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# Rational Numbers and the Coordinate Plane

Unit 3 Lesson 6

# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Students will be able to:

- Describe the coordinate plane.
- Define the terms related to the coordinate plane.
- Identify the different parts of the coordinate plane.
- Name points in the coordinate plane.
- Plot points in the coordinate plane.



# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Key Vocabulary:

Rational Numbers

Coordinate Plane

Quadrants

Ordered Pairs/Number Pairs

x-axis/y-axis

Origin

x-coordinate/abscissa

y-coordinate/ordinate



## Rational Numbers

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

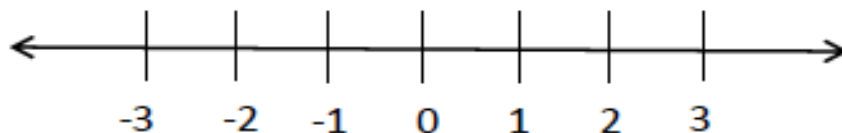
$$\frac{p}{q} \text{ where } p \text{ and } q \text{ are integers and } q \text{ is not zero}$$

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

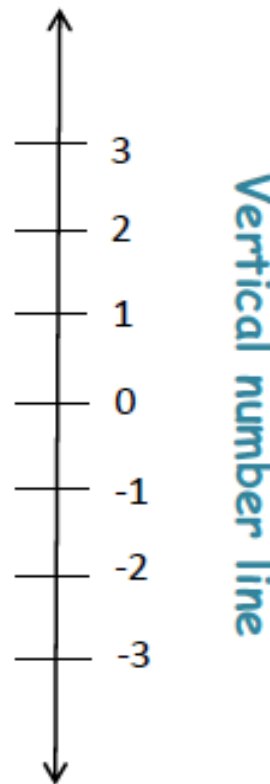
# RATIONAL NUMBERS AND THE COORDINATE PLANE

## The Coordinate Plane

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



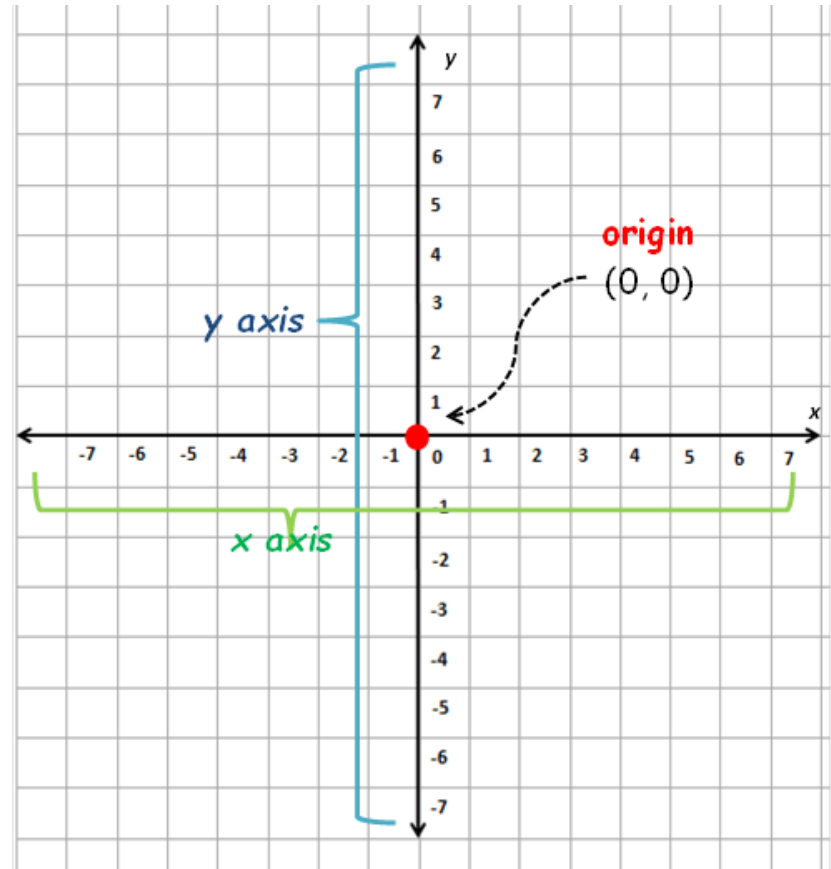
Horizontal number line



# RATIONAL NUMBERS AND THE COORDINATE PLANE

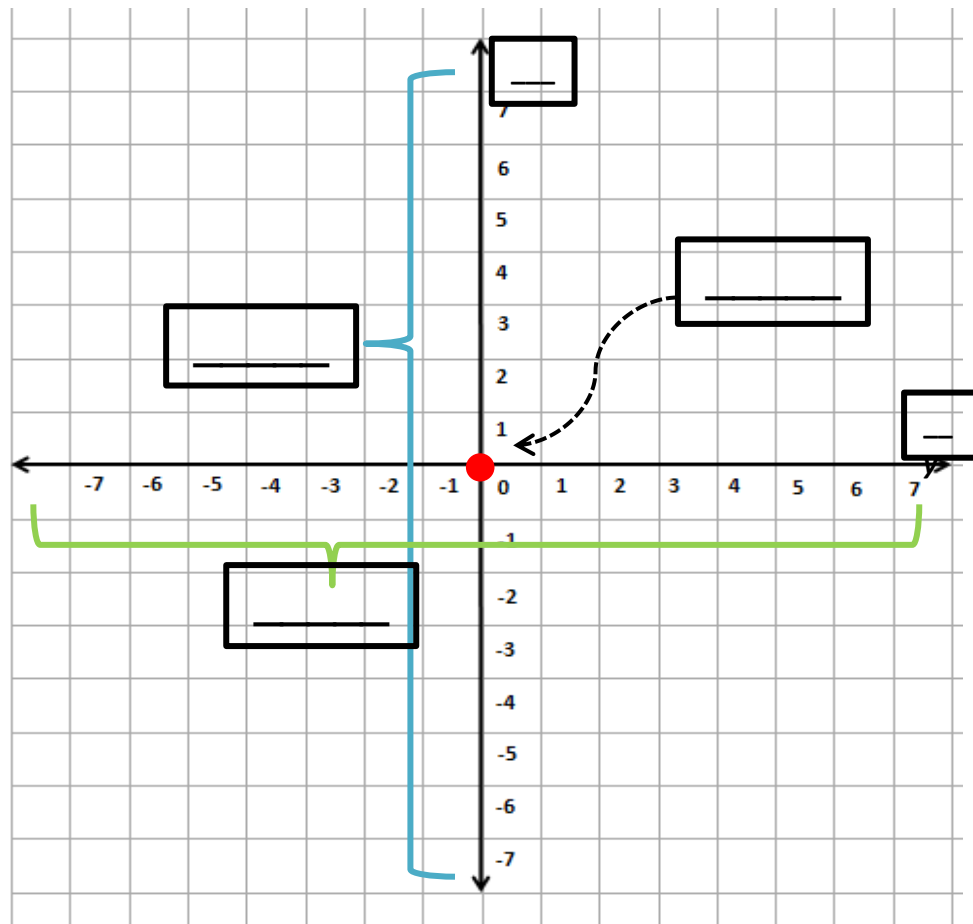
## The Coordinate Plane

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**.



# RATIONAL NUMBERS AND THE COORDINATE PLANE

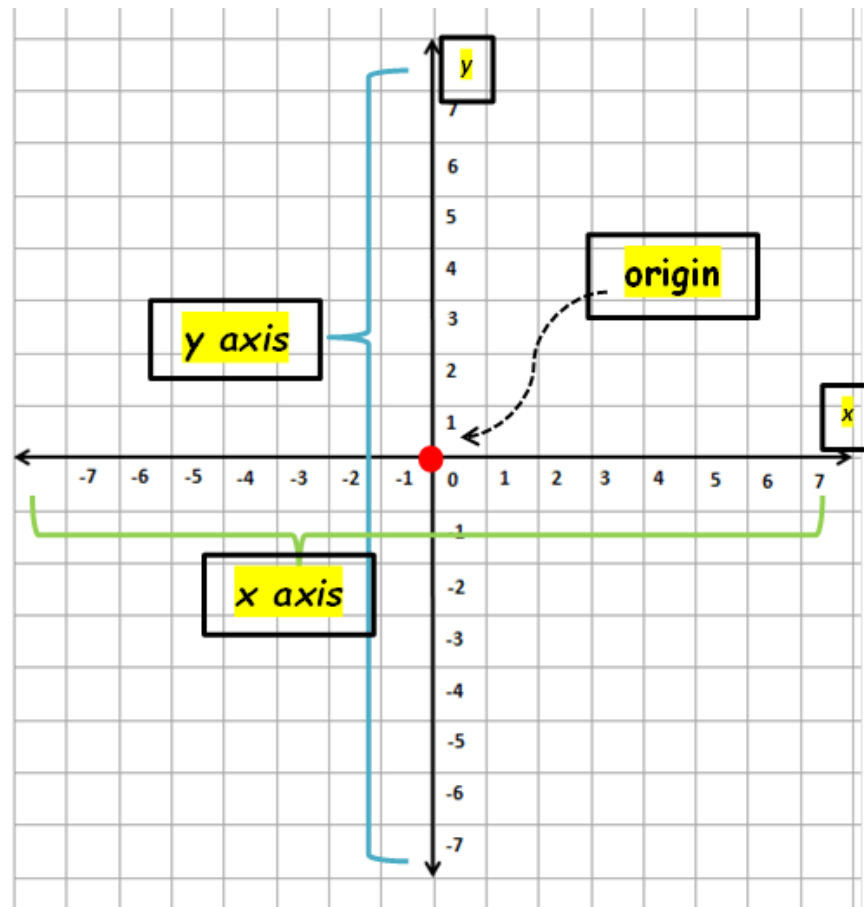
**Sample Problem 1:** Label the parts of the coordinate plane and fill out any missing values.



# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Sample Problem 1:

## Solution

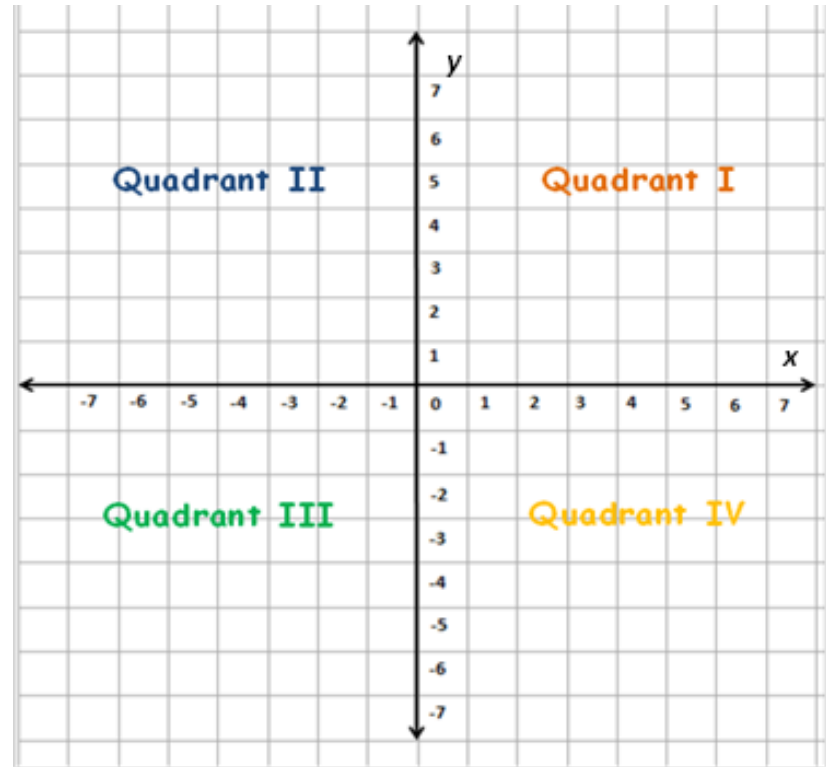




# RATIONAL NUMBERS AND THE COORDINATE PLANE

## 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.

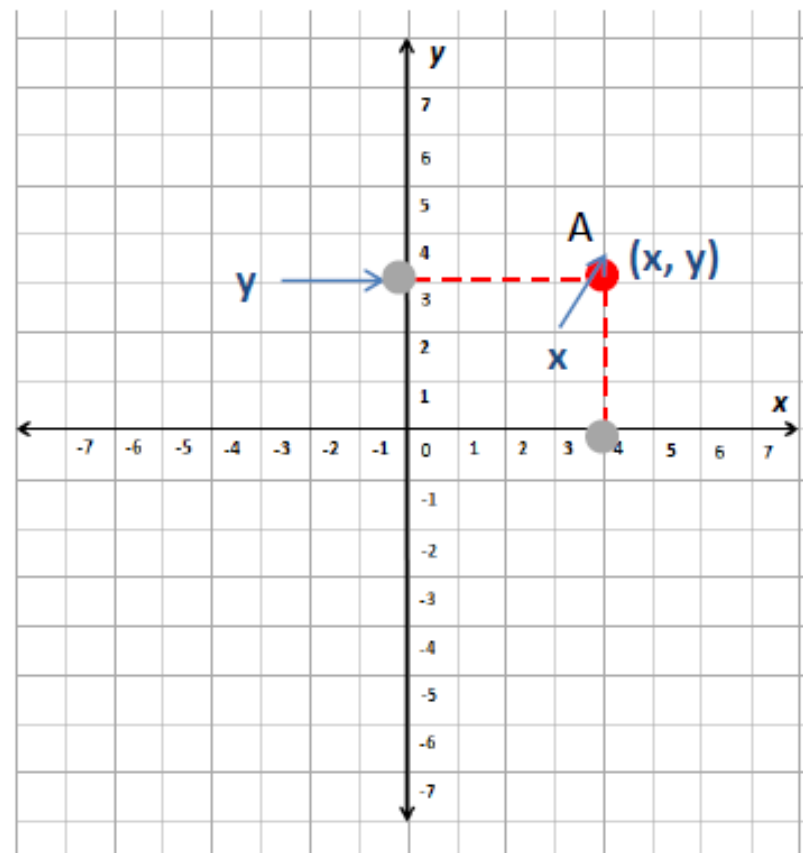


# RATIONAL NUMBERS AND THE COORDINATE PLANE

## 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.

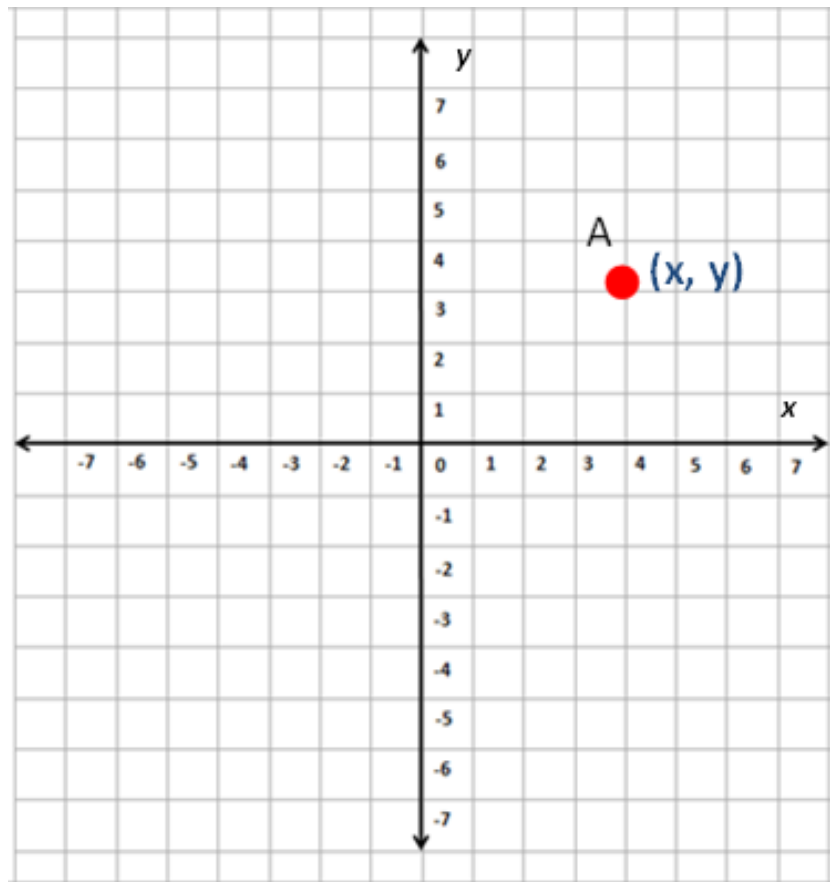


# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Points in the Coordinate Plane

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

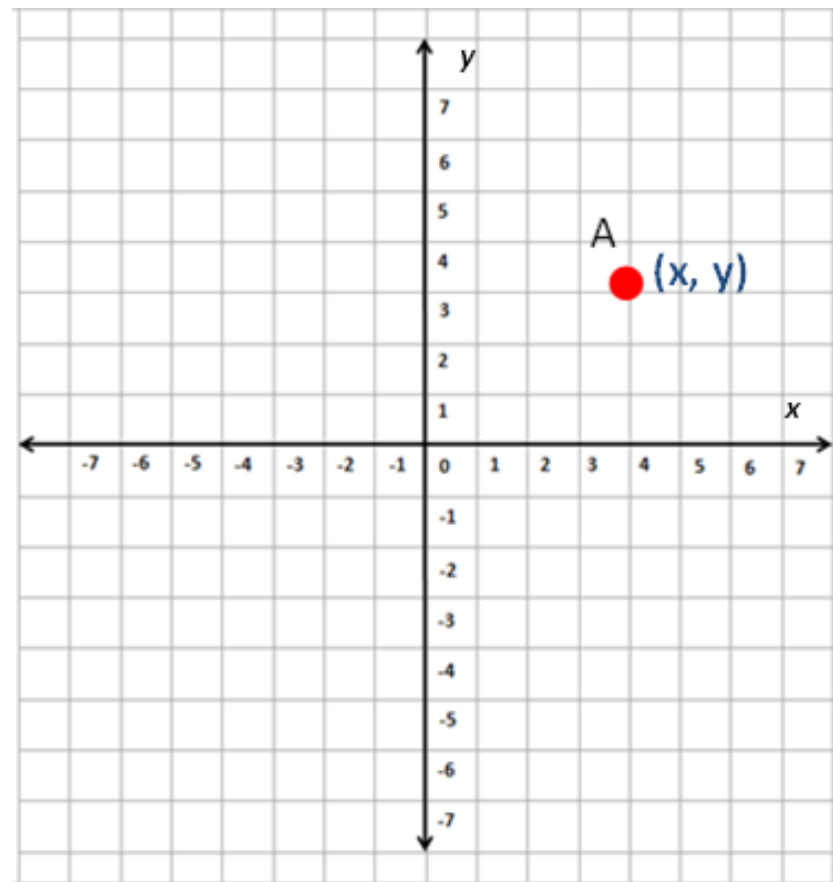
**(x, y)**. This pair of numbers corresponds to point A.



# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Points in the Coordinate Plane

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



## Points in the Coordinate Plane

$(x, y)$

(first coordinate, second coordinate)

(x coordinate, y coordinate)

(abscissa, ordinate)

## RATIONAL NUMBERS AND THE COORDINATE PLANE

**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 $(-25, 0)$		

# RATIONAL NUMBERS AND THE COORDINATE PLANE

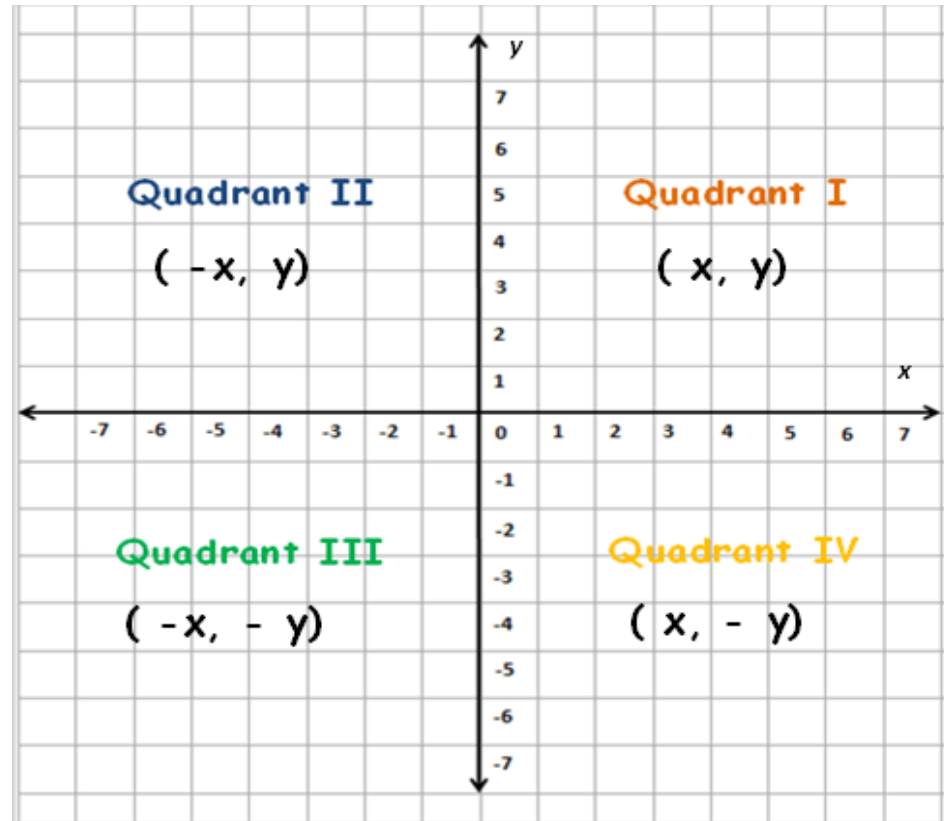
## Sample Problem 2: Solution

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

# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Describing the Points in each Quadrant

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





# RATIONAL NUMBERS AND THE COORDINATE PLANE

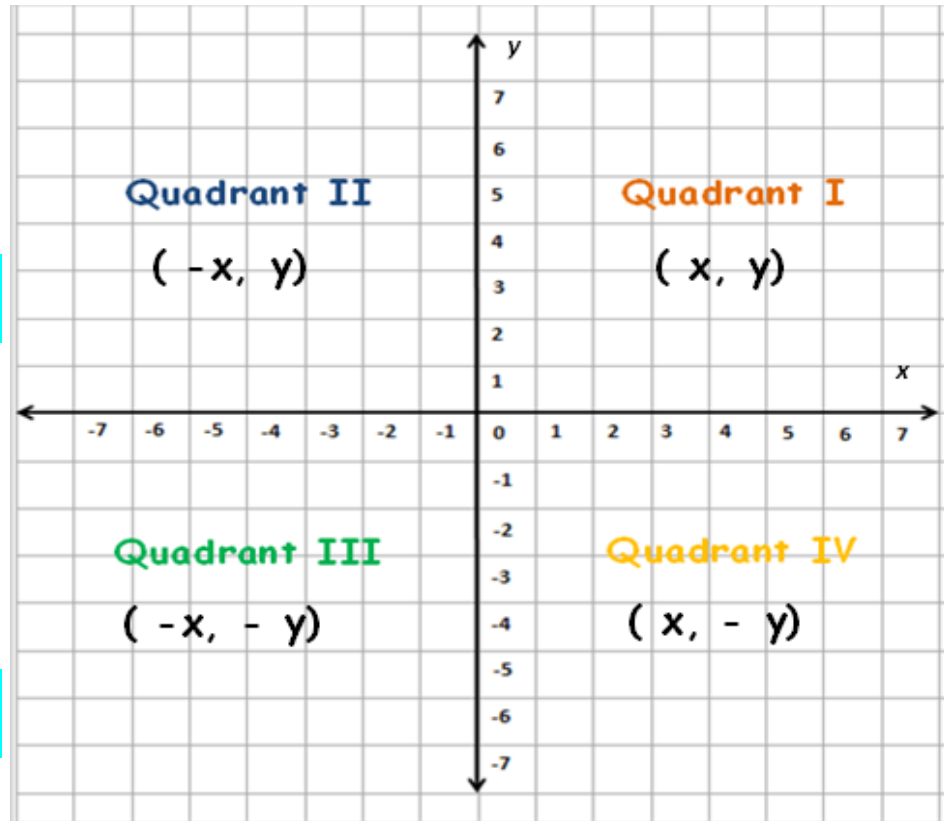
## Describing the Points in each Quadrant

### 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**.



# RATIONAL NUMBERS AND THE COORDINATE PLANE

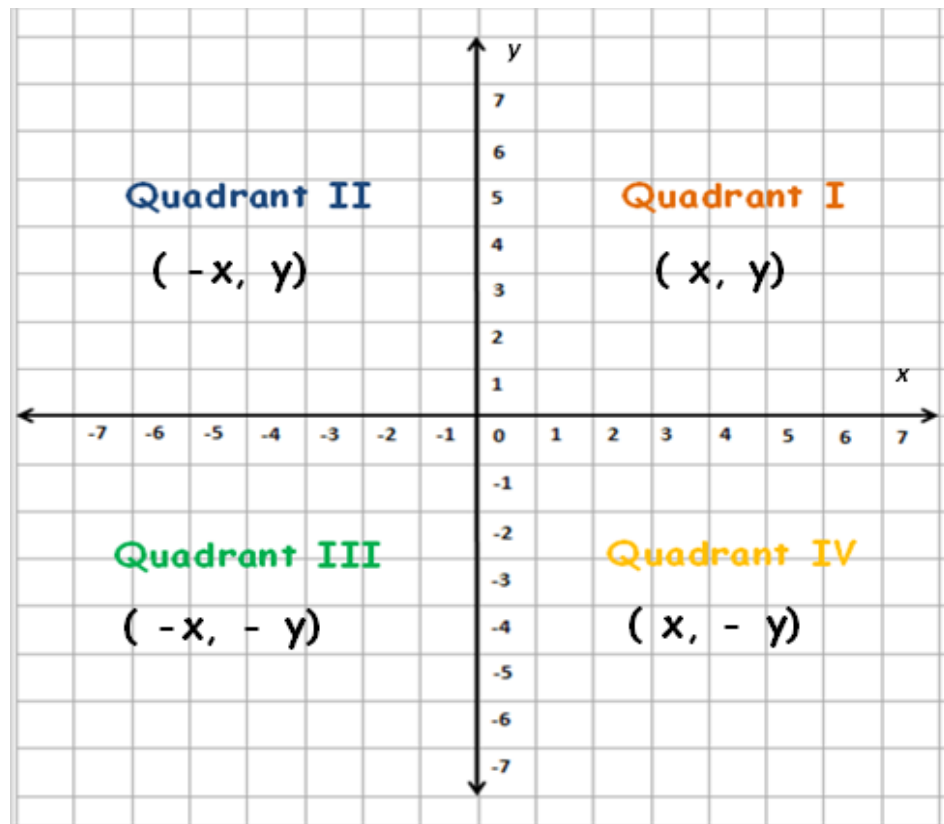
## Describing the Points in each Quadrant

### 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**.



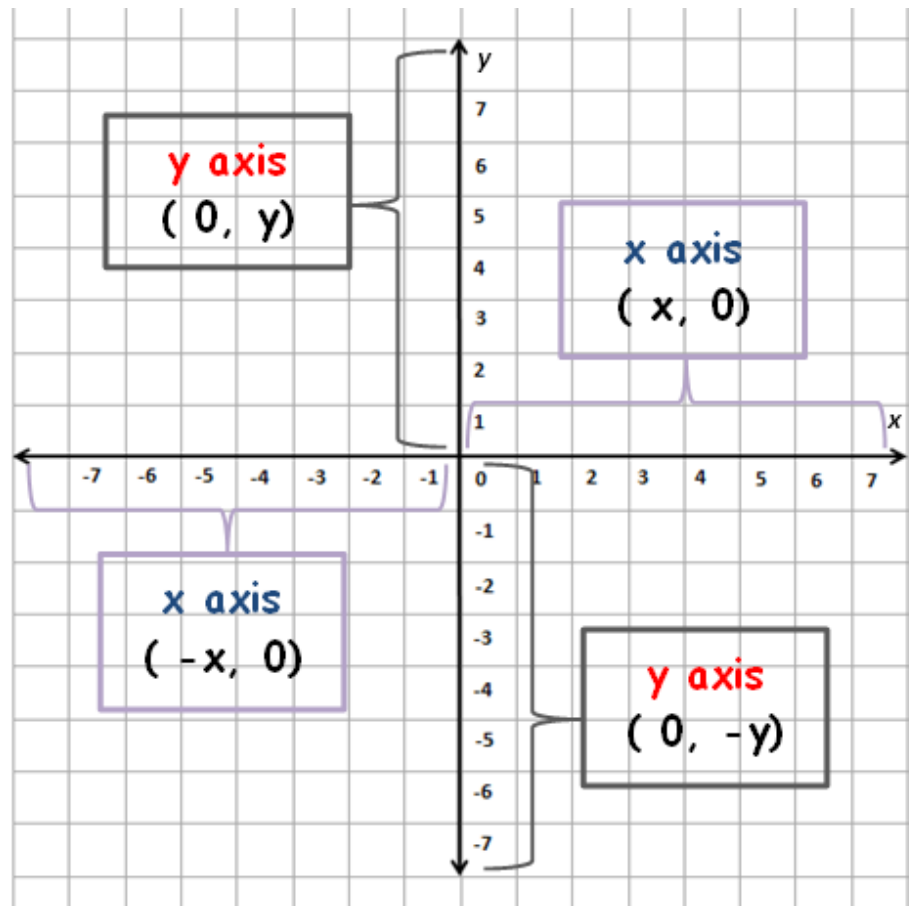
# RATIONAL NUMBERS AND THE COORDINATE PLANE

## 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.



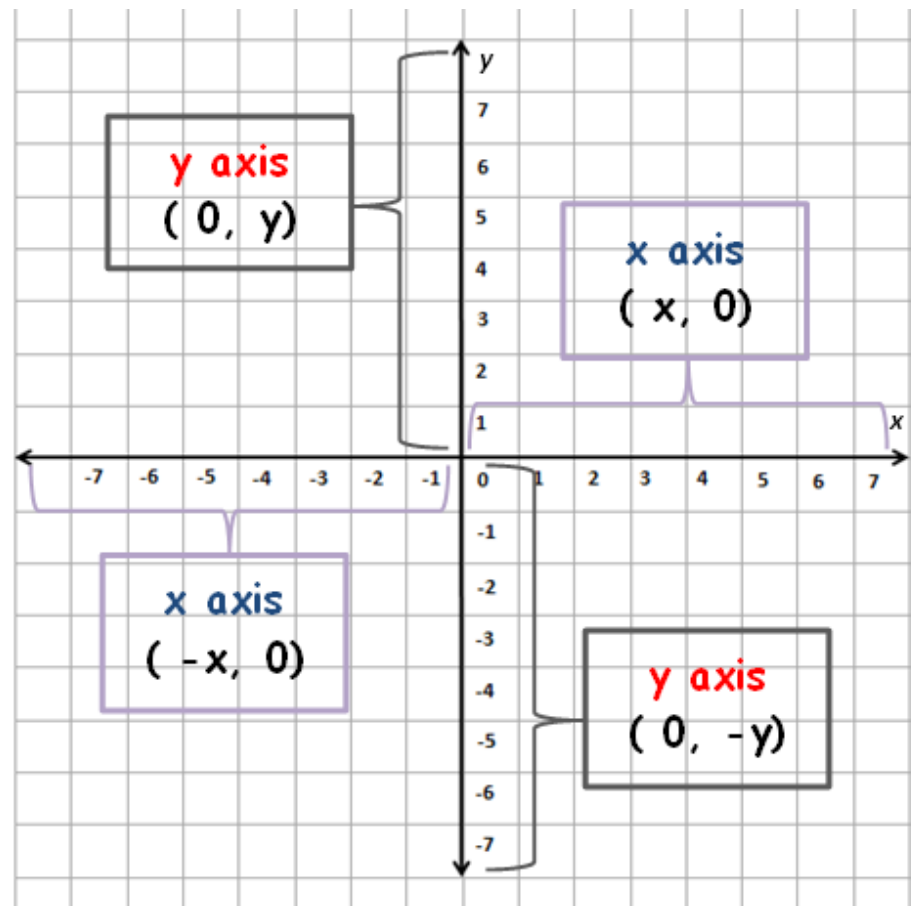
# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Describing the Points on the Axes

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.



# RATIONAL NUMBERS AND THE COORDINATE PLANE

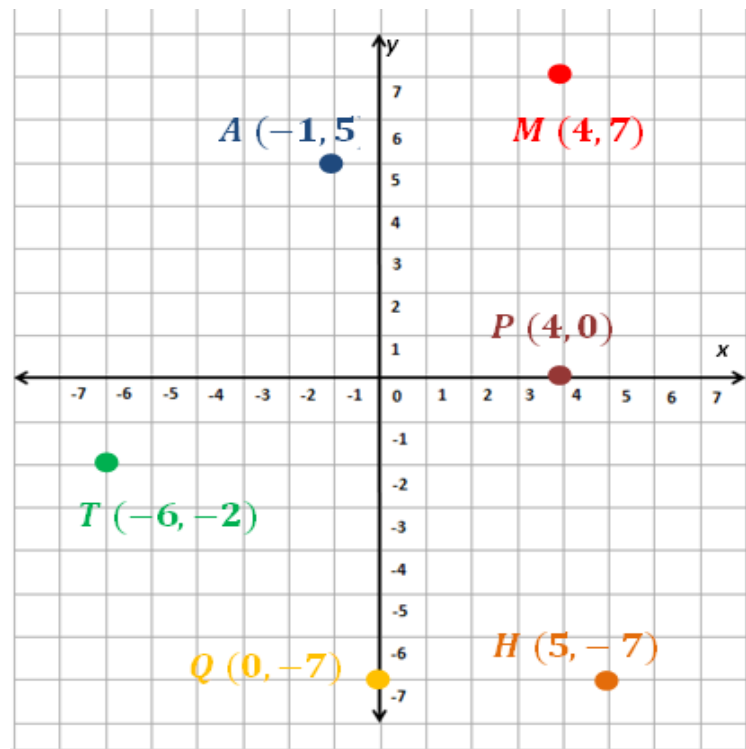
**Example:** Tell where the following points are located in the coordinate plane.

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.



## RATIONAL NUMBERS AND THE COORDINATE PLANE

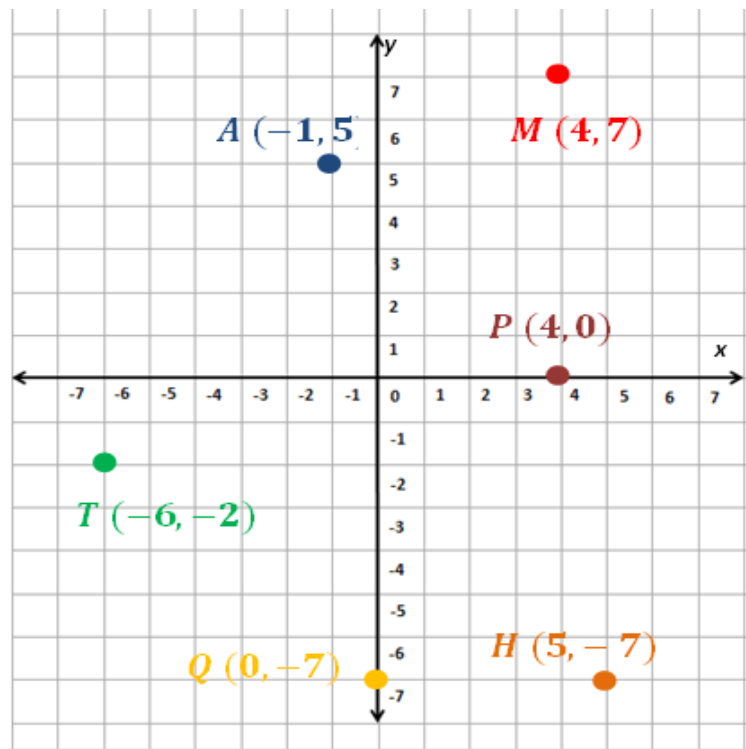
**Example:** Tell where the following points are located in the coordinate plane.

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.



## RATIONAL NUMBERS AND THE COORDINATE PLANE

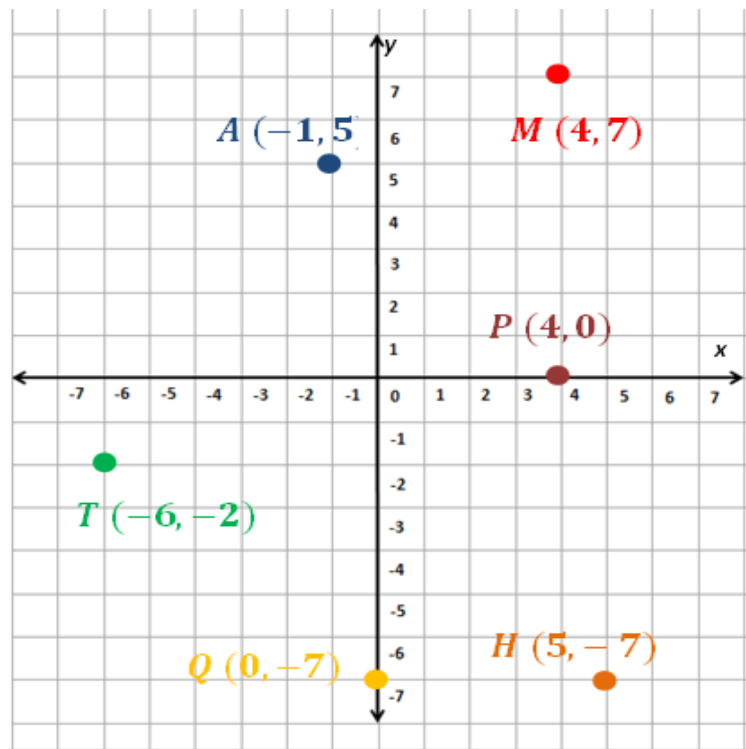
**Example:** Tell where the following points are located in the coordinate plane.

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.



## RATIONAL NUMBERS AND THE COORDINATE PLANE

**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.	$F (\frac{1}{3}, -\frac{2}{3})$	



## RATIONAL NUMBERS AND THE COORDINATE PLANE

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

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



# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Sample Problem 3: Solution

Point		Location
1.	$A (-1, 1)$	Solution: Quadrant II
2.	$B (-9, -4)$	Solution: Quadrant III
3.	$C (0, -12)$	Solution: y axis
4.	$E (0, 0)$	Solution: Origin
5.	$F (\frac{1}{3}, -\frac{2}{3})$	Solution: Quadrant IV

## Sample Problem 3: Solution

Point		Location
6.	$G(-16, -2)$	Solution: Quadrant III
7.	$H(6, -18)$	Solution: Quadrant IV
8.	$I(9, 0)$	Solution: x axis
9.	$J(22, 23)$	Solution: Quadrant I
10.	$K(-\frac{3}{4}, \frac{5}{2})$	Solution: Quadrant II

## Naming Points in the Coordinate Plane

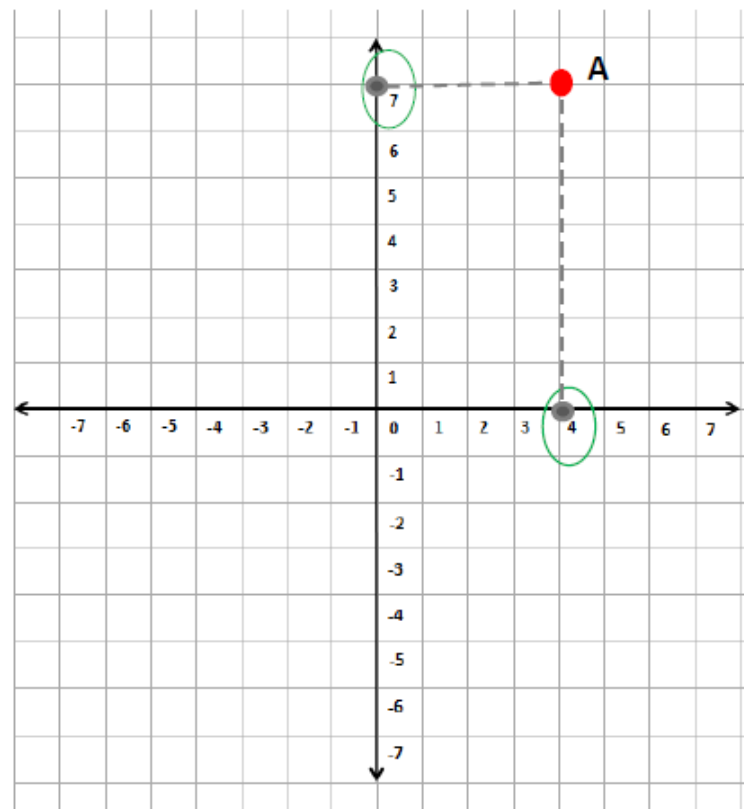
We follow specific rules in naming points in the coordinate plane. Remember that each point on the coordinate plane is determined by two rational numbers of the form  $(x, y)$ , where  $x$  is the first coordinate and  $y$  is the second coordinate. So, we'll name it using the numbers on the  $x$  axis 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?

# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Naming Points in the Coordinate Plane

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**.

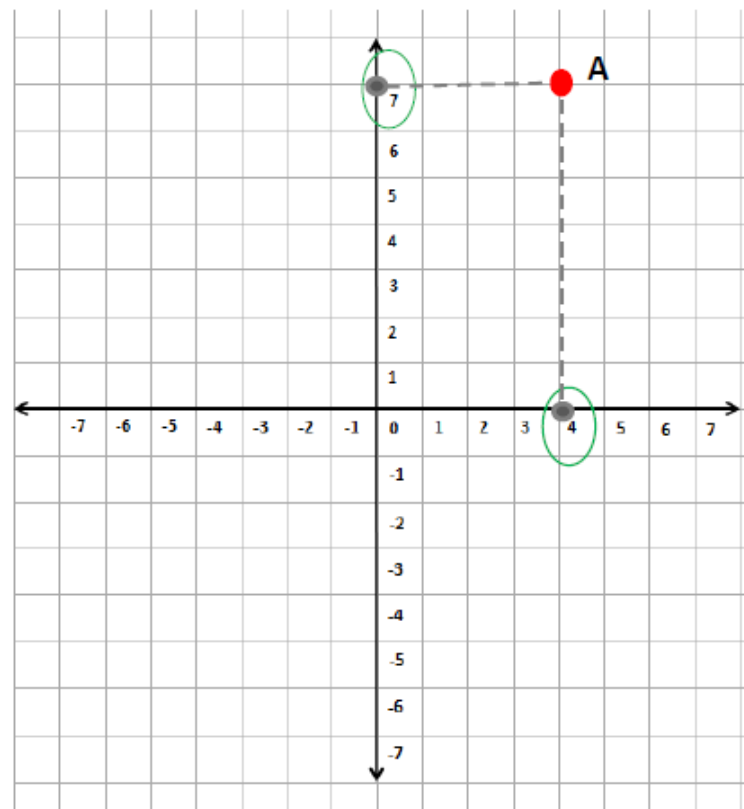


# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Naming Points in the Coordinate Plane

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)**.

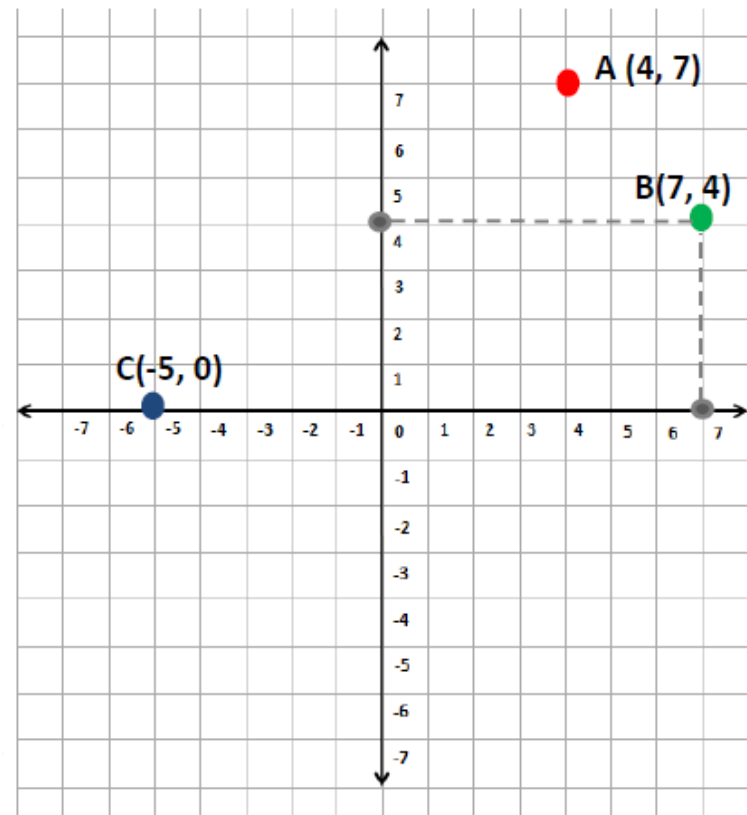


# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Naming Points in the Coordinate Plane

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**.

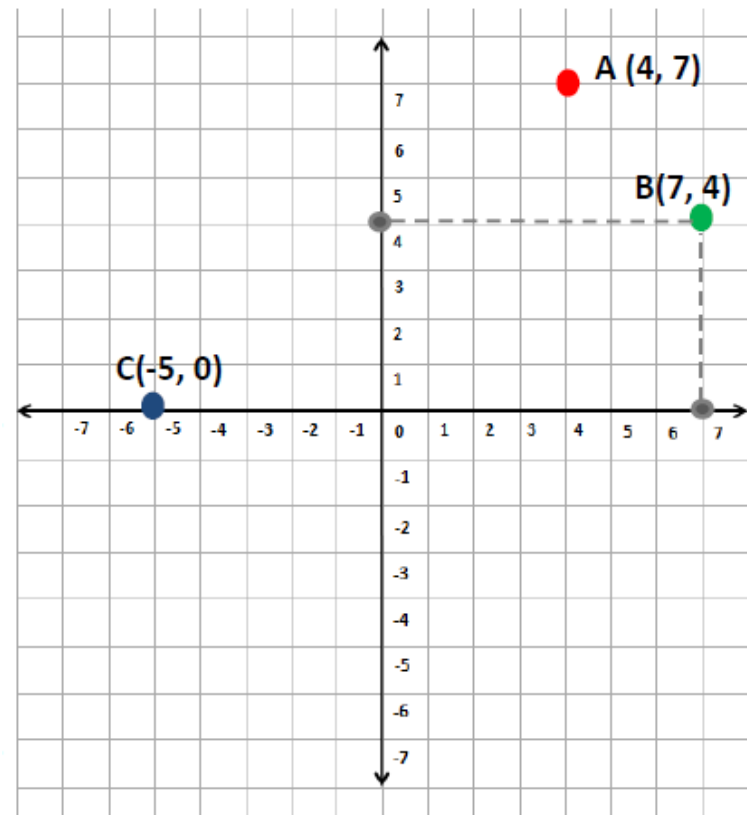


# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Naming Points in the Coordinate Plane

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 )**.





# RATIONAL NUMBERS AND THE COORDINATE PLANE

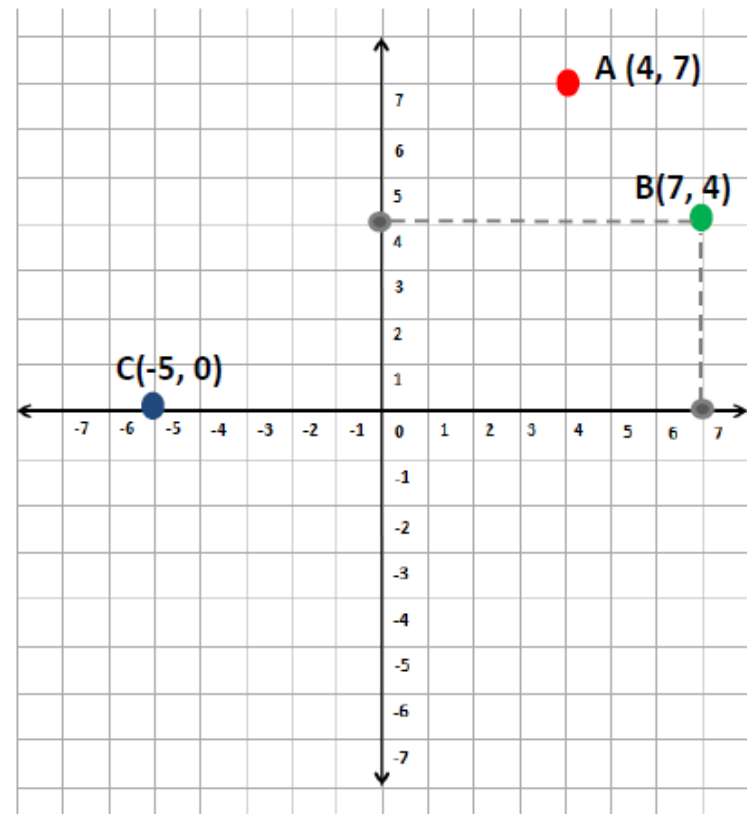
## Naming Points in the Coordinate Plane

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.

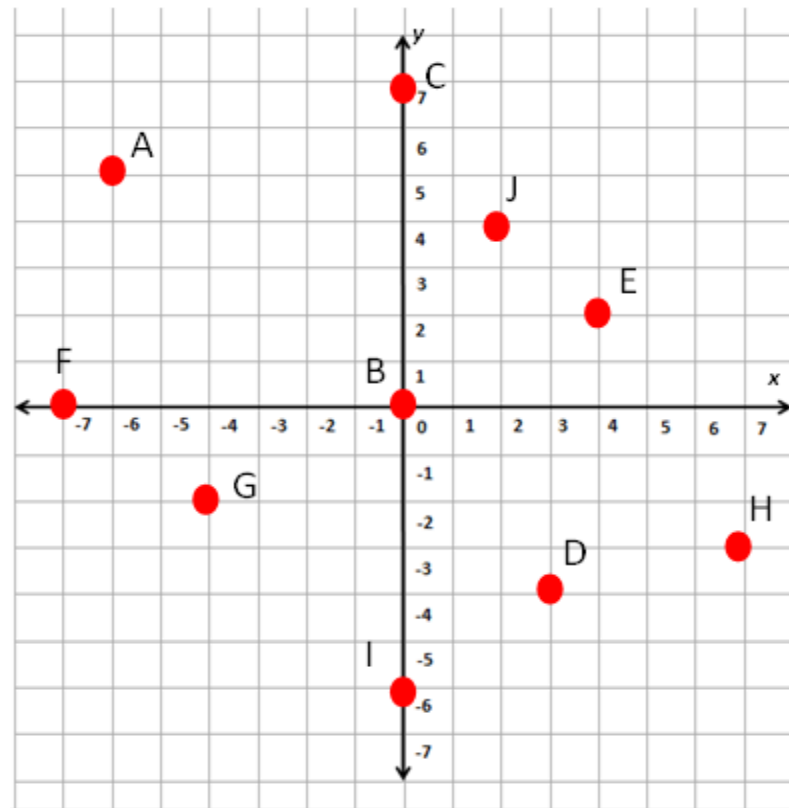
Thus, the coordinates of **point C** is: **(-5, 0)**.



# RATIONAL NUMBERS AND THE COORDINATE PLANE

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

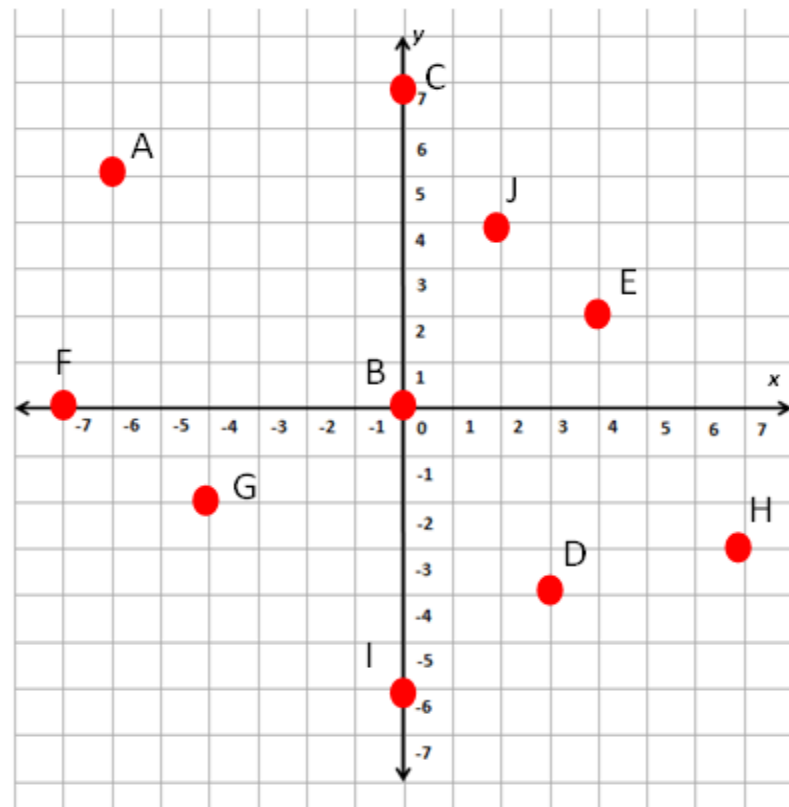
- |      |       |
|------|-------|
| 1. A | 6. F  |
| 2. B | 7. G  |
| 3. C | 8. H  |
| 4. D | 9. I  |
| 5. E | 10. J |



# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Sample Problem 4: Solution

- |                |                 |
|----------------|-----------------|
| 1. A $(-6, 5)$ | 6. F $(-7, 0)$  |
| 2. B $(0, 0)$  | 7. G $(-4, -2)$ |
| 3. C $(0, 7)$  | 8. H $(7, -3)$  |
| 4. D $(3, -4)$ | 9. I $(0, -6)$  |
| 5. E $(4, 2)$  | 10. J $(2, 4)$  |



## 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 (  $x$ ,  $y$  ).

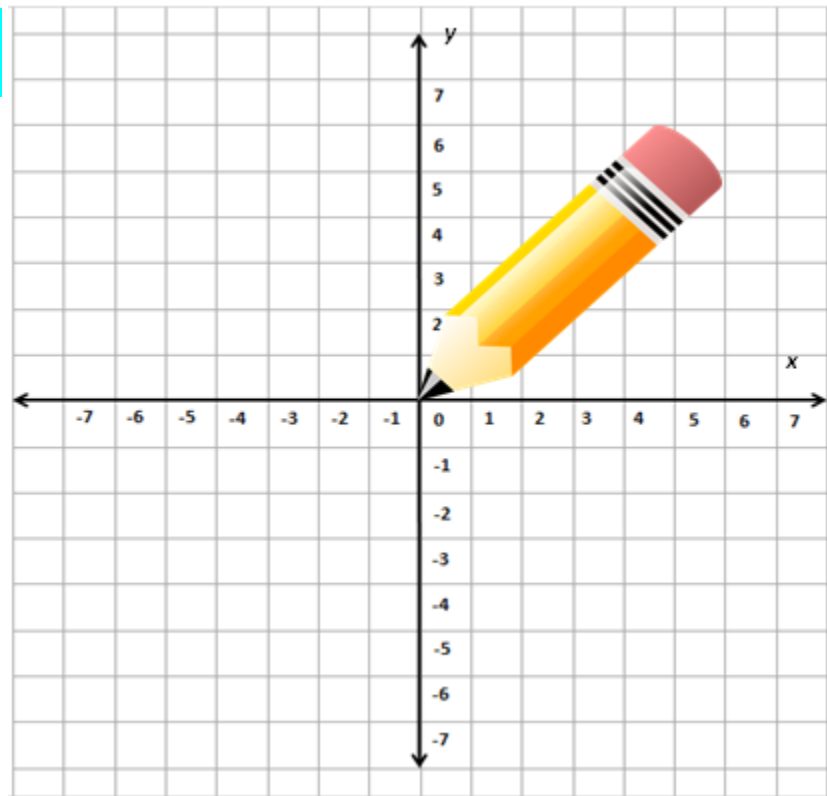
To locate a point in the coordinate plane, take note of the steps in each example.

## Plotting of Points on the Coordinate Plane

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.

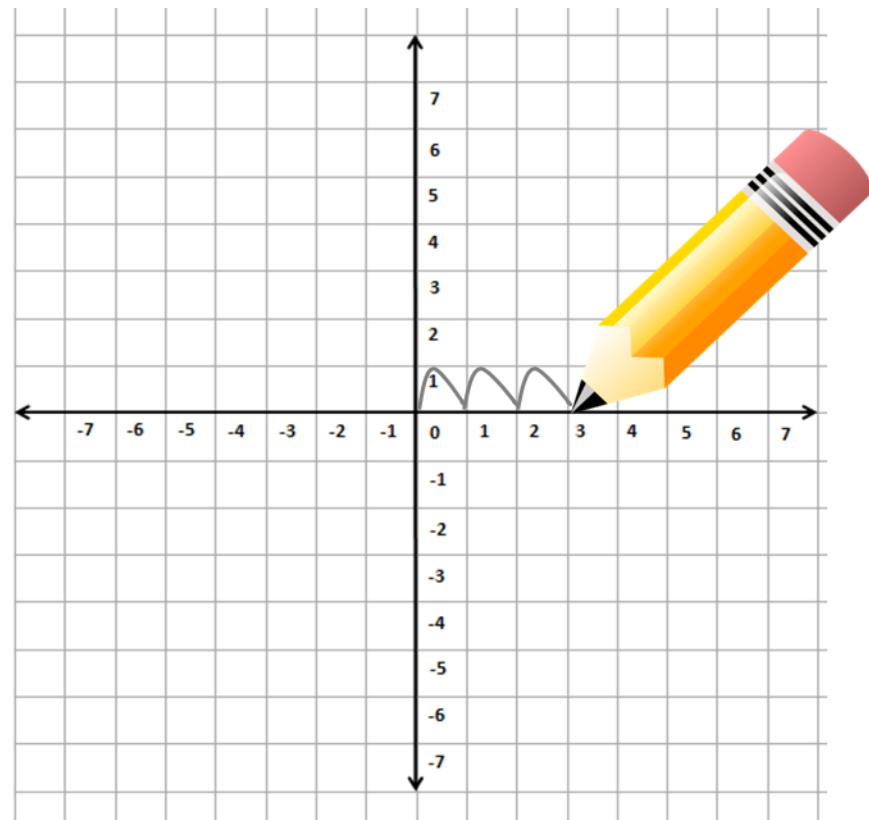
First, position your pen or pencil at the origin with coordinates  $(0, 0)$ .



## Plotting of Points on the Coordinate Plane

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

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

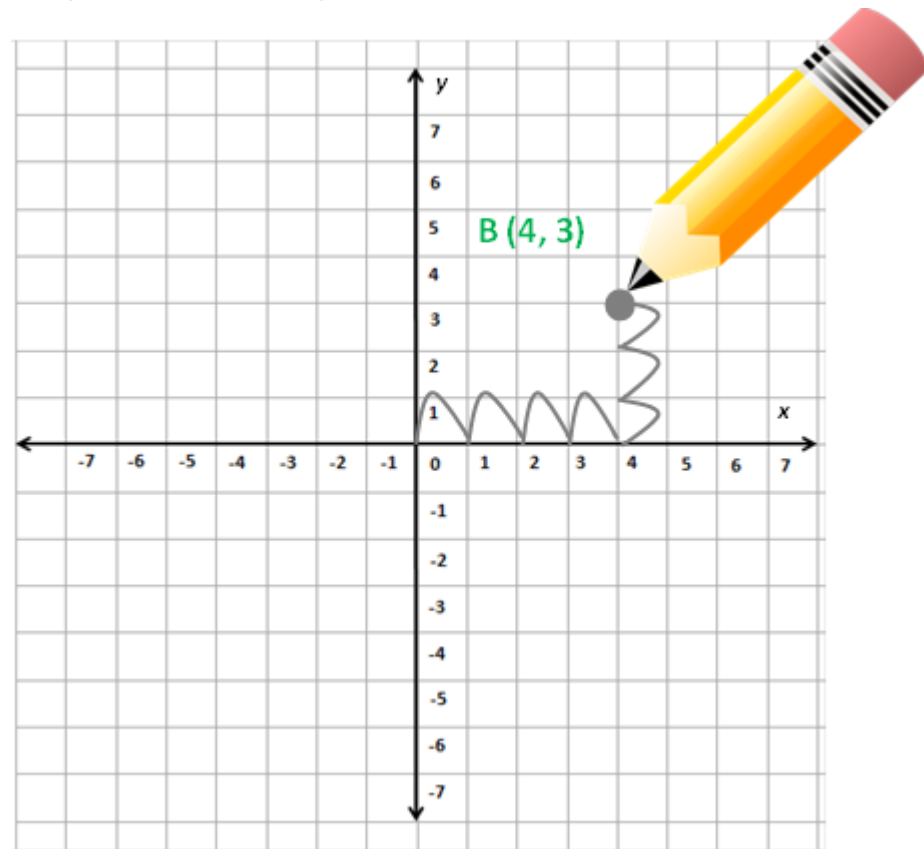


## Plotting of Points on the Coordinate Plane

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  $(0, 0)$ .

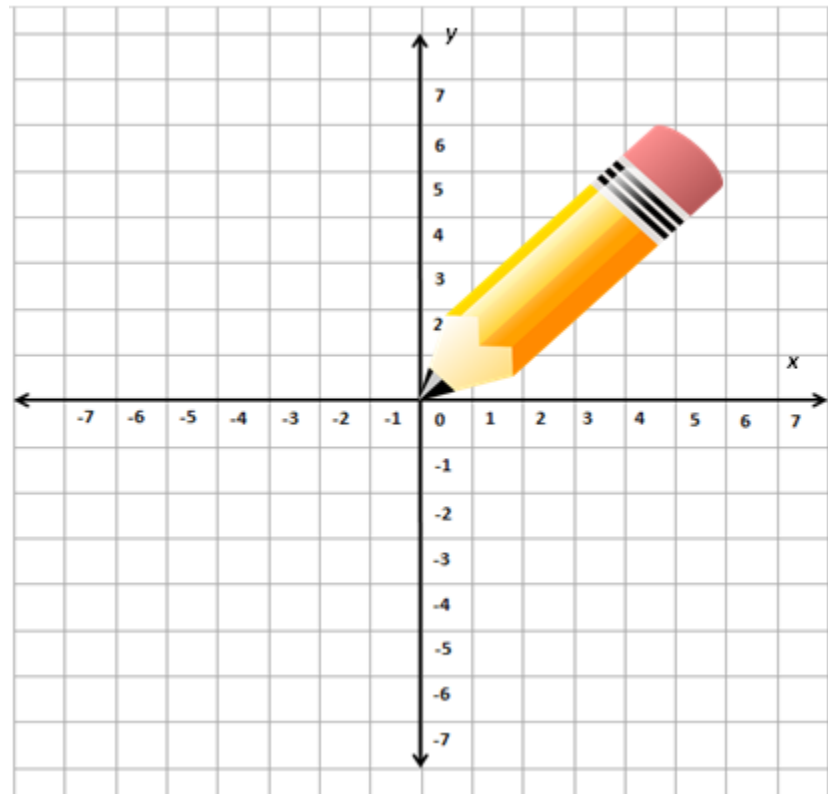


## Plotting of Points on the Coordinate Plane

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  $(0, 0)$ .



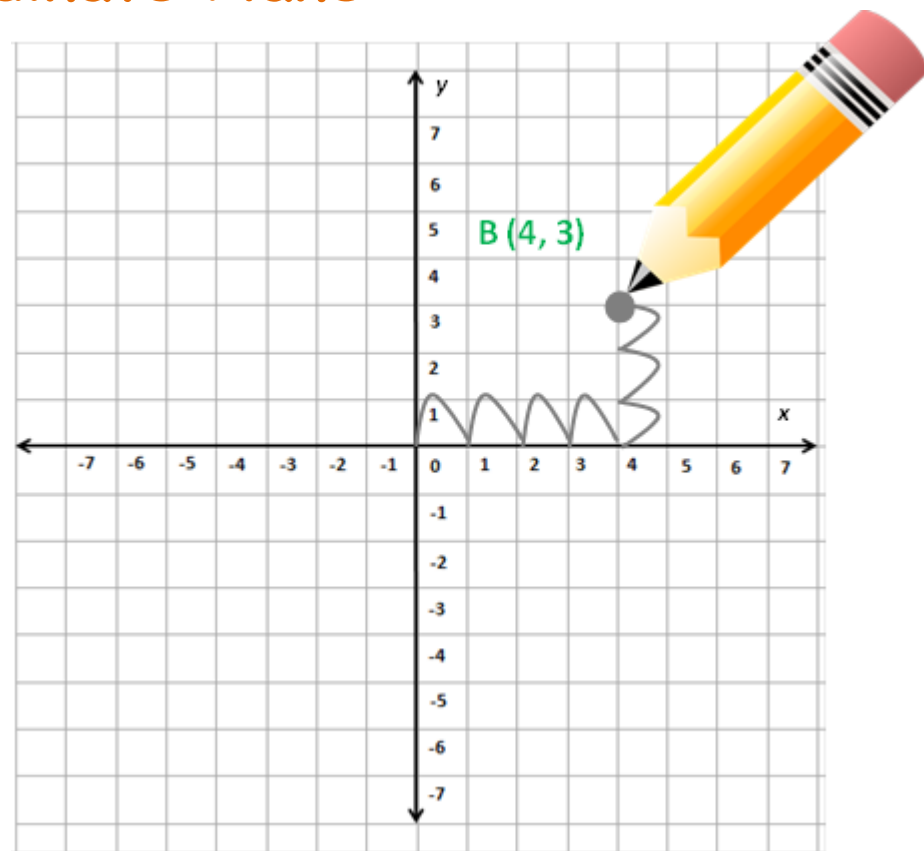


## Plotting of Points on the Coordinate Plane

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

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

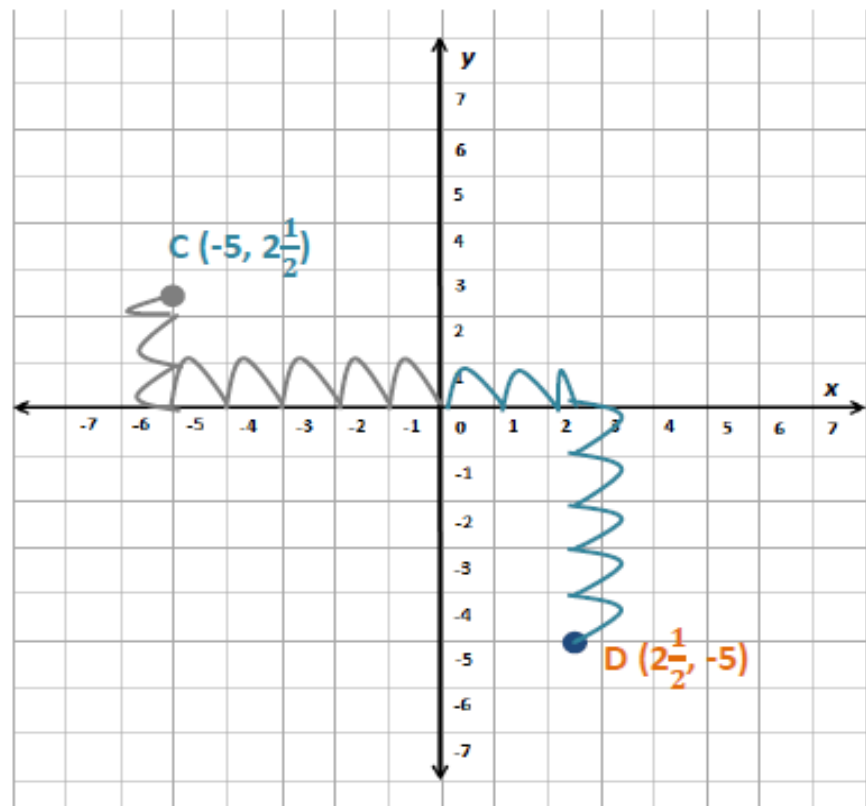
And from that point, move 3 units up, since the *y-coordinate* is positive 3. The point right there is where point  $B$  with coordinates  $(4, 3)$  must be.



## Plotting of Points on the Coordinate Plane

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.

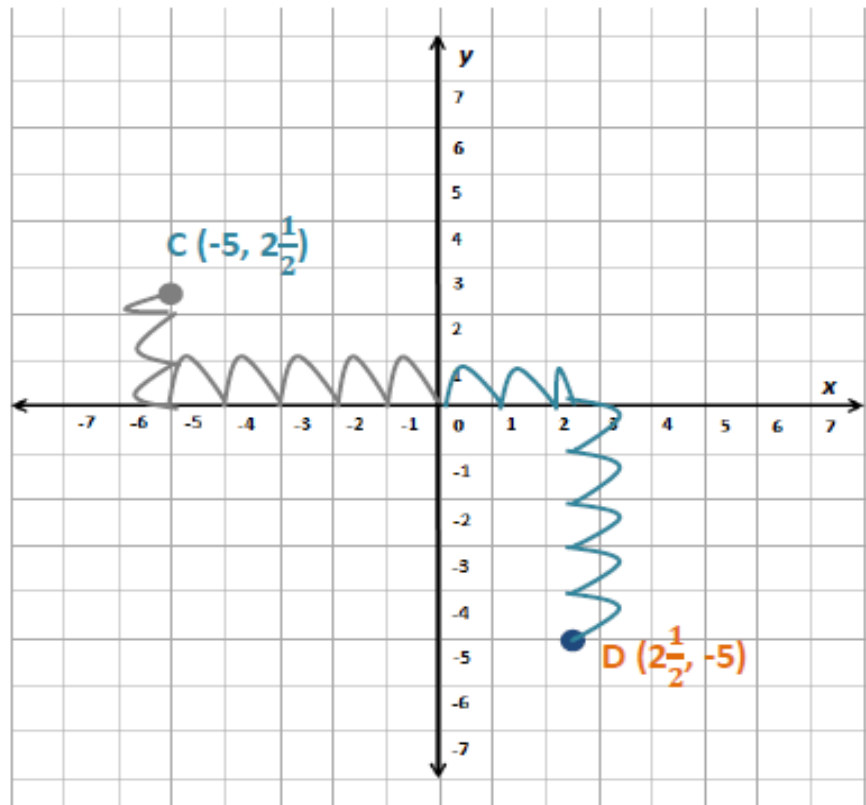


## Plotting of Points on the Coordinate Plane

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

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

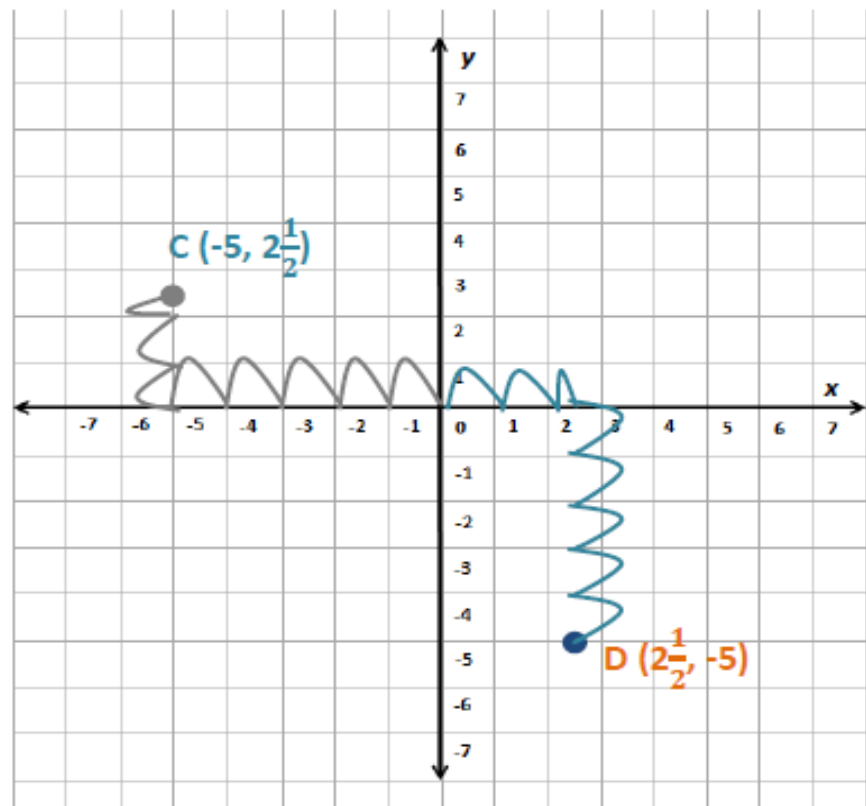
And from that point, move  $2\frac{1}{2}$  units up, since the ***y-coordinate*** is positive  $2\frac{1}{2}$ .



## Plotting of Points on the Coordinate Plane

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

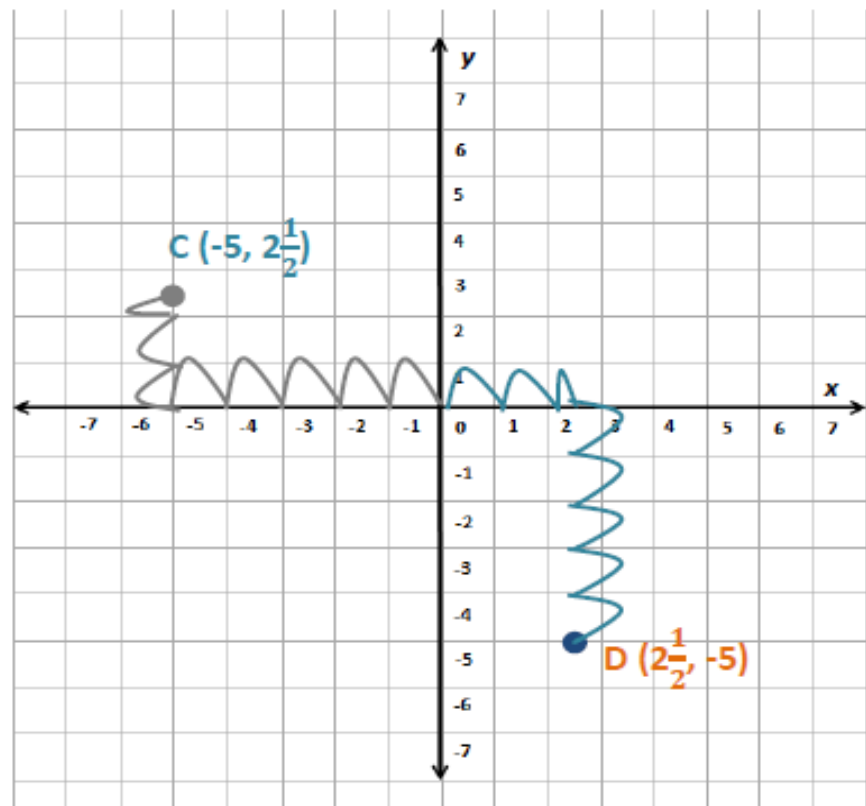
Since the ***x*-coordinate** is positive and the ***y*-coordinate** is negative, point **D** must be located in Quadrant IV.



## Plotting of Points on the Coordinate Plane

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

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

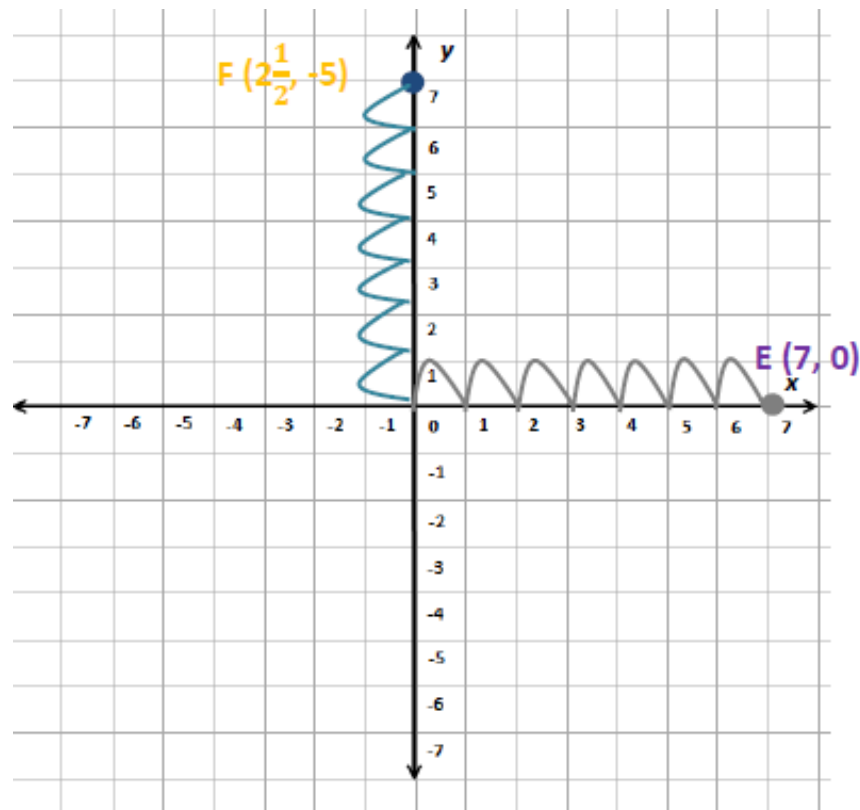


## Plotting of Points on the Coordinate Plane

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.

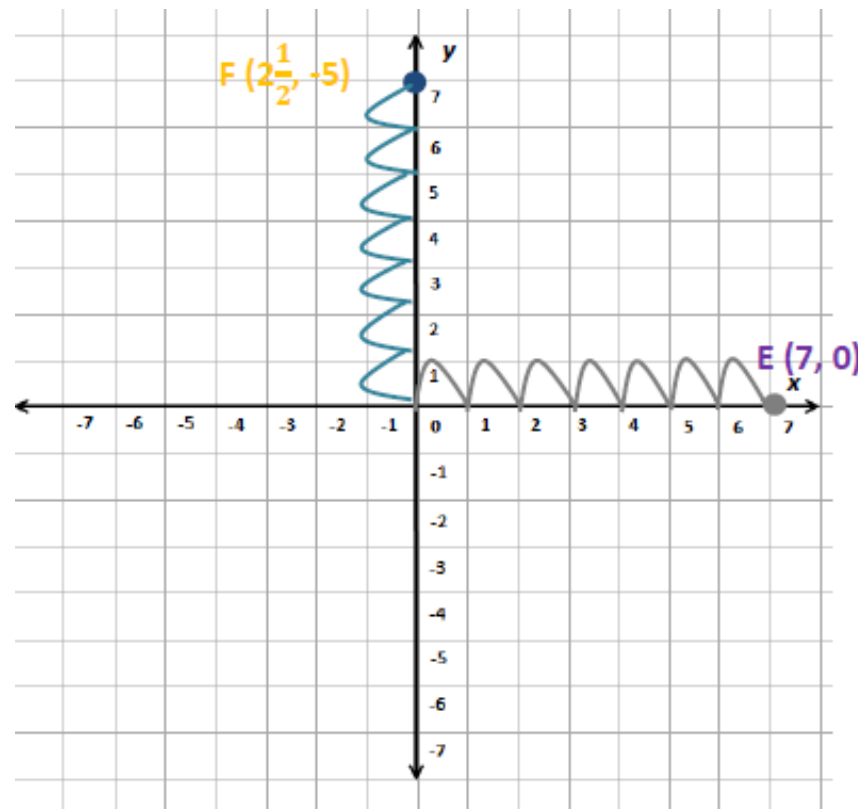
From the origin, move 7 units to the right of zero, since the  $x$ -coordinate is positive 7.



## Plotting of Points on the Coordinate Plane

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

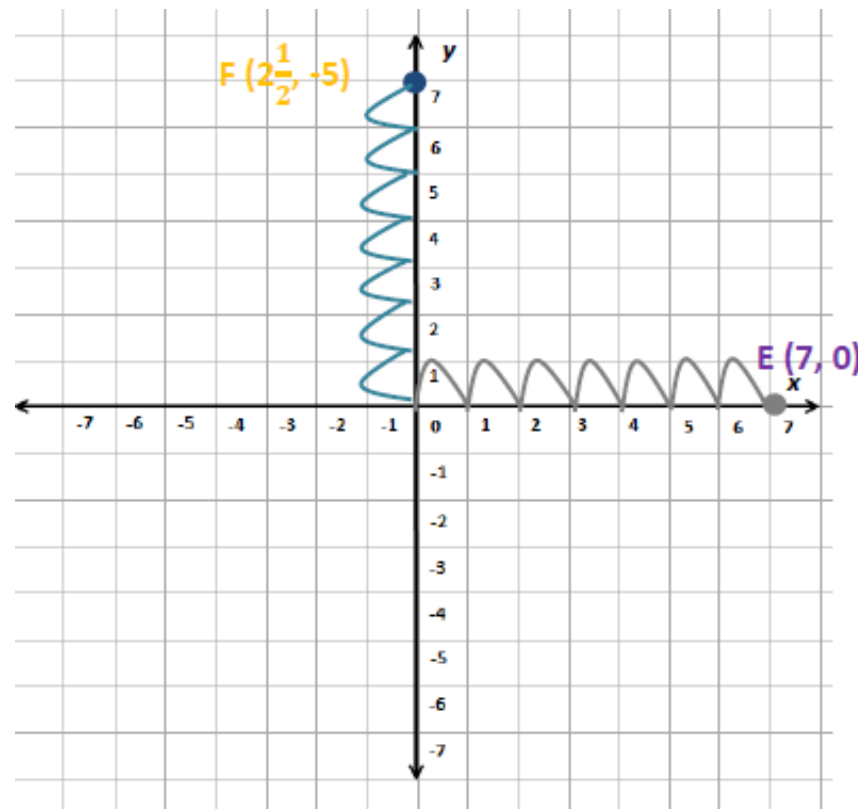
The point stays in that position since the  $y$ -coordinate is 0.



## Plotting of Points on the Coordinate Plane

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.

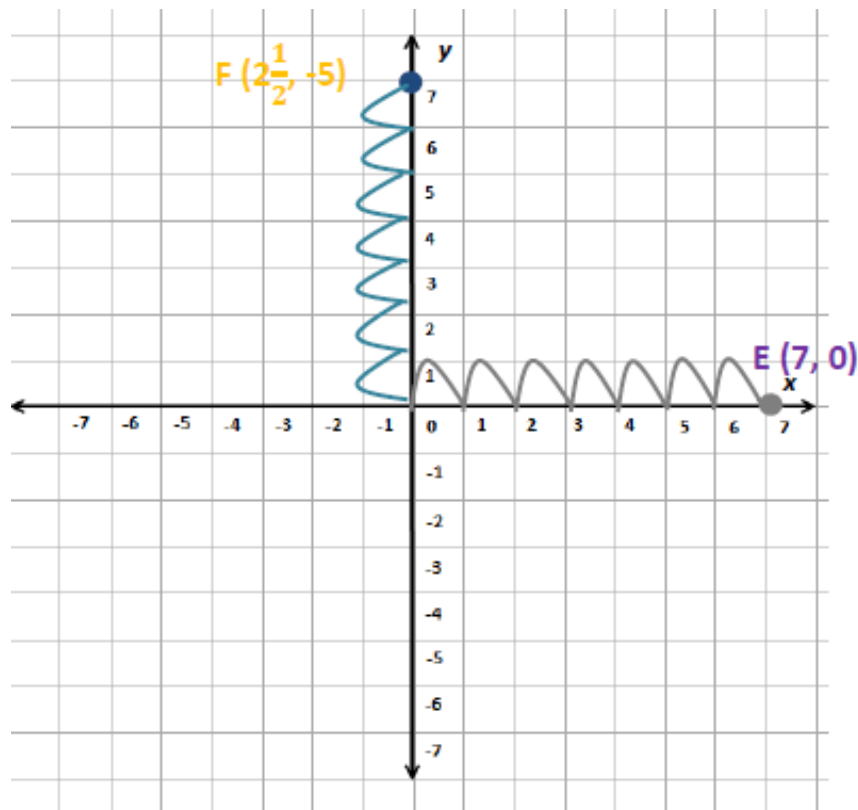




## Plotting of Points on the Coordinate Plane

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

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.



# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Plotting of Points on the Coordinate Plane

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)

# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Plotting of Points on the Coordinate Plane

$A(3, 4)$

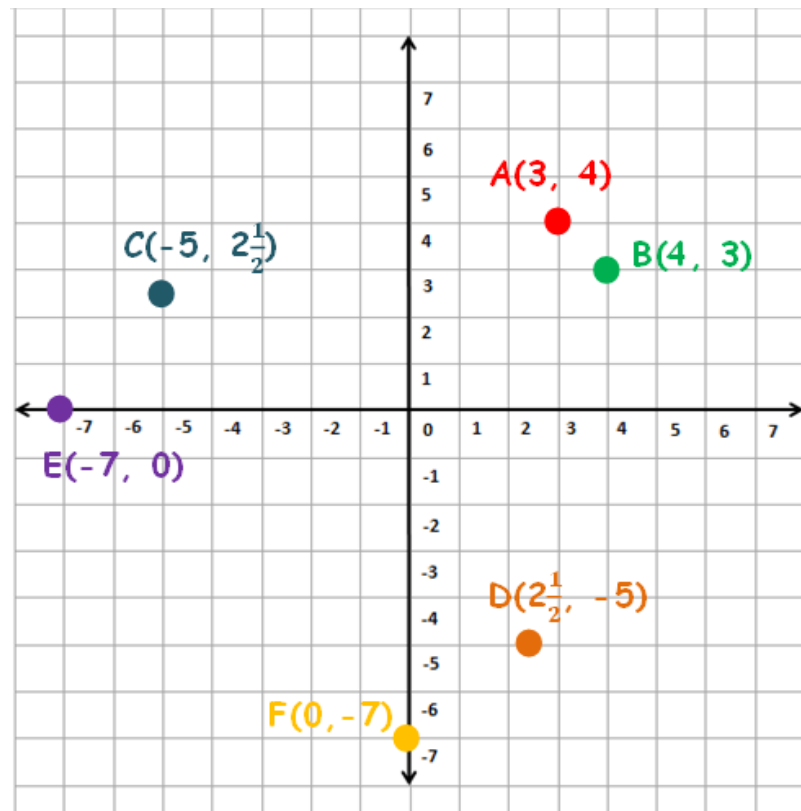
$B(4, 3)$

$C(-5, 2\frac{1}{2})$

$D(2\frac{1}{2}, -5)$

$E(7, 0)$

$F(0, 7)$

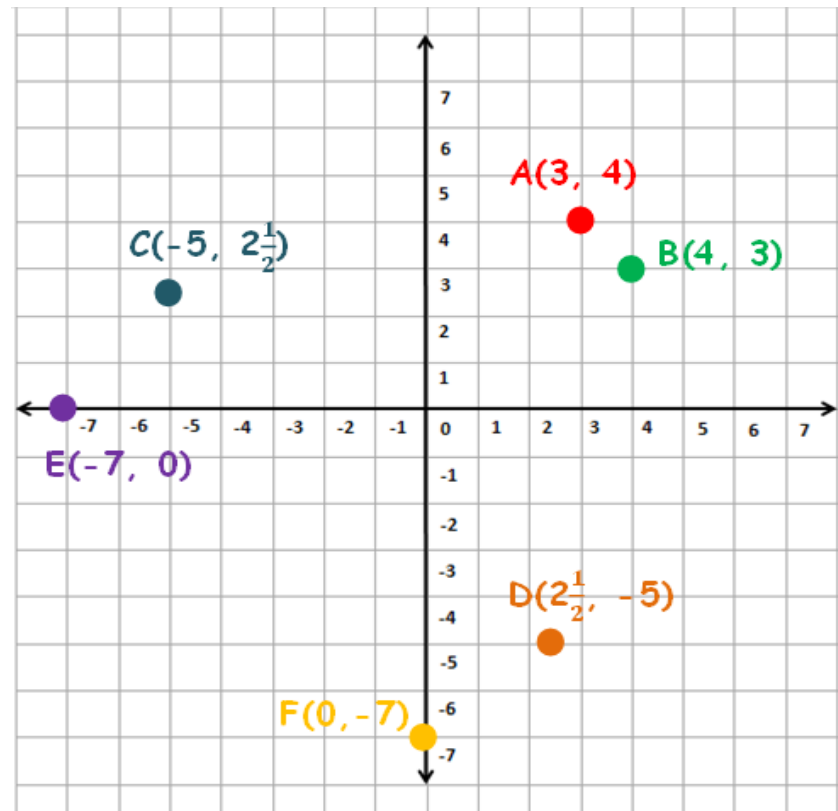


# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Plotting of Points on the Coordinate Plane

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

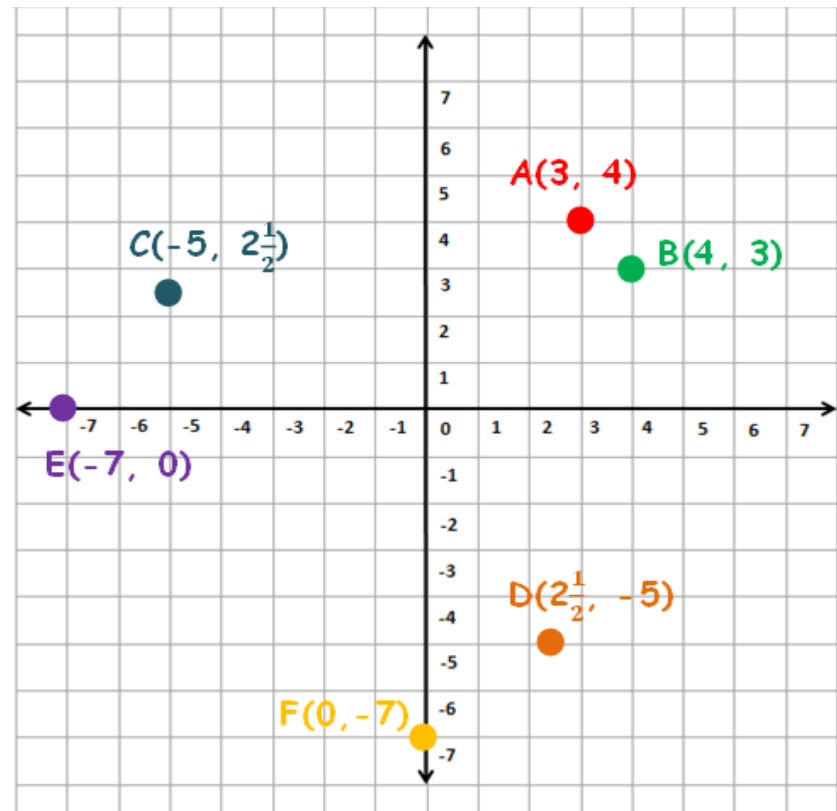
Points  $A(3, 4)$  and  $B(4, 3)$  may have the same numbers in the parenthesis but will have different positions on the plane.



# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Plotting of Points on the Coordinate Plane

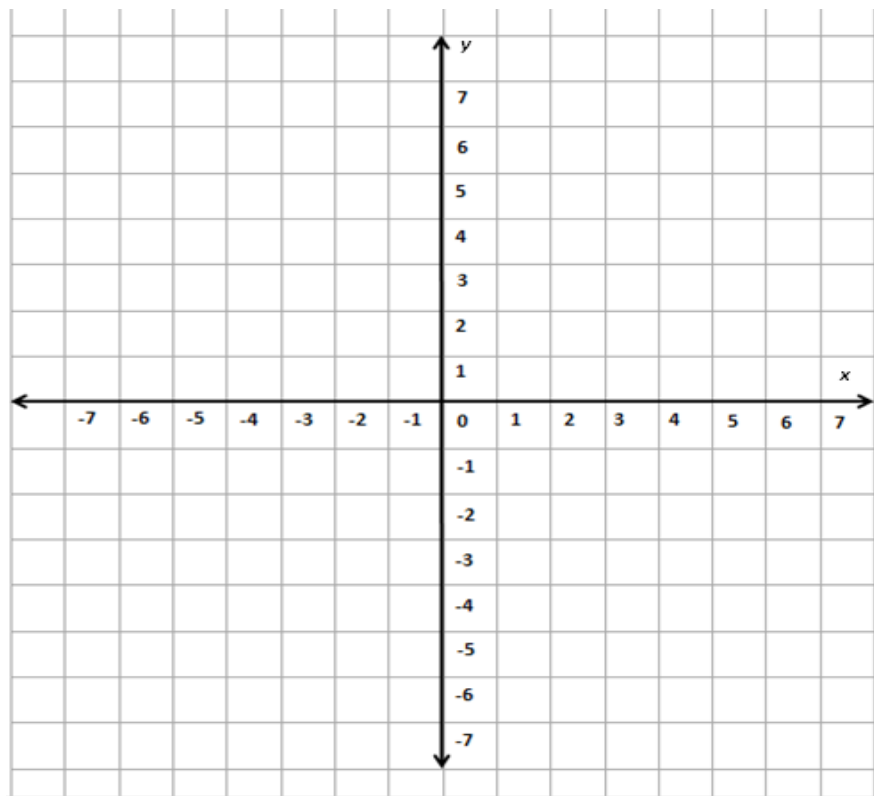
The same thing goes for points  $C(-5, 2\frac{1}{2})$  and  $D(2\frac{1}{2}, -5)$ , and  $E(7, 0)$  and  $F(0, 7)$ .



## RATIONAL NUMBERS AND THE COORDINATE PLANE

**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.  $I(5, -3)$



# RATIONAL NUMBERS AND THE COORDINATE PLANE

## Sample Problem 5: Solution

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

