

# Warm Up

9/29

Does this data represent a linear relationship?

-23 If so, can you write the equation?

x	23	25	27	29
y	22	28	34	40

$\frac{\Delta y}{\Delta x} = \frac{6}{2} = 3$

$y = 3x + b$

$-3(23) = -69$

$-69 + 22 = -47$

$y = 3x - 47$

$$y = 3x - 47$$

## How can we check if our equation is right?

Does this data represent a linear relationship?  
If so, can you write the equation?

x	23	25	27	29
y	22	28	34	40

Use one of the many solutions we have in the table and see if the equation you have chosen balances.

$$y = 3x + b$$

$$y = 3x - 11 \quad ?$$

(23, 22)  
should  
work

$$22 \stackrel{?}{=} 3(23) - 11$$

$$22 \stackrel{?}{=} 69 - 11$$

$$22 \neq 58$$

Doesn't balance.

This equation is  
**INCORRECT.**

$$y = 3x - 47 \quad ?$$

(23, 22)

$$22 \stackrel{?}{=} 3(23) - 47$$

$$22 \stackrel{?}{=} 69 - 47$$

$$22 = 22 \quad \checkmark$$

Balances!

This equation is  
**CORRECT!**

## Rounding?

### Quick Review:

2.34

tenths 2.3

ones 2

4.782

hundredths 4.78

tenths 4.8

ones 5

6.248

hundredths 6.25

tenths 6.2

ones 6

8.447

8.447

### Problem 2.3

## Recap

When finding an equation, it may help to calculate values of the dependent variable for some specific values of the independent variable. Then you can look for a pattern in those calculations. You can use the information given in words, tables of data, and graphs.

**A** Use what you know about linear equations to work out models for the Tree Top Fun business. Find an equation for each of the linear functions described below.

1. The standard charge per customer at TTF is \$25. Write an equation that relates the daily income  $I$  to the number  $n$  of customers.
2. Each TTF site has operating costs of \$500 per day. Write an equation that relates daily profit  $P$  to the number  $n$  of customers.
3. One TTF site bought a new rope bridge for \$4,500. TTF will make monthly payments of \$350 until the bill is paid. Write an equation for the unpaid balance  $B$  after  $m$  monthly payments.

$$I = 25n$$

$$P = 25n - 500$$

$$P = 4500 - 350m$$

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Problem 2.3 *continued*

$$\frac{\Delta y}{\Delta x} = \frac{15}{1}$$

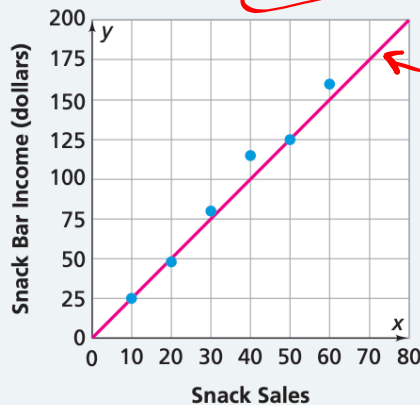
$$\frac{\Delta y}{\Delta x} = \frac{75}{5} = \frac{15}{1}$$

- B** One operator of a Tree Top Fun franchise suggested the group admission fees in the table below.

Number in Group	1	2	3	4	5	10	15	20
Admission (dollars)	75	90	105	120	135	210	285	360

1. Explain how you know the relationship between the admission fee for a group and the number of people in the group is linear.
2. What are the slope and y-intercept of the graph of the data?  $y = 15x + 60$
3. What equation relates admission fee  $A$  to the number  $n$  in the group?

- C** The owners of Tree Top Adventures opened a snack bar at one site. The graph below shows the income from snack sales for six different days. What is the equation of the linear model on the graph?



- D** Suppose you are asked to write an equation of the form  $y = mx + b$  to represent a linear function. What is your strategy for each situation?
1. You are given a description of the function in words.
  2. You are given two or more  $(x, y)$  values or a table of  $(x, y)$  values.
  3. You are given a graph showing points with coordinates.

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Problem 2.3 continued

**E** A state mathematics test asked students to find equations for linear functions. Two students, Dana and Chris, gave the answers below.

1. To find an equation for the line with slope  $-3$  that passes through the point  $(4, 3)$ , Dana wrote the following steps. Is he correct? Explain.

$x \ y$

$$y = -3x + b, \text{ so } 3 = -3(4) + b$$

This means  $b = 15$  and  $y = -3x + 15$ .

$$3 = -3(4) + b$$

$$3 = -12 + b$$

$$+12 \quad +12$$

$$15 = b$$

$(4, 3)$

2. To find an equation for the line that passes through points  $(4, 5)$  and  $(6, 9)$ , Chris wrote the following steps. Is she correct? Explain.

~~$$m = \frac{6-4}{9-5}, \text{ so } y = \frac{1}{2}x + b$$~~

~~This means  $5 = \frac{1}{2}(4) + b, b = 3,$  and  $y = \frac{1}{2}x + 3$ .~~

$$y = -3x + 15$$

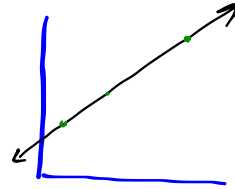
**To write an equation of a line, we need:**

y intercept

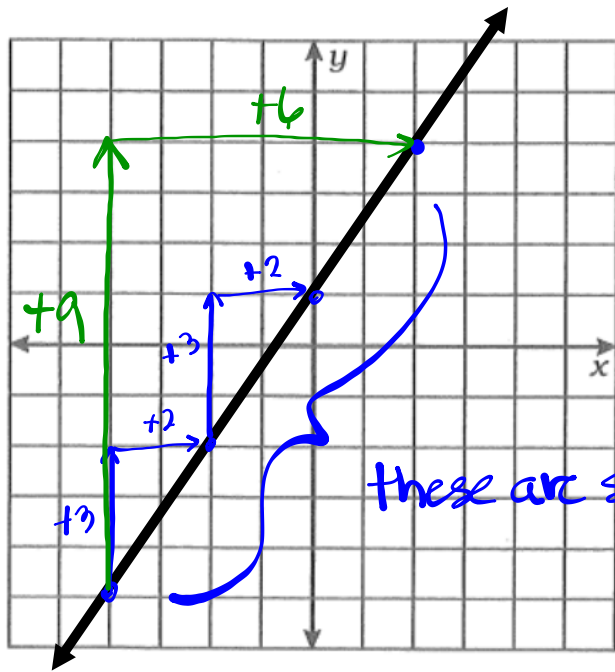
Slope

Things to remember:

- Any 2 points on a line can be used to find the slope.
- If a relationship is linear, the slope is the same between all pairs of points.
- Any point on a line is a **solution** for the equation of the line. *wavy*







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

these are solutions

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

$$\frac{\Delta y}{\Delta x} = \frac{9}{6} = \frac{3}{2}$$

The slope is the same no matter which points you choose!

How do we write the equation of a line if we are just given the slope and one point on the line?

Slope = -1

Line contains the point (-2, 3)

$$y = mx + b$$

$$y = -1x + b$$

$$y = \frac{-1}{1}x + b$$

$$3 = \frac{-1}{1}(-2) + b$$

$$3 = 2 + b$$

$$\begin{array}{r} -2 \quad -2 \\ \hline 1 = b \end{array}$$

2 things I need to write a linear equation



Solution

$$y = -1x + 1$$

$$y = -x + 1$$

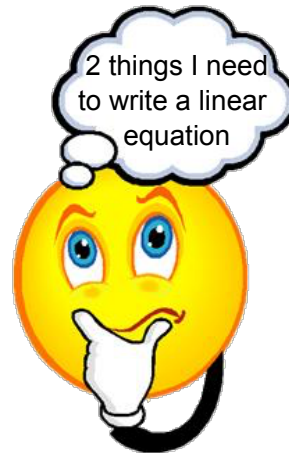
# How do we write the equation of a line if we are just given two points?

Line goes through the points  
(5, 7) and (6, 10)

these are solutions

$$+1 \left\langle \begin{array}{l} 5, 7 \\ 6, 10 \end{array} \right\rangle +3$$

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



$$y = mx + b$$

$$y = 3x + b$$

$$7 = 3(5) + b$$

$$7 = 15 + b$$

$$\begin{array}{r} 7 = 15 + b \\ -15 \quad -15 \\ \hline \end{array}$$

$$-8 = b$$

$$\boxed{y = 3x - 8}$$

Let's look at this again ...

x	23	25	27	29
y	22	28	34	40

Handwritten annotations: Above the x-values (23, 25, 27, 29) are green arrows pointing up with '+2' written above each. Below the x-values (23, 25, 27) are green checkmarks with '+b' written below each. The value 23 in the x-row is circled in blue.

$$\frac{\Delta y}{\Delta x} = \frac{6}{2} = 3$$

$$y = mx + b$$

$$y = 3x + b$$

$$22 = 3(23) + b$$

$$22 = 69 + b$$

$$\begin{array}{r} -69 \quad -69 \\ \hline -47 = b \end{array}$$

$$y = 3x - 47$$

## Writing Equations of Lines

All we need are:

- 
- 

If we are given two points, ( 5, 1 ) and ( 8, 10 )

1. Find the slope between the points:

$\frac{\Delta y}{\Delta x} =$	
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2. Substitute the slope into the Slope-Intercept equation:

$y = \underline{\quad} x + b$
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3. We now need to find the value of "b". We know how to solve for a variable, but what makes this difficult is that we have 3 variables at the moment.

Fortunately we have 2 solutions for this equation and they are the two points on the line! Let's substitute in a point (x, y) and then solve for "b".

Let's try both!

Substitute ( 5 , 1 ) in for x and y:

$$( \quad ) = 3( \quad ) + b$$

Substitute ( 8 , 10 ) in for x and y:

$$( \quad ) = 3( \quad ) + b$$

$b =$
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4. Use your slope and y-intercept to write the equation.