



Student Instruction Sheet: Unit 2, Lesson 2

Equations of Lines, Part 2

Suggested Time: 50 minutes

What's important in this lesson:

In this lesson, you will learn how to write equations of lines, given certain information (i.e., given the slope and y-intercept, two points on a line, the slope, and a point on the line).

Complete the following steps:

1. Read through the lesson portion of the package on your own.
2. Complete the exercises.
3. Check your answers with the Answer Key that your teacher has.
4. Seek assistance from the teacher as required.
5. Complete the Assessment and Evaluation and hand it in. Be sure to ask the teacher for assistance if you are having difficulty.

Hand in the following:

1. Student Handout
2. Assessment and Evaluation

Questions for the teacher:



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Vocabulary

The **slope** of a line describes how steep the line actually is. Remember, we can find the **slope** by writing a fraction where the rise is over the run. Rise is how high the line goes, or the difference in the y values. Run is how far over the line goes, or the difference in the x values.

The **y-intercept** is the point on the y-axis where the line crosses.

You might recall that the equation of a line can be represented by $y = mx + b$, where m is the slope and b is the y-intercept. This form of an equation of a line is called the **slope y-intercept form**.

However, this time we are going to use another form for the equation of a line. The equation is $y = m(x - p) + q$. It is called the **point slope form**, where m is the slope and (p, q) is a point on the line. The point (p, q) could also represent the y-intercept.

Topic 1: Linear Equations is point slope form

Examples:

1. Determine the equation of each line. Use the form $y = m(x - p) + q$.

- [a] the line through the point $(0, 2)$ with slope 2
- [b] the line through the point $(3, 4)$ with slope -3
- [c] the line through the point $(-1, 2)$ with slope $\frac{1}{2}$

[a] In the first example, the slope is 2, so $m = 2$, and the line passes through the point $(0, 2)$, which, in this case, happens to be the y-intercept. Therefore, $p = 0$ and $q = 2$.

When we substitute into the equation, we get

$$y = 2(x - 0) + 2$$

Notice that inside the bracket, 0 is being subtracted from x .
Simplify.

$$y = 2x + 2$$

[b] In this example, $m = -3$ and $p = 3$ and $q = 4$.

When we substitute into the equation, we get

$$y = -3(x - 3) + 4$$



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[c] In this example, $m = \frac{1}{2}$ and $p = -1$ and $q = 2$.

Thus, substituting into the equation, we get

$$y = \frac{1}{2}(x - (-1)) + 2$$

Notice that inside the bracket, we have two negative signs side by side, so we must change this to one sign.

$$y = \frac{1}{2}(x + 1) + 2$$

According to the rules for integers, if we are subtracting a negative number, the sign changes to positive.

2. Determine the equation of each line that:

[a] passes through the points A(1, 2) and B(5, 8)

[b] passes through the points C(-1, 4) and D(2, -8)

In both of these examples, we are going to use $y = m(x - p) + q$, but in order to use this form of the equation, we must know the slope of each line and a point on each line. As you can see, the point on each line is given. In fact, you have a choice of two points—either point will work. But we must first determine the slope to get a value for m .

[a] First, we are going to calculate the slope of the line.

$$m = \text{rise/run}$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Substitute into the formula, using the given

points where Point A is $x_1 = 1$, $y_1 = 2$, and

Point B is $x_2 = 5$, and $y_2 = 8$

$$m = \frac{8 - 2}{5 - 1}$$

Now simplify.

$$m = \frac{6}{4}$$

Fractions must always be in their lowest terms.

$$m = \frac{3}{2}$$



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2. continued

Find the equation for a line that passes through the points A(1, 2) and B(5, 8)

We found the slope is $\frac{3}{2}$.

Now we can use $y = m(x - p) + q$. We can substitute either A(1, 2) or B(5, 8) for the (p, q). It doesn't matter which one we choose.

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

Substitute A. If we choose B, we would have the bottom equation.

$$y = \frac{3}{2}(x - 5) + 8$$

Both equations will graph the same line. Try any x value in both equations. You will calculate the same y value for both.

[b] Find the linear equation that passes through C(-1, 4) and D(2, -8)
In this example, we must find the slope also.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$x_1 = -1, y_1 = 4 \text{ and } x_2 = 2, y_2 = -8$$

$$m = \frac{-8 - 4}{2 - (-1)}$$

Watch the negative signs.

Simplify again.

$$m = \frac{-12}{3}$$

$$m = -4$$

Now we must substitute one of the points into the formula with the slope we just calculated.

$$y = -4(x - (-1)) + 4$$

Substitute point C. Notice that further simplifying is needed.

$$y = -4(x + 1) + 4$$

This is the linear equation in point slope form.



Assessment and Evaluation: Unit 2, Lesson 2

For each of the following questions, write the equation of the line in point slope form.

$$y = m(x-p) + q$$

- a) slope -2, passing through the point (3, 2)

- b) slope 3, passing through the point (-4,-5)

- c) passes through the points A(3, 5) and B(-2, -6)

- d) passes through the points C(-1, 2) and D(4, 7)