Using the Pythagorean Theorem to find distances in the coordinate plane.

By the end of today's lesson, you will be able to graph points and to use the Pythagorean Theorem to find distance in the coordinate plane.

1-7 Distance in the Coordinate Plane

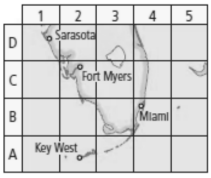
What You'll Learn

To graph points and to use the Pythagorean Theorem to find distances in the coordinate plane

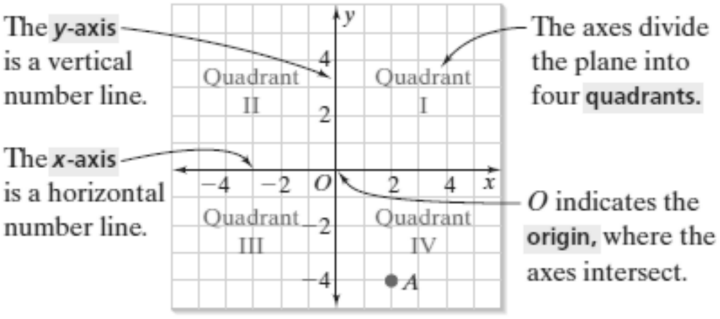
New Vocabulary coordinate plane, *y*-axis, *x*-axis, quadrants, origin, ordered pair, *x*-coordinate, *y*-coordinate

Why Learn This?

Mapmakers use a coordinate grid system for maps. The coordinate plane is another type of grid system.



A **coordinate plane** is a grid formed by the intersection of two number lines. You can use a coordinate plane to locate and name points.



An **ordered pair** (x, y) gives the coordinates of the location of a point. In the graph above, point A has coordinates $(2, -4)$.

$(2, -4)$

The ***x*-coordinate** tells the number of horizontal units a point is from the origin.

The ***y*-coordinate** tells the number of vertical units a point is from the origin.

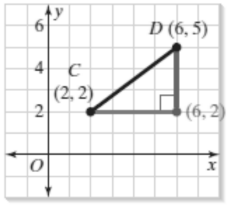
You can graph a point when you know its coordinates.

You can use the Pythagorean Theorem to find distances in the coordinate plane.

EXAMPLES Finding Distance on a Coordinate Plane

1 Find the distance between $C\,(2, 2)$ and $D\,(6, 5)$.

Graph C and D on a coordinate plane. Notice you can draw a right triangle by drawing a vertical segment down from D and a horizontal segment over from C. The point of intersections is $(6, 2)$.



horizontal leg: $6 - 2 = 4$
vertical leg: $5 - 2 = 3$

Subtract the x-coordinates to find the length of the horizontal leg. Subtract the y-coordinates to find the length of the vertical leg.

Use the Pythagorean Theorem to find the distance between C and D.

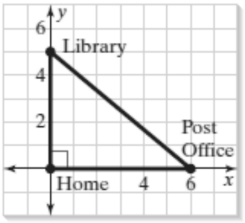
$a^2 + b^2 = c^2$ ← **Pythagorean Theorem.**
$4^2 + 3^2 = c^2$ ← **Substitute.**
$16 + 9 = c^2$ ← **Simplify.**
$25 = c^2$ ← **Add.**
$\sqrt{25} = \sqrt{c^2}$ ← **Find the positive square root of each side.**
$5 = c$

The distance between $C\,(2, 2)$ and $D\,(6, 5)$ is 5 units.

2 **Multiple Choice** The library is 5 miles north of your house. The post office is 6 miles east of your house. To the nearest mile, how far is the library from the post office?

Ⓐ 7 mi Ⓑ 8 mi Ⓒ 9 mi Ⓓ 10 mi

Graph the three locations. Place your home at the origin. Draw a right triangle.



$a^2 + b^2 = c^2$ ← **Pythagorean Theorem.**
$5^2 + 6^2 = c^2$ ← **Substitute.**
$25 + 36 = c^2$ ← **Simplify.**
$61 = c^2$ ← **Add.**
$\sqrt{61} = \sqrt{c^2}$ ← **Find the positive square root of each side.**

$\sqrt{\ }$ 61 = 7.810249676 ← **Use a calculator.**

$c \approx 8$

The answer is B.

Check Your Understanding

Vocabulary Match each ordered pair with the appropriate quadrant.

1. $(-4, 2)$ [redacted]
2. $(3, 5)$ [redacted]
3. $(12, -6)$ [redacted]
4. $(-7, -1)$ [redacted]

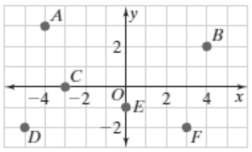
A. Quadrant I
B. Quadrant II
C. Quadrant III
D. Quadrant IV

[redacted]

Find the lengths of the horizontal and vertical legs of a right triangle that can be formed with the given segment as its hypotenuse.

5–7. See left.

5. $\overline{AE}$ 6. $\overline{CF}$ 7. $\overline{ED}$



We will work a guided practice lab together. It will be turned in for points.

Learn well from this lab as you will have an assignment worksheet that follows these steps.

Name _____ Class _____ Date _____

1-7 • Guided Problem Solving

GPS **Student Page 40, Exercise 15:**

On a graph, the points (4, −2), (7, −2), (9, −5), and (2, −5) are connected in order to form a trapezoid. To the nearest tenth, what is its perimeter?

Understand

1. What are you being asked to do?

_____

2. What information do you know?

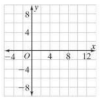
_____

Plan and Carry Out

3. Plot the points on the graph.

4. How can you find the distance between points (4, −2) and (7, −2) and between the points (2, −5) and (9, −5)?

_____



5. What is the distance between (4, −2) and (7, −2)? _____
(2, −5) and (9, −5)? _____

6. How can you find the distance between points (4, −2) and (2, −5) and between the points (7, −2) and (9, −5)?

_____

7. What is the distance between (4, −2) and (2, −5)? _____
(7, −2) and (9, −5)? _____

8. Add the lengths of each side. What is the perimeter? _____

Check

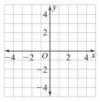
9. Is every point plotted correctly to create the figure?

_____

Solve Another Problem

10. Plot the following points on the grid at the right. Connect the points in order, connecting the last point to the first. What is the perimeter of the shape formed? (−3, −3), (3, −3), (4, 2), (−4, 2)

_____



Hand in this lab sheet.

I will pass out your homework.

Remember, round your answers to the nearest tenth.

Name _____ Class _____ Date _____

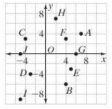
Practice 1-7

Distance in the Coordinate Plane

Find the distance between each pair of points. If necessary, round to the nearest tenth.

1. $A(7, 4)$ and $H(2, 7)$ _____

2. $C(-4, 3)$ and $G(6, 0)$ _____



3. $B(4, -6)$ and $D(-3, -4)$ _____

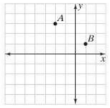
4. $E(5, -3)$ and $C(-4, 3)$ _____

5. $B(4, -6)$ and $I(-5, -9)$ _____

6. $E(5, -3)$ and $F(4, 3)$ _____

7. Arnie plotted points on the graph on the right. He placed his pencil point at A. He can move either right or down any whole number of units until he reaches point B. In how many ways can he do this?

_____



8. Marika had to draw ΔABC that fit several requirements.
   a. It must fit on the grid shown.
   b. The endpoints of $\overline{AB}$ have coordinates $A(-2, 0)$ and $B(2, 0)$.
   c. Point C must be on the y-axis and its y-coordinate is an integer.

   Name all the points that could be point C.

_____
_____
_____