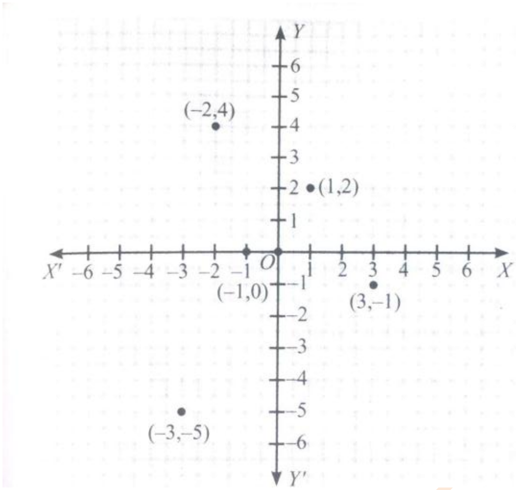
Hence, the area of triangle formed by the mid-points of the sides of ΔABC $=\frac{1}{4}\ (Area\ of\ \Delta ABC)$
$= \frac{1}{4}(14) = 3.5$ sq. units

Q18. In which quadrant or on which axis do each of the points (-2, 4), (3, -1), (-1, 0), (1, 2) and (-3, -5) lie? Verify your answer by locating them on the Cartesian plane.

Sol. The point (-2, 4) lies in the II quadrant.
The point (3, -1) lies in the IV quadrant.
The point (-1, 0) lies on the negative x-axis.
The point (1, 2) lies on the I quadrant.
The point (-3, -5) lies in the III quadrant.

Q19. Find the centroid of the triangle formed by the lines x = 0, y = 0 and x+y = 10 as sides.

Sol. Let OAB be the triangle formed by the given lines O is the point of intersection of x = 0 i.e., origin = O(0, 0)



A is the point of intersection of x = 0 and x+y = 10 i.e., A(0, 10) and B is the point of intersection of y = 0 and x+y = 10, i.e., B(10, 0)

∴ Centroid of ΔOAB is G $= \left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$

$= \left(\frac{0+0+10}{3}, \frac{0+10+0}{3}\right) = \left(\frac{10}{3}, \frac{10}{3}\right)$

Q20. Find a if the distance between the points A (8, -7) and B(-4, a) is 13 units.

Sol. Given AB = 13

$\Rightarrow \sqrt{(-4-8)^2 + (a+7)^2} = 13$

Taking square on both sides, we get

$(a+7)^2 = 169-144 = 25$

$a+7 = \sqrt{25}$

$a+7 = \pm 5$

a= -2 or -12