Geometry H
Section 3.4 – 3.5 Notes

Name : Key
Date : ______________ Period : ____

Slope Criterion for Parallel Lines

Two non-vertical lines are parallel if and only if they have the same slope.

Vertical lines are always parallel.

Example 1: Write equations of parallel lines.

a) Write an equation of the line passing through the point (3, 4) that is parallel to the line with equation $y = -4x + 5$.

x_1, y_1

old slope: -4 new slope: -4

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

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

$y - 4 = -4x + 12$

$\boxed{y = -4x + 16}$

b) Write the equation of the line that passes through (3, 5) and is parallel to the line that passes through (3, 3) and (-3, -1)

x_1, y_1

old slope $= \frac{-1-3}{-3-3} = \frac{-4}{-6} = \frac{2}{3}$ new slope $= \frac{2}{3}$

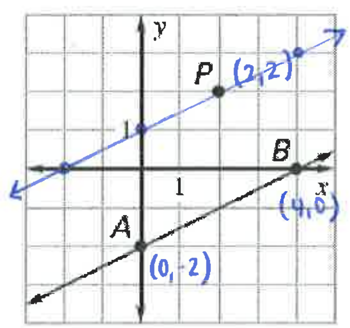
$y - 5 = \frac{2}{3}(x - 3)$

$y - 5 = \frac{2}{3}x - \frac{6}{3}$

$y - 5 = \frac{2}{3}x - 2 \Rightarrow \boxed{y = \frac{2}{3}x + 3}$

c) Graph the line parallel to line *AB* that passes through point *P* and write its equation.

slope of $\overleftrightarrow{AB} = \frac{-2-0}{0-4} = \frac{-2}{-4} = \frac{1}{2}$ new slope $= \frac{1}{2}$



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

$y - 2 = \frac{1}{2}x - 1$

$\boxed{y = \frac{1}{2}x + 1}$

Slope Criterion for Perpendicular Lines

Two non-vertical lines are perpendicular if and only if

they have opposite reciprocal slopes.

Vertical lines and horizontal lines are always perpendicular.

Example 2: Write equations of perpendicular lines.

a) Write an equation of the line passing through the point (6, -3) that is perpendicular to the line with equation $y = 4x - 7$.

$x_1 \quad y_1$

old slope = 4   new slope = $-\frac{1}{4}$

$y+3 = -\frac{1}{4}(x-6)$

$y+3 = -\frac{1}{4}x + \frac{6}{4}$

$y+3 = -\frac{1}{4}x + \frac{3}{2}$

$y + \frac{6}{2} = -\frac{1}{4}x + \frac{3}{2}$

$\boxed{y = -\frac{1}{4}x - \frac{3}{2}}$

b) Write the equation of the line that passes through (-2, 3) and is perpendicular to the line that passes through (0, 1) and (-3, -1)

$x_1 \quad y_1$

old slope = $\frac{-1-1}{-3-0} = \frac{-2}{-3} = \frac{2}{3}$

new slope = $-\frac{3}{2}$

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

$y-3 = -\frac{3}{2}x - \frac{6}{2}$

$y-3 = -\frac{3}{2}x - 3$

$\boxed{y = -\frac{3}{2}x}$

c) Graph the line perpendicular to line *AB* that passes through point *P* and write its equation.

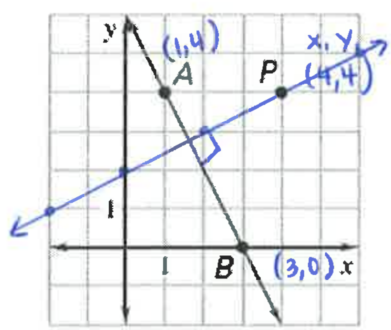
slope of $\overleftrightarrow{AB} = \frac{4-0}{1-3} = \frac{4}{-2} = -2$

new slope = $\frac{1}{2}$

$y-4 = \frac{1}{2}(x-4)$

$y-4 = \frac{1}{2}x - 2$

$\boxed{y = \frac{1}{2}x + 2}$



Equations of Lines
Slope-intercept form: $y = mx + b$
Point – slope form: $y - y_1 = m(x - x_1)$
Standard form: $ax + by = c$

Example 3: Rewrite standard form in slope-intercept form.

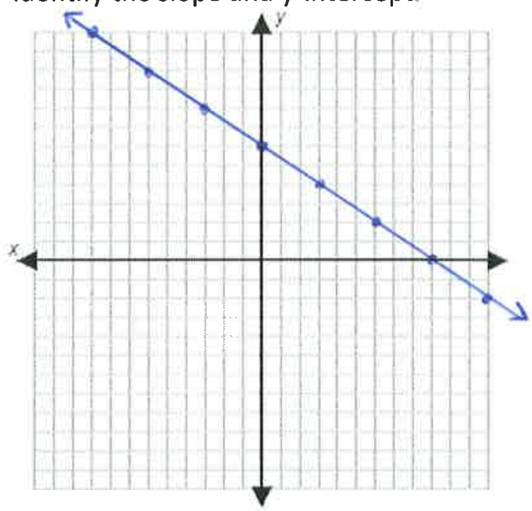
Given $2x + 3y = 18$, rewrite the equation in slope-intercept form. Identify the slope and y-intercept. Then graph the line.

$3y = 18 - 2x$

$y = \frac{18}{3} - \frac{2}{3}x$

$y = -\frac{2}{3}x + 6$

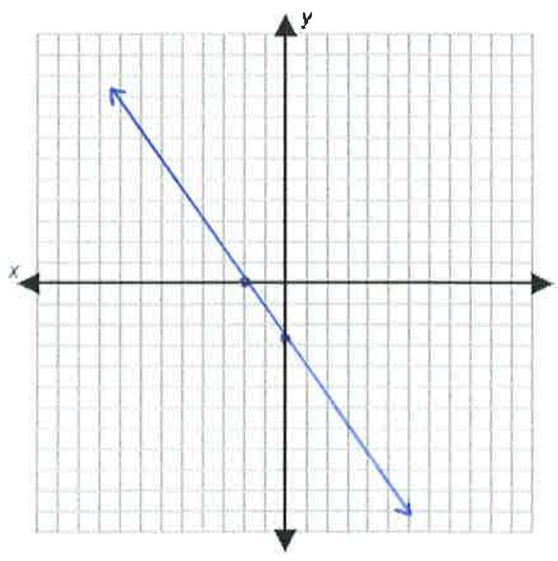
$m = -\frac{2}{3},\ b = 6$



Can we graph an equation from standard form without rewriting it in slope-intercept form first? Of course we can!!! We can use the *x*-intercept and *y*-intercept.

Example 8: Graph a line with the equation in standard form.

a) Given $7x + 5y = -14$, graph the line using intercepts.



To find the *x*-intercept, let $y = 0$, then solve for x.

To find the *y*-intercept, let $x = 0$, then solve for y.

x-int: $7x + 5(0) = -14$ $\Rightarrow (-2, 0)$

$7x = -14$

$x = -2$

y-int: $7(0) + 5y = -14$

$5y = -14 \Rightarrow y = -14/5 \Rightarrow (0, -14/5)$

$= -2.8$

b) Graph $3(y-2)=5x-12$ and $10x-6y=12$ on the same coordinate plane. Then use the graph to estimate how many solutions the equations share.

a. $3y-6=5x-12$

$3y-5x=-6$

x-int: $3(0)-5x=-6$

$0-5x=-6$ $\Rightarrow$ $(6/5, 0)$

$x=6/5$

y-int: $3y-5(0)=-6$

$3y-0=-6$ $\Rightarrow$ $(0,-2)$

$3y=-6$

$y=-2$

b. $10x-6y=12$

y-int: $10(0)-6y=12$

$-6y=12$

$y=-2$

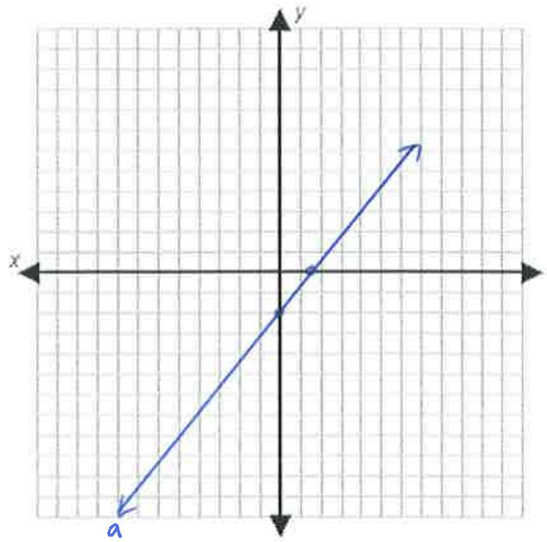
$(0,-2)$

x-int: $10x-6(0)=12$

$10x=12$

$x=\frac{12}{10}=\frac{6}{5}$

$(6/5, 0)$



Same line $\Rightarrow$ infinitely many solutions