Math 1111: Linear Functions and Slope

Objectives:

1. Calculate a line’s slope

2. Write the point-slope form of a line

3. Given an equation, write and graph the slope-intercept of a line

4. Graph horizontal or vertical lines

5. Use intercepts to graph a line

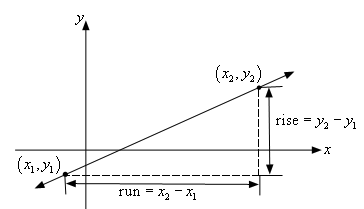
6. Model data with linear functions and make predictions

A linear equation, Ax + By = C graphs a straight line. Every point that is on the line is a solution of the equation and every solution of the equation is a point on the line.

**Objective 1:** Calculate a line’s slope.

The slope of a line is known as the “steepness” of the line. To find the slope of a line, we use the following formula:

m = , where x2 – x1 ≠ 0



When a line falls from the left to the right side, it has a negative slope. When a line rises from the left to the right side, it has a positive slope.

Example #1: Find the slope of the line passing through each pair of points.

A. (3, -2) and (8, 1)

B. (2, 3) and (0, 4)

C. (2, 6) and (-3, 6)

**Objective 2:** Write the point-slope form of a line.

When we are given two points or a slope and a point, we can find the equation of the line by using the point-slope formula. When given two points, after we find the slope we can disregard one of the points. It does not matter which point you disregard because the answer will be the same for either point chosen.

Point-Slope Formula: y – y1 = m(x – x1)

Example #2: Write the equation of a line using the point-slope formula. Solve the equation for y.

A. (8, -2) and (4, 6)

B. m = ½, (5, -3)

**Objective 3:** Write and graph the slope-intercept of a line.

One way that we can graph a line is using the slope-intercept form. When you are given an equation, you will want to solve for y before you can determine the slope (b) and y-intercept (b).

Slope-Intercept Formula: y = mx + b

where m is the slope and b is the y-intercept.

To graph a line that is in the slope-intercept form,

1. Plot the y-intercept (0, b).

2. Use the m, determine the rise and the run.

3. Start at the y-intercept, count out the rise and run to mark the second point.

4. Connect the two points with a straight line.

Example #3: Identify the slope and y-intercept. Then graph the line.

A. – 6x + 2y + 2 = 0

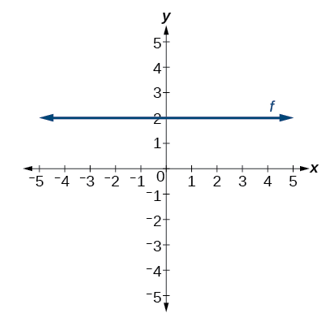


B. 4x + 3y – 6 = 0

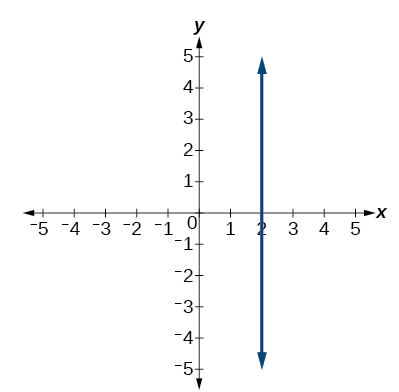


**Objective 4:** Graph horizontal and vertical lines.

There are two special cases of lines on a graph. They are the horizontal and vertical lines.

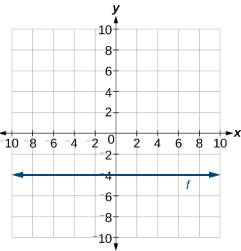
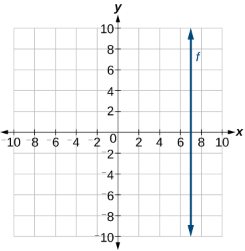


A horizontal line has a constant output value and the slope is 0. The equation of this line is *f(x)* = b. The graph below represents the graph *f(x)* = 2. Notice that for every x-value, the y value is 2.



A vertical line has a constant input value and the slope is undefined (the denominator is zero). The equation of this line is *x* = a. The graph below represents the graph *x* = 2. Notice that for every y-value, the x value is 2.

Example #4: Write the equation of the lines.



A. B.

Graph the vertical or horizontal lines.

C. 2x + 4 = 0 D. 3y + 2 = 5





**Objective 5:** Use intercepts to graph a line.

The intercepts of a graph are points at which the graph crosses the axes. The x-intercept is the point at which the graph crosses the x-axis. At this point, the y-coordinate is zero. The y-intercept is the point at which the graph crosses the y-axis. At this point, the x-coordinate is zero.

To the find the intercepts:

1. Find the *x*-intercept by setting *y* = 0 and solving for *x*.

2. Find the *y*-intercept by setting *x* = 0 and solving for *y*.

Example #5: Find the *x* and *y*-intercepts and graph the lines.

A. y = -3x - 4



B. 2x + 4y = 12



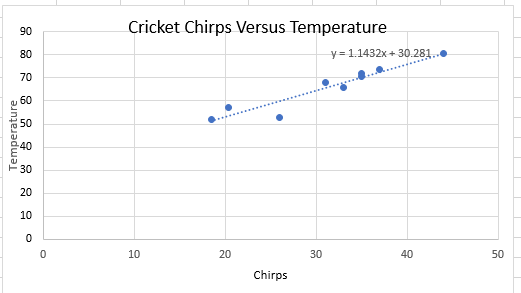
**Objective 6:** Model data with linear functions and make predictions

Linear functions can be useful for modeling data that may fall on a line or close to a line. Although the data may not fall directly on the line, we can draw some conclusions based on the data and graph.

The data below shows the number of cricket chirps in 15 seconds, for several different air temperatures, in degrees (Fahrenheit).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Chirps | 44 | 35 | 20.4 | 33 | 31 | 35 | 18.5 | 37 | 26 |
| Temperature | 80.5 | 70.5 | 57 | 66 | 68 | 72 | 52 | 73.5 | 53 |

Notice that the data is not on the line but we can make some conclusions.



Can we calculate the amount of chirps if the temperature reaches 77°F? The equation has been given as y = 1.1432x + 30.281. Since x represents the chirps, we can solve for y.

70 = 1.1432x + 30.281

46.719 = 1.1432x

40.1 = x

Therefore, when the temperature reaches 77°F, we can expect a cricket to chirp 40.1 chirps per 15 seconds.

Example #6: Gasoline consumption in the US has been steadily increasing. Consumption data from 1994 to 2004 is shown below. Find the model for the data and then use the model to predict the consumption in 2008. The consumption is in billions of gallons. (Use 1994 as the first point and 2004 as the second point to write the equation of the line.)

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Yr. | ‘94 | ‘95 | ‘96 | ‘97 | ‘98 | ‘99 | ‘00 | ‘01 | ‘02 | ‘03 | ‘04 |
| Cons. | 113 | 116 | 118 | 119 | 123 | 125 | 126 | 128 | 131 | 133 | 136 |

http://www.bts.gov/publications/national\_transportation\_statistics/2005/html/table\_04\_10.html

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Dawlins, P.T. (2018). *Paul’s online notes* [Graphing and Functions - Lines]. Retrieved from http://tutorial.math.lamar.edu/