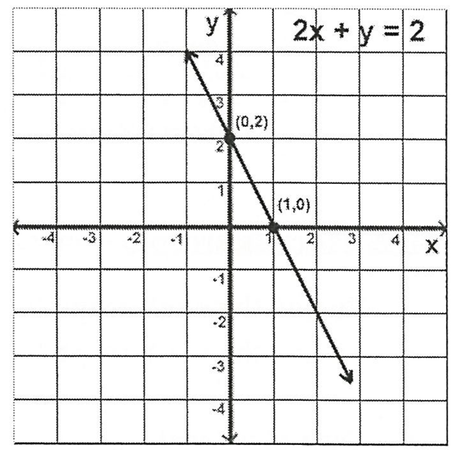
Name Key Period ________

Chapter 3.1 Notes (Graphing Linear Equations)

Objectives:

- Identify linear equations, intercepts, and zeros.
- Graph linear equations.



Linear Equation – forms a *line* when graphed

- No exponents on variables (other than 1)
- No variables in denominator
- No *xy* terms

Standard Form: $Ax + By = C$

- $A \geq 0$
- $A, B,$ and C are integers (no fractions or decimals)
- A and B are *not both* zero

- Examples: Determine whether each equation is linear. Then, convert to standard form (if possible).

1. $y = 4 - 3x$ yes

$y = 4 - 3x$
$+3x \quad +3x$
$\boxed{3x + y = 4}$

3. $\frac{1}{3}y = -1$ yes

$3 \cdot \frac{1}{3}y = -1 \cdot 3$
$\boxed{y = -3}$

2. $6x - xy = 4$

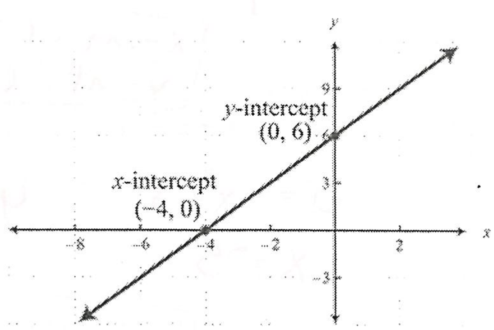
no

4. $y = x^2 - 4$

no

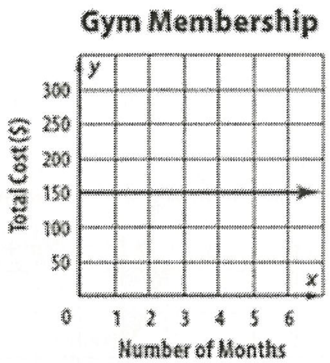
Intercepts

- **X – Intercept**: point at which graph crosses the x-axis (when y=0)
- **Y – Intercept**: point at which graph crosses the y-axis (when x=0)



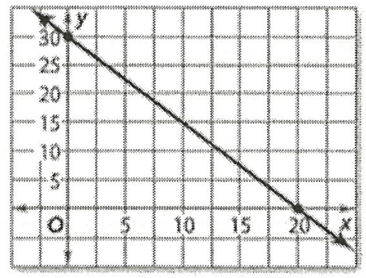
Name ______________________________ Period ________

- Examples: Find the x- and y-intercepts for each graph.



x : none

y : 150
(0,150)



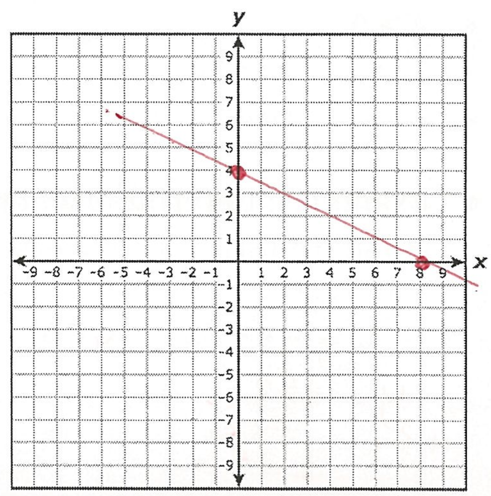
x : 20
(20,0)

y : 30
(0,30)

Graph Using Intercepts – only 2 points are needed to graph a line

- To find the x-intercept, let y=0.
- To find the y-intercept, let x=0.

- Example: Graph $2x + 4y = 16$ by using the x- and y-intercepts.



x : $2x + 4(0) = 16$

$2x = 16$

$x = 8$

y : $2(0) + 4y = 16$

$4y = 16$

$y = 4$

x-int : (8,0)
y-int : (0,4)

- Practice: Find the x- and y-intercepts for each equation. Then, graph each equation.

1. $-x + 2y = 3$

$-(0) + 2y = 3$

$2y = 3$

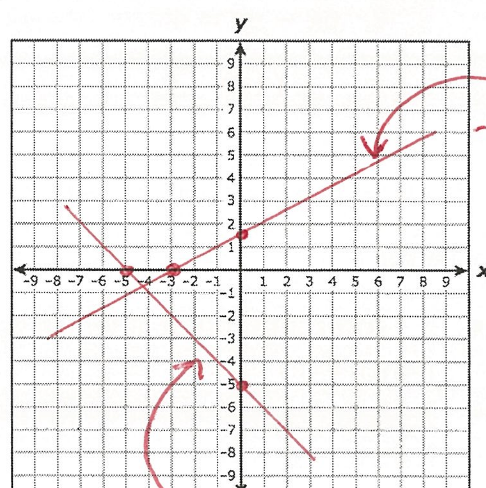
$y = 3/2$

$-x + 2(0) = 3$

$-x = 3$

$x = -3$

x-int : (-3,0)
y-int : (0, 3/2)



$-x+2y=3$

2. $y = -x - 5$

$0 = -x - 5$

$x = -5$

$y = -(0) - 5$

$y = -5$

x-int : (-5,0)
y-int : (0,-5)

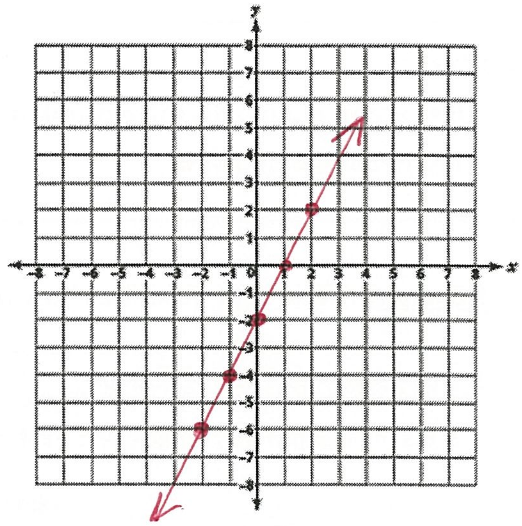
$y=-x-5$

Name Key Period ________

Graph Using a Table

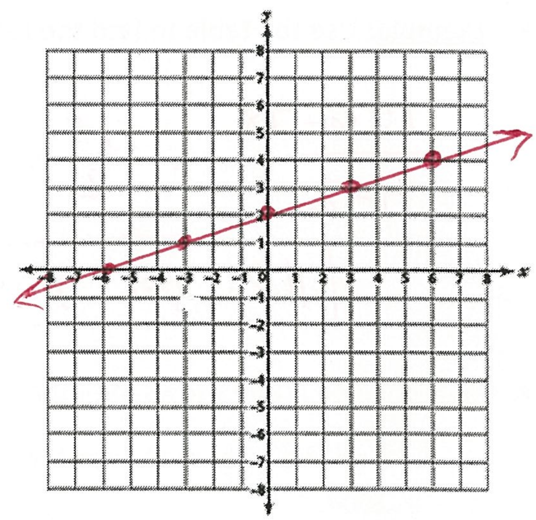
1. $2x - y = 2$ $\Rightarrow$ $y = 2x - 2$

x	$y = 2x - 2$	y	(x, y)
-2	$2(-2) - 2$	-6	$(-2, -6)$
-1	$2(-1) - 2$	-4	$(-1, -4)$
0	$2(0) - 2$	-2	$(0, -2)$
1	$2(1) - 2$	0	$(1, 0)$
2	$2(2) - 2$	2	$(2, 2)$



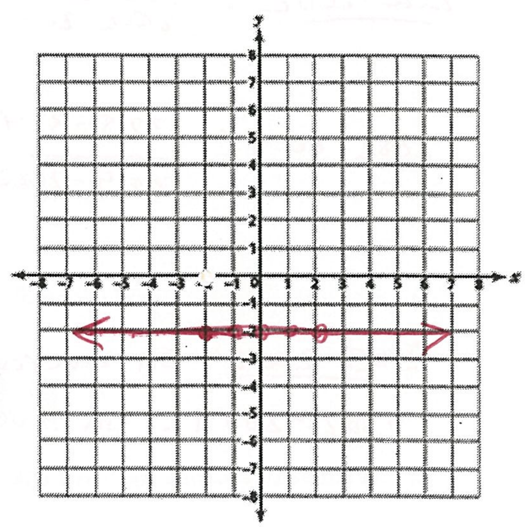
2. $y = \frac{1}{3}x + 2$

x	$y = \frac{1}{3}x + 2$	y	(x, y)
-6	$\frac{1}{3}(-6) + 2$	0	$(-6, 0)$
-3	$\frac{1}{3}(-3) + 2$	1	$(-3, 1)$
0	$\frac{1}{3}(0) + 2$	2	$(0, 2)$
3	$\frac{1}{3}(3) + 2$	3	$(3, 3)$
6	$\frac{1}{3}(6) + 2$	4	$(6, 4)$



3. $y = -2$

x	$y = -2$	y	(x, y)
-2	-2	-2	$(-2, -2)$
-1	-2	-2	$(-1, -2)$
0	-2	-2	$(0, -2)$
1	-2	-2	$(1, -2)$
2	-2	-2	$(2, -2)$



Name ________________________ Period _______

Chapter 3.3 Notes (Rate of Change and Slope)

Objectives:

- Use rate of change to solve problems.
- Find the slope of a line.

Rate of Change – ratio that describes how one quantity changes with respect to another

KeyConcept Rate of Change

If x is the independent variable and y is the dependent variable, then

$$\text{rate of change} = \frac{\text{change in } y}{\text{change in } x}.$$

- Example: Use the table to find the rate of change. Then, explain its meaning.

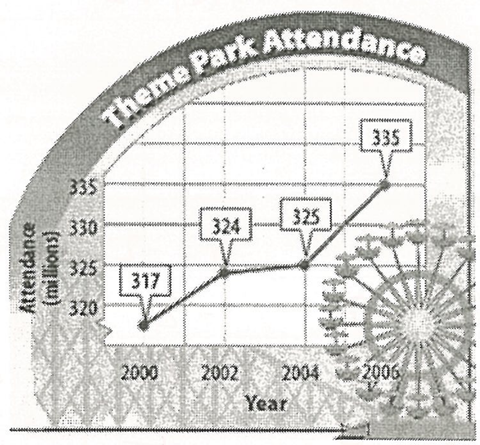
$$\frac{156-78}{4-2} = \frac{78}{2} = 39$$

$\boxed{\$39 \text{ per game}}$

Number of Computer Games	Total Cost ($)
x	y
2	78
4	156
6	234

- Practice: The graph shows the number of people who visited U.S. theme parks in recent years.

a. Find the rates of change for 2000-2002 and 2002-2004.



2000-2002: $\frac{324-317}{2002-2000} = \frac{7}{2} = 3.5$

2002-2004: $\frac{325-324}{2004-2002} = \frac{1}{2}$

b. Explain the meaning of each rate of change.

2000-2002: on average, 3.5 million more people per year

2002-2004: on average, 0.5 million more people per year

c. Without calculating, find the 2-year period that has the least rate of change.

2002 - 2004

Name ____________________________________ Period _______

Remember: All linear functions have a constant rate of change!!

- The change in x-values must be constant.
- The change in y-values must be constant.

- Examples: Determine whether each function is linear. Explain.

a)

x	y
1	-6
4	-8
7	-10
10	-12

-2, -2, -2

Linear

b)

x	y
-2	4
-1	1
0	-1
1	-4

-3, -2, -3

NOT Linear

c)

x	y
0	2
1	4
2	8
3	16

+2, +4, +8

NOT Linear

Slope – number that describes the *steepness* and *direction* of a line

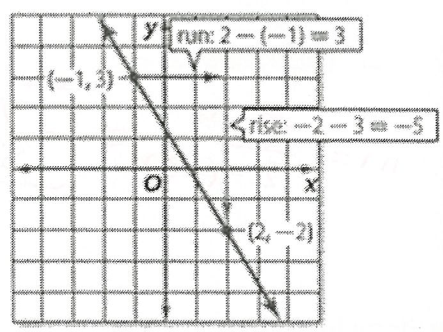
- Slope is usually denoted by m.
- Slope can be found using "*rise over run*."

Slope Formula: $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

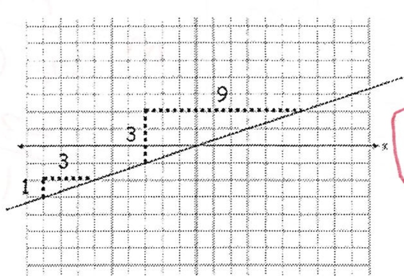
The graph shows a line that passes through (−1, 3) and (2, −2).

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y\text{-coordinates}}{\text{change in } x\text{-coordinates}} = \frac{-2-3}{2-(-1)} \text{ or } -\frac{5}{3}$$

So, the slope of the line is $-\frac{5}{3}$.



[Example 1] Find Slope Using a Graph



$\boxed{m = \frac{1}{3}}$

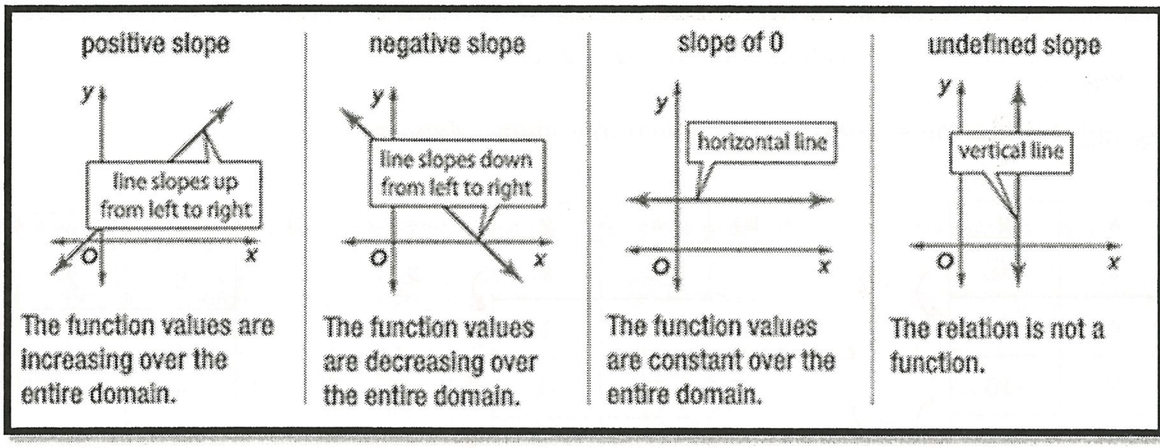
[Example 2] Find Slope Using the Slope Formula

Find the slope between the points (-9,-3) and (6,2).

$m = \dfrac{2-(-3)}{6-(-9)} = \dfrac{5}{15} = \boxed{\dfrac{1}{3}}$

Name ________________________________ Period _______

4 Types of Slope:



"HOY – VUX"

HOY – *Horizontal Lines* have *Zero Slope* and cross the *y-axis*

VUX – *Vertical Lines* have *Undefined Slope* and cross the *x-axis*

- Examples: Find the slope of the line that passes through each pair of points.

1. (-2, 0) and (1, 5)

$m = \frac{5-0}{1-(-2)} = \boxed{\frac{5}{3}}$

3. (-3, -1) and (2, -1)

$m = \frac{-1-(-1)}{2-(-3)} = \frac{0}{5} = \boxed{0}$

2. (-3, 4) and (2, -3)

$m = \frac{-3-4}{2-(-3)} = \boxed{-\frac{7}{5}}$

4. (-2, 4) and (-2, -3)

$m = \frac{-3-4}{-2-(-2)} = \frac{-7}{0}$

$= \boxed{\text{Undefined}}$

Finding Slope in Tables:

- Examples: Determine the slope of each linear equation. (*Hint: Find the rate of change.*)

a)

x	*y*
0	5
1	7
2	9
3	11

$m = \frac{7-5}{1-0}$

$= \boxed{2}$

b)

x	*y*
-7	10
-6	7
-5	4
-4	1

$m = \frac{7-10}{-6-(-7)}$

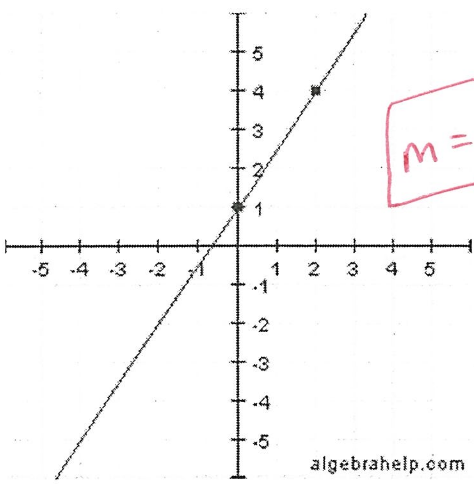
$= \frac{-3}{1} = \boxed{-3}$

Name ____________________________ Period ________

Finding Slope in Graphs:

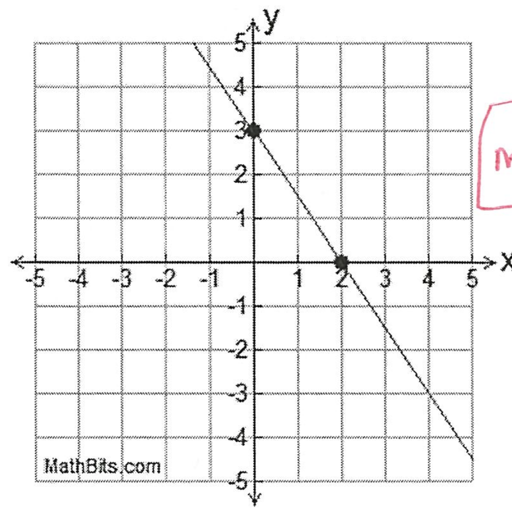
- Examples: Determine the slope of each linear equation. (*Do not use the slope formula.*)

a)



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

b)



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

Application of the Slope Formula: Find Coordinates Given the Slope

- Example: Find the value of r so that the line through (1, 4) and $(-5, r)$ has a slope of $\frac{1}{3}$.

$\frac{1}{3} = \frac{r-4}{-5-1} \Rightarrow \frac{1}{3} = \frac{r-4}{-6}$

$-6(1) = 3(r-4)$

$-6 = 3r - 12$

$6 = 3r$

$\boxed{2 = r}$

- Practice: Find the value of *r* so the line that passes through each pair of points has the given slope.

1. (-2, 6) and (*r*, -4) ; *m* = -5

$-5 = \frac{-4-6}{r-(-2)}$

$-5 = \frac{-10}{r+2}$

$-5(r+2) = -10$

$-5r - 10 = -10$

$-5r = 0$

$\boxed{r = 0}$

2. (*r*, 6) and (4, 8) ; *m* = 2

$2 = \frac{8-6}{4-r}$

$2 = \frac{2}{4-r}$

$2(4-r) = 2$

$8 - 2r = 2$

$-2r = -6 \Rightarrow \boxed{r = 3}$