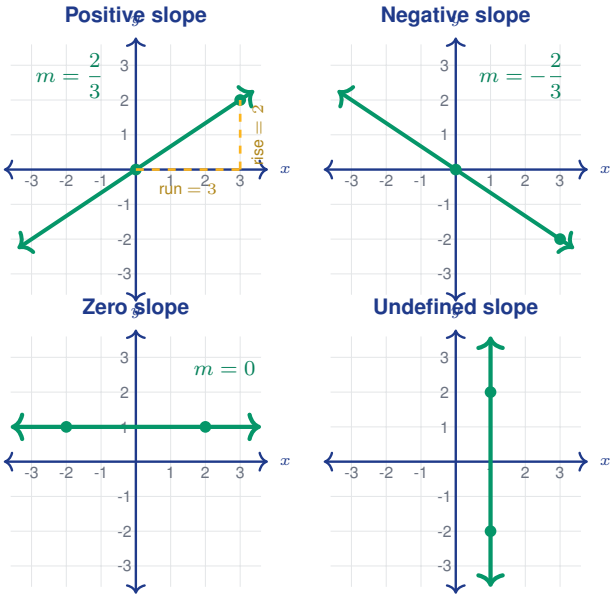
Introduction to Slope and Linear Relationships

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.

1. Find the slope of the line through $(2, 3)$ and $(5, 9)$. _____
2. Find the slope of the line through $(0, 4)$ and $(3, 1)$. _____
3. Find the slope of the line through $(1, -2)$ and $(4, 7)$. _____
4. Find the slope of the line through $(-3, 5)$ and $(1, 5)$. _____
5. Find the slope of the line through $(6, 2)$ and $(6, 8)$. _____
6. Find the slope of the line through $(0, 0)$ and $(4, 10)$. _____
7. Find the slope of the line through $(-1, 3)$ and $(2, -3)$. _____
8. Find the slope of the line through $(3, 7)$ and $(5, 11)$. _____
9. Find the slope of the line through $(4, -1)$ and $(8, 3)$. _____
10. Find the slope of the line through $(-2, -4)$ and $(1, 5)$. _____
11. Find the slope m of the line $y = 4x - 7$. _____
12. Find the slope m of the line $y = -\frac{1}{2}x + 3$. _____
13. Find the slope m of the line $y = x + 6$. _____
14. Find the slope m of the line $y = -5x$. _____
15. 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

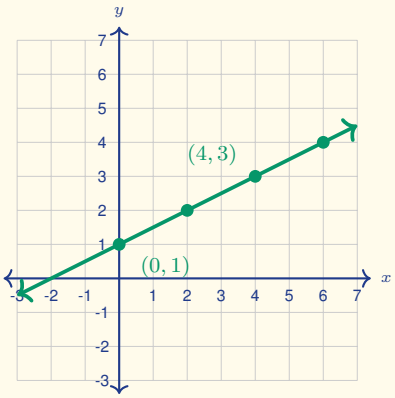
16. A plant is $3\ cm$ tall on Day 1 and $15\ cm$ tall on Day 7. If the growth is linear, what is the rate of growth (slope) in cm per day?

_____

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

Step-by-Step Explanations

Tutoring notes not found for this topic.

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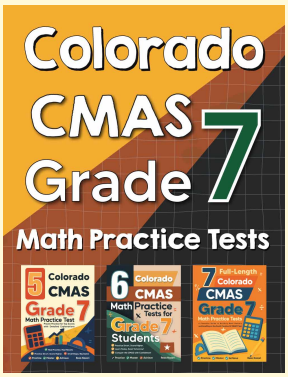

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