LINEAR EQUATIONS AND FUNCTIONS

Algebra 2
Chapter 2

Algebra II 2

- This Slideshow was developed to accompany the textbook
  - *Larson Algebra 2*
  - *By Larson, R., Boswell, L., Kanold, T. D., & Stiff, L.*
  - *2011 Holt McDougal*
- Some examples and diagrams are taken from the textbook.

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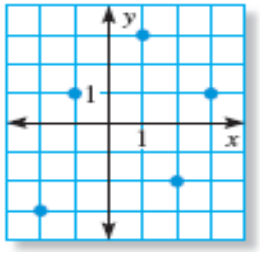
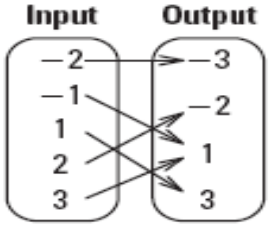
2.1 Represent Relations and Functions

- Relation is mapping (pairing) of input values to output values
  - Input → Domain → often x
  - Output → Range → often y

(-4, 3)
(-2, 1)
(0, 3)
(1, -2)
(-2, 4)

x	y
−4	3
−2	1
0	3
1	−2
−2	−4





Ask domain and range questions for the relations

2.1 Represent Relations and Functions

- Function
  - Relation where each input has exactly one output
  - Same *x* does not go to more than one *y*

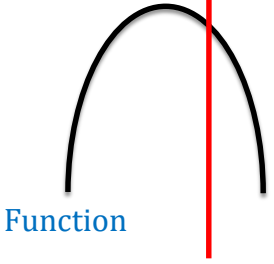
- Tell whether the relation is a function.

x	−2	−1	0	1	3
y	−4	−4	−4	−4	−4

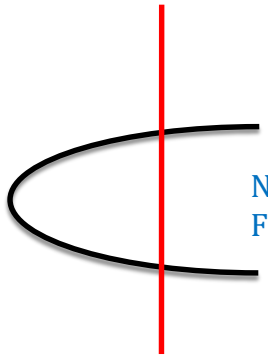
Yes, each x goes to only one y

2.1 Represent Relations and Functions

- Vertical line test
  - The relation is a <u>function</u> if no vertical line touches the graph at more than one point
- Is it a function?



Function



Not a Function

First is a function
Second is <u>NOT</u> a function

2.1 Represent Relations and Functions

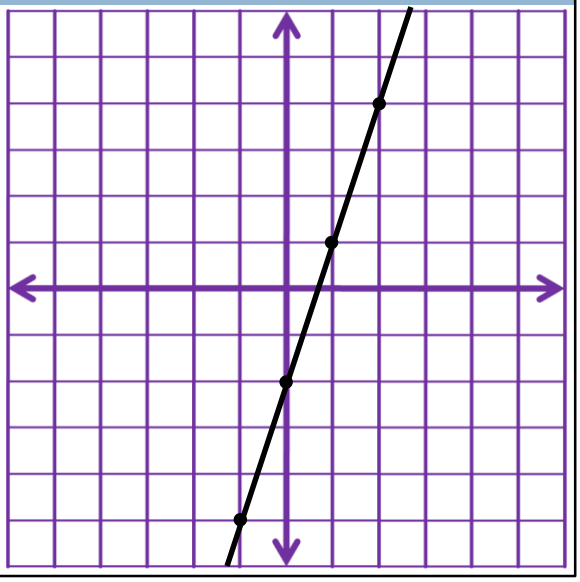
- Equation in two variables
  - Input → usually x → independent variable
  - Output → usually y → dependent variable
  - Solution → ordered pair (x, y) that gives a true statement
- To graph
  - Make a table of values by choosing x and calculating y
  - Plot enough points to see the pattern
  - Connect the points with a line or curve

Make sure the graph actually goes through the points it should go through

2.1 Represent Relations and Functions

- Graph the equation $y = 3x - 2$

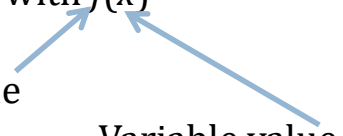
x	*y*
-3	-11
-2	-8
-1	-5
0	-2
1	1
2	4
3	7



x	y
-3	-11
-2	-8
-1	-5
0	-2
1	1
2	4
3	7

2.1 Represent Relations and Functions

- Linear function
  - Can be written in form $y = mx + b$
  - Graphs a line
  - $y = 2x - 3$
- Functional notation
  - Replace the y with $f(x)$
  - Name
  - Variable value



Point out that functions can be named more than just f

2.1 Represent Relations and Functions

- Tell whether the function is linear. Then evaluate the function when $x = -2$.
  - $f(x) = x - 1 - x^3$
    - **Not** Linear (has an exponent on x);
    - $f(-2) = (-2) - 1 - (-2)^3 = \mathbf{5}$
  - $g(x) = -4 - 2x$
    - **Linear**;
    - $f(-2) = -4 - 2(-2) = \mathbf{0}$

Not Linear (has an exponent on x);

$$f(-2) = (-2) - 1 - (-2)^3 = 5$$

Linear;

$$f(-2) = -4 - 2(-2) = 0$$

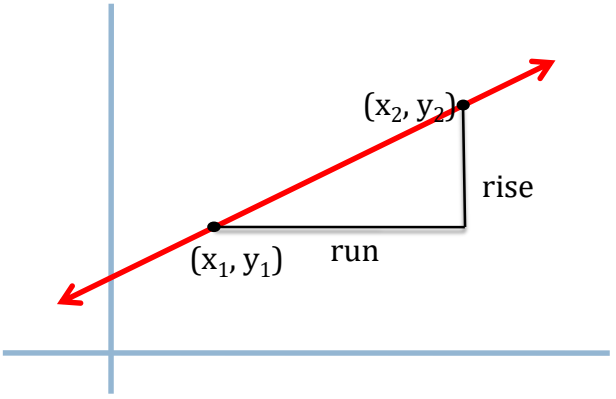
Homework Quiz

- 2.1 Homework Quiz

2.2 Find Slope and Rate of Change

$$Slope = \frac{rise}{run}$$

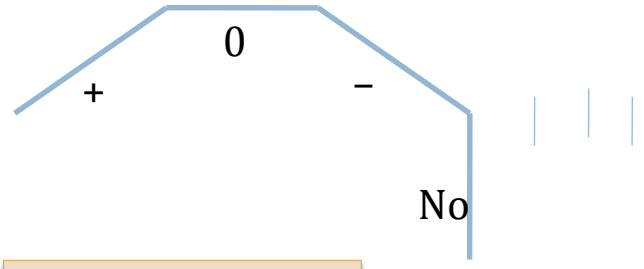
$$m = \frac{y_2 - y_1}{x_2 - x_1}$$



Slope is the rate of change

2.2 Find Slope and Rate of Change

- Positive Slope
  - Rises
- Zero Slope
  - Horizontal
- Negative Slope
  - Falls
- No Slope (Undefined)
  - Vertical



There's **No Slope** to stand on.

2.2 Find Slope and Rate of Change

- Find the slope of the line passing through the given points. Classify as *rises, falls, horizontal,* or *vertical*.
  - (0, 3), (4, 8)
    - $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8-3}{4-0} = \mathbf{\frac{5}{4}}$**; rises**
  - (7, 3), (–1, 7)
    - $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7-3}{-1-7} = \frac{4}{-8} = \mathbf{-\frac{1}{2}}$**; falls**
  - (7, 1), (7, -1)
    - $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-1-1}{7-7} = -\frac{2}{0} =$ **undefined; vertical**

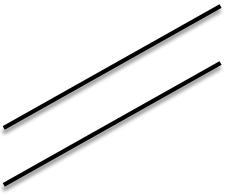
$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8-3}{4-0} = \frac{5}{4}$; rises

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7-3}{-1-7} = \frac{4}{-8} = -\frac{1}{2}$; falls

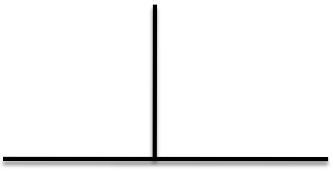
$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-1-1}{7-7} = -\frac{2}{0} =$ undefined; vertical

2.2 Find Slope and Rate of Change

- Parallel Lines
  - In the same plane and do not intersect
  - Go the same direction
  - Slopes are the same



- Perpendicular Lines
  - Intersect to form a right angle
  - Slopes are negative reciprocals
  - OR Product of slopes is -1
  - $\frac{2}{3}$ and $-\frac{3}{2}$



2.2 Find Slope and Rate of Change

- Tell whether the lines are *parallel*, *perpendicular*, or *neither*.
  - Line 1: through (–2, 8) and (2, –4)
  - Line 2: through (–5, 1) and (–2, 2)

    - Line 1: $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-4 - 8}{2 - (-2)} = -\frac{12}{4} = -3$
    - Line 2: $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 1}{-2 - (-5)} = \frac{1}{3}$
    - **Perpendicular**

Line 1: $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-4 - 8}{2 - (-2)} = -\frac{12}{4} = -3$

Line 2: $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 1}{-2 - (-5)} = \frac{1}{3}$

Perpendicular

2.2 Find Slope and Rate of Change

- Tell whether the lines are *parallel*, *perpendicular*, or *neither*.
  - Line 1: through (–4, –2) and (1, 7)
  - Line 2: through (–1, –4) and (3, 5)

    - Line 1: $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7 - (-2)}{1 - (-4)} = \frac{9}{5}$
    - Line 2: $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - (-4)}{3 - (-1)} = \frac{9}{4}$
    - **Neither**

Line 1: $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7 - (-2)}{1 - (-4)} = \frac{9}{5}$

Line 2: $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - (-4)}{3 - (-1)} = \frac{9}{4}$

Neither

2.2 Find Slope and Rate of Change

- In 1983, 87% of New Hampshire was forested. By 2001, that percent had fallen to 81.1%. What is the average rate of change of forested land? Then predict what percentage will be forested in 2005.
  - x = time in years
  - y = percent
  - Points are (1983, 87) and (2001, 81.1)
  - $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{81.1 - 87}{2001 - 1983} = -\frac{5.9}{18} = -0.3278$
  - To get the percent for 2005, take the amount from 2001 and add 4 times the slope to get four more years.
  - $81.1 + 4(-0.3278) = \mathbf{79.8}\%$

x = time in years
y = percent
Points are (1983, 87) and (2001, 81.1)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{81.1 - 87}{2001 - 1983} = -\frac{5.9}{18} = -0.3278$$

To get the percent for 2005, take the amount from 2001 and add 4 times the slope to get four more years.

$$81.1 + 4(-0.3278) = 79.8\%$$

Homework Quiz

- 2.2 Homework Quiz

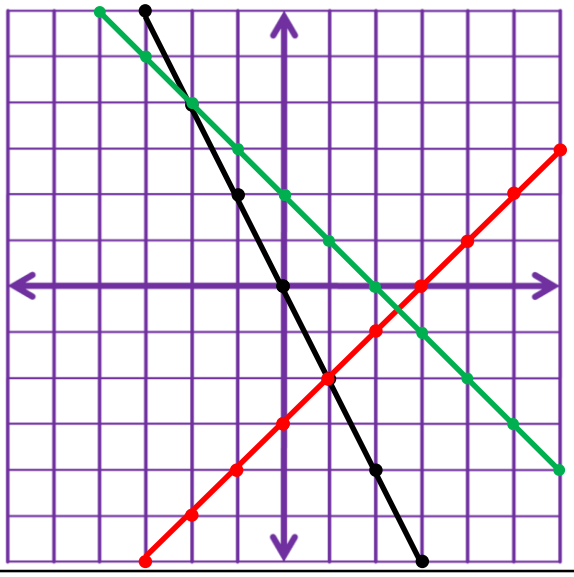
2.3 Graph Equations of Lines

- Slope-intercept form
  - $y = mx + b$
    - m is slope
    - b is y-intercept
- To graph
  - Solve equation for y
  - Plot the y-intercept
  - From there move up and over the slope to find another couple of points
  - Draw a line neatly through the points

y-intercept is where the line crosses the y-axis

2.3 Graph Equations of Lines

- Graph
  - $y = -2x$
    - $y = -2x + 0$
    - $m = -2 = -\frac{2}{1};\ b = 0$
  - $y = x - 3$
    - $y = x - 3$
    - $m = 1 = \frac{1}{1}; b = -3$
  - $f(x) = 2 - x$
    - $f(x) = 2 - x$
    - $f(x) = -x + 2$
    - $m = -1 = -\frac{1}{1}; b = 2$



$$y = -2x + 0$$
$$m = -2 = -\frac{2}{1};\ b = 0$$

$$y = x - 3$$
$$m = 1 = \frac{1}{1}; b = -3$$

$$f(x) = 2 - x$$
$$f(x) = -x + 2$$
$$m = -1 = -\frac{1}{1}; b = 2$$

2.3 Graph Equations of Lines

- Standard Form
  - $Ax + By = C$
    - A, B, and C are integers
- To graph
  - Find the x- and y-intercepts by letting the other variable = 0
  - Plot the two points
  - Draw a line through the two points

- x-intercept:
- $Ax + B(0) = C$
- $Ax = C$
- $x = \frac{C}{A}$

- y-intercept:
- $A(0) + By = C$
- $By = C$
- $y = \frac{C}{B}$

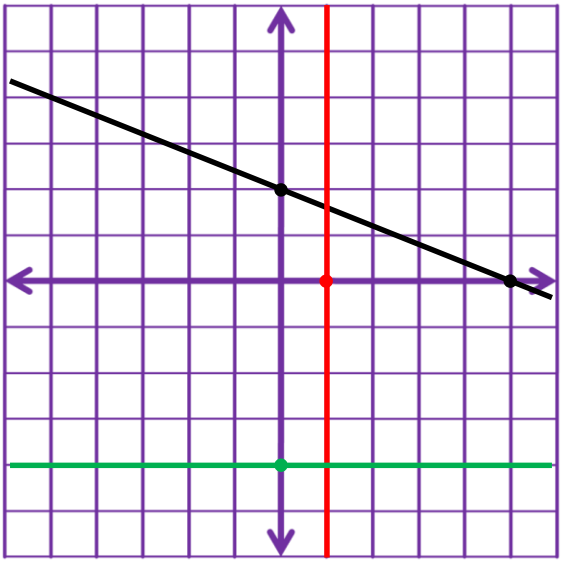
2.3 Graph Equations of Lines

- Horizontal Lines
  - $y = c$

- Vertical Lines
  - $x = c$

2.3 Graph Equations of Lines

- Graph
  - $2x + 5y = 10$
    - x-int: $2x + 5(0) = 10 \rightarrow 2x = 10 \rightarrow x = 5$; $(5, 0)$
    - y-int: $2(0) + 5y = 10 \rightarrow 5y = 10 \rightarrow y = 2$; $(0, 2)$
  - $x = 1$
    - Vertical line
    - x-int: $(1, 0)$
  - $y = -4$
    - Horizontal line
    - y-int: $(0, -4)$



x-int: $2x + 5(0) = 10 \rightarrow 2x = 10 \rightarrow x = 5$; $(5, 0)$
y-int: $2(0) + 5y = 10 \rightarrow 5y = 10 \rightarrow y = 2$; $(0, 2)$

Vertical line
x-int: $(1, 0)$

Horizontal line
y-int: $(0, -4)$

Homework Quiz

- 2.3 Homework Quiz

2.4 Write Equations of Lines

- Given slope and y-intercept
  - Use slope-intercept form $y = mx + b$

- Any other line
  - Find the slope (m)
  - Find a point the line goes through (x_1, y_1)
  - Use point-slope form $y - y_1 = m(x - x_1)$

2.4 Write Equations of Lines

- Write the equation of the line given…
  - m = –2 , b = –4
    - Given slope and y-intercept
    - $y = mx + b$
    - $y = -2x - 4$
  - it passes through (–1, 6) and has a slope of 4.
    - Given slope and point
    - $y - y_1 = m(x - x_1)$
    - $y - 6 = 4\big(x - (-1)\big)$
    - $y - 6 = 4x + 4$
    - $y = 4x + 10$

Given slope and y-intercept

$$y = mx + b$$
$$y = -2x - 4$$

Given slope and point

$$y - y_1 = m(x - x_1)$$
$$y - 6 = 4\big(x - (-1)\big)$$
$$y - 6 = 4x + 4$$
$$y = 4x + 10$$

2.4 Write Equations of Lines

- Write the equation of the line given…
  - it passes through (-1, 2) and (10, 0)

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 2}{10 - (-1)} = -\frac{2}{11}$

$y - y_1 = m(x - x_1)$

$y - 0 = -\frac{2}{11}(x - 10)$

$y = -\frac{2}{11}x + \frac{20}{11}$

2.4 Write Equations of Lines

- Write an equation of the line that passes through (4, –2) and is (a) parallel to, and (b) perpendicular to, the line $y = 3x - 1$.

a) $m = 3$; Parallel lines have same slope

$$y - y_1 = m(x - x_1)$$
$$y - (-2) = 3(x - 4)$$
$$y + 2 = 3x - 12$$
$$y = 3x - 14$$

b) $m = -\frac{1}{3}$; Perpendicular lines have negative reciprocal slopes

$$y - y_1 = m(x - x_1)$$
$$y - (-2) = -\frac{1}{3}(x - 4)$$
$$y + 2 = -\frac{1}{3}x + \frac{4}{3}$$
$$y = -\frac{1}{3}x - \frac{2}{3}$$

a) $m = 3$; Parallel lines have same slope

$$y - y_1 = m(x - x_1)$$
$$y - (-2) = 3(x - 4)$$
$$y + 2 = 3x - 12$$
$$y = 3x - 14$$

b) $m = -\frac{1}{3}$; Perpendicular lines have negative reciprocal slopes

$$y - y_1 = m(x - x_1)$$
$$y - (-2) = -\frac{1}{3}(x - 4)$$
$$y + 2 = -\frac{1}{3}x + \frac{4}{3}$$
$$y = -\frac{1}{3}x - \frac{2}{3}$$

2.4 Write Equations of Lines

- A certain farmer can harvest 44000 bushels of crops in a season. Corn averages 155 bushels per acre and soybeans average 44 bushels per acre in Michigan in 2013. Write an equation that models this situation.

- The "per" means this rate problem.
  Rate × amount = total
- $155x + 44y = 44000$

The "per" means this rate problem. Rate × amount = total
155x + 44y = 44000

2.4 Write Equations of Lines

- In a chemistry experiment, you record the temperature to be -5 °F one minute after you begin. Six minutes after you begin the temperature is 20 °F. Write a linear equation to model this.
  - Two points: (1, -5), (6, 20)
  - $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{20-(-5)}{6-1} = \frac{25}{5} = 5$
  - $y - y_1 = m(x - x_1)$
  - $y - (-5) = 5(x - 1)$
  - $y + 5 = 5x - 5$
  - $y = 5x - 10$

Two points: (1, -5), (6, 20)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{20 - (-5)}{6 - 1} = \frac{25}{5} = 5$$

$$y - y_1 = m(x - x_1)$$

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

$$y + 5 = 5x - 5$$

$$y = 5x - 10$$

Homework Quiz

- 2.4 Homework Quiz

2.5 Model Direct Variation

- Direct Variation
  - $y = ax$ can be used to model the situation
  - a = constant of variation (slope)

- Write a direct variation equation that has the given ordered pair as a solution.
  - (6, -2)
    - $y = ax$
    - $-2 = a(6)$
    - $a = -\frac{1}{3}$
    - $\boldsymbol{y = -\frac{1}{3}x}$

Slope is $\left(-\frac{2}{6}\right) = -\frac{1}{3}$

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

2.5 Model Direct Variation

- Hooke's Law states that the distance *d* a spring stretches varies directly with the force *f* that is applied to it.
  - Suppose a spring stretches 15 in. when a force of 9 lbs. is applied. Write an equation to relate *d* to *f*.
    - Hooke's law: $d = af$
    - $15 = a(9) \rightarrow a = \frac{15}{9} = \frac{5}{3}$
    - $\boldsymbol{d = \frac{5}{3}f}$
  - Predict the distance that the spring will stretch when a force of 6 lbs. is applied.
    - $d = \left(\frac{5}{3}\right)6 = \boldsymbol{10\ in.}$

Hooke's law: d = af
15 = a(9) → a = 15/9 = 5/3
d = 5/3 f

d = (5/3) 6 = 10 in.

2.5 Model Direct Variation

- The dimensions of five rectangles, each with an area of 24 ft^2 are given in the table. Tell whether the length and width show direct variation. If so, write an equation that relates the quantities.

Length, *x*	**1**	**2**	**3**	**4**	**5**
Width, *y*	24	12	8	6	4.8

  - $y = ax$
  - Plug in each point to check if a is constant.
  - $24 = a1$
  - $\frac{24}{1} = a = 24$
  - $12 = a2$
  - $\frac{12}{2} = a = 6$
  - **No,** the length and width are not directly related because the ratios (a) are not constant.

$$y = ax$$

Plug in each point to check if a is constant.

$$24 = a1$$

$$\frac{24}{1} = a = 24$$

$$12 = a2$$

$$\frac{12}{2} = a = 12$$

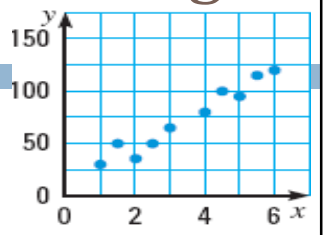
No, the length and width are not directly related because the ratios (a) are not constant.

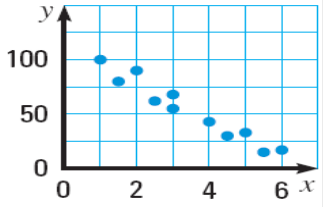
Homework Quiz

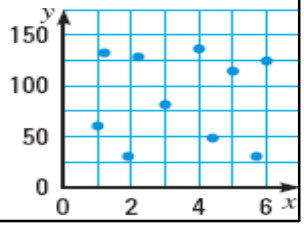
- 2.5 Homework Quiz

2.6 Draw Scatter Plots and Best-Fitting Lines

- Scatter Plot
  - Graph of many data points
- Positive Correlation
  - The slope of the scatter plot tends to be positive
- Negative Correlation
  - The slope of the scatter plot tends to be negative
- No Correlation
  - There is no obvious pattern from the scatter plot





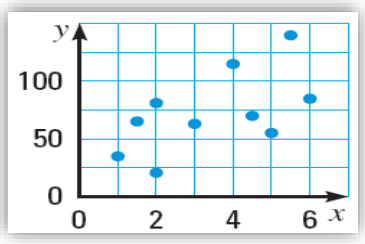


2.6 Draw Scatter Plots and Best-Fitting Lines

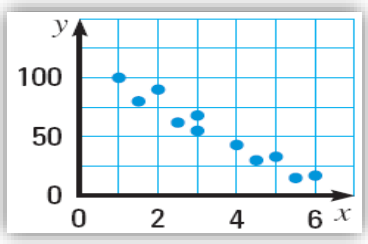
- Correlation Coefficient (r)
  - Number between -1 and 1 that measures how well the data fits a line.
  - Positive for positive correlation, negative for negative
  - $r = 0$ means there is no correlation

2.6 Draw Scatter Plots and Best-Fitting Lines

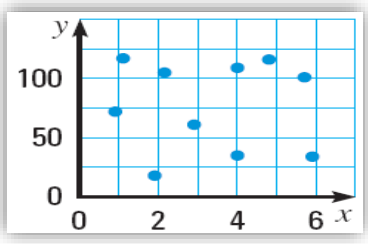
- For each scatter plot, (a) tell whether the data have a *positive correlation*, a *negative correlation*, or *approximately no correlation*, and (b) tell whether the correlation coefficient is closest to –1, –0.5, 0, 0.5, or 1.



Positive, r ≈ 0.5



Negative, r ≈ -1



No correlation, r ≈ 0

Positive, r ≈ 0.5

Negative, r ≈ -1

No correlation, r ≈ 0

2.6 Draw Scatter Plots and Best-Fitting Lines

- Best-fitting line
  - Line that most closely approximates the data
- Find the best-fitting line
  1. Draw a scatter plot of the data
  2. Sketch the line that appears to follow the data the closest
     - There should be about as many points below the line as above
  3. Choose two points on the line and find the equation of the line
     - These do not have to be original data points

See example 5 in the textbook to see how to do this on a TI graphing calculator

2.6 Draw Scatter Plots and Best Lines

x	0	1	2	3	4	5	6	7
y	16.5	11.4	12.5	4.7	9.9	7.1	2.9	1.7

- Monarch Butterflies: The table shows the area in Mexico used by Monarch Butterflies to spend winter, y, in acres x years after 2006.
  - Approximate the best-fitting line for the data.
  - Use your equation from part (a) to predict the area used by the butterflies in 2016.

1. Plot the points.
2. Draw the best-fitting line.
3. Find the equation using 2 points (0,15) and (8,0).

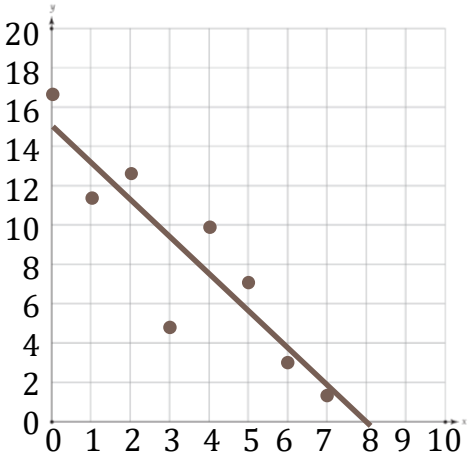
$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{0 - 15}{8 - 0} = -1.875$$

$$y = mx + b$$

$$y = -1.875x + 15$$

- 2016 will be $x = 10$
- $y = -1.875(10) + 15 = -3.75$
- They would have gone extinct!



Sample Answer: $y = -1.89x + 14.97$

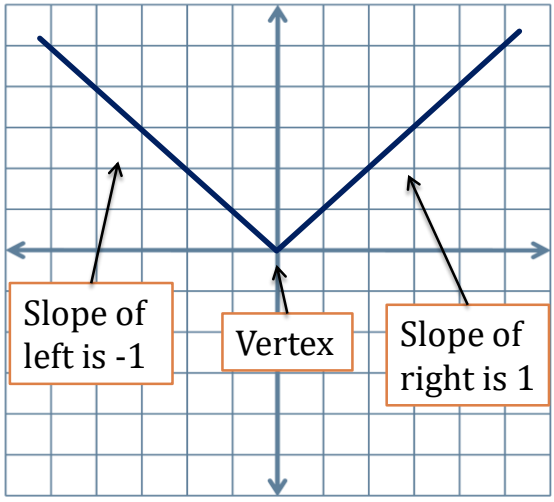
Sample Answer:
$y = -1.89(10) + 14.97 = -3.93$ acres (they would be gone, extinct!)

Homework Quiz

- 2.6 Homework Quiz

2.7 Use Absolute Value Functions and Transformations

- Absolute Value Function
  - $f(x) = a|x - h| + k$
  - Simplest $y = |x|$



2.7 Use Absolute Value Functions and Transformations

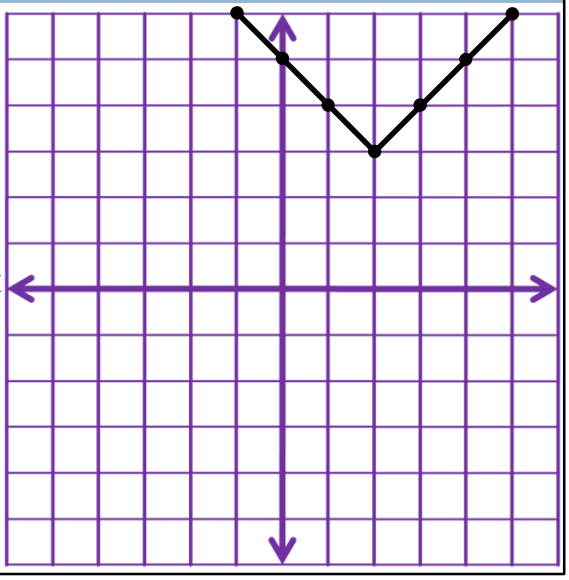
$$f(x) = a|x - h| + k$$

- Transformations (changes to graph's size, shape, position, or orientation)
  - Stretch/Shrink
    - a is the factor the graph is stretched or shrunk vertically
    - Multiply the *y*-coordinates by a
    - Since the slope of the right side of the graph was 1, the new slope will be a
  - Reflection → Flips the graph over a line
    - If a is negative, the graph will be flipped over the x-axis
  - Translation → moves graph
    - h is how far graph moves to right
    - k is how far graph moves up
    - Since the vertex was (0, 0), the new vertex will be (*h*, *k*)
  - Apply stretch/shrinks and reflections before translations
    - Multiply before adding

Absolute value function only

2.7 Use Absolute Value Functions and Transformations

- Graph and compare with $y = |x|$
  - $y = |x - 2| + 3$
    - $y = a|x - h| + k$
    - $y = |x - 2| + 3$
    - $h = 2, k = 3$
    - Translated 2 right and 3 up. The vertex will be $(h, k) = (2, 3)$
    - $a = 1$
    - The slope of the right side will be 1. (**Translated 2 right and 3 up.**)



$$y = a|x - h| + k$$
$$y = |x - 2| + 3$$

$h = 2, k = 3$

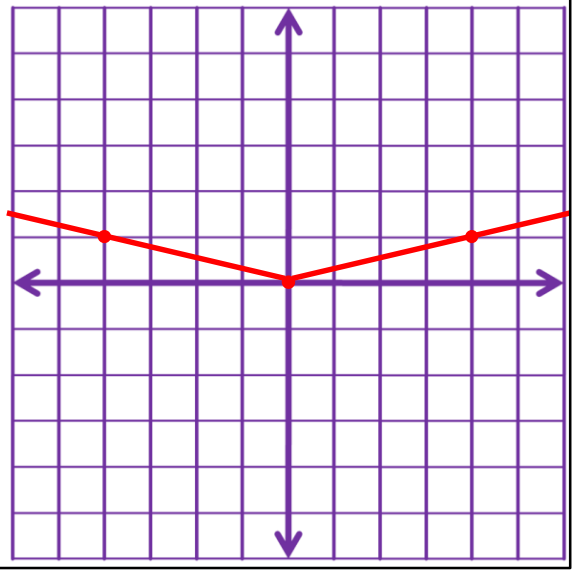
Translated 2 right and 3 up. The vertex will be $(h, k) = (2, 3)$

$a = 1$

The slope of the right side will be 1. (**Translated 2 right and 3 up.**)

2.7 Use Absolute Value Functions and Transformations

- Graph and compare with $y = |x|$
  - $y = \frac{1}{4}|x|$
    - $y = a|x - h| + k$
    - $y = \frac{1}{4}|x|$
    - $h = 0$, $k = 0$ since they are missing
    - Not translated. The vertex will be $(h, k) = (0, 0)$
    - $a = \frac{1}{4}$
    - The slope of the right side will be $1/4$. (**Shrunk vertically by factor of ¼.**)



$$y = a|x - h| + k$$

$$y = \frac{1}{4}|x|$$

$h = 0$, $k = 0$ since they are missing

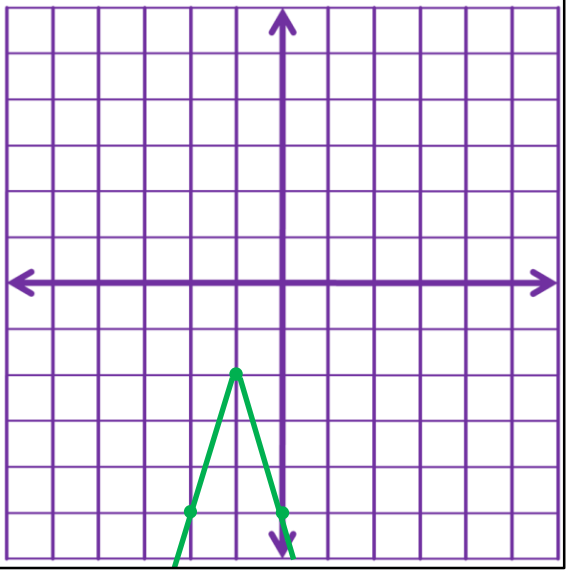
Not translated. The vertex will be $(h, k) = (0, 0)$

$a = \frac{1}{4}$

The slope of the right side will be 1/4. (**Shrunk vertically by factor of ¼.**)

2.7 Use Absolute Value Functions and Transformations

- Graph and compare with $y = |x|$
  - $y = -3|x + 1| - 2$
    - $y = a|x - h| + k$
    - $y = -3|x + 1| - 2$
    - h = -1, k = -2
    - Translated 1 left and 2 down. The vertex will be (h, k) = (-1, -2)
    - a = -3
    - The slope of the right side will be -3. (**Reflected over the x-axis, stretched by factor of 3, translated 1 left and 2 down.**)



$$y = a|x - h| + k$$
$$y = -3|x + 1| - 2$$

h = -1, k = -2

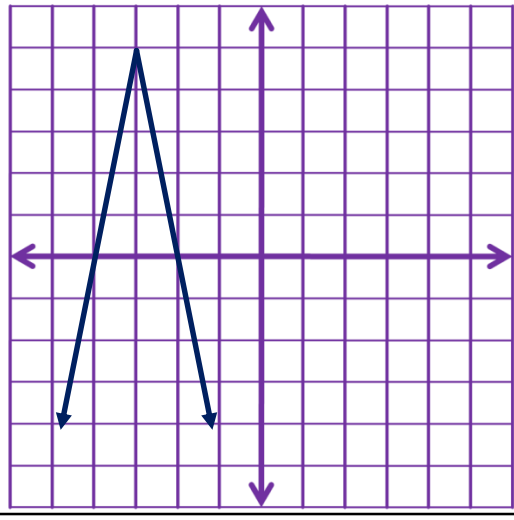
Translated 1 left and 2 down. The vertex will be (h, k) = (-1, -2)

a = -3

The slope of the right side will be -3. (**Reflected over the x-axis, stretched by factor of 3, translated 1 left and 2 down.**)

2.7 Use Absolute Value Functions and Transformations

- Write an absolute value equation for the given graph.
  - Vertex is at (-3, 5), so h = -3 and k = 5.
  - The slope of the right side is $-\frac{5}{1} = -5$, so a = -5
  - $y = a|x - h| + k$
  - $y = -5\,|x + 3| + 5$



Vertex is at (-3, 5), so h = -3 and k = 5.

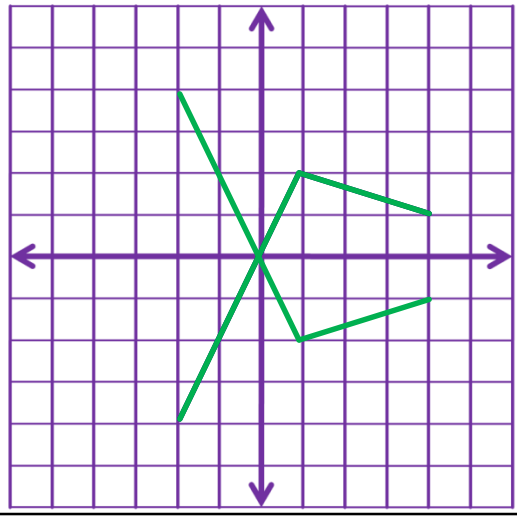
The slope of the right side is $-\frac{5}{1} = -5$, so a = -5

$$y = a|x - h| + k$$

$$y = -5\,|x + 3| + 5$$

2.7 Use Absolute Value Functions and Transformations

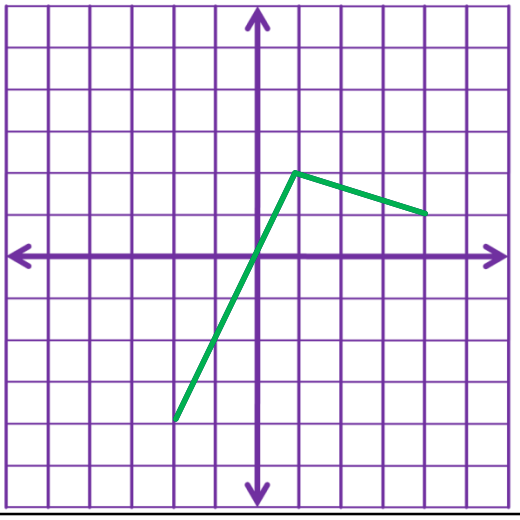
- The graph of $f(x)$ is given. Sketch the following functions.
  - $y = -\frac{1}{2}f(x)$
    - Reflected over the x-axis because of the -, shrunk vertically by factor of ½ because of the ½.
    - Reflect the graph over the x-axis first.
    - Make the distance from each point to the x-axis half the distance.



Reflected over the x-axis because of the -, shrunk vertically by factor of ½ because of the ½.
Reflect the graph over the x-axis first.
Make the distance from each point to the x-axis half the distance.

2.7 Use Absolute Value Functions and Transformations

- The graph of $f(x)$ is given. Sketch the following functions.
  - $y = f(x - 1) + 3$



    - $h = 1$ and $k = 3$, so translated right 1 and up 3.

$h = 1$ and $k = 3$, so translated right 1 and up 3.

Homework Quiz

- 2.7 Homework Quiz

2.8 Graph Linear Inequalities in Two Variables

- Linear Inequality in two variables
  - Like linear equation, but with inequality instead of =

- Tell whether the given ordered pair is a solution of $5x - 2y \leq 6$
  - (0, -4)
    - $5x - 2y \leq 6$
    - $5(0) - 2(-4) \leq 6$
    - $8 \leq 6$
    - Not true, so **not** a solution
  - (-3, 8)
    - $5x - 2y \leq 6$
    - $5(-3) - 2(8) \leq 6$
    - $-15 - 16 \leq 6$
    - $-31 \leq 6$
    - True, so it **is** a solution

$$5x - 2y \leq 6$$
$$5(0) - 2(-4) \leq 6$$
$$8 \leq 6$$

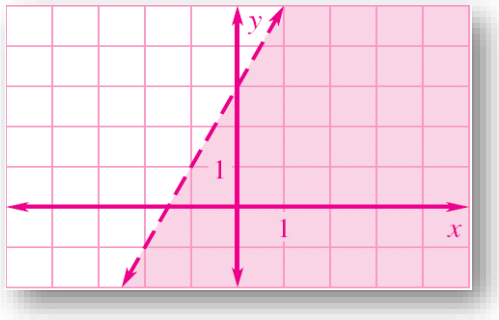
Not true, so **not** a solution

$$5x - 2y \leq 6$$
$$5(-3) - 2(8) \leq 6$$
$$-15 - 16 \leq 6$$
$$-31 \leq 6$$

True, so it **is** a solution

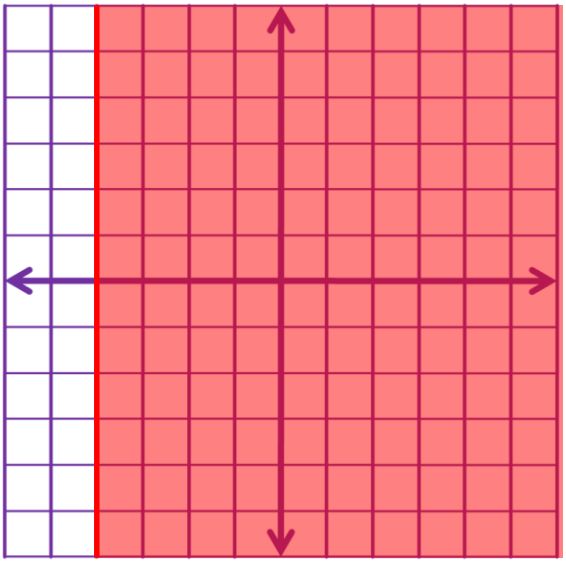
2.8 Graph Linear Inequalities in Two Variables

- Graphing a linear inequality
  - Graph the line as if it was =
  - Dotted or Solid line
    - Dotted if <, >
    - Solid if ≤, =, ≥
  - Shade
    - Test a point not on the line
    - If the point is a solution, shade that side of the line
    - If the point is not a solution, shade the other side of the line



2.8 Graph Linear Inequalities in Two Variables

- Graph
  - $x \geq -4$
    - Graph the line: Vertical line at $x = -4$.
    - Solid because equal to.
    - Shade the right because that is where the x's are bigger than -4.



Graph the line: Vertical line at $x = -4$.
Solid because equal to.
Shade the right because that is where the x's are bigger than -4.

2.8 Graph Linear Inequalities in Two Variables

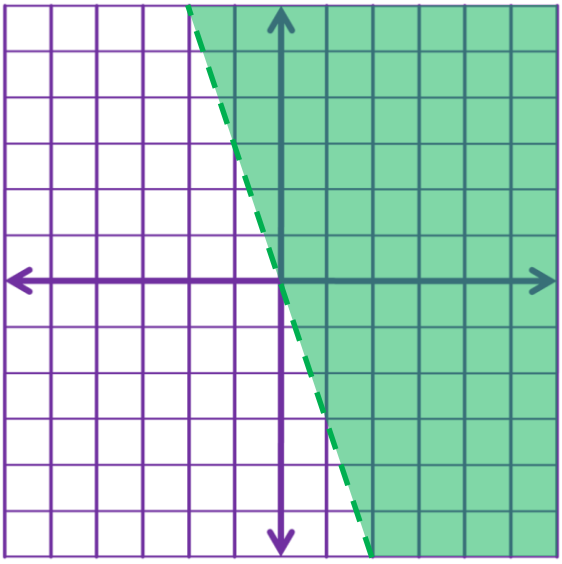
- Graph
  - $y > -3x$
    - Graph line: y-int = 0, slope = -3.
    - Dotted because not equal to.
    - Pick (1, 0) as test point.

      $y > -3x$

      $0 > -3(1)$

      $0 > -3$

      This is true so shade that side of the line.



Graph line: y-int = 0, slope = -3.
Dotted because not equal to.
Pick (1, 0) as test point. $y > -3x \rightarrow 0 > -3(1) \rightarrow 0 > -3$. This is true so shade that side of the line.

2.8 Graph Linear Inequalities in Two Variables

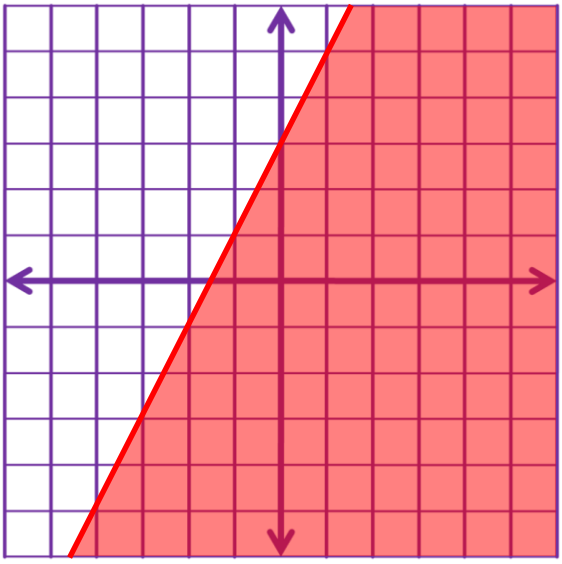
- Graph
  - $y \leq 2x + 3$
    - Graph the line: y-int = 3, slope = 2.
    - Solid because equal to.
    - Pick (0, 0) as test point.

      $y \leq 2x + 3$

      $0 \leq 2(0) + 3$

      $0 \leq 3$

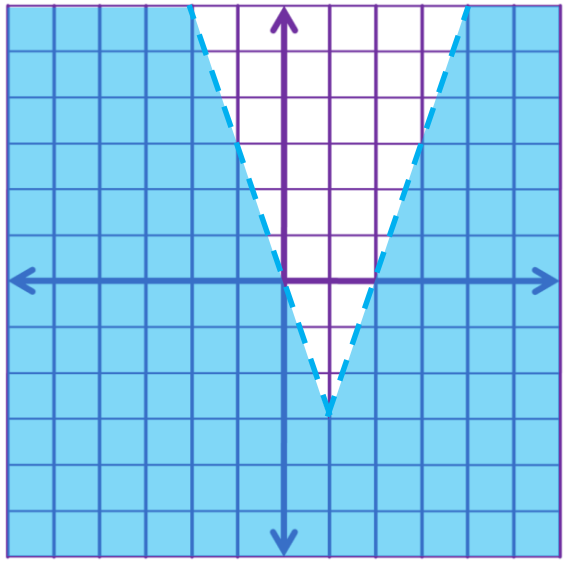
      This is true so shade that side of the line.



Graph the line: y-int = 3, slope = 2.
Solid because equal to.
Pick (0, 0) as test point. $y \leq 2x + 3 \rightarrow 0 \leq 2(0) + 3 \rightarrow 0 \leq 3$. This is true so shade that side of the line.

2.8 Graph Linear Inequalities in Two Variables

- Graph
  - $y < 3|x - 1| - 3$
    - Graph the absolute value: $h = 1$, $k = -3$, $a = 3$
    - Dotted because not equal to.
    - Pick (1, 0) as test point.
      $y < 3|x - 1| - 3$
      $0 < 3|1 - 1| - 3$
      $0 < -3$
      This is false so shade the other side of the line.



Graph the absolute value: $h = 1$, $k = -3$, $a = 3$
Dotted because not equal to.
Pick (1, 0) as test point. $y < 3|x - 1| - 3 \rightarrow 0 < 3|1 - 1| - 3 \rightarrow 0 < -3$. This is false so shade the other side of the line.

2.8 Graph Linear Inequalities in Two Variables

- You have two part-time summer jobs, one that pays $9 an hour and another that pays $12 an hour. You would like to earn at least $240 a week. Write an inequality describing the possible amounts of time you can schedule at both jobs.
  - Rate problem: rate × amount = total
  - $9x + 12y \geq 240$
  - Greater than sign because the 240 is the smallest we want, so the small side of the sign is pointed at 240.

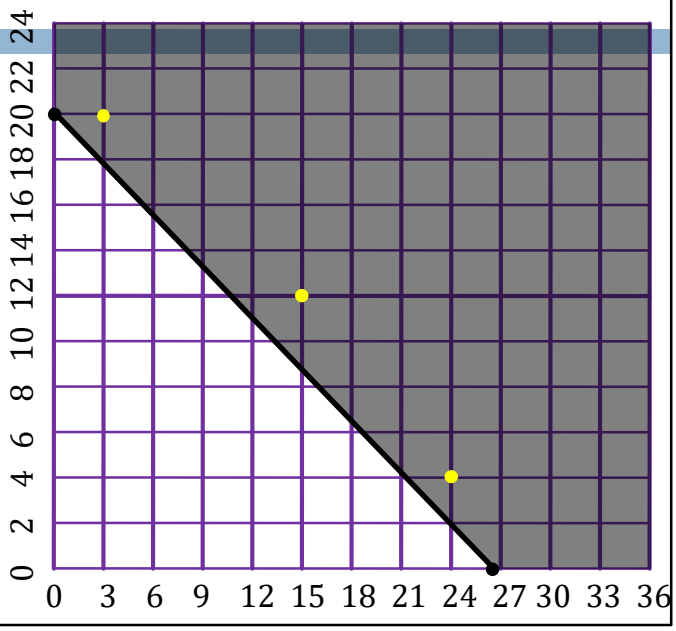
Rate problem: rate × amount = total

$$9x + 12y \geq 240$$

Greater than sign because the 240 is the smallest we want, so the small side of the sign is pointed at 240.

2.8 Graph Linear Inequalities in Two Variables

- Graph the previous answer
  - $9x + 12y \geq 240$
  - Graph the line: This is in standard form, so find the intercepts.
  - x-int: $9x + 12(0) = 240 \rightarrow x \approx 26.7$
  - y-int: $9(0) + 12y = 240 \rightarrow y = 20$
  - Solid line because equal to.
  - Test (0, 0).
    $9x + 12y \geq 0$
    $9(0) + 12(0) \geq 240$
    $0 \geq 240$
    This is false, so shade the other side of the line.
- Identify three possible solutions of the inequality
  - Pick any three points in the shaded area.
  - Sample Answers: (15, 12), (24, 4), (3, 20)



$$9x + 12y \geq 240$$

Graph the line: This is in standard form, so find the intercepts.

x-int: $9x + 12(0) = 240 \rightarrow x \approx 26.7$

y-int: $9(0) + 12y = 240 \rightarrow y = 20$

Solid line because equal to.

Test (0, 0). $9x + 12y \geq 0 \rightarrow 9(0) + 12(0) \geq 240 \rightarrow 0 \geq 240$. This is false, so shade the other side of the line.

Pick any three points in the shaded area.

Sample Answers: (15, 12), (24, 4), (3, 20)

Homework Quiz

- 2.8 Homework Quiz