We will find equations of lines given information like slope or points on the line.

Elementary Algebra
Class Notes
Equations of Lines (section 10.5)

A linear equation could be written in many different forms. Each form has its own advantages. We will use the various forms to write equations depending on what information we are given and our preferences.

fairly easy to find intercepts

	General Equation	Example
Standard Form	$Ax + By = C$	$3x + 4y = 12$
Slope-Intercept Form	$y = mx + b$	$y = \dfrac{-3}{4}x + 3$
Point-Slope Form	$y - y_1 = m(x - x_1)$	$y + 3 = \dfrac{-3}{4}(x - 8)$

slope and y-intercept easy to pick out

slope and one particular point (relatively) easy to pick out

All of these equations describe the same line!

By the way, point-slope form is sometimes hard to remember but it really is just our old friend, the formula for slope. Check out how we derive it below.

slope formula

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

multiply both sides by $x_2 - x_1$

$$m(x_2 - x_1) = \frac{y_2 - y_1}{x_2 - x_1} \cdot \frac{(x_2 - x_1)}{1}$$

cancel $x_2 - x_1$ on top and bottom

$$m(x_2 - x_1) = y_2 - y_1$$

flip it around

$$y_2 - y_1 = m(x_2 - x_1)$$

obscure one of the point's subscripts

$$y - y_1 = m(x - x_1)$$

Here m is the slope and (x_1, y_1) is a specific point on the line. You can think of (x, y) as a generic point on the line.

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expl 1: Write the equation of the line with the given slope and y-intercept.

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

Your equations should have x and y in place. Remember the line's equation tells us how the x and y values of every point are related.

expl 2: Use the slope-intercept form of a line to graph the equation.

$-3x + y = 2$

$y = mx + b$

Draw a neat, evenly-spaced xy-plane. Plot the y-intercept and then use the slope (rise over run) to plot the next point. Connect them with a straight edge.

expl 3: Find the equation of the line that has a slope of 4 and passes through the point $(1, 3)$. Write your answer in standard form.

$Ax + By = C$

You can use either the $y - y_1 = m(x - x_1)$ or the $y = mx + b$ form. Let's use $y - y_1 = m(x - x_1)$ this time.

expl 4: Write the equation of the line that passes through $(8, 5)$ and has the following slope.
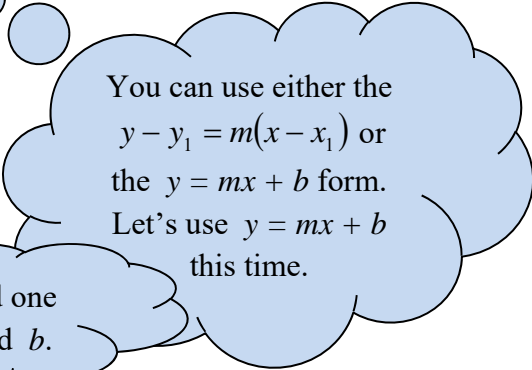
a.) undefined slope

b.) $m = 0$

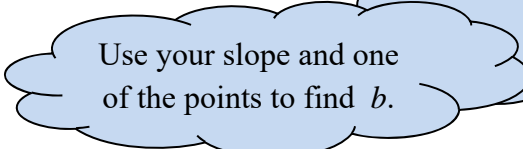Which lines have undefined slope? Which lines have zero slope?

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expl 5: Follow the steps below to find the equation of the line that passes through the points (6, 2) and (8, 8). Write your answer in standard form.

a.) Find m, the slope.

You can use either the $y - y_1 = m(x - x_1)$ or the $y = mx + b$ form. Let's use $y = mx + b$ this time.
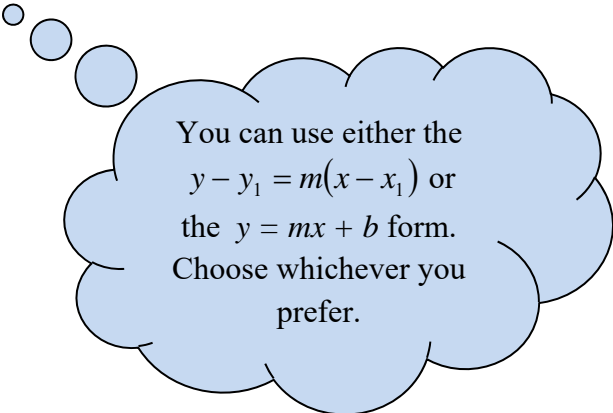
b.) Find b, the y-intercept.

Use your slope and one of the points to find b.

c.) Write your equation in the form $y = mx + b$ with x and y in place.

d.) Convert to the $Ax + By = C$ form.

expl 6: Find the equation of the line that has a slope of 5 and goes through the point (6, –8). Write your final answer in slope-intercept form.

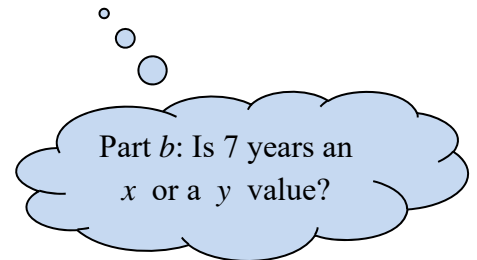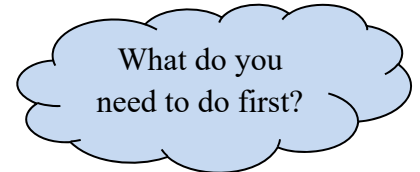You can use either the $y - y_1 = m(x - x_1)$ or the $y = mx + b$ form. Choose whichever you prefer.
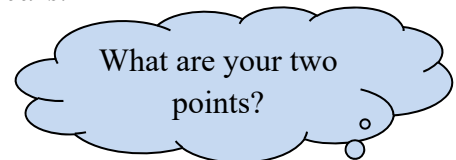
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expl 7: Solve. Write the equation in slope-intercept form.

A Hawaiian fruit company is studying the sales of a pineapple sauce to see if they should keep selling it. At the end of its first year, profits on the sauce amounted to $30,000. At the end of the fourth year, profits were $66,000.

a.) Assume that the relationship between years on the market and profit is linear. Write an equation that describes this relationship. Use ordered pairs of the form (years on market, profit).

b.) Use this equation to predict the profit at the end of 7 years.

What are your two points?

What do you need to do first?

Part *b*: Is 7 years an x or a y value?

expl 8: Find the equation of the line that goes through (8, 6) and is perpendicular to the y-axis.

Graph this line!