

Introduction to Slope and Linear Relationships

Name: _____

Date: _____

Score: _____ / 18

The **slope** of a line tells you its steepness and direction—how much the line rises or falls for every unit you move to the right. You calculate it as $m = \frac{\text{rise}}{\text{run}}$, the change in y divided by the change in x between any two points. A positive slope means the line climbs, a negative slope means it drops, zero gives a flat horizontal line, and an undefined slope gives a vertical one. A **linear relationship** graphs as a straight line whose equation can be written $y = mx + b$, where m is the slope and b is the y -intercept—the point where the line crosses the y -axis. Understand slope now and you will have the foundation for graphing, writing equations, and studying functions in algebra and beyond!



Key Concepts & Quick Review

Slope Formula:

$$m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

- **Positive slope** — line goes *up* from left to right.
- **Negative slope** — line goes *down* from left to right.
- **Zero slope** — horizontal line (y does not change).
- **Undefined slope** — vertical line (x does not change).

Slope-intercept form: $y = mx + b$, where m is the slope and b is the y -intercept (where the line crosses the y -axis).



Examples

① Find the slope of the line passing through (1, 2) and (4, 8).

Think It Through: $m = \frac{8-2}{4-1} = \frac{6}{3} = 2$. The line rises 2 units for every 1 unit to the right.

Answer: $m = 2$

② A line has the equation $y = -3x + 5$. What are the slope and y -intercept?

Think It Through: The equation is already in slope-intercept form $y = mx + b$. So $m = -3$ (the line goes down) and $b = 5$ (crosses the y -axis at (0, 5)).

Answer: slope = -3 , y -intercept = 5

Practice Problems

Find the slope of the line through each pair of points.

- Find the slope of the line through (2, 3) _____ and (5, 9).
- Find the slope of the line through (0, 4) _____ and (3, 1).
- Find the slope of the line through (1, -2) _____ and (4, 7).
- Find the slope of the line through (-3, 5) _____ and (1, 5).
- Find the slope of the line through (6, 2) _____ and (6, 8).
- Find the slope of the line through (0, 0) _____ and (4, 10).
- Find the slope of the line through (-1, 3) _____ and (2, -3).
- Find the slope of the line through (3, 7) _____ and (5, 11).
- Find the slope of the line through (4, -1) _____ and (8, 3).
- Find the slope of the line through (-2, -4) and (1, 5).
- Find the slope m of the line $y = 4x - 7$.

- Find the slope m of the line $y = -\frac{1}{2}x + 3$.

- Find the slope m of the line $y = x + 6$.

- Find the slope m of the line $y = -5x$.

- Find the y -intercept b of the line $y = \frac{2}{3}x - 1$.

Study Tips

- Remember: **rise over run**. Rise is the vertical change (y) and run is the horizontal change (x).
- A **steeper** line has a slope with a larger absolute value. A slope of 5 is steeper than a slope of 2.
- If two points have the **same x -value**, the slope is undefined (you would divide by zero).



 **Word Problems**

16. A plant is 3 *cm* tall on Day 1 and 15 *cm* tall on Day 7. If the growth is linear, what is the rate of growth (slope) in *cm* per day? _____

17. A phone plan charges a \$10 monthly fee plus \$0.05 per text message. Write an equation for the total monthly cost *y* in terms of the number of texts *x*. Then find the cost for 200 texts. _____

18. Use the line graphed here to find the slope of the line, identify the *y*-intercept, and write the equation in the form $y = mx + b$.





Answer Keys

- | | |
|------------------|--|
| 1) 2 | 10) 3 |
| 2) -1 | 11) 4 |
| 3) 3 | 12) $-\frac{1}{2}$ |
| 4) 0 | 13) 1 |
| 5) undefined | 14) -5 |
| 6) $\frac{5}{2}$ | 15) -1 |
| 7) -2 | 16) 2 cm per day |
| 8) 2 | 17) $y = 0.05x + 10$; for 200 texts the cost is \$20. |
| 9) 1 | 18) $m = \frac{1}{2}$; $b = 1$; $y = \frac{1}{2}x + 1$ |

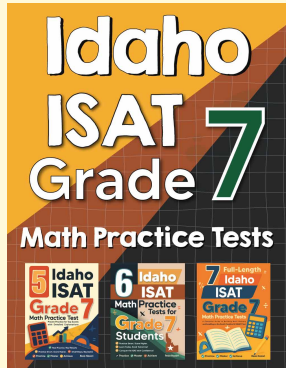
Step-by-Step Explanations

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