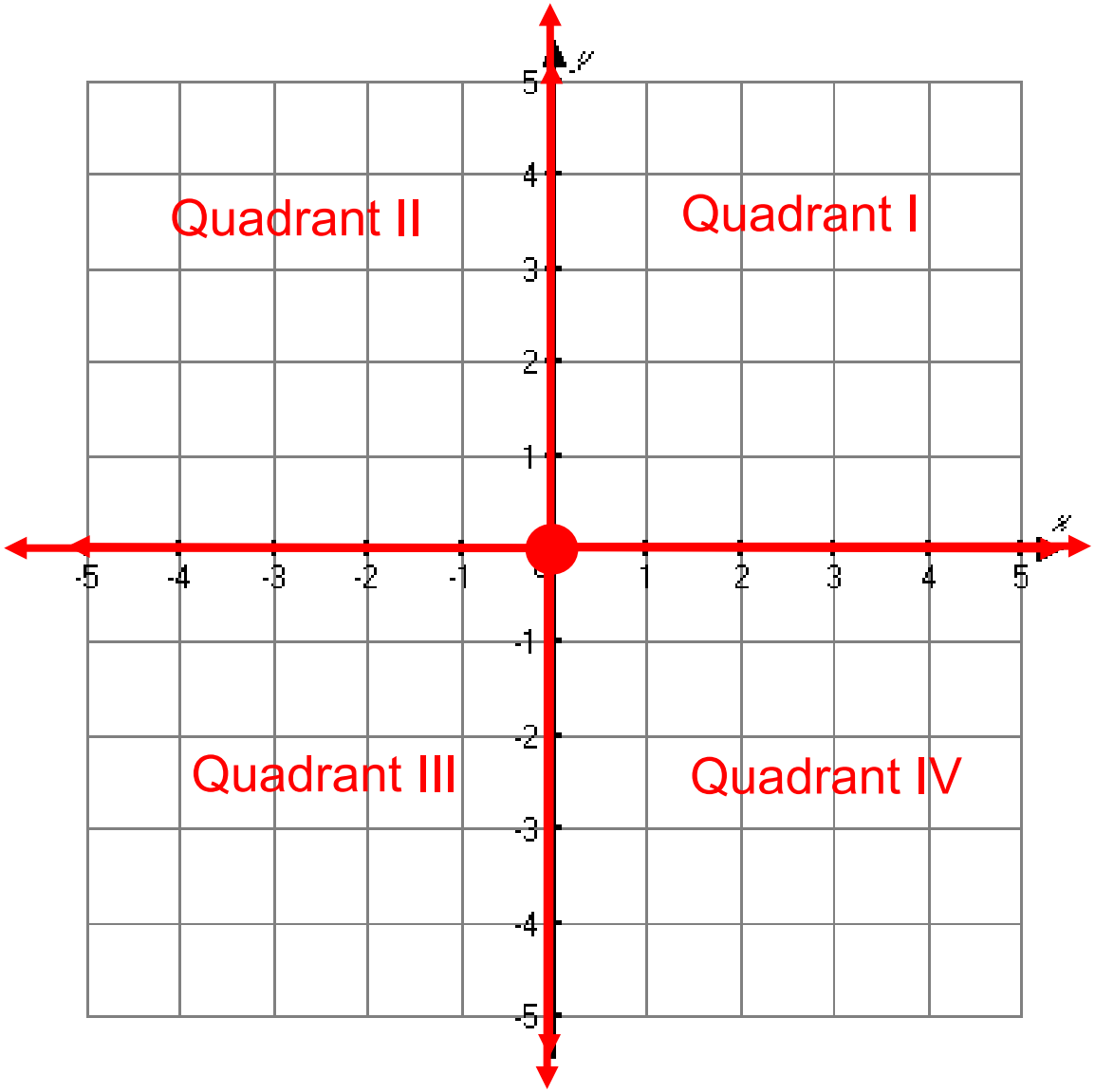
4.1 The Rectangular Coordinate System

1. Determine the coordinates of a given point.
2. Plot points in the coordinate plane.
3. Determine the quadrant for a given coordinate.
4. Determine whether the graph of a set of data points is linear.



x-axis

y-axis

positive

negative

ordered pair
(x,y)

origin
(0, 0)

quadrants

Use Roman numerals to identify quadrants.

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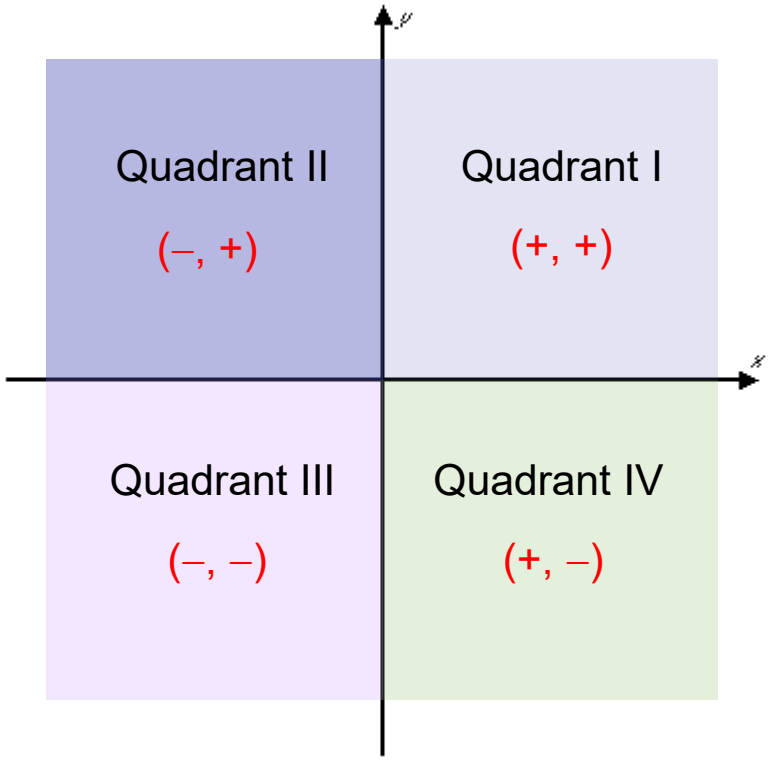


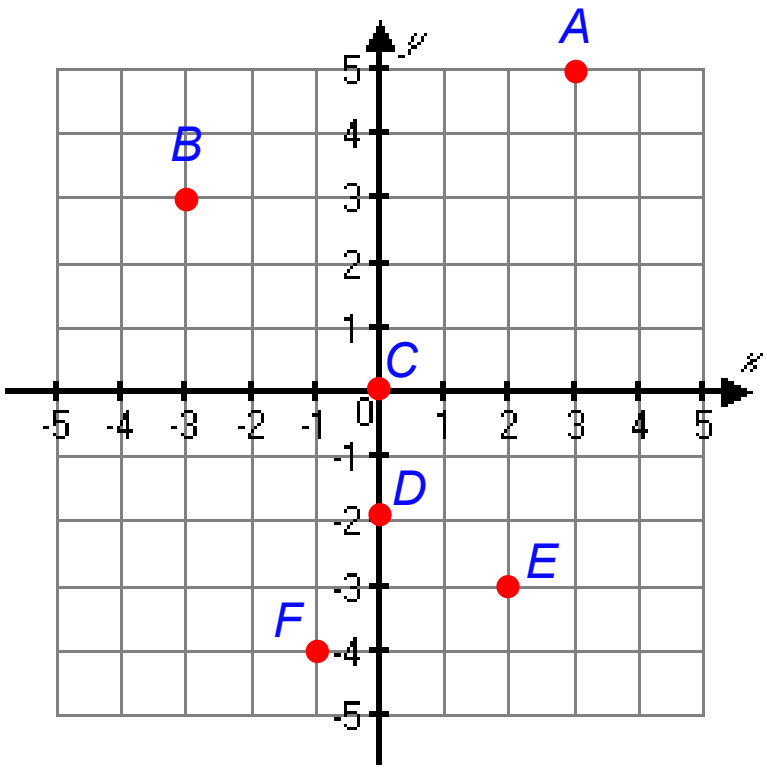
Positive x; negative y

Negative x; negative y

Positive x; positive y

Negative x; positive y

Write the coordinates for each point shown.



A: (3, 5)

B: (-3, 3)

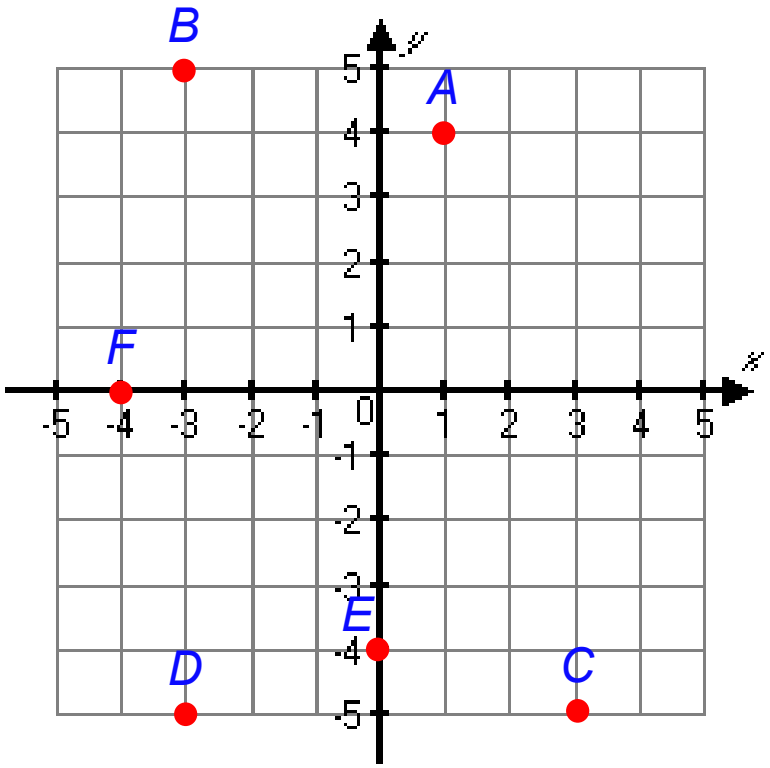
C: (0, 0)

D: (0, -2)

E: (2, -3)

F: (-1, -4)

Plot and label each point. Name the quadrant.



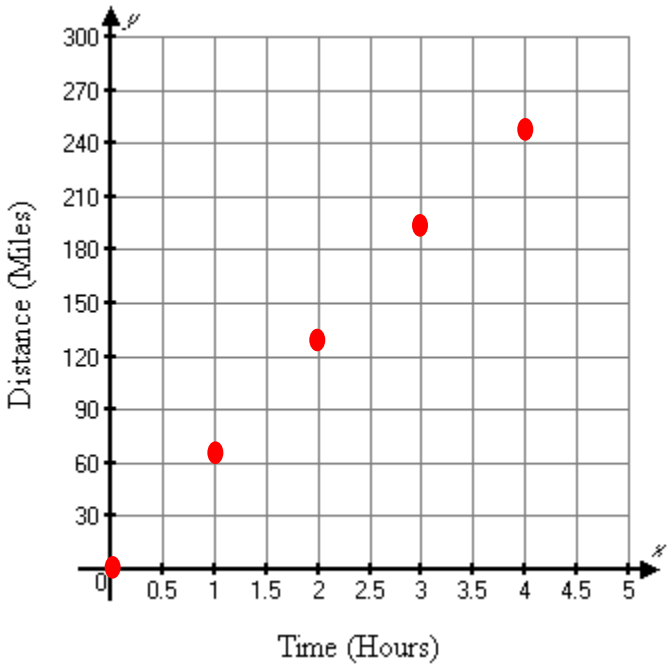
	Quadrant
A: (1,4)	I
B: (-3,5)	II
C: (3,-5)	IV
D: (-3,-5)	III
E: (0,-4)	y-axis
F: (-4,0)	x-axis

Linear versus Non-linear

- In many problems data are listed as ordered pairs.
- If we plot each pair of data as an ordered pair, we can see whether the points form a straight line.
- If they form a straight line they are *linear*.
- Points that do not form a straight line are *nonlinear*.

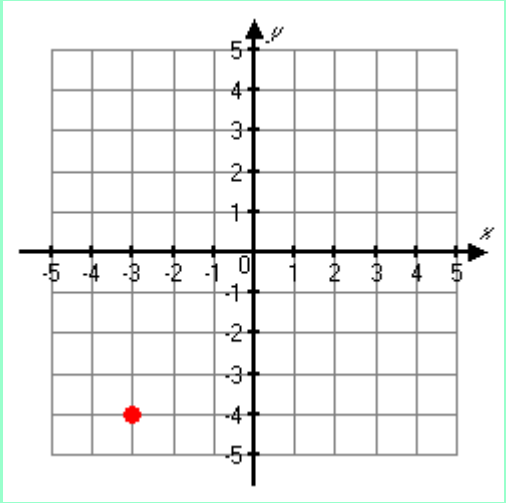
The following points show the path of an object over time. Plot the points with the time along the horizontal axis and the distance along the vertical axis. Then state whether the path is linear or nonlinear.

Time (hours)	Distance (miles)
0	0
1	62
2	124
3	186
4	248



The data points form a straight line; the path of the object is **linear**.

Identify the coordinates of the point shown below.



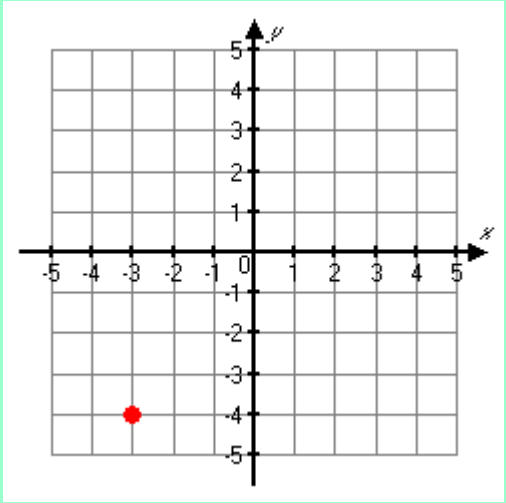
a) (–4, –3)

b) (–3, –4)

c) (4, –3)

d) (–3, 4)

Identify the coordinates of the point shown below.



a) (–4, –3)

b) (–3, –4)

c) (4, –3)

d) (–3, 4)

In which quadrant is the point (5, –2) located?

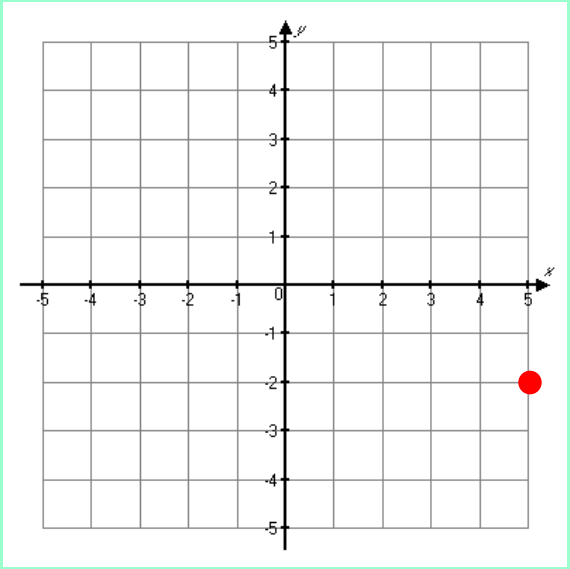
a) I

b) II

c) III

d) IV

In which quadrant is the point (5, –2) located?



a) I

b) II

c) III

d) IV

4.2 Graphing Linear Equations

1. Determine whether a given pair of coordinates is a solution to a given equation with **two unknowns**.
2. Find solutions for an equation with two unknowns.
3. Graph linear equations.

Determine whether the ordered pair is a solution for the equation.

$(-3, 5)$ $\quad y = 4x - 3$

$$y = 4x - 3$$

$$5 \stackrel{?}{=} 4(-3) - 3$$ Replace x with -3 and y with 5.

$$5 \stackrel{?}{=} -12 - 3$$

$$5 \neq -15$$

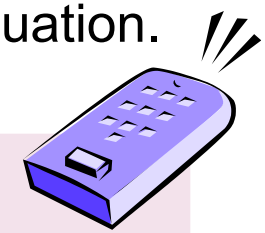
Because the equation is not true, $(-3, 5)$ is not a solution for $y = 4x - 3$.

To determine if a given ordered pair is a solution:

1. Replace the variables in the equation with the corresponding coordinates.

2. Verify that the equation is true.

Determine if the given ordered pair is a solution to the given equation.



(2,3) $x + 2y = 8$

$2+2(3) \stackrel{?}{=} 8$

$2 + 6 = 8$

Yes, a solution

(2,1) $2x - y = 5$

$2(2) - 1 \stackrel{?}{=} 5$

$4 - 1 \stackrel{?}{=} 5$

$3 \neq 5$

Not a solution

(6,–2) $y = -\frac{2}{3}x$

$-2 \stackrel{?}{=} -\frac{2}{3}(6)$

$-2 \neq -4$

Not a solution

(– 8,–8) $y = -\frac{3}{4}x - 2$

$-8 \stackrel{?}{=} -\frac{3}{4}(-8) - 2$

$-8 \stackrel{?}{=} 6 - 2$

$-8 \neq 4$

Not a solution

A: Solution
B: Not a solution

How do we find solutions for an equation with two unknowns?

Find three solutions for the equation. $4x + y = 5$

Replace one of the variables with a *chosen value* and then solve for the other variable.

Choose $x = 0$

$$4x + y = 5$$
$$4(0) + y = 5$$
$$y = 5$$

Solution (0, 5)

Choose $x = 1$

$$4x + y = 5$$
$$4(1) + y = 5$$
$$4 + y = 5$$
$$y = 1$$

Solution (1, 1)

Choose $x = 2$

$$4x + y = 5$$
$$4(2) + y = 5$$
$$8 + y = 5$$
$$y = -3$$

Solution (2, –3)

continued

The solutions can be summarized in a table:

x	y	Ordered Pair
0	5	(0, 5)
1	1	(1, 1)
2	–3	(2, –3)

There are an infinite number of correct solutions for a given equation in two variables.

To Find Solutions to Equations with Two Variables

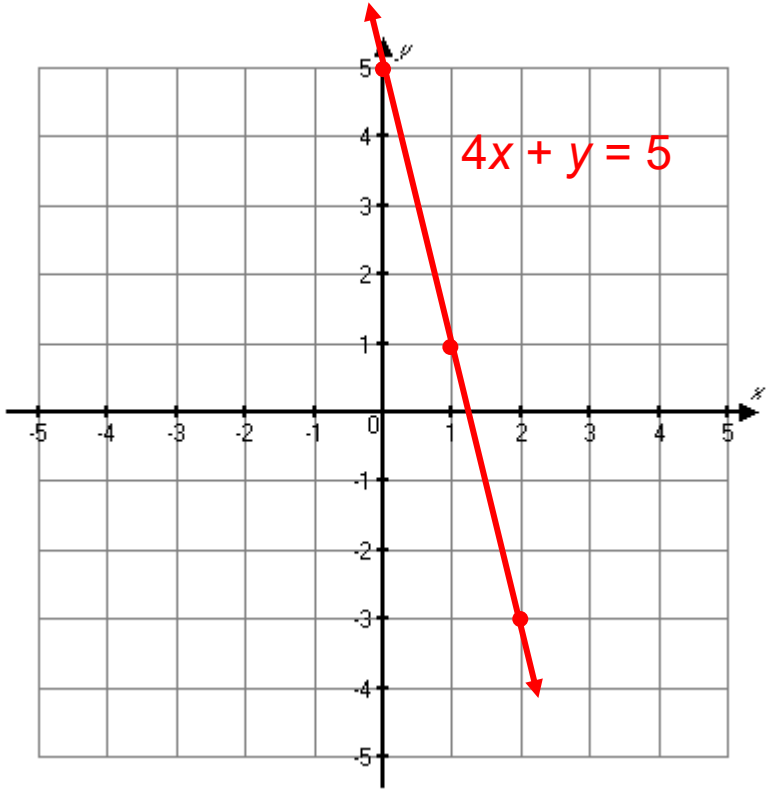
1. Choose a value for one of the variables (any value).
2. Replace the corresponding variable with your chosen value.
3. Solve the equation for the value of the other variable.

To Graph Linear Equations

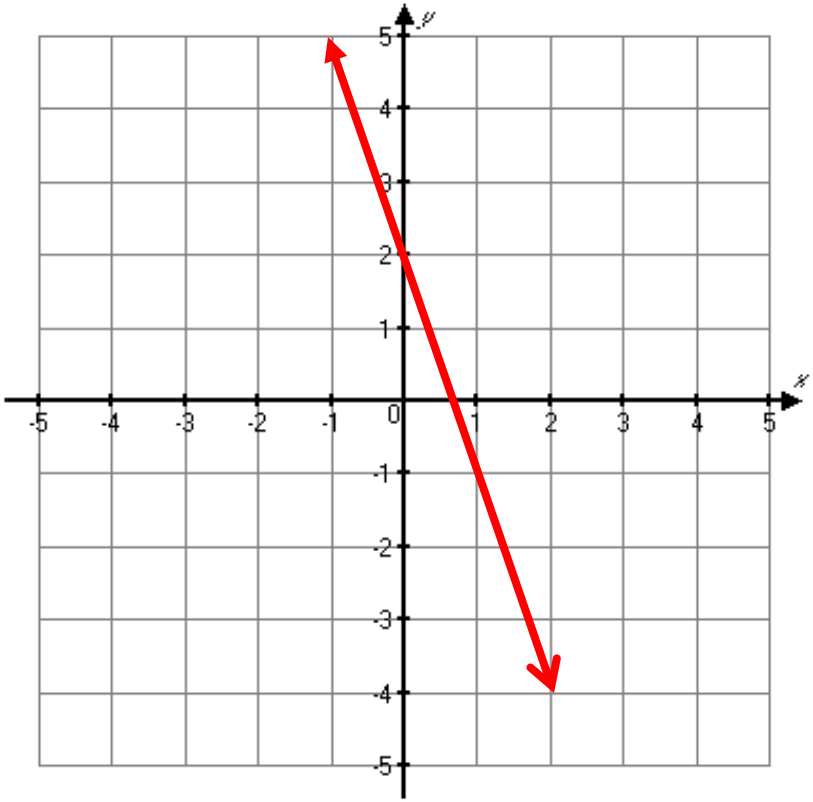
1. Find at least **two** solutions to the equation.
2. Plot the solutions as points in the rectangular coordinate system.
3. Connect the points to form a straight line.

Graph $4x + y = 5$

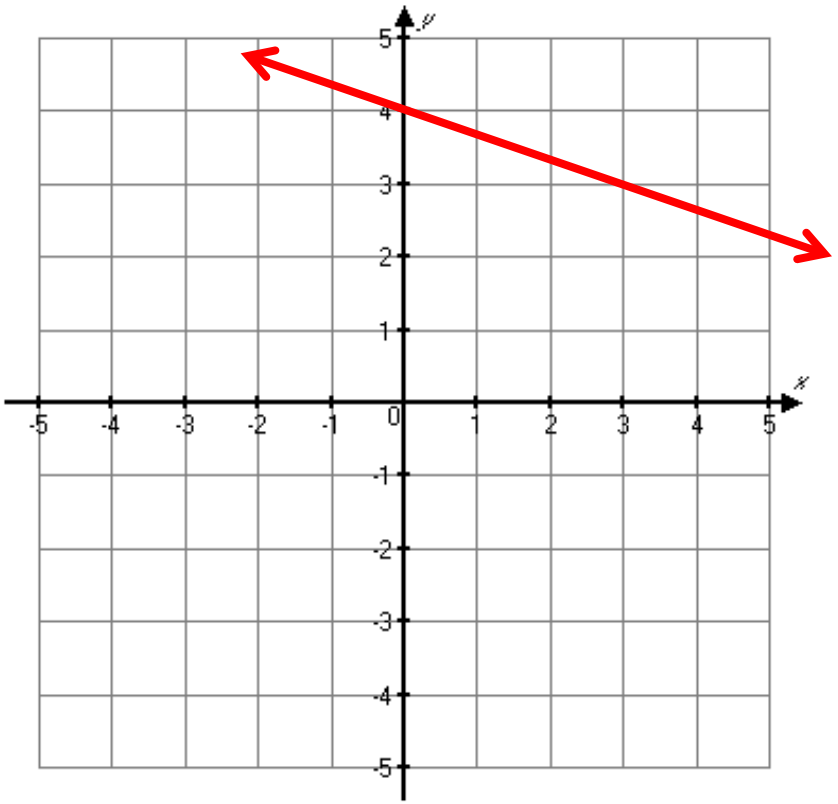
x	y	Ordered Pair
0	5	(0, 5)
1	1	(1, 1)
2	–3	(2, –3)



Graph: $3x + y = 2$

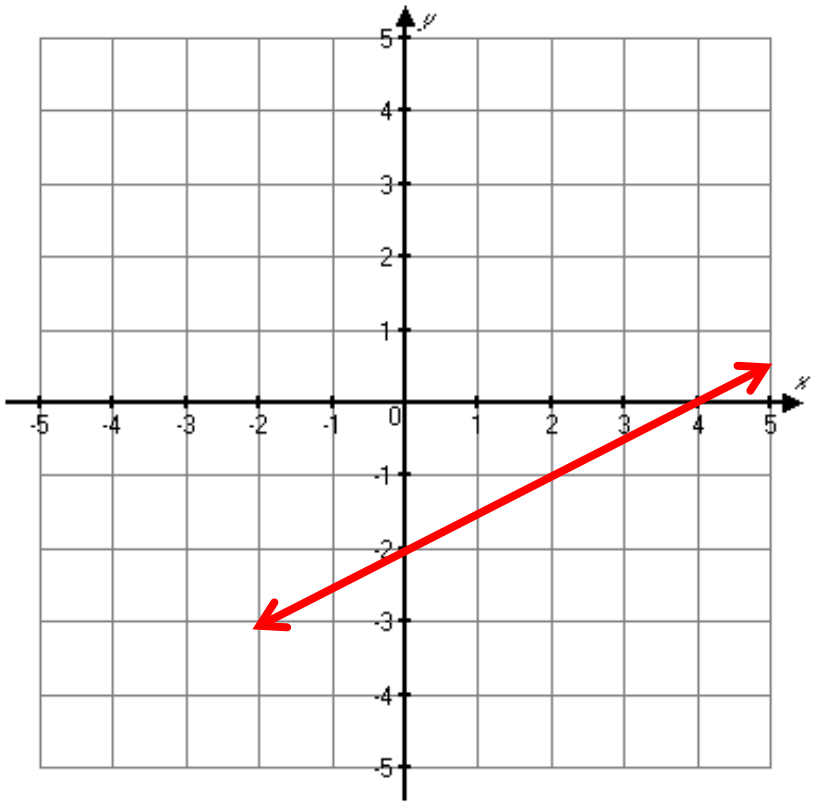


Graph: $y = -\frac{1}{3}x + 4$



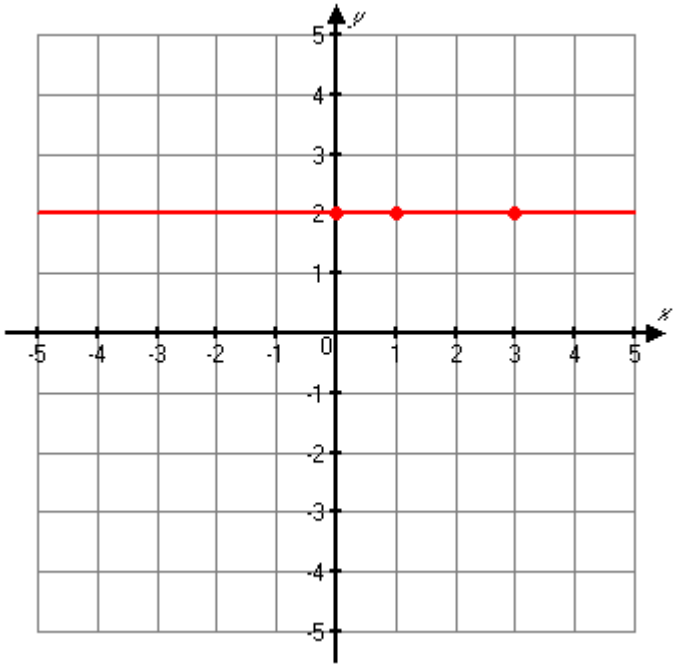
Graph:

$$x - 2y = 4$$



Example 5

Graph $y = 2$



Rewrite the equation

$0x + y = 2$

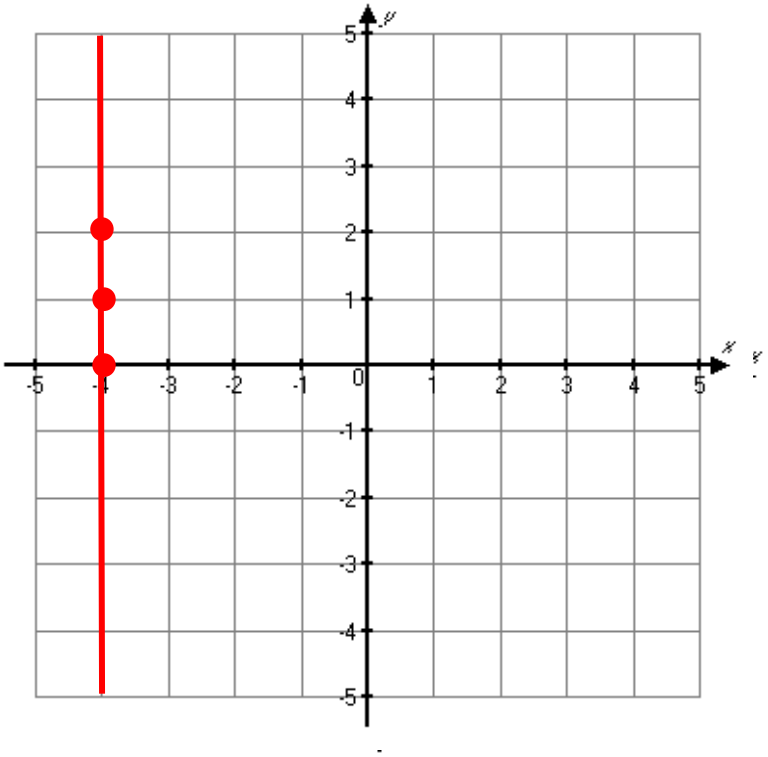
x	y	Ordered Pair
0	2	(0, 2)
1	2	(1, 2)
3	2	(3, 2)

Horizontal Lines $y = c$

If the equation has **only a y**, the line is horizontal.

Example 6

Graph $x = -4$



Rewrite the equation

$$x + 0y = -4$$

x	y	Ordered Pair
-4	0	(-4, 0)
-4	1	(-4, 1)
-4	2	(-4, 2)

Vertical Lines

$x = c$

If the equation has **only an x**, the line is vertical.

Which ordered pair is a solution of the equation $3x - 2y = -6$?

a) $(-4, 3)$

b) $(1, 5)$

c) $(2, 0)$

d) $(0, 3)$

Which ordered pair is a solution of the equation $3x - 2y = -6$?

a) $(-4, 3)$

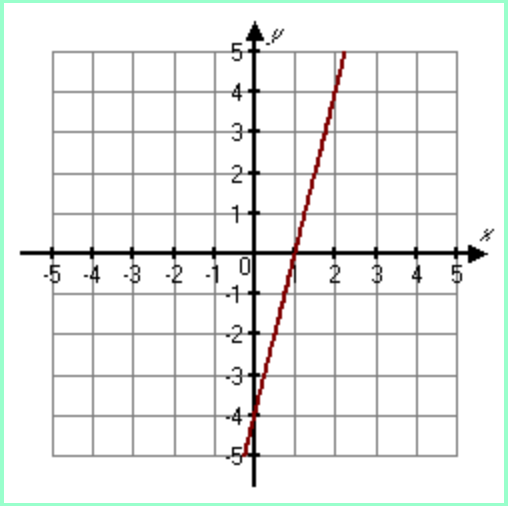
b) $(1, 5)$

c) $(2, 0)$

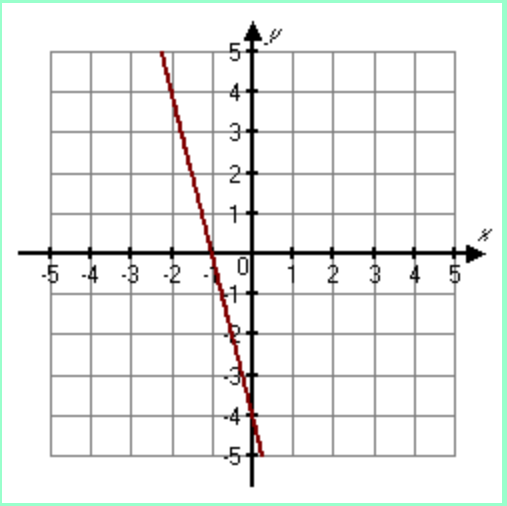
d) $(0, 3)$

Graph $4x - y = -4$

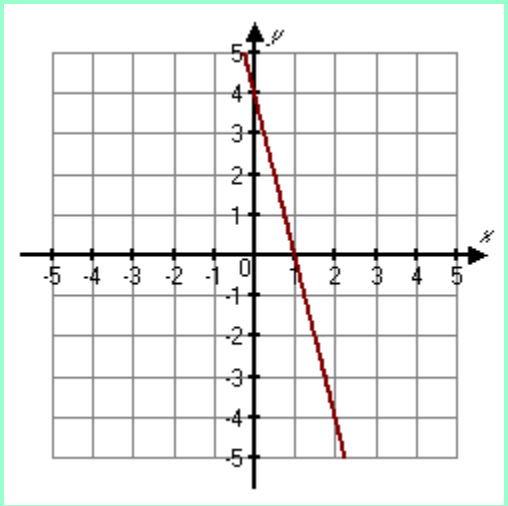
a)



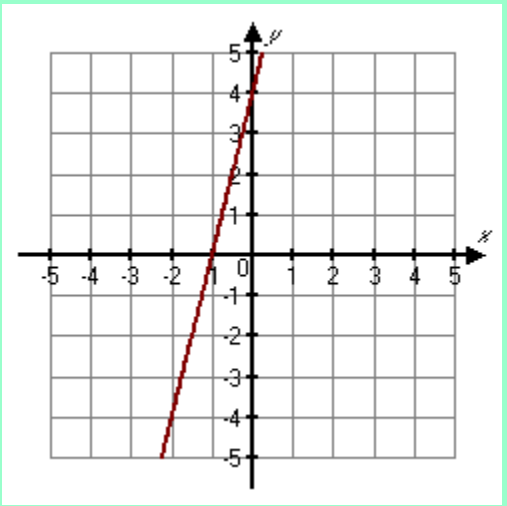
b)



c)

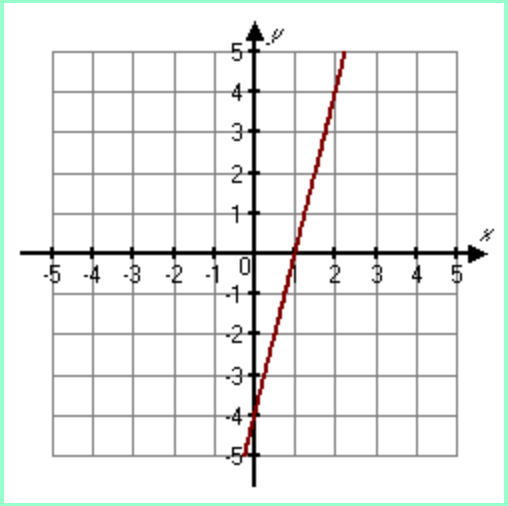


d)

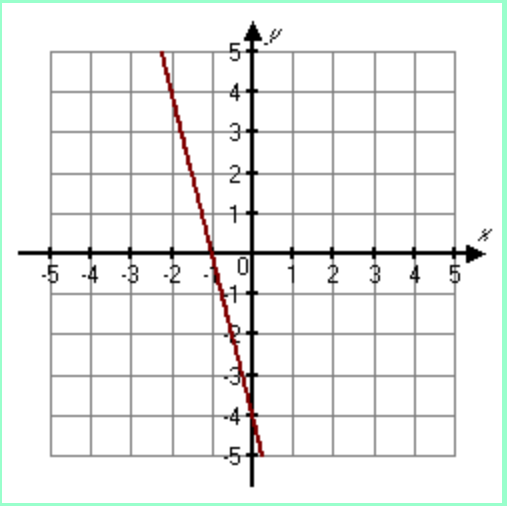


Graph $4x - y = -4$

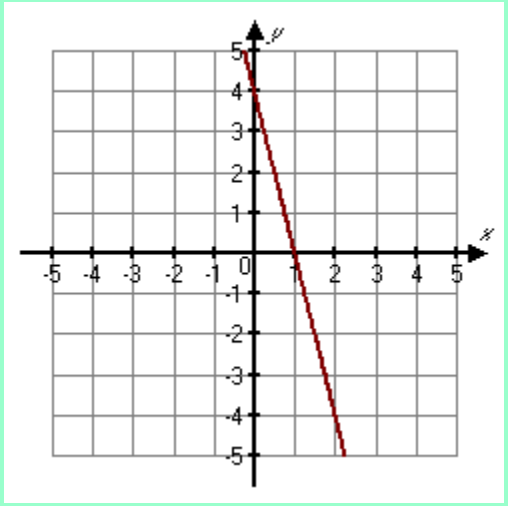
a)



b)



c)



d)