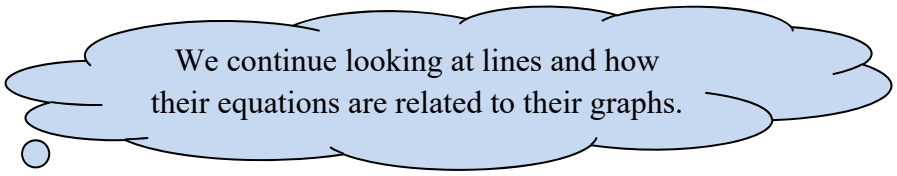


College algebra

Linear Functions 1B: Point-slope Form, Parallel and Perpendicular Lines, Linear Regression (section 1.4)

Recall: Definition: Linear Equation: a linear equation in two variables is an equation that *could be written* in the form $Ax + By = C$ where A, B, and C are real numbers and A and B are not both zero.

In this section, we will see other versions of this equation.

Parallel and Perpendicular Lines:

Optional Worksheet: Parallel and Perpendicular lines: This worksheet focuses on parallel and perpendicular lines and how their slopes are related. It also practices finding slope as "rise over run".

After doing the worksheet or from memory, complete the following information.

Slopes of parallel lines are _____.

Slopes of perpendicular lines are _____.

The product of the slopes of perpendicular lines is _____.

expl 1: Find the slope of a line that is parallel to the line $y = 5x + 3$.

expl 2: Find the slope of a line that is perpendicular to the line $y = 5x + 3$.

Different Forms: 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.

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

fairly easy to find intercepts

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.

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

slope formula

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

multiply by $x_2 - x_1$

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

flip it around

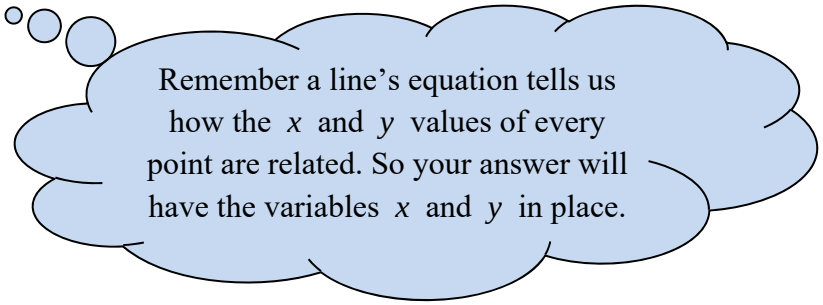
$$y - y_1 = m(x - x_1)$$

obscure one of the point's subscripts

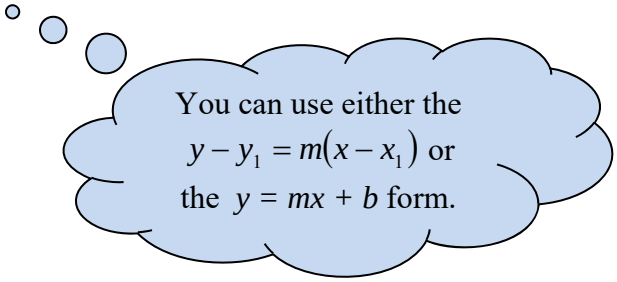
Here m is the slope and (x_1, y_1) is a specific point on the line. You can think of (x, y) as a generic point on the line.

expl 3: Write the equation of the line with the given slope and y-intercept. Graph it too.

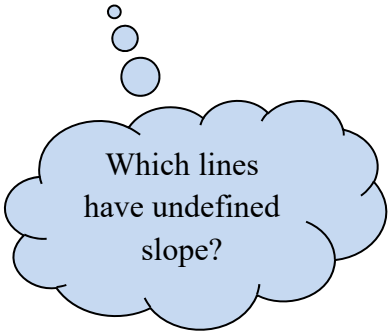
$m = 3,\ b = \frac{2}{3}$



expl 4: Find the equation of the line that has a slope of 4 and passes through the point (1, 3). Write your answer in slope-intercept form. Graph it too.



expl 5: Write the equation of the line that passes through (8, 5) and has undefined slope. Graph it too.



expl 6: 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 slope-intercept 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.

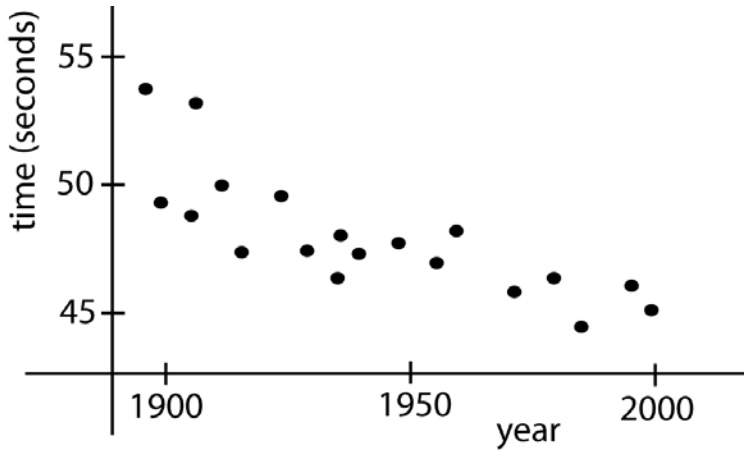
c.) Write your equation in the form $y = mx + b$ with x and y in place.

expl 7: 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. Graph it too.

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

If we call the desired function $h(x)$, how could we write the point (6, –8)?

Linear Regression: Take a look at the scatter plot below that shows the relationship between the time it takes to run the 400 meter dash and the year.



Notice how the scatter plot takes on a linear pattern. If we were to find the equation of the line that best fit this pattern of points, we could use it to predict the time it takes to run the 400 meter dash in any given year. That is the idea of regression.

Worksheet: Linear regression on your calculator:
We will explore a couple of examples with step-by-step instructions on how to find the regression equations using the calculator.

Coefficient of correlation, *r*: This number tells us how well the line fits the pattern of points and if the slope of the line is positive or negative. The coefficient of correlation ranges from -1 to 1. If r is negative, the line has a negative slope. If r is positive, the line has a positive slope. The closer r is to -1 or 1, the better the fit.

Can you estimate r in the graph at the top of the page? Is it positive or negative? What does that mean about the relationship between the time it takes to run 400 meters and the year?