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<p><u>Slope Intercept</u></p> $y = mx + b$ <p><math>m = \text{slope}</math> <math>\frac{\text{rise}}{\text{run}}</math> <math>\frac{+}{\text{up/down}} \frac{-}{\text{right}}</math></p> <p><math>b = y\text{-intercept}</math> <math>x = 0</math> *starting point*</p> <p><math>(x, y)</math> any point on the line</p>	<p><u>Slope formula</u></p> $m = \frac{y_2 - y_1}{x_2 - x_1}$ <p><math>(x_1, y_1)</math> <math>(x_2, y_2)</math></p>	<p><u>Point slope</u></p> $y - y_1 = m(x - x_1)$ <p><math>(x_1, y_1)</math> point</p>
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Topic 1: Writing an equation in slope-intercept form given the slope and a point

Problem 1: Write the equation of a line in slope-intercept form with a slope of 2 and passing through the point (3, 5).

<p><math>m = 2</math></p> $y = mx + b$ $5 = 2(3) + b$ $5 = 6 + b$ $-6 \quad -6$ $-1 = b$ $y = 2x - 1$	<p><math>(3, 5)</math></p> <p>to graph/to write equation:</p> <p>① Find <math>m</math></p> <p>② Find <math>b</math></p>	$y - y_1 = m(x - x_1)$ $y - 5 = 2(x - 3)$ $y - 5 = 2x - 6$ $+5 \quad +5$ $y = 2x - 1$
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Problem 2: Find the equation of a line in slope-intercept form with a slope of  $-1/2$  and passing through the point  $(-4, 7)$ .

<p><math>m = -\frac{1}{2}</math></p> $y = mx + b$ $7 = -\frac{1}{2}(-4) + b$ $\frac{4}{2}$ $7 = 2 + b$ $-2 \quad -2$ $5 = b$ $y = -\frac{1}{2}x + 5$	<p><math>(-4, 7)</math></p>
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Topic 2: Writing the equation of a line through two given points

Problem 1: Write the equation of the line through the points (1, 2) and (3, 6) in slope-intercept form.

$(x_1, y_1)$   $(x_2, y_2)$   $y = mx + b$

$$M = \frac{y_2 - y_1}{x_2 - x_1} \quad (1, 2) \quad (3, 6)$$

$$\frac{6 - 2}{3 - 1} = \frac{4}{2} = \boxed{\frac{m}{2}}$$

$$y = mx + b$$

$$2 = 2(1) + b$$

$$2 = 2 + b$$

$$-2 = -2$$

$$\boxed{0 = b}$$

$$y = mx + b$$

$$\boxed{y = 2x}$$

Problem 2: Find the equation of the line through the points (-2, 3) and (4, -1) in slope-intercept form.

$$\textcircled{1} \text{ Find } m = \frac{y_2 - y_1}{x_2 - x_1} \quad (x_1, y_1) \quad (x_2, y_2)$$

$$\frac{-1 - 3}{4 - (-2)} = \frac{-4}{6} = \boxed{\frac{m}{-\frac{2}{3}}}$$

$$\textcircled{2} \text{ Find } b \quad y = mx + b$$

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

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

$$9 = -4 + 3b$$

$$+4 \quad +4$$

$$\frac{13}{3} = \frac{3b}{3}$$

$$\boxed{\frac{13}{3} = b}$$

$$\text{Multiply by LCD : 3}$$

$$y = mx + b$$

$$\boxed{y = -\frac{2}{3}x + \frac{13}{3}}$$

Topic 3: Writing the equation of a line given the y-intercept and another point

Problem 1: Write the equation of a line with y-intercept 4 and passing through the point (2, 8) in slope-intercept form.

$$\boxed{b = 4} \quad (x, y) \quad (2, 8)$$

$$y = mx + b$$

$$8 = m(2) + 4$$

$$-4 \quad -4$$

$$\frac{4}{2} = \frac{2m}{2}$$

$$\boxed{2 = m}$$

$$\boxed{y = 2x + 4}$$

Problem 2: Find the equation of a line with y-intercept -3 and passing through the point (1, -1) in slope-intercept form.

$$\boxed{b = -3} \quad (x, y) \quad (1, -1)$$

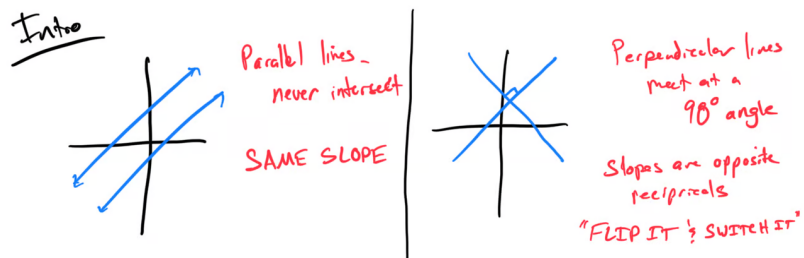
$$y = mx + b$$

$$-1 = m(1) - 3$$

$$+3 \quad +3$$

$$\boxed{2 = m}$$

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



Topic 4: Finding slopes of lines parallel and perpendicular to a line given in slope-intercept form

Problem 1: Find the slopes of lines parallel and perpendicular to  $y = 3x + 2$ .

$$y = 3x + 2$$

original slope:  $3 = \frac{3}{1}$   
parallel slope:  $3$   
perpendicular slope:  $-\frac{1}{3}$

Problem 2: Determine the slopes of lines parallel and perpendicular to  $y = (-\frac{1}{2})x - 5$ .

$$y = -\frac{1}{2}x - 5$$

original slope:  $-\frac{1}{2}$   
parallel slope:  $-\frac{1}{2}$   
perpendicular slope:  $\frac{2}{1} = 2$

Topic 5: Finding slopes of lines parallel and perpendicular to a line given in the form  $Ax + By = C$

Problem 1: Find the slopes of lines parallel and perpendicular to  $2x - 3y = 6$ .

$$\begin{array}{rcl} 2x - 3y & = & 6 \\ -2x & & -2x \\ \hline -3y & = & -2x + 6 \\ -3 & & -3 \\ \hline y & = & \frac{2}{3}x - 2 \end{array}$$

original slope:  $\frac{2}{3}$   
parallel slope:  $\frac{2}{3}$   
perpendicular slope:  $-\frac{3}{2}$

Problem 2: Determine the slopes of lines parallel and perpendicular to  $4x + 5y = 10$ .

$$\begin{array}{rcl} 4x + 5y & = & 10 \\ -4x & & -4x \\ \hline 5y & = & -4x + 10 \\ 5 & & 5 \\ \hline y & = & -\frac{4}{5}x + 2 \end{array}$$

original slope:  $-\frac{4}{5}$   
parallel slope:  $-\frac{4}{5}$   
perpendicular slope:  $\frac{5}{4}$

Topic 6: Identifying parallel and perpendicular lines from equations

Problem 1: Determine if the lines  $y = 2x + 1$  and  $2x - y = 3$  are parallel, perpendicular,

or neither.

$$\begin{array}{l}
 y = 2x + 1 \\
 m = 2
 \end{array}
 \qquad
 \begin{array}{l}
 2x - y = 3 \\
 -2x \quad -2x \\
 \hline
 -y = -2x + 3 \\
 \hline
 y = 2x - 3 \\
 m = 2
 \end{array}
 \qquad
 \begin{array}{c}
 \text{Parallel} \\
 \text{same slope}
 \end{array}$$

Problem 2: Are the lines  $y = (-1/3)x + 4$  and  $3x - y = 2$  parallel, perpendicular, or neither?

$$\begin{array}{l}
 y = -\frac{1}{3}x + 4 \\
 m = -\frac{1}{3}
 \end{array}
 \qquad
 \begin{array}{l}
 3x - y = 2 \\
 -3x \quad -3x \\
 \hline
 -y = -3x + 2 \\
 \hline
 y = 3x - 2 \\
 m = 3 = \frac{3}{1}
 \end{array}
 \qquad
 \begin{array}{c}
 \text{Perpendicular} \\
 \text{"Flip it ; Switch it"}
 \end{array}$$

Topic 7: Writing equations of lines parallel and perpendicular to a given line through a point

Problem 1: Write the equations of lines perpendicular to  $y = 4x - 1$  passing through  $(2, 3)$  in slope-intercept form.

$$\begin{array}{l}
 y = 4x - 1 \quad (x, y) \\
 \text{original slope: } 4 = \frac{4}{1} \\
 \text{perpendicular slope: } -\frac{1}{4}
 \end{array}
 \qquad
 \begin{array}{l}
 y = mx + b \\
 3 = -\frac{1}{4}(\frac{2}{1}) + b \\
 \frac{-2}{4} \\
 2 \quad 3 = -\frac{1}{2} + b \\
 6 = -1 + 2b \\
 \frac{7}{2} = \frac{2b}{2} \\
 \frac{7}{2} = b
 \end{array}$$

$$\boxed{y = -\frac{1}{4}x + \frac{7}{2}}$$

Problem 2: Find the equations of lines parallel to  $3x + 2y = 6$  passing through  $(-1, 5)$  in slope-intercept form.

$$\begin{array}{l}
 3x + 2y = 6 \quad (x, y) \\
 -3x \quad -3x \\
 \hline
 2y = -3x + 6 \\
 \hline
 y = -\frac{3}{2}x + 3
 \end{array}
 \qquad
 \begin{array}{l}
 y = mx + b \\
 5 = -\frac{3}{2}(-1) + b \\
 2 \quad 5 = \frac{3}{2} + b \\
 10 = 3 + 2b \\
 -3 \quad -3 \\
 7 = 2b \\
 \frac{7}{2} = \frac{2b}{2} \\
 \frac{7}{2} = b
 \end{array}$$

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

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