

Name _____

Algebra2
Lesson 2-2 part 2
Linear Equations

In Lesson 2-1 part 1, we learned that slope was a rate and that it could be used to graph linear functions. We also learned that slope had a formula. In this lesson, your main focus will be formulating and writing equations for given sets of information.

First let's review slope. $\text{Slope} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$.

Example: Find the slope between (-2,4) and (3,1)

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 4}{3 - (-2)} = \frac{-3}{3 + 2} = \frac{-3}{5}$$

An equation for a line can be formulated in four different ways:

1. using the slope-intercept form $y = mx + b$
2. using the slope formula given above
3. using the x and y-intercepts and slope formula
4. using point-slope formula $(y_2 - y_1) = m(x_2 - x_1)$ (precal teachers' favorite).

Two of the most efficient and easiest ways: (1) and (2) are shown below:

Example: Write an equation in the $y = mx + b$ form for (-4,-2) and (-1,3)

Step 1: Find the slope.

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - (-2)}{-1 - (-4)} = \frac{5}{-1 + 4} = \frac{5}{3}$$

Step 2: Put one of the given points and slope into $y = mx + b$

$$y = mx + b$$

$$3 = \left(\frac{5}{3}\right)(-1) + b \quad \text{[pick } (-1, 3) \text{ and } m = 5/3]$$

$$3 = -\frac{5}{3} + b$$

$$\frac{10}{3} = b$$

Step 3: Write final equation

$$y = mx + b$$

$$y = \frac{5}{3}x + \frac{10}{3}$$

another way---

Step 1 Find the slope (-5/3)

Step 2 Put one of the given points and slope into $(y_2 - y_1) = m(x_2 - x_1)$. Pick (-4,2) for (x_1, y_1)

$$y - 2 = \frac{5}{3}(x - (-4))$$

Step 3: Rearrange to get "y" by itself

$$y - 2 = \frac{5}{3}x + \frac{20}{3}$$

$$y = \frac{5}{3}x + \frac{26}{3}$$

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Notice that the last example on page 1 was worked two different ways, but still got the same answer. The first method was using the slope-intercept and the second method was using point-slope. Decide on the method(s) that is best for you.

At times, you will have to extract slope form clues about another line. The words, “parallel, perpendicular, vertical, horizontal” are the more common ones. Parallel lines never touch or cross so the slopes of parallel lines must be the same. Lines that are perpendicular meet at 90° angles and have slopes that are negative reciprocals of each other. Vertical lines have undefined slope and Horizontal lines have zero slope.

Parallel lines	equal slope	$m_1=m_2$	$m_1=2$ and $m_2=2$
Perpendicular lines	negative reciprocals	$m_1=-\frac{1}{m_2}$	$m_1=\frac{3}{4}$ and $m_2=-\frac{4}{3}$
Vertical	undefined slope	equation form: $x=a$ number	$x=5$
Horizontal	zero slope	equation form: $y=a$ number	$y=5$

Example: Find the equation of a line that is parallel to $y=3x-2$ and passes through $(-2,4)$.

Step 1: Find the slope $m=$ _____

Step 2 Fill in information into $(y_2-y_1)= m(x_2-x_1)$ form.

$$(y-4)=m(x-2)$$

Step 3: Rearrange to get “y” by itself

$$y-4=3x+6$$

$$y=3x+10$$

Example: Find the equation of a vertical line that passes through $(5,3)$. Since the line is vertical, the slope is undefined and the equation is just the x-value of the given point, $x=5$

Example: Find a linear equation in the $y=mx+b$ form for the data table:

x	0	2	4	6	8
f(x)	-2	1	4	7	10

Step 1: Find the slope. Notice that the difference between any two adjacent x-values is always 2. The difference between any two adjacent y-values is always 3. Thus the slope is

$$\text{slope} = \frac{\text{difference of } y\text{-values}}{\text{difference of } x\text{-values}} = \frac{3}{2}$$

Step 2 Use $(4,4)$ and use the slope in $(y_2-y_1)= m(x_2-x_1)$

$$(y - 4) = \frac{3}{2}(x - 4)$$

$$y - 4 = \frac{3}{2}x - 6$$

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

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Algebra2
Problem Set 2-2 part 2
Linear Equations

1. Write an equation in the $y=mx+b$ form for each of the following.

a) a line with slope 3 and passes through (2,-1)

b) a line that passes through (0,4) and (3,2)

c) a line that has this data table

x	-4	-3	-2	-1	0
f(x)	-1	0	1	2	3

d) a vertical line that passes through (6,-3)

e) a line parallel to $y= \frac{1}{2}x +3$ and passes through (1,-2)

f) a line that is perpendicular to $y=3x+1$ and passes through (3,-2)

2. Are these two lines parallel, perpendicular, or neither?

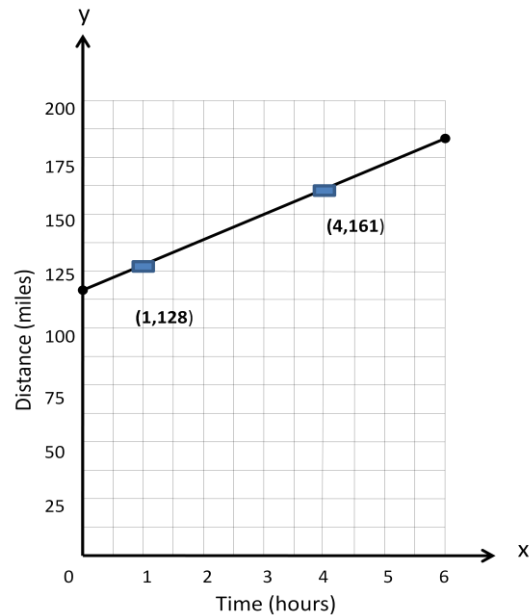
a) $y=3-1/2x$

$2x=8=4y$

b) $x=-3$

$y=4$

3. A person is riding a bicycle along a straight highway. The accompanying graph shows the rider's distance y in miles from an interstate highway after x hours.



a) How fast is the bicyclist traveling?

b) Find the slope-intercept form of the line.

c) How far was the bicyclist away from the interstate initially?

d) How far was the bicyclist from the highway after 1 hour and 15 minutes: