The Four Quadrants Summary

KEY TERM

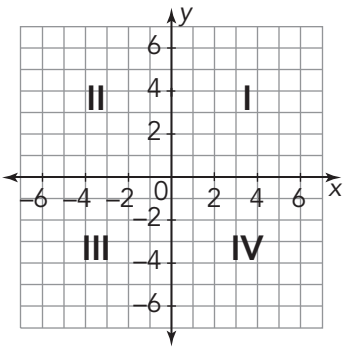
- quadrants

LESSON 1

Four Is Better Than One

The Cartesian coordinate plane is formed by two perpendicular number lines that intersect at the zeros, or the origin. The intersecting number lines divide the plane into four regions, called **quadrants**.

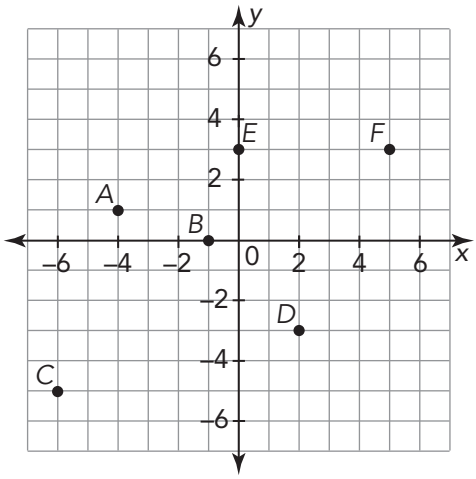
The quadrants are numbered with Roman numerals from one to four (I, II, III, IV) starting in the upper right-hand quadrant and moving counterclockwise.



To plot an ordered pair on the coordinate plane, begin at the origin (0, 0), and first move the distance along the *x*-axis given by the *x*-value of the ordered pair. Move right for a positive value and move left for a negative value. Then, move the distance along the *y*-axis given by the *y*-value of the ordered pair. Move up for a positive value and move down for a negative value.

For example, the following points are plotted on the coordinate plane:

A (−4, 1)
B (−1, 0)
C (−6, −5)
D (2, −3)
E (0, 3)
F (5, 3)



The values of the coordinates of points that are in the same quadrant will be have the same sign before their *x*- and *y*-values.

Quadrant II (−*x*, +*y*)	**Quadrant I** (+*x*, +*y*)
Quadrant III (−*x*, −*y*)	**Quadrant IV** (+*x*, −*y*)

Reflecting a point on the coordinate plane across the *x*-axis results in a new point with the same *x*-value and the opposite *y*-value as the original point.

For example, reflecting point *A* (8, 4) across the *x*-axis gives point *A*′ (8, −4). Reflecting point *B* (−5, −9) across the *x*-axis gives point *B*′ (−5, 9).

Reflecting a point on the coordinate plane across the *y*-axis results in a new point with the opposite *x*-value and the same *y*-value as the original point.

For example, reflecting point *C* (3, −2) across the *y*-axis gives point *A*′ (−3, −2). Reflecting point *D* (−1, 0) across the *y*-axis gives point *B*′ (1, 0).

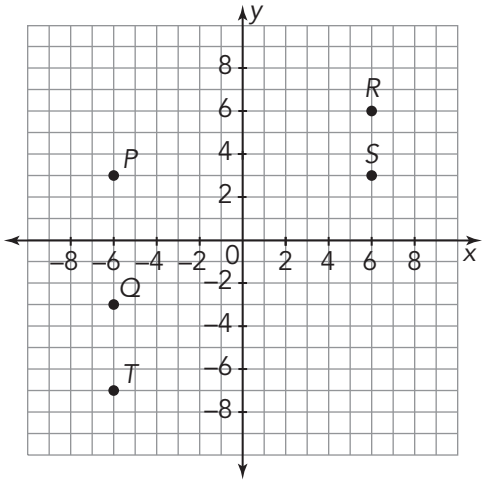
You can use absolute value to determine distances on the coordinate plane.

For example, the distance from point *P* to point *Q* is $|3| + |-3| = 3 + 3 = 6$ units.

The distance from point *P* to point *S* is $|-6| + |6| = 6 + 6 = 12$ units.

The distance from point *R* to point *S* is $|6| - |3| = 6 - 3 = 3$ units.

The distance from point *Q* to point *T* is $|-7| - |-3| = 7 - 3 = 4$ units.



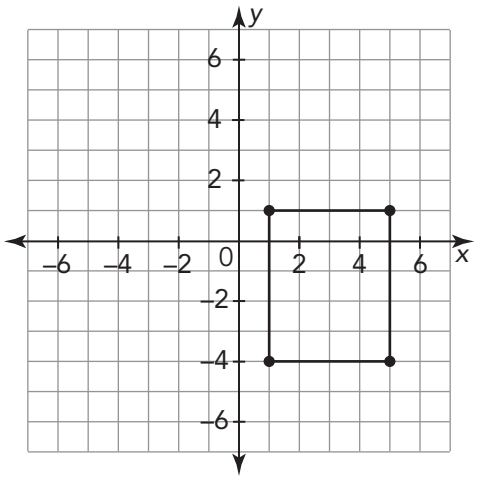
LESSON 2

It's a Bird, It's a Plane...It's a Polygon on the Plane!

One advantage of the Cartesian coordinate plane is that it enables mathematicians to use coordinates to analyze geometric figures.

For example, the points in the table have been graphed on the coordinate plane and connected to form a polygon.

x	*y*
1	1
5	1
5	−4
1	−4



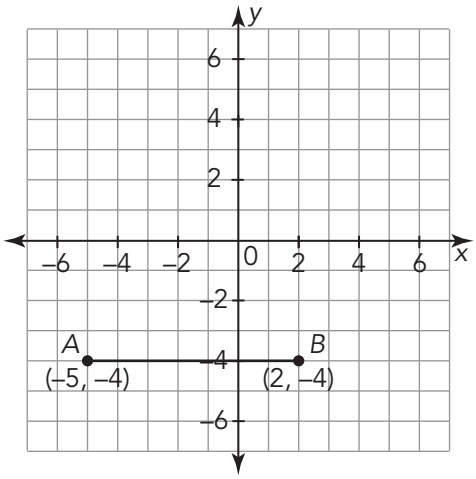
The polygon has opposite sides that are parallel and congruent, so it is a parallelogram. It also has four right angles, so it is a rectangle. The perimeter and area of the rectangle can be calculated by first determining its length and width. The length of the rectangle is 5 units and the width of the rectangle is 4 units.

Perimeter: $4 + 5 + 4 + 5 = 18$ units Area: $5 \times 4 = 20$ square units

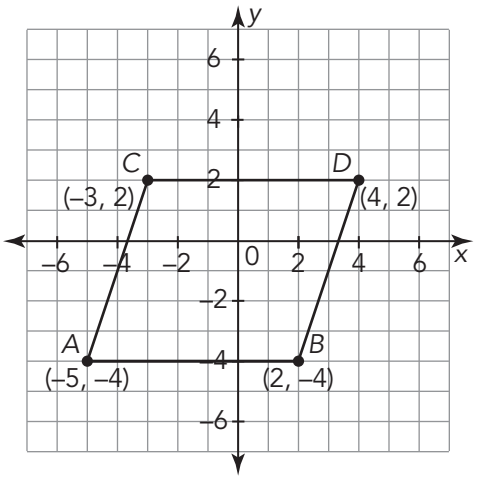
There is often more than one way to complete a polygon on the coordinate plane when given a segment.

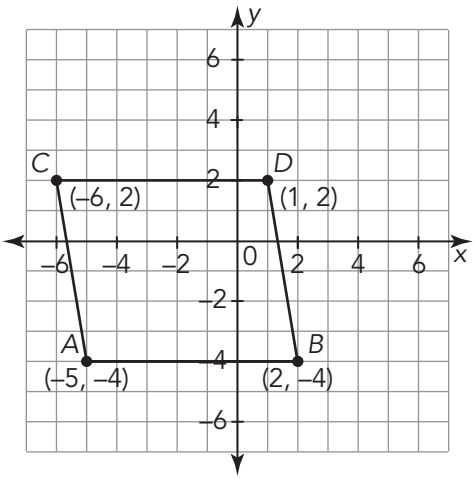
For example, on the coordinate plane, the line segment *AB* is graphed.

Plot and label points *C* and *D* to form a parallelogram with a height of 6 units.



Two different examples of Parallelogram *ABCD* are shown. Each has a length of 7 units and height of 6 units, so they both have an area of $7 \times 6 = 42$ square units.





The distance between two points on a coordinate plane can be calculated by using the coordinates of the two points.

For example, the design of a playground is laid out in a grid with a unit of 1 foot. The coordinates of the sand pit that will go under the swing set are located at (–15, 7), (–10, 7), (–15, –1), and (–10, –1). Determine the volume of the sand pit if the pit is 0.5 foot deep.

Plotting the coordinates of the sand pit on a coordinate plane shows that the shape of the sand pit is a rectangle. Use the coordinates to determine the distance between the points which will give you the length and width of the rectangle.

Width: $|-15| - |-10| = 15 - 10 = 5$ feet
Length: $|7| + |-1| = 7 + 1 = 8$ feet

Area: $8 \times 5 = 40$ square feet
Volume: $8 \times 5 \times 0.5 = 20$ cubic feet

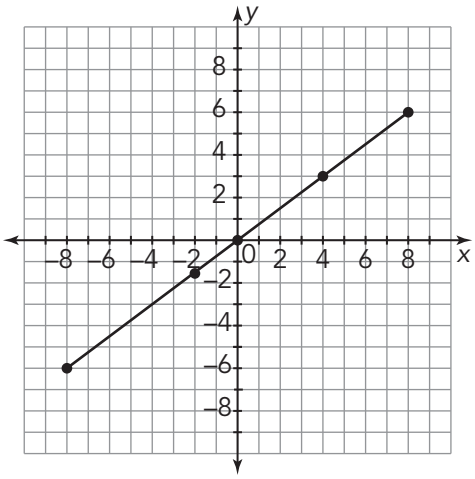
LESSON 3

There Are Many Paths...

Graphs, tables, equations, and scenarios provide various information and allow for different levels of accuracy when solving problems.

For example, the graph given shows the water level of a pool. The *x*-axis represents time, in hours, and the *y*-axis represents the water level, in inches.

The origin represents 3:00 P.M. and the desired water level.



You can create a table of values for the points plotted and describe the meaning of each.

x	*y*	Meaning
−8	−6	At 7:00 A.M., the water level is 6 inches below the desired water level.
−2	$-1\frac{1}{2}$	At 1:00 P.M., the water level is $1\frac{1}{2}$ inches below the desired water level.
0	0	At 3:00 P.M., the water is at the desired water level.
4	3	At 7:00 P.M., the water level is 4 inches above the desired water level.
8	6	At 11:00 P.M., the water level is 6 inches above the desired water level.

You can use the graph to determine that the water went into the pool at a rate of $\frac{3}{4}$ inch per hour. An equation that represents this situation would by $y = \frac{3}{4}x$.