UDAAN 2024

– FOR CLASS 10th STUDENTS

Lecture No.- 02

- **Subject Name- Mathematics**
- **Chapter Name- Coordinate Geometry**

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Topic to be Covered

Topic Questions on distance formula

A (x_1, y_1) ——— B (x_2, y_2)

$$\boxed{AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}}$$

$$\boxed{AB^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Recap of Previous Lecture

Topic Everything form Basic

Topic Distance formula

Topic Most Important Questions

Topic : Distance Formula

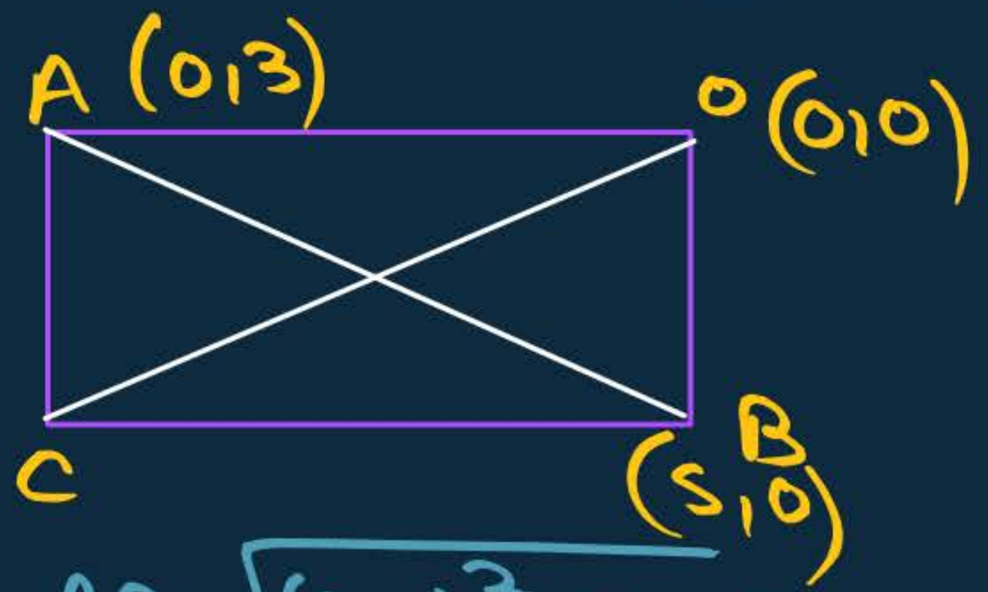
#Q. AOBC is a rectangle whose three vertices are A(0, 3), O(0, 0) and B(5, 0). The length of its diagonal is [NCERT Exemplar]

A) 5 units

B) 3 units

C) $\sqrt{34}$ units

D) 4 units



$$AB = \sqrt{(5-0)^2 + (0-3)^2}$$

$$= \sqrt{25+9}$$

$$= \boxed{\sqrt{34} \text{ units}}$$

Topic : Distance Formula

#Q. Find the point on y-axis which is equidistant form the point (5, –2) and (–3, 2).

A (0, –2)

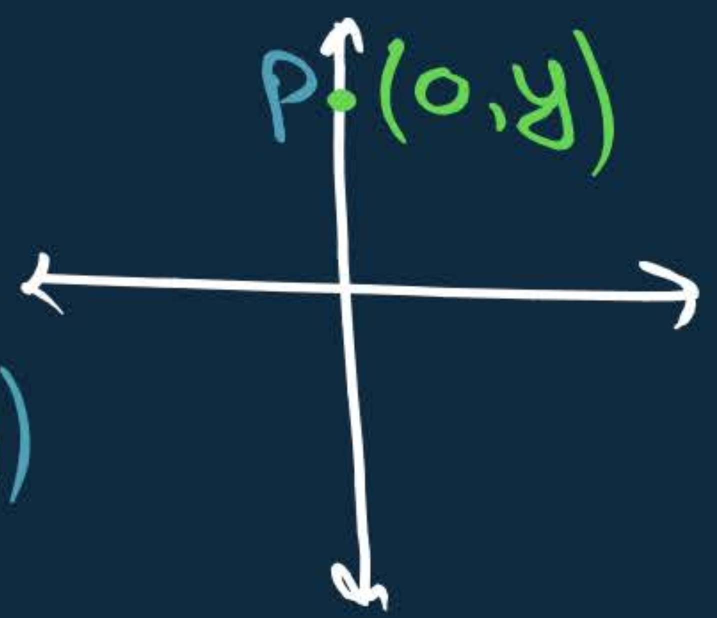
B (0, –3)

C (3, 0)

D (3, 2)

coordinates. (x, y)

let the coordinates of point 'P' be $(0, y)$.



$P(0, y)$

$\boxed{PQ = PR}$

$$D.F = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$Q(5, -2)$ $\quad$ $R(-3, 2)$

$$PQ = \sqrt{(5-0)^2 + (-2-y)^2}$$

$$PQ = \sqrt{25 + 4 + y^2 - 2(-2)(y)}$$

$$\boxed{PQ = \sqrt{29 + y^2 + 4y}}$$

$$PR = \sqrt{(-3-0)^2 + (2-y)^2}$$

$$PR = \sqrt{9 + 4 + y^2 - 4y}$$

$$\boxed{PR = \sqrt{13 + y^2 - 4y}}$$

$PQ = PR$

$\boxed{PQ^2 = PR^2}$

$29 + 4y + \cancel{y^2} = 13 + \cancel{y^2} - 4y$

$29 + 4y = 13 - 4y$

$8y = 13 - 29$

$8y = -16$

$y = -2$

Coordinates of $\boxed{P = (0, -2)}$

Topic : Distance Formula

#Q. If the point P(k – 1, 2) is equidistant from the point A(3, k) and B(k, 5), find the values of k. [CBSE 2014]

$P(k-1,2)$ $A(3,k)$ $B(k,5)$

$PA = PB$

$\boxed{PA^2 = PB^2}$

$(k-1-3)^2+(2-k)^2 = (\cancel{k}-1-\cancel{k})^2+(2-5)^2$

$(k-4)^2+(2-k)^2 = (-1)^2+(-3)^2$

$k^2+16-8k+4+k^2-4k = 1+9$

$2k^2-12k+20 = 10$

$2k^2-12k+10 = 0.$

$2(k^2-6k+5) = 0$

$\boxed{k^2-6k+5=0}$

$P=5,\ S=-6$

$k^2-5k-1k+5=0$

$k(k-5)-1(k-5)=0$

$(k-5)(k-1)=0$

$\boxed{k=5,1}$

Topic : Distance Formula

#Q. Point A(–1, y) and B(5, 7) lie on a circle with centre O(2, –3y). The values of y are [CBSE, Board Term-I, 2021]

A) 1, –7

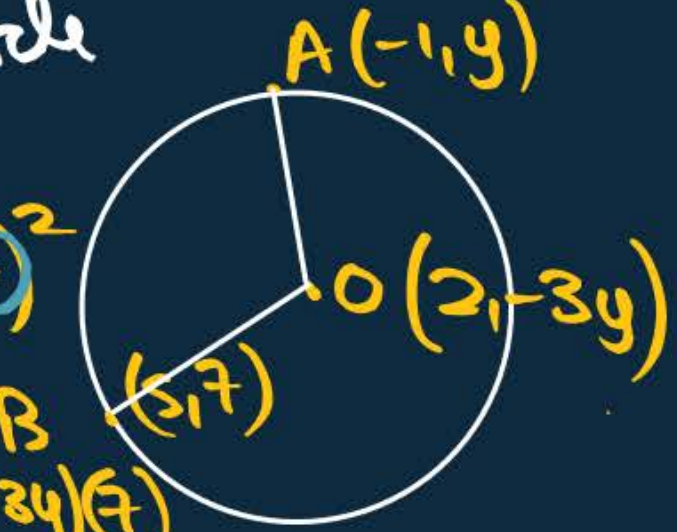
B) –1, 7 ✓

C) 2, 7

D) –2, – 7

$OA = OB$ (radius of same circle)

$OA^2 = OB^2$



$(2+1)^2 + (-3y-y)^2 = (2-5)^2 + (-3y-7)^2$

$\cancel{9} + 16y^2 = \cancel{9} + 9y^2 + 49 - 2(-3y)(7)$

$16y^2 = 9y^2 + 49 + 42y$

$7y^2 - 42y - 49 = 0$

$\boxed{y^2 - 6y - 7 = 0}$

$y^2 - 7y + 1y - 7 = 0$

$y(y-7) + 1(y-7) = 0$

$(y-7)(y+1) = 0$

$y = 7, -1$

Topic : Distance Formula

#Q. The co-ordinates of the point which is reflection of point (–3, 5) in x-axis are

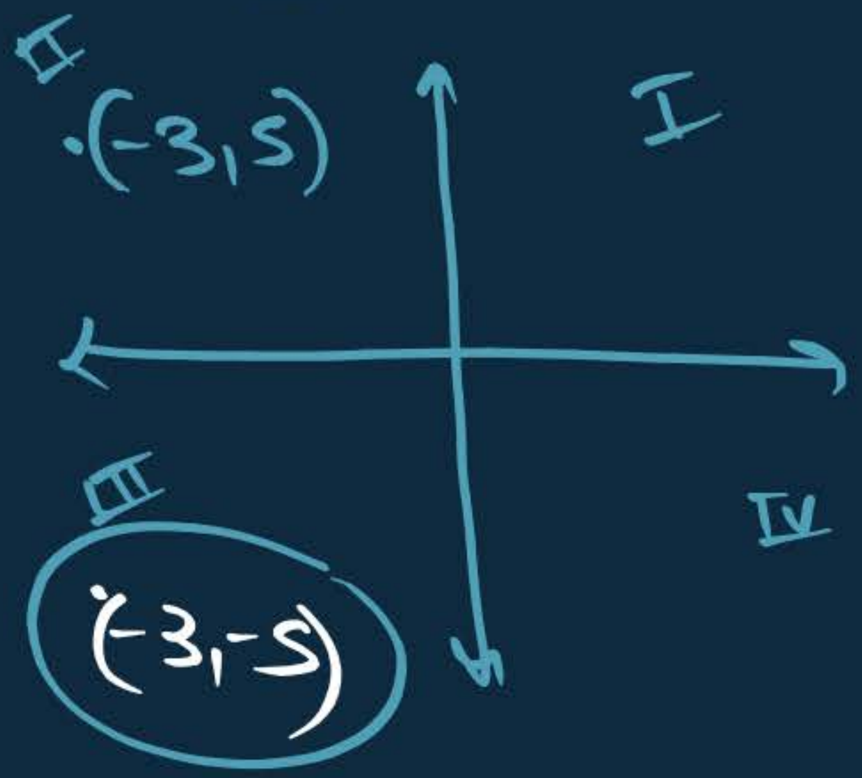
[CBSE]

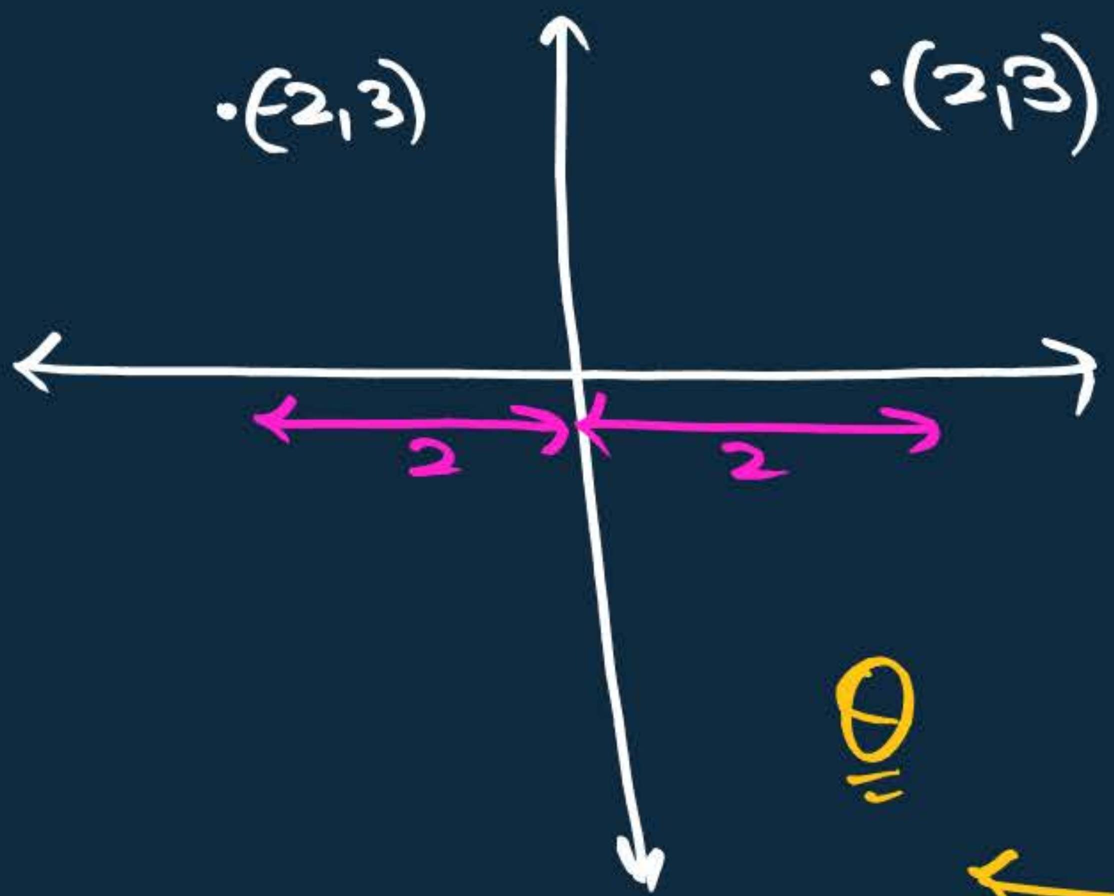
A (3, 5)

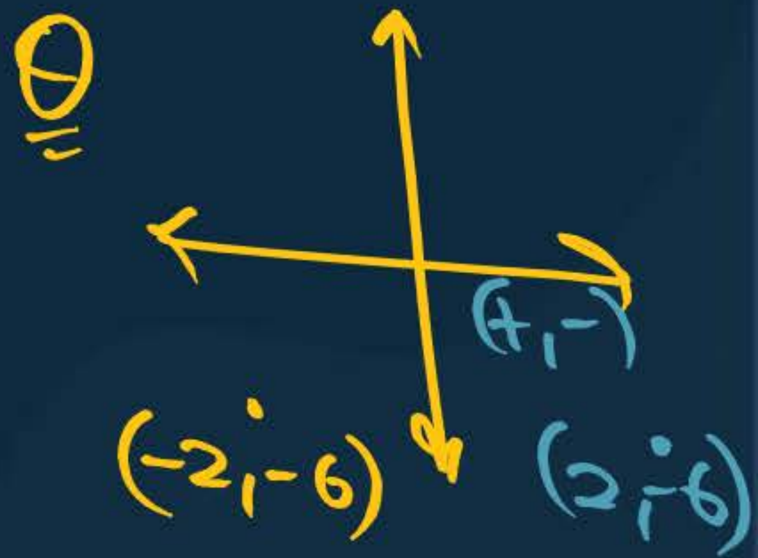
B (3, –5)

C (–3, –5)

D (–3, 5)







Topic : Distance Formula

#Q. The perimeter of a triangle with vertices (0, 4), (0, 0) and (3, 0) is

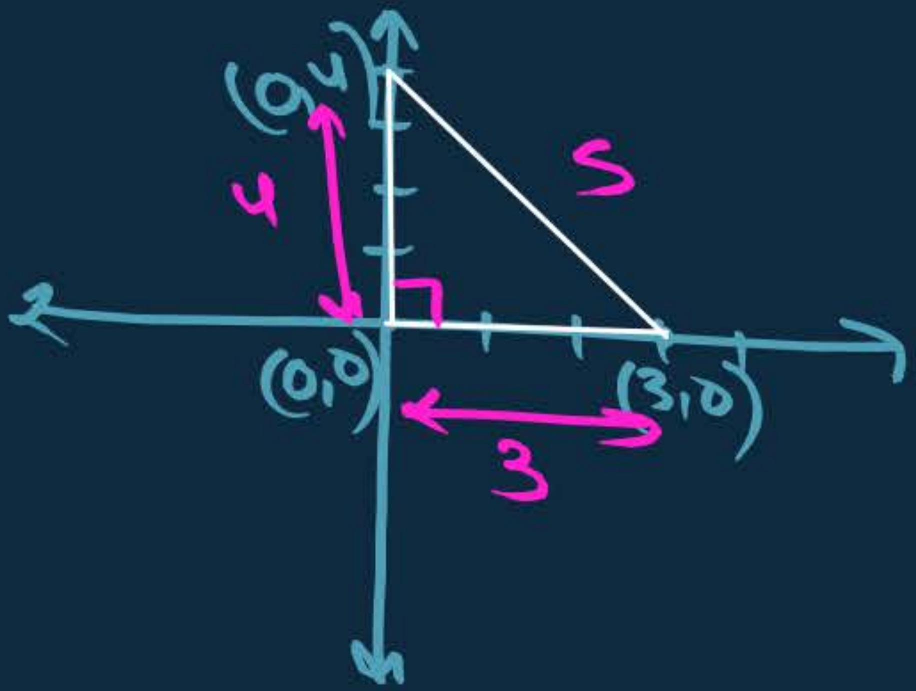
[NCERT Exemplar]

A) 5 units

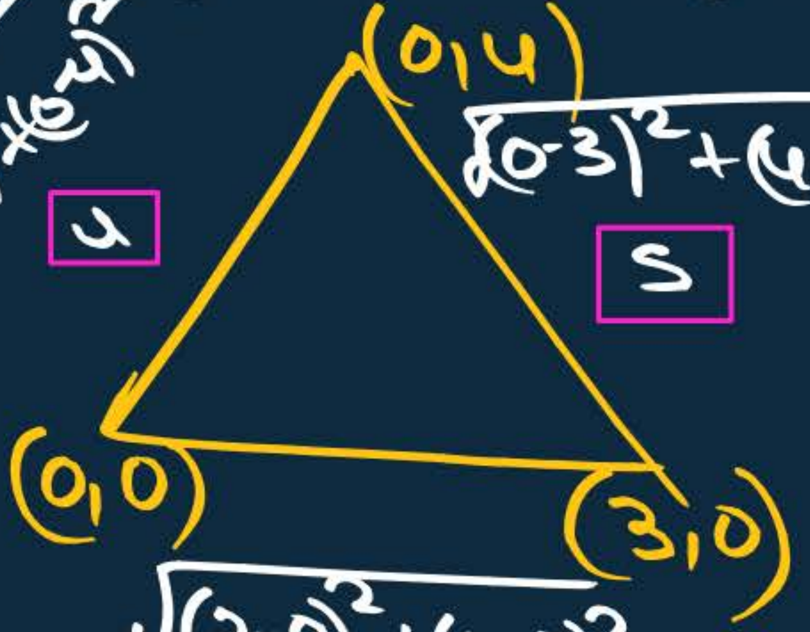
B) 12 units

C) 11 units

D) $7 + \sqrt{5}$ units



$\sqrt{(0-0)^2+(0-4)^2}$ $\boxed{4}$



$\sqrt{(0-3)^2+(4-0)^2}$ $\boxed{5}$

$\sqrt{(3-0)^2+(0-0)^2}$

$= \boxed{3}$

Topic : Distance Formula

#Q. If the point P(x, y) is equidistant from the points Q(a + b, b – a) & R(a – b, a + b), then prove that bx = ay. [CBSE SQP, 2016]

$P(x, y)$ — $Q(a+b, b-a)$

$P(x, y)$ — $R(a-b, a+b)$

$PQ = PR$

$\Rightarrow \boxed{PQ^2 = PR^2}$

$$((a+b)-x)^2 + ((b-a)-y)^2 = ((a-b)-x)^2 + ((a+b)-y)^2$$

$$(a+b)^2 + (x)^2 - 2(a+b)(x) + (b-a)^2 + (y)^2 - 2(b-a)(y)$$

$$= (a-b)^2 + (x)^2 - 2(a-b)(x) + (a+b)^2 + (y)^2 - 2(a+b)(y)$$

$$\cancel{a^2} + \cancel{b^2} + \cancel{2ab} + \cancel{x^2} - \cancel{2ax} - 2bx + \cancel{b^2} + \cancel{a^2} - \cancel{2ab} + \cancel{y^2} - \cancel{2by} + 2ay$$

$$= \cancel{a^2} + \cancel{b^2} - \cancel{2ab} + \cancel{x^2} - \cancel{2ax} + 2bx + \cancel{a^2} + \cancel{b^2} + \cancel{2ab} + \cancel{y^2} - 2ay - \cancel{2by}$$

$$-2bx + 2ay = 2bx - 2ay$$

$$\cancel{4}ay = \cancel{4}bx \rightarrow \boxed{ay = bx}$$

Topic: Properties of Various Types of Quadrilaterals

A quadrilateral is a

(i) Rectangle if its opposite sides are equal and the diagonals are equal.

(ii) Square if all its sides are equal and the diagonals are equal.

(iii) Parallelogram if its opposite sides are equal

(iv) parallelogram but not a rectangle if its opposite sides are equal and the diagonals are not equal.

(v) rhombus but not a square if all its sides are equal and the diagonals are not equal.

Topic : Distance Formula

#Q. Show that the points (1, 1), (–1, 5), (7, 9) and (9, 5) taken in the order are the vertices of a rectangle. Also, find the area of the rectangle. **[CBSE 2009 C]**

$AB = \sqrt{(-1-1)^2 + (5-1)^2} = \sqrt{4+16} = \sqrt{20}$

$BC = \sqrt{(7+1)^2 + (9-5)^2} = 64 + 16 = \sqrt{80}$

$CD = \sqrt{(7-9)^2 + (9-5)^2} = \sqrt{4+16} = \sqrt{20}$

$AD = \sqrt{(9-1)^2 + (5-1)^2} = 64 + 16 = \sqrt{80}$

$AC = \sqrt{(7-1)^2 + (9-1)^2} = \sqrt{36+64} = \sqrt{100} = 10$

$BD = \sqrt{(9+1)^2 + (5-5)^2} = \sqrt{100+0} = \sqrt{100} = 10$

Since $AC = BD$

and $AB = CD$, $AD = CB$

$\therefore$ ABCD is a Rectangle.

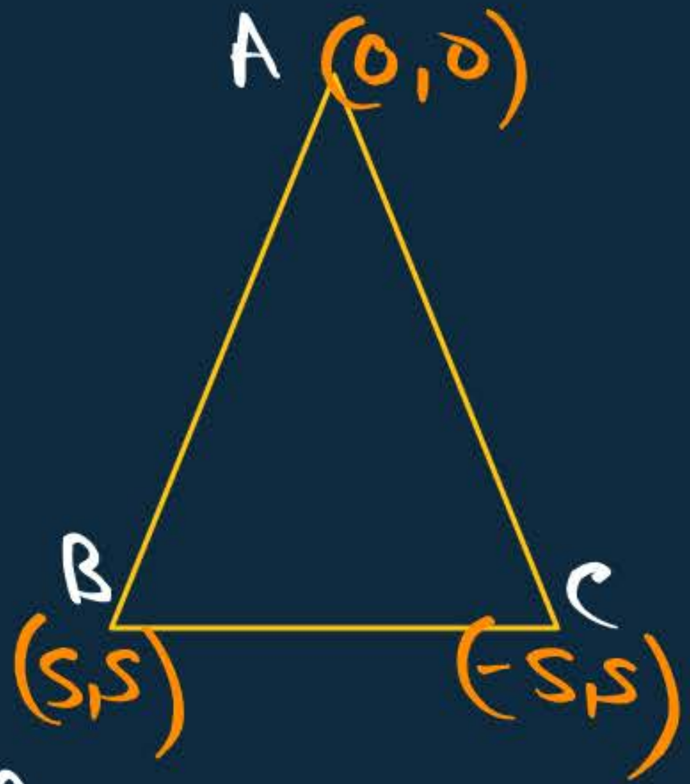
Topic : Distance Formula

#Q. Prove that the points (0, 0), (5, 5) and (–5, 5) are the vertices of a right isosceles triangle. [CBSE 2014]

$$AB = \sqrt{(5-0)^2+(5-0)^2} = \sqrt{25+25} = \boxed{\sqrt{50}}$$

$$AC = \sqrt{(-5-0)^2+(5-0)^2} = \sqrt{25+25} = \boxed{\sqrt{50}}$$

$$BC = \sqrt{(5+5)^2+(5-5)^2} = \sqrt{100+0} = \sqrt{100} = \boxed{10}$$



Since $AB = AC$

$\therefore$ ΔABC is isosceles Δ.

Also,

$$AB^2 + AC^2 = BC^2$$

$$50 + 50 = 100$$

$$\boxed{100 = 100}$$

ΔABC is right angled.

Topic : Distance Formula

P Q R

#Q. Show that the points (1, –1), (5, 2) and (9, 5) are collinear. [CBSE 2006]

points which are in the same line.

$PQ = \sqrt{(1-5)^2 + (-1-2)^2} = \sqrt{16+9} = \sqrt{25} = 5$

$QR = \sqrt{(5-9)^2 + (2-5)^2} = \sqrt{16+9} = \sqrt{25} = 5$

$PR = \sqrt{(1-9)^2 + (-1-5)^2} = \sqrt{64+36} = \sqrt{100} = 10$

$CA + AB = CB$

Since..

$PQ + QR = PR$

$5 + 5 = 10$

$\therefore$ P, Q, R are collinear.

A B C

#Q. Show that the points (a, a) (–a, –a) and $(-\sqrt{3}a, \sqrt{3}a)$ are the vertices of an equilateral triangle. [CBSE 2015]

$AB = \sqrt{(a+a)^2 + (a+a)^2}$

$AB = \sqrt{(2a)^2 + (2a)^2} = \sqrt{4a^2 + 4a^2} = \sqrt{8a^2} = \sqrt{2\times2\times2\times a\times a} = 2\sqrt{2}a$

$BC = \sqrt{(-a+\sqrt{3}a)^2 + (-a-\sqrt{3}a)^2} = \sqrt{a^2 + 3a^2 + 2(-a)(\sqrt{3}a) + a^2 + 3a^2 - 2(-a)(\sqrt{3}a)}$

$= \sqrt{8a^2 - \cancel{2\sqrt{3}a^2} + \cancel{2\sqrt{3}a^2}}$

$= \sqrt{8a^2}$

$= 2\sqrt{2}a$

$$AC = \sqrt{(a+\sqrt{3}a)^2 + (a-\sqrt{3}a)^2}$$

$$AC = \sqrt{a^2 + 3a^2 + \cancel{2\sqrt{3}a^2} + a^2 + 3a^2 - \cancel{2\sqrt{3}a^2}}$$

$$= \sqrt{8a^2}$$

$$AC = 2\sqrt{2}a$$

$$(a - b)^2$$

$$= (\boxed{-a} - \boxed{\sqrt{3}a})^2$$

$$= (-a)^2 + (\sqrt{3}a)^2 - 2(-a)(\sqrt{3}a)$$

$$= \boxed{a^2 + 3a^2 - 2\sqrt{3}a^2}$$

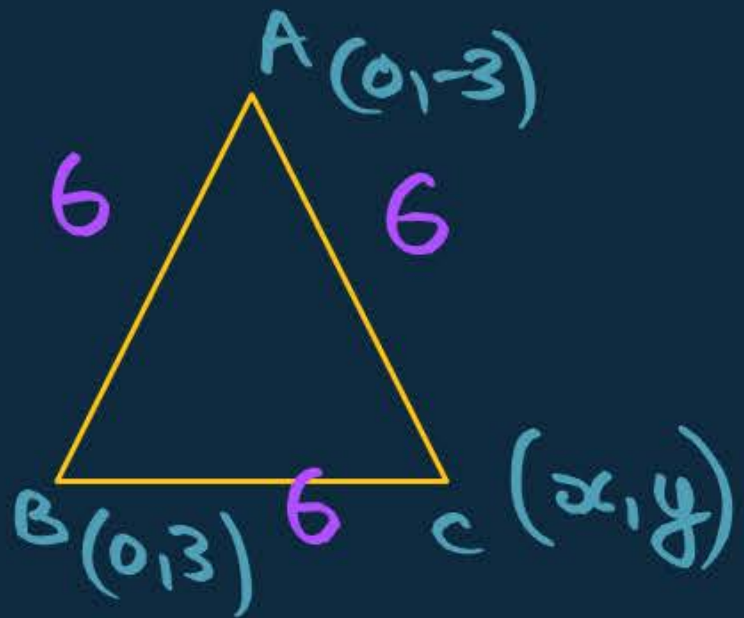
Since $AB = BC = CA = 2\sqrt{2}a$

$\therefore \Delta ABC$ is an equilateral Δ.

Topic : Distance Formula

#Q. If (0, −3) and (0, 3) are the two vertices of an equilateral triangle, find the coordinates of its third vertex. [CBSE 2014]

→ let the coordinates of 'c' be (x, y).



Since $\triangle ABC$ is equilateral $\triangle$ -

$\therefore$ $\boxed{AB = BC = AC}$ → $AB^2 = BC^2 = AC^2$

$BC^2 = (x-0)^2 + (y-3)^2$

$\boxed{BC^2 = x^2 + y^2 + 9 - 6y}$

$AC^2 = (x-0)^2 + (y+3)^2$

$\boxed{AC^2 = x^2 + y^2 + 9 + 6y}$

$AB^2 = (0-0)^2 + (3+3)^2$

$AB^2 = 36$

$AB = \sqrt{36}$

$\boxed{AB = 6}$

$BC^2 = AC^2$

$\cancel{x^2} + \cancel{y^2} + \cancel{9} - 6y = \cancel{x^2} + \cancel{y^2} + \cancel{9} + 6y$

$-6y = 6y$

$-6y - 6y = 0$

$-12y = 0$

$y = \frac{0}{-12}$

$\boxed{y = 0}$

$AC^2 = x^2 + y^2 + 9 + 6y$

$\downarrow$

$6^2 = x^2 + 9$

$36 - 9 = x^2$

$27 = x^2$

$\pm\sqrt{27} = x$

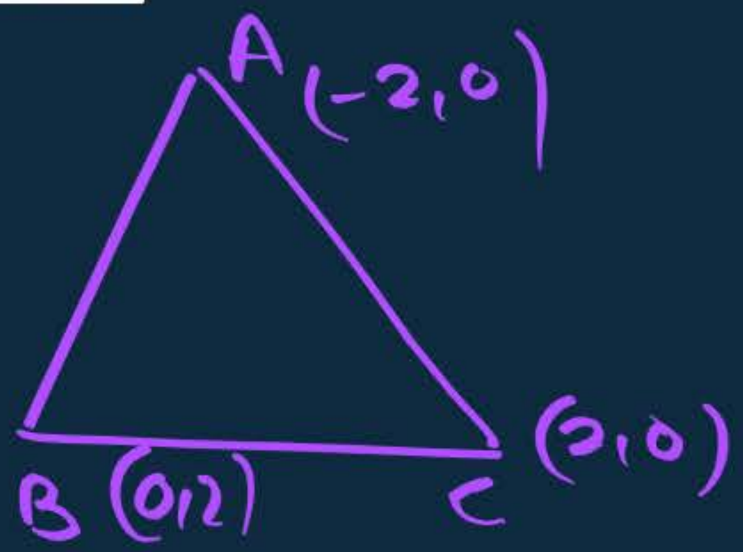
$\boxed{\pm 3\sqrt{3} = x}$

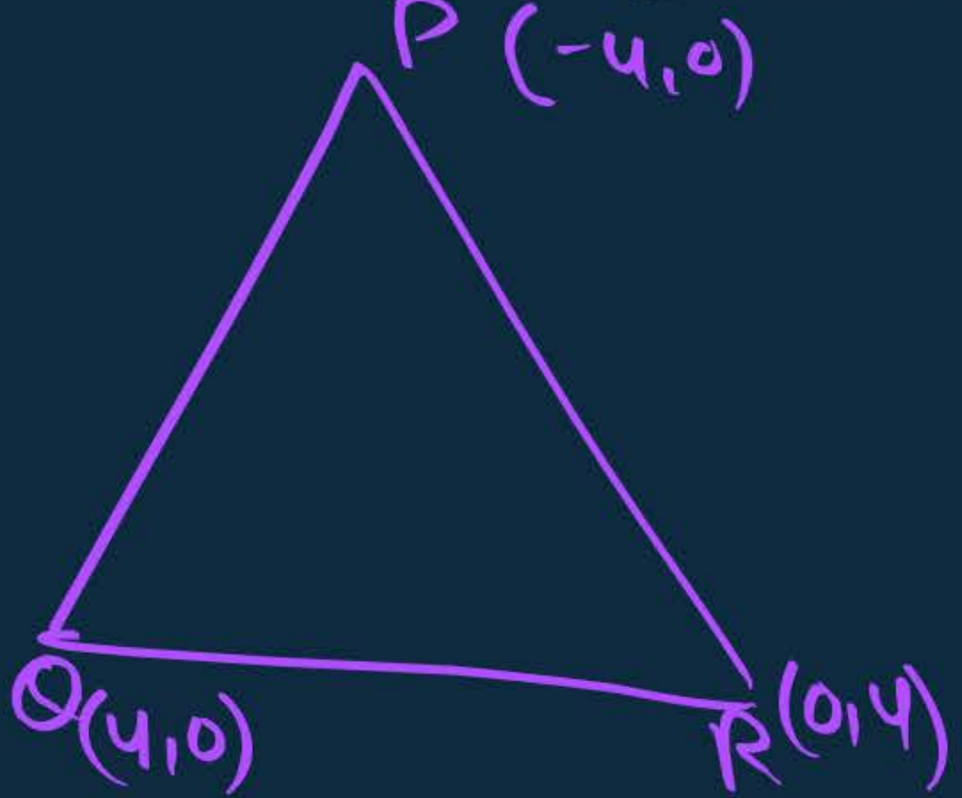
Coordinates of C are $= (3\sqrt{3}, 0)$ or $(-3\sqrt{3}, 0)$

Topic : Distance Formula

#Q. Show that ΔABC where A(–2, 0), B(2, 0), C(0, 2) and ΔPQR, where P(–4, 0), Q(4, 0), R(0, 4) are similar. [CBSE 2017]

H·W



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