

## ***SAT Question***

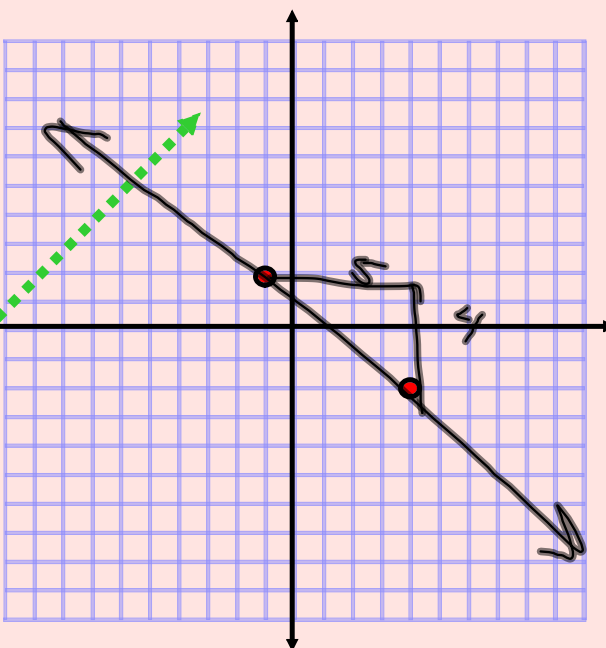
**1. Which of the following is greater than  $\frac{5}{6}$  ?**

- A.  $\frac{2}{5}$**
- B.  $\frac{4}{7}$**
- C.  $\frac{4}{9}$**
- D.  $\frac{8}{7}$**
- E.  $\frac{6}{13}$**

## 2-3 Equations of a Line





Find the slope of the line between  $(-1, 2)$  and  $(4, -2)$ .

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$
$$m = \frac{-4}{5}$$



## 2-3 Equations of a Line

**Table 1** Geometric Interpretation of Slope

Line	Slope	Example
<ul style="list-style-type: none"><li>Rising as <math>x</math> moves from left to right <math>y</math> values are increasing</li></ul>	Positive	
Falling as $x$ moves from left to right $y$ values are decreasing	Negative	
Horizontal $y$ values are constant	0	
Vertical $x$ values are constant	Not defined	

## 2-3 Equations of a Line

### › THEOREM 1 The Equation of a Line

If  $A$ ,  $B$ , and  $C$  are constants, with  $A$  and  $B$  not both 0, and  $x$  and  $y$  are variables, then the graph of the equation

$$\boxed{Ax + By = C} \quad \text{Standard Form} \quad (1)$$

is a line. Any line in a rectangular coordinate system has an equation of this form.

Also, the graph of any equation of the form

$$\boxed{y = mx + b} \quad (2)$$

where  $m$  and  $b$  are constants, is a line. Equation (2), which we will discuss in detail later, is simply a special case of equation (1) for  $B \neq 0$ .

## EXAMPLE

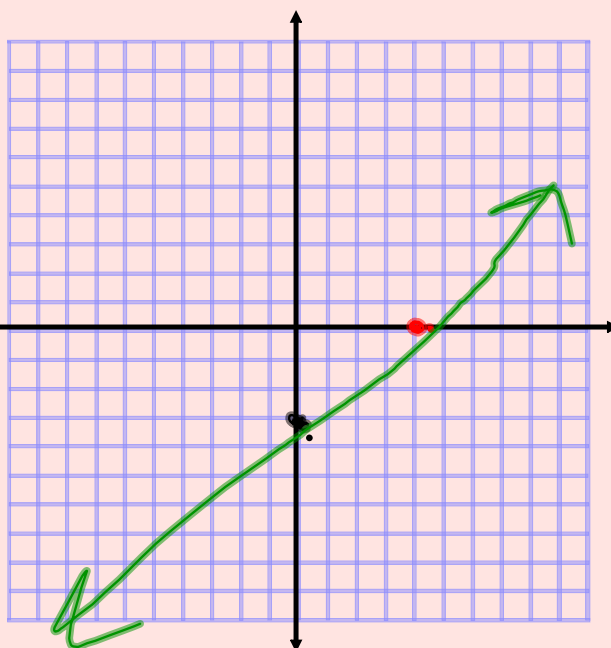
1

## Using Intercepts to Graph a Line

Graph the equation  $3x - 4y = 12$ .

x	y
0	-3
4	0

$$\begin{aligned} 3x - 4y &= 12 \\ 3x - 4(0) &= 12 \\ 3x - 0 &= 12 \\ 3x &= 12 \\ x &= 4 \end{aligned}$$
$$\begin{aligned} 3x - 4y &= 12 \\ 3(0) - 4y &= 12 \\ -4y &= 12 \\ y &= -3 \end{aligned}$$



## 2-3 Equations of a Line



### Technology Connections

To solve Example 1 on a graphing calculator, we first solve the equation for  $y$ :

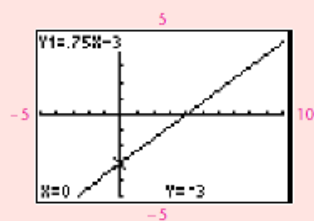
$$3x - 4y = 12$$

$$-4y = -3x + 12$$

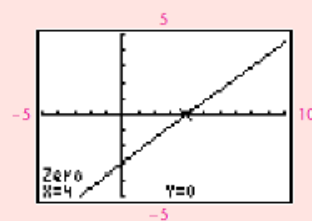
$$y = 0.75x - 3$$

To find the  $y$  intercept of this line, we graph the preceding equation, press **TRACE**, and then enter 0 for  $x$  [Fig. 2(a)]. The displayed  $y$  value is the  $y$  intercept.

The  $x$  intercept can be found by using the **zero** option on the **CALC** menu. After selecting the zero option, you will be asked to provide three  $x$  values: a **left bound** (a number less than the zero), a **right bound** (a number greater than the zero), and a **guess** (a number between the left and right bounds). You can enter the three values from the keypad, but most find it easier to use the cursor. The zero or  $x$  intercept is displayed at the bottom of the screen [Fig. 2(b)].



(a)  $y$  intercept



(b)  $x$  intercept

> Figure 2

## 2-3 Equations of a Line

Find the equation of the line between  $(1, 1)$  and  $(3, 4)$ .

$$m = \frac{3}{2}$$

$$(1, 1)$$

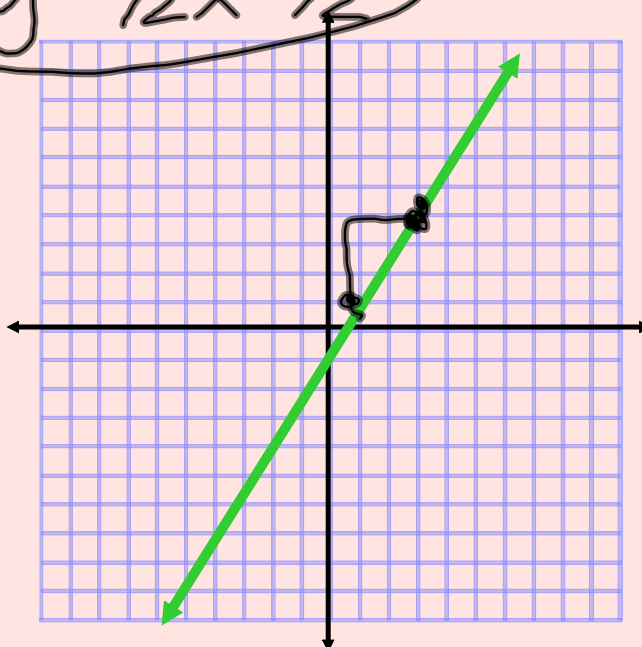
$$y = mx + b$$

$$\cancel{y - y_1 = m(x - x_1)}$$

$$1 = \frac{3}{2}(1) + b$$

$$-\frac{1}{2} = b$$

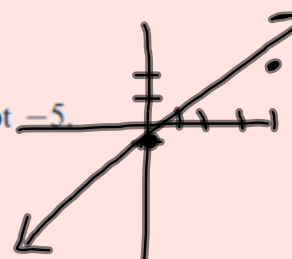
$$y = \frac{3}{2}x - \frac{1}{2}$$



### Using the Slope-Intercept Form

(A) Write the slope-intercept form of a line with slope  $\frac{2}{3}$  and y intercept  $-5$

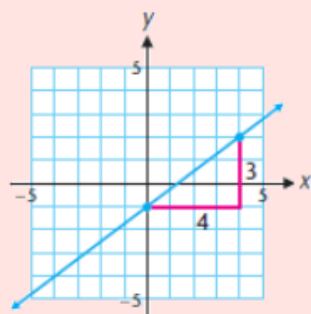
(B) Find the slope and y intercept, and graph  $y = \frac{3}{4}x - 1$ .



**SOLUTIONS**

(A) Substitute  $m = \frac{2}{3}$  and  $b = -5$  in  $y = mx + b$  to obtain  $y = \frac{2}{3}x - 5$ .

(B) The y intercept of  $y = \frac{3}{4}x - 1$  is  $-1$  and the slope is  $\frac{3}{4}$ . If we start at the point  $(0, -1)$  and move four units to the right (run), then the y coordinate of a point on the line must move up three units (rise) to the point  $(4, 2)$ . Drawing a line through these two points produces the graph shown in Figure 7.



> Figure 7



Parallel lines:

Find an equation of the line through  $P(1, -2)$  that is parallel to the line  $L$  with equation

$$3x - 2y = 1.$$

$$\begin{array}{r} 3x - 2y = 1 \\ -3x \quad \quad -3x \\ \hline -2y = -3x + 1 \\ \quad \quad \quad \quad -2 \end{array}$$

$$y = \frac{3}{2}x - \frac{1}{2}$$

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$$m = \frac{3}{2} \quad (1, -2)$$

$$y = mx + b$$

$$-2 = \frac{3}{2}(1) + b$$

$$-2 - \frac{3}{2} = b$$

$$-\frac{7}{2} = b$$

$$y = \frac{3}{2}x - \frac{7}{2}$$

Perpendicular lines:

Find an equation of the line through  $P(2, -3)$  that is perpendicular to the line  $L$  with

equation  $\underline{4x + y} = 3$ .

$$y = -4x + 3$$

$$m = -4$$

$$m = \frac{1}{4} \quad (2, -3)$$

$$y = \frac{1}{4}x - \frac{7}{2}$$

Homework Assignment:  
Assignment 2-2a online