Writing Equations of Lines Given Two Points

Writing Equations Using Slope Intercept Form: $y = mx + b$

1. Calculate the slope using the slope formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$
2. Write the formula: $y = mx + b$.
3. Substitute the value of the slope in for m and the value of one of the points in for x and y.
4. Solve the equation for b.
5. Substitute the value of m and the newly founded b into $y = mx + b$.

Ex 1: Write the equation of a line given points (15, -13) and (5, 27). x_1, y_1 x_2, y_2

m = -4 b = 47

1.) $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{27 - (-13)}{5 - 15} = \frac{40}{-10} = -4$

5.) Equation: $y = -4x + 47$

2.) $y = mx + b$ $m = -4$ $(5, 27)$

3.) $27 = -4(5) + b$

4.) $27 = -20 + b$

$+20 \quad +20$

$47 = b$

Ex 2: Write the equation of a line given points (6, 19) and (0, -35). x_1, y_1 x_2, y_2

m = 9 b = -35

1.) $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-35 - 19}{0 - 6} = \frac{-54}{-6} = 9$

5.) Equation: $y = 9x - 35$

2.) $y = mx + b$ $m = 9$ $(6, 19)$

3.) $19 = 9(6) + b$

4.) $19 = 54 + b$

$-54 \quad -54$

$-35 = b$

Ex 3: Write the equation of a line given points (1, -4) and (3, 2). x_1, y_1 x_2, y_2

m = 3 b = -7

1.) $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - (-4)}{3 - 1} = \frac{6}{2} = 3$

5.) Equation: $y = 3x - 7$

2.) $y = mx + b$ $m = 3$ $(3, 2)$

3.) $2 = 3(3) + b$

4.) $2 = 9 + b$

$-9 \quad -9$

$-7 = b$

Applications of Writing Equations Given Two Points

*When a word problem gives **two relationships at different points in time**, they are giving you two points. You must find the slope and y-intercept to write an equation.*

Example 1: The math department sponsors Math Family Fun Night every year. In the first year, there were 35 participants. In the third year, there were 57 participants. Write an equation that can be used to predict the amount of participants, y, for any given year, x (We are going to assume the relationship is linear). Based on your equation, how many participated are predicted for the 6th year?

Independent Quantity (x): year

Depending Quantity (y): amount of participants

Slope (m): ? = 11

Y-intercept (b): ? = 24

Point(s) (x,y): (x_1, y_1) (x_2, y_2) (1, 35) (3, 57)

Equation (y = mx + b): ? $y = 11x + 24$

* plug in 6 for x:

$y = 11(6) + 24$

$y = 66 + 24$

$y = 90$ participants

1.) $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{57 - 35}{3 - 1}$

$= \frac{22}{2} = 11$

2.) $y = mx + b$

3.) $35 = 11(1) + b$

4.) $35 = 11 + b$

$-11 \quad -11$

$24 = b$

6.) $y = 11x + 24$

Example 2: Biologists have found that the number of chirps some crickets make per minute is related to temperature. The relationship is very close to being linear. When crickets chirp 124 times a minute, it is about 68 degrees. When they chirp 172 times a minute, it is about 80 degrees. Find an equation for the line that models this situation. How warm is it when the crickets are chirping 150 times a minute?

Independent Quantity (x): minutes

Depending Quantity (y): temperature (degrees)

Slope (m): $? = \frac{1}{4}$

Y-intercept (b): ?

Point(s) (x,y): (x_1, y_1) (x_2, y_2) (124, 68) (172, 80)

Equation (y = mx + b): ? $y = \frac{1}{4}x + 37$

* plug in 150 for x:

$y = \frac{1}{4}(150) + 37$

$y = 37.5 + 37$

$y = 74.5$ degrees

1.) $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{80 - 68}{172 - 124}$

$= \frac{12}{48} = \frac{1}{4}$

2.) $y = mx + b$

3.) $68 = \left(\frac{1}{4}\right)(124) + b$

4.) $68 = 31 + b$

$-31 \quad -31$

$37 = b$

5.) $y = \frac{1}{4}x + 37$