



MATHS

BOOKS - ZEN MATHS (KANNADA ENGLISH)

CO-ORDINATE GEOMETRY

Illustrative Example

1. Find a point on the X-axis equidistant from A (5,4) and B(-2,3).



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2. If distances of a point (x, y) are equidistant from $(a + b, b - a)$ and $(a - b, a + b)$, prove that $bx = ay$.



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3. Show that the points $(12, 8)$, $(-2, 6)$, and $(6, 0)$ are vertices of a right-angled triangle.



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4. Find a relation between x and y such that the point (x, y) is equidistant from the point $(3, 6)$ and $(-3, 4)$.



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5. Show that the points $(0, -1)$, $(2, 1)$, $(0, 3)$, and $(-2, 1)$ are the corners of a square.



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6. Show that the points $(1,-1)$, $(5,2)$, and $(9,5)$ are collinear.



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7. Points A $(-1, y)$ and B $(5, 7)$ lie on the circumference of a circle with centre O $(2,-3y)$. Find y . Hence find the radius of the circle.



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8. Find the coordinates of the circumcentre of a triangle whose vertices are $(8, 6)$, $(8, -2)$, and $(-2, -2)$. Also find its circumradius.



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9. Find the coordinates of the points of trisection of the line segment joining $(4, -1)$ and $(-2, -3)$.



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10. Find the midpoint of the line joining $(3,-8)$ and $(2,-2)$. Midpoint M of line joining A $(3,-8)$ and B $(2,-2)$ is



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11. In what ratio is the line joining, A $(4, 4)$ and B $(7, 7)$ divided by P $(F,-1)$



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12. Determine the ratio in which P (m, 6) divides AB where A (-4,3) and B(2,8). Find m.



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13. Determine the ratio in which $2x + 3y + 7$ divides the line joining of A (3,4) and B (7, 8). Find the point.



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14. Prove that $(4,-1)$, $(6, 0)$, $(7,2)$, and $(5,1)$ are the vertices of a rhombus but not a square.



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15. IF the coordinates of the midpoints of the sides of a triangle are $(1, 2)$, $(0, -1)$, and $(2,-1)$, find vertices of triangle.



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16. If the midpoint of the line joining (3,4) and (K, 7) is (y) and $2x + 2y + 1 = 0$, find K.



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17. Find the area of the triangle formed by points (3, 4), (2,-1), and (4,-6).



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18. Check if (-5,1), (5, 5), and (10, 7) are collinear.



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19. Find x for which $(a, 0)$, $(0, b)$, and $(3a, x)$ ($a \neq 0$) lie on a line .



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Textual Exercise Exercise 7 1

1. Find the distance between the following pairs of points :

$(2,3), (4, 1)$



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2. Find the distance between the points $(0, 0)$ and $(36, 15)$.



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3. Determine if the points $(1, 5), (2, 3)$ and $(-2, -11)$ are collinear.



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4. Check whether $(5, -2)$, $(6, 4)$ and $(7, 2)$ are the vertices of an isosceles triangle.



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5. Name the type of quadrilateral formed, if any by the following points, and give reasons for your answer :

$(-3, 5)$, $(3, 1)$, $(0, 3)$, $(-1, -4)$



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6. Find the point on the x -axis which is equidistant from $(2, -5)$ and $(-2, 9)$.



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7. Find the values of y for which the distance between the points $P(2, -3)$ and $Q(10, y)$ is 10 units.



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8. If $Q(0, 1)$ is equidistant from $P(5, -3)$ and $R(x, 6)$, find the values of x . Also find the distance QR and PR .



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9. Find a relation between x and y such that the point (x, y) is equidistant from the point $(3, 6)$ and $(-3, 4)$.



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Textual Exercise Exercise 7 2

1. Find the coordinates of the point which divides the join of $(-1, 7)$ and $(4, -3)$ into the ratio $2 : 3$ internally.



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2. Find the coordinates of the points of trisection of the line segment joining $A(4, -1)$ and $B(-2, -3)$.



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3. To conduct Sports Day activities, in your rectangular shaped school ground ABCD, lines have been drawn with chalk powder at a distance of 1m each. 100 flower pots have been placed at a distance of 1 m from each other along AD, as shown in the following figure. Niharika runs $\frac{1}{4}$ th the distance AD on the 2nd line and posts a green flag. Preet runs $\frac{1}{5}$ th the distance AD on the eighth line and posts a red flag. What is the distance between both the flags? If Rashmi has to post a blue flag

exactly halfway between the line segment joining the two flags, where should she post her flag?



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4. Find the ratio in which the line segment joining the points $(-3, 10)$ and $(6, -8)$ is divided by $(-1, 6)$.



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5. Find the ratio in which the line segment joining $A(1, -5)$ and $B(-4, 5)$ is divided by the x -axis. Also find the coordinates of the point of division.



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6. If $(1, 2)$, $(4, y)$, $(x, 6)$ and $(3, 5)$ are the vertices of a parallelogram taken in order, find x and y .



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7. Find the coordinates of a point A, where AB is the diameter of a circle whose centre is (2, -3) and B is (1, 4).



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8. If A and B are (-2, -2) and (2, -4), respectively, find the coordinates of P such that $AP = \frac{3}{7}AB$ and P lies on the line segment AB.



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9. Find the coordinates of the points which divide the line segment joining A(-2, 2) and B(2, 8) into four equal parts.



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10. Find the area of a rhombus if its vertices are (3, 0), (4, 5), (-1, 4) and (-2, -1) taken in order.

[Hint : Area of a rhombus = $\frac{1}{2}$ (product of its diagonals)].



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Textual Exercise Exercise 7 3

1. Find the area of the triangle whose vertices are:

(i) (2,3), (-1,0), (2,-4) (ii) (-5,-1), (3,-5), (5, 2)



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2. In each of the following find the value of 'k' for which the points are collinear .

(8, 1), (k, - 4), (2, - 5)



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3. Find the area of the triangle formed by joining the mid-points of the sides of the triangle whose vertices are $(0, -1)$, $(2, 1)$ and $(0, 3)$. Find the ratio of this area to the area of the given triangle.



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4. Find the area of the quadrilateral whose vertices, taken in order are $(-4, -2)$, $(-3, -5)$, $(3, -2)$

and (2, 3).



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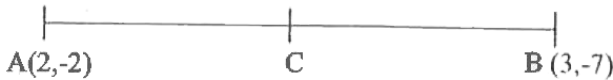
5. You have studied in Class IX, (Chapter 9, Example 3), that a median of a triangle divides it into two triangles of equal areas. Verify this result for $\triangle ABC$ whose vertices are $A(4, -6)$, $B(3, -2)$ and $C(5, 2)$.



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Textual Exercise Exercise 7 4

1. Determine the ratio in which the line $2x + y - 4 = 0$ divides the line segment joining the points $A(2, -2)$ and $B(3, 7)$.



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2. Find a relation between x and y if the points (x, y) , $(1, 2)$ and $(7, 0)$ are collinear.



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3. Find the centre of a circle passing through the points $(6, -6)$, $(3, -7)$ and $(3, 3)$.



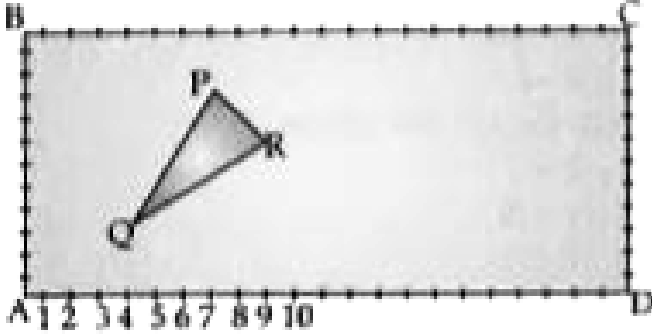
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4. The two opposite vertices of a square are $(-1, 2)$ and $(3, 2)$. Find the coordinates of the other two vertices.



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5. The Class X students of a secondary school in Krishinagar have been allotted a rectangular plot of land for their gardening activity . Sapling of Gul mohar is planted on the boundary at a distance of 1m from each other . There is a triangular grassy lawn in the plot as shown in the figure . The students are to sow seeds of flowering plants on the remaining area of the plot .



(i) Taking A as origin , find the coordinates of the vertices of the triangle .

(ii) What will be the coordinates of the vertices of ΔPQR if C is the origin

Also calculate the areas of the triangles i these cases . What do you observe ?



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6. The vertices of a ΔABC are A (4,6), B (1, 5) and C (7,2). A line is drawn to intersect sides AB and AC at D and E respectively, such that $\frac{AD}{AB} = \frac{AE}{AC} = \frac{1}{4}$. Calculate the area of ΔADE and compare it with area of ΔABC



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7. Let A (4, 2). B (6, 5) and C (1, 4) be the vertices of ΔABC .

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



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8. ABCD is a rectangle formed by the points A (-1,-1), B(-1,4), C (5, 4) and D (5, - 1). P, Q R and S are the mid-points of AB, BC, CD, and DA respectively. Is the quadrilateral PQRS is a square? a rectangle? or a rhombus? Justify your answer.



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Zen Additional Questions Multiple Choice Questions

1. The distance between $(a \cos \theta + b \sin \theta, 0)$ and $(0, a \sin \theta - b \cos \theta)$ is

A. $a^2 + b^2$

B. $a^2 - b^2$

C. $\sqrt{a^2 + b^2}$

D. $\sqrt{a^2 - b^2}$

Answer: C



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2. The co ordinates of the point which is reflection of the point $(-3, 5)$ in X axis are

A. $(3,5)$

B. $(3,-5)$

C. $(-3,-5)$

D. $(-3,5)$

Answer: C



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3. If point $P(6,2)$ divides the line joining $A(6,5)$ and $B(4, y)$ in the ratio $3:4$ then the value of y is

A. 4

B. 3

C. 2

D. 1

Answer: B



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4. The ratio in which the line segment (a_1, b_1) and $B(a_2, b_2)$ is divided by Y-axis is

A. $-a_1 : a_2$

B. $a_1 : a_2$

C. $b_1 : b_2$

D. $-b_1 : b_2$

Answer: A::B



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5. The length of the line segment joining $A(2,3)$ and B is 10 units . If abscissa of B is 10, its ordinate can be

A. 3 or - 9

B. - 3 or 9

C. 6 or 27

D. - 6 or - 27

Answer: C



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6. If the centroid of a triangle formed by the points $a, b), (b, c),$ and (c, a) is at the origin, then $a^3 + b^3 + c^3 =$

A. abc

B. 0

C. $a + b + c$

D. $3abc$

Answer: A::B::C



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7. The coordinates of a point on the X-axis which lie on the perpendicular bisector of the line segment joining $(7, 6)$ and $(-3, 4)$ are

A. $(0,2)$

B. $(3,0)$

C. $(0,3)$

D. $(2,0)$

Answer: B



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8. If $(t, 2t)$, $(-2, 6)$, and $(3, 1)$ are collinear, $t =$

A. $3/4$

B. $4/3$

C. $5/3$

D. $3/5$

Answer: C::D



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9. Length of the median through C of $\triangle ABC$ with A(4,9) B(2, 3), and C (6, 5) is

A. 5 units

B. $\sqrt{10}$ units

C. 25 units

D. 10 units

Answer: A



10. If $P(2, 4)$, $Q(0, 3)$, $R(3, 6)$, and $S(5, y)$ are the vertices of a parallelogram PQRS, value of y is

A. 7

B. 5

C. -7

D. -8

Answer:



11. The distance between the origin and coordinates of point (x, y) is

A. $x^2 + y^2$

B. $\sqrt{x^2 - y^2}$

C. $x^2 + y^2$

D. $\sqrt{x^2 + y^2}$

Answer: B



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Zen Additional Questions Very Short Answer Vsa Type Questions

1. Find the area of the triangle ΔABC with $A(a,b+c)$, $B(b,c+a)$, and $C(c, a+ b)$.



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2. Find the length of the median AD of ΔABC with $A(5,1)$, $B(1,5)$, and $C(-3,-1)$.



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3. Find the ratio in which the line segment PQ
P(4, 5) and Q(3,7), is internally divided by the Y-axis.



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4. Find k if (2,1) , (k,-1) and (-1,3) are collinear.



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5. Find 'a' so that (3,a) lies on the line $2x - 3y = 5$

.



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6. Find k if the centroid of the triangle whose vertices are (2,k) , (-5,2) and (3, 4) is (0,-2) .



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7. The endpoints of the diameter of a circle are $(2, 4)$ and $(3, -1)$. Find the radius of the circle.



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8. Find the distance between $(0, 5)$ and $(-5, 0)$.



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9. Find the point equidistant from $(3, 8)$ and $(-10, -5)$.



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10. Plot these points on the Cartesian plane.

(i) A (-4,0) (ii) B (0,5) (iii) C (3 -4) (iv) D (-2,5) (v) E (-1,-1) (vi) F (3,5)



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11. A square of side 4 units lies in I Quadrant on the X-axis, with its one vertex at the origin.

Plot the coordinates of the other 3 vertices of the square.



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12. Draw the quadrilateral whose vertices are $(1, 1)$, (24) , $(8,4)$, and $(10, 1)$.



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13. Find distance between the pair of points given.

(i) $(a \sin \alpha, -b \cos \alpha), (-a \cos \alpha, b \sin \alpha)$

(ii) $(a + b, b + c), (a - b, c - b)$

(iii) $(4, 10), (7 - 6)$



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14. Find the coordinates of the mid-point of the line joining the points (x_1, y_1) and (x_2, y_2) .



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Zen Additional Questions Short Answer Sa Type Questions

1. Find the value (s) of x if distance between A $(0, 0)$ and B $(x, -4)$ is 5 units.



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2. What is the distance of P (x, y) from the origin?



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3. A line intersects y-axis and x-axis at the points P and Q respectively. If (2, 5) is the mid point of PQ then find the co ordinates of P and Q.



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4. If the distance between P (x, y) from A (5, 1) and B (-1,5) are equal, show that $3x = 2y$.



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5. Find the area of $\triangle ABC$ where $A(-\frac{3}{2}, 3)$, $B(6, -2)$, and $C(-3, 4)$.



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6. Find k if $A(k + 1, 24)$, $B(3k, 2k + 3)$, and $C(5k - 1, 5k)$ are collinear.



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7. Find the ratio in which $x - y - 2 = 0$ divides the line segment joining $(8, -1)$ and $(8, 9)$.

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8. The length of a line segment is $\sqrt{29}$ units. If one end is at $(-3, 5)$ and the ordinate of the other end is 7, show that the absciss is either 2 or -8.

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9. Given $P(at^2, 2at)$, $Q\left(\frac{a}{t^2}, \frac{-2a}{t}\right)$, and $S(a, 0)$, show that $\frac{1}{SP} + \frac{1}{SQ}$ is independent of t .



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10. Use a graph sheet to plot points $P(-2, 2)$, $Q(4, -2)$, and $R(5, 2)$. Complete $\triangle PQR$. Find the altitude drawn from Q to PR from the graph. Also find the area of $\triangle PQR$.



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11. James started from a point X, 4 units away from the origin above the X-axis. He walked to the origin and turned right to Y, 3 units away. What are points X and Y? Locate them on the Cartesian plane. What is distance between X and Y ?



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12. The base AB of an equilateral $\triangle ABC$ of side $2p$ lies along the X-axis such that the midpoint

of AB is at the origin and vertex C is above x-axis. Find coordinates of the vertices of ΔABC .



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13. Plot points P (3, 8) and Q (3,-8). Join AOPQ.

What kind of a Δ is it ? Find its area.



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14. If A (3,y) is equidistant from P (8,-3) and

Q(7, 6), find y and the distance AQ.



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15. Find the values of y for which the distance between the points $P(2, -3)$ and $Q(10, y)$ is 10 units.



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16. Find the equation of the perpendicular bisector of the line segment joining $(7,1)$ and $(3,5)$.



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17. If $P(2,2)$ is equidistant from $A(-2, k)$ and $B(-2k,-3)$, find k . Also find the length AP .



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18. Find a point equidistant from $A(-5, 4)$ and $B(-1,6)$. How many such points are there?



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19. Show that $(1, 0)$, $(0, 1)$, $(-3, 4)$ are on a straight line.



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20. If $P(x, y)$ lies on a circle whose centre is $(3, -2)$ and radius is 3, show that $x^2 + y^2 - 6x + 4y + 4 = 0$.



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21. The centre of a circle is $(2a, a - 7)$. Find the values of a if the circle passes through $(11, -9)$ and has a diameter of $10\sqrt{2}$ units .



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22. Prove that $(2a, 4a)$, $(2a, 6a)$, and $(2a + \sqrt{3}a, 5a)$ are the vertices of an equilateral triangle.



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23. Find the area of a triangle whose vertices are $(1, -1)$, $(-4, 6)$ and $(-3, -5)$.



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24. Prove that the area of the triangle whose vertices are $(t, t - 2)$, $(t + 2, t + 2)$, and $(t + 3, t)$ is independent of t .



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25. Find the area of the quadrilateral ABCD whose vertices are A(1, 1), B(7,-3), C(12, 2), and D(7, 21).



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26. Show That (3, -2) is the 3rd vertex of a Δ ABC where A (2, 3), B (-2,1), and centroid is G (1, 2/3).



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27. Find the area of a parallelogram ABCD if three of its vertices are $A(2, 4)$, $B(2 + \sqrt{3}, 5)$ and $C(2, 6)$.



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28. Find the co - ordinates of points which divides the line segment joining the points A $(4, - 3)$ and B $(8,5)$ in the ratio 3:1 internally

.



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29. Find the distance between the points $(2,3)$ and $(4,1)$.



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30. Find the coordinates of the point which divides the line joining the points $(1,6)$ and $(4,3)$ in the ratio $1:2$.



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31. The points $A(1, 1)$, $B(3, 2)$ and $C(5, 3)$ cannot be the vertices of the triangle ABD .
Justify.



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32. If $A(-2, -1)$ $B(a, 0)$ $C(4, b)$ and $D(1, 2)$ are the vertices of a parallelogram. Find a and b



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33. If $A(-5, 7)$, $B(4, 5)$, $C(-1, -6)$ and $D(4, 5)$ are the vertices of a quadrilateral. Find the area of quadrilateral.



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34. If the points $A(k + 1, 2k)$, $B(3k, 2k + 3)$ and $C(5k - 1, 5k)$ are collinear, then find the value of k .



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35. If the point $P(x, y)$ is equidistant from the points $A(a + b, b - a)$ and $B(a - b, a + b)$. Prove that $bx = ay$.



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36. $A(0, 6)$, $P(4, -3)$, and the origin O form a $\triangle OPA$. $\triangle OPA$ is turned with its base OA on the Y -axis to form $\triangle OQA$. What are the coordinates of Q ? What is figure $OPAQ$? Is

$\triangle OPA \cong \triangle OQA$? Give reason. Find the area of OPAQ.



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37. Find a and b if $M (9a - 2, -b)$ divides the line segment joining $P (3a + 1, -3)$ and $Q (8a, 5)$ in the ratio $3: 1$.



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38. Find the ratio in which $(-4, 6)$ divides the line segment joining $A(6, 10)$ and $B(3, -8)$.



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39. Find the points of trisection of the line segment joining the points. i] $(5, -6)$ and $(-7, 5)$ ii $(2, -2)$ and $(-7, 4)$



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40. Three vertices of a parallelogram are $(a + b, a - b)$, $(2a + b, 2a - b)$, and $(a - b, a + b)$. Find the 4th vertex.



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41. A point P divides the line segment joining A $(3, -5)$ and B $(-4, 8)$ with $\frac{AP}{PB} = k$. If P lies on the line $x + y = 0$. Find k.



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42. If the midpoints of the sides of a triangle are $(3, 4)$, $(4, 6)$, and $(5, 7)$, find the coordinates of the vertices of the triangle.



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43. In what ratio is the join of $(-2, 2)$ and $(4, 5)$ cut by the axes of coordinates?



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44. The vertices of $\triangle ABC$ are A (1, 2), B (4, 6), and C (6, 14). AD bisects $\angle A$ and meets BC at D. Find the coordinates of D.



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45. Show that $(1, -1)$, $(-2, 2)$, $(4, 8)$ and $(7, 5)$ are the angular points of a rectangle.



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46. The line segment joining $(3, -4)$ and $(1, 2)$ is trisected by $P(a, -2)$ and $Q\left(\frac{5}{3}, b\right)$. Find a and b .



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47. The centroid of a triangle ABC is $(1, 2, 2)$ If the coordinates of A and B are $(3, -5, 7)$ and $(-1, 7, -6)$ respectively. Find the coordinates of C .



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48. The vertices of a ΔABC are A (4,6), B (1, 5) and C (7,2). A line is drawn to intersect sides AB and AC at D and E respectively, such that $\frac{AD}{AB} = \frac{AE}{AC} = \frac{1}{4}$. Calculate the area of ΔADE and compare it with area of ΔABC



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49. Prove that the median of ΔABC divides it into two triangles of equal area. .



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50. Find the value of a for which the area of the triangle formed by $A(a, 2a)$, $B(-2, 6)$, and $C(3, 1)$ is 10 sq. units.



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51. If $a \neq b \neq 0$, prove that points (a, a^2) , (b, b^2) , and $(0, 0)$ can never be collinear.



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52. Prove that $(a, 0)$, $(0, b)$, and $(1, 1)$ are collinear if $\frac{1}{a} + \frac{1}{b} = 1$.



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53. Find the values of a and b if $P(9a-2, -b)$ divides the line segment AB where $A(3a+1, -3)$ and $B(8a, 5)$ in the ratio $3:1$.



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54. The centre of a circle is $(2a, a - 7)$. Find the values of a if the circle passes through $(11, -9)$ and has a diameter of $10\sqrt{2}$ units .



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55. For what value of k are $(k, 2 - 2)$, $(-k + 1, 2k)$, and $(4 - k, 6 - 2k)$ collinear?



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56. The vertices of a ΔABC are $A (-3,2)$, $B (-1,-4)$ and $C (5,2)$. If M and N are the mid - points of AB and AC respectively show that $2 MN = BC$.



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57. The vertices of a ΔABC are $A (-5,-1)$, $B (3,-5)$, $C (5,2)$. Show that the area of the ΔABC is four times the area of the triangle formed by joining the mid-points of the sides of the triangle ABC .





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Zen Additional Questions Long Answer La Type Questions

1. The vertices of $\triangle ABC$ are $A(4, 6)$, $B(1, 5)$, and $C(7, 2)$. A line is drawn to intersect sides AB and AC at D and E respectively. Show that $\frac{AD}{AB} = \frac{AE}{AC} = \frac{1}{4}$. Find the area of $\triangle ADE$ and compare it with $\triangle ABC$.



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2. The points A (6, 1), B (8, 2), and C (9, 4) are the three vertices of a parallelogram ABCD. If E is the midpoint of DC, find area of ΔADE .



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3. If $D = \left(\frac{1}{5}, \frac{5}{2}\right)$, $E(7, 3)$ and $F\left(\frac{7}{2}, \frac{7}{2}\right)$ are the mid-point of the sides of ΔABC , find the coordinates of ΔABC .



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



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5. Find the coordinates of the centre of the circle passing through the point $(0,0)$, $(-2,1)$ and $(-3,2)$. Also find the radius.



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6. Find the area of the triangle formed by joining the mid-points of the sides of the triangle whose vertices are $(0, -1)$, $(2, 1)$ and $(0, 3)$. Find the ratio of this area to the area of the given triangle.



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Zen Additional Questions Higher Order Thinking
Skills Hots Questions

1. In what ratio does $4x + 3y - 13 = 0$ divide the line segment joining $(2, 1)$ and $(1, 4)$?



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2. Find the circumcentre of the triangle whose vertices are $(0,0)$, $(3, \sqrt{3})$, and $(0, 2\sqrt{3})$.



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3. Find the 4th vertex of a rhombus formed by $(1,-1)$, $(6, 1)$, and $(8, 8)$.



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4. Find the coordinates of P which divides the line segment joining points $A(1, 3)$ and $B(3, 4)$ externally in the ratio 3:4.



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5. If points $(-3, 6)$, $(-9, a)$, and $(0, 15)$ are collinear, find 'a'.



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6. Check if the following points are collinear using section formula.

i] $(-4, 6)$, $(-6, 10)$, $(3, -8)$ (ii) $(1, -2)$, $(2, 3)$, $(-4, -3)$



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7. Find the perimeter and area of the quadrilaterals formed by the given points.

Mention the type of quadrilateral formed.

(i) $(0,3)$, $(4,0)$, $(0,-8)$, $(-4,0)$

(ii) $(5,0)$, $(0,-5)$, $(0,-9)$, $(9, 0)$

(iii) $(5, 3)$, $(5, - 3)$, $(10, - 6)$, $(10, 6)$



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8. Find the kind of quadrilateral formed by $(1, 3)$, $(0,8)$, $(5, 7)$, and $(8, 0)$.





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9. ABC is a triangle with vertices $A(-8, 3)$, $B(4, 5)$, $C(-6, 1)$. Find the vertices of a parallelogram in this $\triangle ABC$ sharing vertex B and having half the area of $\triangle ABC$. Find the area of the parallelogram so formed.



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10. Find the circumcentre of a triangle formed by $(2, 3)$, $(1, -5)$, and $(-1, 4)$.



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11. Find λ if $2x - 27 + 5 + \lambda (3x - y + 4) = 0$ passes through the midpoint of the line joining $(2,3)$ and $(4,9)$.



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12. Find the point on the Y-axis equidistant from $A(3, -6)$ and $B(-2,5)$.



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13. Find the coordinates of a point which divides the line joining points $A(-3,2)$ and $B(2, 6)$ in the ratio $3: 2$.



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14. Let $A(3,2)$, $B(4, 1)$, $C(3,1)$, and $D(2, 4)$ be the vertices of a quadrilateral $ABCD$. Find the area of the quadrilateral formed by joining the midpoints of the sides of the quadrilateral $ABCD$.



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