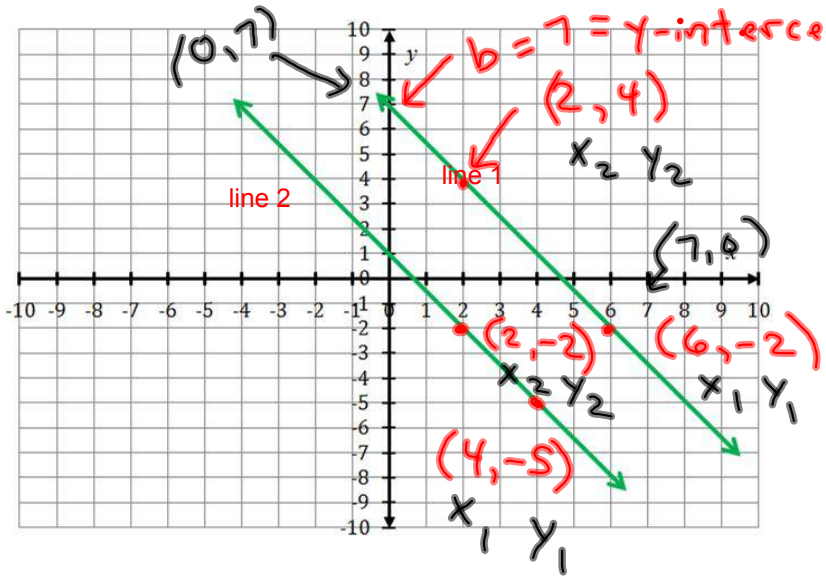
Day 2: Equations of Parallel Lines

Find the slopes of the following lines, and then write the equation for each line.




$l_1$ $\quad m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4+2}{2-6} = \frac{6}{-4} = \frac{\div 2}{\div 2} = -\frac{3}{2}$

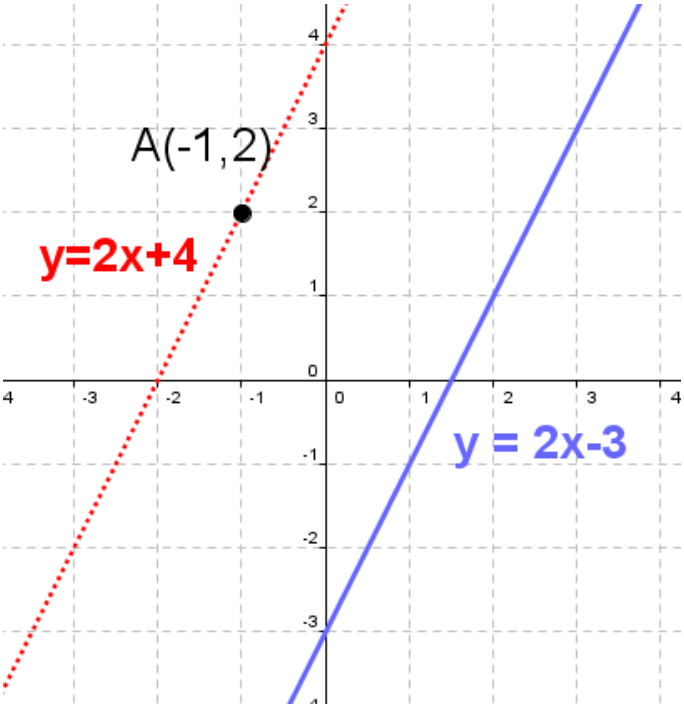
EQN $l_1$: $y = -\frac{3}{2}x + 7$

$l_2$ $\quad m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2+5}{2-4} = \frac{3}{-2} = \frac{-3}{2}$

EQN $l_2$: $y = -\frac{3}{2}x + 1$

What do you notice about the equations for the above lines?

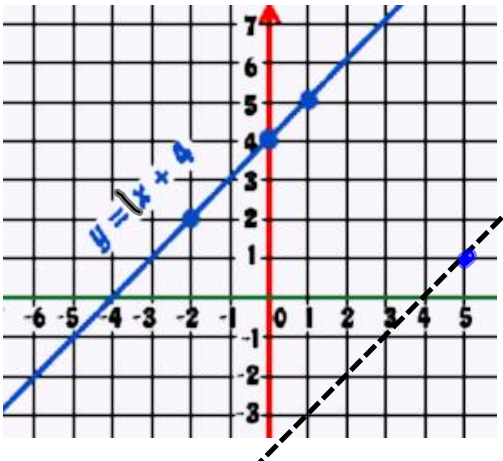
Two parallel lines have the same slope (but their y-intercepts are different).




Parallel lines have THE SAME SLOPE, but they have different y-intercepts!

Now let's do some problems that incorporate everything that we have reviewed so far!

Find the equation of the dotted line below, given that it is parallel to the solid line, and also given that it passes through ( 4 , 0 ).




Blue Line

$m = 1$

Dotted Line

$m = 1$ (5, 1) x y

$y = mx + b$

$1 = (1)(5) + b$

$1 = 5 + b$

$1 - 5 = b$

$-4 = b$

now you try....

Eqn dotted Line:

$y = 1x - 4$

OR $y = x - 4$

1. Determine the equation of the line that passes through point ( - 6 , $\frac{1}{2}$ ) and is parallel to the line whose equation is 4x - 3y = 2.

$l_1 \parallel l_2$ (parallel)

$4x - 3y = 2$

Isolate y to make the slope visible.

$4x - 3y = 2$

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

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

$m = \frac{4}{3}$

$l_2$

$(x, y) = (-6, \frac{1}{2})$

Find eqn.

$m = \frac{4}{3}$

$y = mx + b$

$\frac{1}{2} = \left(\frac{4}{3}\right)\left(\frac{-6}{1}\right) + b$

$\frac{1}{2} = \frac{-24}{3} + b$

$\frac{1}{2} = -8 + b$

$\frac{1}{2} + \frac{8}{1} \cdot \frac{2}{2}$ $\longleftrightarrow$ $\frac{1}{2} + 8 = b$

$\frac{1}{2} + \frac{16}{2} = \frac{17}{2}$

OR $8\frac{1}{2}$

$8\frac{1}{2} = b$

EQN

$y = \frac{4}{3}x + 8\frac{1}{2}$

OR

$y = \frac{4}{3}x + \frac{17}{2}$

2. Determine the equation of the line that passes through point $(-2, \frac{3}{2})$ and is parallel to the line whose equation is $x - \frac{4}{5}y = -5$.

$l_1 \parallel l_2$

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

$\left(\frac{-5}{4}\right)\left(-\frac{4}{5}y\right) = \frac{-5}{4}(1x - 5)$

$y = \frac{5}{4}x + \frac{25}{4}$

$m = \frac{5}{4}$

x y

$(-2, \frac{3}{2})$

$m = \frac{5}{4}$

$y = mx + b$

$\frac{3}{2} = \left(\frac{5}{4}\right)\left(\frac{-2}{1}\right) + b$

$\frac{3}{2} = \frac{-10}{4} + b$ (÷2)

$\frac{3}{2} = \frac{-5}{2} + b$

$\frac{3}{2} + \frac{5}{2} = b$

$4 = \frac{8}{2} = b$

EQN: $y = \frac{5}{4}x + 4$

3. Determine the equation of the line that passes through point $(\frac{4}{9}, -\frac{1}{3})$ and is parallel to the line whose equation is $-3x + 2y = -4$.

$l_1$ $\parallel$ $l_2$

$-3x+2y=-4$

$2y = 3x - 4$

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

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

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

$m = \frac{3}{2}$ $(\frac{4}{9}, -\frac{1}{3})$ (x, y)

$y = mx + b$

$-\frac{1}{3} = (\frac{3}{2})(\frac{4}{9}) + b$

$-\frac{1}{3} = \frac{12}{18} + b$ ($\div 6$)

$-\frac{1}{3} = \frac{2}{3} + b$

$-\frac{1}{3} - \frac{2}{3} = b$

$-1 = \frac{-3}{3} = b$

Eqn: $y = \frac{3}{2}x - 1$

4. Determine the equation of the line that passes through ( 6 , $\frac{3}{4}$ ) and is parallel to the line whose equation is $-x + \frac{6y}{5} = -\frac{1}{5}$ .

$$-x + \frac{6}{5}y = -\frac{1}{5}$$

$l_1$ $\parallel$ $l_2$

$-x + \frac{6}{5}y = -\frac{1}{5}$

$(6, \frac{3}{4})$ $m = \frac{5}{6}$

$\frac{5}{6}\left(\frac{6}{5}y\right) = \frac{5}{6}\left(1x - \frac{1}{5}\right)$

$y = mx + b$

$y = \frac{5}{6}x - \frac{5}{30}$ $\div 5$ $\div 5$

$\frac{3}{4} = \left(\frac{5}{6}\right)\left(\frac{6}{1}\right) + b$

$y = \frac{5}{6}x - \frac{1}{6}$

$m$

$\frac{3}{4} = \frac{30}{6} + b$

$\frac{3}{4} = 5 + b$

$\frac{3}{4} - \frac{5}{1} \cdot \frac{4}{4} = b$

$\frac{3}{4} - \frac{20}{4} = b$

$-4\frac{1}{4} = \frac{-17}{4} = b$

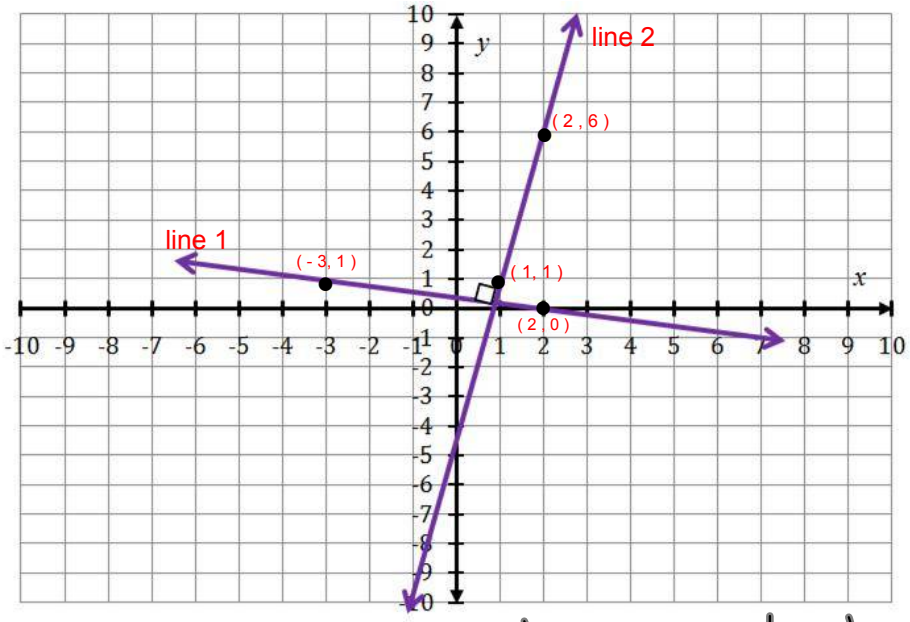
OR

Eqn: $y = \frac{5}{6}x - \frac{17}{4}$

OR

$y = \frac{5}{6}x - 4\frac{1}{4}$

# Equations of Perpendicular Lines




$\perp$ = perpendicular

Calculate the slopes of each of the lines above, and then write the equation for each line.

$l_1$ $(-3,1)$ and $(2,0)$
$x_1\ y_1$ $x_2\ y_2$

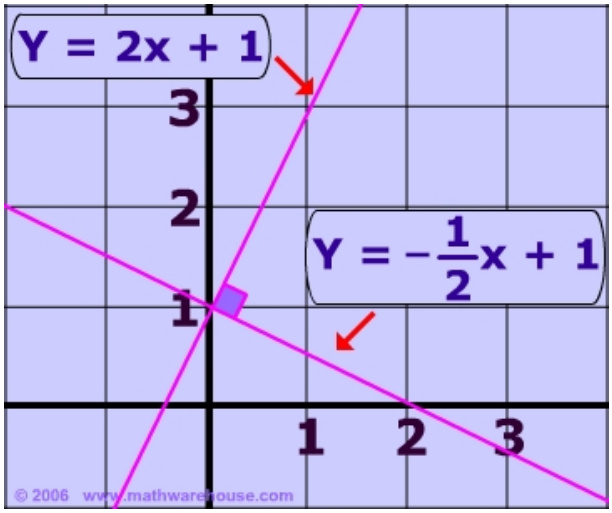
$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0-1}{2+3} = \frac{-1}{5}$$

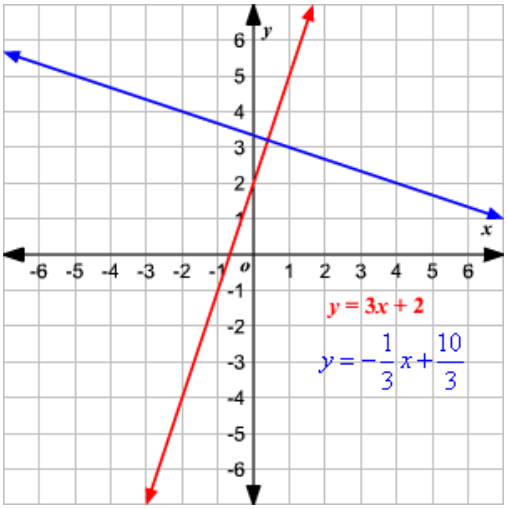
$l_1$

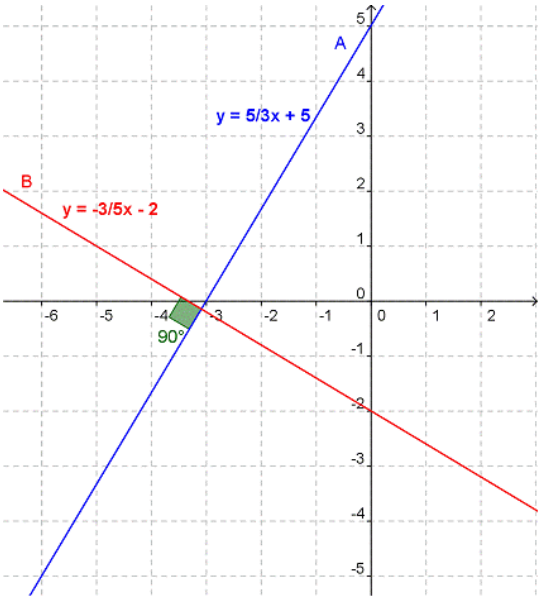
$$m = \frac{-1}{5}$$

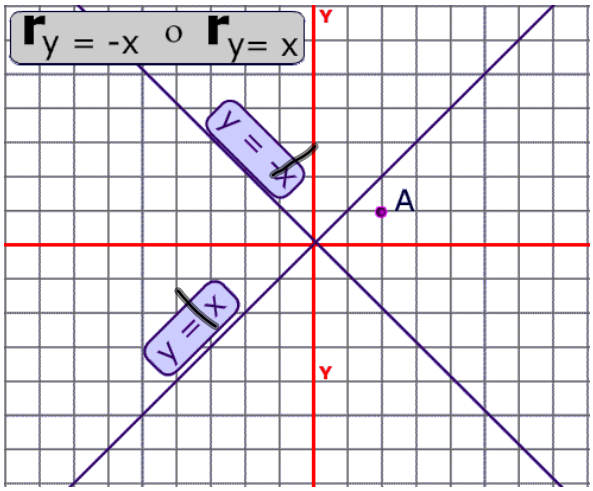
$l_2$ $(1,1)$ and $(2,6)$
$x_1\ y_1$ $x_2\ y_2$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6-1}{2-1} = \frac{5}{1} \text{ OR } 5$$




What do you observe about the slopes of two perpendicular lines?

Remember: For two perpendicular lines..... $m_1 \times m_2 = -1$

$\left(\frac{3}{5}\right)\left(\frac{-5}{3}\right) = \frac{-15}{15} = -1$

The table below shows the slopes for a number of lines, a - In the column on the right, write the slope for the line that is perpendicular to the lines given. The table is started for you...

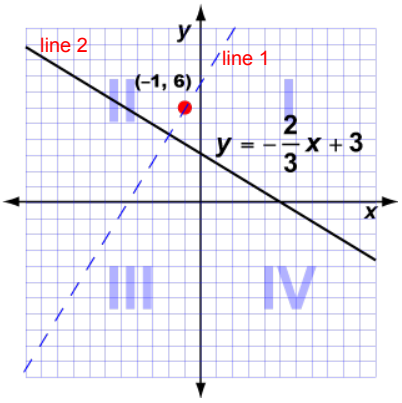
| Slope of line given | Slope of line perpendicular to line given |
|---|---|
| a) m = 2 | m = $-\frac{1}{2}$ |
| b) m = $-\frac{1}{3}$ | m = 3 |
| c) m = $\frac{3}{4}$ | $m = \frac{-4}{3}$ |
| d) m = - 4 | $m = \frac{1}{4}$ |
| e) m = 1 | $m = -1$ |
| f) m = $-\frac{7}{3}$ | $m = \frac{3}{7}$ |
| g) m = - 1 | $m = 1$ |
| h) m = 3.47 | $m = \frac{-1}{3.47} = -0.29$ |
| i) m = $\frac{5}{4}$ | $m = -\frac{4}{5}$ |
| j) m = -0.28 | $m = \frac{1}{0.28} = 3.57$ |

Don't forget that if one of the slopes is negative then the other is positive!

Students usually remember to "flip" the slope, but they sometimes forget to change the sign!

$x^{-1}$

Find the equation of the dotted line ( line 1), given that line 1 is perpendicular to line 2.




$l_1 \perp l_2$

$l_2$: $y = \left(-\frac{2}{3}\right)x + 3$ (m)

$l_1$: $(x, y) = (-1, 6)$

EQN ?

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

$y = mx + b$

$6 = \left(\frac{3}{2}\right)\left(\frac{-1}{1}\right) + b$

$6 = \frac{-3}{2} + b$

$\frac{6}{1} \cdot \frac{2}{2} + \frac{3}{2} = b$

$\frac{12}{2} + \frac{3}{2} = b$

$7\frac{1}{2}$ OR $\frac{15}{2} = b$

EQN: $y = \frac{3}{2}x + \frac{15}{2}$

OR

$y = \frac{3}{2}x + 7\frac{1}{2}$

Now you try these:

1. Determine the equation of the line that passes through point ( $\frac{7}{6}$ , - $\frac{5}{2}$ ) and is perpendicular to the line whose equation is 7x - 3y + 2 = 0.

$l_1$ ⊥ $l_2$

$7x - 3y + 2 = 0$

$\frac{-3y}{-3} = \frac{-7x}{-3} - \frac{2}{-3}$

$y = \frac{7}{3}x + \frac{2}{3}$

$m = \frac{7}{3}$

$(x, y) = \left(\frac{7}{6}, \frac{-5}{2}\right)$

$m = -\frac{3}{7}$

$y = mx + b$

$-\frac{5}{2} = \left(\frac{-3}{7}\right)\left(\frac{7}{6}\right) + b$

$-\frac{5}{2} = \frac{-21}{42} + b$ (÷21, ÷21)

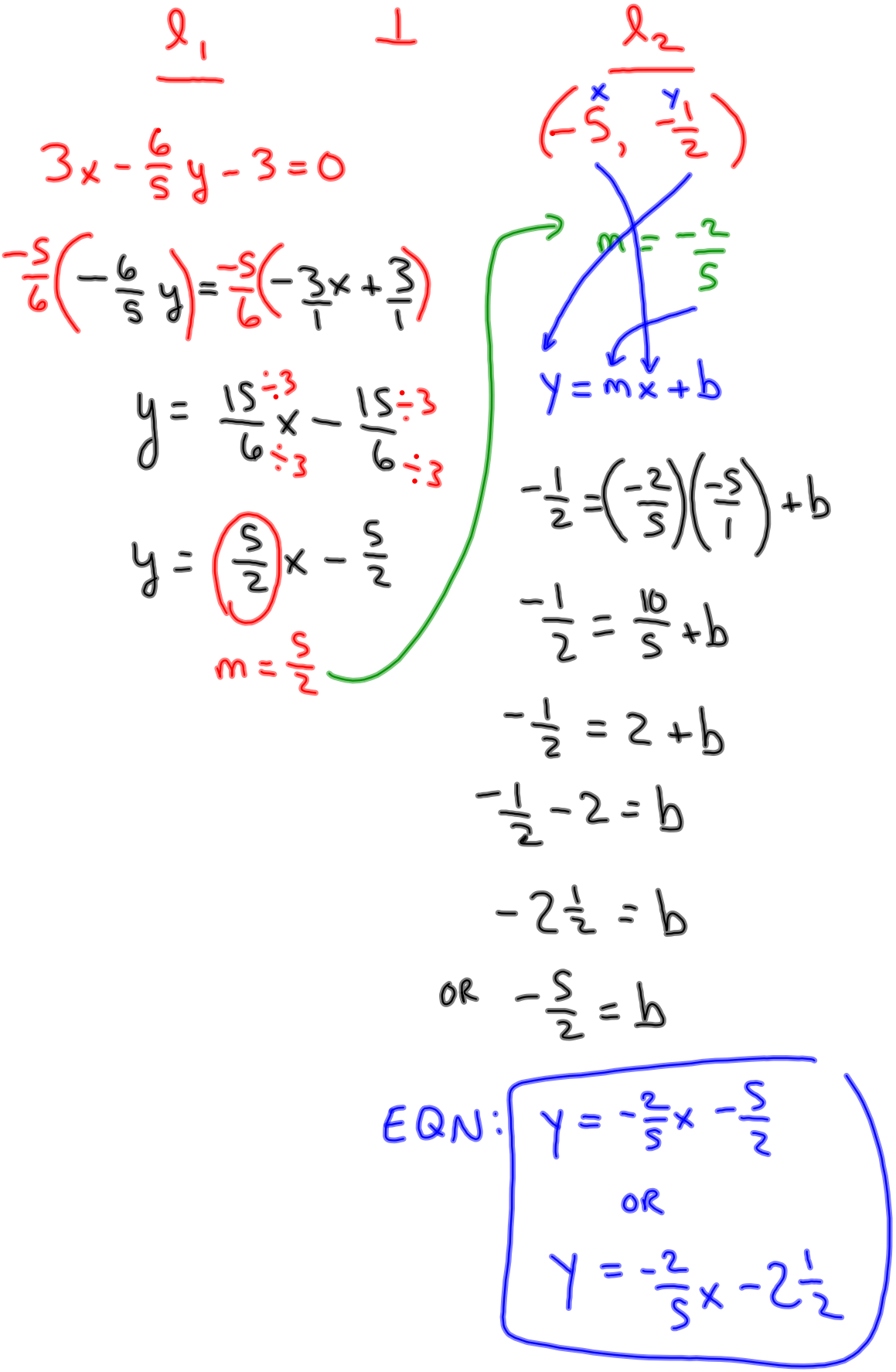
$-\frac{5}{2} = -\frac{1}{2} + b$

$-\frac{5}{2} + \frac{1}{2} = b$

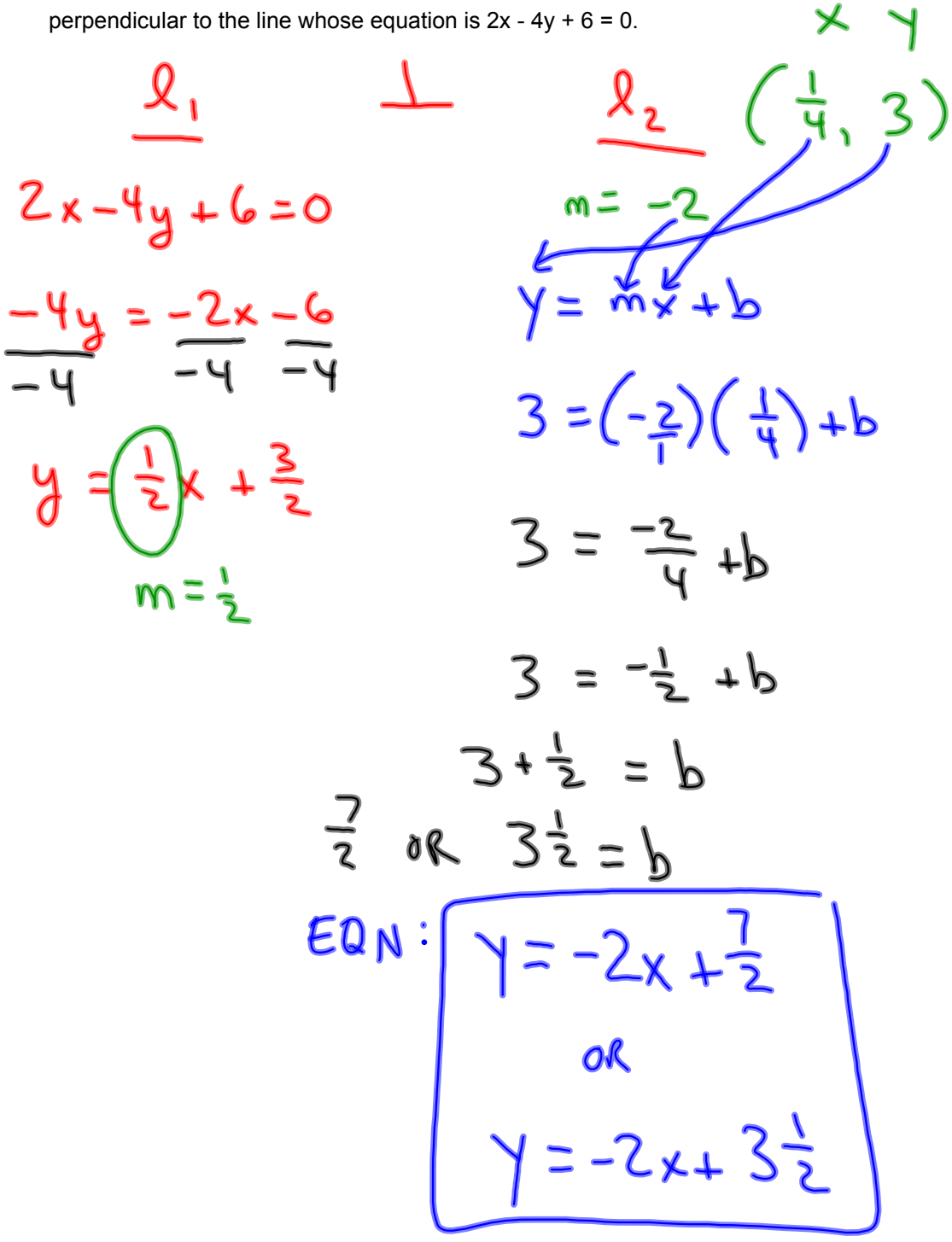
$-2 = -\frac{4}{2} = b$

EQN: $y = -\frac{3}{7}x - 2$

2. Determine the equation of the line that passes through ( - 5, $-\frac{1}{2}$ ) and is perpendicular to the line whose equation is 3x - $\frac{6y}{5}$ - 3 = 0.



3. Determine the equation of the line that passes through ( $\frac{1}{4}$ , 3) and is perpendicular to the line whose equation is 2x - 4y + 6 = 0.



4. Determine the equation of the line that passes through ( -6, $-\frac{1}{3}$ ) and is perpendicular to the line whose equation is 6x - $\frac{2y}{3}$ - 9 = 0.

$l_1$

$6x - \frac{2}{3}y - 9 = 0$

$-\frac{3}{2}\left(-\frac{2}{3}y\right) = -\frac{3}{2}\left(-\frac{6}{1}x + \frac{9}{1}\right)$

$y = \frac{18}{2}x - \frac{27}{2}$

$y = 9x - \frac{27}{2}$

$m = 9$

$l_2$

$(-6, -\frac{1}{3})$ (x, y)

$m = -\frac{1}{9}$

$y = mx + b$

$-\frac{1}{3} = \left(-\frac{1}{9}\right)\left(\frac{-6}{1}\right) + b$

$-\frac{1}{3} = \frac{6 \div 3}{9 \div 3} + b$

$-\frac{1}{3} = \frac{2}{3} + b$

$-\frac{1}{3} - \frac{2}{3} = b$

$-1 = -\frac{3}{3} = b$

EQN: $y = -\frac{1}{9}x - 1$

Do: ① Worksheet # 4

② Review Booklet (yellow)
→ first 8 pages only
(8 questions)

③ Quiz #1

DUE: TUESDAY

*NO SCHOOL MON. FEB 10!