ADDITIONAL MATHEMATICS

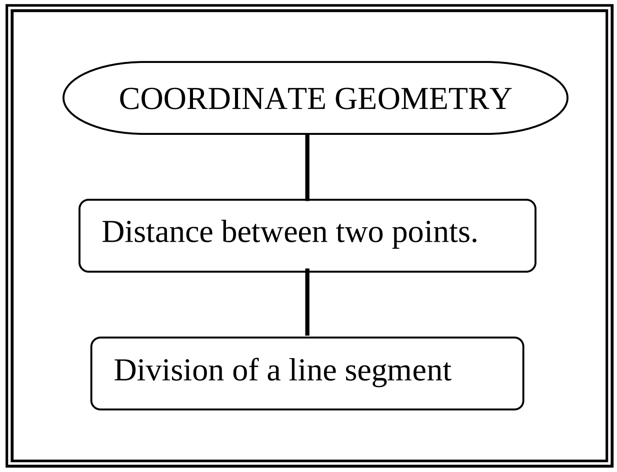
MODULE 10

COORDINATE GEOMETRY

CHAPTER 6 : COORDINATE GEOMETRY

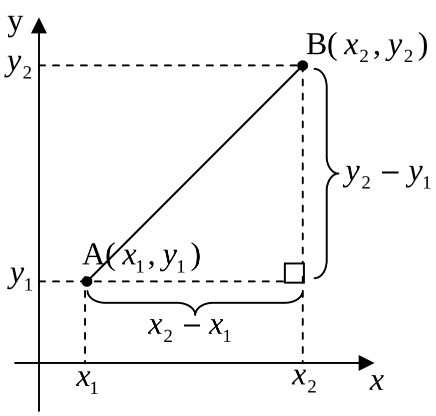
CONTENTS **Page**

6.1 Conceptual map



6.2 Distance between two points.

Note:



Distance AB =

Examples :	Solution.
1. Find the distance between A(2,3) and B(7,6).	Use (x_1, y_1) = (5, 3) and (x_2, y_2) = (8, 7). Therefore, AB = $\sqrt{(8-5)^2 + (7-3)^2}$ = $\sqrt{\quad}$ = = 5 units

Examples :	Solution.
2. Given that the distance between R(4, m) and S(-1, 3) is 13 units, find the value of m.	Given that RS = 13 units, therefore $\sqrt{(-1-4)^2+(m-3)^2} = 13$ = $(m-3)^2 =$ $m-3 =$ = or = m = or m =

EXERCISES 6.2:

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

(a) C(1, 3) and D(4,-1)	(b) R(-2, 6) and T(7, -3)
(c) K(-5, -2) and L(-6,-1)	(d) P($\frac{1}{2}$, 1) and Q(1, -3)

2. Given the points R(-9, -2), S(-1, -6) and T(-1,2),show that TR = RS.

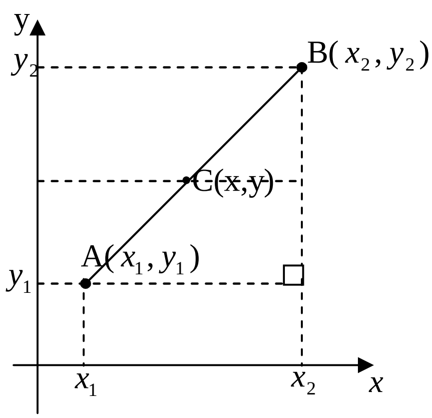
3. The distance between the points U(6,3*t*) and the points V(12,-*t*) is 10 units. Find the possible value of *t*.

4. Given point P(*h*, *k*) is equidistant from points A(2, 5) and B(-2, 4). Show that $2k + 8h = 9$.

6.3 Division of A Line Segment

6.3.1 The midpoint of two points.

Note:



If C is the midpoint of the line AB,

then coordinate C =

Examples :	Solution.
1. Find the midpoints of points P(3, 4) and Q(5, 8)	(a) Midpoint PQ = $\left(\frac{3+5}{2}, \frac{4+8}{2}\right)$ $= \left(\frac{8}{2}, \frac{12}{2}\right)$ = (4,6).

Examples :	Solution.
2. Points A and B are (5, r) and (1, 7) respectively. Find the value of r,if the midpoint of AB = (3, 5).	Midpoint of AB = $\left(\frac{5+1}{2}, \frac{r+7}{2}\right)$ (3, 5) = $\left(3, \quad \right)$ $\frac{r+7}{2} =$ r =
3. B(3, 4), C(7, 5), D(6, 2) and E are the vertices of a parallelogram. Find the coordinates of the point E	Let the vertex E be (x, y). The midpoint of BD = $\left(\frac{3+6}{2}, \quad \right)$ $= \left(\quad ,3\right)$. The midpoint of CE = $\left(\quad , \frac{5+y}{2}\right)$ The midpoint of BD = The midpoint of CE. $\left(\quad , \quad \right) = \left(\frac{9}{2}, 3\right)$ $\frac{7+x}{2} = \frac{9}{2}$ and $\frac{5+y}{2} = 3$ $x =$ and $y =$.

EXERCISES 6.3.1

1. Find the midpoint of each pair of points.

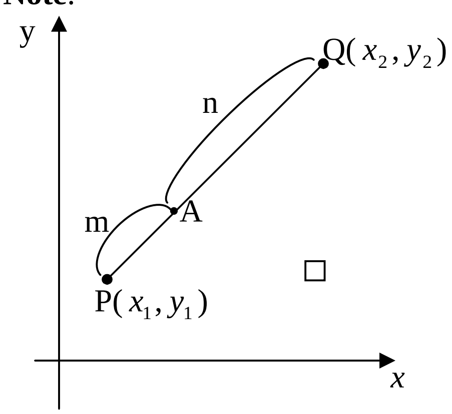
(a) I(4, -5) and J(6, 13)	(b) V(-4, 6) and W(2,-10)

2. If M(3, q) is the midpoint of the straight line K(2, 6) and L(4, 5). Find the value of q.

3. The coordinates of points R and S are (4, *k*) and (h,5) respectively. Point T(-1, 2) is the midpoint of RS. Find the values of h and *k*.

6.3.2 Finding the coordinates of a point that divides a line according to a given ratio *m* : *n*.

Note:



If A divides PQ according to a ratio m : n,then

A(x, y) =

Examples	Solution
1. Given that G(-3, 6) and H(7, 1). If B divides GH according to the ratio 2:3, find the coordinates of B.	Let the coordinates of point B be (x,y). Coordinates of point B = $\left(\frac{nx_1 + mx_2}{m+n}, \frac{ny_1 + my_2}{m+n}\right)$ $= \left(\frac{3(-3)+2(7)}{2+3}, \frac{3(6)+2(1)}{2+3}\right)$ $=$ (1, 4).

Examples	Solution
2. Given the points P(-1, 3) and Q(8, 9). Point R lies on the straight line PQ such that 2PR = RQ. Find the coordinates of point R.	Given 2PR = RQ, therefore $\frac{PR}{RQ} = \frac{1}{2}$, m = 1 and n = 2 Coordinates of point R = $\left(\frac{2(-1)+1(8)}{1+2}, \frac{2(3)+1(9)}{1+2} \right)$ = (2, 5)
3. Point P(-3, -2) divides internally a line segment joining two points R(6, 1) and S(-6, -3). Find the ratio of division of line segment RS.	Let the ratio is (m, n). (-3,-2) = $\left(\frac{n(6)+m(-6)}{m+n}, \frac{n(1)+m(-3)}{m+n} \right)$ -3 = $\frac{6n+6m}{m+n}$ -3(m + n) = 6n + 6m -3m – 3n = 6n + 6m 3m = 9n $\frac{m}{n} = \frac{3}{1}$, m : n = 3 : 1.

EXERCISES 6.3.2

1. The coordinates of K and L are (10, 5) and (5, 15) respectively. If point M divides KL to the ratio of 2 : 3, find the coordinates of point M.

2. Given point P(*k*, 1), Q(0,3) and R(5, 4) find the possible values of *k* if the length of PQ is twice the length of QR.

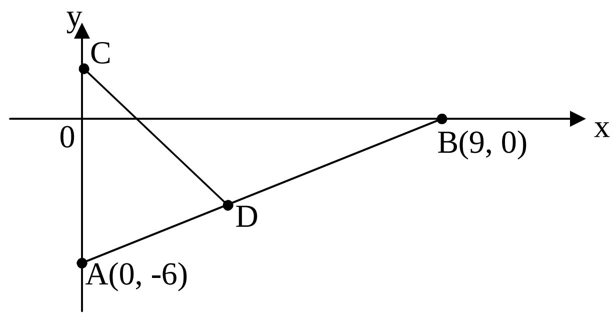
3. P(a, 1) is a point dividing the line segment joining two points A(4, 3) and B(-5, 0) internally in the ratio m : n. Find
   (a) m : n.
   (b) the value of a.

4. K(-4, 0), L and P(8, 6) are three points on the straight line KL such that $\frac{KL}{LP} = m$. Find the coordinates of point L in terms of m.

SPM QUESTIONS.

1. The points A(2h, h), B(p, t) and C(2p, 3t) are on a straight line. B divides AC internally in the ratio 2 : 3. Express p in the terms of t. (2003, Paper 1)

2. Diagram 1 shows a straight line CD meets a straight line AB at the point D. The point C lies on the y- axis. (2004/P2)



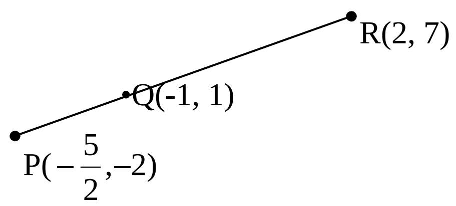
Given that 2AD = DB, find the coordinates of D.

ASSESSMENT **(30 minutes)**

1. Given the distance between point Q (4, 5) and R (2, t) is $2\sqrt{5}$, find the possible values of t.

2. Given the points A (-2, 3), B (-4, 7) and C (5, -6).If P is the midpoint of AB, find the length of PC.

3. In the diagram, PQR is a straight line. Find the ratio of PQ : QR.



4. The points P(h, 2h), Q(k , l) and R(3k , 2l) are collinear. Q divides PR internally in the ratio 3 : 2. Express k in the terms of l.

ANSWERS:

Exercise 6.2

1. (a) 5 units
   (b) 12.728 units
   (c) 1.4142 units
   (d) 4.0311 units

3. 2, -2 units.

Exercise 6.3.1

1. (a) (5 , 4)
   (b) (-1, -2)
2. $5\frac{1}{2}$
3. h = -6, k = -1.

Exercise 6.3.2

1. (8, 9)
2. -10
3. (a) 2 : 1
   (b) -2

4. $\left(\frac{8m-4}{m+1}, \frac{6m}{m+1} \right)$

SPM QUESTIONS

1. p = -2t
2. D = (3, -4)

ASSESSMENT

1. 1 , 9
2. 13.6015 units.
3. 1 : 2
4. $m = \frac{1}{8}n$

ADDITIONAL MATHEMATICS

MODULE 11

COORDINATE GEOMETRY

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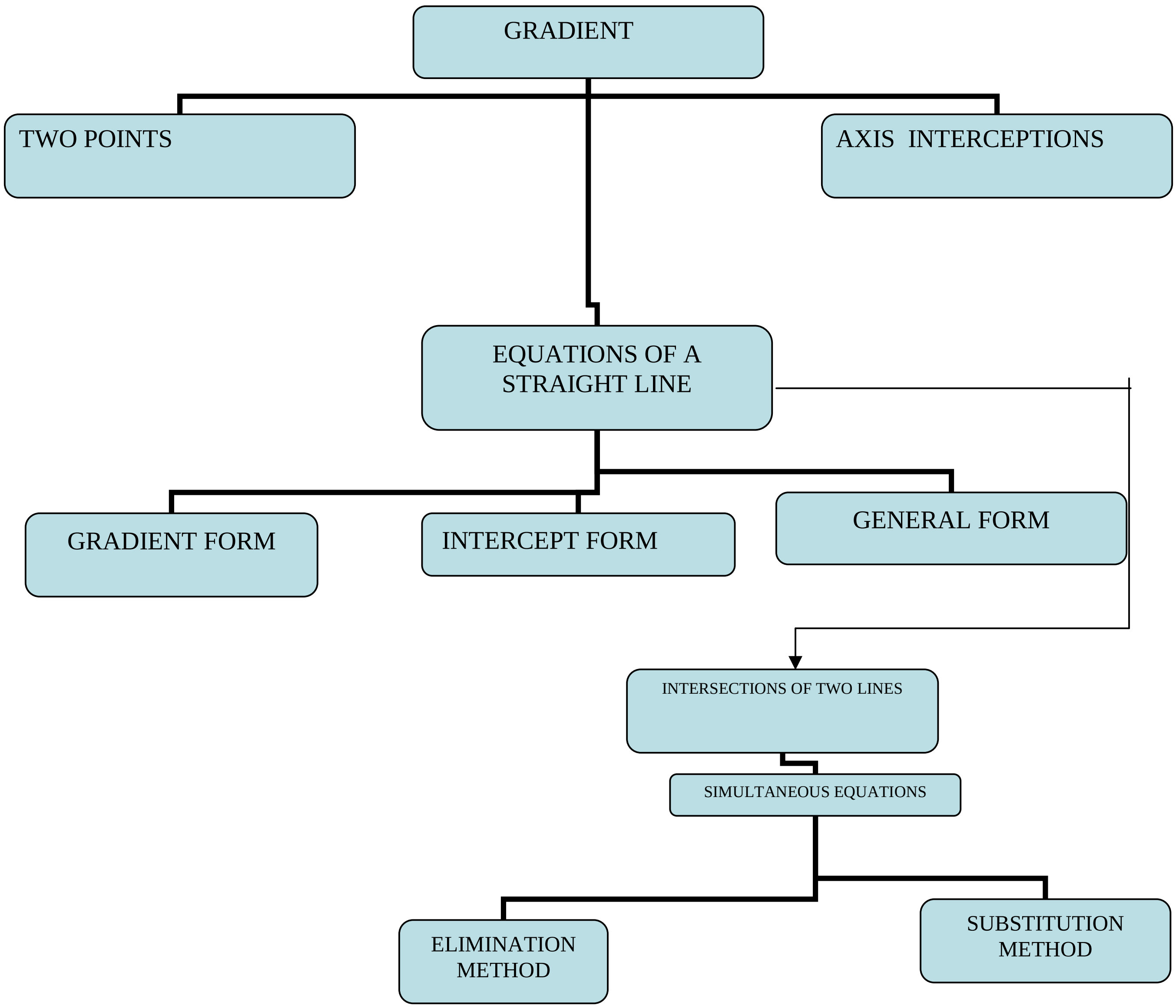
CHAPTER 6: COORDINATE GEOMETRY
6.1 : CONCEPT MAP

THE GIST OF THIS MODULE

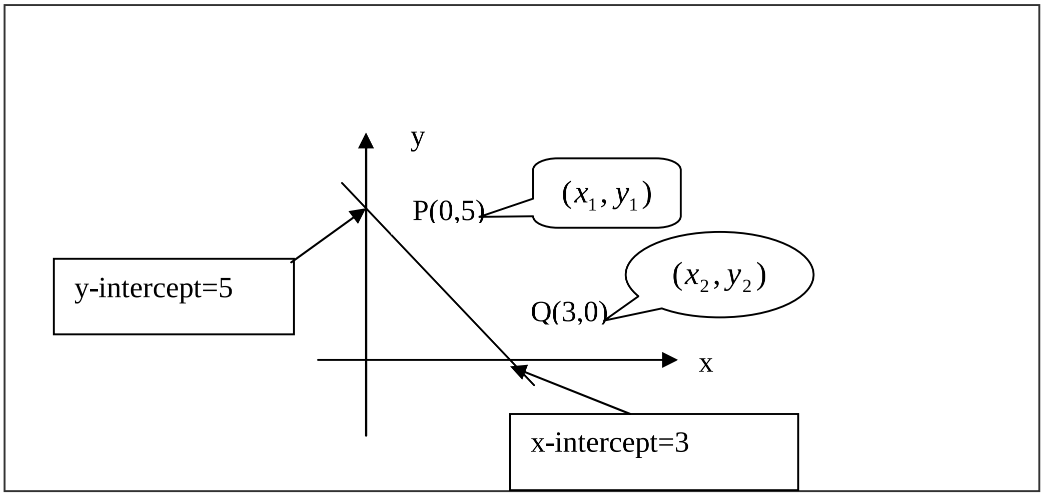


6.2.GRADIENT OF A STRAIGHT LINE

6.2.1 AXIS INTERCEPTIONS

Find the x-intercepts,y-intercepts and gradients of the following straight lines PQ.

Example:

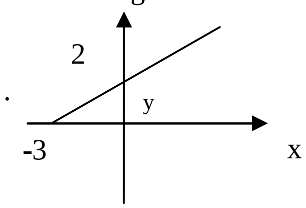


$$Gradient PQ = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{0-5}{3-0} \qquad = -\frac{5}{3}$$

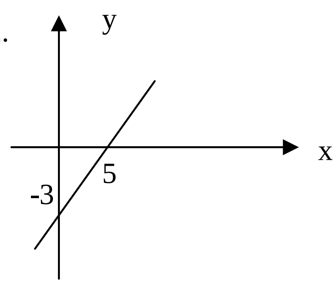
EXERCISE 1:

1.Find the gradients of the following straight lines.



Gradient=............

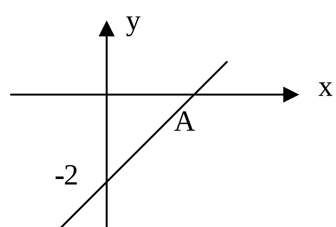
2.



Gradient =..

3.Find the gradient of a straight line that intercepts the x-axis at 2 and the y-axis at -4
Answer:

4.



The diagram shows a straight line which has a gradient of ½. Find the coordinates of point A.
Answer:

6.3.Gradient of a straight line that passes through two points

Gradient = $\dfrac{y_2 - y_1}{x_2 - x_1}$

Example: Find the gradient of a straight line that passes through points A (2,-4) and B(4,8)

Solution:

Gradient of AB , $m_{AB} = \dfrac{8-(-4)}{4-2}$

$= 6$

EXERCISE 2

1. Find the gradient of the straight line joining each of the following pairs of points

(a) (1,3) and (4,9)

Answer:

(b) (-1,2) and (1,8)

Answer:

2. Find the value of h if the straight line joining the points (2h,-3) and (-2,-h + 2) has a gradient of 2.

Answer:

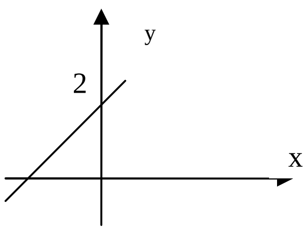
3.Given P(3a-1,-a), Q(-5,3) and R(1,6) are three points on a straight line. Find the value of a.

Answer:

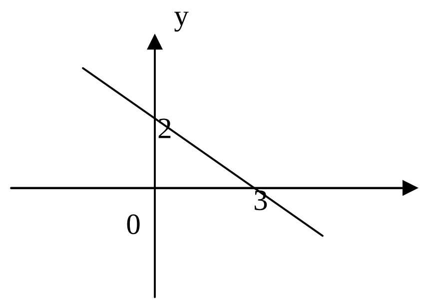
Self assessment I !

1.Find the gradients of the following straight lines.

(a)



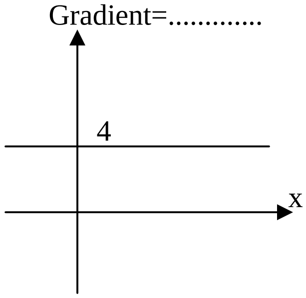
(b)



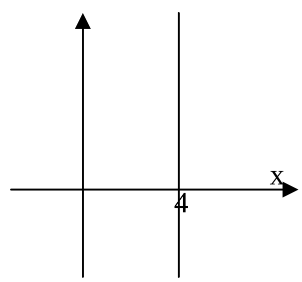
Gradient =..........

Gradient=............

(c)



(d)

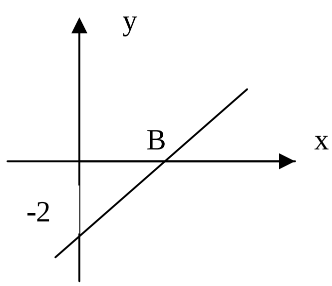


Gradient =.............

Gradient =..............

2.The diagram shows a straight line which has a gradient of 2. Find the coordinates of point B.

Answer...



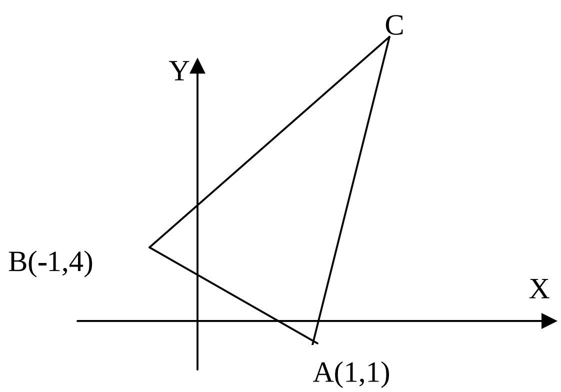
3.A straight line with a gradient of ½ passes through a point (-2,4) and intersects the x-axis and the y-axis at points A and B respectively. Find the coordinates of points A and B.
Answer:

4.A straight line has a gradient of h/4 and passes through a point (0,4h).
(a) Find the equation of the straight line.
(b) If the straight line passes through point (-4,3),find the value of h.
Answer:

(a)

(b)

5..



The figure on the previous page shows a triangle ABC with A(1,1) and B(-1,4). The gradients of AB, AC and BC are -3m,3m and m respectively.

(i) Find the value of m
(ii) Find the coordinates of C
(iii) Show that AC=2AB

Answer:

(i)

(ii)

(iii)

****

6.4 EQUATION OF A STRAIGHT LINE

METHODOLOGY:

6.4.1. GIVEN THE GRADIENT (m) AND PASSING THROUGH POINT (X_1, Y_1)
6.4.2 LINE WHICH PASSED THROUGH TWO POINTS (X_1, Y_1) AND (X_2, Y_2)
6.4.3 GIVEN THE GRADIENT(m) AND Y-INTERCEPTS(c)

6.4.1 *GIVEN THE GRADIENT(m) AND PASSING THROUGH POINT* (X_1, Y_1)

	m	(x1,y1)	Y-y1=m(x-x1)	Y=mx + c	Equation in general form ax+by+c=0
Examples:	5	(0,-4)	Y-(-4)=5(x-0) Y+4 =5x	Y=5x-4	5x-y-4=0
1.	$\frac{1}{3}$	(3,0)			
2.	$\frac{-1}{3}$	(-3,0)			
3.	-3	(-1,4)			

6.4.2 *LINE WHICH PASSED THROUGH TWO POINTS* (X_1, Y_1) *AND* (X_2, Y_2)

	x_1	y_1	x_2	y_2	$\frac{y-y_1}{x-x_1}=\frac{y_2-y_1}{x_2-x_1}$	Y=mx+c	Equation in general form (ax+by+c=0)
Example	1	3	4	9	$\frac{y-3}{x-1}=\frac{9-3}{4-1}$		

					$\frac{y-3}{x-1}=\frac{6}{3}=2$ y-3=2(x-1) y-3=2x-2	Y=2x-2+3 Y=2x+1	2x-y+1=0
1.	-1	2	1	-8			
2.	2	-2	-b	4b			
3.	3a-1	-a	-5	3			

6.4.3 ***GIVEN THE GRADIENT(m) AND Y-INTERCEPTS(c)***

	m	y-intercept	Y=Mx+c	$\frac{x}{a}+\frac{y}{b}=1$	Ax+by+c=0
Example:	$\frac{-3}{2}$	-3	Y=$\frac{-3}{2}$x − 3	$\frac{x}{-2}+\frac{y}{-3}=1$	-3x-2y-6=0
1	5	-4			
2	$-\frac{1}{2}$	-6			
3	$-\frac{2}{5}$	-2			

****

6.5 Self assessment III!

1.A straight line which passes through the points (2,3) and (5,m) has gradient m. Find the value of m.

Answer:

2.Find the equation of the straight line which joins the points P(-3,4) and Q (-1,-2). Given that the line intersects the y-axis at the point R, find the length of PR

Answer:

3.Given the points A (-1,15), B(2,7) and C (4,10). The point P divides the straight line BC in the ratio 1:2. Find the equation of the straight line which passes through the points P and A.

Answer:

4.The straight line intersects x-axis and y-axis at point A(3,0) and B(0,20 respectively. Find

(a) the equation of straight line in:

(i) Intercept form

Answer

(ii) Gradient form

Answer

(iii) general form
Answer:

(b) the equation of straight line that passes through the point A and with gradient 2
Answer:

6.4.4 Point of intersection of two lines

example: Find the point of intersection of the straight lines y=-2x + 1 and y = $\frac{1}{2}x + 6$

Solution: y = -2x + 1 ....(1)

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

(2) x 4: 4y =2x + 24 ....(3)
(1) + (3): 5y = 25
y = 5
Substitute y =5 into (1)
5 = -2x + 1
2x = -4
x = -2
Therefore the point of intersection is (-2,5)
****

6.6 Self assessment III !

1.Two straight lines $\frac{y}{6} - \frac{x}{2} = 1$ and ky = -x + 12 intersect the y-axis at the same point. Find the value of k
Answer;

2.A straight line passes through a point (5,1) and the x-intercept is 10. If the straight line intersects the y-axis at point R, find

(a) the equation of the straight line

Answer

(b) the coordinate of point R

Answer

****

Short Test (20 minute)

****

1. The diagram below shows a straight line CD which meets a straight line AB at point C. Point D lies on the y-axis.

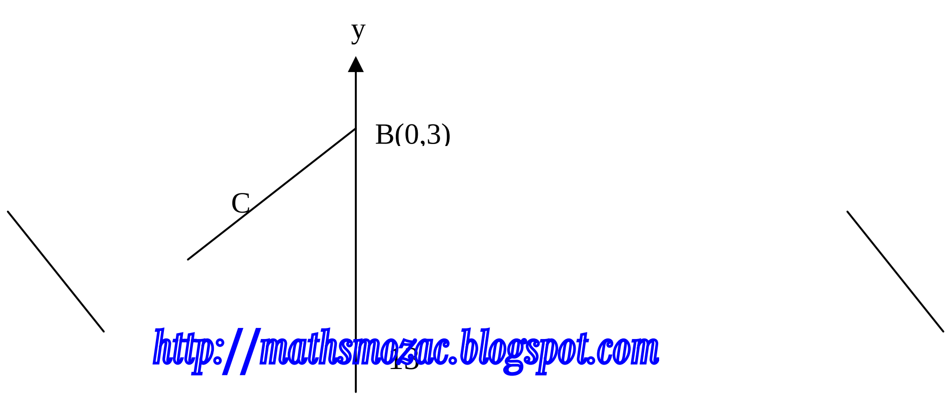
(a) Write down the equation of AB in the intercept form

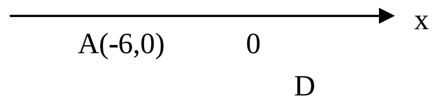
(b) Given that 2AC = CB, find the coordinate of point C

Answer:

(a)

(b)





Answers:

Exercise 1.

1) 2/3 2) 3/5 3) 2 4) 4

Exercise 2

1a) m=2 1b) m=3

2) h= -3

3.) a= -2

Self assessment I

1a) $\frac{2}{3}$

1b) $-\frac{2}{3}$

1c.) zero

1d) undefined

2) A(4,0)

3) A(-10,0) , B(0,5)

4a) $y = \frac{h}{4}x + 4h$

4b) h= 1

5(i) m=½ (ii) C=(5,7) (iii) AC=$\sqrt{52}, AB = \sqrt{13}$

Self assessment II

1) m=-3/2 2)PR=$\sqrt{90}unit$ 3) 11y+21x=144

4a.(i) $\frac{x}{3}+\frac{y}{2}=1$

(ii) $y=2-\frac{2}{3}x$

(iv) -2x-3y + 6 =0

4b) y=2x-6

Self assessment III

1) k=2 2a) 5y=-x+10 2b) R(0,2)

Short test

1a) $\frac{x}{-6}+\frac{y}{3}=1$ 1b) C(-4,1)

ADDITIONAL MATHEMATICS

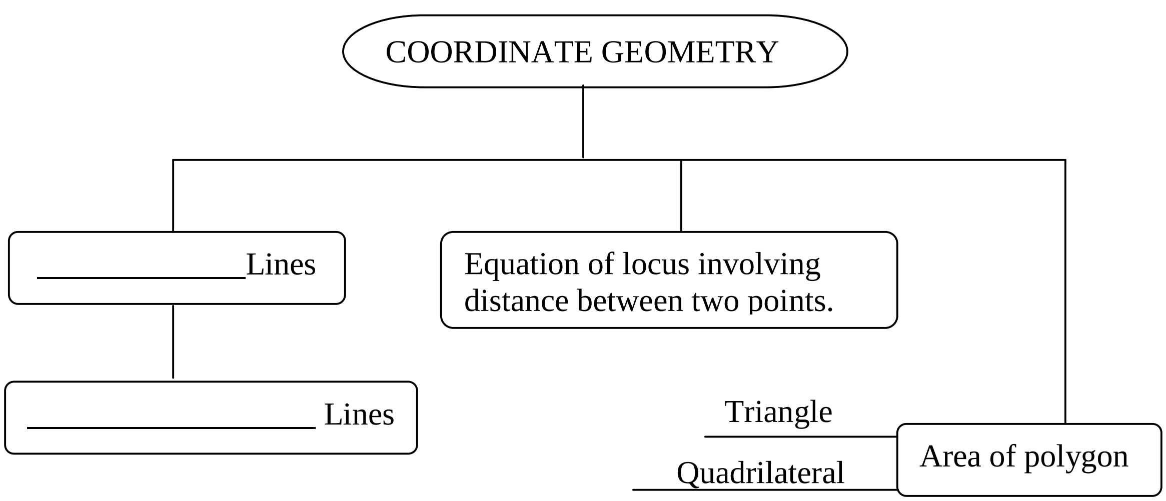
MODULE 12

COORDINATE GEOMETRY

CONTENTS

6.0 PARALLEL LINES AND PERPENDICULAR LINES.

6.1 Conceptual Map



6.2.1 Parallel line.

Notes:
Two straight line are parallel if $m_1 = m_2$ and vise versa.

Examples	Solution
1. Determine whether the straight lines 2y – x = 5 and x – 2y = 3 are parallel.	2y – x = 5, y = $\frac{1}{2}x+5$, $m_1 = \frac{1}{2}$ x – 2y = 3 y = $\frac{1}{2}x-3$, $m_2 = \frac{1}{2}$ Since $m_1 = m_2$, therefore the straight lines 2y – x = 5 and x – 2y = 3 are parallel.
2. Given that the straight lines 4x + py = 5 and 2x – 5y – 6 = 0 are parallel, find the value of p.	Step1: Determine the gradients of both straight lines. 4x + py = 5 y = $-\frac{4}{p}x+\frac{5}{p}$, $m_1 = -\frac{4}{p}$ 2x – 5y – 6 = 0 y = $\frac{5}{2}x+3$, $m_2 = \frac{5}{2}$ Step 2: Compare the gradient of both straight lines. Given both straight lines are parallel, hence $m_1 = m_2$ $-\frac{4}{p} = \frac{2}{5}$ p = -10
3. Find the equation of the straight line which passes through the point P(-3, 6) and is parallel to the straight line 4x – 2y + 1 = 0.	4x – 2y + 1 = 0, y = 2x + $\frac{1}{2}$. Thus, the gradient of the line, m = 2. Therefore, the equation of the line passing through P(-3, 6) and parallel to the line 4x – 2y + 1 = 0 is y - 6 = 2 (x - -3) y = 2x + 12.

EXERCISES 6.2.1.

1. Find the value of k if the straight line y = kx + 1 is parallel to the straight line 8x – 2y + 1 = 0.

2. Given a straight line 3y = mx + 1 is parallel to $\frac{x}{3}+\frac{y}{5}=1$. Find the value of m.

3. Given the points A(1, 2), B(4, -3),C(5, 4) and D(h, -1). If the straight line AB is parallel to the straight line CD, find the value of h.

4. Find the equation of a straight line that passes through B(3, -1) and parallel to 5x – 3y = 8.

5. Find the equation of the straight line which passes through the point A(-2, 3) and is parallel to the straight line which passes through the points P(1, 2) and Q(5, 1).

6.2.2 Perpendicular Lines.

Notes:
Two straight lines are perpendicular to each other if $m_1 m_2 = -1$ and vise versa.

Examples	Solution
1. Determine whether the straight lines 3y – x – 2 = 0 and y + 3x + 4 = 0 are perpendicular.	3y – x – 2 = 0 y = $\frac{1}{3}x + \frac{2}{3}$, $m_1 = \frac{1}{3}$ y + 3x + 4 = 0 y= – 3x – 4, $m_2 = -3$ $m_1 m_2 = \frac{1}{3} \times (-3)$ = -1. Hence, both straight lines are perpendicular.

Examples	Solution
2. Find the equation of the straight line which is perpendicular to the straight line x + 2y – 6 = 0 and passes through the point (3, -4).	x + 2y – 6 = 0 y = $-\frac{1}{2}x + 3$, $m_1 = -\frac{1}{2}$ Let the gradient of the straight line which is perpendicular = m_2 $\left(-\frac{1}{2}\right)m_2$ = -1 m_2 = The equation of the straight line = y =

EXERCISES 6.2.2.

1. The equation of two straight line are $\frac{x}{3}+\frac{y}{5}=1$ and 3x – 5y = 8. Determine whether the lines are perpendicular to each other.

2. Find the equation of the straight line which passes through point (2, 3) and perpendicular of the straight line 2y + x = 4.

3. Given the points A(k, 3), B(5, 2), C(1, -4) and D(0, 6). If the straight line AB is perpendicular to the straight line CD, find the value of k.

4. Find the value of h if the straight line y – hx + 2 = 0 is perpendicular to the straight line 5y + x + 3 = 0

6.2.3 Problem involving The Equations Of Straight Lines.

Examples	Solution
1. Given A(3, 2) and B(-5, 8). Find the equation of the perpendicular bisectors of the straight line AB.	The gradient of AB, $m_1 = \text{——} = -\text{——}$ The gradient of the perpendicular line = m_2 $m_1 m_2 =$ $m_2 =$ The midpoint of AB = The equation of the perpendicular bisector, =

EXERCISES 6.5.4

1. Given that PQRS is a rhombus with P(-1, 1) and R(5, 7), find the equation of QS.

2. ABCD is a rectangle with A(-4, 2) and B(-1, 4). If the equation of AC is 4x + 7y +2 = 0, find
   (a) the equation of BC.
   (b) the coordinates of points C and D.

3. PQRS is a rhombus with P(0, 5) and the equation of QS is y = 2x + 1. Find the equation of the diagonal PR.

4. A(2, k), B(6, 4) and C(-2, 10) are the vertices of a triangle which is right-angled at A. Find the value of k.

6.3 EQUATION OF A LOCUS

6.3.1 Locus of a point that moves in such a way that its distance from a fixed point is a constant.

Example:	Solution
1. A point K moves such that its distance from a fixed point A(2,1) is 3 units. Find the equation of the locus of K.	Let the coordinates of K be (x,y) Distance of KA = = 3 unit Hence, $\sqrt{(x-2)^2+(y-1)^2}$ = = $x^2-4x+4+y^2-2y+1=9$ $x^2-4x+4+y^2-2y+1-9=0$ $x^2+y^2-4x-2y-4=0$ The equation of the locus of P is $x^2+y^2-4x-2y-4=0$

Exercises 6.3.1

1. Find the equation of the locus point M which moves such that its distance from each fixed point is as follows.

a. 5 units from A (-2,1)	b. 7 units from B (-3,-1)
c. 12 units from C (0,1)	d. 3 units from D (2,0)

6.3.2 Locus of a point that moves in such away that the ratio of its distances from two fixed points is a constant.

Example:
A point P moves such that it is equidistant from points A (2,-1) and B (3,2). Find the equation of the locus of P.

Solution:

Let the coordinates of P be (x,y)
Distance of AP = Distance of BP

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

$$x^2-4x+4+y^2+2y+1=x^2-6x+9+y^2-4y+4$$

$$2x + 6y = 8$$

$$x + 3y = 4$$

The equation of the locus of P is x+ 3y =4

Exercises 6.3.2

1. A point P moves such that it is equidistant from points A (3,2) and B (2,1). Find the equation of the locus of P.
2. Given points R(4,2), S(-2,10) and P (x,y) lie on the circumference of diameter RS. Find the equation of the moving point P.
3. Points A(4,5),B(-6,5) and P are vertices of a triangle APE. Find the equation of the locus of point P which moves such that triangle APB is always right angled at P.

6.3.3 Problems solving involving loci

Example:

1. Given points A (2, 5), B (-6,-1) and P(x, y) lie on the circumference of a circle of diameter AB. Find the equation of the moving point P.

Solution:

Distance of AB = $\sqrt{(2--6)^2+(5--10)^2}$

= $\sqrt{}$

= 10 units

So radius of circle = ____

Let the mid-point of points A and B be C. C is also the center of the circle.

Coordinates of C = $\left(\frac{2+(-6)}{2}, \frac{5+(-1)}{2}\right)$

= (-2,2)

Hence, CP = 5

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

$$x^2+4x+4+y^2-4y+4=25$$

$$\boxed{x^2+y^2+4x-4y-17=0}$$

The equation of the locus of P is ____

Exercise 6.3.3

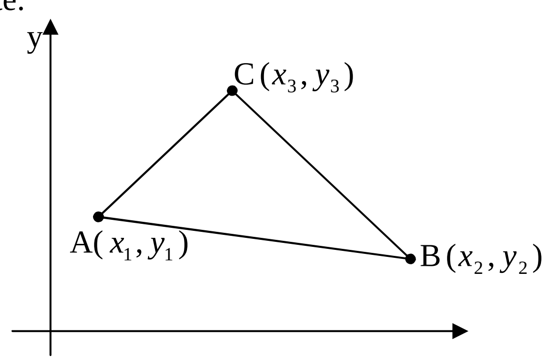
1. A point P moves along the arc of a circle with center C (3,1). The arc passes through A(0,3) and B (7,s). Find
   (a) the equation of the locus of point P
   (b) the values of s

2. Given the points are A (1,-2) and B(2,-1) . P is a point that moves in such a way that the ratio AP: BP = 1:2
   (a) Find the equation of the locus of point P
   (b) Show that point Q (0,-3) lies on the locus of point P.
   (c) Find the equation of the straight line AQ
   (d) Given that the straight line AQ intersects again the locus of point P at point D, find the coordinate of point D.

6.4 AREA OF POLYGON.

6.4.1 Finding the area of triangle

Note:



Area of triangle ABC = $\frac{1}{2}\left| \qquad \right|$

$= \frac{1}{2}\left(\qquad \right)$

x

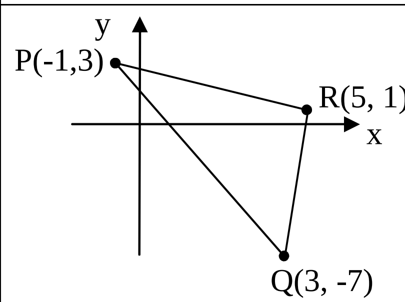
- Area of triangle ABC = 0 $\leftrightarrow$ A, B and C are ________________________.
- If the coordinate of the vertices are arranged clockwise in the matrix form, the area of triangle obtained will be a ________________ value.

6.4.2 Finding the area of quadrilateral

- Given a quadrilateral with vertices A(x_1, y_1), B(x_2, y_2), C(x_3, y_3) and D((x_4, y_4) .

The area of quadrilateral ABCD = $\frac{1}{2}\left| \qquad\qquad\qquad\qquad \right|$

=

Example	Solution
1. Given P(-1, 3) , Q(3, -7) and R(5, 1), find the area of triangle PQR.	 Area of triangle PQR = $\frac{1}{2}\begin{vmatrix} -1 & 3 & 5 & -1 \\ 3 & -7 & 1 & 3 \end{vmatrix}$ = $\frac{1}{2}\left[7+3+15-9-(-35)-(-1)\right]$ = $\frac{1}{2}(52)$ = 26 units.
2. The vertices of a triangle are (-3, q) , (5,1) and (-1, 3). If the triangles has an area of 20 unit^2, find the possible values of q.	Area of triangle = $\frac{1}{2}\begin{vmatrix} 5 & -1 & -3 & 5 \\ 1 & 3 & q & 1 \end{vmatrix} = \pm 20$

	$\frac{1}{2}[15+(-q)+(-3)-(-1)-(-9)-5q] = \pm 20$ $22 - 6q = \pm 40$ $22 - 6q = 40$ or $22 - 6q = -40$ $q = -3$ or $q = 10\frac{1}{3}$.
3. ABCD is a parallelogram. Given A (-2, 7), B(4, -3)and C(8, -11), find (a) point D (b) the area of the parallelogram.	(a) Let the vertex D be (x, y). The midpoint of AC = $\left(\frac{-2+8}{2}, \frac{7+(-11)}{2}\right)$ = (3, -2) The midpoint of BD = $\left(\frac{4+x}{2}, \frac{-3+y}{2}\right)$ The midpoint of BD = The midpoint of AC. $\left(\frac{4+x}{2}, \frac{-3+y}{2}\right)$ = (3, -2) $\frac{4+x}{2} = 3$ and $\frac{-3+y}{2} = -2$ $x = 2$ and $y = -1$. Point D(2, -1). (b) The area = $\frac{1}{2}\begin{vmatrix} -2 & 2 & 8 & 4 & -2 \\ 7 & -1 & -11 & -3 & 7 \end{vmatrix}$ $= \frac{1}{2}(2+(-22)+(-24)+(28)-14-(-8)-(-44)-6)$ $= \frac{1}{2}(16)$ = 8 units^2.

EXERCISES 6.4

1. Given S(2, 2), T(0,7) and U(5,4) are the vertices of ΔSTU. Find the area of ΔSTU.

2. Find the possible values of k if the area of a triangle with vertices A(3, 2), B(-1, 6) and C(k, 5) is 8 units^2.

3. Show that the points (-9, 2), (3, 5) and (11, 7) are collinear

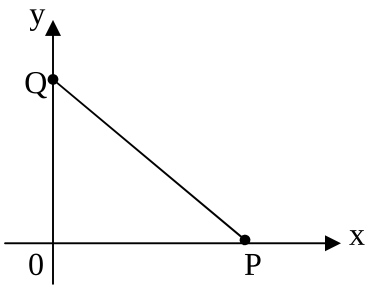
4. The vertices of quadrilateral PQRS are P(5, 2) , Q(a, $2a$), R(4, 7) and S(7, 3). Given the area of quadrilateral PQRS is 12 unit^2, find the possible values of a.

5. Given that the area of the quadrilateral with vertices A(5, -3), B(4, 2), C(-3, 4) and D(p, q) is 19 unit^2, show that $7p + 8q - 6 = 0$.

SPM QUESTIONS.

1. The equations of two straight lines are $\frac{y}{5}+\frac{x}{3}=1$ and 5y = 3x + 24. Determine whether the lines are perpendicular to each other. (2003/P1)

2. Diagram shows a straight line PQ with the equation $\frac{x}{2}+\frac{y}{3}=1$. The points P lies on the x-axis and the point Q lies on the y–axis. (2004/P1)



Find the equation of a straight line perpendicular to PQ and passing through the point Q.

3. A point P moves along the arc of a circle with centre A(2, 3). The arc passes through Q(-2, 0) and R(5,k). (2003/P2)
   (a) Find the equation of the locus of the point P,
   (b) Find the values of k.

5. The point A is (-1, 3) and the point B is (4, 6). The point P moves such that PA:PB = 2:3. Find the equation of the locus P.

<u>ASSESSMENT</u> (30 minutes)

5. Find the equation of the straight line which is parallel to line 2y + x = 7 and passes through the point of intersection between the lines 2x – 3y = 1 and x – 2y = 3.

6. Given A(6, 0) and B(0,-8). The perpendicular bisector of AB cuts the axes at P and Q. Find
   (a) the equation of PQ,
   (b) the area of ΔPOQ, where O is the origin.

7. The point moves such that its distance from Q(0, 4) and R(2, 0) are always equal. The point S however moves such that its distance from T(2, 3) is always 4 units. The locus of point P and the locus of point S intersect at two points.
   (a) Find the equation of the locus of the point P.
   (b) Show that the locus of the point S is $x^2 + y^2 - 4x - 6y - 3 = 0$.
   (c) Find the coordinates of the points of intersection for the two loci.

8. Find the possible values of k if the area of a triangles with vertices A(9, 2), B(4, 12) and C(k, 6) is 30 units^2.

Answer:

Exercise 6.2.1

1. k = 4
2. m = -5
3. h = 8
4. $y = \frac{5}{3}x - 6$
5. $y = -\frac{1}{4}x + \frac{5}{2}$

Exercise 6.2.

1. perpendicular to each other

2. y = x + 1
3. k = 15
4. h = 5

Exercise 6.2.3

1. x + y – 6 = 0
2. (a) 3x + 2y – 5 = 0
   (b) C(3, -2), D(0, -4)
3. x + 2y – 10 = 0
4. k =2 or k = 12.

Exercise 6.3.1.

1a. $x^2 + y^2 + 4x - 2y = 0$
 b. $x^2 + y^2 + 6x + 2y + 3 = 0$
 c. $x^2 + y^2 - 2y - 143 = 0$
 d. $x^2 + y^2 - 4x - 5 = 0$

Exercise 6.3.2

1. x + y = 4
2. $x^2 + y^2 - 2x - 12y + 12 = 0$
3. $x^2 + y^2 + 2x - 10y + 1 = 0$

Exercise 6.3.3

1 a. $x^2 + y^2 - 6x - 2y - 15 = 0$
  b. s = 4 @ s = -2
2 a. $3x^2 + 3y^2 - 4x + 14y + 15 = 0$.
  b. substitute x = 0, y = –3
  c. y = x – 3
  d. $D(\frac{4}{3}, -\frac{5}{3})$

Exercise 6.4

1. $\frac{19}{2}$ units
2. k = -4, 4
3. a $= 8\frac{6}{7}$ or a= 2

SPM QUESTION

1. Perpendicular
2. $y = \frac{2}{3}x + 3$
3. $x^2 + y^2 - 4x - 6y - 12 = 0$
4. k = -1 or k = 7.

ASSESSMENT

1. $2y + x + 17 = 0$
2. (a) $3x + 4y + 7 = 0$

   (b) $2\frac{1}{24}$ unit^2
3. (a) $x - 2y + 3 = 0$

   (c) x = 5.76, -1.36

   y = 4.38, 0.82