Definitions:

- **Slope:** of a line tells how fast y changes for each unit of change in x.
- **Linear equation in two variables:** is an equation that can be written as

$$ax + by = c$$

where a, b, and c are real numbers and a and b cannot both be zero.

Important Formulas:

- **Slope formula:** The slope of the line through the points (x_1, y_1) and (x_2, y_2) is given by

$$\boxed{m = \frac{y_1 - y_2}{x_1 - x_2} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{change in } y}{\text{change in } x} = \frac{\text{rise}}{\text{run}}}$$

Note that it does not matter if you start with y_1 or y_2. However, you must start with its corresponding x in the denominator.

- **Slope-intercept form:** The slope-intercept form of an equation with slope m and $y-$intercept b is given by

$$\boxed{y = mx + b.}$$

- **Point-slope formula:** The equation of the line with slope m and passing through (x_1, y_1) can be found using

$$\boxed{y - y_1 = m(x - x_1).}$$

Common Mistakes to Avoid:

- When identifying the slope and $y-$intercept using the slope-intercept form, remember to divide each term by the coefficient on y. The slope and $y-$intercept can only be identified once you have isolated y.
- Remember that the change in y is in the numerator of the slope formula. DO NOT place it in the denominator.

PROBLEMS

1. **Identify the slope and the $y-$intercept of each line.**

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

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

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

$$\boxed{y - \text{intercept} = (0, -3)}$$

(b) $5x + 10y = -3$

$$\begin{aligned} 5x + 10y &= -3 \\ 10y &= -5x - 3 \\ y &= -\frac{5}{10}x - \frac{3}{10} \\ y &= -\frac{1}{2}x - \frac{3}{10} \end{aligned}$$

$$\boxed{m = -\frac{1}{2}}$$

$$\boxed{y - \text{intercept} = \left(0, -\frac{3}{10}\right)}$$

2. **Find the slope of the line passing through $(-1, 3)$ and $(5, -2)$.**

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ m &= \frac{-2 - 3}{5 - (-1)} \\ m &= -\frac{5}{6} \end{aligned}$$

$$\boxed{m = -\frac{5}{6}}$$

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3. **Find the slope of the line passing through $(-9, 2)$ and $(-5, 5)$.**

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ m &= \frac{5 - 2}{-5 - (-9)} \\ m &= \frac{3}{4} \end{aligned}$$

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

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4. **Find the equation of the line with slope $m = -3$ and passes through $(5, -2)$.**

$$\begin{aligned} y - y_1 &= m(x - x_1) \\ y - (-2) &= -3(x - 5) \\ y + 2 &= -3x + 15 \\ y &= -3x + 13 \end{aligned}$$

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

5. **Find the equation of the line with $m = \frac{3}{4}$ and passing through $(-1, 2)$.**

$$
\begin{aligned}
y - y_1 &= m(x - x_1) \\
y - 2 &= \frac{3}{4}(x - (-1)) \\
y - 2 &= \frac{3}{4}x + \frac{3}{4} \\
y &= \frac{3}{4}x + \frac{11}{4}
\end{aligned}
$$

$$\boxed{y = \frac{3}{4}x + \frac{11}{4}}$$

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6. **Find the equation of the line passing through $(-2, 3)$ and $(4, -5)$.**

NOTE: First, we must find the slope of the line.

$$m = \frac{-5 - 3}{4 - (-2)} = \frac{-8}{6} = \frac{-4}{3}$$

$$
\begin{aligned}
y - y_1 &= m(x - x_1) \\
y - 3 &= -\frac{4}{3}(x - (-2)) \\
y - 3 &= -\frac{4}{3}x - \frac{8}{3} \\
y &= \frac{4}{3} + \frac{1}{3}
\end{aligned}
$$

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

7. **Find the equation of the line passing through $(-7, 2)$ and has a $y-$intercept at 3.**

NOTE: First, we must find the slope of the line. Remember that a $y-$intercept at 3 translates to the ordered pair $(0, 3)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 3}{-7 - 0} = \frac{-1}{-7} = \frac{1}{7}$$

$$
\begin{aligned}
y &= mx + b \\
y &= \frac{1}{7}x + 3
\end{aligned}
$$

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

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8. **Find the equation of the line which has an $x-$intercept at -2 and a $y-$intercept at 4.**

NOTE: This means that the line passes through $(-2, 0)$ and $(0, 4)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 0}{0 - (-2)} = \frac{4}{2} = 2$$

$$
\begin{aligned}
y &= mx + b \\
y &= 2x + 4
\end{aligned}
$$

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

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9. **Find the equation of the line passing through $(-7, 2)$ and has an $x-$intercept at 3.**

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 0}{-7 - 3} = \frac{2}{-10} = -\frac{1}{5}$$

$$
\begin{aligned}
y - 0 &= -\frac{1}{5}(x - 3) \\
y &= -\frac{1}{5}x + \frac{3}{5}
\end{aligned}
$$

$$\boxed{y = -\frac{1}{5}x + \frac{3}{5}}$$