If the x values in a data table increase by different amounts, how can we decide if the relationship is linear or not?

x	y
4	20
7	14
11	6
17	-6

$+3 <$ > -6

$+4 <$ > -8

$+6 <$ > -12

All solutions of the linear eq.

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

$\frac{\Delta y}{\Delta x} = \frac{-8}{4} = -2$

$\frac{\Delta y}{\Delta x} = \frac{-12}{6} = -2$

If linear, write the equation!

Slopes are all the same → LINEAR

$$y = mx + b$$

$$y = -2x + b$$

Choose (4, 20)

$$20 = -2(4) + b$$

$$20 = -8 + b$$

$$\underline{+8 \quad +8}$$

$$28 = b$$

$$\boxed{y = -2x + 28}$$

Is (7, 14) really a solution?

$$y = -2x + 28$$

$$14 \overset{?}{=} -2(7) + 28$$

$$14 \overset{?}{=} -14 + 28$$

$$14 = 14$$

This balances because (7,14) is a SOLUTION of $y = -2x + 28$

Writing Equations of Lines

<u>All we need are</u>:

- slope
- y-intercept

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

1. **Find the slope between the points:**

$+3 < \begin{array}{c} 5,1 \\ 8,10 \end{array} > +9$ $\dfrac{\Delta y}{\Delta x} = \dfrac{9}{3} = 3$ OR $\dfrac{\Delta y}{\Delta x} = \dfrac{10-1}{8-5} = \dfrac{9}{3} = 3$ $\boxed{\dfrac{\Delta y}{\Delta x} = \dfrac{3}{1} = 3}$

2. **Substitute the slope into the Slope-Intercept equation:**

$$\boxed{y = \underline{3}\ x + b}$$

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 <u>solve for "b"</u>**.

Let's try both!

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

$$(\mathbf{1}) = 3(\mathbf{5}) + b$$
$$1 = 15 + b$$
$$\underline{-15 \quad\quad -15}$$
$$-14 = b$$

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

$$(\mathbf{10}) = 3(\mathbf{8}) + b$$
$$10 = 24 + b$$
$$\underline{-24 \quad\quad -24}$$
$$-14 = b$$

It doesn't matter which point you use!

$$\boxed{b = 14}$$

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

$$y = 3x - 14$$

Practice:

slope = 5   passes through (10, 48)

x   y

$$y = mx + b$$

$$y = 5x + b$$

$$48 = 5(10) + b$$

$$48 = 50 + b$$

$$-50 \quad -50$$

$$-2 = b$$

$$\boxed{y = 5x - 2}$$

passes through (6, 0) and (–12, –12)

We need slope and y-intercept

Slope $\quad -18 < \begin{matrix} 6, 0 \\ -12, -12 \end{matrix} > -12$

$\dfrac{\Delta y}{\Delta x} = \dfrac{-12}{-18} = \dfrac{12}{18} = \dfrac{2}{3}$

$y = mx + b$

It doesn't matter which point you pick!

$y = \dfrac{2}{3}x + b$

$-12 = \dfrac{2}{3}\left(\dfrac{-12}{1}\right) + b$

$-12 = -8 + b$

$\underline{+8 \quad +8}$

$-4 = b$

$y = \dfrac{2}{3}x - 4$

$y = \dfrac{2}{3}x + b$

$0 = \dfrac{2}{3}\left(\dfrac{6}{1}\right) + b$

$0 = 4 + b$

$\underline{-4 \quad -4}$

$-4 = b$

$y = \dfrac{2}{3}x - 4$

Writing Equations of Lines Practice

Write the slope-intercept form of the equation of the line through the given point with the given slope.

1) through: $(3, 2)$, slope $= -1$

2) through: $(-1, 0)$, slope $= 2$

3) through: $(-5, 4)$, slope $= -\dfrac{8}{5}$

4) through: $(3, -1)$, slope $= -2$

Write the slope-intercept form of the equation of the line through the given points.

5) through: $(-2, 5)$ and $(-1, -4)$

6) through: $(0, -5)$ and $(-3, -4)$

7) through: $(0, 0)$ and $(3, -4)$

8) through: $(2, -3)$ and $(0, 2)$

Homework

Finish classwork