Summer MA 15200 Lesson 17 Parts of Sections 2.3 and 2.4

Equations of Lines can be written several ways. In the last lesson, the slope-intercept form was discussed, $y = mx + b$.

I Point-Slope Form of the Equation of a Line

Begin with the slope formula and drop the subscript 2's, putting them back as regular variables.

$$m = \frac{y_2 - y_1}{x_2 - x_1} \rightarrow m = \frac{y - y_1}{x - x_1} \rightarrow \text{cross multiply} \rightarrow y - y_1 = m(x - x_1)$$

This is known as the point-slope form of the equation of a line.

Point-Slope Form
If a line contains the point (x_1, y_1) and has the slope m, then the equation in **point-slope form is** $y - y_1 = m(x - x_1)$.

When using point-slope form, substitute values for x_1, y_1, and m. Never substitute for *x* and *y*. These are the variables of the equation.

Ex 1: *a*) Write an equation in point-slope form for a line with a slope of $\frac{2}{3}$ and through the point (2, 12).

b) Find the slope and an indicated point for a line with equation $y + 2 = -4(x - 5)$.

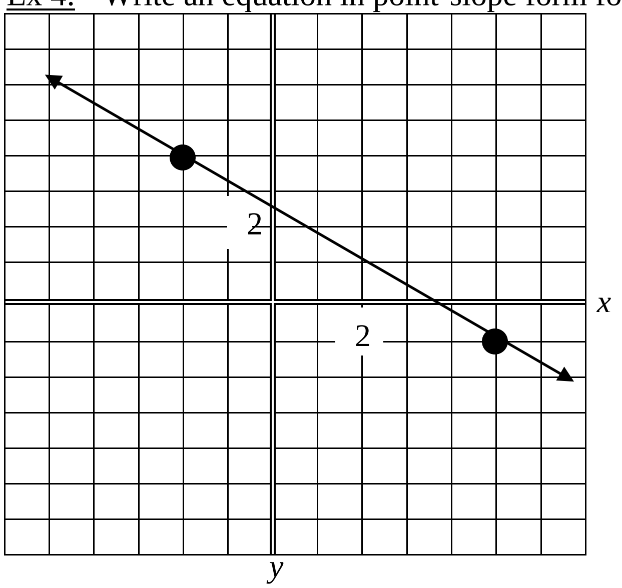
Ex 2: Write an equation of a line with the given points in point-slope form, then solve for *y*.

a) $m = -4, \ P(-3, 8)$

b) $m = \frac{3}{4}, \ P(-2, 12)$

Ex 3: Find the equation of the line through points $P(-2,-5)$ and $Q(6,-4)$ in point-slope form and then solve for *y*.

Ex 4: Write an equation in point-slope form for the line shown. Solve for *y*.



II Slope-Intercept Form of the Equation of a Line

We've already discussed slope-intercept form, but how is it derived? Let the point known be the *y*-intercept and call it (0, *b*).

$$y - y_1 = m(x - x_1)$$
$$y - b = m(x - 0)$$
$$y - b = mx$$
$$y = mx + b$$

If a line has slope *m* and a *y*-intercept at *b*, then the **slope-intercept form of the equation of the line is** $y = mx + b$ or $f(x) = mx + b$.

Ex 5: Find an equation of a line with slope $-\frac{3}{8}$ and point $(0,-6)$ in slope-intercept form.

Ex 6: Find an equation in slope-intercept form for a line with the following slope and point
$m=\frac{3}{2},\ P(-6,-1)$

Ex 7: Find the slope and y-intercept for a line $5x-4y=15$.

III General Form of an Equation of a Line

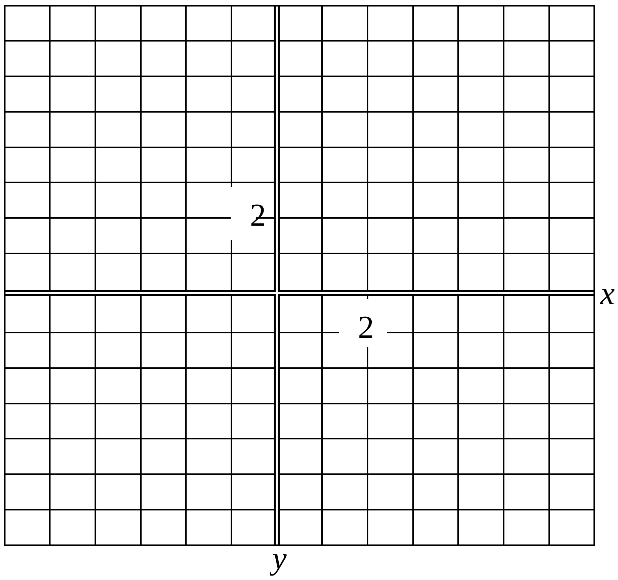
The **General Form of the Equation of a Line is** $Ax+By+C=0$, where *A, B,* and *C* are integers and *A* is positive. Some textbooks, have General or Standard form as $Ax+By=C$. Note: **This is the form that some problems on MyMathLab want for equations of the lines.**

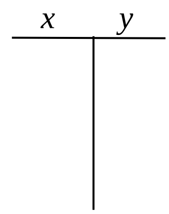
Ex 8: Find an equation of the line containing points (2, -3) and (-4, -8) in general form.

IV Using Intercepts to Graph a Line

1. Find the *x*-intercept by letting *y* = 0 and solving for *x*. Plot the point.
2. Find the *y*-intercept by letting *x* = 0 and solving for *y*. Plot the point.
3. Draw a line through the two points that are the intercepts.

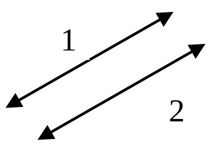
Ex 9: Find the intercepts and use them to graph the line. $4x - 3y - 12 = 0$





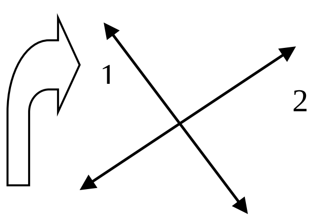
V Parallel and Perpendicular Lines

Parallel Lines: Two lines that are parallel will have the **same slope** or two lines with the same slope will be parallel.



$m_1 = m_2$

Perpendicular lines: Two lines that are perpendicular will have **slopes with a product of -1 (opposite reciprocals or negative reciprocals)**. Two lines whose slopes of negative reciprocals will be perpendicular.



$m_1 = -\frac{1}{m_2}$ or $m_2 = -\frac{1}{m_1}$

Ex 10: Determine is the lines with given slopes or given pairs of points are parallel, perpendicular, or neither (simply intersect).

$a) \quad m_1 = -\frac{4}{3}, \; m_2 = \frac{4}{3}$

$b) \quad m_1 = -3, \; m_2 = \frac{1}{3}$

Ex 11: Find the equation in slope-intercept form and general form for each line described.

$a)$ $P(12,15)$, parallel to $4x - y = 9$

$b)$ $P(6,4)$, perpendicular to $y = -3x - 4$

VI Applied Problems

Ex 12: Steven has an antique watch that has appreciated in value from the time he purchased it. He bought the watch for $900. After 6 years, it was worth $1150. The graph of the ordered pairs representing (years, value of watch) for a straight line.

a) Write an equation of its value after t years in the form $V = mt + b$.

b) Use your equation to predict the value of the watch after 10 years.

c) In how many years is the watch worth $2000?

Ex 13: In 2000 in a certain town, 38% of children from ages 12 to 18 had their own computer. This has been increasing by 2.8% per year since then. Find a linear function P(x) in slope-intercept form, to find the percent of children of those ages who have their own computer for years since 2000.