Student Name:	Contact Person Name:
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Date: ______________________________	Phone Number: ____________________

Texas Assessment of Knowledge and Skills

Exit Level Math Review

Lesson 8
Linear Functions

TAKS Objective 3 – Demonstrate an understanding of linear functions

Lesson Objectives:

- Given the graph of a linear function, find the slope and y-intercept

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The Texas Assessment of Knowledge and Skills (TAKS) exit level exam covers ten learning objectives. These lessons are designed to teach math concepts specific to each objective as well as strategies to consider when approaching typical TAKS questions. To successfully complete the TAKS exit level exam, the student should be able to:

1) **Describe functional relationships in a variety of ways.**
2) **Demonstrate an understanding of the properties and attributes of functions.**
3) **Demonstrate an understanding of linear functions.**
4) **Formulate and use linear equations and inequalities.**
5) **Demonstrate an understanding of quadratic equations and other nonlinear functions.**
6) **Demonstrate an understanding of geometric relationships and spatial reasoning.**
7) **Demonstrate an understanding of two- and three-dimensional representations of geometric relationships and shapes.**
8) **Demonstrate an understanding of concepts and uses of measurement and similarity.**
9) **Demonstrate an understanding of percents, proportional relationships, probability, and statistics in application problems.**
10) **Demonstrate an understanding of the mathematical processes and tools used in problem solving.**

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TAKS Mathematics Chart

Length

Metric	Customary
1 kilometer = 1000 meters	1 mile = 1760 yards
1 meter = 100 centimeters	1 mile = 5280 feet
1 centimeter = 10 millimeters	1 yard = 3 feet
	1 foot = 12 inches

Capacity and Volume

Metric	Customary
1 liter = 1000 milliliters	1 gallon = 4 quarts
	1 gallon = 128 fluid ounces
	1 quart = 2 pints
	1 pint = 2 cups
	1 cup = 8 fluid ounces

Mass and Weight

Metric	Customary
1 kilogram = 1000 grams	1 ton = 2000 pounds
1 gram = 1000 milligrams	1 pound = 16 ounces

Time

1 year = 365 days

1 year = 12 months

1 year = 52 weeks

1 week = 7 days

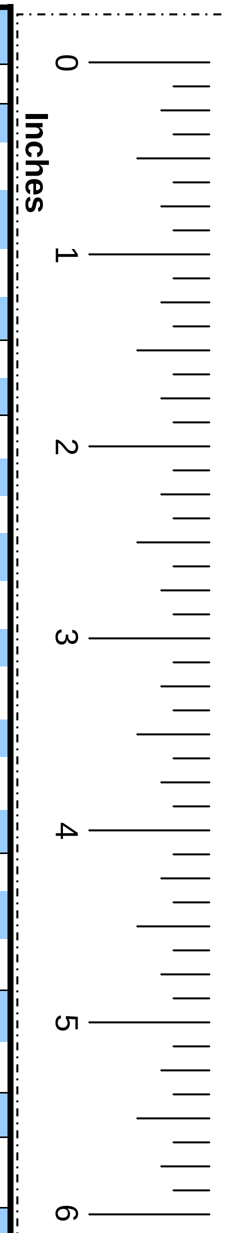
1 day = 24 hours

1 hour = 60 minutes

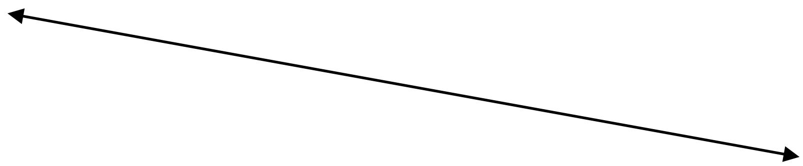
1 minute = 60 seconds

TAKS Mathematics Chart

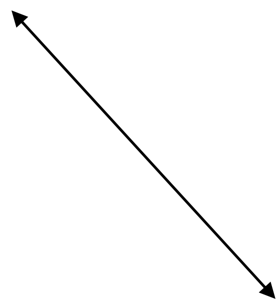
Perimeter	Rectangle	$P = 2l + 2w$ or $P = 2(l + w)$
Circumference	Circle	$C = 2\pi r$ or $C = \pi d$
Area	Rectangle	$A = lw$ or $A = bh$
	Triangle	$A = \frac{1}{2}bh$ or $A = \frac{bh}{2}$
	Trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$ or $A = \frac{(b_1 + b_2)h}{2}$
	Regular polygon	$A = \frac{1}{2}aP$
	Circle	$A = \pi r^2$
P represents the perimeter of the base of a three-dimensional figure.		
B represents the area of the base of a three-dimensional figure.		
Surface Area	Cube (total)	$S = 6s^2$
	Prism (lateral)	$S = Ph$
	Prism (total)	$S = Ph + 2B$
	Pyramid (lateral)	$S = \frac{1}{2}Pl$
	Pyramid (total)	$S = \frac{1}{2}Pl + B$
	Cylinder (lateral)	$S = 2\pi rh$
	Cylinder (total)	$S = 2\pi rh + 2\pi r^2$ or $S = 2\pi r(h + r)$
	Cone (lateral)	$S = \pi rl$
	Cone (total)	$S = \pi rl + \pi r^2$ or $S = \pi r(l + r)$
	Sphere	$S = 4\pi r^2$
Volume	Prism or Cylinder	$V = Bh$
	Pyramid or Cone	$V = \frac{1}{3}Bh$
	Sphere	$V = \frac{4}{3}\pi r^3$
Special Right	30°, 60°, 90°	$x, x\sqrt{3}, 2x$
Triangles	45°, 45°, 90°	$x, x, x\sqrt{2}$
Pythagorean Theorem		$a^2 + b^2 = c^2$
Distance Formula		$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Slope of a Line		$m = \frac{y_2 - y_1}{x_2 - x_1}$
Midpoint Formula		$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
Quadratic Formula		$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Slope-Intercept Form of an Equation		$y = mx + b$
Point-Slope Form of an Equation		$y - y_1 = m(x - x_1)$
Standard Form of an Equation		$Ax + By = C$
Simple Interest Formula		$I = prt$



Imagine you are riding your bike down a hill. Wouldn't your experience biking down a hill such as this:



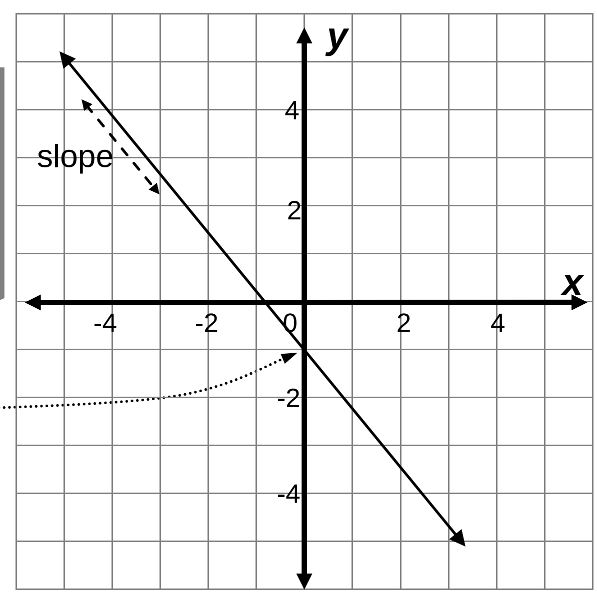
be different from biking down one like this?



These lines have different levels of steepness, called **slope**. In math, there is a formal way of studying linear functions using their steepness and placement.

In general, every linear function (non-vertical line graph) can be distinguished by its **slope** and by the place where it crosses the *y*-axis, called the ***y*-intercept**.

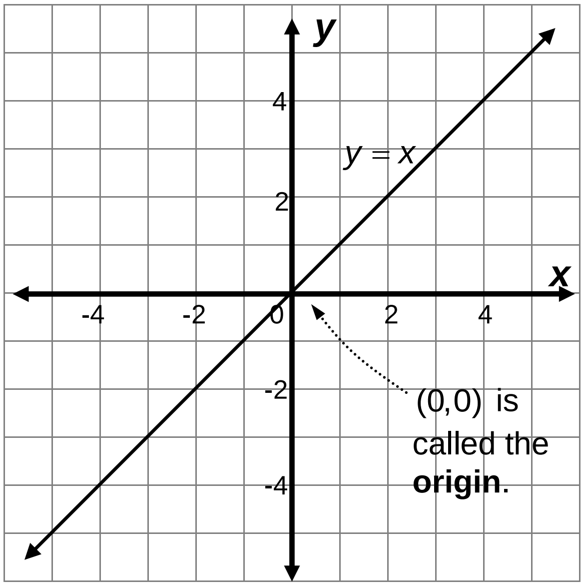
The steepness of a line is called **slope**. The slope of a line denotes its **rate of change**, or how quickly the line moves up or down.



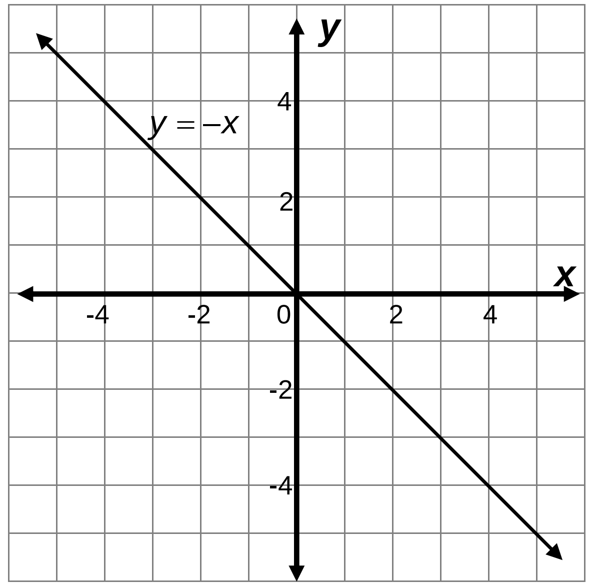
The ***y*-intercept** of a function is where it crosses the *y*-axis.

First, we will investigate slopes of linear functions.

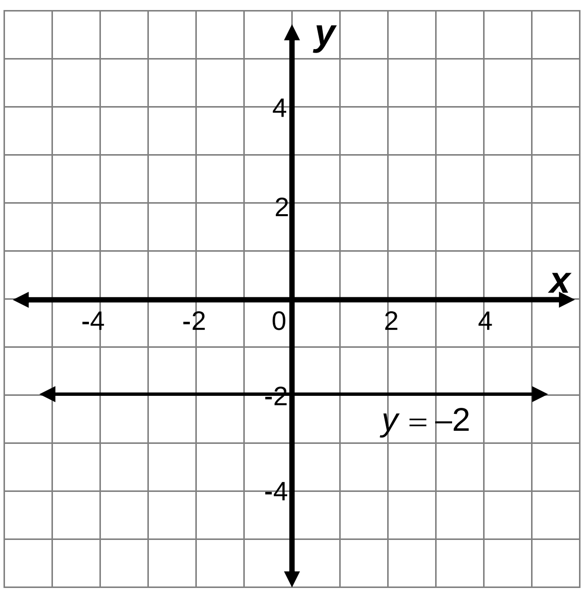
Lines that rise from left to right have a positive slope.



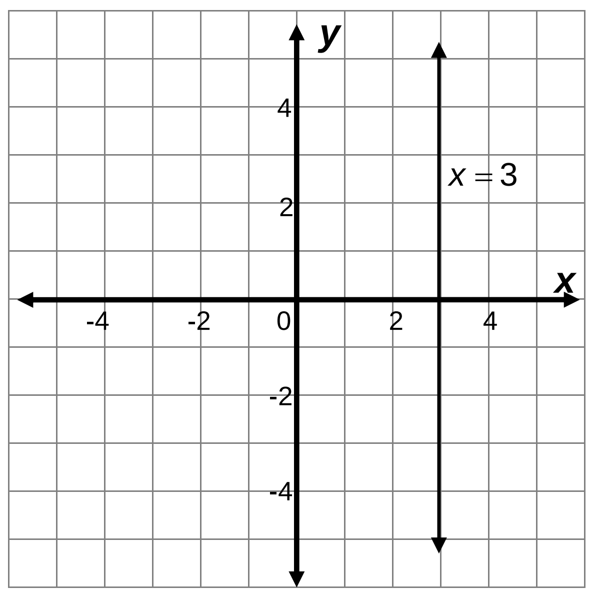
Lines that go down from left to right have a negative slope.



Horizontal lines have zero slope.



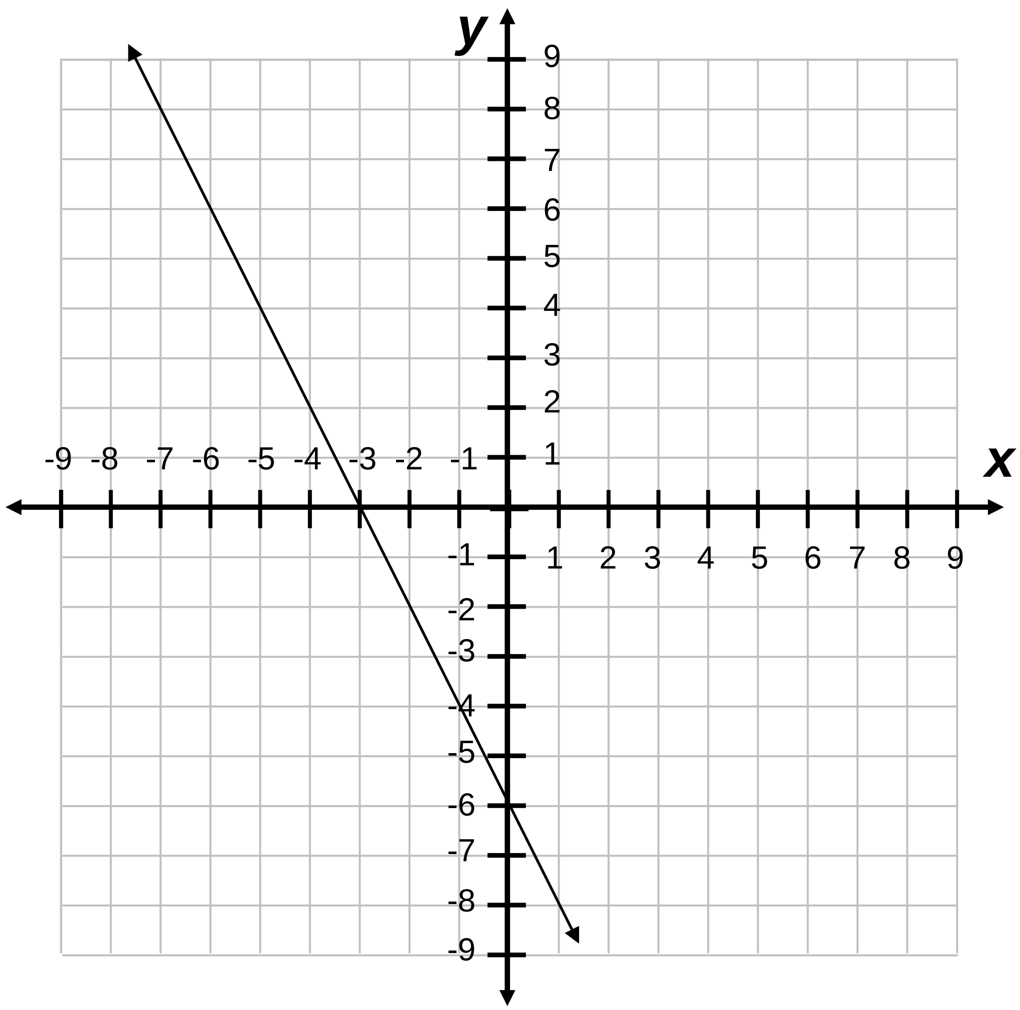
Vertical lines have an undefined slope. Vertical lines are not functions. (Why?)



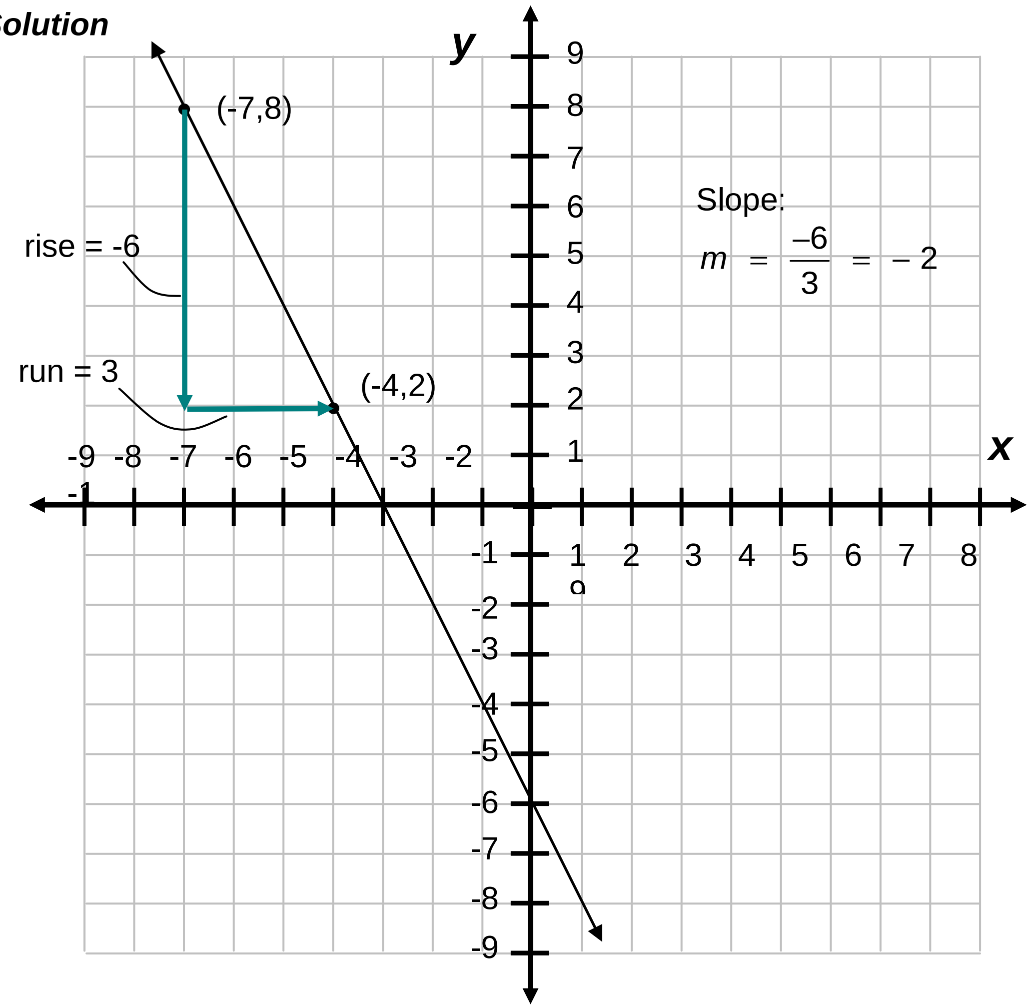
The slope of a line graph is the ratio of rise (change in *y*) over run (change in *x*).

Example

Find the slope of the line.



Solution



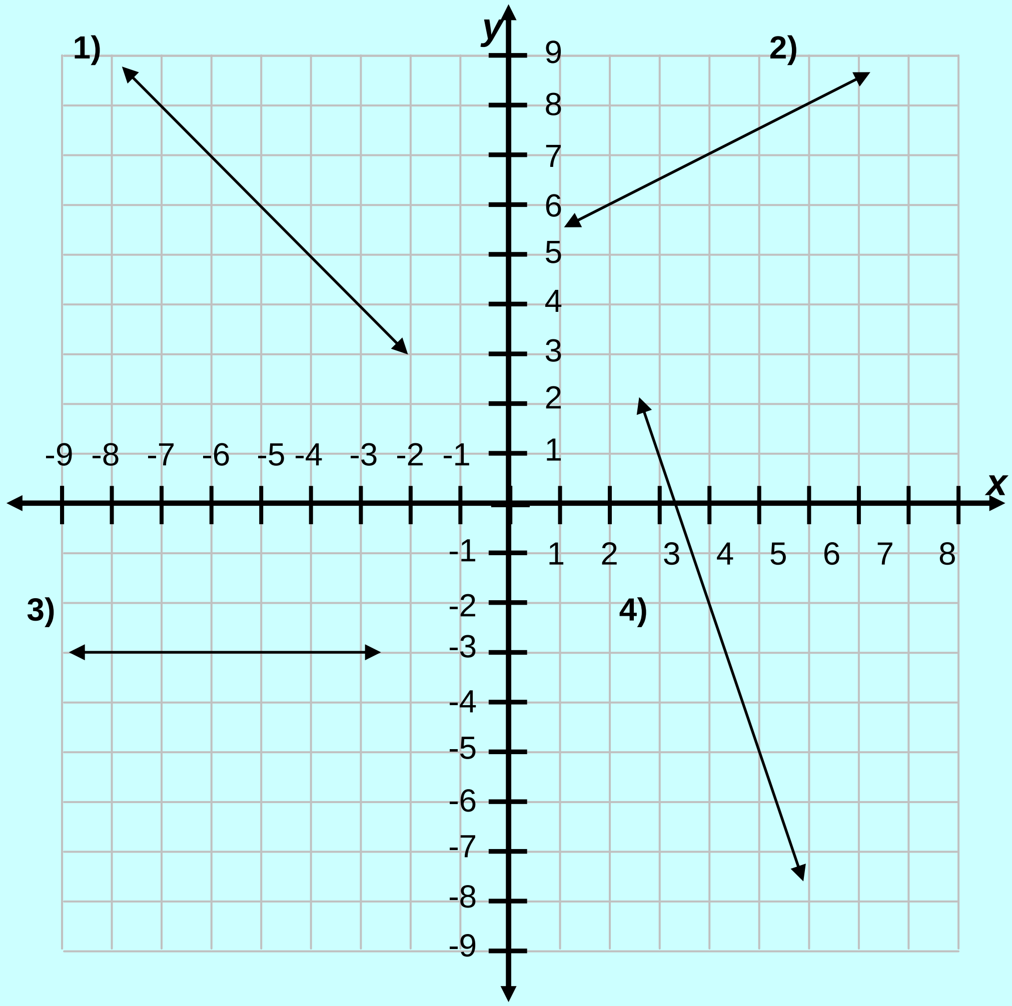
This line has a negative slope because the line slants downward from left to right. We picked two points on the line: (-7,8) and (-4,2).

Find the rise by starting with the leftmost point and counting down to the second point. In this case, we count down 6 units. Show this with a negative sign. The rise is -6.

Next, find the run by counting to the right from the first point to the second. Because we count to the right 3 units, the run is +3.

Using the slope formula, $\text{slope} = \frac{\text{rise}}{\text{run}}$, we see that the $\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{-6}{3}$. This is a fraction that can be reduced. Finally, $\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{-6}{3} = -2$.

Find the slope of each line by picking two points on the line, and using the formula slope $= \frac{\text{rise}}{\text{run}}$.



1)

2)

3)

4)

Slope Formula

For any two points (x_1, y_1) and (x_2, y_2), the slope, *m*, of the line that passes through them is:

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

From now on, use *m* to refer to slope.

Example

Find the slope of the line that passes through the points $(2,5)$ and $(4,-1)$.

Solution

Use the slope formula. Note how the coordinates in the question correspond to those in the formula.

(x_1, y_1)	(x_2, y_2)
$(2, 5)$	$(4, -1)$

Substitute into the formula, and simplify the top and bottom of the fraction.

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

$$m = \frac{-1 - 5}{4 - 2}$$

$$m = \frac{-6}{2} = -3$$

If possible, reduce the fraction.

FACT

This formula also works:

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

$$m = \frac{5 - -1}{2 - 4}$$

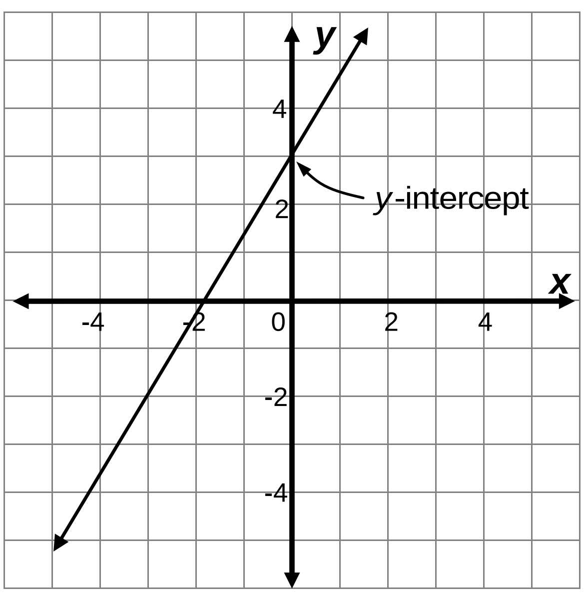
$$m = \frac{6}{-2} = -3$$

A slope of $m = -3$ tells you that for every unit traveled right, the linear function travels down 3 units.

5) What is the slope of the line passing through the points $(2,6)$ and $(4,-7)$?

6) Find the slope of the line that passes through the points $(-3,1)$ and $(5,1)$

Next, we will take a closer look at the ***y*-intercept** of a line.



At left, the *y*-intercept is the point $(0,3)$. However, it is enough to say that the *y*-intercept is 3.

FACT

The x-coordinate is always zero at the y-intercept.

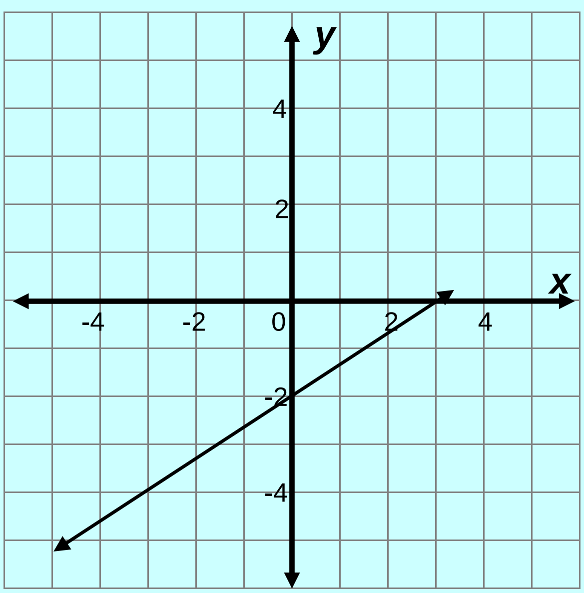
The fact that *x* is zero at the *y*-intercept is crucial in solving the next example.

Example

Find the *y*-intercept of the linear function $y = -\frac{7}{4}x - 8$.

> ***Solution***
>
> Use the fact that *x* is zero at the *y*-intercept.
>
> $y = -\frac{7}{4}(0) - 8$
>
> $y = 0 - 8$
>
> $y = -8$
>
> The *y*-intercept is -8.

7) Which is the *y*-intercept of the following graph?



A $\frac{2}{3}$

B (–2,0)

C –2

D $\frac{3}{2}$

8) Find the *y*-intercept of the linear function $y = 3x + 4$.

Review

Know these concepts:

1. **Slope** of a line
    a. The **rate of change** of a line
    b. $m = \dfrac{\text{change in } y}{\text{change in } x} = \dfrac{\text{rise}}{\text{run}} = \dfrac{y_2 - y_1}{x_2 - x_1}$
2. ***y*-intercept** of a line
    a. where a line crosses the *y*-axis
    b. *x* is always **zero** at the *y*-intercept.
3. Every line can be uniquely identified by its slope and *y*-intercept.

Practice Problems
Lesson 8

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1) slope =

y-intercept =

2) slope =

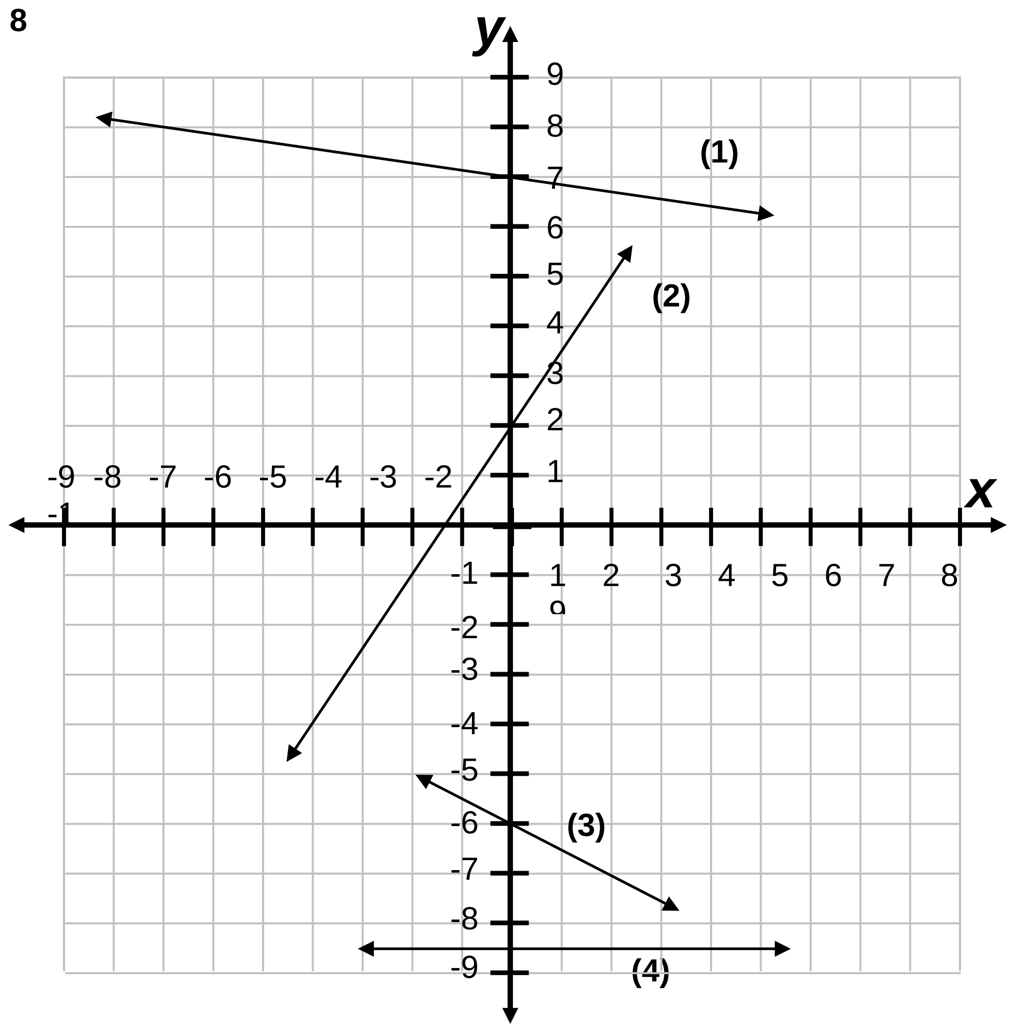
y-intercept =

3) slope =

y-intercept =

4) slope =

y-intercept =



5) Find the slope of the line passing through the points $(1,3)$ and $(2,6)$.

6) Which best represents the slope of the line that passes through $(-4,3)$ and the origin?

A $\frac{3}{4}$

B $-\frac{3}{4}$

C $\frac{4}{3}$

D $-\frac{4}{3}$

7) Find the slope of the line passing through the points $(-6,-1)$ and $(-2,7)$.

8) What is the *y*-intercept of the linear function $y = 17x + 14$?

9) What is the *y*-intercept of the linear function $y = -45 - 12x$?

ANSWERS TO TRY IT

1) slope $= -1$ **2)** slope $= \frac{1}{2}$ **3)** slope $= 0$

4) slope $= -3$

5) $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-7-6}{4-2} = -\frac{13}{2}$

6) $m = \frac{1-1}{5--3} = \frac{0}{8} = 0$ **7)** **C** **8)** 4

End of Lesson 8