2.4 Notes Another Look at Linear Graphs

Graphing Horizontal Lines and Vertical Lines

To find the slope of a line, we use two points on the line. For horizontal line, those two points have the same y coordinate and we can label then (x_1, y_1) and (x_2, y_1)
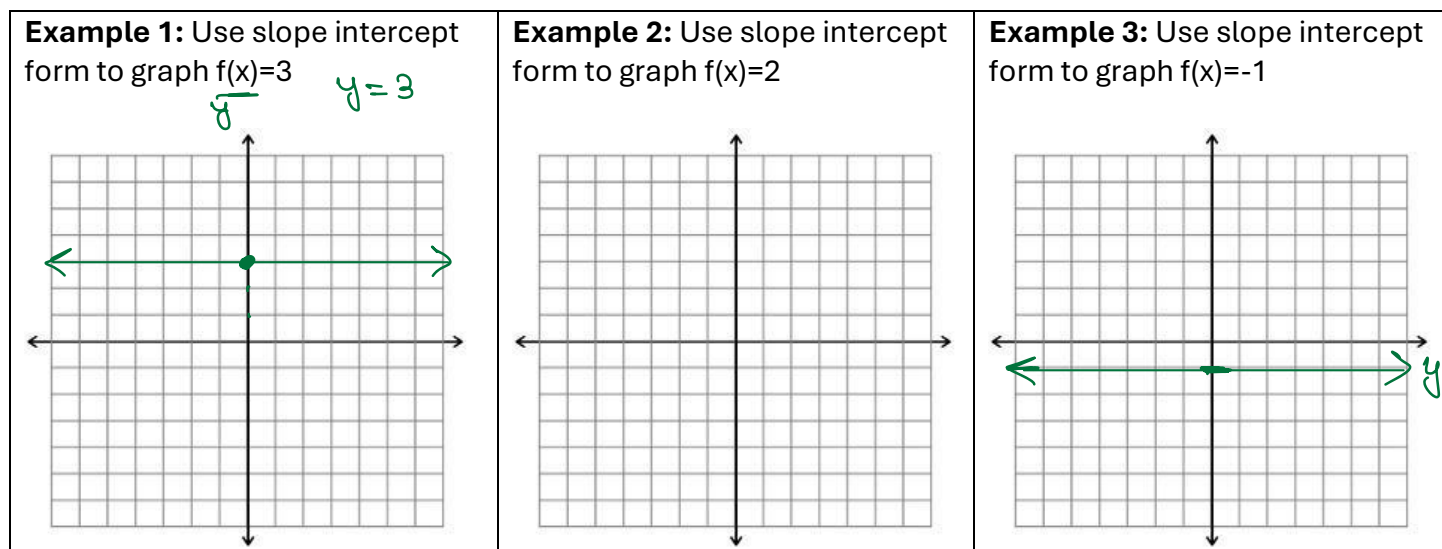
This gives us: $m = \dfrac{y_1 - y_1}{x_2 - x_1} = 0$

$$y = mx + b$$
$$\underset{0}{\uparrow}$$
$$\boxed{y = b}$$

THE SLOPE OF A HORIZONTAL LINE IS __0__

Example 1: Use slope intercept form to graph f(x)=3 $y=3$	**Example 2:** Use slope intercept form to graph f(x)=2	**Example 3:** Use slope intercept form to graph f(x)=-1
		$y=-1$

Now, suppose two different points are on a vertical line, then they have the same first coordinate.
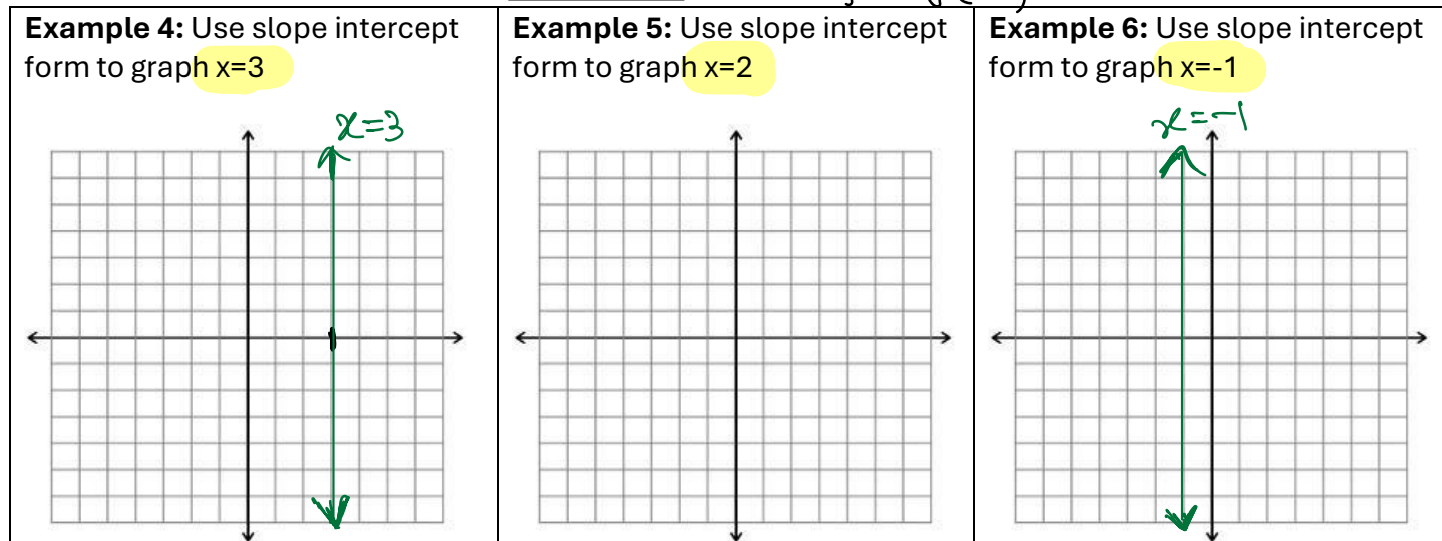This gives us:

Equation of the x-axis is $y = 0$

$m = \dfrac{y_2 - y_1}{x_1 - x_1} = \dfrac{y_2 - y_1}{0}$
$\uparrow$
unde-fined

THE SLOPE OF A VERTICAL LINE IS undefined or infinity (∞)

Example 4: Use slope intercept form to graph x=3	**Example 5:** Use slope intercept form to graph x=2	**Example 6:** Use slope intercept form to graph x=-1
$x=3$		$x=-1$

Example 7: Find the slope of each line. If the slope is undefined state this

a) $3y + 2 = 14$	b) $2x = 10$	c) $2y = y + 1$
$3y = 12$	$2x = 10$	$2y - y = 1$
$\Rightarrow y = 4$	$\Rightarrow x = 5$	$\Rightarrow y = 1$
$m = 0$	$m = undefined$	$m = 0$

Parallel and Perpendicular Lines

Two lines are parallel if they lie in the same plane and do not intersect no matter how far they are extended. If two lines are vertical they are parallel.

We can determine if non-vertical lines are parallel by looking at their slope.

<mark>Two lines are parallel if they have the same slope or if both lines are vertical</mark>

Example 8: Determine whether the lines are parallel

a) $f(x) = -3x - 4.3 \text{ and } 6x + 2y = 1$	b) $8x + y = 2 \text{ and } f(x) = 8x + 7$
$y = -3x - 4.3$ $\qquad 2y = -6x + 1$	$y = -8x + 2 \qquad y = 8x + 7$
$m_1 = -3 \qquad \Rightarrow y = -3x + \frac{1}{2}$	$m_1 = -8 \qquad m_2 = 8$
$\qquad \Rightarrow m_2 = -3$	$\Rightarrow$ <mark>Not Parallel</mark>
$\Rightarrow$ <mark>Parallel.</mark>	

Two lines are <mark>perpendicular</mark> if the <mark>product of their slopes is -1 (opposite reciprocals)</mark> or if one line is vertical and the other line is horizontal $\quad$ <mark>$m_1 m_2 = -1$</mark>

$$\Rightarrow m_2 = \frac{-1}{m_1}$$

Example 9: Determine whether the graphs are perpendicular

a) $2x + y = 8 \text{ and } y = \frac{1}{2}x + 7$	b) $x + y = 3 \text{ and } x - y = 8$
$\qquad\qquad m_2 = \frac{1}{2}$	$y = -x + 3 \qquad -y = -x + 8$
$y = -2x + 8$	$\qquad\qquad\qquad y = x - 8$
$m_1 = -2 \qquad \Rightarrow m_1 m_2 = -2 \cdot \frac{1}{2}$	$m_1 = -1 \qquad \Rightarrow m_2 = 1$
$\qquad\qquad\qquad = -1$	$m_1 m_2 = -1$
$\Rightarrow$ <mark>Perpendicular</mark>	$\Rightarrow$ Perpendicular

Graphing using intercepts

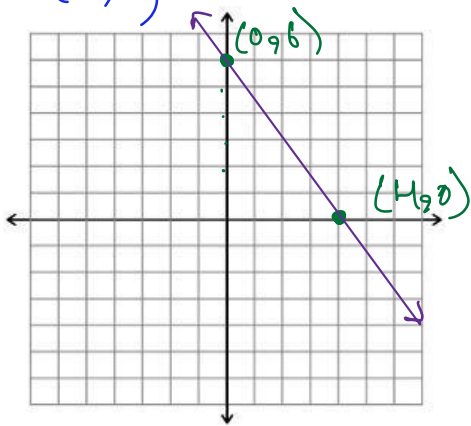The **x-intercept is (a,0)**. To find a, let y=0 and solve for x
The **y-intercept is (0,b)**. To find b, let x=0 and solve for y

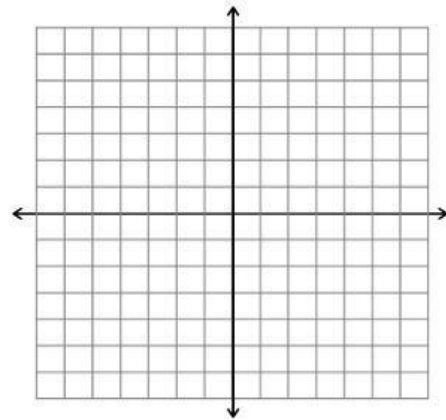**Example 10: Graph the following equations by using intercepts**

a) $3x + 2y = 12$

$\underline{x\text{-intercept}} : \quad 3x = 12 \Rightarrow x = 4$
$\qquad\qquad (4, 0)$

$\underline{y\text{-intercept}} : \quad 2y = 12 \Rightarrow y = 6$
$\qquad\qquad (0, 6)$

$(0, 6)$

$(4, 0)$

b) $x - 5y = 5$

c) $f(x) = -2x + 5 \quad \Longleftrightarrow \quad y = -2x + 5$

$\underline{x\text{-int}} : \quad 0 = -2x + 5 \Rightarrow 2x = 5$
$\qquad\qquad\qquad\qquad \Rightarrow x = \frac{5}{2}$

$\underline{y\text{-int}} : \quad y = 5 \; (0, 5)$
$\qquad\qquad\qquad\qquad (\frac{5}{2}, 0)$

$(0, 5)$

$(\frac{5}{2}, 0)$
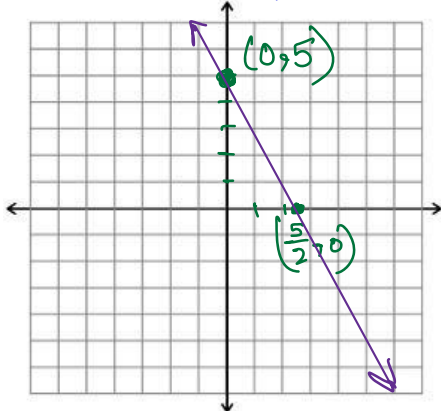
d) $f(x) = -\frac{1}{3}x \quad = \quad y = -\frac{1}{3}x$

$\underline{x\text{-int}} \Rightarrow 0 = -\frac{1}{3}x \Rightarrow 0 = x$

$\underline{y\text{-int}} \Rightarrow y = 0 \qquad (0, 0)$
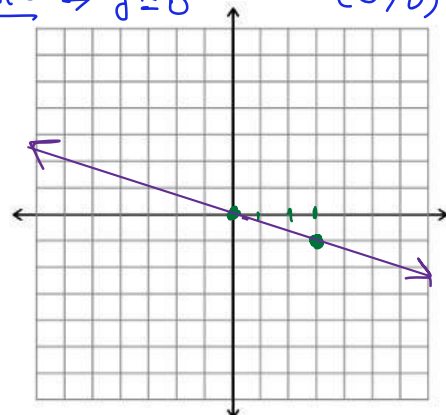
Solving Equations Graphically

Example 11: Solve the following equations Graphically

a) $2x + 5 = -3$	b) $\frac{1}{2}x + 3 = 2$	c) $\frac{3}{2}x + 3 = 2$
Plot $y = 2x + 5$ Plot $y = -3$ (0,5) $y = 2x+5$ $y = -3$ (-4,-3) $x = -4$		Plot $y = \frac{3}{2}x + 3$ $y = 2$ $\left(-\frac{2}{3}, 2\right)$ $x = -\frac{2}{3}$
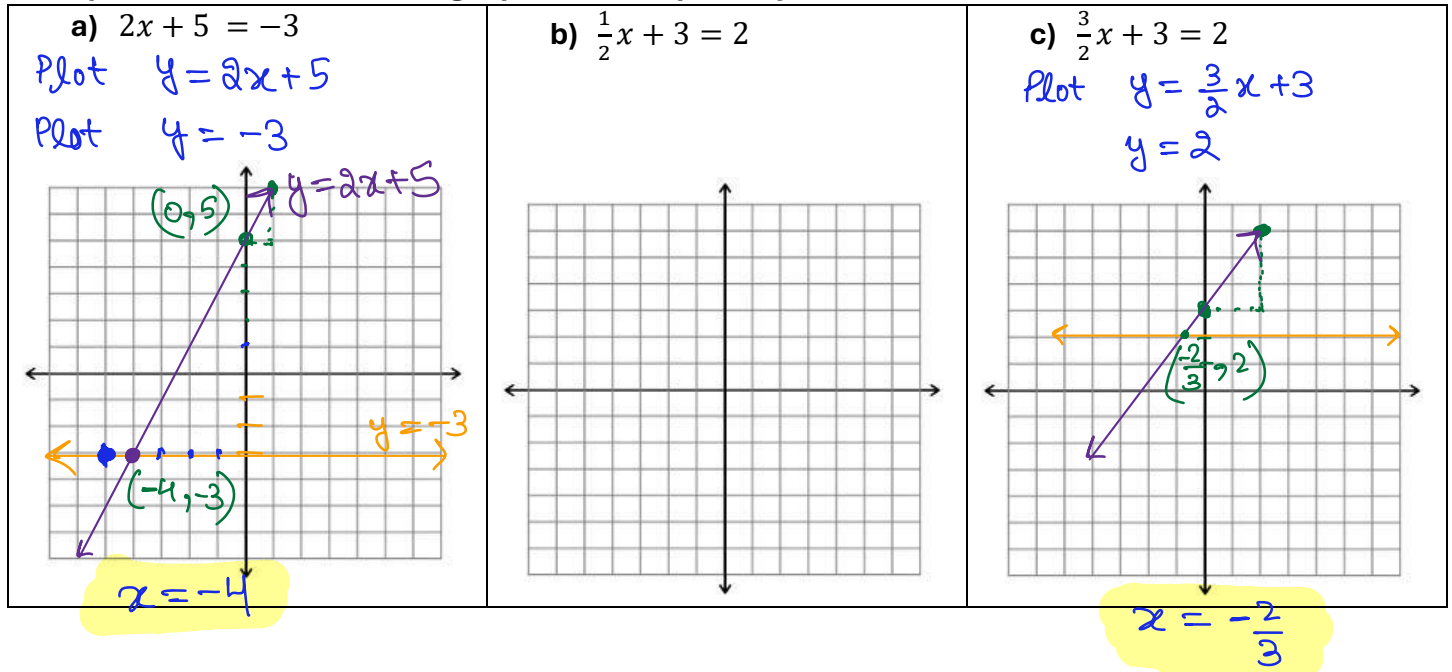
Example 12: In 2012, a 16-GB Apple iPad cos $630. AT&T offered a plan allowing up to 250MB of data for $15 per month. Write and graph a mathematical model for the total cost of an iPad 2 purchased in 2012 and put into use with a 250-MB data plan. Then use the model to estimate the number of months required for the total cost to reach $750.

Let C be the cost after x months.

After x months total cost = fixed cost + $x \left(\text{Cost per month}\right)$

$$C = 630 + 15x$$

$C = 750 \Rightarrow 630 + 15x = 750 \Rightarrow 15x = 750 - 630 = 120 \Rightarrow x = \frac{120}{15} = 8 \text{ months}$

Example 13: Becoming a member at Keeping Fit Club costs $75 plus a monthly fee of $35. Estimate how many months Kerry has been a member if the total paid so far is $215.

$$C = 75 + 35x$$

$75 + 35x = 215 \Rightarrow 35x = 140 \Rightarrow x = \frac{140}{35} = 4 \text{ months}$