Co-ordinate Geometry

Practice Set 5.1

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

(1) A(2, 3), B(4, 1)
(2) P(-5, 7), Q(-1, 3)
(3) R(0, -3), S(0, 5/2)
(4) L(5, -8), M(-7, -3)
(5) T(-3, 6), R(9, -10)
(6) $W\left(\frac{-7}{2}, 4\right)$**, X(11, 4)**

Answer : The distance between points A(x_1, y_1) and B(x_2, y_2) is given by,

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

1. **Given Points:** A(2, 3) and B(4, 1)
We can see that, $x_1 = 2$
$x_2 = 4$
$y_1 = 3$
$y_2 = 1$
Putting the values in the distance formula we get, d = $\sqrt{\{(2-4)^2 + (3-1)^2\}}$

⇒ d = $\sqrt[2]{4 + 4}$

⇒ d = √8

2. **Given Points:** P(-5, 7) and Q(-1, 3)
we can see that, $x_1 = -5$
$x_2 = -1$
$y_1 = 7$
$y_2 = 3$
Putting these values in distance formula we get,

d = $\sqrt[2]{\left(-5-(-1)\right)^2 + (7-3)^2}$

d = √32

3. Given Points: R(0, -3), S(0, 5/2)
we can see that,x_1 = 0
x_2 = 0
y_1 = -3
y_2 = 5/2

On putting these values in distance formula we get,

d = $\sqrt[2]{(0-0)^2 + \left(-3-\frac{5}{2}\right)^2}$

d = $\sqrt{\left(-\frac{11}{2}\right)^2}$

d = $\sqrt{\frac{121}{4}}$

4. Given Points: L(5, -8), M(-7, -3)
we can see that,
x_1 = 5
x_2 = -7
y_1 = -8
y_2 = -3

On putting these values in distance formula we get,

d = $\sqrt[2]{\left(5-(-7)\right)^2 + \left(-8-(-3)\right)^2}$

d = $\sqrt[2]{144 + 25}$

d = $\sqrt{169}$ = 13

5. Given Points: T(-3, 6), R(9, -10)
we can see that,
x_1 = -3
x_2 = 9
y_1 = 6
y_2 = -10

On putting these values in distance formula we get,

d = $\sqrt[2]{(-3-9)^2 + \left(6-(-10)\right)^2}$

d = $\sqrt[2]{144 + 256}$

d = 20

6. Given Points: W($-\frac{7}{2}, 4$), X(11, 4)
we can see that,
x_1 = -7/2
x_2 = 11
y_1 = 4
y_2 = 4

On putting these values in distance formula we get,

d = $\sqrt[2]{\left(-\frac{7}{2}-11\right)^2 + (4-4)^2}$

d = $\sqrt[2]{\left(-\frac{29}{2}\right)^2 + 0}$

d = $\frac{29}{2}$

Q. 2. Determine whether the points are collinear.

(1) A(1, -3), B(2, -5), C(-4, 7)
(2) L(-2, 3), M(1, -3), N(5, 4)
(3) R(0, 3), D(2, 1), S(3, -1)
(4) P(-2, 3), Q(1, 2), R(4, 1)

Answer : If Three points (a,b), (c,d), (e,f) are collinear then the area formed by the triangle by the three points is zero.

$$\text{Area of a triangle} = \frac{1}{2}|a(d-f) + c(f-b) + e(b-d)| \ldots(1)$$

(a,b) = (1,-3)

(c,d) = (2,-5)

(e,f) = (-4,7)

$$\text{Area} = \frac{1}{2}|1(-5-7) + 2\big(7-(-3)\big) + (-4)\big(-3-(-5)\big)|$$

$$\text{Area} = \frac{1}{2}|-12 + 20 - 8| = 0$$

Hence the points are collinear.

2. (a,b) = (-2,3)

(c,d) = (1,-3)

(e,f) = (5,4)

Area = $\frac{1}{2}|(-2)(-3-4) + 1(4-3) + 5(3-(-3)|$

Area = $\frac{1}{2}|14 + 1 + 30| = \frac{45}{2}$

Hence the points are not collinear.

3. (a,b) = (0,3)

(c,d) = (2,1)

(e,f) = (3,-1)

Area = $\frac{1}{2}|0\big(1-(-1)\big) + 2(-1-3) + 3(3-1)|$

Area = $\frac{1}{2}|0-8 + 6| = -1$

Hence the points are non collinear.

4. (a,b) = (-2,3)

(c,d) = (1,2)

(e,f) = (4,1)

Area = $\frac{1}{2}|(-2)(2-1)\ +\ 1(1-3)\ +\ 4(3-2)|$

Area = $\frac{1}{2}|-2-2\ +\ 4|\ =\ 0$

Q. 3. Find the point on the X-axis which is equidistant from A(-3, 4) and B(1, -4).

Answer : A point in the x = axis is of the form (a,0)

Distance d between two points(a,b) and (c,d)is given by

$$d\ =\ \sqrt[2]{(a-c)^2\ +\ (b-d)^2}$$

Distance between (-3,4) and (a,0) =

D = $\sqrt{(-3-a)^2\ +\ (0-4)^2}$

D $\sqrt{(3\ +\ a)^2\ +\ 16}$

Distance between (1,-4) and (a,0)

D = $\sqrt{(1-a)^2\ +\ \left(0-(-4)\right)^2}$

D = $\sqrt{(1-a)^2\ +\ 16}$

As the two points are equidistant from the point (a.0)

$\sqrt{(1-a)^2\ +\ 16}$ = $\sqrt{(3\ +\ a)^2\ +\ 16}$

Squaring both sides, we get

$(1-a)^2 + 16 = (3 + a)^2 + 16$

$1 + a^2 -2a = 9 + a^2 + 6a$

8a = -8

a = -1

Hence the point is (-1,0)

Q. 4. Verify that points P(-2, 2), Q(2, 2) and R(2, 7) are vertices of a right angled triangle.

Answer : In a right angles triangle ABC, right angled at B, according to the pythagoras theorem

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

According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$d = \sqrt[2]{(a-c)^2 + (b-d)^2}$ .....(1)

For the given points Distance between P and Q is

PQ = $\sqrt{(-2-2)^2 + (2-2)^2} = \sqrt{16}$

QR = $\sqrt{(2-2)^2 + (7-2)^2} = \sqrt{25}$

PR = $\sqrt{(-2-2)^2 + (2-7)^2} = \sqrt{16 + 25} = \sqrt{41}$

$PQ^2 = 16$

$QR^2 = 25$

$PR^2 = 41$

As $PQ^2 + QR^2 = PR^2$

Hence the given points form a right angled triangle.

Q. 5. Show that points P(2, -2), Q(7, 3), R(11, -1) and S (6, -6) are vertices of a parallelogram.

Answer : In a parallelogram, opposite sides are equal and parallel.

According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$d = \sqrt[2]{(a-c)^2 + (b-d)^2}$ .....(1)

For the given points, length PQ = $\sqrt{(2-7)^2 + (-2-3)^2}$

PQ = $\sqrt{50}$

Length QR = $\sqrt{(11-7)^2 + \left(3-(-1)\right)^2}$

QR = $\sqrt{16 + 16}$ = 32

Length RS = $\sqrt{(11-6)^2 + \left(-1-(-6)\right)^2}$

RS = $\sqrt{25 + 25}$ = $\sqrt{50}$

Length SP = $\sqrt{(6-2)^2 + \left(-6-(-2)\right)^2}$

SP = $\sqrt{16 + 16}$ = $\sqrt{32}$

As PQ = RS and QR = SP

Checking for slopes

Slope of a line between two points (a,b) and (c,d) is

$$m = \frac{d-b}{c-a}$$

Slope PQ = $\frac{7-2}{3-(-2)}$ = 1

Slope QR = $\frac{11-7}{-1-3}$ = -1

Slope RS = $\frac{6-11}{-6-(-1)} = 1$

Slope SP = $\frac{6-2}{-6-(-2)} = -1$

As PQ = RS and their slope = 1

And

QR = SP and their slope = -1.

Hence the given points form a parallelogram.

Q. 6. Show that points A(-4, -7), B(-1, 2), C(8, 5) and D(5, -4) are vertices of a rhombus ABCD.

Answer : In a Rhombus the sides are equal and the diagonals bisect each other at 90°

According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$d = \sqrt[2]{(a-c)^2 + (b-d)^2}$ .....(1)

Length AB = $\sqrt{\left(-4-(-1)\right)^2 + (-7-2)^2} = \sqrt{90}$

Length BC = $\sqrt{(-1-8)^2 + (2-5)^2} = \sqrt{90}$

Length CD = $\sqrt{(8-5)^2 + \left(5-(-4)\right)^2} = \sqrt{90}$

Length AD = $\sqrt{(-4-5)^2 + \left(-7-(-4)\right)^2} = \sqrt{90}$

Slope of a line between two points (a,b) and (c,d) is

$$m = \frac{d-b}{c-a}$$

Slope of Diagonal AC = $\frac{-7-5}{-4-8}$ = 1

Slope of diagonal BD = $\frac{-4-2}{5-(-1)}$ = -1

Note: If the Product of slopes of two lines = -1 then they are perpendicular to each other.

As the product of slopes pf two diagonals = -1. Hence they're perpendicular to each other.

Hence The given points form a rhombus.

Q. 7. Find x if distance between points L(x, 7) and M(1, 15) is 10.

Answer : According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$d = \sqrt[2]{(a-c)^2 + (b-d)^2}$ .....(1)

Distance between LM = $\sqrt{(x-1)^2 + (7-15)^2}$ = 10

Squaring both sides, we get

$(x-1)^2 + 64 = 100$

$(x-1)^2 = 36$

x-1 = ±6

Hence x = 7 or -5

Q. 8. Show that the points A(1, 2), B(1, 6), C(1 + 2 √3, 4) are vertices of an equilateral triangle.

Answer : For an equilateral triangle, all its sides are equal.

According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$d = \sqrt[2]{(a-c)^2 + (b-d)^2}$ .....(1)

Length AB = $\sqrt{(1-1)^2 + (6-2)^2} = \sqrt{16} = 4$

Length BC = $\sqrt{\left(1 + 2\sqrt{3} - 1\right)^2 + (4-6)^2} = \sqrt{12 + 4} = 4$

Length AC = $\sqrt{\left(1 + 2\sqrt{3} - 1\right)^2 + (4-2)^2} = \sqrt{12 + 4} = 4$

Hence The given points form an equilateral triangle.

Practice Set 5.2

Q. 1. Find the coordinates of point P if P divides the line segment joining the points A(-1,7) and B(4,-3) in the ratio 2:3.

Answer : A point P(x,y) divides the line formed by points (a,b) and (c,d) in the ratio of m:n, then the coordinates of the point P is given by

$$x = \frac{an + cm}{m + n} \text{ and } y = \frac{bn + dm}{m + n}$$

In the given question $x = \frac{(-1)3 + 4(2)}{2 + 3}$

$$x = \frac{8}{8} = 1$$

$$y = \frac{7(3) + (-3)(2)}{2 + 3}$$

y = 3

Hence the coordinates of the point are (1,3).

Q. 2. In each of the following examples find the co-ordinates of point A which divides segment PQ in the ratio a:b.

(1) P(-3, 7), Q(1, -4), a:b = 2:1
(2) P(-2, -5), Q(4, 3), a:b = 3:4
(3) P(2, 6), Q(-4, 1), a:b = 1:2

Answer : A point P(x,y) divides the line formed by points (a,b) and (c,d) in the ratio of m:n, then the coordinates of the point P is given by

$$x = \frac{an + cm}{m + n} \text{ and } y = \frac{bn + dm}{m + n}$$

Where m and n is defined as the ratio in which the line segments are divided

1. $x = \frac{(-3)(1)+7(2)}{2+1}$

$x = \frac{11}{3}$

$y = \frac{(1)7+(-4)2}{2+1}$

$y = \frac{-1}{3}$

2. $x = \frac{(-2)4+(4)3}{4+3}$

$X = \frac{4}{7}$

$y = \frac{(-5)4+(3)3}{4+3}$

$y = \frac{-11}{7}$

3. $x = \frac{2(2)+(-4)1}{2+1} = 0$

$y = \frac{(6)2+1(1)}{2+1}$

$y = \frac{13}{3}$

Q. 3. Find the ratio in which point T(-1, 6)divides the line segment joining the points P(-3, 10) and Q(6, -8).

Answer : A point P(x,y) divides the line formed by points (a,b) and (c,d) in the ratio of m:n, then the coordinates of the point P is given by

$x = \frac{an + cm}{m + n}$ and $y = \frac{bn + dm}{m + n}$

In the given question,

Let the point T divide the line PQ in the ratio m:n

Here x = -1 and y = 6

$-1 = \frac{-3n + 6m}{m + n}$ ...(1)

$6 = \frac{10n - 8m}{m + n}$ .... (2)

Simplifying (1) we get,

-m-n = -3n + 6m

2n = 7m

Simplifying (2) we get,

6m + 6n = 10n-8m

14m = 4n

From both we get $\frac{m}{n} = \frac{2}{7}$

Hence the point T divides PQ in the ratio 2:7

Q. 4. Point P is the centre of the circle and AB is a diameter. Find the coordinates ofpoint B if coordinates of point A and P are (2, -3) and (-2, 0) respectively.

Answer : According to the mid-point theorem the coordinates of the point P(x,y) dividing the line formed by A(a,b) and B(c,d) is given by:

$x = \frac{a + c}{2}$

$y = \frac{b + d}{2}$

In the given question A = (1,-3) and midpoint P is (-2,0).

Let coordinates of B be (c,d)

Then,

$$-2 = \frac{2 + c}{2}$$

And

$$0 = \frac{-3 + d}{2}$$

Solving for c and d, we get

-4 = 2 + c

c = -6

d = 3

Hence the coordinates of point B are (-6,3).

Q. 5. Find the ratio in which point P(k, 7) divides the segment joining A(8, 9) andB(1, 2). Also find k.

Answer : A point P(x,y) divides the line formed by points (a,b) and (c,d) in the ratio of m:n, then the coordinates of the point P is given by

$$x = \frac{an + cm}{m + n} \text{ and } y = \frac{bn + dm}{m + n}$$

In the given question,

Let the point P divide AB is the ratio 1:k

Y coordinate of P

$$7 = \frac{9k + 2}{k + 1}$$

Simplifying

7k + 7 = 9k + 2

2k = 5

k = $\frac{5}{2}$

And the ratio = 1:$\frac{5}{2}$

= $\frac{2}{5}$

Therefore point P divides AB in the ratio 2:5

Q. 6. Find the coordinates of midpoint of the segment joining the points (22,20) and (0, 16).

Answer : According to the mid-point theorem the coordinates of the point P(x,y) dividing the line formed by A(a,b) and B(c,d) is given by:

$$x = \frac{a + c}{2}$$

$$y = \frac{b + d}{2}$$

The coordinates of midpoint(x,y) are

$$x = \frac{22 + 0}{2} = 11$$

$$y = \frac{20 + 16}{2} = 18$$

Hence the coordinates are (11,18)

Q. 7. Find the centroids of the triangles whose vertices are given below.

(1) (-7, 6), (2, -2), (8, 5)
(2) (3, -5), (4, 3), (11, -4)
(3) (4, 7), (8, 4), (7, 11)

Answer : The coordinates of the centroid (x,y) od a triangle formed by points (a,b), (c,d), (e,f) is given by

$$x = \frac{a + c + e}{3}$$

$$y = \frac{b + d + f}{3}$$

1. $x = \frac{-7 + 2 + 8}{3} = 1$

$$y = \frac{6 - 2 + 5}{3} = 3$$

2. $x = \frac{3 + 4 + 11}{3} = 6$

$$y = \frac{-5 + 3 - 4}{3} = -2$$

3. $x = \frac{4 + 8 + 7}{3} = \frac{19}{3}$

$$y = \frac{7 + 4 + 11}{3} = \frac{22}{3}$$

Q. 8. In ΔABC, G (-4, -7) is the centroid. If A (-14, -19) and B(3, 5) then find theco-ordinates of C.

Answer : The coordinates of the centroid (x,y) od a triangle formed by points (a,b), (c,d), (e,f) is given by

$$x = \frac{a + c + e}{3}$$

$$y = \frac{b + d + f}{3}$$

In the given question (x,y) = (-4,-7)

Hence $-4 = \frac{-14 + 3 + e}{3}$

Solving for e, we get

e = -1

$$-7 = \frac{-19 + 5 + f}{3}$$

Solving for f, we get

f = -7

Hence the coordinates of the third point are (-1,-7)

Q. 9. A(h, -6), B(2, 3) and C(-6, k) are the co-ordinates of vertices of a triangle whose centroid is G (1, 5). Find h and k.

Answer : The coordinates of the centroid (x,y) od a triangle formed by points (a,b), (c,d), (e,f) is given by

$$x = \frac{a + c + e}{3}$$

$$y = \frac{b + d + f}{3}$$

In the given question:

$$1 = \frac{h + 2 - 6}{3}$$

Solving for h we get

h = 7

$$5 = \frac{-6 + 3 + k}{3}$$

Solving for k we get

k = 18

Q. 10. Find the co-ordinates of the points of trisection of the line segment AB with A(2, 7) and B(-4, -8).

Answer : let The points of trisection of a given line AB be P and Q

Then the ratio AP:PQ:QB = 1:1:1

Hence we get AP:PB = 1:2

And AQ:QB = 2:1

A point P(x,y) divides the line formed by points (a,b) and (c,d) in the ratio of m:n, then the coordinates of the point P is given by

$$x = \frac{an + cm}{m + n} \text{ and } y = \frac{bn + dm}{m + n}$$

To find point P(x,y)

$$x = \frac{2(2) + (-4)1}{2 + 1}$$

x = 0

$$y = \frac{(7)2 + (-8)1}{2 + 1}$$

y = 2

To find the point Q(x',y')

$$x' = \frac{\left((2)1 + (-4)2\right)}{2 + 1}$$

x' = -2

$$y' = \frac{(1)7 + (-8)2}{2 + 1}$$

y' = -3

Hence point P = (0,2) and Q = (-2,-3)

Q. 11. If A (-14, -10), B(6, -2) is given, find the coordinates of the points whichdivide segment AB into four equal parts.

Answer : let the points dividing AB be C,D,E.

AC:CD:DE:EB::1:1:1:1

A point P(x,y) divides the line formed by points (a,b) and (c,d) in the ratio of m:n, then the coordinates of the point P is given by

$$x = \frac{an + cm}{m + n} \text{ and } y = \frac{bn + dm}{m + n}$$

For C m:n :: 1:3

$$x = \frac{(-14)3 + (6)1}{1 + 3} = -9$$

$$y = \frac{(-10)3 + (-2)1}{1 + 3} = -8$$

For D m:n ::2:2

$$x = \frac{(-14)2 + (6)2}{2 + 2} = -4$$

$$y = \frac{(-10)2 + (-2)2}{2 + 2} = -6$$

For E m:n :: 3:1

$$x = \frac{(-14)1 + (6)3}{3 + 1} = 1$$

$$y = \frac{(-10)1 + (-2)3}{1 + 3} = -4$$

Hence coordinates of C = (-9,-8)

D = (-4,-6)

E = (1,-4)

Q. 12. If A (20, 10), B(0, 20) are given, find the coordinates of the points which divide segment AB into five congruent parts.

Answer : Let the points dividing AB be C,D,E,F

AC:CD:DE:EF:FB::1:1:1:1:1

A point P(x,y) divides the line formed by points (a,b) and (c,d) in the ratio of m:n, then the coordinates of the point P is given by

$$x = \frac{an + cm}{m + n} \text{ and } y = \frac{bn + dm}{m + n}$$

For C m:n :: 1:4

$$x = \frac{(20)4 + (0)1}{1 + 4} = 16$$

$$y = \frac{10(4) + (20)1}{1 + 4} = 12$$

For D m:n :: 2:3

$$x = \frac{(20)3 + (0)2}{2 + 3} = 12$$

$$y = \frac{(10)3 + (20)2}{2 + 3} = 14$$

For E m:n :: 3:2

$$x = \frac{(20)2 + (0)3}{2 + 3} = 8$$

$$y = \frac{(10)2 + (20)3}{2 + 3} = 16$$

For F m:n :: 4:1

$$x = \frac{(20)1 + (0)3}{1 + 4} = 4$$

$$y = \frac{(10)1 + (20)4}{1 + 4} = 18$$

Practice Set 5.3

Q. 1. Angles made by the line with the positive direction of X-axis are given. Find the slope of these lines.

(1) 45°
(2) 60°
(3) 90°

Answer : Slope is given as the tangent of the angle formed with the positive direction of x-axis

1. tan 45° = 1

2. tan60° = $\sqrt{3}$

3. tan 90° = cannot be determined.

Q. 2. Find the slopes of the lines passing through the given points.

(1) A (2, 3), B (4, 7)
(2) P (-3, 1), Q (5, -2)
(3) C (5, -2), D (7, 3)
(4) L (-2, -3), M (-6, -8)
(5) E(-4, -2), F (6, 3)
(6) T (0, -3), S (0, 4)

Answer : Slope m of a line passing through two points A(a,b) and B(c,d) ig given by

$$m = \frac{d - b}{c - a}$$

1. A (2, 3), B (4, 7)

$$m = \frac{7-3}{4-2} = \frac{4}{2} = 2$$

2. P (-3, 1), Q (5, -2)

$$m = \frac{-2-1}{5-(-3)} = \frac{-3}{5+3} = \frac{-3}{8}$$

3. C (5, -2), D (7, 3)

$$m = \frac{3-(-2)}{7-5} = \frac{3+2}{7-5} = \frac{5}{2}$$

4. L (-2, -3), M (-6, -8)

$$m = \frac{-8-(-3)}{-6-(-2)} = \frac{-8+3}{-6+2} = \frac{-5}{-4} = \frac{5}{4}$$

5. E(-4, -2), F (6, 3)

$$m = \frac{3-(-2)}{6-(-4)} = \frac{3+2}{6+4} = \frac{5}{10} = \frac{1}{2}$$

6. T (0, -3), S (0, 4)

$$m = \frac{4-(-3)}{0-0}$$

As denominator is 0,

So, slope cannot be determined.

Q. 3. Determine whether the following points are collinear.

(1) A(-1, -1), B(0, 1), C(1, 3)
(2) D(-2, -3), E(1, 0), F(2, 1)
(3) L(2, 5), M(3, 3), N(5, 1)
(4) P(2, -5), Q(1, -3), R(-2, 3)
(5) R(1, -4), S(-2, 2), T(-3, 4)
(6) A(-4, 4), K(-2, 5/ 2), N(4, -2)

Answer : Three points are said to be collinear if they all lie in a straight line.
If Three points (x_1, y_1), (x_2, y_2), (x_3, y_3) are collinear then no triangle can be formed using three points and so the area formed by the triangle by the three points is zero.

Area of Triangle = 1/2 [$x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)$] ...(1)

1. For triangle, A(-1, -1), B(0, 1), C(1, 3)

Area = $\frac{1}{2}\left(-1(1-3)\ +\ 0\left(3-(-1)\right)\ +\ 1(-1-1)\right)$

= 1/2 [-1(-2) + 0(3+1) + 1(-1-1)] = 1/2 [2 + 0 - 2] = 1/2 [2-2] = 0Hence the points are collinear

2. For triangle, D(-2, -3), E(1, 0), F(2, 1)

Using 1,

Area = 1/2 [-2(0-1) + 1(1-(-3)) + 2(-3-0)] = 1/2 [-2(-1) + 1(1+3) + 2(-3)] = 1/2 [2 + 4 -6] = 1/2 [6 - 6] = 1/2 (0) = 0Hence the points are collinear.

3. For triangle, L(2, 5), M(3, 3), N(5, 1)

Using 1,

Area = 1/2 [2(3-1) + 3(1-5) + 5(5-3)] = 1/2 [2(2) + 3(-4) + 5(2)] = 1/2 [4 - 12 + 10] = 1/2 [14 - 12] = 1/2 (2) = 1

Hence the points are not collinear.

4. For triangle, P(2, -5), Q(1, -3), R(-2, 3)

Using 1,Area = $\frac{1}{2}(2(-3-3) + 1(3-(-5)) + (-2)(-5-(-3)) = 0$

Area = 1/2 [2(-3-3) + 1(3-(-5)) + (-2)(-5-(-3))] = 1/2 [2(-6) + 1(3+5) - 2 (-5+3)] = 1/2 [-12 + 8 -2(-2)] = 1/2 [-12 + 8 +4] = 1/2 [-12 + 12] = 1/2 (0)

= 0

Hence the points are collinear.

5. For triangle, R(1, -4), S(-2, 2), T(-3, 4)

Area = $\frac{1}{2}\left(1(2-4) + (-2)(4-(-4)) + (-3)(-4-2)\right) = 0$

Hence the points are collinear.

6. For triangle, A(-4, 4), K(-2, 5/ 2), N(4, -2)

Area = $\frac{1}{2}((-4)\left(\frac{5}{2}-(-2) + (-2)(-2-4) + 4\left(4-\frac{5}{2}\right)\right) = 0$

Hence the points are collinear.

Q. 4. If A (1, -1),B (0, 4),C (-5, 3) are vertices of a triangle then find the slope of each side

Answer : Slope m of a line passing through two points A(a,b) and B(c,d) is given by

$$m = \frac{d-b}{c-a}$$

Slope of AB =

$$= \frac{4-(-1)}{0-1} = -5$$

Slope of BC =

$$\frac{3-4}{-5-0} = \frac{1}{5}$$

Slope of AC =

$$\frac{3-(-1)}{-5-1} = -\frac{2}{3}$$

Q. 5. Show that A (-4, -7),B (-1, 2), C (8, 5) and D (5, -4) are the vertices of a parallelogram.

Answer : In a parallelogram, opposite sides are equal and parallel.

According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$$d = \sqrt[2]{(a-c)^2 + (b-d)^2}$$ .....(1)

Slope m of a line passing through two points A(a,b) and B(c,d) ig given by

$$m = \frac{d-b}{c-a}$$

In the question,

$$AB = \sqrt{\left(-4-(-1)\right)^2 + \left(2-(-7)\right)^2} = \sqrt{90}$$

$$BC = \sqrt{\left(8-(-1)\right)^2 + (5-2)^2} = \sqrt{90}$$

$$CD = \sqrt{(8-5)^2 + \left(5-(-4)\right)^2} = \sqrt{90}$$

$$AD = \sqrt{\left(5-(-4)\right)^2 + \left(-7-(-4)\right)^2} = \sqrt{90}$$

$$\text{Slope of AB} = \frac{2-(-7)}{-1-(-4)} = 3$$

$$\text{Slope of BC} = \frac{5-2}{8-(-1)} = \frac{1}{3}$$

$$\text{Slope of CD} = \frac{-4-5}{5-8} = 3$$

$$\text{Slope of AD} = \frac{-4-(-7)}{5-(-4)} = \frac{1}{3}$$

As AB = DC and BC = AD

And Slope AB = Slope CD

Slope BC = slope AD

Hence the given points form a parallelogram.

Q. 6. Find k, if R(1, -1), S (-2, k) and slope of line RS is -2.

Answer : Slope m of a line passing through two points A(a,b) and B(c,d) ig given by

$$m = \frac{d - b}{c - a}$$

In the given question

$$-2 = \frac{k - (-1)}{-2 - 1}$$

Simplifying

6 = k + 1

K = 5

Q. 7. Find k, if B(k, -5), C (1, 2) and slope of the line is 7.

Answer : Slope m of a line passing through two points A(a,b) and B(c,d) ig given by

$$m = \frac{d - b}{c - a}$$

In the given question

$$7 = \frac{2 - (-5)}{1 - k}$$

Simplifying

7 – 7k = 7

k = 0

Q. 8. Find k, if PQ || RS and P(2, 4), Q (3, 6), R(3, 1), S(5, k) .

Answer : two lines are said to be parallel if their slopes are equal

If PQ||RS then their slopes must be equal

$$\text{Slope of PQ} = \frac{6-4}{3-2} = 2$$

$$\text{Slope pf RS} = \frac{k-1}{5-3}$$

As their slopes are equal, we get

$$2 = \frac{(k-1)}{2}$$

Simplifying

K – 1 = 4

k = 5

Problem Set 5

Q. 1. A. Fill in the blanks using correct alternatives.

Seg AB is parallel to Y-axis and coordinates of point A are (1,3) then co-ordinates of point B can be ....
A. (3,1)

B. (5,3)
C. (3,0)
D. (1,-3)

Answer : To be parallel to y-axis, it's x coordinate should remain the same. i.e. 1 and y coordinate can change.

A. x coordinate has changed.

B. x coordinate has changed.

C. x coordinate has changed.

D. x coordinate is same.

Therefore the answer is D.

Q. 1. B. Fill in the blanks using correct alternatives.

Out of the following, point .... lies to the right of the origin on X- axis.
A. (-2,0)
B. (0,2)
C. (2,3)
D. (2,0)

Answer : To be on the X-axis, it's y coordinate = 0

And to be on the right of the origin, its x coordinate must be positive.

A. y is 0 but x is negative

B. y is not 0

C. y is not 0

D. y is 0 and x is positive.

Therefore the answer is D

Q. 1. C. Fill in the blanks using correct alternatives.

Distance of point (-3,4) from the origin is ....
A. 7

B. 1
C. 5
D. -5

Answer : According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$$d = \sqrt[2]{(a-c)^2 + (b-d)^2} \text{ .....(1)}$$

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

Therefore answer is C

Q. 1. D. Fill in the blanks using correct alternatives.

A line makes an angle of 30° with the positive direction of X- axis. So the slope of the line is ....

A. $\frac{1}{2}$

B. $\frac{\sqrt{3}}{2}$

C. $\frac{1}{\sqrt{3}}$

D. $\sqrt{3}$

Answer : Slope = tangent of angle formed with positive x-axis

Slope = tan30° = $\frac{1}{\sqrt{3}}$

Hence answer is C

Q. 2. Determine whether the given points are collinear.

(1) A(0,2) , B(1,-0.5), C(2,-3)
(2) P(1, 2) , Q(2, 8/5) , R(3, 6/5)
(3) L(1,2) , M(5,3) , N(8,6)

Answer : If Three points (a,b), (c,d), (e,f) are collinear then the area formed by the triangle by the three points is zero.

Area of a triangle $= \frac{1}{2}|a(d-f) + c(f-b) + e(b-d)|$...(1)

1. area $= \frac{1}{2}\left(0\left(-0.5-(-3)\right) + 1(-3-2) + 2\left(2-(-0.5)\right)\right) = 0$

Hence the points are collinear.

2. area $= \frac{1}{2}\left(1\left(\frac{8}{5}-\frac{6}{5}\right) + 2\left(\frac{6}{5}-2\right) + 3\left(2-\frac{8}{5}\right)\right) = 0$

Hence the points are collinear

3. area $= \frac{1}{2}\left(1(3-6) + 5(6-2) + 8(2-3)\right) = \frac{9}{2}$

Hence the points are not collinear

Q. 3. Find the coordinates of the midpoint of the line segment joining P(0,6)and Q(12,20).

Answer : According to the mid-point theorem the coordinates of the point P(x,y) dividing the line formed by A(a,b) and B(c,d) is given by:

$$x = \frac{a + c}{2}$$

$$y = \frac{b + d}{2}$$

In question $x = \frac{0 + 12}{2} = 6$

$$y = \frac{6 + 20}{2} = 13$$

Hence mid-point is (6,13)

Q. 4. Find the ratio in which the line segment joining the points A(3,8) and B(-9, 3)is divided by the Y-axis.

Answer : A point P(x,y) divides the line formed by points (a,b) and (c,d) in the ratio of m:n, then the coordinates of the point P is given by

$x = \frac{an + cm}{m + n}$ and $y = \frac{bn + dm}{m + n}$

On y axis x coordinate = 0

Let the y-axis divide AB is ratio 1:k.

the points A(3,8) and B(-9, 3)is divided by the Y-axis.

For x coordinate

$$0 = \frac{3k - 9}{k + 1}$$

Solving for k we get

3k - 9 = 03 k = 9

k = 3

Q. 5. Find the point on X-axis which is equidistant from P(2,-5) and Q(-2,9).

Answer : According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$d = \sqrt[2]{(a - c)^2 + (b - d)^2}$ .....(1)

As the point is on the x = axis it is of the form (x,0)

Distance from point P = $\sqrt{(2 - x)^2 + (-5 - 0)^2} = \sqrt{(2 - x)^2 + 25}$

Distance from point Q = $\sqrt{(-2 - x)^2 + (9 - 0)^2} = \sqrt{(2 + x)^2 + 81}$

As the two points are equidistant from (x,0)

$$\sqrt{(2 - x)^2 + 25} = \sqrt{(2 + x)^2 + 81}$$

Squaring both sides

$(2-x)^2 + 25 = (2 + x)^2 + 81$

Expanding and simplifying

$-4x + 25 = 4x + 81$

$8x = -56$

$x = -7$

Q. 6. Find the distances between the following points.

(i) A(a, 0), B(0, a)
(ii) P(-6, -3), Q(-1, 9)
(iii) R(-3a, a), S(a, -2a)

Answer : According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$$d = \sqrt[2]{(a-c)^2 + (b-d)^2} \text{ .....(1)}$$

(i) A(a, 0), B(0, a)

i. $d = \sqrt{(a-0)^2 + (0-a)^2}$
$= \sqrt{2a^2}$
$= a\sqrt{2}$

(ii) P(-6, -3), Q(-1, 9)

$d = \sqrt{\left(-6-(-1)\right)^2 + (-3-9)^2}$

$= \sqrt{(-5)^2 + (-12)^2}$

$= \sqrt{25 + 144}$

$= \sqrt{169} = 13$

(iii) R(-3a, a), S(a, -2a)

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

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

$$=\sqrt{16a^2+9a^2}$$

$$=\sqrt{25a^2}$$

= 5a

Q. 7. Find the coordinates of the circumcentre of a triangle whose vertices are (-3,1),(0,-2) and (1,3)

Answer : The circumcentre is equidistant from all the points of the triangle.

Let the coordinates of circumcentre be (x,y)

$\sqrt{(-3-x)^2 + (1-y)^2} = \sqrt{x^2 + (y+2)^2}$ ...i

And

$\sqrt{x^2 + (y+2)^2} = \sqrt{(1-x)^2 + (3-y)^2}$ ...ii

Squaring and simplifying i , we get

2x-2y = -6

Squaring and simplifying ii , we get

2x + 10y = 6

Solving the above equations, we get

x = $-\frac{1}{3}$

y = $\frac{2}{3}$

Hence the coordinates of circumcircle is ($-\frac{1}{3}, \frac{2}{3}$)

Q. 8. In the following examples, can the segment joining the given points form a triangle? If triangle is formed, state the type of the triangle considering sides of the triangle.

(1) L(6,4), M(-5,-3) , N(-6,8)
(2) P(-2,-6), Q(-4,-2), R(-5,0)
(3) $A\left(\sqrt{2},\sqrt{2}\right), B\left(-\sqrt{2},-\sqrt{2}\right), C\left(-\sqrt{6},\sqrt{6}\right)$

Answer : According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$$d = \sqrt[2]{(a-c)^2 + (b-d)^2} \quad .....(1)$$

1. LM = $\sqrt{(6 + 5)^2 + (4 + 3)^2} = \sqrt{170}$

MN = $\sqrt{(-6 + 5)^2 + (8 + 3)^2} = \sqrt{122}$

NL = $\sqrt{(-6 - 6)^2 + (8 - 4)^2} = \sqrt{160}$

As sum of any two sides are greater than the third side,

The following points form a scalene triangle.

2. PQ = $\sqrt{(-4 + 2)^2 + (-2 + 6)^2} = \sqrt{20}$

QR = $\sqrt{(-5 + 4)^2 + (0 + 2)^2} = \sqrt{5}$

RP = $\sqrt{(-5 + 2)^2 + (0 + 6)^2} = \sqrt{45}$

As PQ + QR < RP

The following points do not form a triangle.

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

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

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

As AB = BC = AC

The following points form an equilateral triangle.

Q. 9. Find k if the line passing through points P(-12,-3) and Q(4, k)has slope $\frac{1}{2}$.

Answer : Slope of a line between two points (a,b) and (c,d) is

$$m = \frac{d-b}{c-a}$$

Slope = $\frac{k-(-3)}{4-(-12)} = \frac{1}{2}$

Simplifying

K = 5

Q. 10. Show that the line joining the points A(4, 8) and B(5, 5) is parallel to the line joining the points C(2,4) and D(1,7).

Answer : Slope of a line between two points (a,b) and (c,d) is

$$m = \frac{d-b}{c-a}$$

Slope of AB = $\frac{5-8}{5-4} = -3$

Slope of AC = $\frac{7-4}{1-2} = -3$

As slopes are equal, the two lines are parallel.

Q. 11. Show that points P(1,-2), Q(5,2), R(3,-1), S(-1,-5) are the vertices of a parallelogram.

Answer : According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$d = \sqrt[2]{(a-c)^2 + (b-d)^2}$ .....(1)

Slope of a line between two points (a,b) and (c,d) is

$$m = \frac{d-b}{c-a}$$

Distance PQ = $\sqrt{(1-5)^2 + (-2-2)^2} = \sqrt{32}$

Distance QR = $\sqrt{(5-3)^2 + (-1-2)^2} = \sqrt{13}$

Distance RS = $\sqrt{(-1-3)^2 + (-5+1)^2} = \sqrt{32}$

Distance SP = $\sqrt{(-1-1)^2 + (-2+5)^2} = \sqrt{13}$

Slope PQ = $\frac{2+2}{5-1} = 1$

Slope QR = $\frac{-1-2}{3-5} = \frac{3}{2}$

Slope RS = $\frac{-5+1}{-1-3} = 1$

Slope SP = $\frac{-5+2}{-1-1} = \frac{3}{2}$

As opposite sides are equal and parallel, the points from a parallelogram.

Q. 12. Show that the □PQRS formed by P(2,1), Q(-1,3), R(-5,-3) and S(-2,-5) is a rectangle.

Answer : According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$d = \sqrt[2]{(a-c)^2 + (b-d)^2}$ .....(1)

Slope of a line between two points (a,b) and (c,d) is

$$m = \frac{d-b}{c-a}$$

Note: If the Product of slopes of two lines = -1 then they are perpendicular to each other.

PQ = $\sqrt{(2\ +\ 1)^2\ +\ (1-3)^2} = \sqrt{13}$

QR = $\sqrt{(-1\ +\ 5)^2\ +\ (3\ +\ 3)^2} = \sqrt{52}$

RS = $\sqrt{(-5\ +\ 2)^2\ +\ (-3\ +\ 5)^2} = \sqrt{13}$

SP = $\sqrt{(2\ +\ 2)^2\ +\ (1\ +\ 5)} = \sqrt{52}$

Slope PQ = $\frac{3-1}{-1-2} == \frac{2}{3}$

Slope QR = $\frac{-3-3}{-5+1} = \frac{2}{3}$

Slope RS = $\frac{-5+3}{-2+5} = -\frac{2}{3}$

Slope SP = $\frac{-5-1}{-2-1} = \frac{2}{3}$

As opposite sides are equal and parallel and perpendicular to each other, points form a rectangle.

Q. 13. Find the lengths of the medians of a triangle whose vertices are A(-1,1), B(5, -3) and C(3, 5).

Answer : According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$d\ =\ \sqrt[2]{(a-c)^2\ +\ (b-d)^2}$ .....(1)

According to the mid-point theorem the coordinates of the point P(x,y) dividing the line formed by A(a,b) and B(c,d) is given by:

$$x = \frac{a + c}{2}$$

$$y = \frac{b + d}{2}$$

Mid point of AB x coordinate = $\frac{-1+5}{2} = 2$

Y coordinate = $\frac{1-3}{2} = -1$

Mid point of BC x coordinate = $\frac{5+3}{2} = 4$

Y coordinate = $\frac{-3+5}{2} = 1$

Mid point of AC x coordinate = $\frac{-1+3}{2} = 1$

Y coordinate = $\frac{5+1}{2} = 3$

Length of median through A is the distance between pt A and the midpoint of BC

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

Length of median through B is the distance between pt B and the mid point of AC

$D_b = \sqrt{(5-1)^2 + (-3-3)}^2 = 2\sqrt{13}$

Length of median through C is the distance between pt C and the mid point of AB

$D_c = \sqrt{(3-2)^2 + (-1-5)^2} = \sqrt{(37)}$

Q. 14. Find the coordinates of centroid of the triangles if points D(-7,6),E(8,5) and F(2, -2) are the mid-points of the sides of that triangle.

Answer : The coordinates of the centroid (x,y) od a triangle formed by points (a,b), (c,d), (e,f) is given by

$$x = \frac{a + c + e}{3}$$

$$y = \frac{b + d + f}{3}$$

X coordinate = $\frac{-7+8+2}{3} = 1$

Y coordinate = $\frac{6+5-2}{3} = 3$

Hence coordinates are (1,3)

Q. 15. Show that A(4, -1), B(6, 0), C(7, -2) and D(5, -3)are vertices of a square.

Answer : According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$$d = \sqrt[2]{(a-c)^2 + (b-d)^2} \text{ .....(1)}$$

Slope of a line between two points (a,b) and (c,d) is

$$m = \frac{d-b}{c-a}$$

Note: If the Product of slopes of two lines = -1 then they are perpendicular to each other.

$$AB = \sqrt{(6-4)^2 + (-1 + 2)^2} = \sqrt{5}$$

$$BC = \sqrt{(6-7)^2 + (-2-0)\text{^}2} = \sqrt{5}$$

$$CD = \sqrt{(7-5)^2 + (-2 + 3)^2} = \sqrt{(5)}$$

$$AD = \sqrt{(5-4)^2 + (-1 + 3)^2} = \sqrt{5}$$

$$\text{Slope } AB = \frac{0-(-1)}{6-4} = \frac{1}{2}$$

$$\text{Slope } BC = \frac{-2-0}{7-6} = -2$$

$$\text{Slope } CD = \frac{-3+2}{5-7} = \frac{1}{2}$$

$$\text{Slope } AD = \frac{-3+1}{5-4} == 2$$

As all sides are equal and ajdacent sides are perndicular. Given points form a square.

Q. 16. Find the coordinates of circumcentre and radius of circumcircle of triangle ABC if A(7, 1), B(3, 5) and C(2, 0) are given.

Answer : Let the circumcentre be (x,y)

As the circumcentre is equidistant from all the 3 points, we get

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

And

$\sqrt{(2-x)^2 + y^2} = \sqrt{(7-x)^2 + (y-1)^2}$...................ii

Squaring both sides of i and simplifying, we get

-2x-10y = -30

Squaring both sides of ii and simplifying, we get

10x + 2y = 46

Solving the above equations, we get

x = $\frac{25}{6}$

y = $\frac{13}{6}$

Radius of circumcircle is the distance between any point on the triangle and the circumcentre.

Radius = $\sqrt{\left(2-\frac{25}{6}\right)^2 + \left(0-\frac{13}{6}\right)^2} = \frac{13}{6}\sqrt{2}$

Q. 17. Given A(4,-3), B(8,5). Find the coordinates of the point that divides segment AB in the ratio 3 : 1.

Answer : A point P(x,y) divides the line formed by points (a,b) and (c,d) in the ratio of m:n, then the coordinates of the point P is given by

$$x = \frac{an + cm}{m + n} \text{ and } y = \frac{bn + dm}{m + n}$$

$$\text{X coordinate} = \frac{(4 \times 1 + (8 \times 3))}{(3 + 1)} = 7$$

$$\text{Y coordinate} = \frac{(-3)1 + (5)3}{(1 + 3)} = 3$$

Hence the point is (7,3)

Q. 18. Find the type of the quadrilateral if points A(-4, -2), B(-3, -7) C(3, -2) and D(2, 3) are joined serially.

Answer : According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$$d = \sqrt[2]{(a-c)^2 + (b-d)^2} \quad .....(1)$$

Slope of a line between two points (a,b) and (c,d) is

$$m = \frac{d-b}{c-a}$$

AB = $\sqrt{(-4\ +\ 3)^2\ +\ (-2\ +\ 7)^2} = \sqrt{(26)}$

BC = $\sqrt{(-3-3)^2\ +\ (-7\ +\ 2)^2} = \sqrt{(61)}$

CD = $\sqrt{(2-3)^2\ +\ (-2-3)^2} = \sqrt{(26)}$

AD = $\sqrt{(-4-2)^2\ +\ (-2-3)^2} = \sqrt{61}$

Slope AB = $\frac{-7+2}{-3+4} = -5$

Slope BC = $\frac{-2+7}{3+3} = \frac{5}{6}$

Slope CD = $\frac{3+2}{2-3} = -5$

Slope AD = $\frac{3+2}{2+4} = \frac{5}{6}$

As opposite sides are equal and parallel, it forms a parallelogram.

Q. 19. The line segment AB is divided into five congruent parts at P, Q, R and S such that A-P-Q-R-S-B. If point Q(12, 14) and S(4, 18) are given find the coordinates of A, P, R,B.

Answer : A point P(x,y) divides the line formed by points (a,b) and (c,d) in the ratio of m:n, then the coordinates of the point P is given by

$x = \frac{an + cm}{m + n}$ and $y = \frac{bn + dm}{m + n}$

Coordinates of R as QR:RS :: 1:1

$X = \frac{12 + 4}{2} = 8$

$Y = \frac{14 + 18}{2} = 16$

As RS:SB::1:1

Coordinates of B

$$4 = \frac{8 + x}{2}$$

X = 0

And

$$18 = \frac{16 + y}{2}$$

Y = 20

As PQ:QR::1:1

Coordinates of P

$$12 = \frac{x + 8}{2}$$

x = 16

And

$$14 = \frac{y + 16}{2}$$

y = 12

As AP:PQ::1:1

Coordinates of A

$$16 = \frac{x + 12}{2}$$

x = 20

And

$$12 = \frac{y + 14}{2}$$

y = 10

Q. 20. Find the coordinates of the centre of the circle passing through the points P(6,-6), Q(3,-7)and R(3,3).

Answer : According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$d = \sqrt[2]{(a - c)^2 + (b - d)^2}$ .....(1)

Let the centre be A(x,y)

As it passes through the given points, distance between centre and the points is the radius.

AP = $\sqrt{(x - 6)^2 + (y + 6)^2}$

AQ = $\sqrt{(x - 3)^2 + (y + 7)^2}$

AR = $\sqrt{(x - 3)^2 + (y - 3)^2}$

As AP = AQ

Squaring both sides

$(x-6)^2 + (y + 6)^2 = (x-3)^2 + (y + 7)^2$

Simplifying

$12y-12x + 72 = 14y-6x + 58$

$2y + 6x-14 = 0$... (a)

AP = AR

Squaring both sides and simplifying

$6y-6x + 54 = 0$ ...(b)

Solving for x and y using (a) and (b)

We get x = 3; y = -2

Hence centre is (3,-2)

Q. 21. Find the possible pairs of coordinates of the fourth vertex D of the parallelogram, if three of its vertices are A(5,6), B(1,-2)and C(3,-2).

Answer : According to the distance formula, the distance 'd' between two points (a,b) and (c,d) is given by

$$d = \sqrt[2]{(a-c)^2 + (b-d)^2} \text{ .....(1)}$$

Slope of a line between two points (a,b) and (c,d) is

$$m = \frac{d-b}{c-a}$$

In the given question, for it to be a parallelogram AD = BC and slope AD = Slope BC

And

AB = DC and Slope AB = Slope CD

Let D be (x,y)

As AD = BC we get

$\sqrt{(5-x)^2 + (6-y)^2} = \sqrt{(1-3)^2 + (-2+2)^2} = 2$ i

As AB = CD we get

$\sqrt{(3-x)^2 + (y+2)^2} = \sqrt{(5-1)^2 + (6+2)^2} = 4\sqrt{5}$ ii

As slope AD = Slope BC

$\frac{6-y}{5-x} = \frac{-2+2}{3-1} = 0$ iii

As slope AB = Slope DC

$\frac{3-x}{-2-y} = \frac{-2-6}{1-5} = 2$ iv

From iii we gey y = 6

Putting y = 6 in (i) we get

x = 3

And putting y = 6 in (ii) we get x = 7

Hence the possible coordinates of the point D are (7,6) and (3,6).

Q. 22. Find the slope of the diagonals of a quadrilateral with vertices A(1,7), B(6,3), C(0,-3) and D(-3,3).

Answer : Slope of a line between two points (a,b) and (c,d) is

$$m = \frac{d-b}{c-a}$$

A quadrilateral ABCD has diagonals AC and BD