Warm Up

9/15

Solve for x:

$5 - 7(x - 3) = 4 - 2x$

Distributive Property

$5 - 7x + 21 = 4 - 2x$

Combined Like Terms

$26 - 7x = 4 - 2x$

$+7x \quad +7x$

$26 = 4 + 5x$

$-4 \quad -4$

$\frac{22}{5} = \frac{5x}{5}$

$\frac{22}{5} = x$

Leave answer as improper fraction

2.2 Up and Down the Staircase

Exploring Slope

Linear Equation

$y = mx + b$

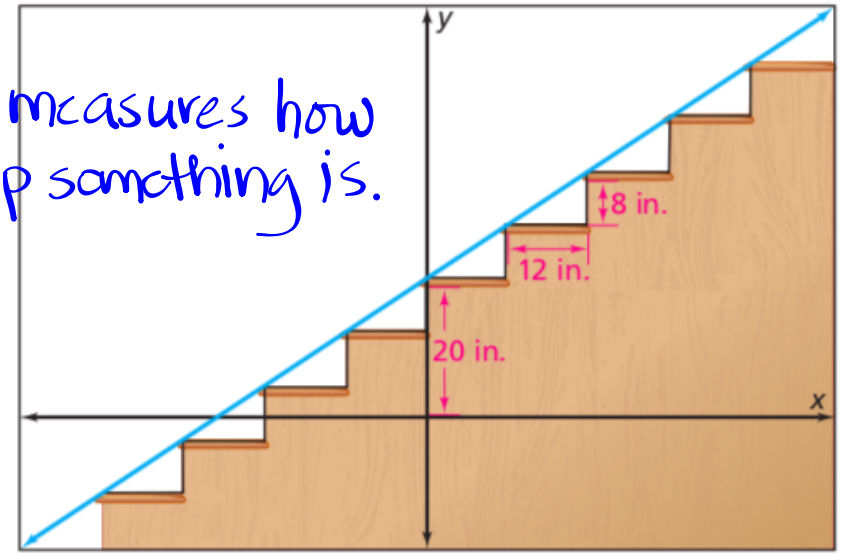
slope y-int

Linear functions are often used as models for patterns in data plots. In *Moving Straight Ahead*, you learned several facts about equations representing linear functions.

- Any linear function can be expressed by an equation in the form $y = mx + b$.
- The value of the coefficient m tells the rate at which the values of y increase (or decrease) as the values of x increase by 1. Since m tells you the change in y for every one-unit change in x, it can also be called the *unit rate*. A unit rate is a rate in which the second number is 1, or 1 of a quantity.
- The value of m also tells the steepness and direction (upward or downward) of the graph of the function.
- The value of b tells the point at which the graph of the function crosses the y-axis. That point has coordinates $(0, b)$ and is called the **y-intercept.**

In any problem that calls for a linear model, the goal is to find the values of m and b for an equation with a graph that fits the data pattern well. To measure the steepness of a linear equation graph, it helps to imagine a staircase that lies underneath the line.

Slope measures how steep something is.



The steepness of the line is the ratio of rise to run. This ratio is the **slope** of the line.

$$\text{slope} = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x} = \frac{\Delta y}{\Delta x}$$

up/down

left/right

$$\text{slope} = \frac{\Delta y}{\Delta x}$$

Linear equation basics:

Slope Intercept Form:

$y = mx + b$ ← y-intercept

m → slope $= \frac{\Delta y}{\Delta x}$ (measure of steepness)

y-intercept: the value of y when $x = 0$

$(0, b)$ ← y-int

Let $x = 0$

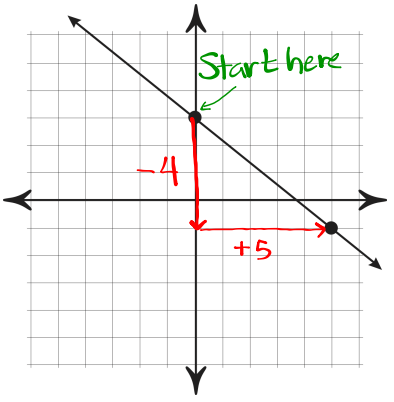
$y = mx + b$

$y = m(0) + b$

$y = b$

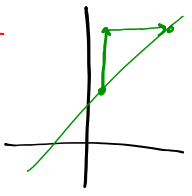
When $x = 0$, $y = b$ which is the y-intercept

Slope Calculation: From a graph, a table, or 2 points.



$$\text{Slope} = \frac{\Delta y}{\Delta x}$$

$$\frac{\Delta y}{\Delta x} = \frac{-4}{5}$$



x	y
3	7
5	15
7	23

Δx: +2, +2 $\quad$ Δy: +8, +8

$$\text{Slope} = \frac{\Delta y}{\Delta x} = \frac{8}{2} = 4$$

(2, 7) and (5, 37)

$$+3 \left\langle \begin{matrix} 2, 7 \\ 5, 37 \end{matrix} \right\rangle +30$$

We can "stack" the coordinate pairs and find the changes like we would in a table.

$$\text{Slope} = \frac{\Delta y}{\Delta x} = \frac{30}{3} = 10$$

Does order matter?

$$-3 \left\langle \begin{matrix} 5, 37 \\ 2, 7 \end{matrix} \right\rangle -30$$

$$\frac{\Delta y}{\Delta x} = \frac{-30}{-3} = 10$$

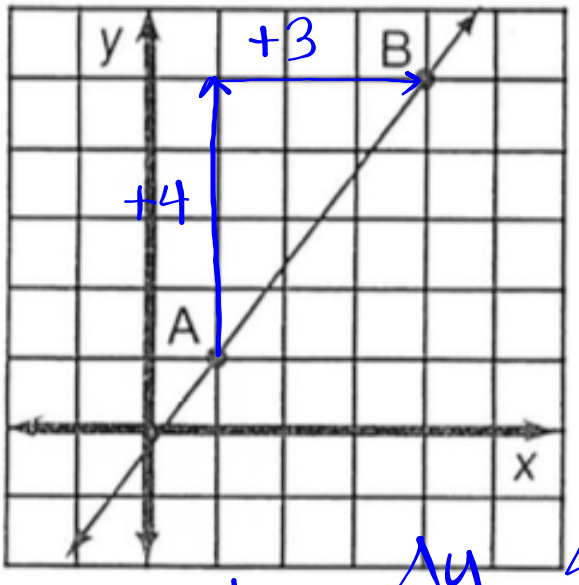
Same slope as above

No!

Practice

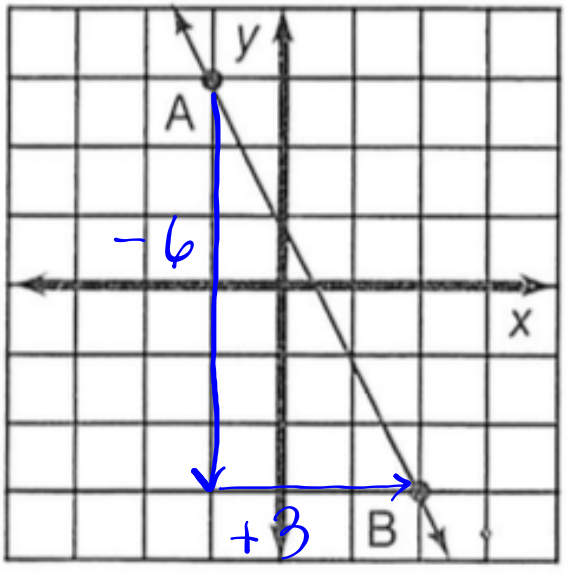
Start with the left hand point and travel vertically, then horizontally to the second point.

1



$$\text{Slope} = \frac{\Delta y}{\Delta x} = \frac{4}{3}$$

2



$$\text{Slope} = \frac{\Delta y}{\Delta x} = \frac{-6}{3} = -\frac{2}{1}$$

Practice

⑦ (2, 1); (5, 3)

$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{2}{3}$

$+3 < \begin{matrix} 2,1 \\ 5,3 \end{matrix} > +2$

⑧ (8, 3); (2, 5)

$-6 < \begin{matrix} 8,3 \\ 2,5 \end{matrix} > +2$ OR $+6 < \begin{matrix} 2,5 \\ 8,3 \end{matrix} > -2$

The order in which you "stack" your coordinate pairs does not matter. **The slope is always the same.**

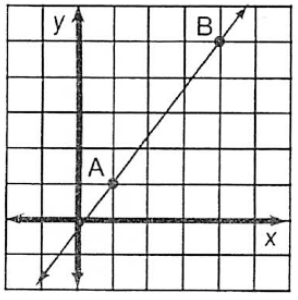
$\frac{\Delta y}{\Delta x} = \frac{2}{-6} = \frac{-1}{3}$ $\frac{\Delta y}{\Delta x} = \frac{-2}{6} = \frac{-1}{3}$

What Do You Call a Duck That Steals?

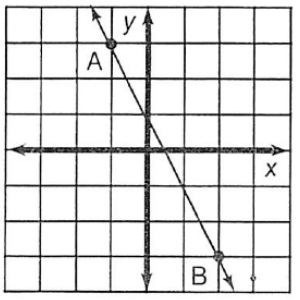
slope = $\frac{\Delta y}{\Delta x}$

For the first six exercises, find the slope of the line $\overleftrightarrow{AB}$. For the remaining exercises, find the slope of the line that passes through the two given points. Cut out each box in the table below that contains a correct answer. When you finish, print the letters from the remaining boxes in the spaces at the bottom of the page.

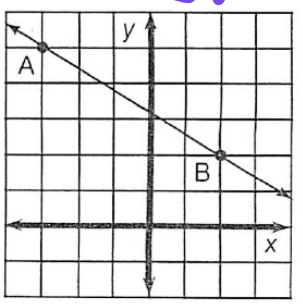
(1)



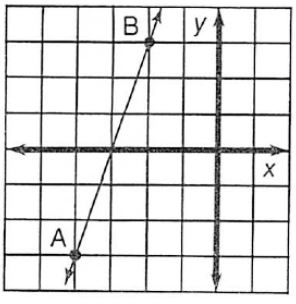
(2)



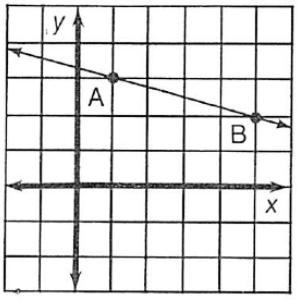
(3)



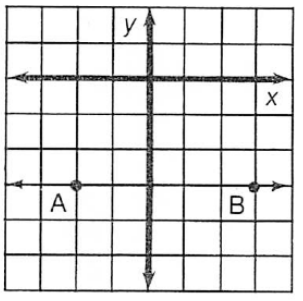
(4)



(5)



(6)



(7) (2, 1); (5, 3)

(8) (8, 3); (2, 5)

(9) (1, −4); (6, −2)

(10) (−3, 1); (−7, 4)

(11) (9, 2); (3, −1)

(12) (−5, 8); (−4, 2)

(13) (0, −1); (4, −7)

(14) (1, −1); (−2, −6)

(15) (−4, −8); (−2, 0)

(16) (−3, −3); (0, 0)

(17) (2, 5); (9, 1)

(18) (0, 0); (−2, 7)

DU 0	AB −6	CK $-\frac{3}{5}$	ST $-\frac{4}{7}$	AR 9	IG $\frac{1}{2}$	AT $-\frac{7}{2}$	OB $-\frac{7}{6}$	IG $\frac{4}{3}$	ET $\frac{2}{3}$	BE $-\frac{5}{4}$	ST $\frac{5}{3}$
CA $\frac{2}{5}$	RD $\frac{1}{6}$	RI $-\frac{1}{4}$	CH −2	UC −8	RI $-\frac{3}{2}$	ME 1	AQ $-\frac{1}{3}$	UA $-\frac{3}{4}$	KY $\frac{8}{5}$	ET 4	CK 3

OBJECTIVE 5–h: To find the slope of a line given two points on the line (not using the graph).