THEORETICAL PART:

Definition:

Let L stand for a given line in the Cartesian plane, and let (x_1, y_1) and (x_2, y_2) be the coordinates of two distinct points on L. The slope of the line L is the ratio

$$m = \frac{y_2 - y_1}{x_2 - x_1},$$

which can be described in words as "change in y over change in x" or "rise over run".

Caution.

Correct:

$$\frac{y_2 - y_1}{x_2 - x_1} \quad \textbf{or} \quad \frac{y_1 - y_2}{x_1 - x_2}$$

Incorrect:

$$\frac{y_1 - y_2}{x_2 - x_1} \quad \textbf{or} \quad \frac{y_2 - y_1}{x_1 - x_2}$$

Properties:

- **Horizontal lines**, which can be written in the form $y = c$, have a **slope of** 0.
- **Vertical lines**, which can be written in the form $x = c$, have an **undefined slope**.

Definition (Slope-Intercept Form).

If the equation of the nonvertical line in x and y is solved for y, the result is an equation in **slope-intercept form**:

$$y = mx + b.$$

The constant m is the slope of the line, and the y-intercept of the line is $(0, b)$.

Definition (Point-Slope Form).

The **point-slope form** of the equation for the line passing trough the point (x_1, y_1) with slope m is

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

Note, that m, x_1 and y_1 are all constants.

Definition (Standard Form).

The **standard form** for the line L is the following form:

$$ax + by = c.$$

PRACTICAL PART:

1. Determine the slopes of the lines passing through the following pairs of points in $\mathbb{R}^2$:

(a) $(-4, -3)$ and $(2, -5)$

(b) $\left(\frac{3}{2}, 1\right)$ and $\left(1, -\frac{4}{3}\right)$

2. Determine the slopes of the lines defined by the following equations:

   (a) $4x - 3y = 12$

   (b) $x = -\frac{3}{4}$

   (c) $y = 9$

3. Use the slope-intercept form of the line to graph the equation $4x - 3y = 6$.

4. Find the equation of the line that passes through the point $(0, 3)$ and has a slope of $-\frac{3}{5}$. Then graph the line.

5. Find the equation, in slope-intercept form, of the line that passes through the point $(-2, 5)$ and has a slope 3.

6. Find the equation, in slope-intercept form, of the line that passes through the two points $(-3,-2)$ and $(1,6)$.