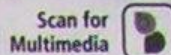


EXAMPLE 1

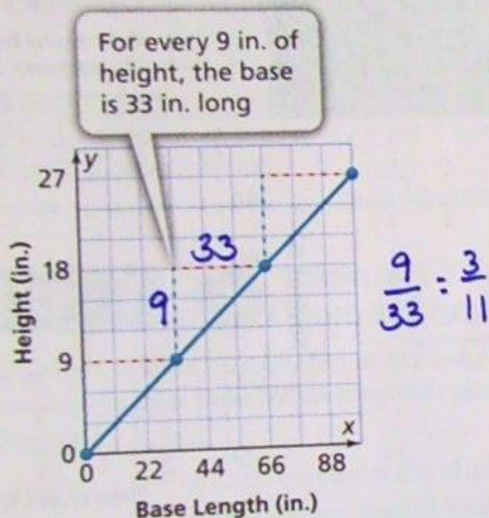
Write a Function from a Graph



A plan for a skateboard ramp shows that the plywood for the triangular sides of the ramp should be cut such that for every 9 inches of height, the triangle should have a base that is 33 inches long. What is the height of the skateboard ramp shown?



STEP 1 Use a graph to represent the situation and to determine the slope.



STEP 2 Use the slope to write an equation that represents the function shown in the graph. Then use the equation to find the height for a base length of 110 inches.

Height Slope Base length

The equation is $y = \frac{3}{11}x$.

$$y = \frac{3}{11}(110)$$

$$y = 30$$

The height of the ramp is 30 inches.

The slope of the line is the change in height (y) divided by the change in base length (x), which is $\frac{9}{33} = \frac{3}{11}$.

Try It!

$$m = \frac{3}{15} = \frac{1}{5}$$

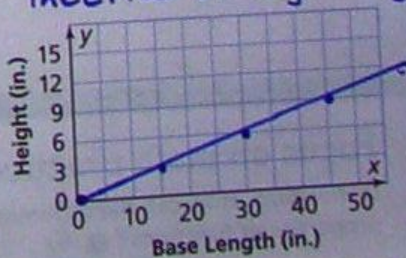
How will the height of the ramp change if the plan shows that for every 3 inches of height, the triangle should have a base that is 15 inches long?

Graph the function. The slope of the function shown in the graph

is $\frac{1}{5}$. The equation of the function is $y = \frac{1}{5}x$. If the base length

is 110 inches, then the height of the ramp will be 22 inches.

The Effect of length on height



Convince Me! Explain why the initial value and the y -intercept are equivalent.

Initial value is y -intercept we when $x = 0$.



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KEY CONCEPT



A function in the form $y = mx + b$ represents a linear relationship between two quantities, x and y .

Slope or constant rate of change

$$y = mx + b$$

y-Intercept or initial value

Do You Understand?

1. **Essential Question** How can you use a function to represent a linear relationship?

$m = \text{slope} = \text{rate of change}$
constant

$b = \text{y-intercept} = \text{starting point}$
(original or initial)
 #

2. **Make Sense and Persevere** Tonya is looking at a graph that shows a line drawn between two points with a slope of -5 . One of the points is smudged and she cannot read it. The points as far as she can tell are $(3, 5)$ and $(x, 10)$. What must the value of x be? Explain. MP.1

3. **Reasoning** What is the initial value of all linear functions that show a proportional relationship? MP.2

$$b = 0$$

Do You Know How?

4. Write a function in the form $y = mx + b$ for the line that contains the points $(-8.3, -5.2)$ and $(6.4, 9.5)$.

5. The data in the table below represent a linear relationship. Fill in the missing data.

x	0	10	20	30	40
y	5	10	15	20	25

Handwritten notes: +10 +10 +10 +10 (above x-axis); +5 +5 +5 +5 (below x-axis)

6. What is an equation that represents the linear function described by the data in Item 5?

$$m = \frac{5}{10} = \frac{1}{2}$$

$$b = 5$$

(where $x=0$)

$$y = mx + b$$

$$y = \frac{1}{2}x + 5$$

Name: _____

Practice & Problem Solving



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- A line passes through the points (4, 19) and (9, 24). Write a linear function in the form $y = mx + b$ for this line.
- What is a linear function in the form $y = mx + b$ for the line passing through (4.5, -4.25) with y-intercept 2.5?
- A car moving at a constant speed passes a timing device at $t = 0$. After 8 seconds, the car has traveled 840 feet. What linear function in the form $y = mx + b$ represents the distance in feet, d , the car has traveled any number of seconds, t , after passing the timing device?
- At time $t = 0$, water begins to drip out of a pipe into an empty bucket. After 56 minutes, 8 inches of water are in the bucket. What linear function in the form $y = mx + b$ represents the amount of water in inches, w , in the bucket after t minutes?

11 The graph of the line represents the cost of renting a kayak. Write a linear function in the form $y = mx + b$ to represent the relationship of the total cost, c , of renting a kayak for t hours.

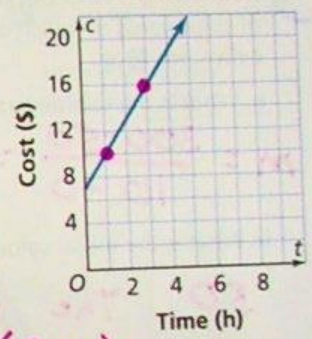
slope (m) = $\frac{10-16}{1-3} = \frac{-6}{-2} = 3$

y-int (b) = 7

$y = 3x + 7$
 $c = 3t + 7$

x	y
0	7
+1	10
+2	16
3	16

(1, 10) (3, 16)



- An online clothing company sells custom sweatshirts. The company charges \$6.50 for each sweatshirt and a flat fee of \$3.99 for shipping.
 - Write a linear function in the form $y = mx + b$ that represents the total cost, y , in dollars, for a single order of x sweatshirts.
 - Describe how the linear function would change if the shipping charge applied to each sweatshirt.

- A store sells packages of comic books with a poster.
 - Model with Math** Write a linear function in the form $y = mx + b$ that represents the cost, y , of a package containing any number of comic books, x .
 - Construct Arguments** Suppose another store sells a similar package, modeled by a linear function with initial value \$7.99. Which store has the better deal? Explain.

