

Skills: Solve distance, midpoint, and right triangle problems.**Warm-Up: Prerequisite Skills**

You'll use these three skills constantly in this unit — make sure they're solid before we start

1. Distance on a number line: $|a - b|$

Ex: distance from -3 to 5

Your turn:
distance from -6 to 4:

2. Pythagorean Theorem

$$a^2 + b^2 = c^2$$

Your turn:
legs 6 and 8, find hypotenuse c

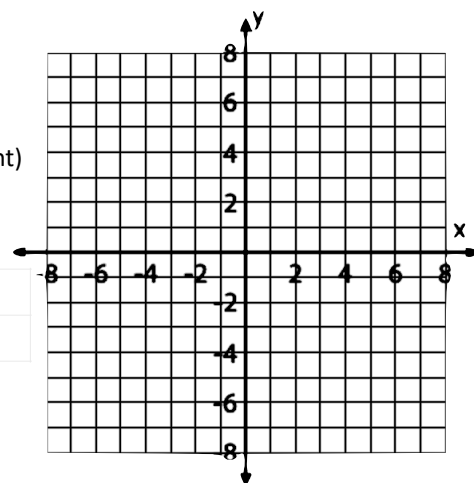
3. Simplifying a radical

Ex: $\sqrt{72}$

Your Turn: $\sqrt{20}$

Vocabulary

- Cartesian plane — the coordinate grid formed by two number lines at right angles
- x-axis / y-axis — the horizontal / vertical number line
- origin — the point (0, 0) where the axes cross
- quadrants — the 4 regions the axes create (I, II, III, IV, going counter-clockwise from upper right)
- ordered pair (x, y) — x is the directed distance from the y-axis;
y is the directed distance

**The Cartesian Plane**

Label each quadrant with its sign pattern, e.g. QI = (+, +).

Ex: (-1, 2), (3, 4), (0, 0), (3, 0), (-2, -3)

QII: (__, __)

QI: (+, +)

QIII: (__, __)

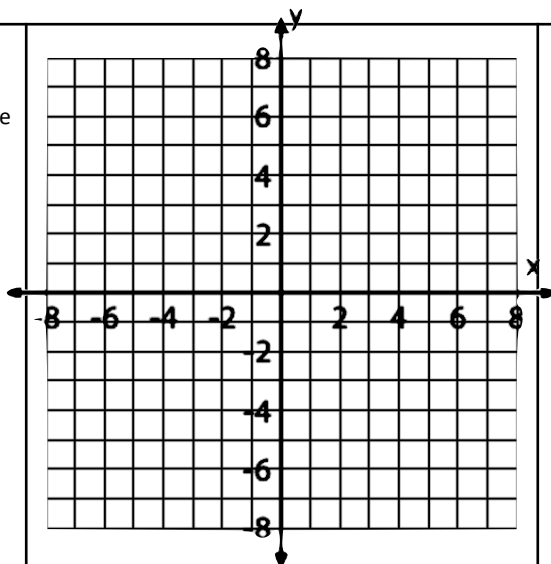
QIV: (__, __)

You try: Graph the following and state the quadrant:

A(2, -3) quadrant: _____ B(-4, 1) quadrant: _____ C(0, 5) quadrant: _____ Quick check: if $x < 0$ and $y > 0$, the point is in Quadrant _____

The Distance Formula

From the Pythagorean Theorem: the horizontal leg is $|x_2 - x_1|$, the vertical leg is $|y_2 - y_1|$, and the distance d is the hypotenuse.



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

Ex: Find the distance between (-2, 1) and (3, 4)

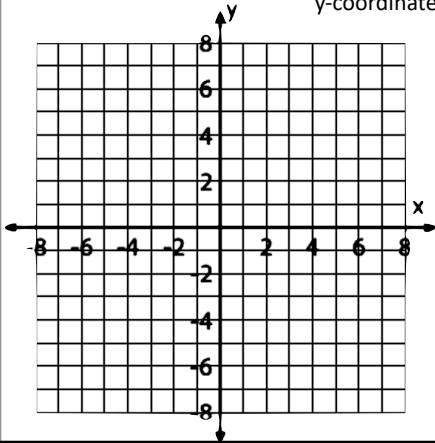
You try - (2, 1) and (4, 7).

Verifying a Right Triangle

Points A(0, 0), B(4, 0), and C(0, 3) are the vertices of a triangle. Find each side length, then use the **converse** of the Pythagorean Theorem to confirm it's a right triangle.

The Midpoint Formula

The midpoint is just the average of the x-coordinates and the average of the y-coordinates.



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

Ex: Find the midpoint of the segment joining (-4, 2) and (2, -6).

You try — Find the midpoint of the segment joining (3, -1) and (-9, 5)

Application: Estimating a Value

A company had sales of \$13.3 billion in 2020 and \$16.4 billion in 2022. Use the Midpoint Formula to estimate the 2021 sales (assume a linear trend).

Section 1.1 Summary — Can you...

- ☐ Plot points and name their quadrant in the Cartesian plane?
- ☐ Use the Distance Formula to find the length between two points?
- ☐ Use the Midpoint Formula to find the center of a segment?
- ☐ Apply the coordinate plane to a real-life estimation problem?

Formulas at a Glance — Section 1.1

$$d = |x_2 - x_1|$$

$$a^2 + b^2 = c^2$$

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

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