

CHAPTER 7

Coordinates

WHAT WILL YOU LEARN?



- 7.1** Distance in the Cartesian Coordinate System
- 7.2** Midpoint in the Cartesian Coordinate System
- 7.3** The Cartesian Coordinate System



WORD LINK

- | | |
|-------------------|----------------|
| • Midpoint | • Titik tengah |
| • Distance | • Jarak |
| • Position | • Kedudukan |
| • Coordinate | • Koordinat |
| • x -axis | • Paksi- x |
| • y -axis | • Paksi- y |
| • Hypotenuse | • Hipotenus |
| • Origin | • Asalan |
| • Plots | • Plot |
| • Cartesian Plane | • Satah Cartes |
| • Scale | • Skala |

Cartesian Coordinate System is a method to determine the position of a point or object on a plane, or into two or three dimensions.

The position on a plane is determined by the position of the point on a straight line or number. The position of a point in two dimensions is determined by the coordinate system on a Cartesian plane. The position in three dimensions is determined by three numbers.



WALKING THROUGH TIME

The Cartesian Coordinate System was introduced by René Descartes from France or better known as Cartesius. He introduced a coordinate plane which is formed by two perpendicular lines called 'axis'. Coordinates are a set of numbers that locate a point or a line.

For more information:



http://rimbunanilmu.my/mat_t2e/ms121

WHY STUDY THIS CHAPTER?

- The coordinate system has contributed a lot in the field of archaeology and geography.
- Archaeologists begin their search according to coordinate points on a map digitally.
- Astronomers can determine the position of the stars through this coordinate system.
- A location is determined by a combination of coordinate points which help geographers to identify the area and position on Earth.

CREATIVE ACTIVITY

Aim: Identifying the position of a point

Material: Worksheet

Steps:

1. Open the file MS122A and print out the worksheet.
2. By joining the vertical and horizontal distances, determine the position of the following towns: Batu Pahat, Kluang and Segamat.

QR CODE

Scan the QR Code or visit http://rimbunanilmu.my/mat_t2e/ms122a to get the worksheet.



You have learnt about coordinates of a location on a certain Cartesian plane. A coordinate is a pair of numbers that is used to determine the position of a point on the Cartesian plane. The coordinate of a point is determined based on the distance from x -axis, the distance from y -axis and the origin. Were you able to determine the distance between two points from the activity above?

7.1 Distance in a Cartesian Coordinate System

7.1.1 Distance between two points on the Cartesian plane

COGNITIVE STIMULATION

Aim: Identifying the distance between two points on a Cartesian plane

Material: Worksheet

Step:

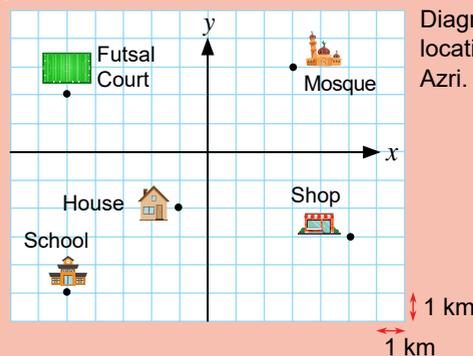


Diagram shows the plan of locations often passed by Azri.

1. Open the file MS122B and print out the worksheet.
2. In pairs, identify Azri's movements to the destinations as in the table.
3. Azri's movement must be drawn in the form of a right angled triangle.
4. Measure the horizontal and vertical distances based on 1 grid box equal to 1 km and fill in the table as show in the example.
5. Add the total distance by completing the table.

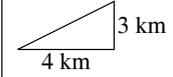
LEARNING STANDARD

Explain the meaning of distance between two points on the Cartesian plane.

QR CODE

Scan the QR Code or visit http://rimbunanilmu.my/mat_t2e/ms122b to get the worksheet.



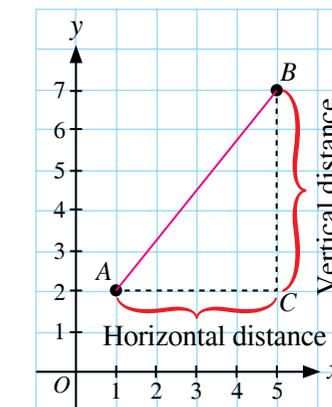
Azri's Destination	Triangular representation	Horizontal Distance	Vertical Distance	Total distance travelled = Horizontal distance + Vertical distance
School to house		4 km	3 km	4 km + 3 km = 7 km
House to futsal field				
Mosque to shop				
School to mosque				
School to shop				

Discussion:

- (i) From the representation of the right angled triangle, can you identify the nearest distance taken by Azri to a certain destination?
- (ii) What is the easiest way to calculate the shortest distance?
- (iii) What do you understand about distance on a Cartesian plane?

To determine distance between two points on a Cartesian plane, the right angled triangle representation method is used. In this method you have to identify the horizontal distance and the vertical distance of two points on a Cartesian plane. This distance can be determined from the scale on the x -axis and the y -axis.

AB is the shortest distance, taken without going through C



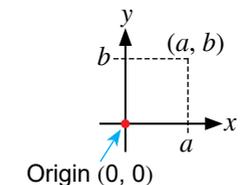
The Pythagoras theorem is used to calculate the distance AB , that is

$$AB^2 = AC^2 + CB^2$$

$$AB = \sqrt{AC^2 + CB^2}$$

DO YOU KNOW?

The Cartesian plane has two axes as in the diagram. The horizontal line is the x -axis and the vertical line is y -axis. Both lines will intersect perpendicularly. The intersection point is the origin which is the starting point for both x -axis and y -axis. The value of the numbers will increase when it moves to the right and upwards. However, the value of a number will decrease when it moves to the left and downwards.

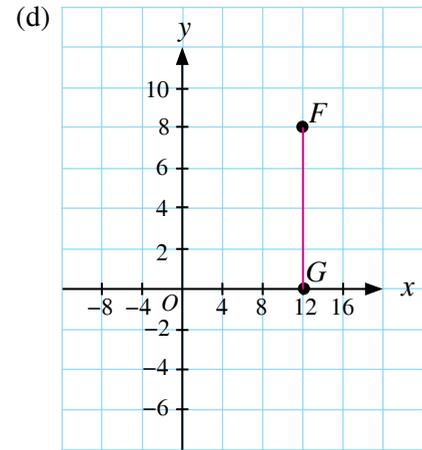
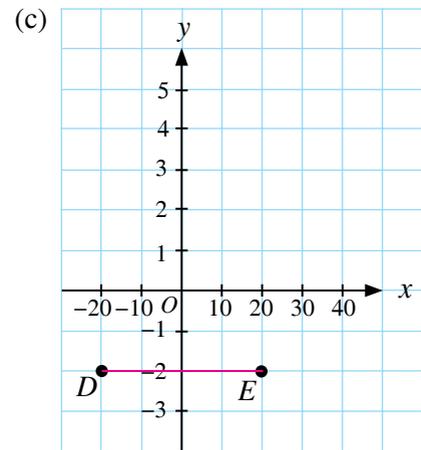
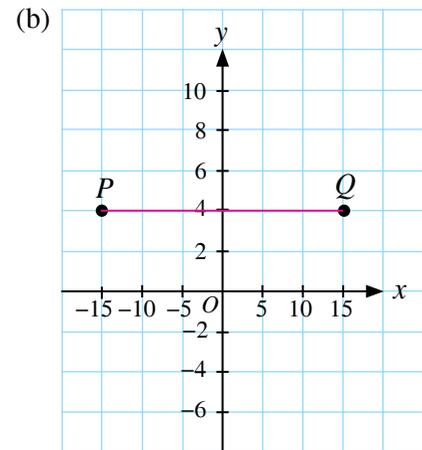
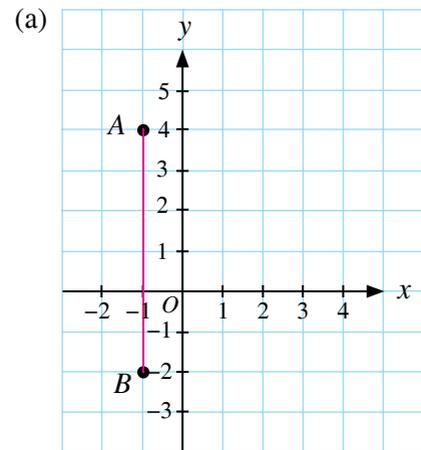


TIPS

In coordinates (x, y) , the value of x is written first followed by the value of y .

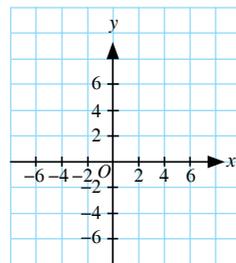
EXAMPLE 1

Determine the distance between two points in the following Cartesian plane.



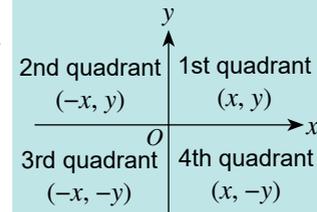
DO YOU KNOW?

What is a scale? Scales need to be determined in the Cartesian coordinate system. The units that can be written on the x -axis are 1, 2, 3, ... and on the text of the origin are -1, -2, -3, The units that can be written on the y -axis are 1, 2, 3, ... and the values below the origin are -1, -2, -3, This is how each box is represented as one unit. Apart from that, scales can be written in the sequence of 2, 4, 6, 8, ... or 5, 10, 15, ... on both axes. These conditions depend on the suitability in certain situations.



Scale on x -axis is 2 units
Scale on y -axis is 2 units

THINK SMART



If (x, y) is (3, 4) in the 1st quadrant, state the coordinates of the point in the 2nd quadrant 3rd quadrant and 4th quadrant. What type of transformation is experienced by the point?

Solution:

(a) The scale on x -axis and y -axis is 1 unit
Distance of AB
 $= 6 \times 1$
 $= 6$ units

(b) The scale on x -axis is 5 units and y -axis is 2 units.
Distance of PQ
 $= 6 \times 5$
 $= 30$ units

(c) The scale on x -axis is 10 units and y -axis is 1 unit.
Distance of DE
 $= 4 \times 10$
 $= 40$ units

(d) The scale on x -axis is 4 units and y -axis is 2 units.
Distance of FG
 $= 4 \times 2$
 $= 8$ units

7.1.2 The formula if the distance between two points on the plane

LEARNING STANDARD

Derive the formula of the distance between two points on the Cartesian plane.

COGNITIVE STIMULATION



Aim: Determining the distance between two points with the same x -coordinate and y -coordinate.

Material: Printed Worksheet

Steps:

1. With a friend, identify the coordinates on the x -axis and the y -axis.
2. Complete the table by determining the coordinates with common axis.

Example:

Coordinate		Same coordinate	Distance
$A(2, 1)$	$B(2, 4)$	x -coordinate	$4 - 1 = 3$ unit
$C(-1, 3)$	$D(7, 3)$		
$E(6, 5)$	$F(6, -5)$		
$G(-7, 2)$	$H(1, 2)$		

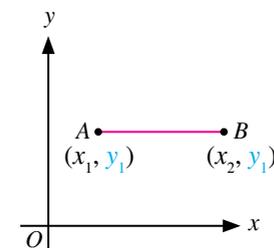
Discussion:

How can you create a simple formula for determining the distance between two points that has

- (i) the same x -coordinate?
- (ii) the same y -coordinate?

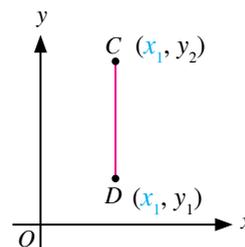
Distance can be determined if,

- (i) Two points have the same y -coordinate



Distance for $AB = (x_2 - x_1)$ unit

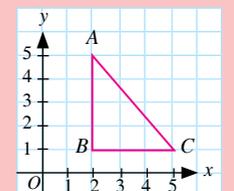
- (ii) Two points have the same x -coordinate.



Distance for $CD = (y_2 - y_1)$ unit

FLASHBACK

Look at the triangle on the Cartesian plane below.



The base of the triangle BC is parallel to the x -axis. This makes the y -coordinates the same. This is called common y -axis. It is the same the other way around.

EXAMPLE 2

Calculate the distance between the points.

- (a) (2, -3) and (4, -3)
- (b) (0, 1) and (0, -2)

Solution:

(a) The distance between the two points is
 $= 4 - 2$
 $= 2$ units ← Horizontal distance $= x_2 - x_1$

(b) The distance between the two points is
 $= 1 - (-2)$
 $= 3$ units ← Vertical distance $= y_2 - y_1$

EXAMPLE 3

The diagram shows the distance between two points A and B . Complete the coordinates of A and B .

Solution:

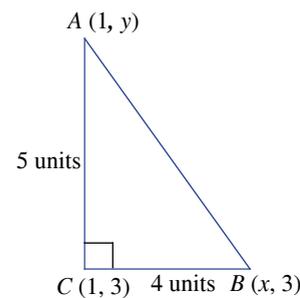
$$\begin{aligned} y - 3 &= 5 \text{ units} \\ y &= 5 + 3 \\ &= 8 \text{ units} \end{aligned}$$

$$\begin{aligned} x - 1 &= 4 \text{ units} \\ x &= 4 + 1 \\ &= 5 \text{ units} \end{aligned}$$

Therefore, coordinate A is (1, 8). Therefore, coordinate B is (5, 3).

QR CODE

Scan the QR Code or visit http://rimbunanilmu.my/mat_t2e/ms126a for the Submarine Target game.

LEARNING STANDARD

Determine the distance between two points on a Cartesian plane.

QR CODE

Scan the QR Code or visit http://rimbunanilmu.my/mat_t2e/ms126b to identify the distance between two points.



7.1.3 Distance between two points on a plane

If the straight line that joins two points on a Cartesian plane is not parallel to the x -axis or y -axis, then the distance between the two can be determined using the Pythagoras theorem.

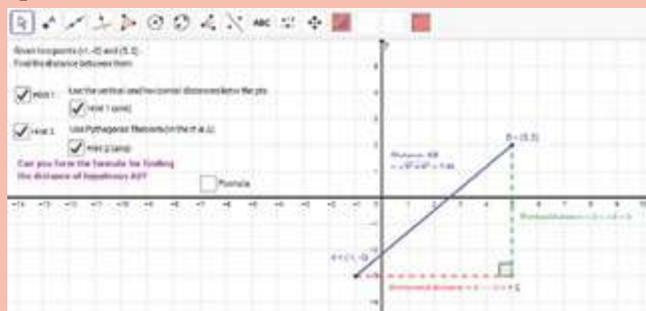
COGNITIVE STIMULATION

Aim: Identifying the distance between two points

Material: Dynamic geometry software

Steps:

1. Open the file MS126B.



2. Move the coordinates A and B on the Cartesian plane based on the table below.
3. Identify the horizontal distance and the vertical distance for the line AB .
4. Compare the displayed answers with the answers using the formula.
5. Complete the table below with the answers by choosing *Hint*.

	Points		Difference in Distance		Distance AB $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
	A	B	Horizontal $y_2 - y_1$	Vertical $x_2 - x_1$	
(a)	(1, 5)	(1, 7)	$1 - 1 = 0$	$7 - 5 = 2$	
(b)	(4, 1)	(1, 1)			
(c)	(8, 2)	(0, -4)			
(d)	(6, 7)	(2, 4)			

Discussion:

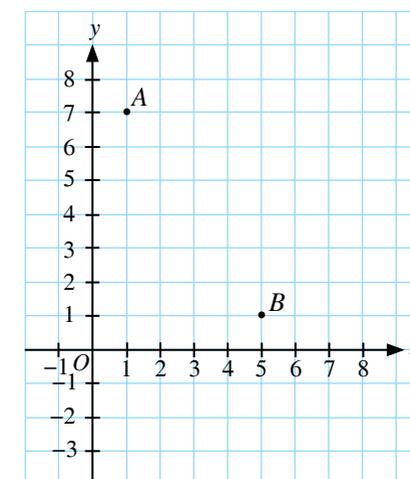
- (i) What do you understand about the distance of AB ?
- (ii) What is the relevance of Pythagoras theorem?

The distance AB is the hypotenuse. The Pythagoras theorem is used to determine the distance between two points on a Cartesian plane.

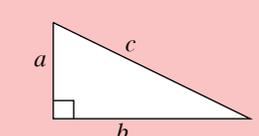
The distance between two points on a Cartesian plane $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

EXAMPLE 4

Calculate the distance between point A and point B on the Cartesian plane in the diagram below.



FLASHBACK



$$c = \sqrt{a^2 + b^2}$$

What is this formula?

The theorem shows that for a right-angled triangle, the square of its hypotenuse is equal to the sum of the squares of the other two sides.

Solution:

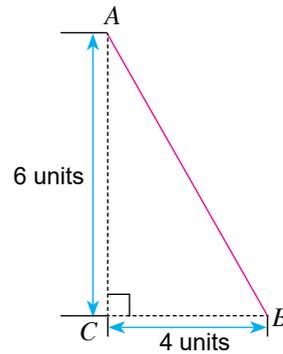
Method 1

Based on the diagram, draw a right-angled triangle ACB .

$AC = 6$ units, $BC = 4$ units

Using Pythagoras theorem

$$\begin{aligned} AB^2 &= BC^2 + AC^2 \\ AB^2 &= 4^2 + 6^2 \\ AB^2 &= 16 + 36 \\ AB &= \sqrt{52} \\ &= 7.21 \text{ units} \end{aligned}$$

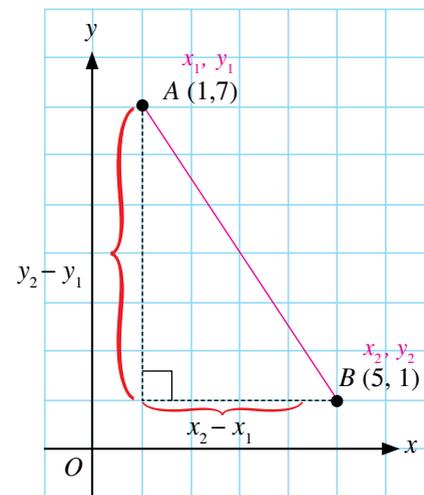


Method 2

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

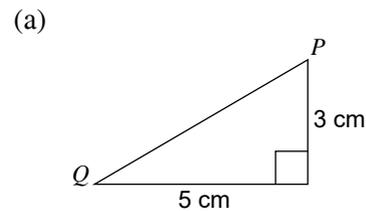
$$\begin{aligned} \text{Distance } AB &= \sqrt{(5 - 1)^2 + (1 - 7)^2} \\ &= \sqrt{4^2 + (-6)^2} \\ &= \sqrt{16 + 36} \\ &= \sqrt{52} \\ &= 7.21 \text{ units} \end{aligned}$$

Therefore, the distance of AB is 7.21 units.



EXAMPLE 5

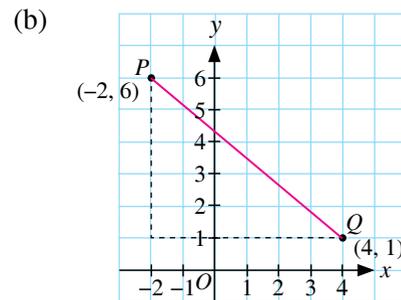
Calculate the distance between point P and point Q .



Solution:

$$\begin{aligned} \text{(a) } PQ^2 &= 5^2 + 3^2 \\ &= 25 + 9 \\ PQ &= \sqrt{34} \\ &= 5.83 \text{ cm} \end{aligned}$$

Therefore, the distance of PQ is 5.83 cm.



$$\begin{aligned} \text{(b) } PQ^2 &= \sqrt{[4 - (-2)]^2 + (1 - 6)^2} \\ &= \sqrt{6^2 + (-5)^2} \\ &= \sqrt{36 + 25} \\ &= \sqrt{61} \\ &= 7.81 \text{ cm} \end{aligned}$$

Therefore, the distance of PQ is 7.81 cm.

7.1.4 Solving problems

EXAMPLE 6

Calculate the perimeter of an isosceles triangle if the vertices for the triangle are $A(1, 1)$, $B(3, 4)$ and $C(5, 1)$.

Solution:

Understanding the problem

ABC is an isosceles triangle with vertices $A(1, 1)$, $B(3, 4)$ and $C(5, 1)$.

Planning the strategy

- Draw and determine the points on a Cartesian plane.
- Perimeter $\Delta ABC = AB + BC + AC$
- The distance of AC and AB .

Implementing the strategy

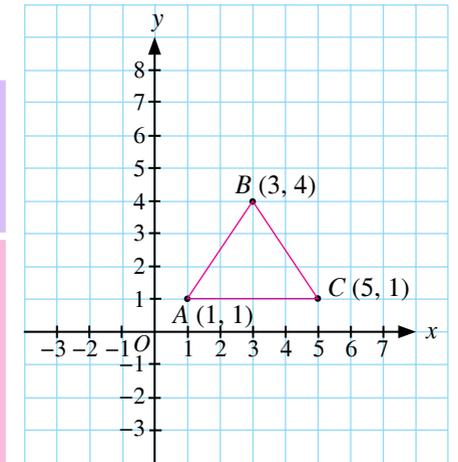
$$\begin{aligned} \text{Distance } AB &= \sqrt{3^2 + 2^2} \\ &= \sqrt{9 + 4} \\ &= \sqrt{13} \\ &= 3.6 \text{ units} \\ AB &= BC \end{aligned}$$

Conclusion

Therefore, the perimeter of the triangle ABC is $3.6 + 3.6 + 4 = 11.2$ units.

LEARNING STANDARD

Solve problems involving the distance between two points in the Cartesian coordinate system.



TIPS

The distance between two points
Distance = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Distance is the measurement of length between two points.

EXAMPLE 7

Given that the distance of $AB = 10$ units. Calculate the value of v .

Solution:

Understanding the problem

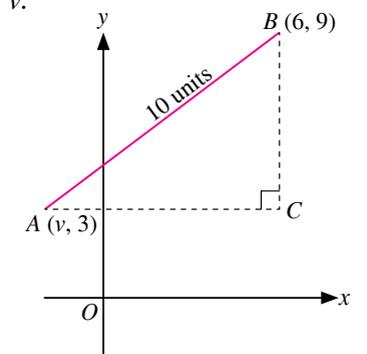
Calculate the value of v .

Planning the strategy

Distance $AB = 10$
Formula of distance
 $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Implementing the strategy

$$\begin{aligned} AB &= \sqrt{(6 - v)^2 + (9 - 3)^2} \\ 10 &= \sqrt{(6 - v)^2 + 6^2} \\ 10 &= \sqrt{(6 - v)^2 + 36} \\ 10^2 &= (\sqrt{(6 - v)^2 + 36})^2 \\ 10^2 - 36 &= (6 - v)^2 \\ \sqrt{64} &= 6 - v \\ 8 &= 6 - v \\ v &= 6 - 8 \\ v &= -2 \end{aligned}$$

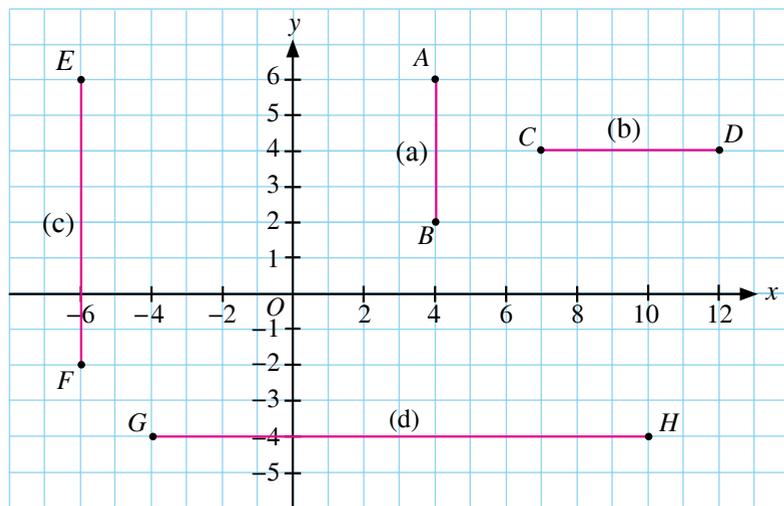


Conclusion

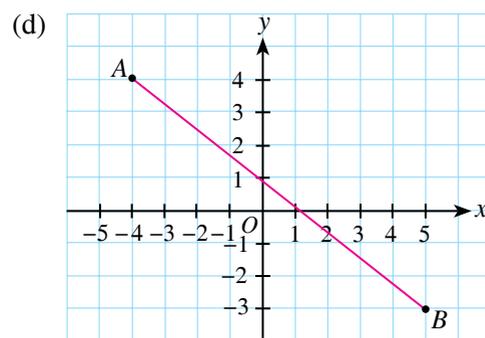
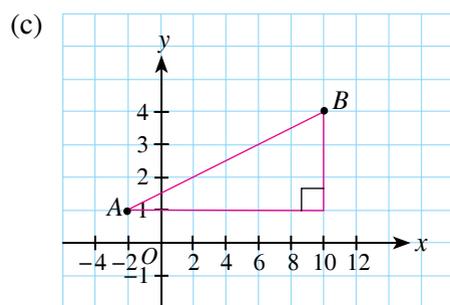
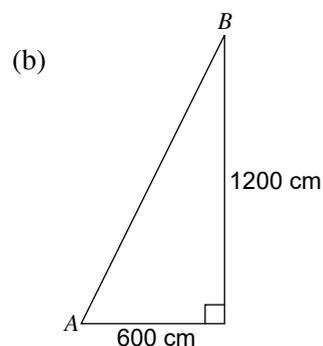
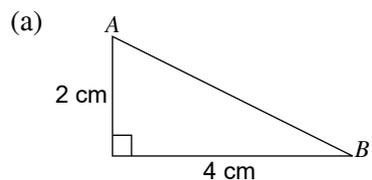
Therefore, the value of v is -2 .

SELF PRACTICE 7.1

1. Determine the distance between two points on the following Cartesian plane.



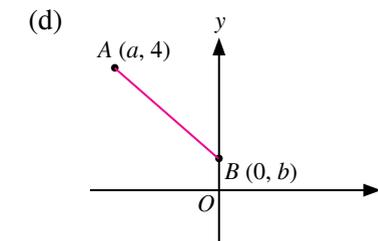
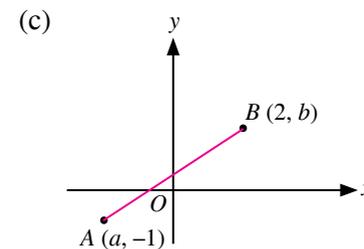
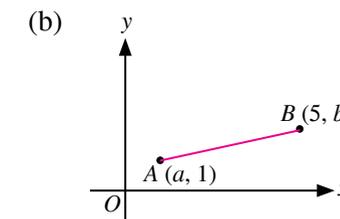
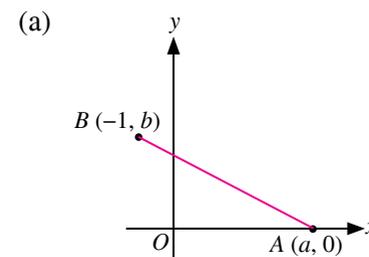
2. Calculate the distance of AB .



3. State the distance between each set of points below.

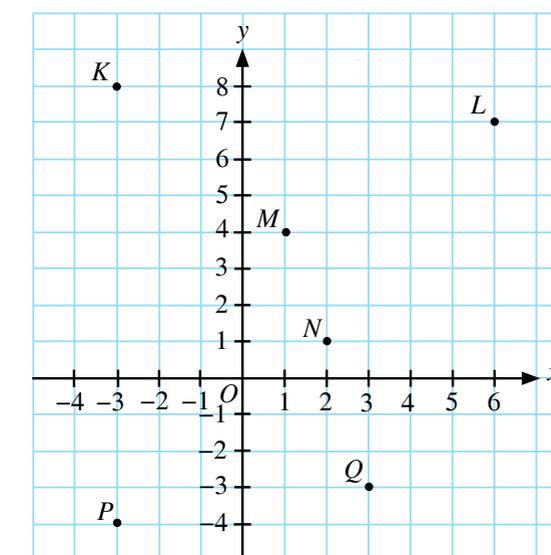
- (a) $(1, 3)$ and $(1, 7)$
- (b) $(0, -9)$ and $(0, 9)$
- (c) $(5, -2)$ and $(-2, -2)$
- (d) $(7, 4)$ and $(8, 4)$

4. Given that the horizontal distance is 4 units and the vertical distance is 3 units for the points A and B , calculate the values of a and b .



5. The diagram shows the points K, L, M, N, P and Q on the Cartesian plane. Calculate the distance between the points.

- (a) KM
- (b) ML
- (c) PN
- (d) KQ

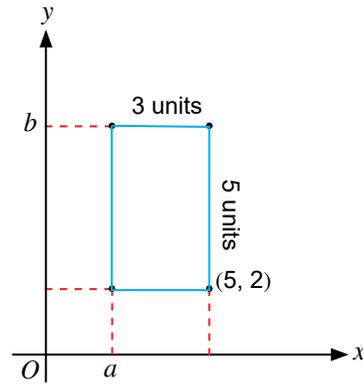


6. Determine the distance of the points KL given $K(2, 2)$ and L is on the x -axis with a distance of 7 units to the right from the y -axis.

7. Determine the distance of AB if each of them is located on the y -axis with a distance of 5 units upwards and 2 units downwards from the x -axis.

8. Calculate the distance between the points KL if L is located on the origin and K is 3 units to the left of y -axis and 5 units upwards from the x -axis.

9. Determine the values of a and b based on the information in the diagram below.

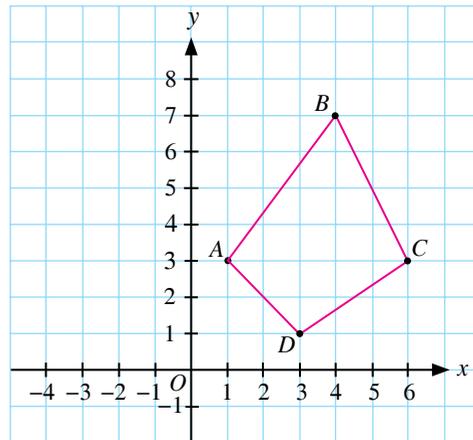


10. The vertical distance of point V is 4 units to the north of point W . Determine the coordinates of W if the coordinates of V are



- (a) $(4, -3)$
- (b) $(2, -5)$
- (c) $(5, -2)$
- (d) $(0, -4)$

11. Based on the diagram, calculate the perimeter for $ABCD$.



12. The triangle ABC has vertices $A(-2, -1)$, $B(-2, 5)$ and $C(1, -1)$. Calculate the perimeter for the triangle.



7.2 Midpoint in The Cartesian Coordinate System

7.2.1 Midpoint between two points

You have learned how to determine a radius for a certain diameter in a circle. Do you understand the concept of midpoint? Discuss this concept with your friends.

LEARNING STANDARD

Explain the meaning of midpoint between two points on the Cartesian plane.

COGNITIVE STIMULATION



Aim: Identifying the midpoint on a line

Materials: Grid paper, compasses and ruler

Steps:

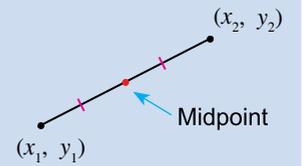
1. Student A constructs a Cartesian plane on grid paper.
2. Student B chooses two coordinate points and draws a line that joins the points.
3. Student C constructs a perpendicular bisector on the line.

Discussion:

What do you understand when you construct the perpendicular bisector on the line?

Midpoint is a point that divide a line segment equally.

TIPS



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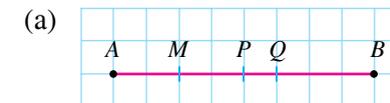


Scan the QR Code or visit http://rimbunanilmu.my/mat_t2e/ms133 to watch an animated video on determining midpoints.



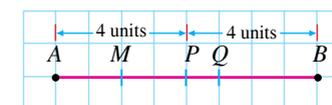
EXAMPLE 8

Determine the midpoint of the straight line AB .



Solution:

(a) Midpoint of the straight line AB is P .

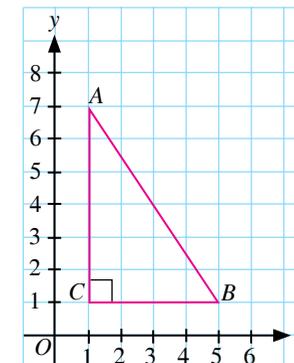


(b) Midpoint of the straight line AB is D .



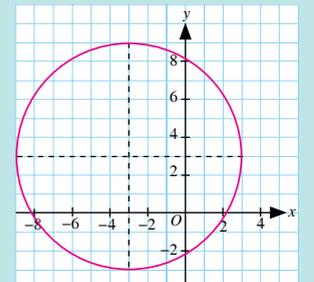
EXAMPLE 9

P is the midpoint of the straight line AB . Determine coordinates P .



THINK SMART

State the coordinates of the centre of the circle for the diagram below. What is the connection between the centre of a circle and the midpoint?



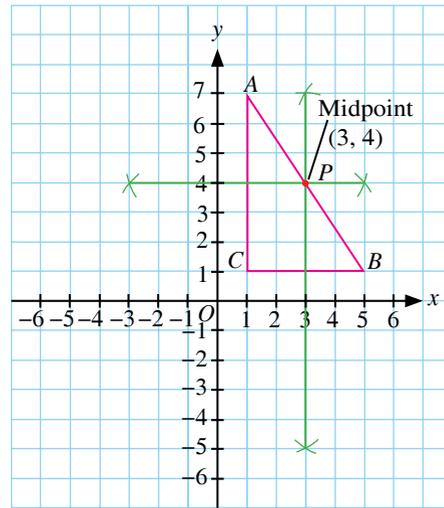
Solution:

Step 1: Determine the midpoint of AC and BC .

Step 2: Construct a perpendicular bisector of AC and BC .

Step 3: Intersection between the perpendicular bisector of AC and BC is the midpoint of the line AB .

Step 4: Therefore, point P is $(3, 4)$.



7.2.2 The midpoint formula

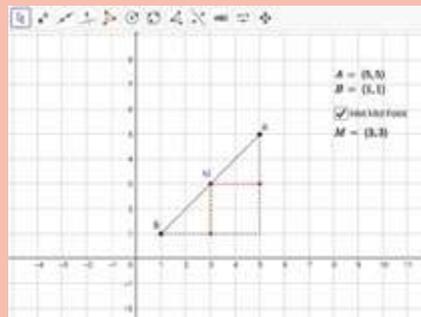
COGNITIVE STIMULATION

Aim: Deriving the midpoint formula

Material: Dynamic geometry software

Steps:

1. Open the file MS134.



2. Identify point A and point B .
3. Change the location of the points as in the table provided.
4. Identify horizontal distance and vertical distance.
5. Open file MS135 and complete the table given.
6. Calculate the midpoint M .

LEARNING STANDARD

Derive the formula of the midpoint between two points on the Cartesian plane.

QR CODE

Scan the QR Code or visit http://rimbunanilmu.my/mat_t2e/ms134 to identify the midpoint.



Point		Midpoint of:		Midpoint $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
A	B	Horizontal distance	Vertical distance	
(4, 5)	(2, 1)			
(-1, 5)	(3, 1)			
(1, 3)	(7, 1)			
(3, 4)	(-5, -1)			
(1, 2)	(-5, 2)			

Discussion:

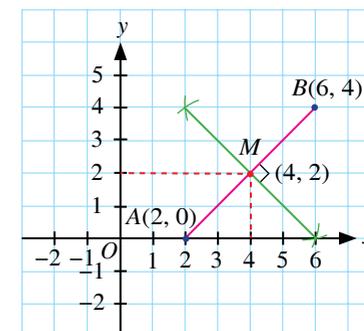
- (i) Is the midpoint of the straight line AB the result of the intersection for the midpoint of horizontal distance and vertical distance?
- (ii) Derive the formula for midpoint.

Midpoint for a slanting line can be determined by identifying the horizontal distance and vertical distance which are both divided by two.

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

7.2.3 Midpoint coordinates between two points

The location of a midpoint can be shown by constructing a perpendicular bisector. The intersection between the perpendicular bisector with the line segment will determine the coordinates of the midpoint on a Cartesian plane.



$$M = \left(\frac{6 + 2}{2}, \frac{4 + 0}{2}\right)$$

$$M = (4, 2)$$

QR CODE

Scan the QR Code or visit http://rimbunanilmu.my/mat_t2e/ms135 to get the worksheet.

LEARNING STANDARD

Determine the coordinates of midpoint between two points on the Cartesian plane.

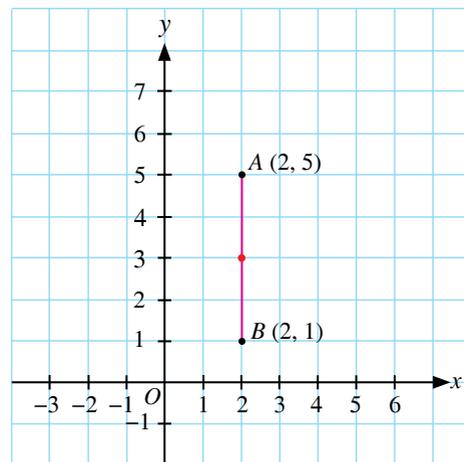
EXAMPLE 10

Calculate the coordinate of the midpoint on the straight line AB given $A(2, 5)$ and $B(2, 1)$.

Solution:

$A(2, 5)$ is (x_1, y_1) and $B(2, 1)$ is (x_2, y_2)

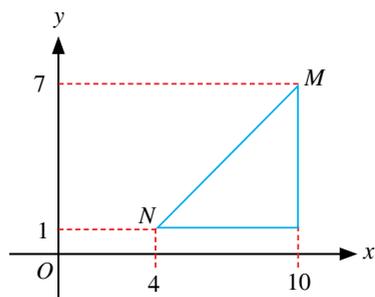
$$\begin{aligned} \text{Midpoint } AB &= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) \\ &= \left(\frac{2 + 2}{2}, \frac{5 + 1}{2} \right) \\ &= \left(\frac{4}{2}, \frac{6}{2} \right) \\ &= (2, 3) \end{aligned}$$



Therefore, the midpoint of AB is $(2, 3)$.

EXAMPLE 11

Calculate the coordinate of the midpoint on the straight line MN .



Solution:

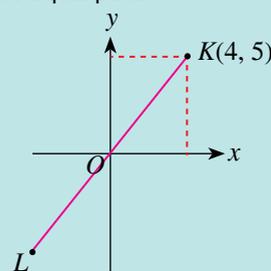
$M(10, 7)$ is (x_1, y_1) and $N(4, 1)$ is (x_2, y_2)

$$\begin{aligned} \text{Midpoint } MN &= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) \\ &= \left(\frac{10 + 4}{2}, \frac{7 + 1}{2} \right) \\ &= \left(\frac{14}{2}, \frac{8}{2} \right) \\ &= (7, 4) \end{aligned}$$

Therefore, the midpoint of MN is $(7, 4)$.

THINK SMART

Midpoint is a point on a line segment that divides it into two equal parts.



If the origin is the midpoint for the line KL , can you determine the coordinates of L ?

7.2.4 Solving problems

EXAMPLE 12

The diagram shows the line PAQ on a Cartesian plane. A is the midpoint for the line PQ . Determine the coordinates of P .

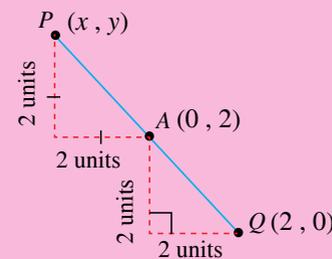
Solution:

Understanding the problem

Distance of $AP = AQ$.
Let $P = (x, y)$.

Planning the strategy

Distance of $AP = AQ$



Implementing the strategy

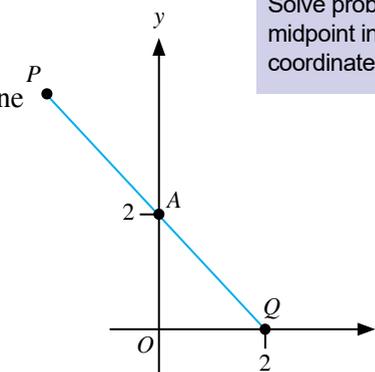
Calculate the horizontal and vertical distance starting from point A which is 2 units respectively.

Midpoint, $A(0, 2)$

$$\begin{aligned} P(x, y) \quad \frac{x+2}{2} = 0, \quad \frac{y+0}{2} = 2 \\ Q(2, 0) \quad \frac{x+2}{2} = 0, \quad y = 4 \\ \qquad \qquad \qquad x = -2 \end{aligned}$$

LEARNING STANDARD

Solve problems involving midpoint in the Cartesian coordinate system.



Conclusion

Therefore, coordinates of P are $(-2, 4)$.

EXAMPLE 13

Point P is the midpoint on the straight line KL . Given coordinates of $K(-3, 12)$ and coordinates of $P(2, 9)$, calculate coordinates of L .

Solution:

$K(-3, 12)$ is (x_1, y_1) and $L(x_2, y_2)$

$$\begin{aligned} \text{Midpoint, } P &= \left(\frac{-3 + x_2}{2}, \frac{12 + y_2}{2} \right) \\ (2, 9) &= \left(\frac{-3 + x_2}{2}, \frac{12 + y_2}{2} \right) \\ \frac{-3 + x_2}{2} &= 2, \quad \frac{12 + y_2}{2} = 9 \\ -3 + x_2 &= 4, \quad 12 + y_2 = 18 \\ x_2 &= 7, \quad y_2 = 6 \end{aligned}$$

Therefore, coordinates of L are $(7, 6)$.

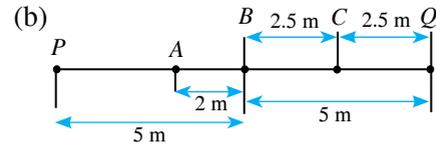
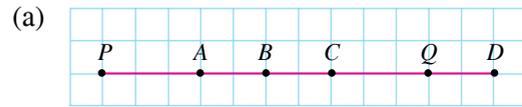
THINK SMART



The KLCC Tower has 88 floors. The distance which is the most suitable to build a skybridge is at the 42nd and the 43rd floors. Why?

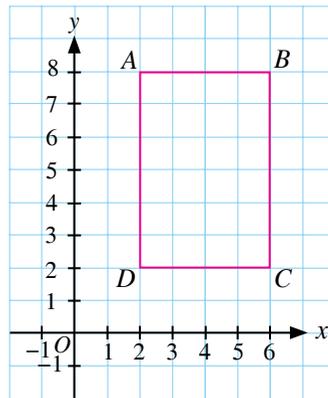
SELF PRACTICE  **7.2**

1. In each of the diagrams below, determine the midpoint of the straight line PQ .



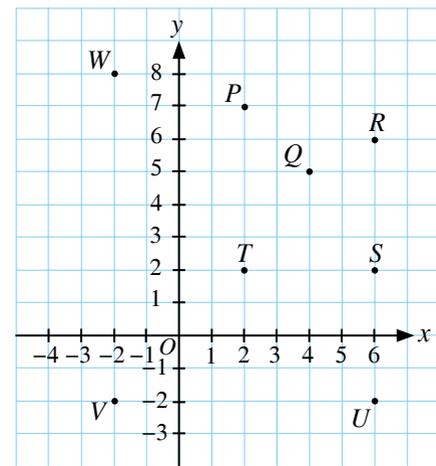
2. Based on the diagram below, state the coordinates of the midpoint of

- (a) AB
- (b) CD
- (c) AD



3. Determine the midpoint of the straight line

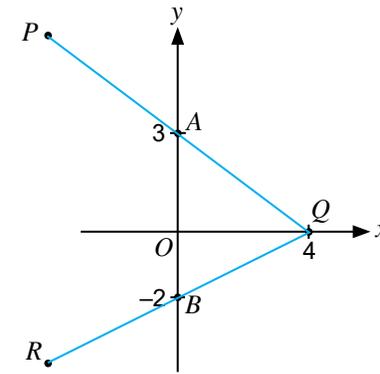
- (a) PQ
- (b) RS
- (c) TU
- (d) WV



4. Determine the midpoint for the following coordinates

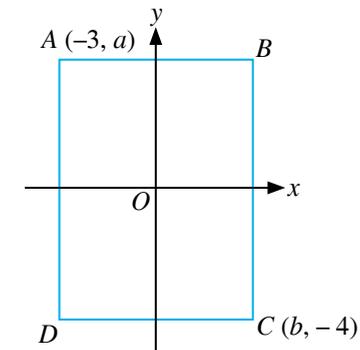
- (a) $P(-1, 7)$ and $Q(-1, 1)$.
- (b) $R(3, -6)$ and $S(3, 2)$.
- (c) $A(3, 1)$ and $B(5, 1)$.
- (d) $C(5, 0)$ and $D(1, 0)$.

5. Referring to the diagram, A is the midpoint of PQ and B is the midpoint of RQ . Determine the coordinates of P and R .



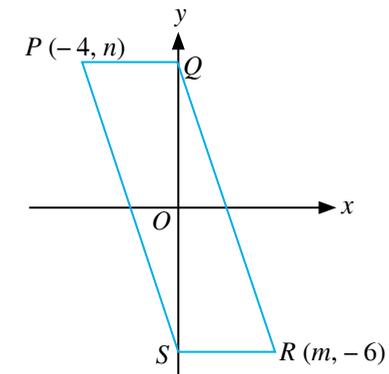
6. Midpoint for the square in the diagram below is at the origin. Determine

- (a) the values of a and b .
- (b) the distance of line BC .
- (c) the coordinates of B .



7. The origin is the midpoint for the height of the parallelogram. Calculate

- (a) the values of m and n .
- (b) the midpoint of PQ .
- (c) the midpoint of SR .



8. Given the straight line $AB = BD$ with $D(-1, 3)$ and $B(1, 1)$, calculate the coordinates of point A .



9. A straight line that joins points $(-8, 3)$ and $(s, 3)$ has the midpoint $(0, u)$. Calculate the values of s and u .



10. The line AB is parallel to x -axis with point $A(3, a)$ and midpoint of AB is $(5, 1)$. Calculate



- (a) the value of a .
- (b) the coordinates of B .

7.3 The Cartesian Coordinate System

7.3.1 Solving problems

EXAMPLE 14

The diagram shows a rhombus. Given the distance between the point A and B is 5 units. Calculate

- (a) the coordinates of A .
- (b) the midpoint of the straight line AC .

Solution:

(a) Understanding the problem

Determine point A where AB is parallel to DC .

Planning the strategy

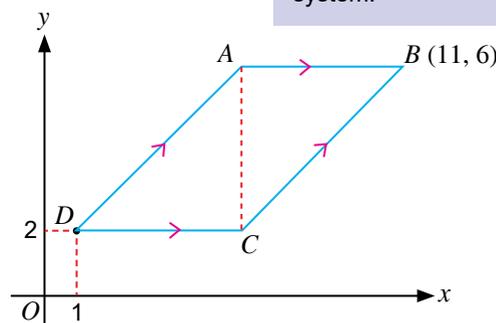
Straight line AB is parallel to the x -axis. y -coordinate for point A is 6.

Implementing the strategy

Distance of $AB = 5$ units.
 x -coordinate $= 11 - 5$
 $= 6$

Conclusion

Therefore, coordinates of A are $(6, 6)$.



(b) Understanding the problem

The line AC is parallel to the y -axis, with a common x -coordinate, which is 6.

Planning the strategy

Formula for midpoint $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$.

Implementing the strategy

$A(6, 6)$ $C(6, 2)$
 x_1, y_1 x_2, y_2
 $\left(\frac{6+6}{2}, \frac{6+2}{2}\right) = (6, 4)$

Conclusion

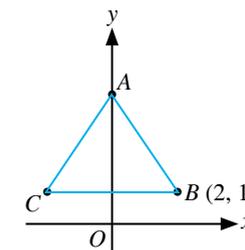
Therefore, midpoint of AC is $(6, 4)$.

LEARNING STANDARD
 Solve problems involving the Cartesian coordinate system.

SELF PRACTICE 7.3

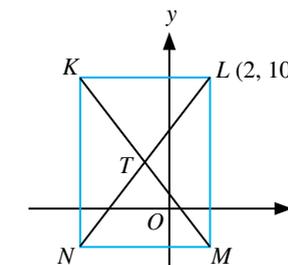
1. The diagram on the right is an isosceles triangle where the height is 4 units. Calculate

- (a) the coordinates of C .
- (b) the coordinates of A .
- (c) the coordinates of midpoint of the line AB .
- (d) the distance of the line AC .



2. The diagram on the right is a rectangle. The distance of KL is 8 units and KN is 12 units. Calculate

- (a) the distance of LN .
- (b) the coordinates of midpoint of line MN .
- (c) the coordinates of T .



3. If the line PQ is parallel to the y -axis and the midpoint $M(4, 0)$ with a distance of MP is 3 units, calculate

- (a) the coordinates of P .
- (b) the coordinates of Q .
- (c) the distance of PQ .

4. The distance $AB = KL$, that is 8 units and each is parallel with the y -axis. If midpoint AB is $(0, 3)$ and the distance from midpoint of AB to midpoint of KL is 2 units downwards, calculate

- (a) the coordinates of K and L .
- (b) the coordinates of the midpoint of KL .

5. Given that $P(4, 0)$ and Q is located on the y -axis with 6 units upwards from the x -axis, calculate

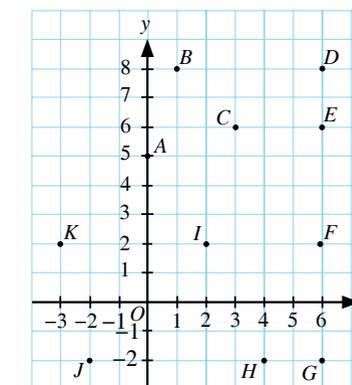
- (a) the midpoint of PQ .
- (b) the distance between the point P and midpoint of PQ .



GENERATING EXCELLENCE

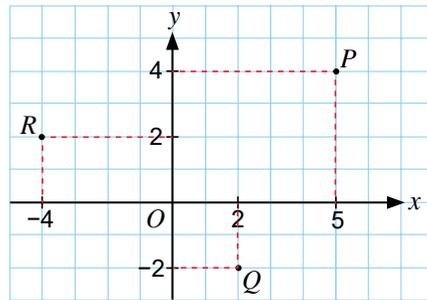
1. Which of the following points represent

- (a) $(-3, 2)$
- (b) $(0, 5)$
- (c) $(4, -2)$
- (d) $(6, 8)$



2. If point K is located on the x -axis and 4 units to the left of the y -axis, determine coordinates of L which is 5 units upwards from point K .

3. If points P , Q and R each move 2 units to the south and 1 unit to the left respectively, state the new locations for the points. Calculate the distance for each new location from PQ to RQ .



4. $ABCD$ is a square with A as the origin and $B(-5, 0)$. Calculate the perimeter of the square.



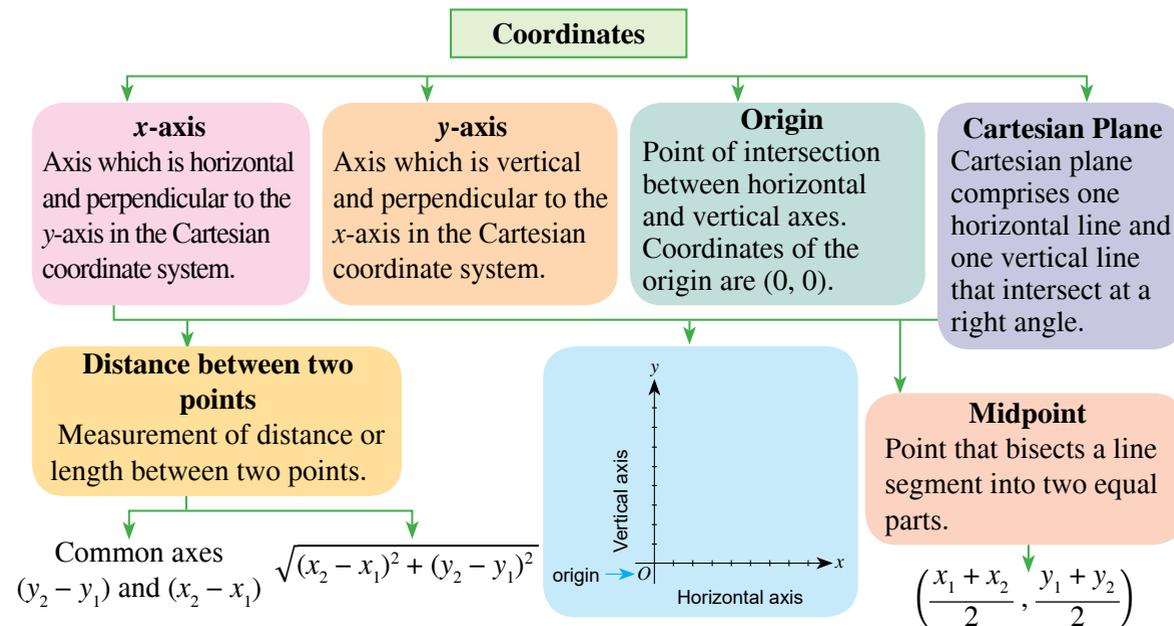
5. KLM is a right angled triangle with points $K(1, 0)$ and $L(5, 0)$ as the base and ML is the height for the triangle. If the distance from M to L is 5 units, calculate the area of the triangle.



6. The midpoint of the diagonal of a square is 2 units from the vertex of the square. Calculate the area of the square.



CHAPTER SUMMARY



SELF REFLECTION

At the end of this chapter, I am able to:



1. Explain the meaning of distance between two points on the Cartesian plane.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Derive the formula of the distance between two points on a Cartesian plane.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Determine the distance between two points on the Cartesian plane.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Solve problems involving the distance between two points in the Cartesian coordinate system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Explain the meaning of midpoint between two points on the Cartesian plane.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Derive the formula of the midpoint between two points on the Cartesian plane.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Determine the coordinates for midpoint between two points on the Cartesian plane.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Solve problems involving midpoint in the Cartesian coordinate system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Solve problems involving the Cartesian coordinate system.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



MINI PROJECT

Draw a plan of your classroom seating position on a grid paper with a scale of 1 cm to 2 metres on the horizontal axis and 1 cm to 2 metres on the vertical axis. You may change the scale. Determine the coordinates of your friends' seats. Paste the plan in front of your class for reference.