

module module

TEACHING & LEARNING

ADDITIONAL MATHEMATICS

FORM 4

COORDINATE GEOMETRY

CHAPTER 6

NAME:.....

FORM :.....

Date received :

Date completed

Marks of the Topical Test :

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Additional Mathematics Department
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For Internal Circulations Only

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

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

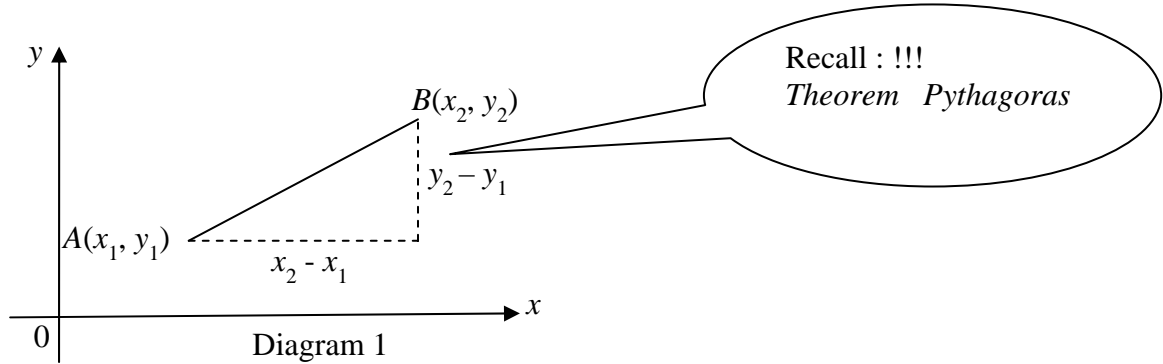
3 A point dividing segment of a line, $(x, y) = \left(\frac{nx_1 + mx_2}{m + n}, \frac{ny_1 + my_2}{m + n} \right)$

4 Area of triangle $= \frac{1}{2} |(x_1y_2 + x_2y_3 + x_3y_1) - (x_2y_1 + x_3y_2 + x_1y_3)|$

Students will be able to:

1. Find distance between two points
- 1.1 Find the distance between two points using formula.

1. Finding Distance Between Two Points



Distance between A and B given by , $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Example 1 [Ans a) 15 unit b) $p = 0$ or $p = 10$]

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| <p>a) Find the distance between $A(4,15)$ $B(-5,3)$</p> | <p>b) Distance between $A(p,-6)$ and $B(-5,6)$ is 13 unit. Find the possible value of p</p> |
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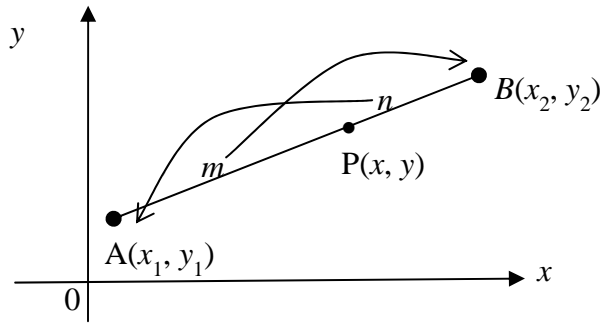
Exercise 1 [Ans a) 13 unit b) $b = -3$ or 9]

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| <p>a) Find the distance between $A(7,-4)$ and $B(2,8)$</p> | <p>b) Given points $P(2,6)$, $Q(7,3)$ and $R(-3,b)$. Find the value of b if $PQ = \frac{1}{2}QR$</p> |
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Homework Text Book Skill Practice 6.1 page 91

Students will be able to:

2. Understand the concept of division of a line segments .
- 2.1 Find the midpoint of two given points.
- 2.2 Find the coordinates of a point that divides a line according to a given ratio $m : n$.



Given $A(x_1, y_1)$ and $B(x_2, y_2)$, the mid point of AB
 $= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

The coordinates of a point, P that internally divides a line segment in the ratio $m : n =$

$$(x, y) = \left(\frac{nx_1 + mx_2}{m + n}, \frac{ny_1 + my_2}{m + n} \right)$$

Example 2 [Ans a) (-1, 1) b) (0,9)]

a) Find the coordinates of midpoint of the pair of points $A(6, -5)$ and $B(-8, 7)$

b) $ABCD$ is a parallelogram. Given that the diagonal intersection is at $(1, 6)$ and point D is $(2, 3)$. Find the coordinates of B

Exercise 2 [Ans a) $x = 8, y = 14$ b) $a = 5, b = -1/12, c = -23/12$]

a) Given that the midpoint AB is $(3, 4)$, $A(-2, -6)$ and $B(x, y)$. Find the value of x and y

b) Given that vertices of a rhombus are $A(-1, 2)$, $B(a, b)$, $C(0, -4)$ and $D(-6, c)$, Find the value of a, b , and c

Example 3 [Answer (3 , 3/2) b) m : n = 2 : 3]

| | |
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| a) The point G (x, y) internally divides the line segment joining points A(6,3) and B(2,1) in the ratio 3 : 1. Find the coordinates of point G | b) The point P (6/5 , -1) internally divides the line segment joining points S (4,3) and T (-3,-7) in the ratio m : n. Find the ratio m : n . |
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Exercise 3 [Answer (-1 , $-6\frac{1}{2}$) b) 1 : 5 , a = -1 c) (-9, $22\frac{1}{2}$) d) (8 , $2\frac{2}{3}$)]

| | |
|---|---|
| a) Point C internally divides the line AB in the ratio 5 : 3. Given that point A and B are (-6, -9) and (2, -5). Find the coordinates of C | b) The point P (-3, a) internally divides the line segment joining points A (-6, -2) and B(12,4) in the ratio m : n. Find the ratio m : n and the value of a |
| c) Point P internally divides the line AB so that $PA = \frac{2}{3}PB$. If the coordinates of P is (-3, 12) and point A is (1,5), Find the coordinates of B. | d) The coordinates of points A and B are (11, 1) and (2,6) respectively. Point Q lies on the straight line AB such that $2AQ = QB$. Find the coordinates of point Q. |



Students will be able to:

- 3.0 Find areas of polygons.
- 3.1 Find the area of a triangle based on the area of specific geometrical shapes.
- 3.2 Find the area of a triangle by using formula.
- 3.3 Find the area of a quadrilateral using formula.

Notes

The area of a polygon formed by the points $A(x_1, y_1)$, $B(x_2, y_2)$, $C(x_3, y_3)$ $G(x_n, y_n)$ as vertices is given by the positive values of the formula

$$Area = \frac{1}{2} \begin{vmatrix} x_1 & x_2 & x_3 & \dots & x_n & x_1 \\ y_1 & y_2 & y_3 & \dots & y_n & y_1 \end{vmatrix}$$

All points must arranged in order i.e point ABCD or ADCB **not** ACDB .

Example 4 [Answer 11 unit² b) 34 unit²]

a) Find the areas of a triangle with vertices are A (5,2), B (1,3) and C(-5 - 1)

b) The vertices of a quadrilateral are A (1 ,-2) B(6,2), C (5,6) and D (-2,3). Find the area of a quadrilateral ABCD.

Exercise 4 [Answer 10 unit² b) 35 unit²]

c) Find the areas of a triangle with vertices are A (2,6) , B (-5,5) and C (1,3)

d) The vertices of a quadrilateral are A (5,10) B(10,11) C (12,6) and D (3,5). Find the area of a quadrilateral ABCD.

Example 5 [Answer $a = 15$ or $-6\frac{1}{2}$]

a) The vertices of a triangle are $(2a, a)$, $(5, 6)$ and $(9, 4)$. Find the value of a if the area of the triangle is 43 unit^2 .

b) Show that $A(-4, 1)$, $B(1, -2)$ and $C(6, -5)$ lie on a straight line

Exercise 5 [Answer $a = 3$ b) $q = 3$ or $-1\frac{1}{3}$]

a) The vertices of a quadrilateral are $(-a, 4a)$, $(9, 11)$ and $(1, 2)$ and $(-11, 3)$. Find the value of a if the area of quadrilateral is 116 unit^2 .

b) Find the value of q if the points $A(2, 1)$, $B(6, q)$ and $C(3q, \frac{9}{2})$ are collinear.

Homework Text Book Skill Practice 6.3 pg 100

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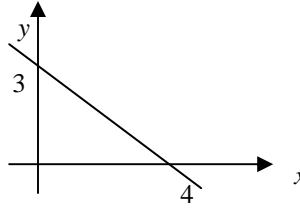
Students will be able to:

4. Understand and use the concept of equation of a straight line.
 - 4.1 Determine the x -intercept and the y -intercept of a line.
 - 4.2 Find the gradient of a straight line that passes through two points.
 - 4.3 Find the gradient of a straight line using the x -intercept and y -intercept.
 - 4.4 Find the equation of a straight line given:
 - a) gradient and one point; b) two points; c) x -intercept and y -intercept.
 - 4.5 Find the gradient and the intercepts of a straight line given the equation.
 - 4.6 Change the equation of a straight line to the general form.
 - 4.7 Find the point of intersection of two lines.

4.1 Determining the x-intercept and the y-intercept of a line
Example 6

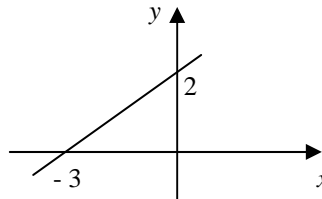
a) State the x – intercept and the y – intercept of the straight line passing through each of the following pairs of points (0, -9) and (8, 0).

b) Find the intercept of the following graphs



c) State the x – intercept and the y – intercept of the straight line passing through each of the following pairs of points (- 4, 0) and (0 , -6).

d) Find the intercept of the following graphs



Home work Text Book exercise 6.4.1 pg 101

4.2 Finding the gradient of a straight line that passes through two points.

$$\text{The gradient of a straight line that passes through two points is given } m = \frac{y_1 - y_2}{x_1 - x_2}$$

Example 7

a) Find the gradient of the straight line that passing the points (- 2 , -9) and (8, 5).

b) Given that the gradient of the straight line passing through P (1, a) and Q (4p , 9) is 3, Find the value of a

c) Find the gradient of the straight line that passing the points (- 4 , -7) and (3, 5).

d) Given that the gradient of the straight line passing through A (a , 3) and Q (4 , 9) is 2 , Find the value of a

Homework Text Book exercise 6.4.2 pg 103

4.3 Finding the gradient of a straight line using the x-intercept and y-intercept.

$$\text{Gradient, } m = - \frac{y - \text{intercept}}{x - \text{intercept}}$$

Find the gradient of each line in 4.1

| | | | |
|----|----|----|----|
| a) | b) | c) | d) |
| | | | |

Homework Text Book exercise 6.4.3 pg 105

4.4 Finding the equation of a Straight Line

- | | |
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| <p>1. If the gradient m and a point (x_1, y_1) lie on a straight line The equation of a straight line is given by $y - y_1 = m(x - x_1)$</p> <p>2. If two point (x_1, y_1) and (x_2, y_2) lies on a straight line is given The equations of a straight line is $\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$</p> | <p>3. Given two point $(a, 0)$ and $(0, b)$ where a is x-intercept and b is y-intercept The equation of a straight line is given by $\frac{x}{a} + \frac{y}{b} = 1$</p> |
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Example 6 [Answer $y = 2/3x + 5$, b) $y = 3 - x$ c) $2x + y = 10$]

| | | |
|--|---|--|
| <p>a) Find the equation of a straight line where the gradient is $\frac{2}{3}$ and passing through the point $(-6, 1)$</p> | <p>b) Find the equation of the straight line that passes through the points $(-2, 5)$ and $(4, -1)$</p> | <p>c) Find the equation of the straight line that passes through the points $(5, 0)$ and $(0, 10)$</p> |
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Exercise 6 [Answer $y = 3x + 11$ b) $x + 5y = 16$ c) $5x + 3y = 15$]

| | | |
|---|---|---|
| <p>a) Find the equation of a straight line where the gradient is 3 and passing through the point $(-2, 5)$</p> | <p>b) Find the equation of the straight line that passes through the points $(1, 3)$ and $(6, 2)$</p> | <p>b) Find the equation of the straight line that passes through the points $(3, 0)$ and $(0, 5)$</p> |
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Home work Text Book exercise 6.4.4 pg 107

4.5 Finding the gradient and the intercepts of a straight line given the equation.

The equations of a straight line can be expressed in gradient form or intercept form and subsequently determine the gradient and the intercept of the straight line

- a) Gradient form, $y = mx + c$, where m is the gradient and c is the y -intercept
- b) Intercept form $\frac{x}{a} + \frac{y}{b} = 1$ where a is the x -intercept and b is the y -intercept

Example 7 [Answer $y = -3/2x + 7$, b) $y = \frac{5}{3}x - 7$ c) $\frac{x}{-10} + \frac{y}{-2} = 1$]

| | | |
|--|---|---|
| <p>a) Express the equation of the straight line $2y + 3x = 14$ in gradient form. Hence state the gradient and the y-intercept of the line</p> | <p>b) Write the equation of the straight line with a gradient of $\frac{5}{3}$ and y-intercept of -7 in gradient form .</p> | <p>c) Express the equation of the straight line $5y + 4x + 10 = 0$ in intercept form. Hence, state the x- intercept and y- intercept</p> |
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Exercise 7 $y = -\frac{5}{3}x - 3$, b) $y = -7x + 11$ c) $\frac{x}{-4} + \frac{y}{2} = 1$]

| | | |
|---|--|--|
| <p>a) Express the equation of the straight line $3y + 5x + 9 = 0$ in gradient form. Hence state the gradient and the y-intercept of the line</p> | <p>b) Write the equation of the straight line with a gradient of -7 and y-intercept of 11 in gradient form .</p> | <p>c) Express the equation of the straight line $2x + 8 = 4y$ in intercept form. Hence, state the x- intercept and y- intercept</p> |
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Home work Text Book exercise 6.4.5 pg 109

4.6 Changing the equation of a straight line to the general form.

The equation of a straight line in general form is written as $ax + by + c = 0$

Example 8

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|---|---|--|
| <p>a) Express the equation of the straight line $2y + 3x = 14$ in general form</p> | <p>b) Express the equation of the straight line $y = -\frac{3}{2}x - 14$ in general form</p> | <p>c) Express the equation of the straight line $\frac{x}{5} - \frac{y}{4} = 1$ in general form</p> |
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Exercise 8

| | | |
|--|--|--|
| <p>a) Express the equation of the straight line $2y + 8 = 7x$ in general form</p> | <p>b) Express the equation of the straight line $y = \frac{7}{5}x - 12$ in general form</p> | <p>c) Express the equation of the straight line $\frac{3x}{5} - \frac{2y}{3} = 1$ in general form</p> |
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Home work Text Book exercise 6.4.6 pg 109

4.7 Find the point of intersection of two lines.

When two lines intersect, the point of intersection is the point that lies on both lines. Hence, we can find the point of intersection by solving the equations of both lines simultaneously

Example 8 [Answer a) (0,9) b) $y = 3x$]

a) Find the point of intersection of the straight lines $y = 4x - 9$ and $\frac{x}{18} - \frac{y}{9} = 1$

b) Find the equation of the straight line that passes through the origin and the intersection point of $3x - 2y + 3 = 0$ and $3x + y - 6 = 0$.

Exercise 8 [a) Answer (11,-3) b) $x - 4y + 3 = 0$

a) Find the point of intersection of the straight lines $x + 2y = 5$ and $2x + y = 19$

b) Find the equation of a straight line that has a gradient of $\frac{1}{4}$ and passes through the point of intersection of the straight lines $y = 3x - 2$ and $2x + 3y - 5 = 0$

Home work Text Book exercise 6.4.7 pg 111 Skill practice 6.4 pg 111

5.1

Students will be able to:

5. Understand and use the concept of parallel and perpendicular lines

5.1 Determine whether two straight lines are parallel when the gradients of both lines are known and vice versa.

5.2 Find the equation of a straight line that passes through a fixed point and parallel to a given line.

5.3 Determine whether two straight lines are perpendicular when the gradients of both lines are known and vice versa.

5.4 Determine the equation of a straight line that passes through a fixed point and perpendicular to a given line.

5.5 Solve problems involving equations of straight lines.

5.1 Determining whether two straight lines are parallel when the gradients of both lines are known and vice versa

If two lines have an equal gradient, they must be parallel. Conversely if two lines are parallel, they have an equal gradient. $y = m_1x + c_1$ and $y = m_2x + c_2$ are parallel if and only if $m_1 = m_2$

Example 9 [b) Answer $k = -10/3$]

| | |
|---|---|
| a) Show that $A(-1, 2)$, $B(2, 3)$ and $C(5, 4)$ are collinear | b) Given that the straight line $5x + ky = 3$ and $2y - 3x - 8 = 0$ are parallel. Find the value of k |
|---|---|

Exercise 9 [Answer $k = 4$]

| | |
|---|---|
| a) Given that the straight line $kx - 2y + 1 = 0$ and $8x - 4y - 3 = 0$ are parallel. Find the value of k | b) If $A(-2, 4)$, $B(1, k)$ and $C(2, -8)$ are collinear find the value of k |
|---|---|

Homework Text Book exercise 6.5.1 pg 114

5.2 Finding the equation of a straight line that passes through a fixed point and parallel to a given line.

Example 10 Answer a) $2y = 5x - 17$ b) $6y = -5x + 64$]

| | |
|--|--|
| a) Find the equation of the straight line that passes through $A(5, 4)$ and parallel to the line $5x - 2y - 1 = 0$ | b) Find the equation of the straight line that passes through $P(8, 4)$ and parallel to the line which joins $A(-1, 2)$ and $B(5, -3)$ |
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Exercise 10 Answer a) $y = \frac{3}{2}x + 7$ b) $y = -1/2x - 2$

| | |
|---|--|
| a) Find the equation of the straight line that passes through $A(-2, 4)$ and parallel to the line $3x - 2y - 1 = 0$ | c) Find the equation of the straight line that passes through $A(2, -3)$ and parallel to the line which joins $B(2, 0)$ and $C(-6, 4)$ |
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Homework Text Book exercise 6.5.2 pg 115

5.4 Determining whether two straight lines are perpendicular when the gradients of both lines are known and vice versa.

Two straight lines with gradient m_1 and m_2 are perpendicular if and only if $m_1 m_2 = -1$

Example 11 [Answer $p = -6$]

| | |
|--|---|
| <p>a) Given that the straight line $px - 10y - 7 = 0$ and $5x - 3y - 4 = 0$ are perpendicular to each other Find the value of p</p> | <p>b) Given the point P (-3,3) , Q (3,1) and R (-2,4) and S ((1,5) , show that PQ is perpendicular to RS</p> |
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Exercise 11 [Answer $p = 2/3$]

| | |
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| <p>a) Given that the straight line $y + mx = 5$ and $2y = 3x + 4$. are perpendicular to each other Find the value of m.</p> | <p>b) Given the point A (4,3) , B (8,4) and R (7,1) and S ((6,5) , show that AB is perpendicular to RS</p> |
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Homework Text Book exercise 6.5.3 pg 118

5.5 Determining the equation of a straight line that passes through a fixed point and perpendicular to a given line

Example 12 [a) $3x - 4y + 23 = 0$ b) $2x + y + 1 = 0$]

| | |
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| <p>a) Given that P(2,1) and Q (-4,9). Find an equation of the perpendicular bisector of PQ</p> | <p>b) Find an equation of the straight line passing through the point (1 , -3) and perpendicular to the line $x - 2y + 6 = 0$</p> |
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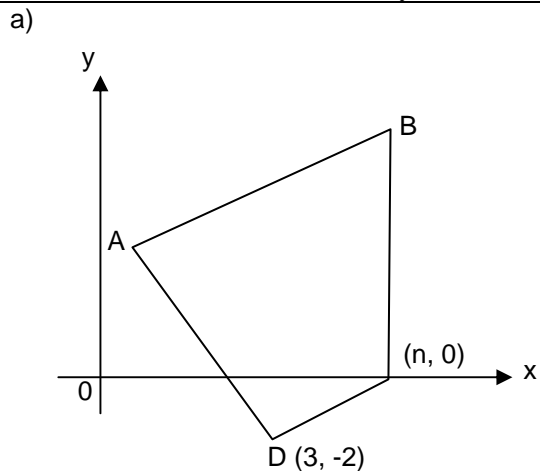
Exercise 12 [a) $x - 6y + 4 = 0$ b) $3x + 2y + 3 = 0$]

| | |
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| <p>a) Given that R(3,-5) and S (1,7). Find an equation of the perpendicular bisector of RS</p> | <p>b) Find an equation of the straight line passing through the point (3 , -3) and perpendicular to the line $2x - 3y + 6 = 0$</p> |
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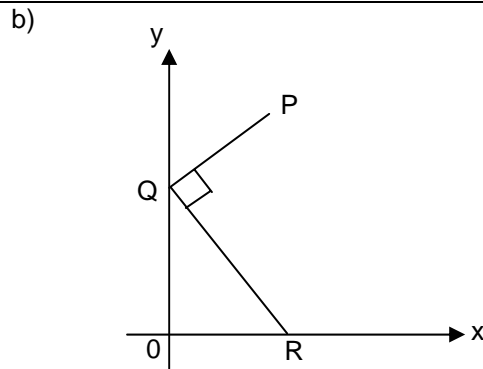
Homework Text Book exercise 6.5.4 pg 119

5.6 Solve problems involving equations of straight lines.

Example 12 [a) $n = 6$ b) $4y = x + 32$]



The diagram shows a trapezium $ABCD$. Given that the equation of straight line of AB is $3y - 2x - 1 = 0$. Find the value of n .



In the above diagram, PQ dan QR are a straight line that perpendicular to each other at point Q . Given that the equation of QR ialah $y = 8 - 4x$, Find the equation PQ .

Homework Text Book Skill Practice 6.5 pg 121

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Students will be able to:

6.0 Understand and use the concept of equation of locus involving distance between two points.

6.1 Find the equation of locus that satisfies the condition if:

- a) the distance of a moving point from a fixed point is constant;
- b) the ratio of the distances of a moving point from two fixed points is constant.

6.2 Solve problems involving loci.

Example 12 [Answer $x^2 + y^2 + 4x - 6y - 12 = 0$, b) $3x - 5y - 5 = 0$]

a) A point P moves in a Cartesian plane such that its distance from $A(-2,3)$ is 5 unit. Find the equation of the locus of P

b) Find the equation of the locus of a moving point R such that its distance from $A(4,-2)$ is equal to its distance from $B(1,3)$

Exercise 12 [Answer a) $x^2 + y^2 - 4x + 10y - 35 = 0$ b) $5x^2 + 5y^2 - 64x - 2y + 189 = 0$

a) Find the equation of locus of a moving P such that its distance from point $A(2, -5)$ is 8 unit

b) A moving point R moves such that its distance from $A(0, -3)$ and $B(6, 0)$. are in ratio $RA : RB = 4 : 1$. Find the equation of the locus of R

c) A moving point A moves such that its distance from $P(2, 1)$ and $Q(-1, 3)$ are in the ratio $1 : 2$. Find the equation of the locus of P
[Answer $3x^2 + 3y^2 - 18x - 2y + 10 = 0$]

d) $P(2, 6)$ and $R(-4, -2)$ is a diameter of a circle. Point $Q(x, y)$ moves along the arc of a circle. Find the equation of the locus of the point Q [Answer $x^2 + y^2 + 2x - 4y - 20 = 0$]