

**Study Aid**

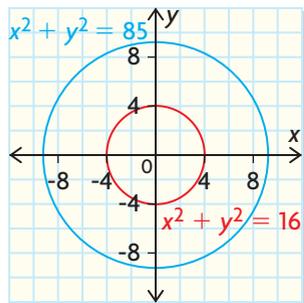
- See Lesson 2.1, Example 1.
- Try Mid-Chapter Review Questions 1 and 2.

**Study Aid**

- See Lesson 2.2, Examples 1 to 3.
- Try Mid-Chapter Review Questions 6 to 9.

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- See Lesson 2.3, Examples 1 and 3.
- Try Mid-Chapter Review Question 11.

**FREQUENTLY ASKED Questions**

**Q:** How do you determine the coordinates of the midpoint of a line segment if you know the coordinates of the endpoints?

**A:** You can use the midpoint formula  $M = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ . This formula shows that the coordinates of the midpoint are the means of the coordinates of the endpoints.

**Q:** How do you determine the length of a line segment if you know the coordinates of the endpoints?

**A:** If the endpoints have the same  $x$ -coordinate, then the line segment is vertical. The length of the line segment is the difference in the  $y$ -coordinates of the endpoints. Similarly, if the endpoints have the same  $y$ -coordinate, then the line segment is horizontal. The length of the line segment is the difference in the  $x$ -coordinates of the endpoints.

For all types of line segments, including those which are neither vertical nor horizontal, you can use the distance formula to calculate its length.

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

**Q:** How do you determine the equation of a circle that has its centre at the origin?

**A1:** The equation of a circle with centre  $(0, 0)$  is  $x^2 + y^2 = r^2$ , where  $r$  is the radius. For example, the equation of a circle with centre  $(0, 0)$  and a radius of 4 units is  $x^2 + y^2 = 4^2$ , or  $x^2 + y^2 = 16$ .

**A2:** If you only know the coordinates of a point on the circle, you can substitute these values for  $x$  and  $y$  and then solve for  $r$ . For example, suppose that you want to determine the equation of a circle that has its centre at the origin and passes through point  $(2, -9)$ . You substitute 2 for  $x$  and  $-9$  for  $y$ .

$$2^2 + (-9)^2 = r^2$$

$$4 + 81 = r^2$$

$$85 = r^2$$

The circle has equation  $x^2 + y^2 = 85$ .

## PRACTICE Questions

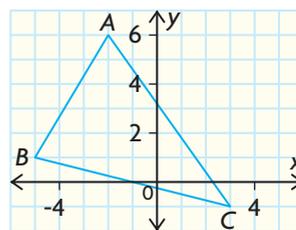
### Lesson 2.1

- Determine the coordinates of the midpoint of the line segment with each pair of endpoints.
  - $(-1, -2)$  and  $(-7, 10)$
  - $(5, -1)$  and  $(-2, 9)$
  - $(0, -4)$  and  $(0, 12)$
  - $(6, 4)$  and  $(0, 0)$
- A diameter of a circle has endpoints  $A(9, -4)$  and  $B(3, -2)$ . Determine the centre of the circle.
- Describe all the points that are the same distance from points  $A(-3, -1)$  and  $B(5, 3)$ .
- A hockey arena is going to be built to serve two rural towns. On a plan of the area, the towns are located at  $(1, 7)$  and  $(8, 5)$ . If the arena needs to be the same distance from both towns, determine an equation to describe the possible locations for the arena.
- $\triangle PQR$  has vertices at  $P(12, 4)$ ,  $Q(-6, 2)$ , and  $R(-4, -2)$ .
  - Determine the coordinates of the midpoints of its sides.
  - Determine the equation of the median from vertex  $Q$ .
  - What is the equation of the perpendicular bisector of side  $PQ$ ?

### Lesson 2.2

- Calculate the distance between each pair of points.
  - $(2, 2)$  and  $(7, 4)$
  - $(-3, 0)$  and  $(8, -5)$
  - $(2, 9)$  and  $(-5, 9)$
  - $(9, -3)$  and  $(12, -4)$
- A power line is going to be laid from  $A(-22, 15)$  to  $B(7, 33)$  to  $C(10, 18)$  to  $D(-1, 4)$ . If the units are metres, what length will the power line be?
- Determine the distance between point  $(-4, 4)$  and the line  $y = 3x - 4$ .

- Show that  $\triangle ABC$  has three unequal sides.



### Lesson 2.3

- State the coordinates of the centre of the circle described by each equation below.
  - State the radius and the  $x$ - and  $y$ -intercepts of the circle.
  - Sketch a graph of the circle.
    - $x^2 + y^2 = 169$
    - $x^2 + y^2 = 2.89$
    - $x^2 + y^2 = 98$
- Determine the equation of a circle that has its centre at  $(0, 0)$  and passes through each point.
 

a) $(-5, 0)$	c) $(-3, -8)$
b) $(0, 7)$	d) $(4, -9)$
- A raindrop falls into a puddle, creating a circular ripple. The radius of the ripple grows at a steady rate of  $5 \text{ cm/s}$ . If the origin is used as the location where the raindrop hits the puddle, determine the equation that models the ripple exactly  $6 \text{ s}$  after the raindrop hits the puddle.
- Determine whether each point is on, inside, or outside the circle  $x^2 + y^2 = 45$ . Explain your reasoning.
 

a) $(6, -3)$	c) $(-3, 5)$
b) $(-1, 7)$	d) $(-7, -2)$
- A line segment has endpoints  $A(6, -7)$  and  $B(2, 9)$ .
  - Verify that the endpoints of  $AB$  are on the circle with equation  $x^2 + y^2 = 85$ .
  - Determine the equation of the perpendicular bisector of  $AB$ .
  - Explain how you can tell, from its equation, that the perpendicular bisector goes through the centre of the circle.