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Rational Numbers and the Coordinate Plane Guided Notes Math 6

Rational Numbers

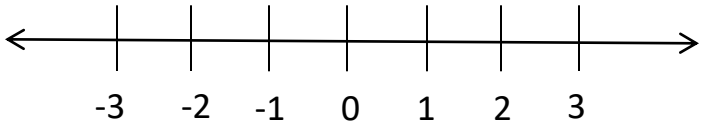
Rational numbers are numbers that can be written in the form of:

$$\frac{p}{q} \quad \text{where } p \text{ and } q \text{ are integers and } q \text{ is not zero}$$

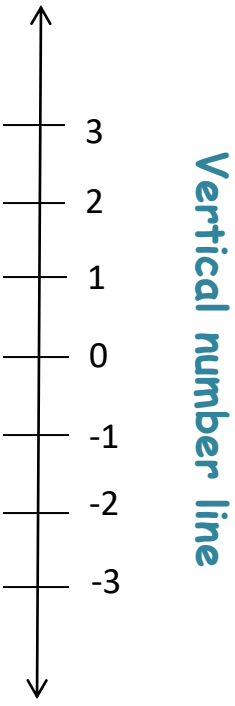
Similar to integers, rational numbers can be plotted or graphed on the **coordinate plane**. What is a coordinate plane?

The Coordinate Plane

The coordinate plane is composed of two number lines, one of which is vertical and the other one is horizontal.



Horizontal number line



Vertical number line

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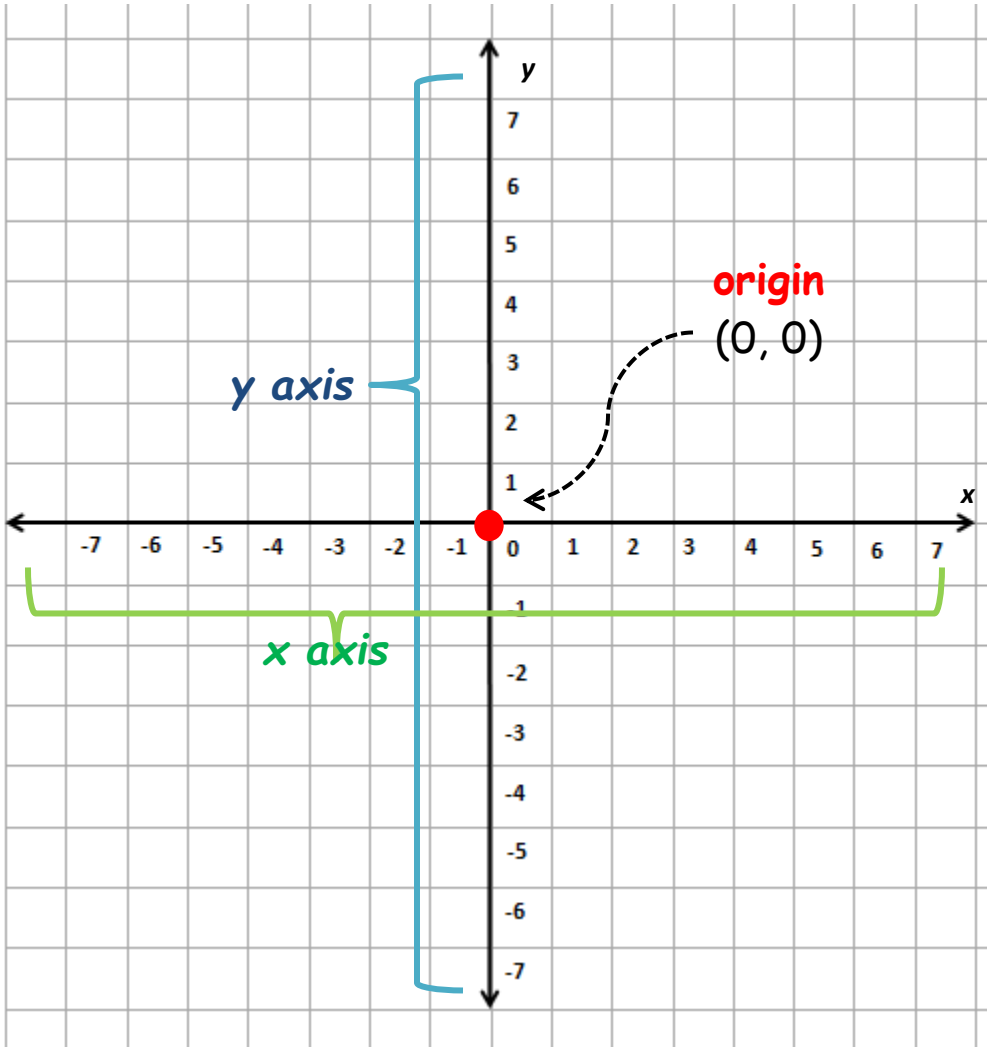
These number lines make a perpendicular intersection and meet at a common point called the **origin**, with **coordinates (0. 0)**. The **horizontal number line** is called the ***x-axis*** and the **vertical number line** is called the ***y-axis***.



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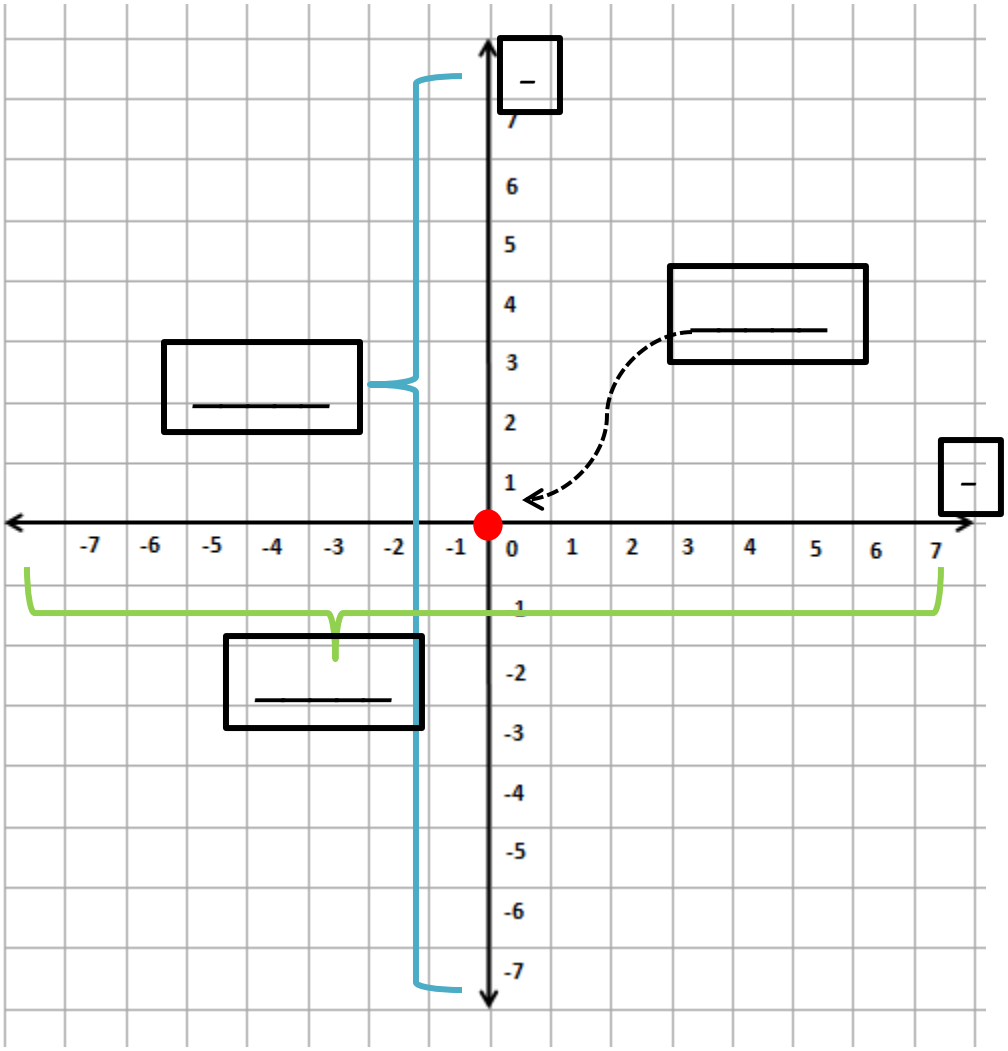
Sample Problem 1: Label the parts of the coordinate plane and fill out any missing values.



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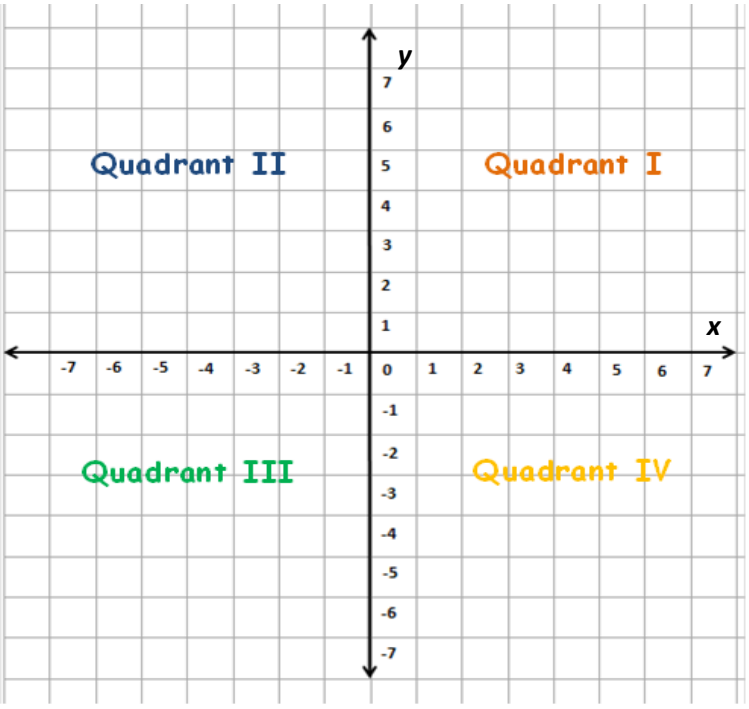
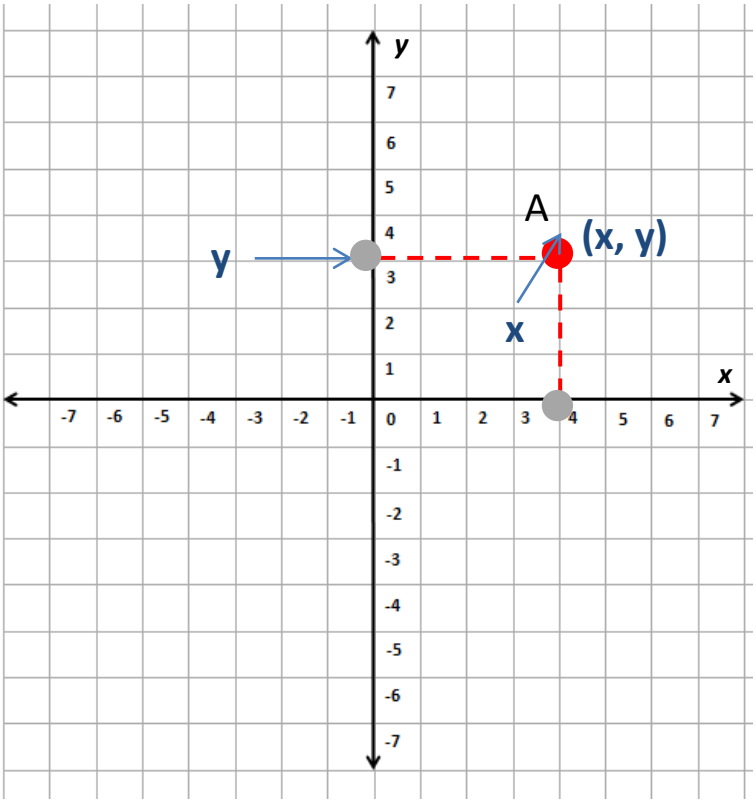
The Quadrants

When the horizontal number line ***(x-axis)*** and the vertical number line ***(y-axis)*** meet at the origin with point **(0, 0)**, four regions called **quadrants** are formed. These quadrants are labeled with Roman numerals I - IV in a counterclockwise manner.



Points in the Coordinate Plane



The coordinate plane is made up of infinitely many points. Take a look at **point *A***.

Drawing a line perpendicular from the given point to the ***x axis*** and another line perpendicular to the ***y axis*** determines the location of the point in the coordinate plane.

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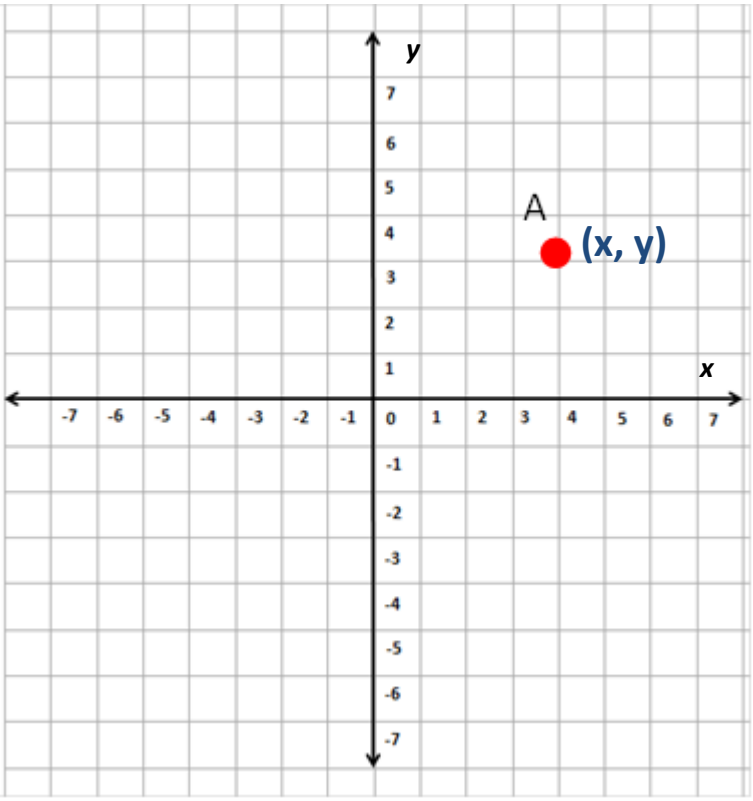

To avoid confusion, we locate point *A* by giving the number ***x*** first, then the number ***y***. This will form the ordered pair or coordinates **(x, y)**. This pair of numbers corresponds to point *A*.

The **first number *x*** is called the **x coordinate** or the **abscissa**, while the **second number *y*** is the **second coordinate** or the **ordinate**.

(x, y)

(first coordinate, second coordinate)

(x coordinate, y coordinate)

(abscissa, ordinate)

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Rational Numbers and the Coordinate Plane Guided Notes Math 6

Sample Problem 2: Complete the table by giving the x coordinate and y coordinate of the given points.

	Points in the Coordinate Plane	x coordinate	y coordinate
1.	A $(-1, 9)$		
2.	B $(11, 8)$		
3.	C $(\frac{1}{4}, 5)$		
4.	D $(20, -\frac{9}{4})$		
5.	E $(-6, 6)$		
6.	F $-9, -10)$		
7.	G $(0, 0)$		
8.	H $(-25, 0)$		

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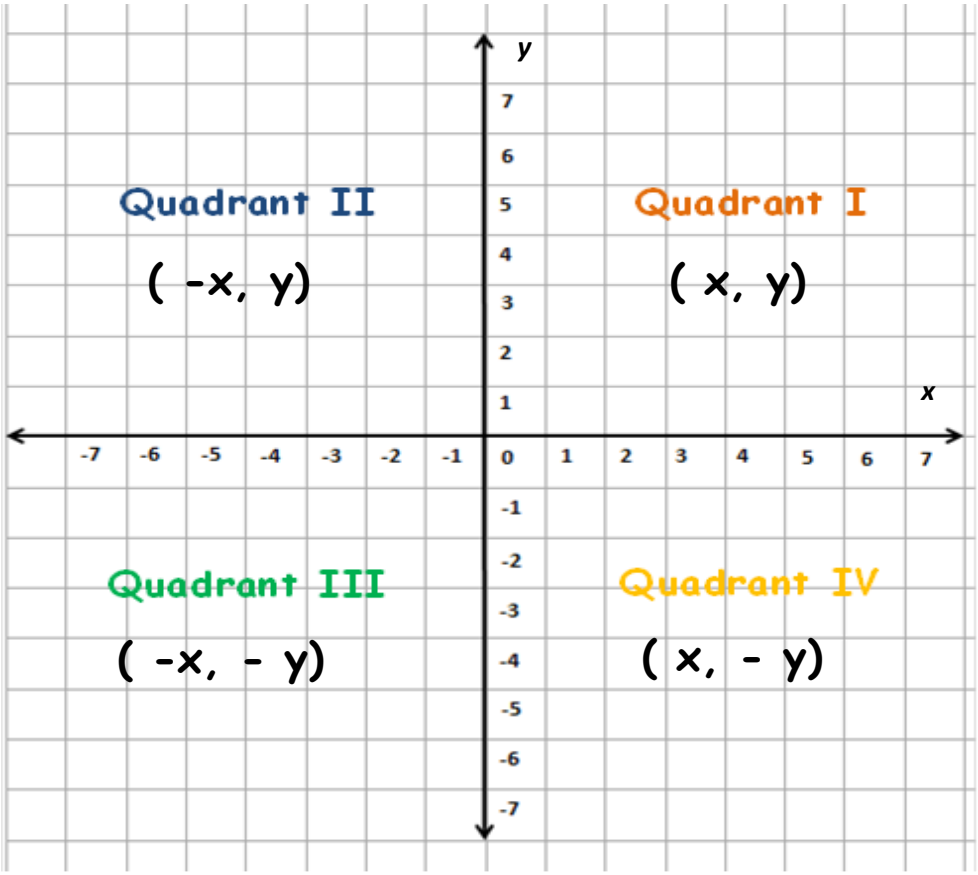
Describing the Points in each Quadrant

The coordinates in each quadrant of the coordinate plane varies. Take a look at the illustration below:



In Quadrant I:
The **x coordinate** and the **y coordinate** are both **positive**.

In Quadrant II:
The **x coordinate** is **negative** and the **y coordinate** is **positive**.

In Quadrant III:
The **x coordinate** and the **y coordinate** are both **negative**.

In Quadrant IV:
The **x coordinate** is **positive** and the **y coordinate** is **negative**.

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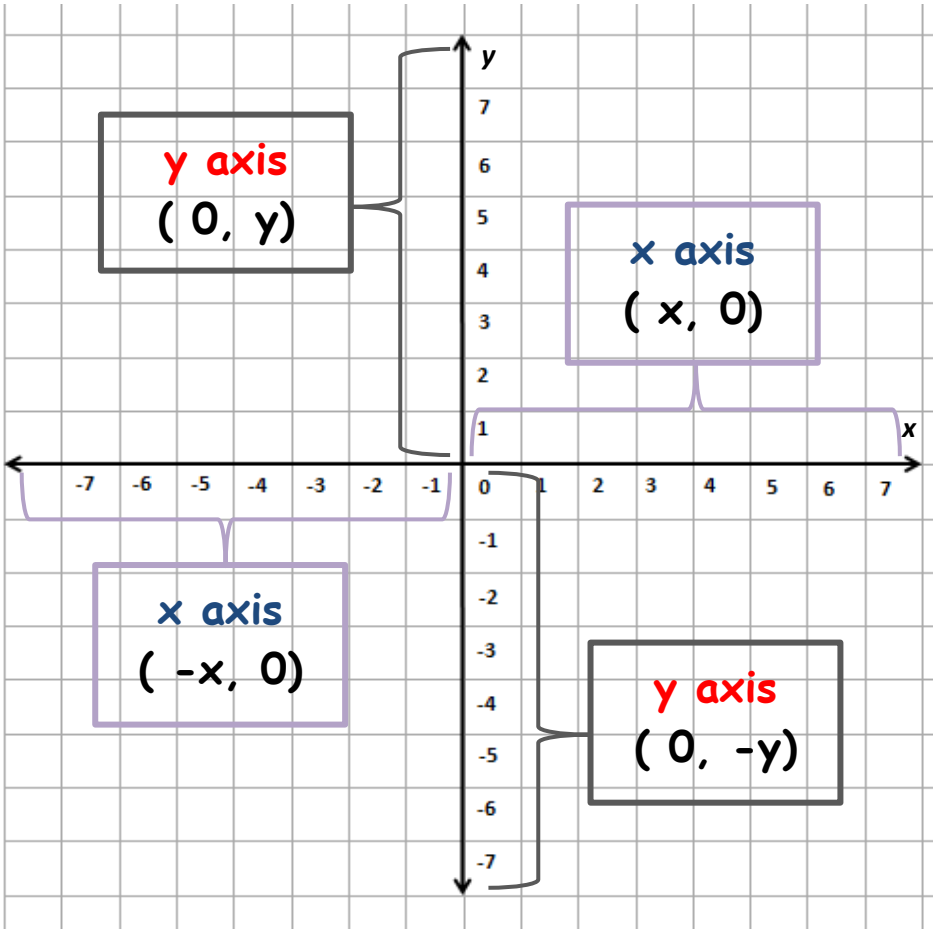
Describing the Points on the Axes



In the x axis:

The x coordinate to the right of 0 is positive and the y coordinate is 0.

The x coordinate to the left of 0 is negative and the y coordinate is 0.

In the y axis:

The y coordinate above 0 is positive and the x coordinate is 0.

The y coordinate below 0 is negative and the x coordinate is 0

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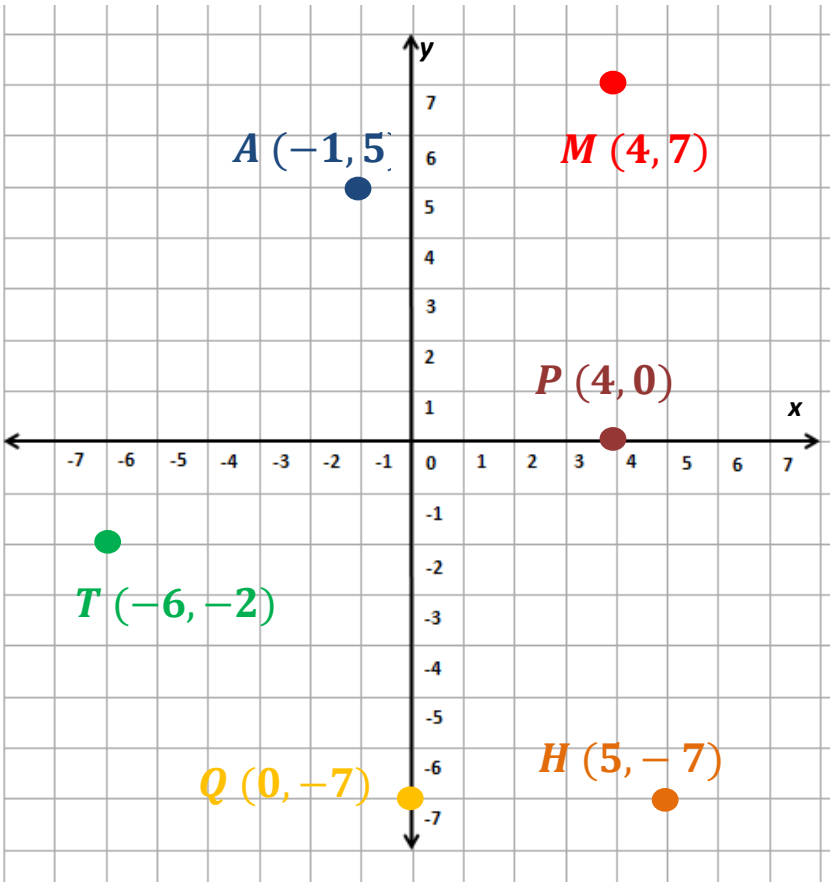
Example: Tell where the following points are located in the coordinate plane.



1. $M\ (4, 7)$
   Point *M* is located in Quadrant I because both the x and y coordinates are positive.

2. $A\ (-1, 5)$
   Point *A* is located in Quadrant II because the x coordinate is negative and the y coordinate is positive.

3. $T\ (-6, -2)$
   Point *T* is located in Quadrant III because the x coordinate and the y coordinate are both negative.

4. $H\ (5, -7)$
   Point *H* is located in Quadrant IV because the x coordinate is negative and the y coordinate is positive.

5. $P\ (4, 0)$
   Point *P* is on the x axis because the y coordinate is 0.

6. $Q\ (0, -7)$
   Point *Q* is on the y axis because the x coordinate is 0.

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Sample Problem 3: Determine the location of the given points on the coordinate plane.

Point	Location
1. $A\ (-1, 1)$	
2. $B\ (-9, -4)$	
3. $C\ (0, -12)$	
4. $E\ (0, 0)$	
5. $F\ (\frac{1}{3}, -\frac{2}{3})$	

Point	Location
6. $G\ (-16, -2)$	
7. $H\ (6, -18)$	
8. $I\ (9, 0)$	
9. $J\ (22, 23)$	
10. $K\ (-\frac{3}{4}, \frac{5}{2})$	

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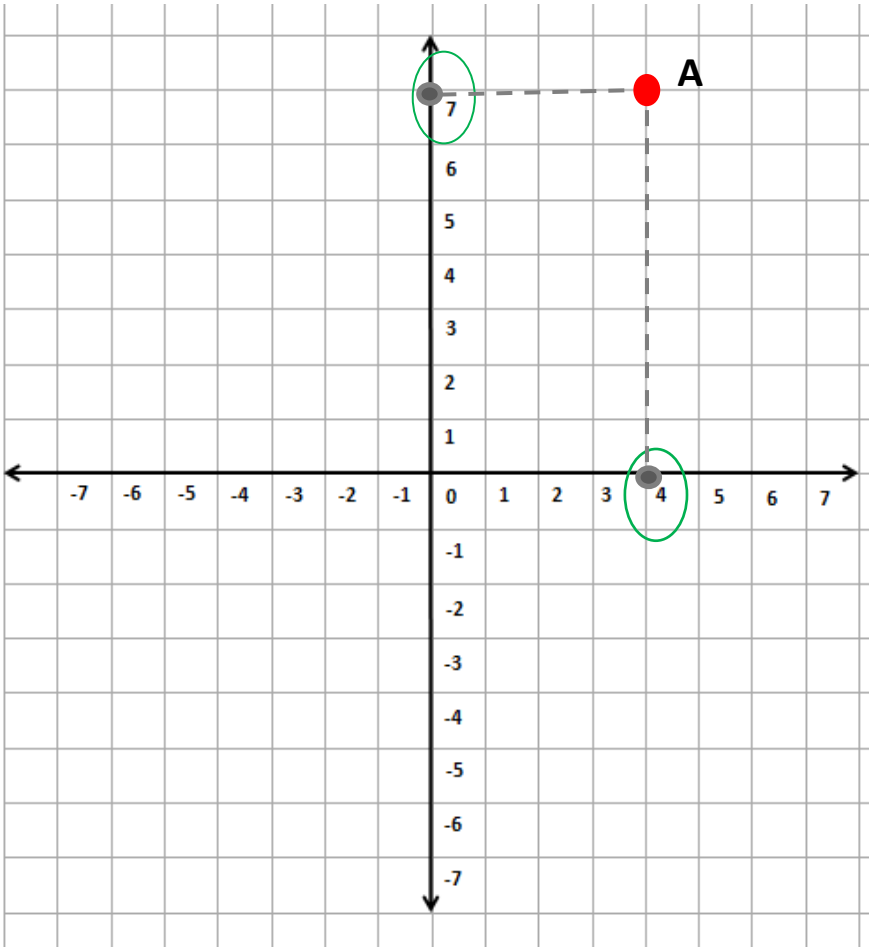
Naming Points on the Coordinate Plane

We follow specific rules in naming points in the coordinate plane. Remember that each point on the coordinate plane is determined by two rational numbers of the form **(x, y)**, where x is the first coordinate and y is the second coordinate. So, we'll name it using the numbers on the x axis first, followed by the number on the y axis. Take a look at the points on the coordinate plane. What are the coordinates of the given points?



Let's start with **point A**.

The x-coordinate of **point A** describes the point's position in relation to the x-axis. Drawing a line from the point to the x-axis, the *x-coordinate* of **point A** is **4**.

The y-coordinate of **point A** describes the point's position in relation to the y-axis. Drawing a line from the point to the y-axis, the *y-coordinate* of **point A** is **7**.

Since the **point A** is in Quadrant I, the coordinates of **point A** are both positive: **(4, 7)**.

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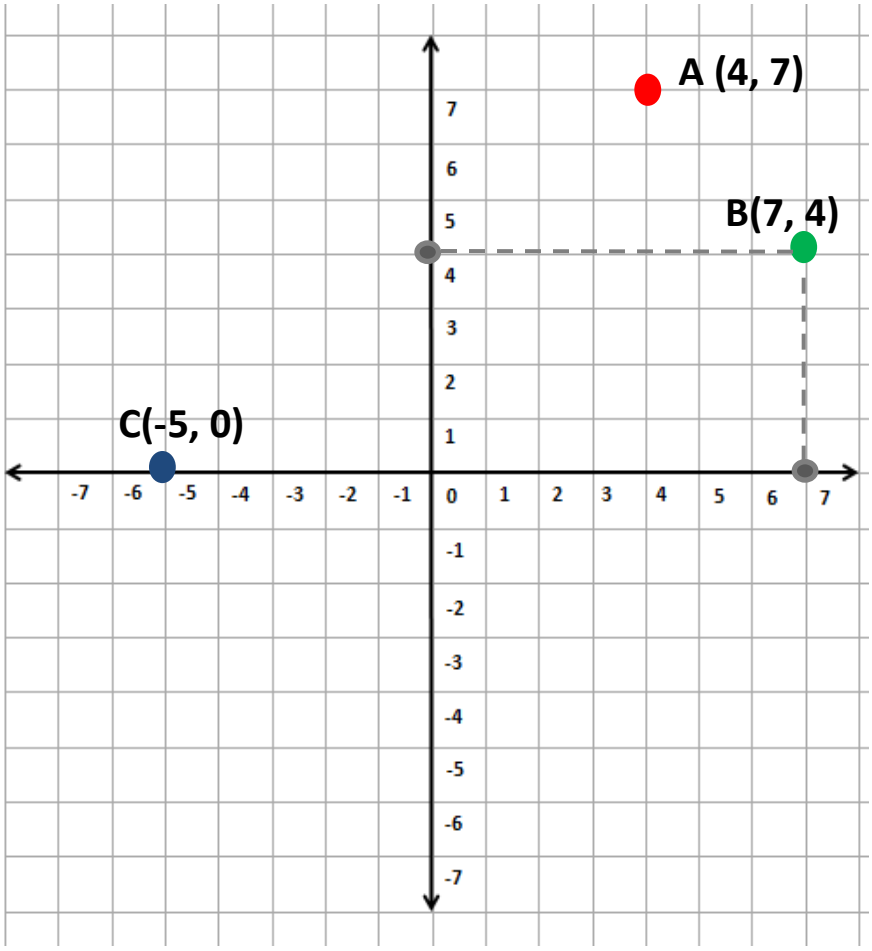
Now, name the coordinates of **point B**.

The x-coordinate of **point B** describes the point's position in relation to the x-axis. Drawing a line from the point to the x-axis, the *x-coordinate* of **point B** is 7.

The x-coordinate of **point B** describes the point's position in relation to the y-axis. Drawing a line from the point to the x-axis, the *x-coordinate* of **point B** is 4.



Since the **point B** is in Quadrant I, the coordinates of **point B** are both positive: **(7, 4)**.

Name the coordinates of **point C**.

Here **point C** is 5 units from the *y-axis* and since **point C** is on the x-axis to the left of 0, the x-coordinate is -5.

It follows that the distance of **point C** from the x-axis is 0 units; therefore the y-coordinate is 0.

Thus, the coordinates of point C is: (-5, 0).

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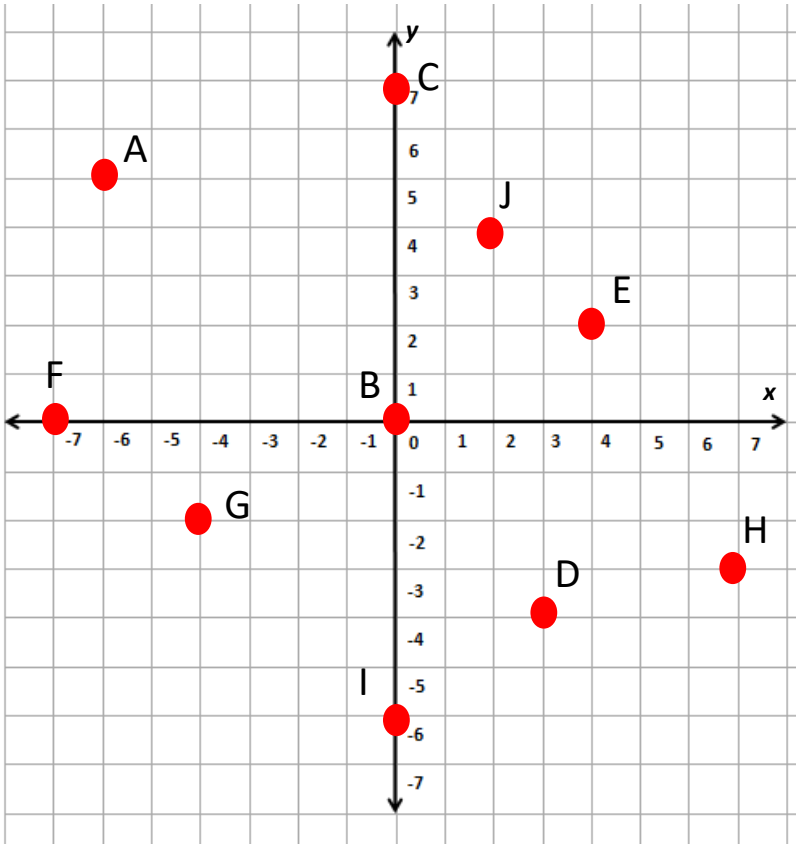
Sample Problem 4: Name the following points in the coordinate plane.

1. A
2. B
3. C
4. D
5. E
6. F
7. G
8. H
9. I
10. J



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Plotting of Points on the Coordinate Plane

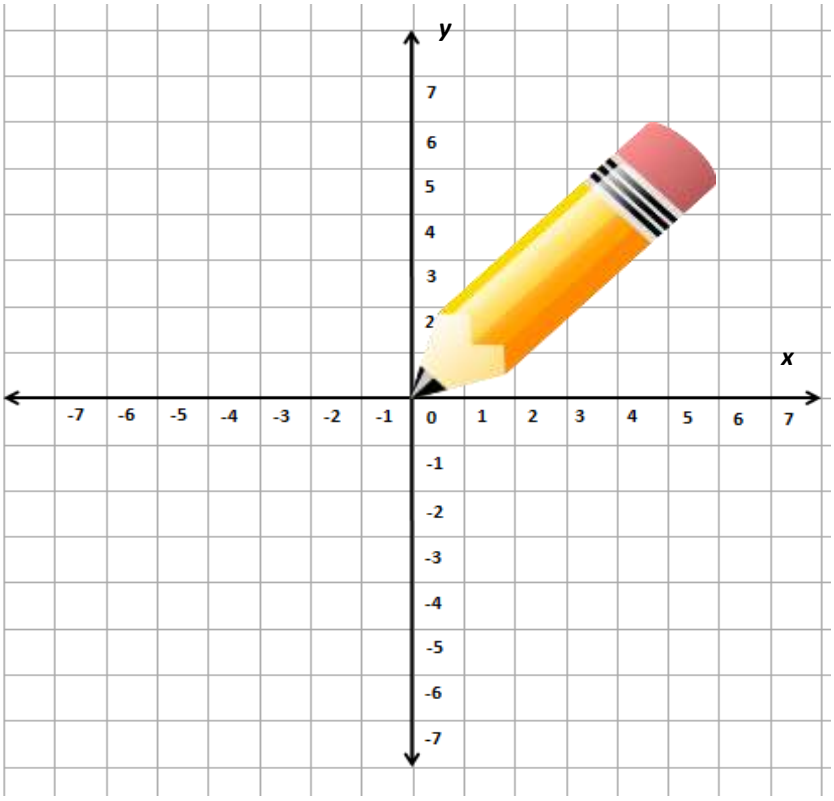
If points on the coordinate plane can be named, points can also be plotted or located in the plane using number pairs also called as their coordinates (x, y).

To locate a point in the coordinate plane, take note of the steps in each example.

1. Plot point *A* with coordinates (3, 4).

Since the x coordinate and the y coordinate are both positive, point *A* must be located in Quadrant I.

First, position your pen or pencil at the origin with coordinates (0, 0).



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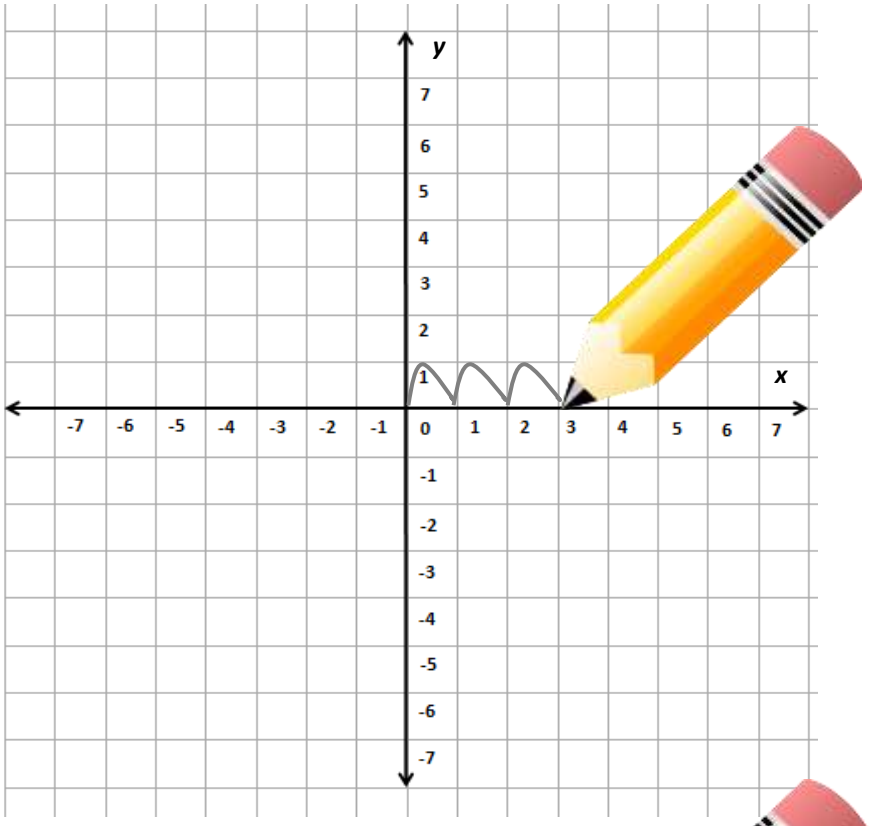
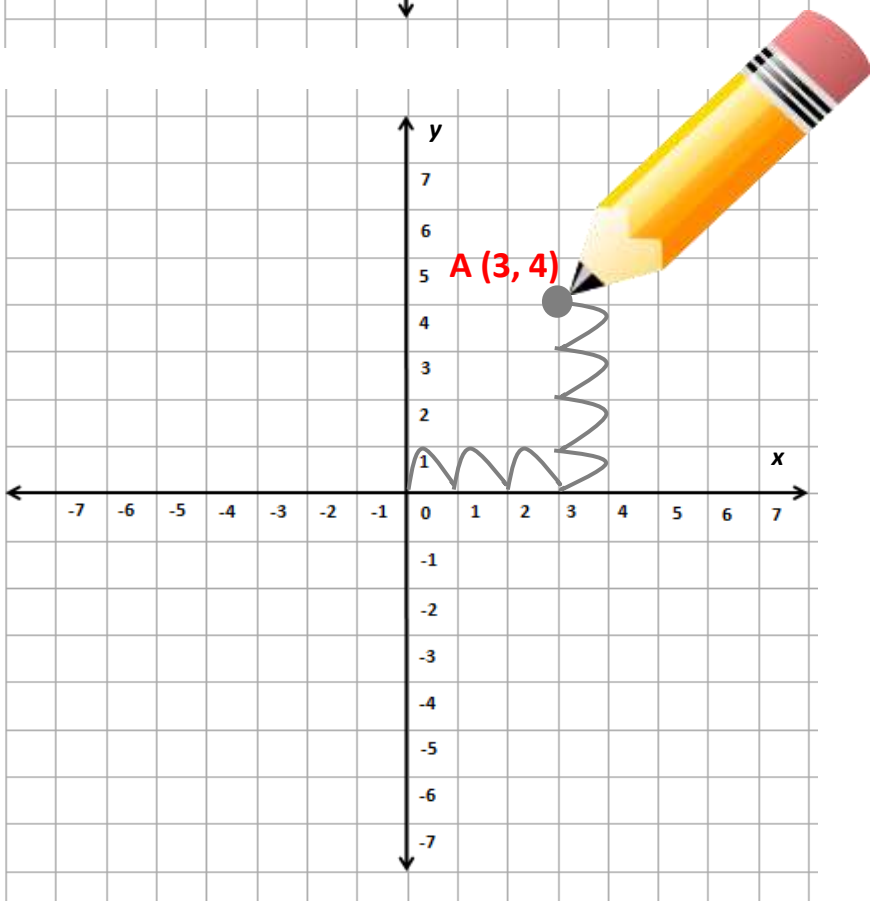
From that point, move 3 units to the right of zero, since the ***x-coordinate*** is positive 3.



And from that point, move 4 units up, since the ***y-coordinate*** is positive 4.



Yay! The point right there is where point *A* with coordinates (3, 4) must be.

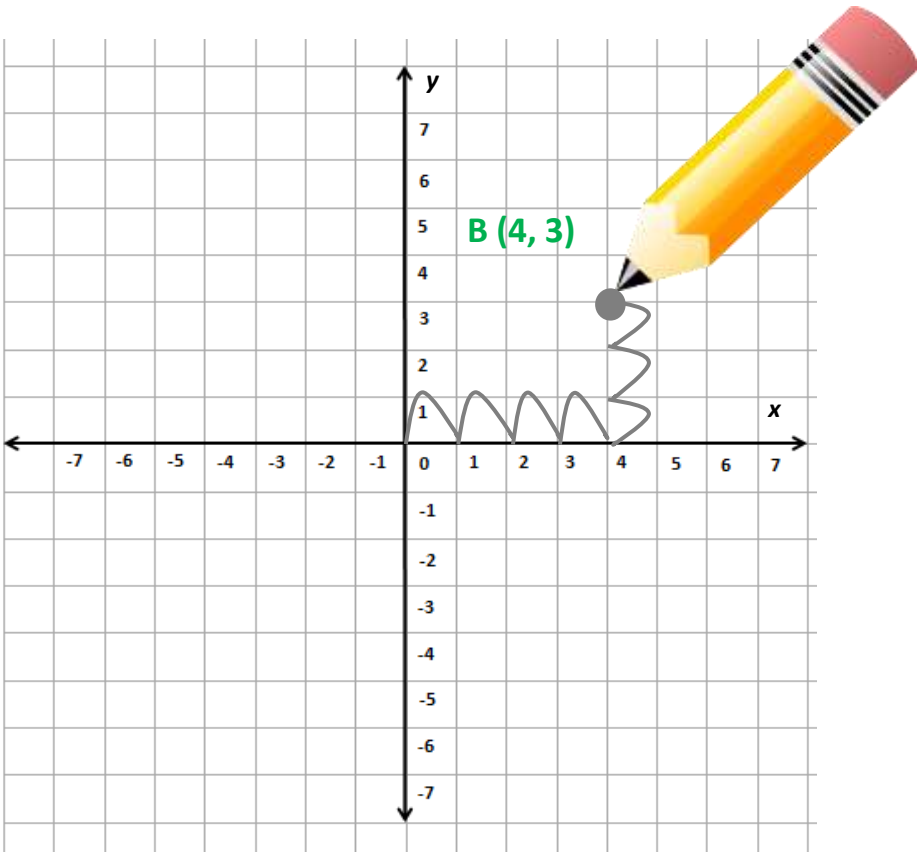
Rational Numbers and the Coordinate Plane Guided Notes Math 6

2. Plot point *B* with coordinates (4, 3).

Since the ***x-coordinate*** and the ***y-coordinate*** are both positive, point B must be located in Quadrant I.

First, position your pen or pencil at the origin with coordinates (0, 0).

From that point, move 4 units to the right of zero, since the ***x-coordinate*** is positive 4.



And from that point, move 3 units up, since the ***y-coordinate*** is positive 3. The point right there is where point *B* with coordinates (4, 3) must be.

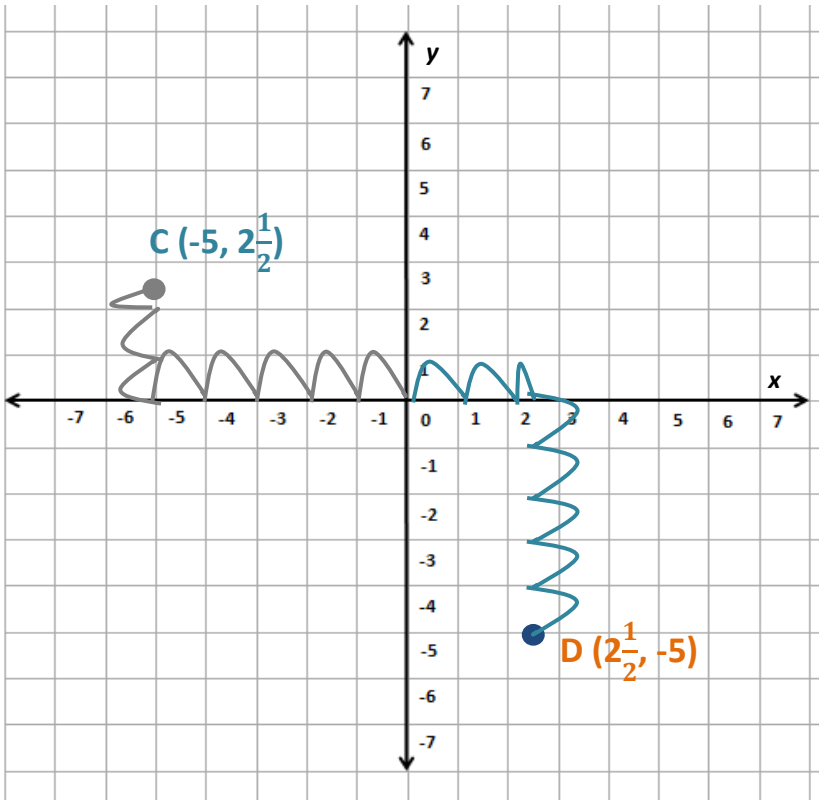
Rational Numbers and the Coordinate Plane Guided Notes Math 6

3. Plot point *C* with coordinates (-5, $2\frac{1}{2}$).

Since the ***x-coordinate*** is negative and the ***y-coordinate*** is positive, point *C* must be located in Quadrant II.

From the origin, move 5 units to the left of zero, since the ***x-coordinate*** is negative 5.

And from that point, move $2\frac{1}{2}$ units up, since the ***y-coordinate*** is positive $2\frac{1}{2}$.



4. On the same coordinate plane; plot point *D* with coordinates ($2\frac{1}{2}$, -5).

Since the ***x-coordinate*** is positive and the ***y-coordinate*** is negative, point ***D*** must be located in Quadrant IV.

From the origin, move $2\frac{1}{2}$ units to the right of zero, since the ***x-coordinate*** is positive $2\frac{1}{2}$.

And from that point, move 5 units down, since the ***y-coordinate*** is negative 5.

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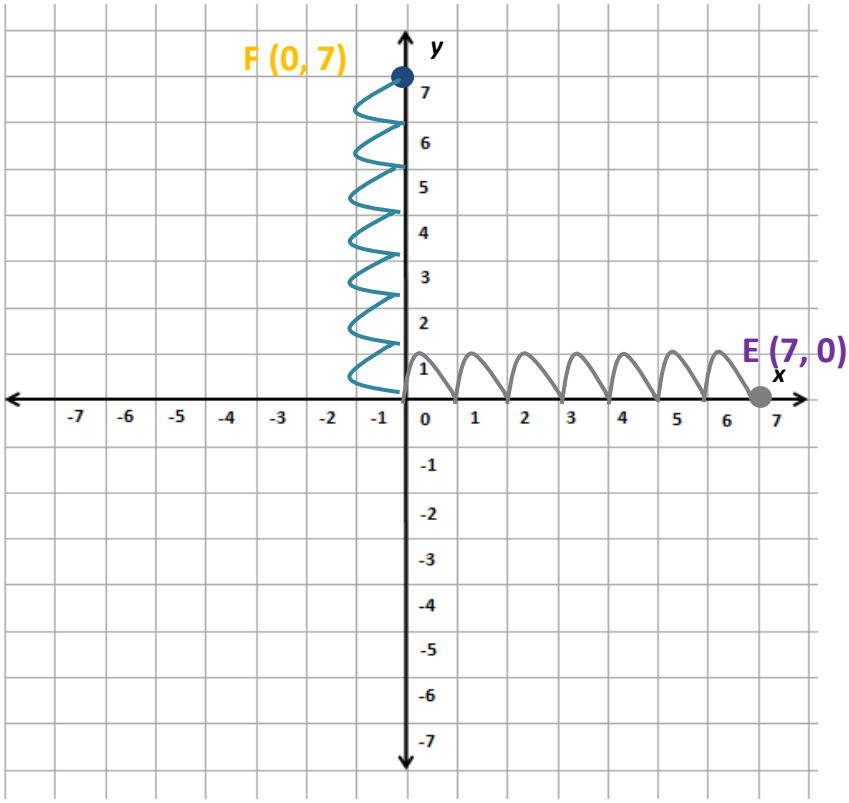
Rational Numbers and the Coordinate Plane Guided Notes Math 6

5. Plot point ***E*** with coordinates (7, 0).

Since the ***x-coordinate*** is positive and the ***y-coordinate*** is 0, point E must be located in the *x axis*.

From the origin, move 7 units to the right of zero, since the ***x-coordinate*** is positive 7.

The point stays in that position since the *y-coordinate* is 0.



6. On the same coordinate plane; plot point ***F*** with coordinates (0, 7).

Since the ***x-coordinate*** is 0 and the ***y-coordinate*** is positive, point ***F*** must be located in the *y-axis*.

From the origin, there should be no right or left movement since the *x-coordinate* is 0. Just continue moving 7 units up since the *y-coordinate* is positive 7.

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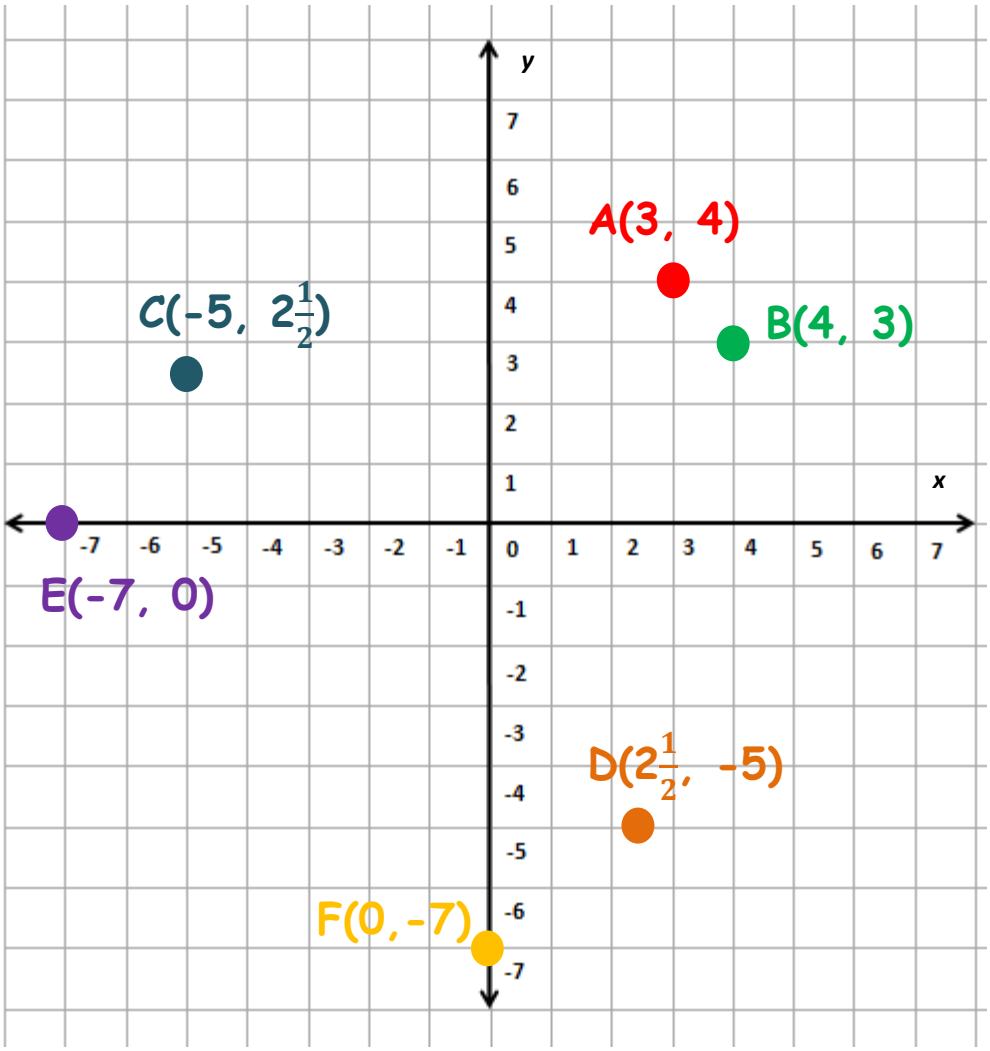
Now using the examples above, compare the location of the points on the coordinate plane. What have you observed?

A(3, 4) B(4, 3) C(-5, $2\frac{1}{2}$) D($2\frac{1}{2}$, -5) E(7,0) F(0, 7)

The order of numbers in the coordinates affects the location of the point on the coordinate plane.

Points A(3, 4) and B(4, 3) may have the same numbers in the parenthesis but will have different positions on the plane.

The same thing goes for points C(-5, $2\frac{1}{2}$) and D($2\frac{1}{2}$, -5),and E(7,0) and F(0, 7).



Rational Numbers and the Coordinate Plane Guided Notes **Math 6**

Sample Problem 5: Plot the following points on the coordinate plane.

1. A(0, 0)
2. B(-2, 4)
3. C(4, -2)
4. D($6\frac{1}{2}$, 3)
5. E(4, 0)
6. F(0, -4)
7. G(-5, -3)
8. H(5, 3)
9. I(5, -3)