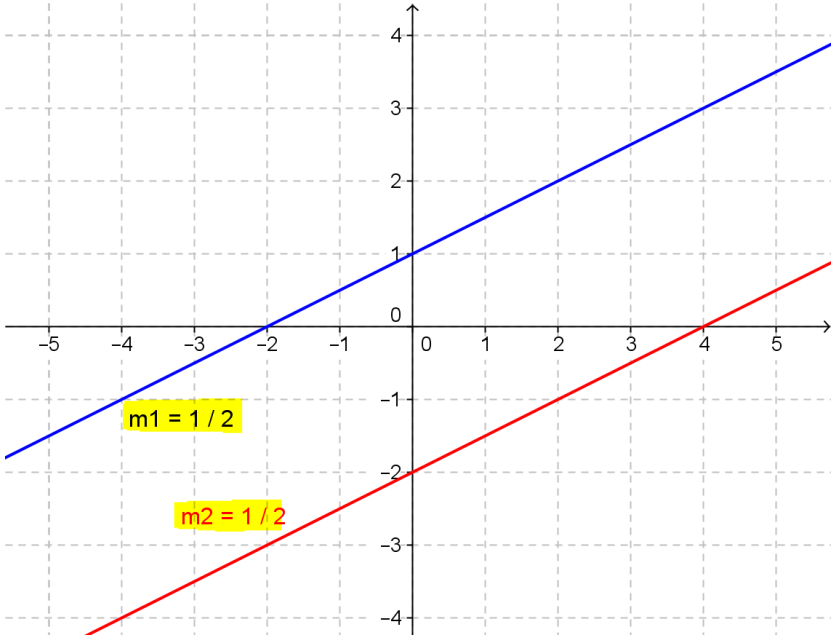
Math 1300 Section 2.5

Section 2.5: Parallel and Perpendicular Lines

$m_1 = m_2$ AND $b_1 = b_2$ SAME

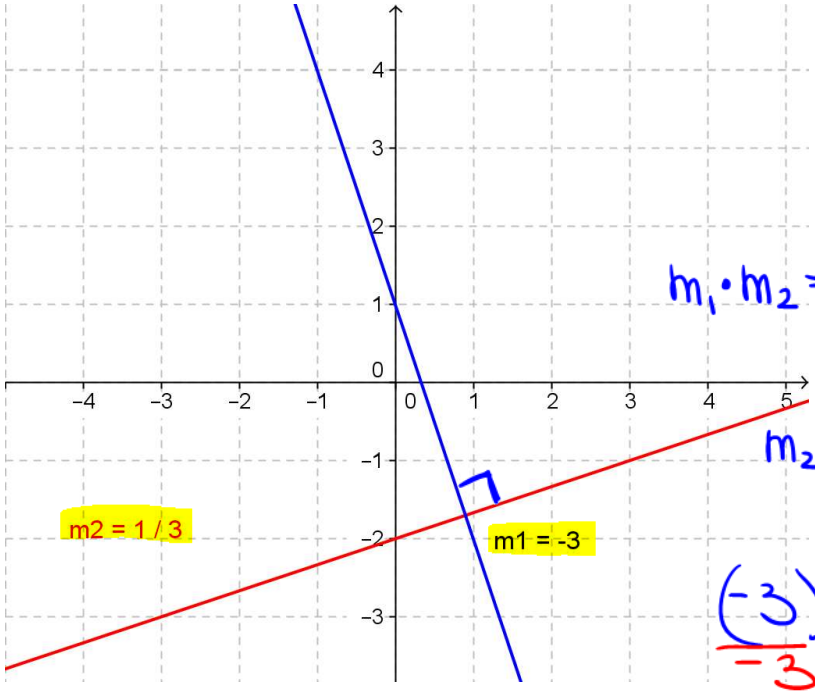
Two lines with slopes m_1 and m_2 are **parallel** if and only if $m_1 = m_2$



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

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

Two lines with slopes m_1 and m_2 are **perpendicular** if and only if $m_1 * m_2 = -1$



$m_1 \cdot m_2 = (-3)\left(\frac{1}{3}\right) = -1$

m_2 is a negative res. of m_1

$\frac{(-3)}{-3} \cdot m_2 = \frac{-1}{-3}$

$m_2 = \frac{1}{3}$

$a \cdot \left(\frac{-1}{a}\right) = -1$

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Example 1:

If you have a line with slope -2;

Any line that is parallel to this line has slope: -2.

Any line that is perpendicular to this line has slope: $-\left(\frac{1}{-2}\right) = \frac{1}{2}$.

If you have a line with slope 7;

Any line that is parallel to this line has slope: 7.

Any line that is perpendicular to this line has slope: $-\frac{1}{7}$.

If you have a line with slope 4/9;

Any line that is parallel to this line has slope: $\frac{4}{9}$.

Any line that is perpendicular to this line has slope: $-\frac{9}{4}$.

Example 2: State whether the following lines are parallel, perpendicular, neither or the same.

$y = -5x + 4$
$y = -5x - 9$

$m_1 = -5$
$m_2 = -5$

lines are parallel

$y = mx + b$
m = slope
b = y-int.

Example 3: State whether the following lines are parallel, perpendicular, neither or the same.

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

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

$m_1 = 4$
$m_2 = -\frac{1}{4}$

$4\left(-\frac{1}{4}\right) = -1$

$y = mx + b$

lines are perpendicular.

Example 4: State whether the following lines are parallel, perpendicular, neither or the same.

$3x + 2y = 6$
$-6x - 4y = -12$

$-2(3x + 2y) = (6) - 2$

$-6x - 4y = -12$

$3x + 2y = 6$
$-3x \quad -3x$

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

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

$-6x - 4y = -12$
$+6x \quad +6x$

$\frac{-4y}{-4} = \frac{6x - 12}{-4}$

$y = -\frac{6x}{4_2} + 3$

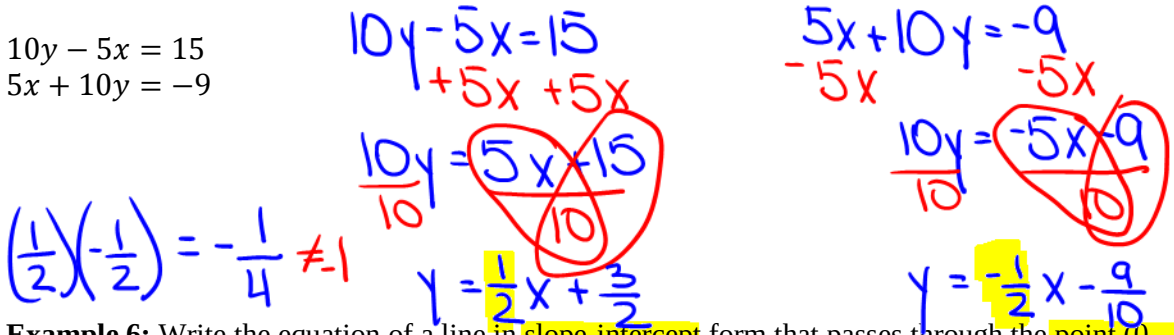
$y = -\frac{3}{2}x + 3$

$m_1 = m_2$

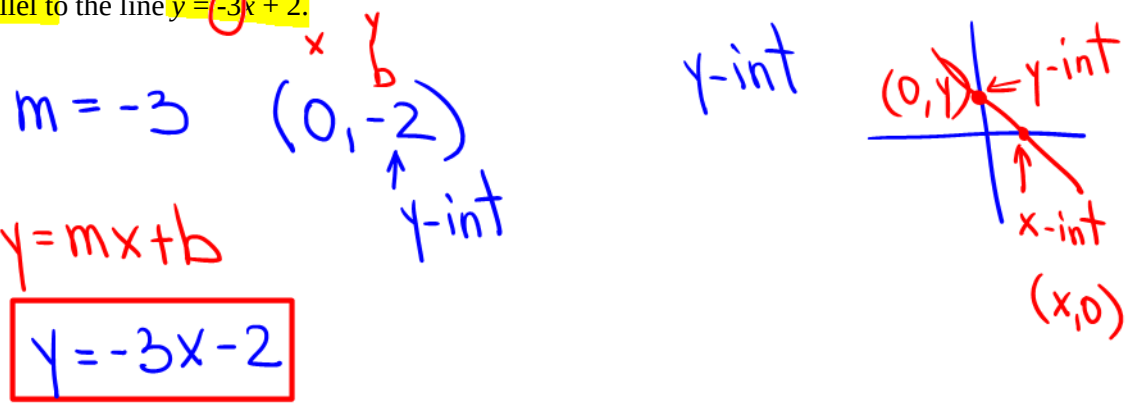
same

Example 5: State whether the following lines are parallel, perpendicular, neither or the same.

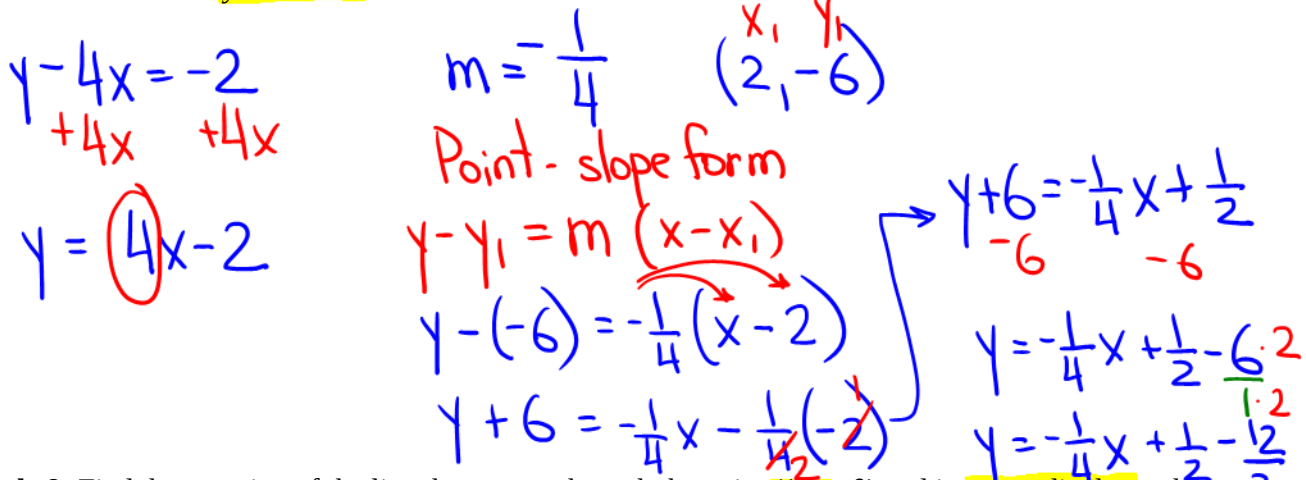
$10y - 5x = 15$
$5x + 10y = -9$



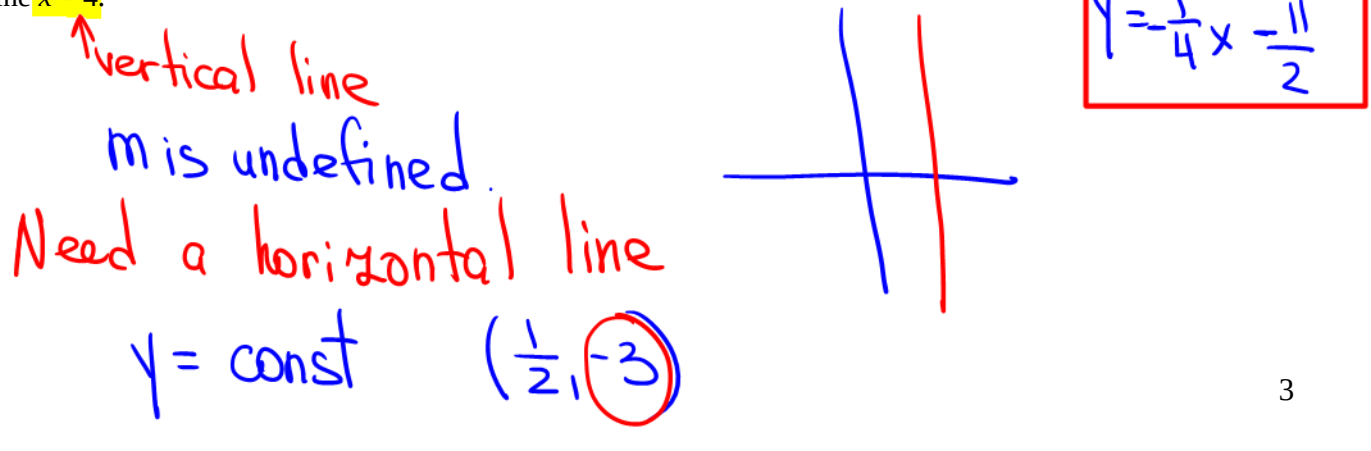
Example 6: Write the equation of a line in slope-intercept form that passes through the point (0, -2) and is parallel to the line $y = -3x + 2$.



Example 7: Write the equation of a line in slope-intercept form that passes through (2, -6) and is perpendicular to the line $y - 4x = -2$.



Example 8: Find the equation of the line that passes through the point (1/2, –3) and is perpendicular to the line $x = 4$.



$Ax+By=C$

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Example 9: 9. Write the equation in standard form for the line that passes through the point (2, 2) and is parallel to the graph of the line $4x - 5y = -12$.

$4x-5y=-12$

$-4x \quad -4x$

$\frac{-5y}{-5} = \frac{-4x-12}{-5}$

$y = \frac{4}{5}x + \frac{12}{5}$

$m = \frac{4}{5}$ (x_1, y_1) $(2,2)$

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

$y-2 = \frac{4}{5}(x-2)$

$y-2 = \frac{4}{5}x - \frac{8}{5}$

$+2 \quad +2$

$y = \frac{4}{5}x - \frac{8}{5} + \frac{2\cdot 5}{1\cdot 5}$

$y = \frac{4}{5}x + \frac{-8+10}{5}$

$y = \frac{4}{5}x + \frac{2}{5}$

$-\frac{4}{5}x$

Example 10: Write the equation of a line in slope-intercept form that passes through (1,2) and is parallel to the line that passes through the points (4, 6) and (6, 10).

(x_1, y_1) $(4,6)$ (x_2, y_2) $(6,10)$

$m = \frac{y_2-y_1}{x_2-x_1} = \frac{10-6}{6-4} = \frac{4}{2} = 2$

$m = 2$ slope (x_1, y_1) $(1,2)$ point

Point-slope: $y-y_1 = m(x-x_1)$

$y-2 = 2(x-1)$

$y-2 = 2x-2$

$+2 \quad +2$

$y = 2x$

$\frac{4}{5}x + y = \frac{2\cdot 5}{5}$

$-4x+5y=2$

Check: $(1,2)$

$2(1)=2$