Class: 9
Subject: Maths

Chapter # 9
Coordinate Geometry

Exercise 9.1

1/ Find the distance b/w the following pairs of points

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

Distance formula is

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

$$d = \sqrt{(9-7)^2+(2-2)^2}$$

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

$$= \sqrt{4+0} = \sqrt{4}$$

$$\boxed{d = 2}$$

1/(b) A (2, -6), B (3, -6)

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

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

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

$$= \sqrt{1+0}$$

$$= \sqrt{1}$$

$$\boxed{d = 1}$$

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

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

$$= \sqrt{(-8-6)^2+(1-1)^2}$$

$$= \sqrt{(-14)^2+0} = \sqrt{196+0}$$

$$= \sqrt{196}$$

$$\boxed{d = 14}$$

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

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

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

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

$$d = \sqrt{(\sqrt{2}+3)^2} = \boxed{\sqrt{2}+3}$$

1/(e) A (3, -11), B (3, -4)

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

$$= \sqrt{(3-3)^2+(-11+4)^2}$$

$$= \sqrt{(0)^2+(-7)^2}$$

$$= \sqrt{0+49}$$

$$= \sqrt{49}$$

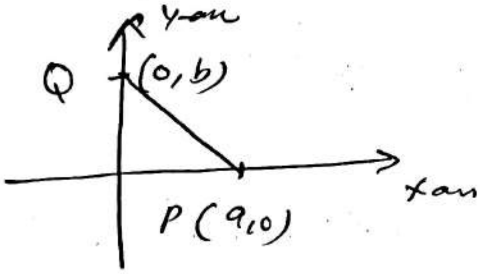
$$\boxed{d = 7}$$

Exercise 9.1

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

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

2 Let $P(a,0)$ and $Q(0,b)$



$\therefore$ (i) $P(a,0) = P(9,0)$
$Q(0,b) = Q(0,7)$

$$\therefore d = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$$
$$= \sqrt{(9-0)^2 + (0-7)^2}$$
$$= \sqrt{81+49}$$
$$d = \sqrt{130}$$

2 (ii) $P(a,0) = P(2,0)$
$Q(0,b) = Q(0,3)$

$\therefore$ distance from P to Q is

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

(iii) $P(a,0) = P(-8,0)$
$Q(0,b) = Q(0,6)$

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

(iv) $P(a,0) = P(-2,0)$
$Q(0,b) = Q(0,-3)$

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

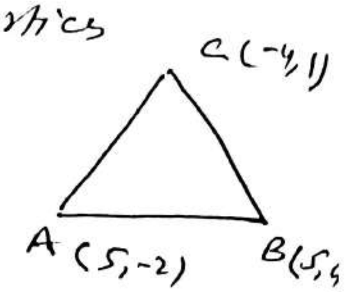
Q2 (v)

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

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

1/ Show that whether the points with vertices $(5,-2)$ $(5,4)$ and $(-4,1)$ are vertices of an Equilateral triangle or an isosceles triangle?

Sol Let $A(5,-2)$, $B(5,4)$ $C(-4,1)$ are three vertices



$$|AB| = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$$
$$= \sqrt{(5-5)^2 + (-2-4)^2}$$
$$= \sqrt{0 + (-6)^2}$$
$$= \sqrt{0+36} = \sqrt{36}$$
$$|AB| = 6 \quad \text{——— (1)}$$
$$|BC| = \sqrt{(5+4)^2 + (4-1)^2}$$
$$= \sqrt{(9)^2 + (3)^2}$$
$$= \sqrt{81+9}$$
$$= \sqrt{90} = \sqrt{9 \times 10}$$
$$|BC| = \sqrt{9} \times \sqrt{10} = \boxed{3\sqrt{10}}$$
$$|BC| = 3\sqrt{10} \quad \text{——— (2)}$$

Exercise 9.2

1/ Remaining Points

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

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

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

$= \sqrt{81+9}$

$= \sqrt{90} = \sqrt{9\times 10}$

$|CA| = 3\sqrt{10}$ —— (3)

$\therefore$ The Δ is an isosceles Δ because 2 sides are Equal i.e $|BC| = |CA|$

2/ Show whether or not the Points of Square with vertices $A(-1,1)$ $B(5,4)$, $C(2,-2)$ and $D(-4,1)$

Sol

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

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

$= \sqrt{6^2+3^2}$

$= \sqrt{36+9}$

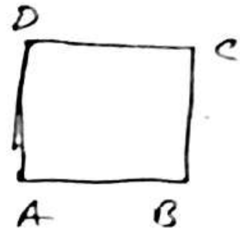
$|AB| = \sqrt{45}$ —— (1)

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

$= \sqrt{3^2+6^2}$

$= \sqrt{9+36}$

$|BC| = \sqrt{45}$ — (2)



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

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

$= \sqrt{36+9}$

$|CD| = \sqrt{45}$ —— (3)

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

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

$= \sqrt{9+0} = \sqrt{9}$

$|DA| = 3$ —— (4)

$\therefore$ from (1), (2), (3) and (4) We can say that the given Points do not form a Square.

Exercise 9.2

3/ Show whether or not the Points with Coordinates (1,3), (4,2) and (−2,6) are vertices of a right angled triangle.

Sol Let $A(1,3)$; $B(4,2)$ and $C(-2,6)$ are vertices of a triangle.

$|AB| = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$
$= \sqrt{(4-1)^2 + (2-3)^2}$
$= \sqrt{(3)^2 + (-1)^2}$
$= \sqrt{9+1}$
$= \sqrt{10}$ ——— (1)

$|BC| = \sqrt{(4+2)^2 + (2-6)^2}$
$= \sqrt{(6)^2 + (4)^2}$
$= \sqrt{36+16}$
$= \sqrt{52}$ ——— (2)

$|CA| = \sqrt{(-2-1)^2 + (6-3)^2}$
$= \sqrt{(-3)^2 + (3)^2}$
$= \sqrt{9+9}$
$= \sqrt{18}$ ——— (3)

Now use Pythagoras Theorem to check right angled Δ.

$|BC|^2 = |AB|^2 + |CA|^2$
$(\sqrt{52})^2 = (\sqrt{10})^2 + (\sqrt{18})^2$
$52 = 10 + 18$
$52 \neq 28$

$\therefore$ The given Points are not the vertices of right angled triangle.

4/ Use distance formula to Prove whether or not the Points $A(1,1)$, $B(-2,-8)$ and $C(4,10)$ lie on a St. line.

Sol: $|AB| = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$
$= \sqrt{(-2-1)^2 + (-8-1)^2}$
$= \sqrt{(-3)^2 + (-9)^2}$
$= \sqrt{9+81} = \sqrt{90}$
$= \sqrt{9\times 10} = \boxed{3\sqrt{10}}$ — (1)

$|BC| = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$
$= \sqrt{(4+2)^2 + (10+8)^2}$
$= \sqrt{6^2 + 18^2}$
$= \sqrt{36+324} = \sqrt{360}$
$= \sqrt{36\times 10} = \boxed{6\sqrt{10}}$ — (2)

Q4 Remaing.

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

$= \sqrt{(4-1)^2+(10-1)^2}$

$= \sqrt{3^2+9^2}$

$= \sqrt{9+81} = \sqrt{90}$

$= \sqrt{9\times 10}$

$= 3\sqrt{10}$ —— (3)

From (1), (2) and (3)
we can say that Paints
A, B, C are the Collinear
Paints because.

$|BC| = |AB| + |CA|$

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

$6\sqrt{10} = 6\sqrt{10}$ (Proved.)

Q5/ Find K, given that the
given pants (2, K) is
Equidistant from (3, 7) and
(9, 1)

Sol. Let A (2, k)
B (3, 7) C (9, 1)
are the Pants

$|AB| = |AC|$

$|AB| = \sqrt{(3-2)^2+(7-k)^2}$

$= \sqrt{(1)^2+49+k^2-14k}$

$= \sqrt{1+49+k^2-14k}$

$= \sqrt{50+k^2-14k}$ —— (1)

$|AC| = \sqrt{(9-2)^2+(1-k)^2}$

$= \sqrt{7^2+1+k^2-2k}$

$= \sqrt{50+k^2-2k}$ —— (2)

$\therefore$ $|AC| = |AB|$

$\left(\sqrt{50+k^2-2k}\right)^2 = \left(\sqrt{50+k^2-14k}\right)^2$

by taking Square on both sides

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

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

$12k = 0$

$k = 0/12$

$\boxed{k=0}$

Q6 Use distance formula to verify that the points A(0, 7), B(3, −5), C(−2, 15) are Collinear

Sol: Now find |AB|, |BC| and |CA|

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

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

$= \sqrt{9 + 144}$

$= \sqrt{153}$ —— ①

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

$= \sqrt{(-5)^2 + (20)^2}$

$= \sqrt{25 + 400}$

$= \sqrt{425}$ —— ②

$|CA| = \sqrt{(-2-0)^2 + (15-7)^2}$

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

$= \sqrt{4 + 64} = \sqrt{68}$ —— ③

From ①, ② and ③ we have

$|BC| = |AB| + |CA|$

$\sqrt{425} = \sqrt{153} + \sqrt{68}$

$\sqrt{17 \times 25} = \sqrt{17 \times 9} + \sqrt{17 \times 4}$

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

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

Hence Proved that A, B, and C are the collinear points.

Q7 verify whether or not the points O(0, 0), A($\sqrt{3}$, 1), B($\sqrt{3}$, −1) are the vertices of an Equilateral triangle.

Sol

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

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

$= \sqrt{3 + 1} = \sqrt{4}$

$|OA| = 2$ —— ①

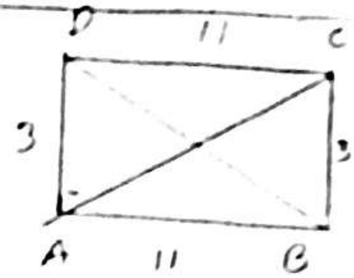
Q7 (Remaining Part)

$$|AB| = \sqrt{(\sqrt{3}-\sqrt{3})^2 + (1+1)^2}$$
$$= \sqrt{0^2 + 2^2}$$
$$= \sqrt{2^2} = 2 \quad \text{—— (2)}$$

$$|BO| = \sqrt{(\sqrt{3}-0)^2 + (-1-0)^2}$$
$$= \sqrt{(\sqrt{3})^2 + (-1)^2}$$
$$= \sqrt{3+1} = \sqrt{4}$$
$$|BO| = 2 \quad \text{—— (3)}$$

From Eq (1), (2) and (3) we have proved that O, A and B are the points of Equilateral Δ.

Q8 Show that the points A(−6,−5), B(5,−5), C(5,−8) and D(−6,−8) are vertices of a rectangle. Find the lengths of its diagonal. Are they Equal?



$$|AB| = \sqrt{(5+6)^2 + (-5+5)^2}$$
$$= \sqrt{(11)^2 + (0)^2}$$
$$= \sqrt{11^2} = \boxed{11} \quad \text{—— (1)}$$

$$|BC| = \sqrt{(5-5)^2 + (-8+5)^2}$$
$$= \sqrt{(0)^2 + (-3)^2}$$
$$= \sqrt{0+9} = \sqrt{9}$$
$$= \boxed{3} \quad \text{—— (2)}$$

$$|CD| = \sqrt{(5+6)^2 + (-8+8)^2}$$
$$= \sqrt{(11)^2 + (0)^2} = \sqrt{11^2}$$
$$= \boxed{11} \quad \text{—— (3)}$$

$$|DA| = \sqrt{(-6+6)^2 + (-8+5)^2}$$
$$= \sqrt{0^2 + (-3)^2}$$
$$= \sqrt{0+9} = \sqrt{9}$$
$$= \boxed{3} \quad \text{—— (4)}$$

From Eq (1), (2), (3) and (4) we have proved that points A, B, C and D are the vertices of a rectangle.

Now find the lengths of diagonal

$$|AC| = \sqrt{(5+6)^2 + (-8+5)^2}$$
$$= \sqrt{(11)^2 + (-3)^2}$$
$$= \sqrt{121 + 9}$$
$$|AC| = \sqrt{130} \quad \text{—— (1)}$$

$$|BD| = \sqrt{(-6-5)^2 + (-8+5)^2}$$
$$= \sqrt{(-11)^2 + (-3)^2}$$
$$= \sqrt{121 + 9}$$
$$= \sqrt{130} \quad \text{—— (2)}$$

Eq (1) and (2) shows that lengths of diagonals are equal.

9/ Show that the points $M(-1, 4)$, $N(-5, 3)$, $P(1, -3)$ and $Q(5, -2)$ are the vertices of a parallelogram.

Sol:

$$|MN| = \sqrt{(-5+1)^2 + (3-4)^2}$$
$$= \sqrt{(-4)^2 + (-1)^2}$$
$$= \sqrt{16+1} = \sqrt{17} \quad \text{—— (1)}$$

$$|NP| = \sqrt{(1+5)^2 + (-3-3)^2}$$
$$= \sqrt{6^2 + (-6)^2}$$
$$= \sqrt{36 + 36} = \sqrt{72}$$
$$|NP| = \boxed{\sqrt{72}} \quad \text{—— (2)}$$

$$|PQ| = \sqrt{(5-1)^2 + (-2+3)^2}$$
$$= \sqrt{(4)^2 + (1)^2}$$
$$= \sqrt{16+1} = \boxed{\sqrt{17}} \quad \text{—— (3)}$$

$$|QM| = \sqrt{(5+1)^2 + (-2-4)^2}$$
$$= \sqrt{(6)^2 + (-6)^2}$$
$$= \sqrt{36+36} = \boxed{\sqrt{72}} \quad \text{—— (4)}$$

∴ From Eq (1), (2), (3) and (4) we know that

$|MN| = |PQ| = \sqrt{17}$ →

and $|NP| = |QM| = \sqrt{72}$ →

i.e opposite sides of quadrilateral are equal.

Now find

$$|MP| = \sqrt{(1+1)^2 + (-3-4)^2}$$
$$= \sqrt{(2)^2 + (-7)^2}$$
$$= \sqrt{4+49} = (\sqrt{53}) \quad \text{—— (5)}$$

$$\therefore (MN)^2 + (NP)^2 \neq (MP)^2$$

9/ Remaining Part.

$(\sqrt{17})^2 + (\sqrt{72})^2 \neq (\sqrt{53})^2$

$17 + 72 \neq 53$

$89 \neq 53$

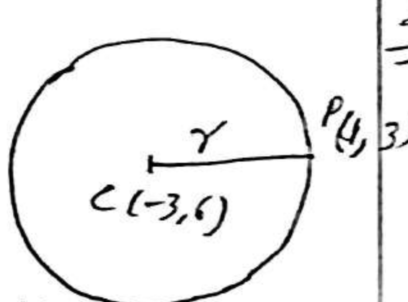
$\therefore$ $m\angle MNP$ is not a right angle.

So given points are the points vertices of Parallelogram.

10/ Find the length of the diameter of a circle having centre at $C(-3, 6)$ and passing through $P(1, 3)$

Sol

$|CP| = r$



First find radius $|CP|$

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

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

$= \sqrt{16 + 9}$

$= \sqrt{25} = 5$

because Diameter $= 2r$

$\therefore$ Diameter $= 2 \times 5$

$= 10$ unit

Exercise 9.3

Formula of Mid Point is

$$\text{Mid Point} = \left(\frac{x_2 + x_1}{2}, \frac{y_2 + y_1}{2}\right)$$

1/ Find the mid point of the line segment joining each of the following pairs of points

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

Mid point of AB is $= \left(\frac{9+7}{2}, \frac{2+2}{2}\right)$

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

$= (8, 2)$

Exercise 9.3

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

$$\text{Mid Point} = \left(\frac{2+3}{2}, \frac{-6-6}{2}\right)$$
$$= \left(\frac{5}{2}, \frac{-12}{2}\right)$$
$$= \left(\frac{5}{2}, -6\right)$$

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

$$\text{Mid Point} = \left(\frac{-8+6}{2}, \frac{1+1}{2}\right)$$
$$= \left(\frac{-2}{2}, \frac{2}{2}\right)$$
$$= (-1, 1)$$

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

$$\text{Mid Point} = \left(\frac{-4-4}{2}, \frac{9-3}{2}\right)$$
$$= \left(\frac{-8}{2}, \frac{6}{2}\right)$$
$$= (-4, 3)$$

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

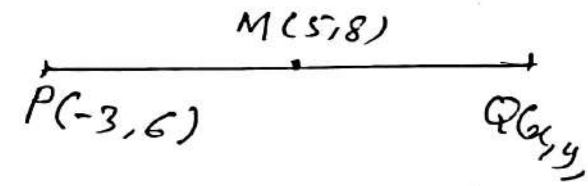
$$\text{Mid Point} = \left(\frac{3+3}{2}, \frac{-11-4}{2}\right)$$
$$= \left(\frac{6}{2}, \frac{-15}{2}\right)$$
$$= (3, -7.5)$$

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

$$\text{Mid Point} = \left(\frac{0+0}{2}, \frac{0-5}{2}\right)$$
$$= \left(\frac{0}{2}, \frac{-5}{2}\right)$$
$$= (0, -2.5)$$

Q2 The end Point P of a line segment PQ is $(-3,6)$, and its Mid Point is $(5,8)$. find the coordinate of the end Point Q.

Sol:



$\because$ $$\text{Mid Point} = \left(\frac{x_1+x_2}{2}, \frac{y_2+y_1}{2}\right)$$
$$(5,8) = \left(\frac{-3+x}{2}, \frac{6+y}{2}\right)$$

By comparing we have.

$\frac{-3+x}{2} = \frac{5}{1}$	$\frac{6+y}{2} = \frac{8}{1}$
$-3+x = 10$	$6+y = 16$
$x = 10+3$	$y = 16-6$
$\boxed{x = 13}$	$\boxed{y = 10}$

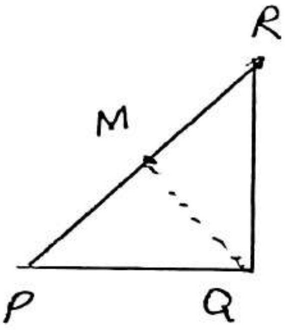
$\therefore$ Point Q is $(13, 10)$

Exercise 9.3

Q3 Prove That mid Point of the hypotenuse of right triangle is Equidistant from three vertices $P(-2,5)$ $Q(1,3)$ and $R(-1,0)$

Sol.

First find the Hyp of Δ



$$|PQ| = \sqrt{(1+2)^2+(3-5)^2}$$
$$= \sqrt{3^2+(-2)^2}$$
$$= \sqrt{9+4} = \sqrt{13} \quad (1)$$

$$|QR| = \sqrt{(1+1)^2+(3-0)^2}$$
$$= \sqrt{2^2+3^2}$$
$$= \sqrt{4+9} = \sqrt{13} \quad (2)$$

$$|PR| = \sqrt{(-1+2)^2+(0-5)^2}$$
$$= \sqrt{(1)^2+(-5)^2}$$
$$= \sqrt{1^2+25} = \sqrt{1+25}$$
$$|PR| = \sqrt{26} \quad (3)$$

$\therefore$ PR is the Hyp because the largest side is called (hyp)

Now find the Mid Point of PR.

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

$$\text{Mid point} = \left(\frac{-2-1}{2}, \frac{5+0}{2}\right)$$

$$\text{Mid Point} = M\left(-\frac{3}{2}, \frac{5}{2}\right)$$

Now we will find lengths $|MR|$, $|MP|$ and $|MQ|$

$$|MR| = \sqrt{\left(-1+\frac{3}{2}\right)^2+\left(0-\frac{5}{2}\right)^2}$$
$$= \sqrt{\left(\frac{1}{2}\right)^2+\left(-\frac{5}{2}\right)^2}$$
$$= \sqrt{\frac{1}{4}+\frac{25}{4}}$$
$$= \sqrt{\frac{26}{4}} = \sqrt{\frac{13}{2}} \quad (4)$$

$$|MQ| = \sqrt{\left(1+\frac{3}{2}\right)^2+\left(3-\frac{5}{2}\right)^2}$$
$$= \sqrt{\left(\frac{5}{2}\right)^2+\left(\frac{1}{2}\right)^2}$$
$$= \sqrt{\frac{25}{4}+\frac{1}{4}} = \sqrt{\frac{26}{4}} = \sqrt{\frac{13}{2}} \quad (5)$$

$$|MP| = \sqrt{\left(-2+\frac{3}{2}\right)^2+\left(5-\frac{5}{2}\right)^2}$$
$$= \sqrt{\left(-\frac{1}{2}\right)^2+\left(\frac{5}{2}\right)^2}$$
$$= \sqrt{\frac{1}{4}+\frac{25}{4}}$$
$$= \sqrt{\frac{26}{4}} = \sqrt{\frac{13}{2}} \quad (6)$$

Q3 Remaining Part

So from (4), (5) and (6) we have proved that Mid Point is Equidistant from three vertices P, Q and R

4/ If $O(0,0)$, $A(3,0)$, $B(3,5)$ are three Points in the Plane, find M_1 and M_2 as Mid Points of the line segment AB and OB respectively. Find $|M_1 M_2|$

Sol.

M_1 = Mid Point of AB

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

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

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

M_2 = Mid Point of OB

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

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

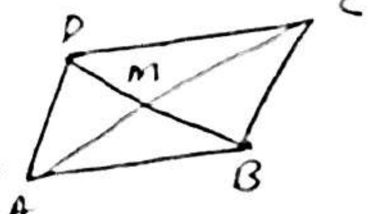
$$\therefore |M_1 M_2| = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$$

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

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

$$= \sqrt{\left(\frac{3}{2}\right)^2} = \boxed{\frac{3}{2}}$$

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.



Sol: First find the mid Point of AC

$$\therefore \text{Mid Point of } AC = \left(\frac{1-1}{2}, \frac{2-3}{2}\right)$$

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

$$= \left(0, -\frac{1}{2}\right) \quad (1)$$

$$\text{Mid Point of } BD = \left(\frac{-4+4}{2}, \frac{-3+2}{2}\right)$$

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

$$= \left(0, -\frac{1}{2}\right) \quad (2)$$

$\therefore$ Diagonals bisect each other from (1) and (2)

Q6 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 mid points of the line segment PR, QR is $\frac{1}{2}PQ$.

Sol: mid point of PR is M_1

$$= M_1\left(\frac{4-8}{2}, \frac{6+2}{2}\right)$$

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

$$= M_1(-2, 4) \quad -(1)$$

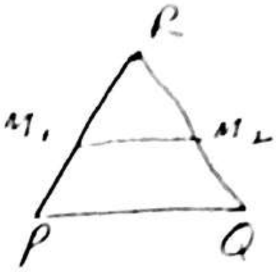
mid point of QR is M_2

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

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

$$= M_2(-5, -1) \quad -(2)$$

Now find the lengths of M_1M_2 and PQ we have.



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

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

$$= \sqrt{9+25} = \sqrt{34} \quad -(3)$$

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

$$= \sqrt{(6)^2 + (10)^2}$$

$$= \sqrt{36+100} = \sqrt{136}$$

$$= \sqrt{4 \times 34} = 2\sqrt{34} \quad -(4)$$

∴ from Eq (3) and (4) we have proved that

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

$$\sqrt{34} = \frac{1}{2} \times 2\sqrt{34}$$

$$\sqrt{34} = \sqrt{34}$$

3/ Find the distance b/w the following pairs of points

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

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

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

$= \sqrt{3^2+6^2}$

$= \sqrt{9+36} = \boxed{\sqrt{45}}$

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

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

$= \sqrt{6^2+6^2} = \sqrt{36+36}$

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

$d = \boxed{6\sqrt{2}}$

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

$d = \sqrt{(0+4)^2+(0+3)^2}$

$d = \sqrt{4^2+3^2}$

$= \sqrt{16+9}$

$= \sqrt{25}$

$\boxed{d = 5}$

4/ Find the Mid Point b/w following pairs of points

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

Mid Point $= \left(\frac{x_1+x_2}{2} ; \frac{y_1+y_2}{2}\right)$

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

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

$= (5, 2)$

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

Mid Point $= \left(\frac{-5-7}{2} ; \frac{-7-5}{2}\right)$

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

$= (-6, -6)$

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

Mid Point $= \left(\frac{8+0}{2} ; \frac{0-12}{2}\right)$

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

$= (4, -6)$