Math Sci 9: Test		Total No. 40

Name:____________________ Roll No. :_______

Date:_____-_____-20 Teacher's Signature: ________

Q.1: Tick (✓) the correct answer. **سوال نمبر 1۔ درست جواب پر (✓) کا نشان لگائیں۔**

Distance between points S (-1,3) and R(3,-2) is: **1۔ نقاط S(-1,3) اور R(3,-2) کے درمیان فاصلہ ہے:**

(A) $\sqrt{2}$ (B) $\sqrt{41}$ (C) $\sqrt{13}$ (D) $\sqrt{-3}$

If three points lie on the same line, then these points are called: **2۔ اگر تین نقاط ایک ہی خط پر واقع ہوں تو وہ ____ نقاط کہلاتے ہیں:**

(A) Collinear/ہم خط (B) Non Collinear/غیر ہم خط (C) Parallel/متوازی (D) Unparallel/غیر متوازی

Distance between points (0,-5) and (0,0): **3۔ نقاط (0,-5) اور (0,0) کے درمیان فاصلہ ہے:**

(A) 0 (B) 5 (C) -5 (D) 25

A quadrilateral having each angle equal to 90, is called: **4۔ ایک چوکور جس کا ہر زاویہ 90 کا ہو ____ کہلاتی ہے:**

(A) Parallelogram/متوازی الاضلاع (B) Trapezium/ذوزنقہ (C) Rectangle/مستطیل (D) Rhombus/معین

Distance between points (0,0) and R(-4,-3) is: **5۔ نقاط (0,0) اور (-4,-3) کے درمیان فاصلہ ہے:**

(A) 7 (B) -5 (C) 5 (D) 25

A triangle is formed by ___ non collinear points: **6۔ ایک مثلث ____ غیر ہم خط نقاط سے بنتی ہے:**

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

A closed figure consisting of three non collinear points is called **7۔ تین غیر ہم خط نقاط والی بند شکل کہلاتی ہے:**

(A) Triangle/مثلث (B) Square/مربع (C) Rectangle/مستطیل (D) Circle/دائرہ

Distance between points $(0,0)$ and $(1,1)$ is: **8۔ نقاط $(0,0)$ اور $(1,1)$ کے درمیان فاصلہ ____ ہے:**

(A) 0 (B) 1 (C) 2 (D) $\sqrt{2}$

A triangle having all sides equal is called ______: **9۔ ایک مثلث کے تینوں اضلاع کی لمبائی برابر ہو، وہ ____ کہلاتی ہے:**

(A) Isosceles / متساوی الساقین (B) Scalene / مختلف الاضلاع (C) Equilateral / مساوی الاضلاع (D) None ان میں سے کوئی نہیں

Distance between points $(1,0)$ and $(0,1)$ is: **10۔ نقاط $(1,0)$ اور $(0,1)$ کا درمیانی فاصلہ ____ ہے:**

(A) 0 (B) 1 (C) $\sqrt{2}$ (D) 2

$10\times 2=20$ **Write short answers to any ten (10) questions.** **سوال نمبر 2۔ کوئی سے 10 سوالات کے جوابات تحریر کیجیے۔**

i. Define plane geometry and coordinate geometry. پلین جیومیٹری اور کوآرڈی نیٹ جیومیٹری کی تعریف کیجیے۔

ii. Find distance between following pairs of points: $A(2,-6), B(3,-6)$ نقاط کے جوڑوں کے درمیان فاصلہ معلوم کیجیے:

iii. Define triangle. مثلث کی تعریف کیجیے۔

iv. Define rectangle. مستطیل کی تعریف کیجیے۔

v. What is parallelogram? متوازی الاضلاع کیا ہوتی ہے؟

vi. Write down mid point formula of two points. دو نقاط کا درمیانی نقطہ معلوم کرنے کا فارمولا لکھیں۔

vii. Find the mid point between the points . $B(7,2), A(9,2)$ نقاط کا درمیانی نقطہ معلوم کریں۔

viii. Find the mid point between the points $A(-8,1), B(6,1)$. نقاط $A(-8,1), B(6,1)$ کا درمیانی نقطہ معلوم کریں۔

ix. Find the distance betwen the pair of points: $(7,5),(1,-1)$ نقاط کے جوڑوں کے درمیان فاصلہ معلوم کریں۔

x. What is meant by scalene triangle? Draw it. مختلف الاضلاع مثلث سے کیا مراد ہے؟ شکل بنائیے۔

xi. Find distance between points using distance formula: $U(0,2)$, $V(-3,0)$ فاصلہ فارمولا کی مدد سے نقاط کے جوڑوں کے درمیان فاصلہ معلوم کیجیے:

xii. Define isosceles triangle. متساوی الساقین مثلث کی تعریف کیجیے۔

$1\times 10=10$ **Write answer to any One (1) question.** **نوٹ: کوئی سے ایک سوال کا جواب لکھیے۔**

سوال نمبر 3۔ Prove that mid point of the hypotenuse of a right triangle is equidistant from its three vertices $P(-2,5), Q(1,3)$ and $R(-1,0)$.

ثابت کیجیے کہ ایک قائمہ زاویہ مثلث کے وتر کا درمیانی نقطہ مثلث کے تینوں نقاط $Q(1,3), P(-2,5)$ اور $R(-1,0)$ سے یکساں فاصلہ پر ہے۔

Exercise 9.1

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

Solution:

(a) $A(9,2), B(7,2)$

$$\text{Distance} = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$
$$|AB| = \sqrt{|7-9|^2 + |2-2|^2}$$
$$|AB| = \sqrt{(-2)^2 + (0)^2}$$
$$|AB| = \sqrt{4}$$
$$|AB| = 2$$

(b) $A(2,-6), B(3,-6)$

$$\text{Distance} = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$
$$|AB| = \sqrt{|3-2|^2 + |-6-(-6)|^2}$$
$$|AB| = \sqrt{(1)^2 + (-6+6)^2}$$
$$|AB| = \sqrt{1 + (0)^2}$$
$$|AB| = \sqrt{1}$$
$$AB = 1$$

(c) $A(-8,1), B(6,1)$

$$\text{Distance} = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$
$$|A\,B| = \sqrt{|6-(-8)|^2 + |1-1|^2}$$
$$|A\,B| = \sqrt{(6+8)^2 + (0)^2}$$
$$|A\,B| = \sqrt{(14)^2}$$
$$|A\,B| = 14$$

(d) $A(-4,\sqrt{2}), B(-4,-3)$

$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$
$$|A\,B| = \sqrt{|-4-(-4)|^2 + |-3-\sqrt{2}|^2}$$
$$|A\,B| = \sqrt{(-4+4)^2 + \left(-(3+\sqrt{2})\right)^2}$$
$$|A\,B| = \sqrt{(0)^2 + (3+\sqrt{2})^2}$$
$$|A\,B| = \sqrt{(3+\sqrt{2})^2}$$
$$|A\,B| = 3+\sqrt{2}$$

(e) $A(3,-11), B(3,-4)$

$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$
$$|A\,B| = \sqrt{|3-3|^2 + |-4-(-11)|^2}$$
$$|A\,B| = \sqrt{(0)^2 + (-4+11)^2}$$
$$|A\,B| = \sqrt{(7)^2}$$
$$|A\,B| = 7$$

(f) $A(0,0), B(0,-5)$

$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$
$$|A\,B| = \sqrt{|0-0|^2 + |-5-0|^2}$$
$$|A\,B| = \sqrt{(-5)^2}$$
$$|A\,B| = \sqrt{25}$$
$$|A\,B| = 5$$

Q.2 Let P be the print on x-axis with x-coordinate a and Q be the point on y-axis with y coordinate b as given below. Find the distance between P and Q

Solution:

(i) $a = 9, b = 7$

P is (9, 0) and Q (0, 7)

$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$
$$|P\,Q| = \sqrt{|0-9|^2 + |7-0|^2}$$

$$|PQ| = \sqrt{(-9)^2 + (7)^2}$$
$$|PQ| = \sqrt{81+49}$$
$$|PQ| = \sqrt{130}$$

(ii) $a = 2, b = 3$

$$P(2,0), Q(0,3)$$
$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$
$$|PQ| = \sqrt{|0-2|^2 + |3-0|^2}$$
$$|PQ| = \sqrt{(-2)^2 + (3)^2}$$
$$|PQ| = \sqrt{4+9}$$
$$|PQ| = \sqrt{13}$$

(iii) $a = -8, b = 6$

$$P(-8,0), Q(0,6)$$
$$|d| = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$
$$|PQ| = \sqrt{|0-(-8)|^2 + |6-0|^2}$$
$$|PQ| = \sqrt{(8)^2 + (6)^2}$$
$$|PQ| = \sqrt{64+36}$$
$$|PQ| = \sqrt{100}$$
$$|PQ| = 10$$

(iv) $a = -2, b = -3$

$$P(-2,0), Q(0,-3)$$
$$|d| = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$
$$d = \sqrt{|0-(-2)|^2 + |-3-0|^2}$$
$$d = \sqrt{(2)^2 + (-3)^2}$$
$$d = \sqrt{4+9}$$
$$d = \sqrt{13}$$

(v) $a = \sqrt{2}, b = 1$

$$P(\sqrt{2},0), Q(0,1)$$
$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$
$$d = \sqrt{|0-\sqrt{2}|^2 + |1-0|^2}$$
$$d = \sqrt{(-\sqrt{2})^2 + (1)^2}$$
$$d = \sqrt{2+1}$$
$$d = \sqrt{3}$$

(vi) $a = -9, b = -4$

$$P(-9,0), Q(0,-4)$$
$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$
$$|PQ| = \sqrt{|0-(-9)|^2 + |-4-0|^2}$$
$$|PQ| = \sqrt{(9)^2 + (-4)^2}$$
$$|PQ| = \sqrt{81+16}$$
$$|PQ| = \sqrt{97}$$

Exercise 9.2

Q.1 Show whether the points with vertices (5,-2),(5,4) and (-4,1) are the vertices of equilateral triangle or an isosceles triangle

$P(5,-2), Q(5,4), R(-4,1)$

Solution:

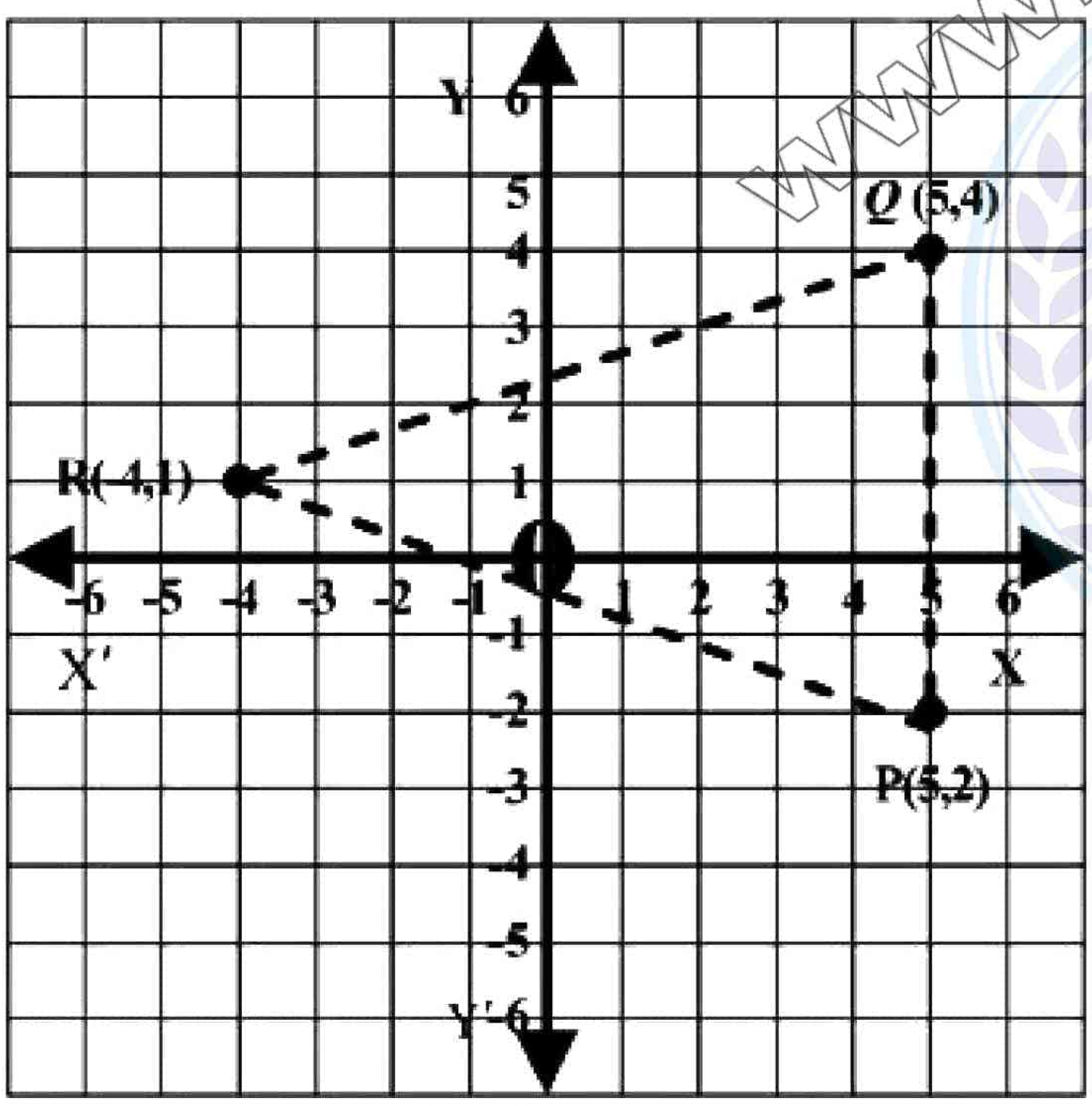
We know that the distance formula is

$$=\sqrt{|x_2-x_1|^2+|y_2-y_1|^2}$$

We have $P(5,-2), Q(5,4)$

$$|PQ|=\sqrt{|5-5|^2+|4-(-2)|^2}$$

$$|PQ|=\sqrt{(0)^2+(4+2)^2}$$



$$|PQ|=\sqrt{(6)^2}$$

$$|PQ|=6$$

$Q(5,4), R(-4,1)$

$$|QR|=\sqrt{|-4-5|^2+|1-4|^2}$$

$$|QR|=\sqrt{(-9)^2+(-3)^2}$$

$$|QR|=\sqrt{81+9}$$

$$|QR|=\sqrt{90}$$

$$|QR|=\sqrt{9\times 10}=3\sqrt{10}$$

$R(-4,1), P(5,-2)$

$$|RP|=\sqrt{|5-(-4)|^2+|-2-1|^2}$$

$$|RP|=\sqrt{(5+4)^2+(-3)^2}$$

$$|RP|=\sqrt{(9)^2+9}$$

$$|RP|=\sqrt{81+9}$$

$$|RP|=\sqrt{90}$$

$$|RP|=\sqrt{9\times 10}=3\sqrt{10}$$

$|QR|=|PR|$

Two lengths of triangle are equal

So it is a isosceles triangle

Q.2 Show whether or not the points with vertices (-1,1),(2,-2) and (-4,1) form a Square

Solution:

$P(-1,1)Q(5,4)R(2,-2)S(-4,1)$

$$\text{Distance}=\sqrt{|x_2-x_1|^2+|y_2-y_1|^2}$$

$$|PQ|=\sqrt{|5-(-1)^2|+|4-1|^2}$$

$$|PQ|=\sqrt{|5+1|^2+|3|^2}$$

$$|PQ|=\sqrt{6^2+9}$$

$$|PQ|=\sqrt{36+9}$$

$$|PQ|=\sqrt{45}$$

$$|PQ|=\sqrt{9\times 5}$$

$$|PQ|=3\sqrt{5}$$

$$|QR|=\sqrt{|2-5|^2+|-2-4|^2}$$

$|QR| = \sqrt{(-3)^2 + (6)^2}$

$|QR| = \sqrt{9+36}$

$|QR| = \sqrt{45}$

$|QR| = \sqrt{9\times 5}$

$|QR| = 3\sqrt{5}$

$|RS| = \sqrt{|-4-2|^2 + |1-(-2)|^2}$

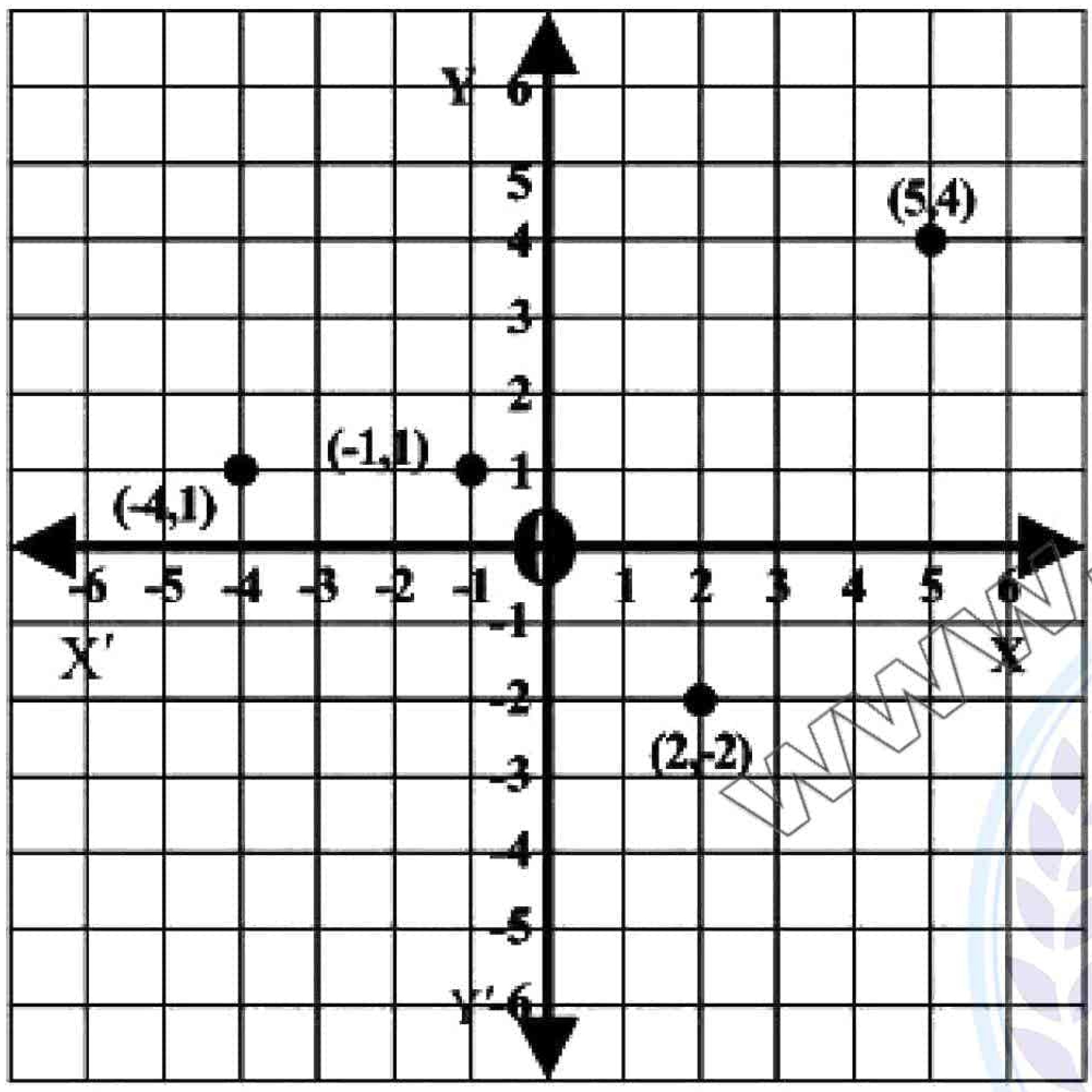
$|RS| = \sqrt{(-6)^2 + (1+2)^2} = \sqrt{36+(3)^2}$

$|RS| = \sqrt{36+9}$

$|RS| = \sqrt{45}$

$|RS| = \sqrt{9\times 5}$

$|RS| = 3\sqrt{5}$



$|SP| = \sqrt{|-4-(-1)|^2 + |1-1|^2}$

$|SP| = \sqrt{(-4+1)^2 + (0)^2}$

$|SP| = \sqrt{(-3)^2}$

$|SP| = \sqrt{9}$

$|SP| = 3$

If all the length are same then it will be a Square all the length are not equal so it is not square.

$|PQ| = |QR| = |RS| \neq |SP|$

Q.3 Show whether or not the points with coordinates $(1,3), (4,2)$ and $(-2,6)$ are vertices of a right triangle?

Solution:

$A(1,3), B(4,2), C(-2,6)$

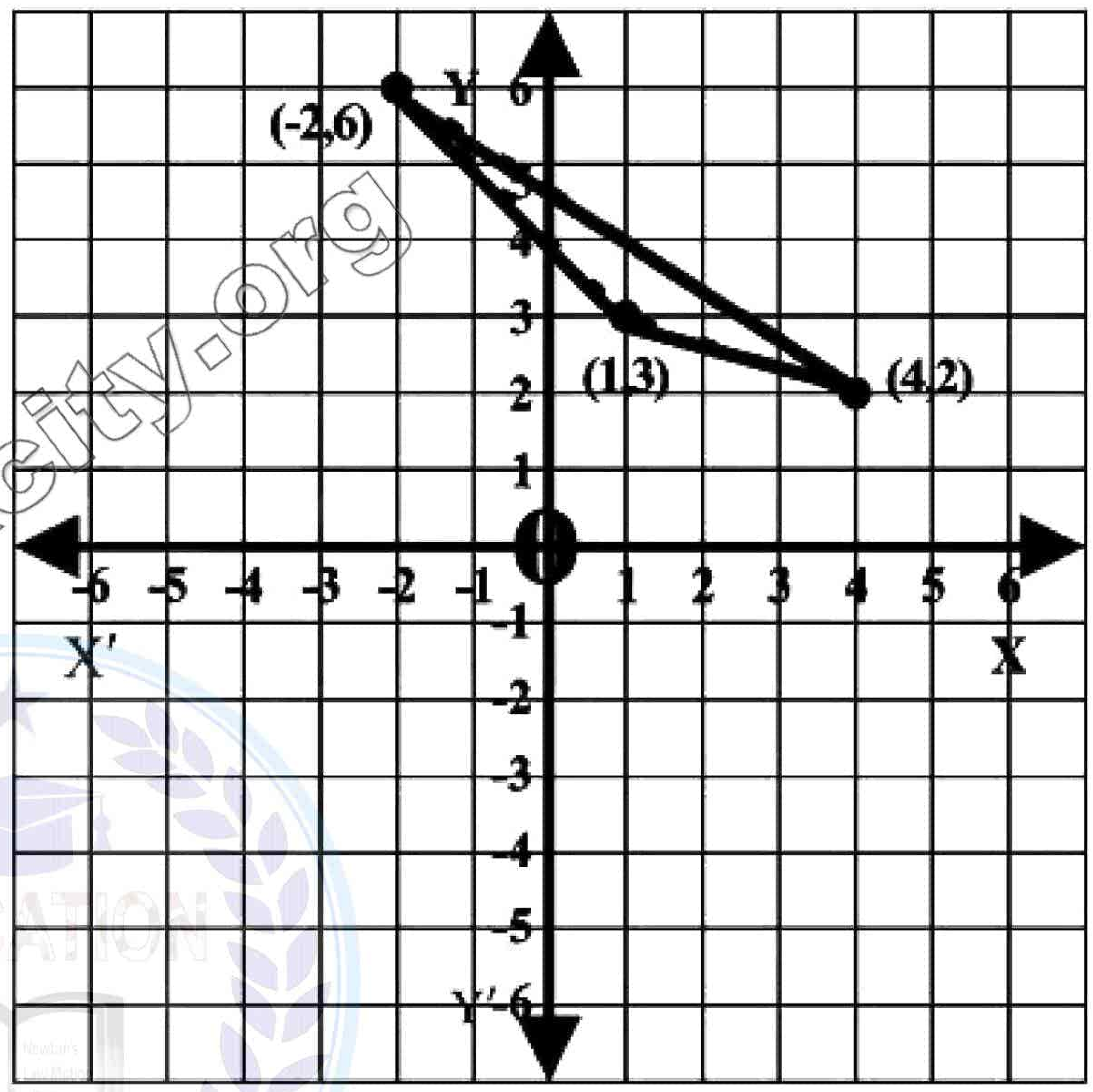
$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$

$|AB| = \sqrt{|4-1|^2 + |2-3|^2}$

$|AB| = \sqrt{(3)^2 + (-1)^2}$

$|AB| = \sqrt{9+1}$

$|AB| = \sqrt{10}$



$|BC| = \sqrt{|-2-4|^2 + |6-2|^2}$

$|BC| = \sqrt{(-6)^2 + (4)^2}$

$|BC| = \sqrt{36+16}$

$|BC| = \sqrt{52}$

$|CA| = \sqrt{|-2-1|^2 + |6-3|^2} = \sqrt{(-3)^2 + (3)^2}$

$|CA| = \sqrt{9+9}$

$|CA| = \sqrt{18}$

By Pythagoras theorem

$(\text{Hyp})^2 = (\text{Base})^2 + (\text{Perp})^2$

$(\sqrt{52})^2 = (\sqrt{18})^2 + (\sqrt{10})^2$

$52 = 18 + 10$
$52 = 28$
Since $52 \neq 28$
So it not right angle triangle.

Q.4 Use distance formula to prove whether or not the points $(1,1),(-2,-8)$ and $(4,10)$ lie on a straight line?

Solution:

$A(1,1), B(-2,-8), C(4,10)$

$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$

$$|AB| = \sqrt{|-2-1|^2 + |-8-1|^2}$$

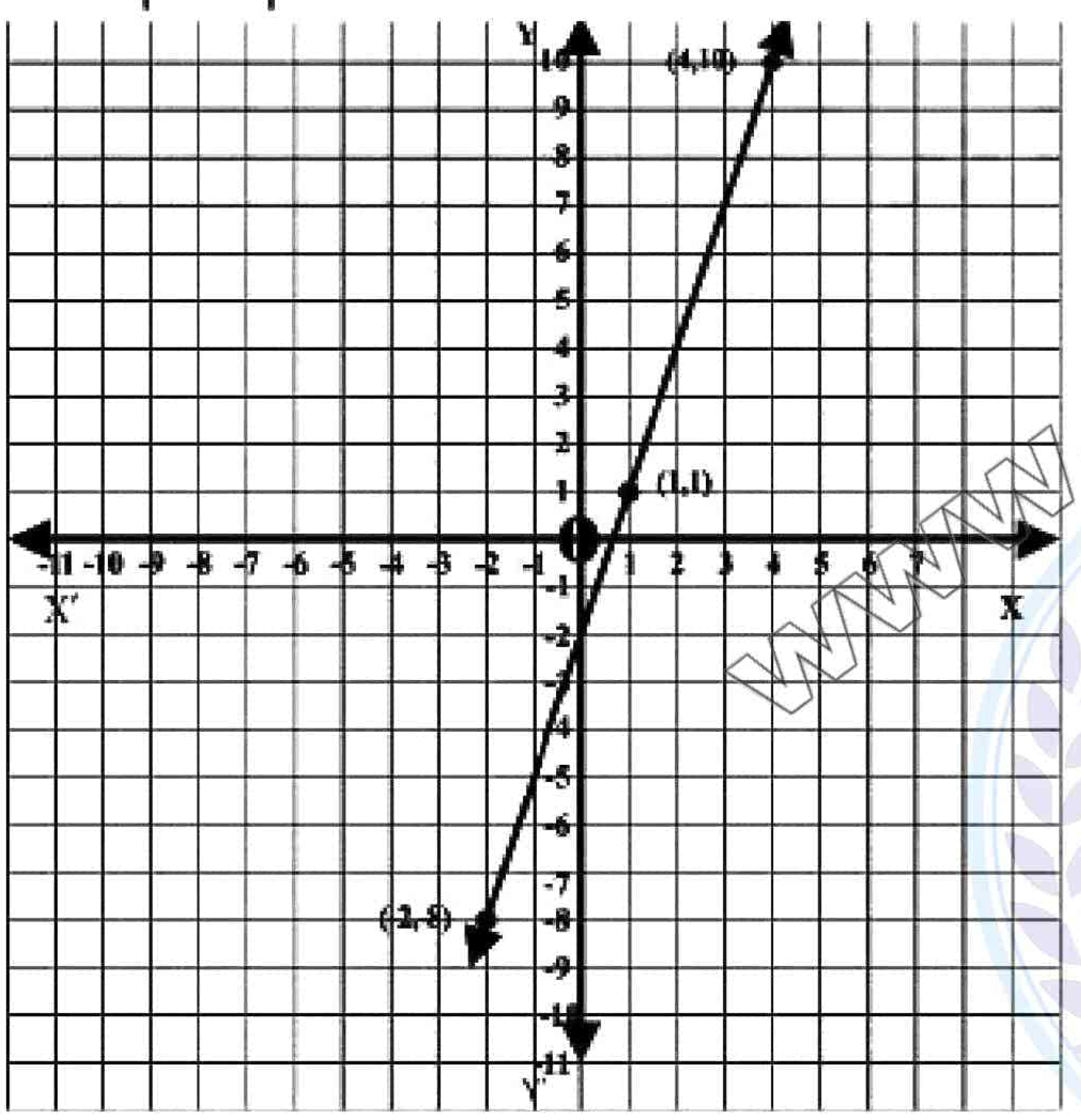
$$|AB| = \sqrt{(-3)^2 + (-9)^2}$$

$$|AB| = \sqrt{9+81}$$

$$|AB| = \sqrt{90}$$

$$|AB| = \sqrt{9 \times 10}$$

$$|AB| = 3\sqrt{10}$$



$$|BC| = \sqrt{|4-(-2)|^2 + |10-(-8)|^2}$$

$$|BC| = \sqrt{(4+2)^2 + (10+8)^2}$$

$$|BC| = \sqrt{(6)^2 + (18)^2}$$

$$|BC| = \sqrt{36+324}$$

$$|BC| = \sqrt{360}$$

$$|BC| = \sqrt{36 \times 10}$$

$$|BC| = 6\sqrt{10}$$

$$|AC| = \sqrt{|4-1|^2 + |10-1|^2}$$

$$|AC| = \sqrt{(3)^2 + (9)^2}$$

$$|AC| = \sqrt{9+81}$$

$$|AC| = \sqrt{90}$$

$$|AC| = \sqrt{9 \times 10}$$

$$|AC| = 3\sqrt{10}$$

$$|AC| + |AB| = |BC|$$

$$3\sqrt{10} + 3\sqrt{10} = 6\sqrt{10}$$

$$6\sqrt{10} = 6\sqrt{10}$$

It means that they lie on same line so they are collinear.

Q.5 Find K given that point (2, K) is equidistance from (3, 7) and (9,1)

Solution: $M(2,K), A(3,7)$ and $B(9,1)$

(3,7) A ——— (2,K) M ——— (9,1) B

$$|\overline{AM}| = |\overline{BM}|$$

$$\sqrt{|2-3|^2 + |K-7|^2} = \sqrt{|9-2|^2 + |1-K|^2}$$

$$\sqrt{(-1)^2 + (K-7)^2} = \sqrt{(7)^2 + (1-K)^2}$$

Taking square on both Side

$$\left(\sqrt{1+K^2+49-14K}\right)^2 = \left(\sqrt{49+1+K^2-2K}\right)^2$$

$$K^2 - 14K + 50 = 50 + K^2 - 2K$$

$$K^2 - 14K + 50 - 50 - K^2 + 2K = 0$$

$$-12K = 0$$

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

$$K = 0$$

Q.6 Use distance formula to verify that the points $A(0,7), B(3,-5), C(-2,15)$ are Collinear.

Solution:

$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$

$$|AB| = \sqrt{|3-0|^2 + |-5-7|^2}$$

$$|AB| = \sqrt{(3)^2 + (-12)^2}$$

$$|AB| = \sqrt{9+144}$$

$$|AB| = \sqrt{153}$$

$$|AB| = \sqrt{9 \times 17}$$

$52 = 18 + 10$
$52 = 28$
Since $52 \neq 28$
So it not right angle triangle.

Q.4 Use distance formula to prove whether or not the points $(1,1), (-2,-8)$ and $(4,10)$ lie on a straight line?

Solution:

$A(1,1), B(-2,-8), C(4,10)$

$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$

$$|AB| = \sqrt{|-2-1|^2 + |-8-1|^2}$$

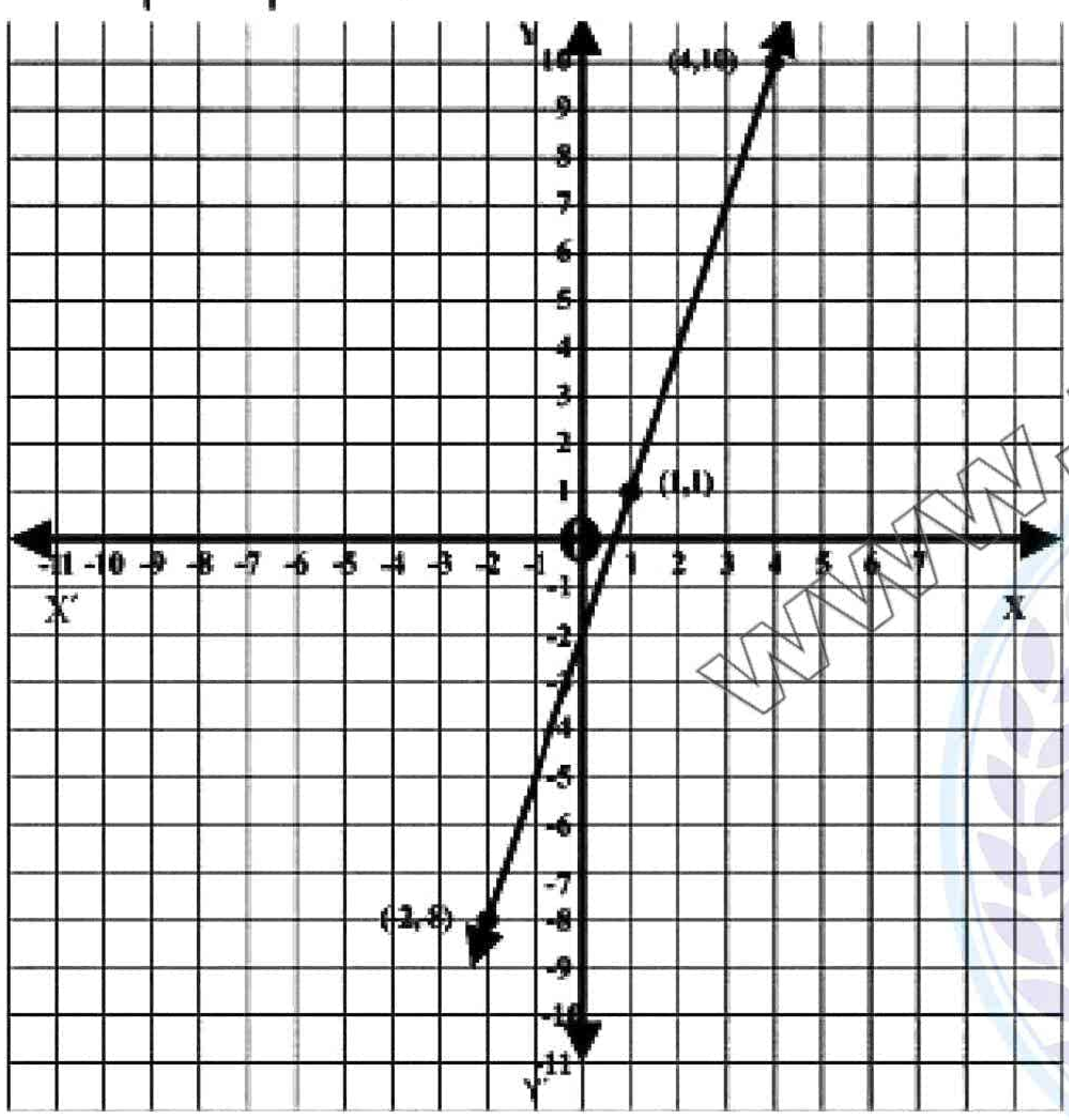
$$|AB| = \sqrt{(-3)^2 + (-9)^2}$$

$$|AB| = \sqrt{9+81}$$

$$|AB| = \sqrt{90}$$

$$|AB| = \sqrt{9 \times 10}$$

$$|AB| = 3\sqrt{10}$$



$$|BC| = \sqrt{|4-(-2)|^2 + |10-(-8)|^2}$$

$$|BC| = \sqrt{(4+2)^2 + (10+8)^2}$$

$$|BC| = \sqrt{(6)^2 + (18)^2}$$

$$|BC| = \sqrt{36+324}$$

$$|BC| = \sqrt{360}$$

$$|BC| = \sqrt{36 \times 10}$$

$$|BC| = 6\sqrt{10}$$

$$|AC| = \sqrt{|4-1|^2 + |10-1|^2}$$

$$|AC| = \sqrt{(3)^2 + (9)^2}$$

$$|AC| = \sqrt{9+81}$$

$$|AC| = \sqrt{90}$$

$$|AC| = \sqrt{9 \times 10}$$

$$|AC| = 3\sqrt{10}$$

$$|AC| + |AB| = |BC|$$

$$3\sqrt{10} + 3\sqrt{10} = 6\sqrt{10}$$

$$6\sqrt{10} = 6\sqrt{10}$$

It means that they lie on same line so they are collinear.

Q.5 Find K given that point (2, K) is equidistance from (3, 7) and (9,1)

Solution: $M(2,K), A(3,7)$ and $B(9,1)$

(3,7) A ——— (2, K) M ——— (9, 1) B

$$|\overline{AM}| = |\overline{BM}|$$

$$\sqrt{|2-3|^2 + |K-7|^2} = \sqrt{|9-2|^2 + |1-K|^2}$$

$$\sqrt{(-1)^2 + (K-7)^2} = \sqrt{(7)^2 + (1-K)^2}$$

Taking square on both Side

$$\left(\sqrt{1+K^2+49-14K}\right)^2 = \left(\sqrt{49+1+K^2-2K}\right)^2$$

$$K^2 - 14K + 50 = 50 + K^2 - 2K$$

$$\cancel{K^2} - 14K \cancel{+50} \cancel{-50} \cancel{-K^2} + 2K = 0$$

$$-12K = 0$$

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

$$K = 0$$

Q.6 Use distance formula to verify that the points $A(0,7), B(3,-5), C(-2,15)$ are Collinear.

Solution:

$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$

$$|AB| = \sqrt{|3-0|^2 + |-5-7|^2}$$

$$|AB| = \sqrt{(3)^2 + (-12)^2}$$

$$|AB| = \sqrt{9+144}$$

$$|AB| = \sqrt{153}$$

$$|AB| = \sqrt{9 \times 17}$$

$$|AB| = 3\sqrt{17}$$

$$|BC| = \sqrt{|-2-3|^2 + |15-(-5)|^2}$$

$$|BC| = \sqrt{(-5)^2 + (15+5)^2}$$

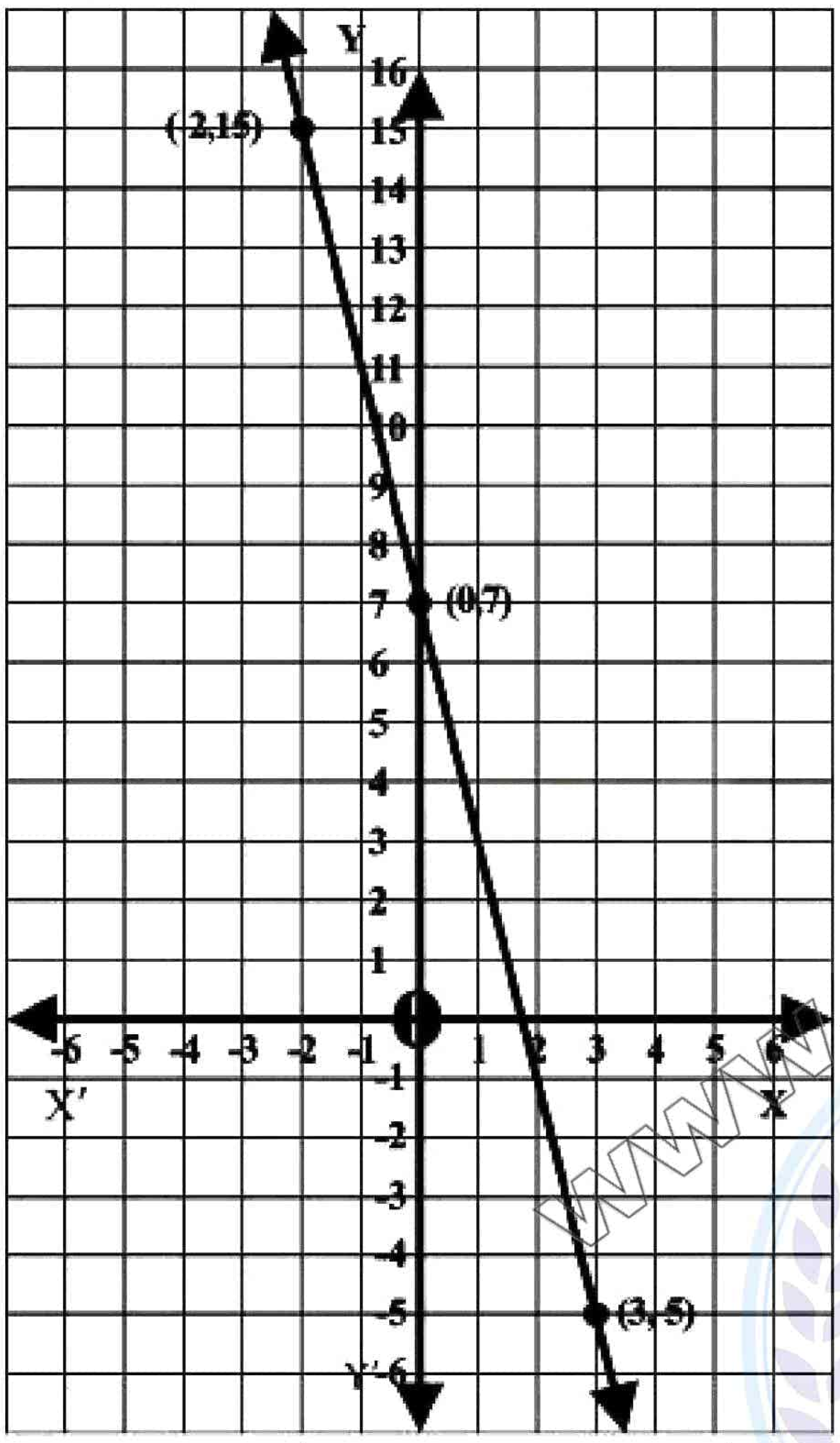
$$|BC| = \sqrt{25 + (20)^2}$$

$$|BC| = \sqrt{25 + 400}$$

$$|BC| = \sqrt{425}$$

$$|BC| = \sqrt{25 \times 17}$$

$$|BC| = 5\sqrt{17}$$



$$|AC| = \sqrt{|-2-0|^2 + |15-7|^2}$$

$$|AC| = \sqrt{(-2)^2 + (8)^2}$$

$$|AC| = \sqrt{4 + 64}$$

$$|AC| = \sqrt{68}$$

$$|AC| = \sqrt{4 \times 17}$$

$$|AC| = 2\sqrt{17}$$

$$|AB| + |AC| = |BC|$$

$$3\sqrt{17} + 2\sqrt{17} = 5\sqrt{17}$$

$$5\sqrt{17} = 5\sqrt{17}$$

L.H.S = R.H.S So

They lie on same line and they are collinear.

Q.7 Verify whether or not the points $O(0,0)$ $A(\sqrt{3},1), B(\sqrt{3},-1)$ are the vertices of an equilateral triangle

Solution:

$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$

$$|OA| = \sqrt{|\sqrt{3} - 0|^2 + |0 - 1|^2}$$

$$|OA| = \sqrt{(\sqrt{3})^2 + (-1)^2}$$

$$|OA| = \sqrt{3 + 1}$$

$$|OA| = \sqrt{4}$$

$$|OA| = 2$$

$$|OB| = \sqrt{|\sqrt{3} - 0|^2 + |-1 - 0|^2}$$

$$|OB| = \sqrt{(\sqrt{3})^2 + (-1)^2}$$

$$|OB| = \sqrt{3 + 1}$$

$$|OB| = \sqrt{4}$$

$$|OB| = 2$$

$$|AB| = \sqrt{|\sqrt{3} - \sqrt{3}|^2 + |-1 - 1|^2}$$

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

$$|AB| = \sqrt{4}$$

$$|AB| = 2$$

All the sides are same in length so it is equilateral triangle

Q.8 Show that the points $A(-6,-5), B(5,-5), C(5,-8)$ and $D(-6,-8)$ are the vertices of a rectangle find the length of its diagonals are equal

Solution:

$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$

$$A(-6,-5), B(5,-5)$$

$|AB| = 3\sqrt{17}$

$|BC| = \sqrt{|-2-3|^2 + |15-(-5)|^2}$

$|BC| = \sqrt{(-5)^2 + (15+5)^2}$

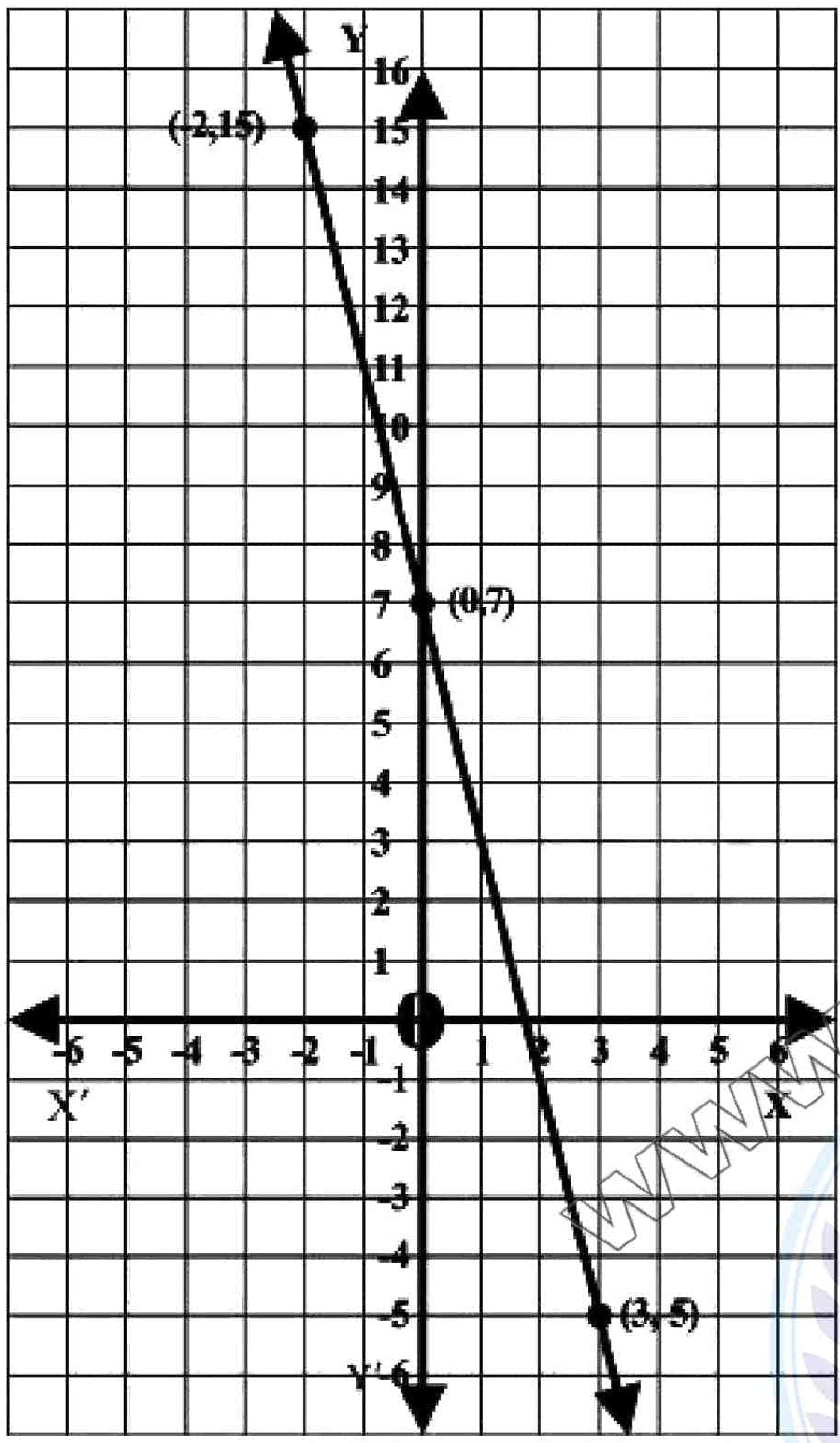
$|BC| = \sqrt{25 + (20)^2}$

$|BC| = \sqrt{25+400}$

$|BC| = \sqrt{425}$

$|BC| = \sqrt{25 \times 17}$

$|BC| = 5\sqrt{17}$



$|AC| = \sqrt{|-2-0|^2 + |15-7|^2}$

$|AC| = \sqrt{(-2)^2 + (8)^2}$

$|AC| = \sqrt{4+64}$

$|AC| = \sqrt{68}$

$|AC| = \sqrt{4 \times 17}$

$|AC| = 2\sqrt{17}$

$|AB| + |AC| = |BC|$

$3\sqrt{17} + 2\sqrt{17} = 5\sqrt{17}$

$5\sqrt{17} = 5\sqrt{17}$

L.H.S = R.H.S So

They lie on same line and they are collinear.

Q.7 Verify whether or not the points $O(0,0)$ $A(\sqrt{3},1), B(\sqrt{3},-1)$ are the vertices of an equilateral triangle

Solution:

$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$

$|OA| = \sqrt{|\sqrt{3}-0|^2 + |0-1|^2}$

$|OA| = \sqrt{(\sqrt{3})^2 + (-1)^2}$

$|OA| = \sqrt{3+1}$

$|OA| = \sqrt{4}$

$|OA| = 2$

$|OB| = \sqrt{|\sqrt{3}-0|^2 + |-1-0|^2}$

$|OB| = \sqrt{(\sqrt{3})^2 + (-1)^2}$

$|OB| = \sqrt{3+1}$

$|OB| = \sqrt{4}$

$|OB| = 2$

$|AB| = \sqrt{|\sqrt{3}-\sqrt{3}|^2 + |-1-1|^2}$

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

$|AB| = \sqrt{4}$

$|AB| = 2$

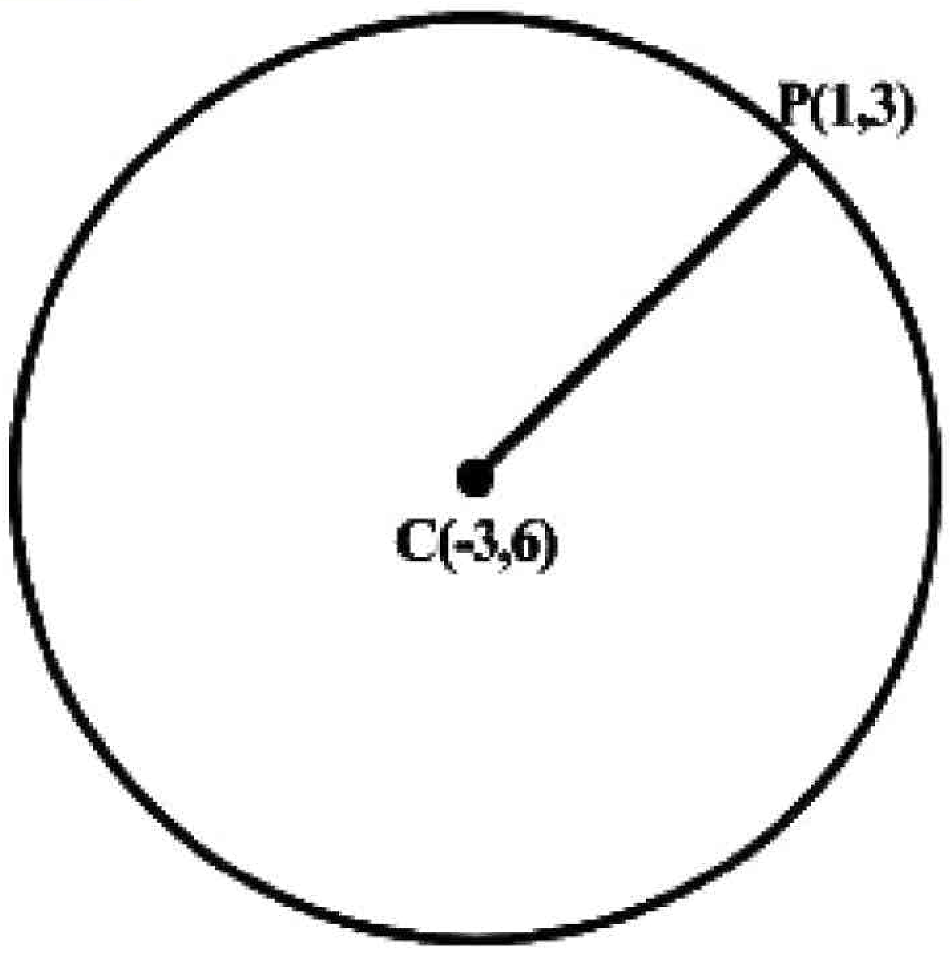
All the sides are same in length so it is equilateral triangle

Q.8 Show that the points $A(-6,-5), B(5,-5), C(5,-8)$ and $D(-6,-8)$ are the vertices of a rectangle find the length of its diagonals are equal

Solution:

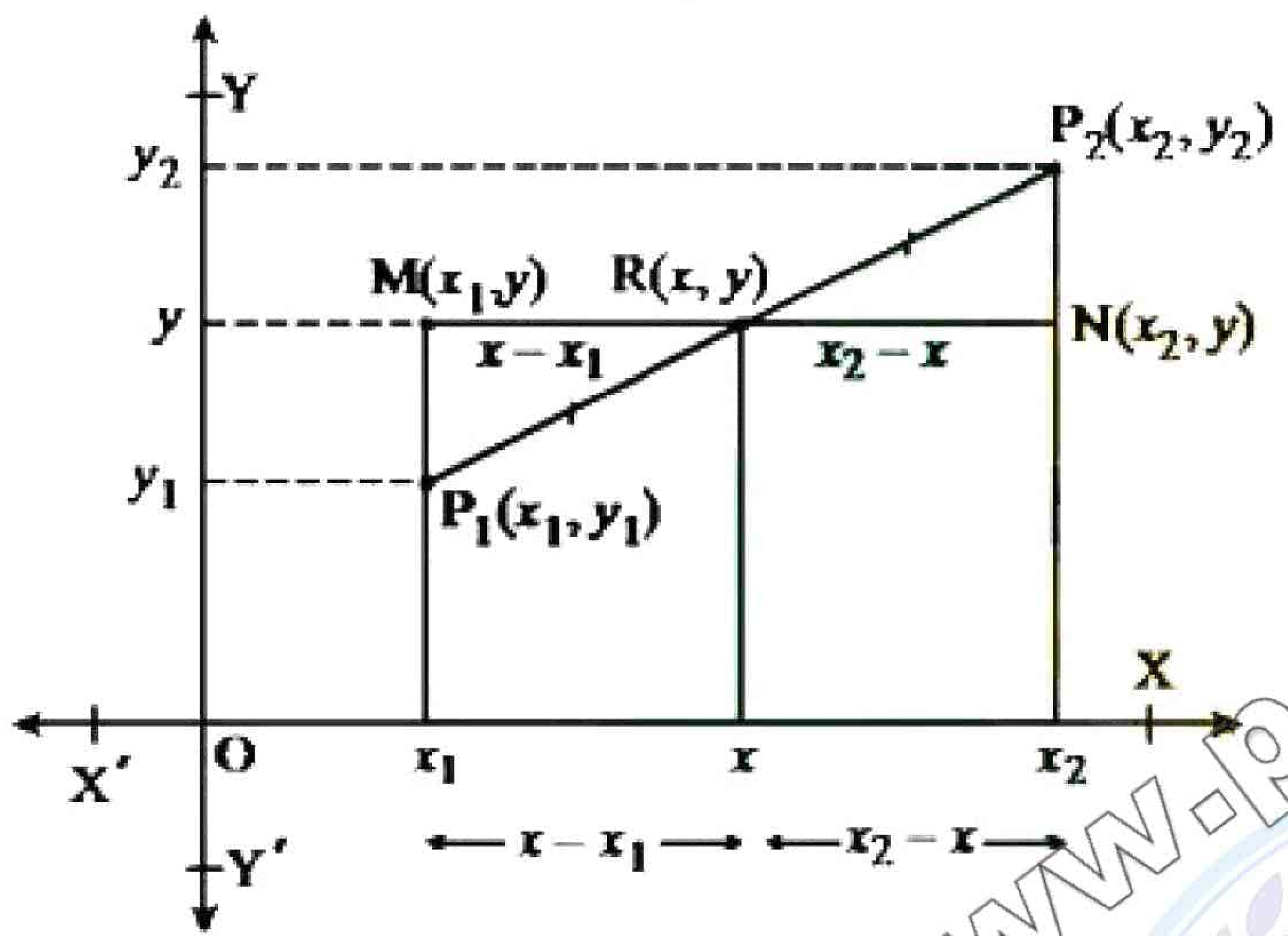
$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$

$A(-6,-5), B(5,-5)$



Recognition of the midpoint formula for any two points in the plane

Let $P_1(x, y)$ and $P_2(x_2, y_2)$ be any two points in the plane and $R(x, y)$ be midpoint of point P_1 and P_2 on the line segment P_1P_2 as shown in the figure.



If the line segment MN, parallel to *x-axis* has its midpoint $R(x, y)$,

then, $x_2 - x = x - x_1$

$$x_2 + x_1 = x + x$$

$$2x = x_1 + x_2 \Rightarrow x = \frac{x_1 + x_2}{2}$$

Similarly, $y = \frac{y_1 + y_2}{2}$

Thus the point R (x, y)

$= R\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$ is the midpoint of the points $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$

Verification of the midpoint formula

$$|P_1R| = \sqrt{\left(\frac{x_1 + x_2}{2} - x_1\right)^2 + \left(\frac{y_1 + y_2}{2} - y_1\right)^2}$$

$$|P_1R| = \sqrt{\left(\frac{x_1 + x_2 - 2x_1}{2}\right)^2 + \left(\frac{y_1 + y_2 - 2y_1}{2}\right)^2}$$

$$|P_1R| = \sqrt{\left(\frac{x_2 - x_1}{2}\right)^2 + \left(\frac{y_2 - y_1}{2}\right)^2}$$

$$|P_1R| = \sqrt{\frac{(x_2 - x_1)^2}{4} + \frac{(y_2 - y_1)^2}{4}}$$

$$|P_1R| = \sqrt{\frac{(x_2 - x_1)^2 + (y_2 - y_1)^2}{4}}$$

$$|P_1R| = \frac{\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}}{2}$$

OR

$$|P_1R| = \frac{1}{2}\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \frac{1}{2}|P_1P_2|$$

and $|P_2R| = \sqrt{\left(\frac{x_1 + x_2}{2} - x_2\right)^2 + \left(\frac{y_1 + y_2}{2} - y_2\right)^2}$

$$|P_2R| = \sqrt{\left(\frac{x_1 + x_2 + 2x_2}{2}\right)^2 + \left(\frac{y_1 + y_2 - 2y_2}{2}\right)^2}$$

$$|P_2R| = \sqrt{\left(\frac{x_1 - x_2}{2}\right)^2 + \left(\frac{y_1 - y_2}{2}\right)^2}$$

$$|P_2R| = \sqrt{\frac{(x_1 - x_2)^2}{4} + \frac{(y_1 - y_2)^2}{4}}$$

$$|P_2R| = \sqrt{\frac{(x_1 - x_2)^2 + (y_1 - y_2)^2}{4}}$$

$$|P_2R| = \frac{\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}}{2}$$

OR

$$|P_2R| = \frac{1}{2}\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

$$\Rightarrow |P_2R| = |P_1R| = \frac{1}{2}|P_1R_2|$$

Thus it verifies that

$R\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$ is the midpoint of the line segment P_1RP_2 which lies on the line segment since $|P_1R| + |P_2R| = |P_1P_2|$

Exercise 9.3

Q.1 Find the midpoint of the line Segments joining each of the following pairs of points

Solution:

(a) $A(9,2), B(7,2)$

Let $M(x,y)$ the midpoint of AB

$$(x,y)=\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$$

Midpoint formula

$$M(x,y)=M\left(\frac{9+7}{2},\frac{2+2}{2}\right)$$

$$=M\left(\frac{16}{2},\frac{4}{2}\right)$$

$$=M(8,2)$$

(b) $A(2,-6), B(3,-6)$

Let $M(x,y)$ the point of AB

$$(x,y)=\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$$

Midpoint formula

$$M(x,y)=M\left(\frac{2+3}{2},\frac{-6-6}{2}\right)$$

$$M(x,y)=M\left(\frac{5}{2},\frac{-12}{2}\right)$$

$$M(x,y)=M(2.5,-6)$$

(c) $A(-8,1), B(6,1)$

Let $M(x,y)$ midpoint of AB

$$(x,y)=\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$$

Formula

$$M(x,y)=M\left(\frac{-8+6}{2},\frac{1+1}{2}\right)$$

$$M(x,y)=M\left(\frac{-2}{2},\frac{2}{2}\right)$$

$$M(x,y)=M(-1,1)$$

(d) A (-4 , 9) , B (-4 , -3)

Let $M(x,y)$ midpoint of AB

$$(x,y)=\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right) \text{ Formula}$$

$$M(x,y)=M\left(\frac{-4-4}{2},\frac{9-3}{2}\right)$$

$$M(x,y)=M\left(\frac{-8}{2},\frac{6}{2}\right)$$

$$M(x,y)=M(-4,3)$$

(e) $A(3,11), B(3,-4)$

Let $M(x,y)$ is the midpoint of AB

$$M(x,y)=\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$$

$$M(x,y)=M\left(\frac{3+3}{2},\frac{-11-4}{2}\right)$$

$$M(x,y)=M\left(\frac{6}{2},\frac{-15}{2}\right)$$

$$M(x,y)=M(3,-7.5)$$

(f) A (0, 0) , B (0, -5)

Let $M(x,y)$ is the midpoint of AB

$$(x,y)=\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$$

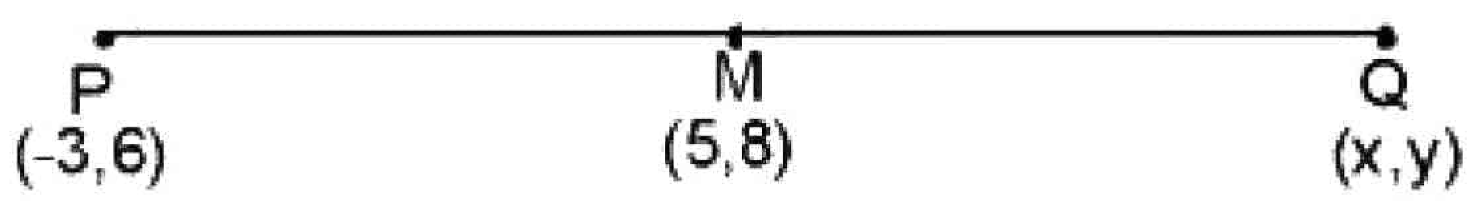
$$M(x,y)=M\left(\frac{0+0}{2},\frac{0-5}{2}\right)$$

$$M(x,y)=M\left(\frac{0}{2},\frac{-5}{2}\right)$$

$$=M(0,-2.5)$$

Q.2 The end point of line segment PQ is $(-3,6)$ and its midpoint is $(5,8)$ find the coordinates of the end point Q

Solution:



Let Q be the point (x,y), $M(5,8)$ is the midpoint of PQ

$$M(x,y)=\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$$

$$x=\frac{x_1+x_2}{2}$$
$$5=\frac{-3+x}{2}$$
$$5\times 2=-3+x$$
$$10+3=x$$
$$x=13$$
$$y=\frac{y_1+y_2}{2}$$
$$8=\frac{6+y}{2}$$
$$2\times 8=6+y$$
$$16-6=y$$
$$y=10$$
Hence point Q is $(13,10)$

Q.3 Prove that midpoint of the hypotenuse of a right triangle is equidistance from it three vertices $P(-2,5), Q(1,3)$ and $R(-1,0)$

Solution:

$$(x,y)=\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$$
$$d=\sqrt{|x_2-x_1|^2+|y_2-y_1|^2}$$
$P(-2,5), Q(1,3)$
$$|PQ|=\sqrt{|-2-1|^2+|5-3|^2}$$
$$|PQ|=\sqrt{(-3)^2+(2)^2}$$
$$|PQ|=\sqrt{9+4}$$
$$|PQ|=\sqrt{13}$$
$Q(1,3), R(-1,0)$
$$|QR|=\sqrt{|1-(-1)|^2+|3-0|^2}$$
$$|QR|=\sqrt{(1+1)^2+(3)^2}$$
$$|QR|=\sqrt{(2)^2+9}=\sqrt{4+9}$$
$$|QR|=\sqrt{13}$$
$P(-2,5), R(-1,0)$
$$|PR|=\sqrt{|-2-(-1)|^2+|5-0|^2}$$
$$|PR|=\sqrt{|-2+1|^2+|5|^2}$$
$$|PR|=\sqrt{(-1)^2+(5)^2}=\sqrt{1+25}$$
$$|PR|=\sqrt{26}$$

To find the length of hypotenuse and whether it is right angle triangle we use the Pythagoras theorem

$$(PR)^2=(PQ)^2+(QR)^2$$
$$\left(\sqrt{26}\right)^2=\left(\sqrt{13}\right)^2+\left(\sqrt{13}\right)^2$$
$$26 = 13 + 13$$
$$26 = 26$$
It is a right angle triangle and PR is hypotenuse

$P(-2,5), R(-1,0)$

Midpoint of PR
$$M(x,y)=\left(\frac{-2-1}{2},\frac{5+0}{2}\right)$$
$$M(x,y)=\left(\frac{-3}{2},\frac{5}{2}\right)$$
$MP=MR$

$M\left(\frac{-3}{2},\frac{5}{2}\right), P(-2,5), R(-1,0)$
$$|MP|=|MR|$$

(i)
$$|MP|=\sqrt{\left|\frac{-3}{2}-(-2)\right|^2+\left|\frac{5}{2}-5\right|^2}$$
$$=\sqrt{\left(\frac{-3}{2}+2\right)^2+\left(\frac{5-10}{2}\right)^2}$$
$$|MP|=\sqrt{\left(\frac{-3+4}{2}\right)^2+\left(\frac{-5}{2}\right)^2}$$
$$=\sqrt{\left(\frac{1}{2}\right)^2+\frac{25}{4}}$$
$$|MP|=\sqrt{\frac{1}{4}+\frac{25}{4}}=\sqrt{\frac{1+25}{4}}$$
$$|MP|=\sqrt{\frac{26}{4}}$$
$$|MP|=\frac{\sqrt{26}}{2}$$

(ii) $M\left(\frac{-3}{2},\frac{5}{2}\right), R(-1,0)$
$$|MR|=\sqrt{\left|\frac{-3}{2}-(-1)\right|^2+\left|\frac{5}{2}-0\right|^2}$$

$$|MR| = \sqrt{\left(\frac{-3}{2}+1\right)^2 + \left(\frac{5}{2}\right)^2}$$

$$|MR| = \sqrt{\left(\frac{-3+2}{2}\right)^2 + \frac{25}{4}}$$

$$= \sqrt{\left(\frac{-1}{2}\right)^2 + \frac{25}{4}}$$

$$|MR| = \sqrt{\frac{1}{4} + \frac{25}{4}}$$

$$|MR| = \sqrt{\frac{1+25}{4}} = \sqrt{\frac{26}{4}}$$

$$|MR| = \frac{\sqrt{26}}{2}$$

(iii) $M\left(\frac{-3}{2}, \frac{5}{2}\right)$

$Q(1,3)$

$$|MQ| = \sqrt{\left(\frac{-3}{2}-1\right)^2 + \left(\frac{5}{2}-3\right)^2}$$

$$= \sqrt{\left(\frac{-3-2}{2}\right)^2 + \left(\frac{5-6}{2}\right)^2}$$

$$= \sqrt{\left(\frac{-5}{2}\right)^2 + \left(\frac{-1}{2}\right)^2}$$

$$= \sqrt{\frac{25}{4} + \frac{1}{4}} = \sqrt{\frac{26}{4}}$$

Hence proved $MP = MR = |MQ|$

Q.4 If $O(0,0)$, A$(3,0)$ and $B(3,5)$ are three points in the plane find M_1 and M_2 as the midpoint of the line segments AB and OB respectively find $|M_1M_2|$

Solution:

M_1 is the midpoint of AB

$$M_1(x,y) = M_1\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

$A(3,0), B(3,5)$

$$M_1\left(\frac{3+3}{2}, \frac{0+5}{2}\right)$$

$$M_1\left(\frac{6}{2}, \frac{5}{2}\right)$$

$$M_1\left(3, \frac{5}{2}\right)$$

M_2 is the midpoint of OB

$$M_2\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

$O(0,0), B(3,5)$

$$M_2\left(\frac{0+3}{2}, \frac{0+5}{2}\right)$$

$$M_2\left(\frac{3}{2}, \frac{5}{2}\right)$$

$$M_1\left(3, \frac{5}{2}\right) M_2\left(\frac{3}{2}, \frac{5}{2}\right)$$

$$|M_1M_2| = \sqrt{\left|\frac{3}{2}-3\right|^2 + \left|\frac{5}{2}-\frac{5}{2}\right|^2}$$

$$|M_1M_2| = \sqrt{\left(\frac{3-6}{2}\right)^2 + (0)^2}$$

$$= \sqrt{\left(\frac{-3}{2}\right)^2 + 0}$$

$$|M_1M_2| = \sqrt{\frac{9}{4}}$$

$$|M_1M_2| = \frac{3}{2}$$

Q.5 Show that the diagonals of the parallelogram having vertices $A(1,2), B(4,2), C(-1,-3)$ and $D(-4,-3)$ bisect each other.

Solution:

$ABCD$ is parallelogram which vertices are

$A(1,2), B(4,2), C(-1,-3) D(-4,-3)$

Let $\overline{BD}$ and $\overline{AC}$ the diagonals of parallelogram they intersect at point M

$A(1,2), C(-1,-3)$ midpoint of AC

Midpoint formula

$$M_1(x,y) = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

$$M_1(x,y)=M_1\left(\frac{1-1}{2},\frac{2-3}{2}\right)$$

$$M_1(x,y)=M_1\left(\frac{0}{2},\frac{-1}{2}\right)=\left(0,\frac{-1}{2}\right)$$

Midpoint of BD,

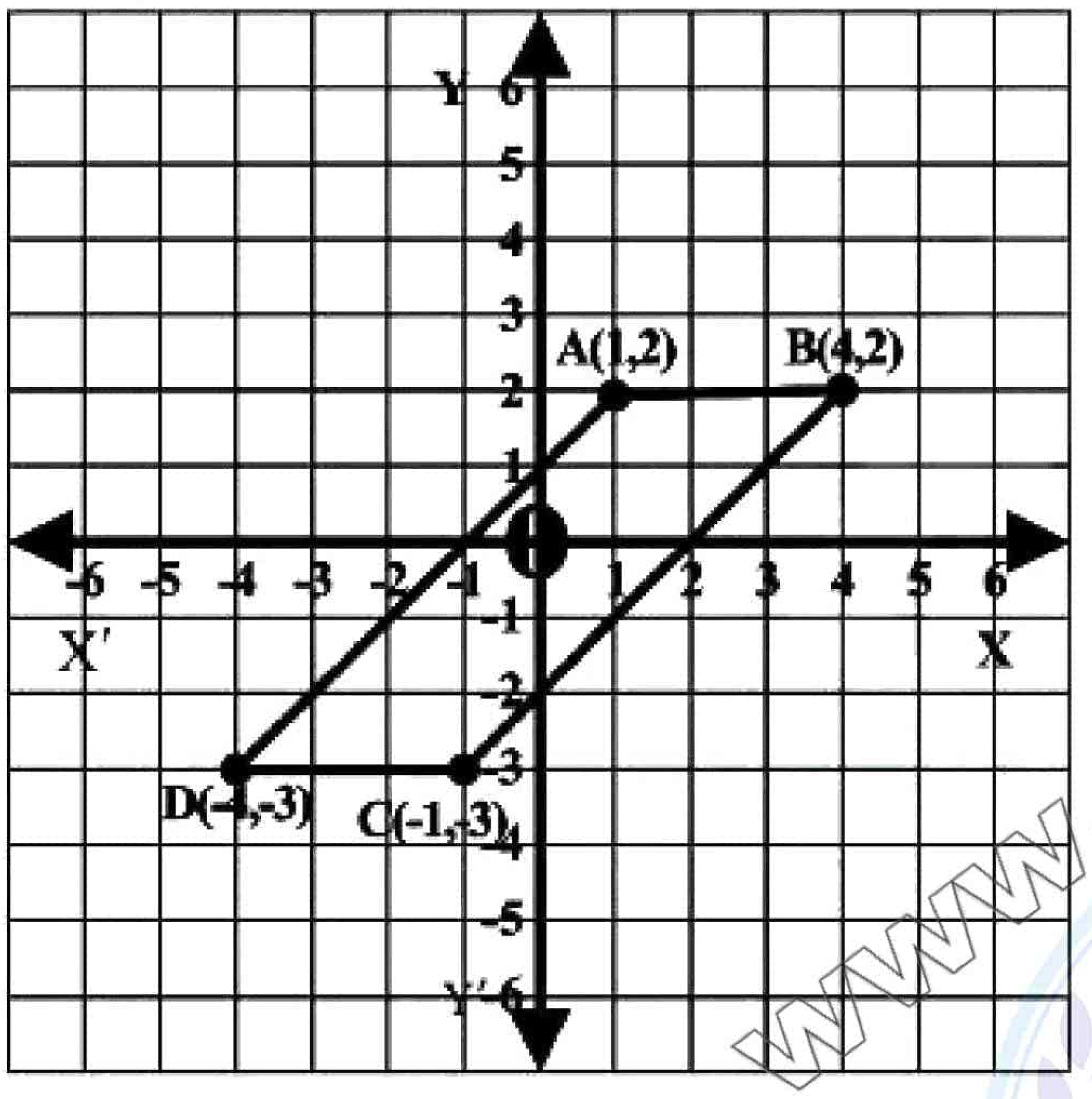
$$M_2(x,y)=M_2\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$$

$$M_2(x,\ y)=M_2\left(\frac{4-4}{2},\frac{2-3}{2}\right)$$

$$M_2(x,y)=M_2\left(\frac{0}{2},\frac{-1}{2}\right)$$

$$M_2(x,y)=M_2\left(0,\frac{-1}{2}\right)$$

As M_1 and M_2 Coincide the diagonals of the parallelogram bisect each other.



Q.6 The vertices of a triangle are $P(4,6), Q(-2,-4)$ and $R(-8,2)$. Show that the length of the line segment joining the midpoints of the line segments $\overline{PR}, \overline{QR}$ is $\frac{1}{2}\overline{PQ}$

Solution:

M_1 the midpoint of QR is

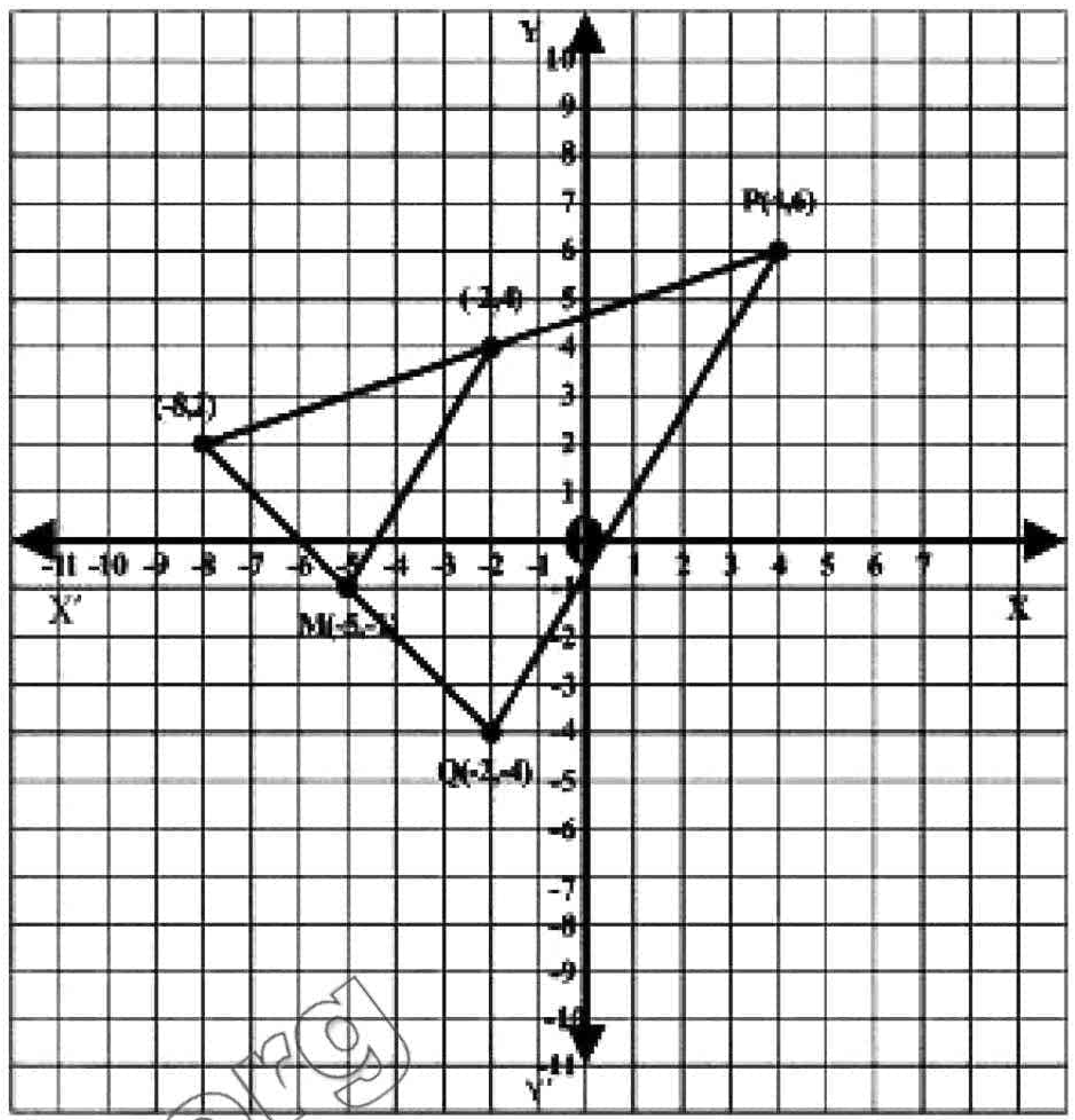
$Q(-2,-4), R(-8,2)$

$$M_1(x,y)=M_1\left(\frac{-2-8}{2},\frac{-4+2}{2}\right)$$

$$=M_1\left(\frac{-10}{2},\frac{-2}{2}\right)$$

$$=M_1(-5,-1)$$

$$M_1(-5,-1)$$



M_2 the midpoint of PR is

$P(4,6), Q(-8,+2)$

$$M_2(x,y)=M\left(\frac{4-8}{2},\frac{6+2}{2}\right)$$

$$M_2(x,y)=M_2\left(\frac{-4}{2},\frac{8}{2}\right)$$

$$M_2(x,y)=M_2(-2,4)$$

$$M_2(-2,4)$$

$$|M_1M_2|=\sqrt{|-5+2|^2+|4+1|^2}$$

$$|M_1M_2|=\sqrt{(-3)^2+(5)^2}$$

$$|M_1M_2|=\sqrt{9+25}$$

$$|M_1M_2|=\sqrt{34}$$

$$|P\ Q|=\sqrt{|4+2|^2+|6+4|^2}$$

$$|P\ Q|=\sqrt{(6)^2+(10)^2}=\sqrt{36+100}$$

$$|P\ Q|=\sqrt{136}$$

$$|PQ| = \sqrt{4 \times 34}$$

$$|PQ| = 2\sqrt{34}$$

$$\frac{|PQ|}{2} = \sqrt{34}$$

OR

$$\frac{1}{2}|PQ| = \sqrt{34}$$

Hence we proved that

$$|M_1M_2| = \frac{1}{2}|PQ|$$

Review Exercise 9

Q.1 Choose the Correct answer

(i) Distance between point (0 , 0) and (1, 1) is

(a) 0 **(b)** 1

(c) 2 **(d)** $\sqrt{2}$

(ii) Distance between the point (1 , 0) and (0 ,1) is

(a) 0 **(b)** 1

(c) $\sqrt{2}$ **(d)** 2

(iii) Midpoint of the (2, 2) and (0, 0) is

(a) (1, 1) **(b)** (1, 0)

(c) (0, 1) **(d)** (-1, -1)

(iv) Midpoint of the points (2, -2) and (-2 , 2) is

(a) (2, 2) **(b)** (-2, -2)

(c) (0 , 0) **(d)** (1, 1)

(v) A triangle having all sides equal is called

(a) Isosceles **(b)** Scalene

(c) Equilateral **(d)** None of these

(vi) A triangle having all sides different is called

(a) Isosceles **(b)** Scalene

(c) Equilateral **(d)** None of these

ANSWER KEYS

i	ii	iii	iv	v	vi
d	c	a	c	c	b

Q.2 Answer the following which is true and which is false

(i) A line has two end points (False)

(ii) A line segment has one end point (False)

(iii) A triangle is formed by the three collinear points (False)

(iv) Each side of triangle has two collinear vertices. (True)

(v) The end points of each side of a rectangle are Collinear (True)

(vi) All the points that lie on the x-axis are Collinear (True)

(vii) Origin is the only point Collinear with the points of both axis separately (True)

Q.3 Find the distance between the following pairs of points

Solution:

(i) $(6,3)(3,-3)$

$A(6,3), B(3,-3)$

$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$

$|AB| = \sqrt{|3-6|^2 + |-3-3|^2}$

$|AB| = \sqrt{(-3)^2 + (-6)^2}$

$|AB| = \sqrt{9+36}$

$|AB| = \sqrt{45}$

$|AB| = \sqrt{9\times 5}$

$|AB| = 3\sqrt{5}$

(ii) $(7,5),(1,-1)$

$A(7,5), B(1,-1)$

$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$

$|AB| = \sqrt{|7-1|^2 + |5-(-1)|^2}$

$|AB| = \sqrt{(6)^2 + (5+1)^2}$

$|AB| = \sqrt{36+(6)^2} = \sqrt{36+36}$

$|AB| = \sqrt{72} = \sqrt{36\times 2}$

$|AB| = 6\sqrt{2}$

(iii) $(0,0),(-4,-3)$

$A(0,0), B(-4,-3)$

$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$

$|AB| = \sqrt{|0-4|^2 + |0-(-3)|^2}$

$|AB| = \sqrt{(-4)^2 + (3)^2}$

$|AB| = \sqrt{16+9}$

$|AB| = \sqrt{25}$

$|AB| = 5$

Q.4 Find the midpoint between following pairs of points

Solution:

(i) $(6,6),(4,-2)$

$M(x,y) = M\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

$M(x,y) = M\left(\frac{6+4}{2}, \frac{6-2}{2}\right)$

$M(x,y) = M\left(\frac{10}{2}, \frac{4}{2}\right)$

$M(x,y) = M(5,2)$

(ii) $(-5,-7),(-7,-5)$

$M(x,y) = M\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

$M(x,y) = M\left(\frac{-5-7}{2}, \frac{-7-5}{2}\right)$

$M(x,y) = M\left(\frac{-12}{2}, \frac{-12}{2}\right)$

$M(x,y) = M(-6,-6)$

(iii) $(8,0),(0,-12)$

$M(x,y) = M\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

$M(x,y) = M\left(\frac{8+0}{2}, \frac{0-12}{2}\right)$

$M(x,y) = M\left(\frac{8}{2}, \frac{-12}{2}\right)$

$M(x,y) = M(4,-6)$

Q.5 Define the following

Solution:

(i) Co-ordinate Geometry:-

Co-ordinate geometry is the study of geometrical shapes in the Cartesian plane (or coordinate plane)

(ii) Collinear:-

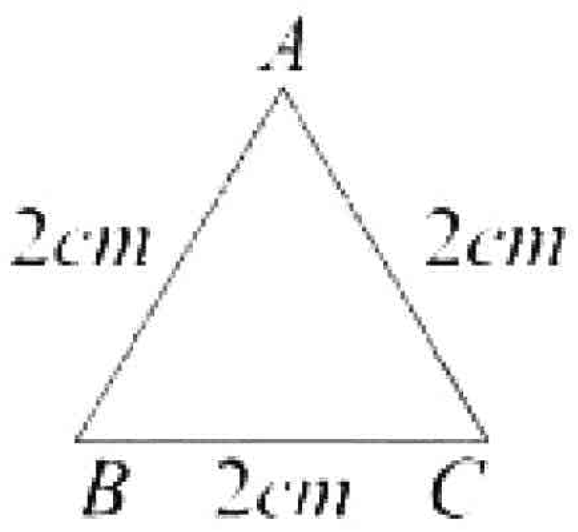
Two or more than two points which lie on the same straight line are called collinear points with respect to that line.

(iii) Non- Collinear:-

The points which do not lie on the same straight line are called non-collinear.

(iv) Equilateral Triangle:-

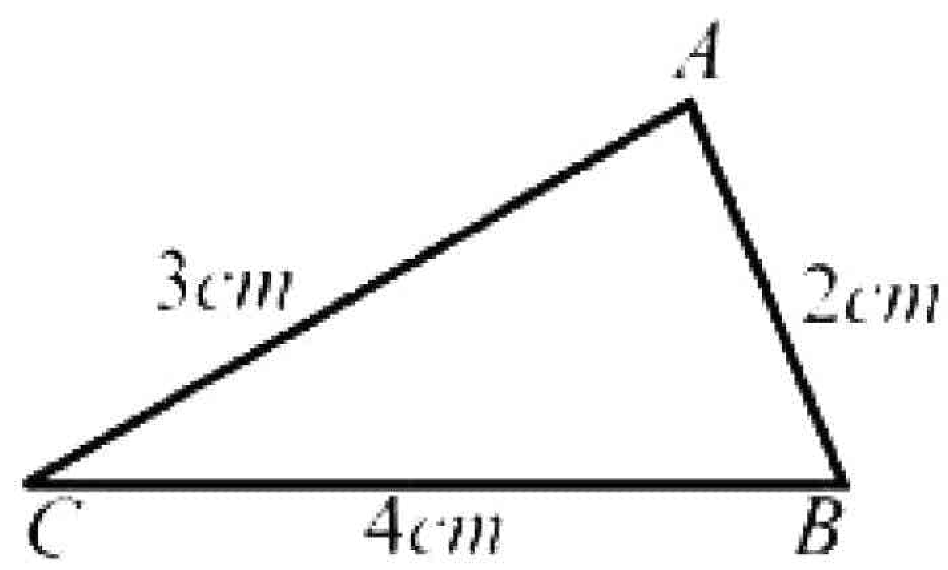
If the length of all three sides of a triangle are same then the triangle is called an equilateral triangle.



ΔABC is an equilateral triangle.

(v) Scalene Triangle:-

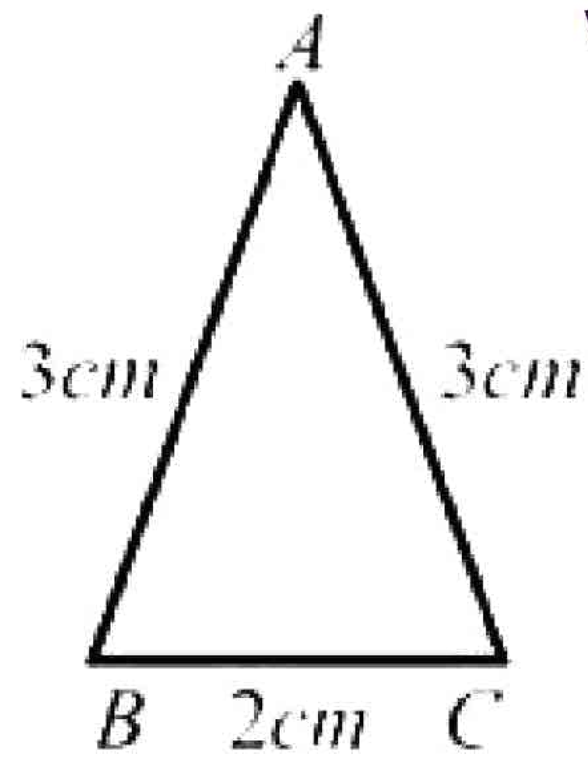
A triangle is called a scalene triangle if measure of all sides are different.



ΔABC is a Scalene triangle.

(vi) Isosceles Triangle:-

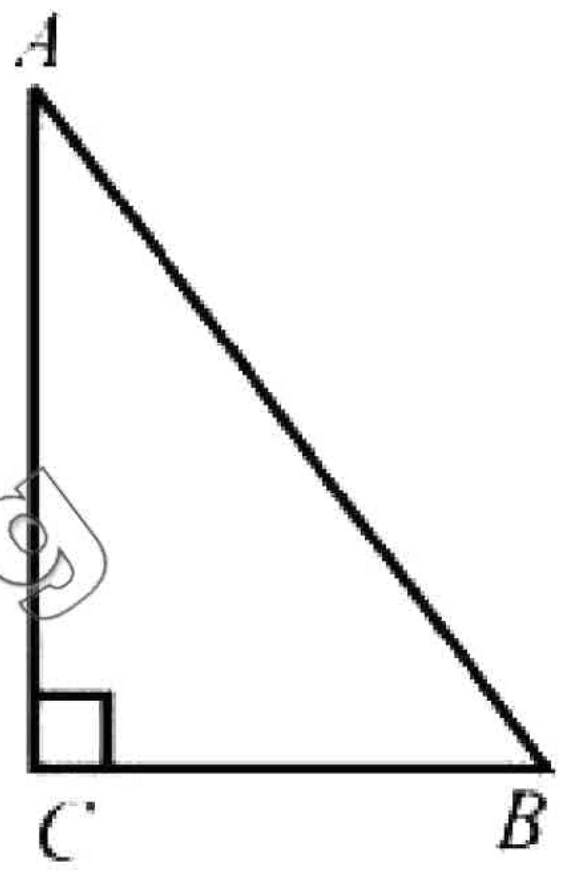
An isosceles triangles is a triangle which has two of its sides with equal length while the third side has different length.



ΔABC is an isosceles triangle

(vii) Right Triangle:-

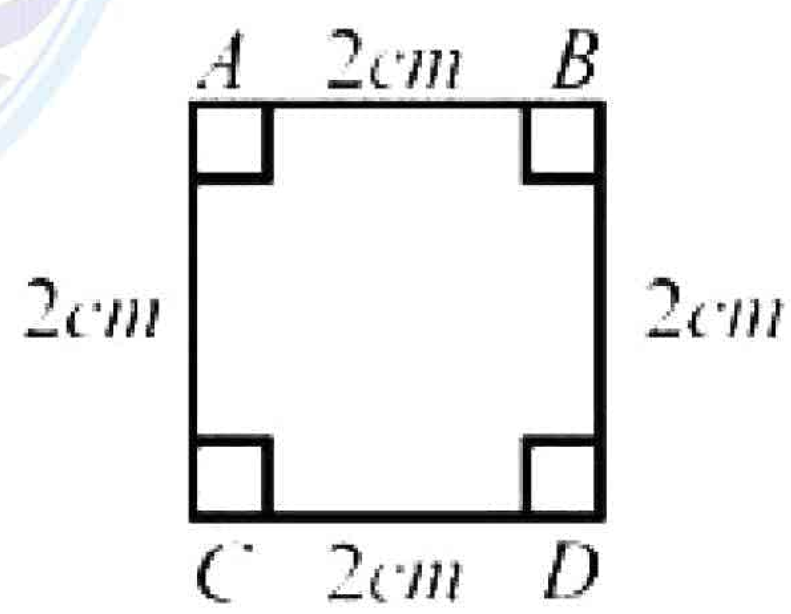
A triangle in which one of the angles has measure equal to 90° is called a right triangle.



ΔABC is a right angled triangle.

(viii) Square:-

A Square is closed figure formed by four non- collinear points such that lengths of all sides are equal and measure of each angles is 90°.



$ABCD$ is a square.

Unit 9: Introduction to Coordinate Geometry

Overview

Coordinate Geometry:

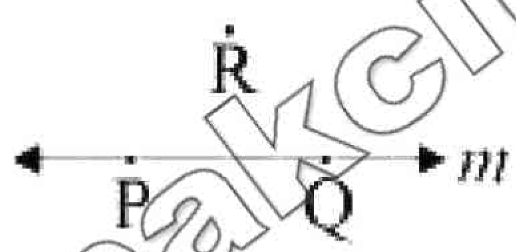
The study of geometrical shapes in a plane is called plane geometry. Coordinate geometry is the study of geometrical shapes in the Cartesian plane (coordinate plane).

Collinear Points:

Two or more than two points which lie on the same straight line are called collinear points with respect to that line.

Non-collinear points:

Tow or more points which does not lie on the same straight line are called non-collinear points.



Equilateral Triangle:

If the lengths of all the three sides of a triangle are same, then the triangle is called an equilateral triangle.

An Isosceles Triangle:

An isosceles triangle PQR is a triangle which has two of its sides with equal length while the third side has a different length.

Right Angle Triangle

A triangle in which one of the angles has measure equal to 90° is called a right angle triangle.

Scalene Triangle:-

A triangle is called a scalene triangle if measure of all sides are different.

Square:-

A Square is closed figure formed by four non- collinear points such that lengths of all sides are equal and measure of each angles is 90°.

Rectangle

A figure formed in the plane by four non-collinear points is called a rectangle if,

(i) Its opposite sides are equal in length

(ii) The angle at each vertex is of measure 90°

Parallelogram

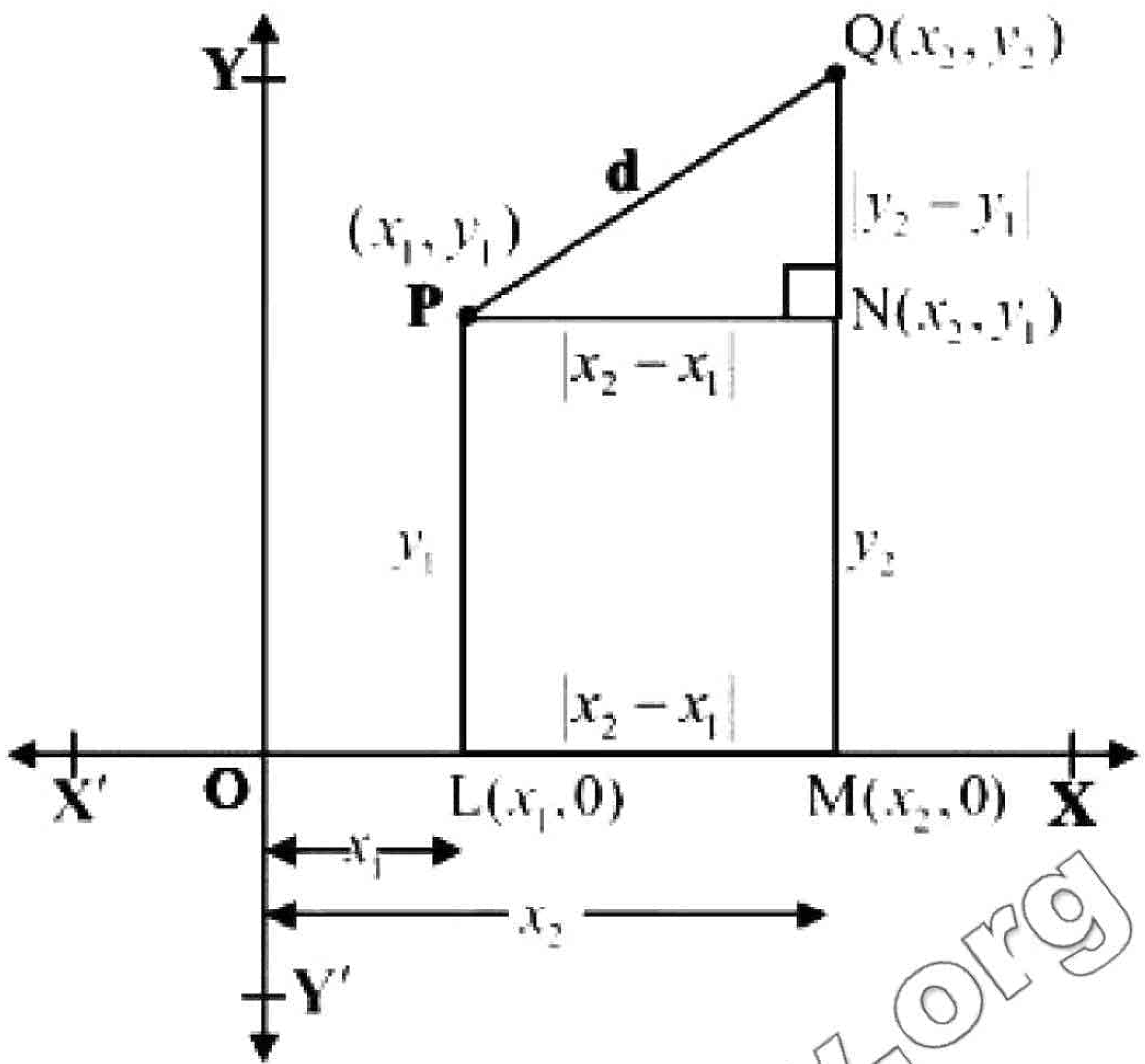
A figure formed by four non-collinear points in the plane is called a parallelogram if

(i) Its opposite sides are of equal length

(ii) Its opposite sides are parallel

(iii) Meausre of none of the angles is 90°.

Finding distance between two points.



Let $P(x_1, y_1)$ and $Q(x_2, y_2)$ be two points in the coordinate plane where d is the length of the line segment PQ i,e, $|\overline{PQ}| = d$

The line segments MQ and LP parallel to y-axis meet x-axis at point M and L respectively with coordinates M(x_2 , o) and L (x_1 , o)

The line segment PN is parallel to x-axis

In the right triangle PNQ $|\overline{NQ}| = |y_2 - y_1|$ and $|\overline{PN}| = |x_2 - x_1|$

Using Pythagoras theorem

$$(\overline{PQ})^2 = (\overline{PN})^2 + (\overline{QN})^2$$

$$d^2 = |x_2 - x_1|^2 + |y_2 - y_1|^2$$

Taking under root on both side

$$\sqrt{d^2} = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$

$$d = \sqrt{|x_2 - x_1|^2 + |y_2 - y_1|^2}$$

Since d > 0 always