USING COORDINATE GEOMETRY

This unit is about analyzing shapes using coordinate geometry. Using the knowledge of coordinate geometry and basic two-dimensional shapes, coordinates of shapes will be given; but, one of the ordered pairs will be missing. Connecting these points to a geometric idea, it is possible to predict the missing point.

Analyze Shapes Using Coordinate Geometry

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Now let’s consider some ideas about graphing in the coordinate plane that are more closely related to geometry.

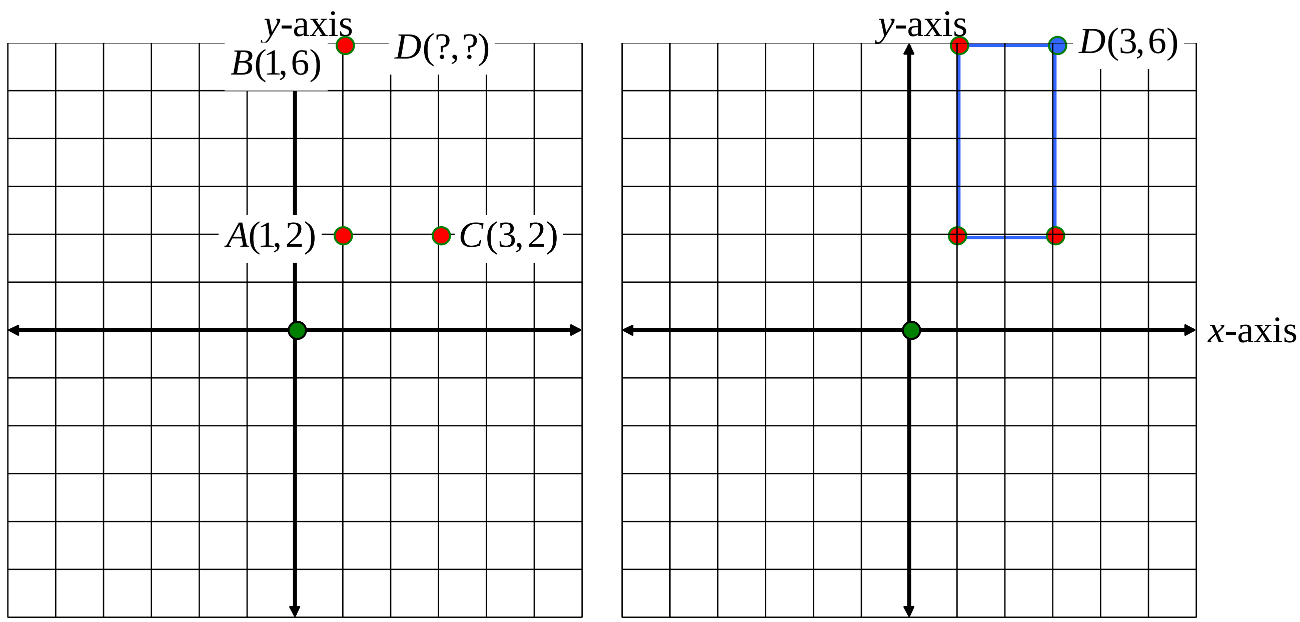
First we will review a few shapes and their properties.

Square - 4 sides congruent, 4 right angles
Rectangle - 4 right angles, 2 pairs of parallel and congruent sides.
Parallelogram - opposite sides are parallel and congruent.
Trapezoid - one pair of parallel sides.
Equilateral triangle - all three sides congruent, all angles 60˚.

If we take certain points on a coordinate plane and connect them to a geometric idea, we should be able to predict a missing point.

Example 1: Consider a rectangle: $A(1,2), B(1,6), C(3,2),$ and $D(x, y)$. Find the coordinates for point D that completes the shape into a rectangle.

Plot the points and take a look. We can find the missing ordered pair!



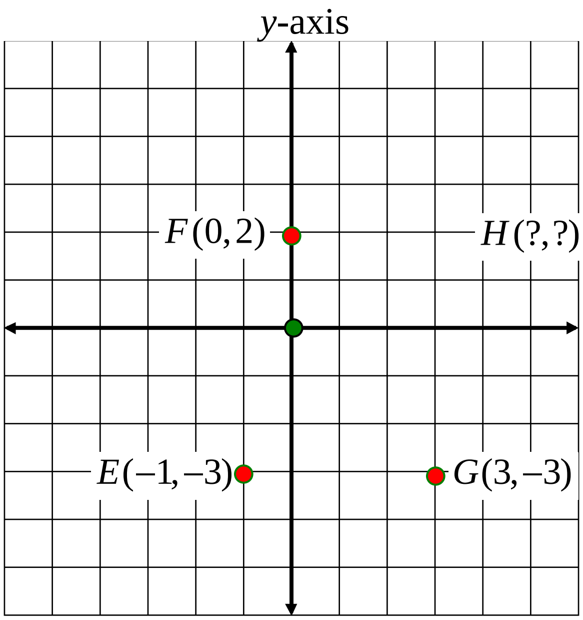
Make observations keeping the properties of a rectangle in mind.

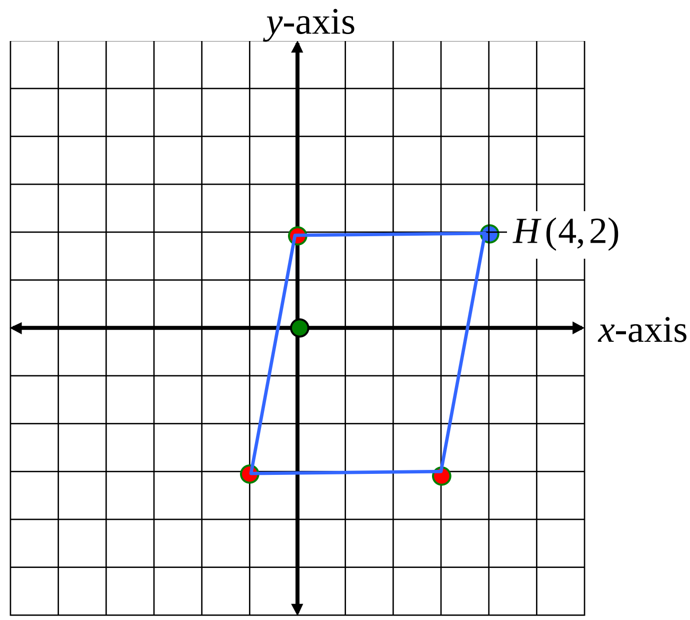
-Since point D is located directly above point C, both points will have the same ***x*-coordinate**, **3**.
-Since point D is located directly across from point B, both points will have the same ***y*-coordinate**, **6**.

Thus, the missing point must be (3, 6).

Example 2: Consider the parallelogram $E(-1,-3), F(0,2), G(3,-3),$ and $H(x,y)$. Find the coordinates for a point that completes the shape into a parallelogram.

Plot the points and take a look to find the missing ordered pair.





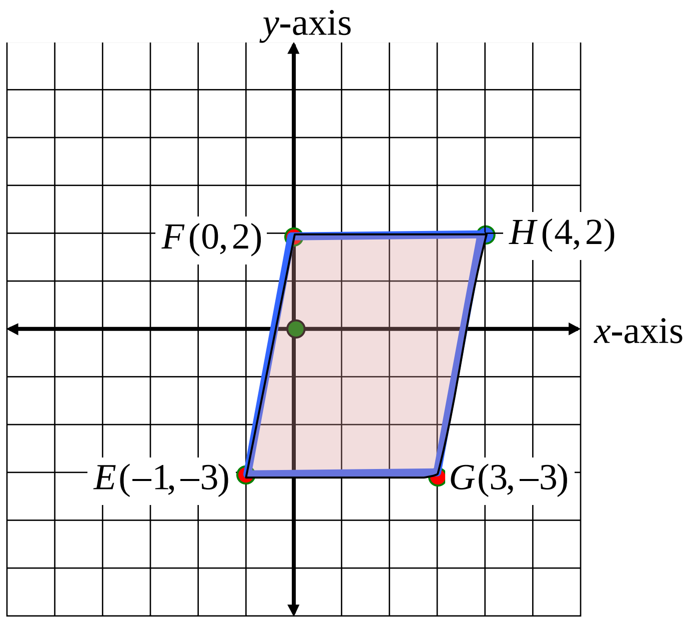
Make observations keeping the properties of a parallelogram in mind.

-Since point F is located one unit to the right of point E, the ***x*-coordinate** of point H will be in a similar position with point G; that is, one unit to the right of point G, $(3+1)$, **4**.

-Since point H will be located on the same line as point F, the ***y*-coordinate** will be the same as point F, **2**.

The missing point must be (4, 2).

Example 3: What is the area of parallelogram EFGH in the previous example?



To find the area of a parallelogram ($A = bh$), first determine the base and height of the parallelogram.

Base: The base is the length across the bottom of the parallelogram.
- Count the spaces across the bottom of the parallogram (4 spaces)
  OR
- subtract the x-values of the coordinates of the endpoints of segment EG, the base of the paralleogram $[3-(-1)=4]$.

Base = 4 units

Height: The height of the parallelogram is the perpendicular line from the top of the parallelogram to the base of the parallelogram.
- Count the spaces along a perpendicular line from the top of the parallelogram to the base of the parallelogram (5 spaces)
  OR
- subtract the y-values of the coordinates of the endpoints of segment EF or GH, $[2-(-3)=5]$.

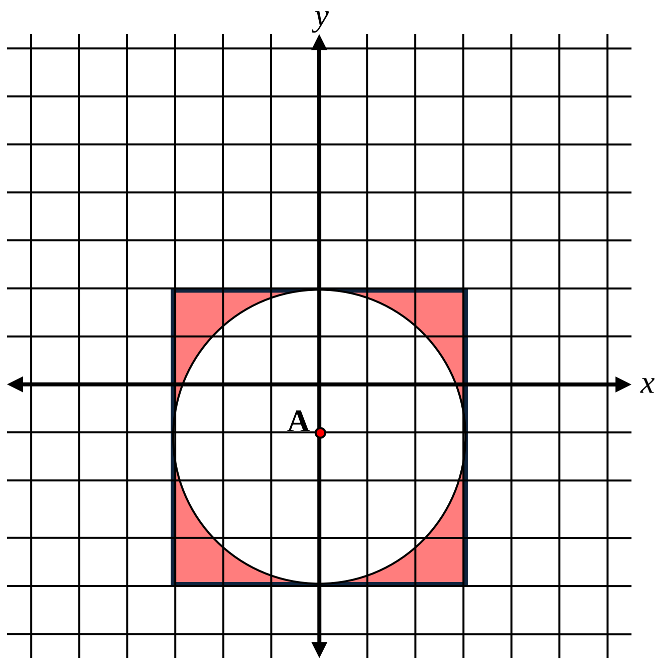
Height = 5 units

Now, find the area of the parallelogram.

$$A = bh$$
$$A = 4(5)$$
$$A = 20$$

The area of parallelogram EFGH is 20 square units.

Example 4: A circular area is cut out of the square in the grid. What is the area of the remaining parts of the square (the red area)?



Area of the Square - To find the area of a square $(A = s^2)$, determine the length of one side, and then compute.

The length of one side of the square is 6 units (six spaces along one side of the square).

$$A = s^2$$
$$A = 6^2$$
$$A = 36$$

The area of the square is 36 square units.

Area of the Circle - To find the area of a circle $(A = \pi r^2)$, determine the radius, and then compute.

The radius of the circle is 3 units (three spaces from the center to the edge).

$$A = \pi r^2$$
$$A = 3.14(3)^2$$
$$A = 3.14(9)$$
$$A = 28.26$$

The area of the circle is 28.26 square units.

Since the circular area "cuts out" an area from the square, subtract to find the difference between the two areas.

Area of Square – Area of Circle = Corner Areas (red areas)

36 – 28.26 = 36.00 – 28.26 = 7.74

The corner areas of the square (the red areas) equal 7.74 square units.