

Slope and Rate of Change

Name: _____

Date: _____

Score: _____ / 26

Q Quick Review

Slope measures how steep a line is — how much y changes for every 1 unit of x . The formula: $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}}$. Positive slope goes *up* left-to-right; negative slope goes *down*; zero slope is *horizontal*; undefined slope is *vertical* (you'd be dividing by zero). Slope is the same as **rate of change** — in a word problem, “\$5 per hour” is a slope of 5 (dollars per hour). The trick when computing: keep the order of subtraction consistent. If y_2 comes from the second point on top, x_2 must come from the second point on bottom.

PRACTICE

Find the slope.

- | | | | |
|----------------------|-------|---|-------|
| 1. (1, 2), (3, 8) | _____ | 11. (2, 3), (2, 9) | _____ |
| 2. (0, 5), (4, 13) | _____ | 12. (-1, -3), (2, 3) | _____ |
| 3. (-1, 4), (2, -2) | _____ | 13. Rise 10, run 4 | _____ |
| 4. (3, 7), (3, -1) | _____ | 14. Up 6, right 3 | _____ |
| 5. (-2, 5), (4, 5) | _____ | 15. (7, 2), (10, 11) | _____ |
| 6. (0, 0), (5, 15) | _____ | 16. Table: $x = 1 \rightarrow y = 5$, $x = 3 \rightarrow y = 11$ | _____ |
| 7. (1, 1), (4, 7) | _____ | 17. (0, 8), (4, 0) | _____ |
| 8. (-3, -2), (1, 6) | _____ | 18. (-4, 1), (4, 5) | _____ |
| 9. (5, -1), (2, 8) | _____ | 19. (6, -2), (9, -2) | _____ |
| 10. (0, -4), (6, -4) | _____ | 20. (1, 10), (5, 2) | _____ |

◆ VISUAL PRACTICE

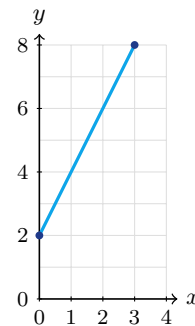
Use the graph, table, chart, or diagram to answer the question.

21. Use the table to find the rate of change.

hours	0	1	2	3
miles	0	3	6	9

Answer: _____

22. Find the rate of change of the graphed line.



Answer: _____



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◆ Word Problems

23. A car drives 180 miles in 3 hours at a steady speed. What's the speed (slope)?

Model: _____

Answer: _____

24. A science class measures a plant and finds that it grew 2 cm over 5 days. What is the plant's average growth rate in centimeters per day?

Model: _____

Answer: _____

25. A pool starts with 1000 gal and drops to 760 gal after 4 hours of draining. Find the drain rate.

Model: _____

Answer: _____

26. A roof rises 4 feet over a horizontal run of 12 feet. Find the slope of the roof and connect it to the roof's pitch.

Model: _____

Answer: _____



Answer Keys

- | | |
|--|---|
| 1. <input type="text" value="3"/> | 14. <input type="text" value="2"/> |
| 2. <input type="text" value="2"/> | 15. <input type="text" value="3"/> |
| 3. <input type="text" value="-2"/> | 16. <input type="text" value="3"/> |
| 4. <input type="text" value="undefined"/> | 17. <input type="text" value="-2"/> |
| 5. <input type="text" value="0"/> | 18. <input type="text" value="1/2"/> |
| 6. <input type="text" value="3"/> | 19. <input type="text" value="0"/> |
| 7. <input type="text" value="2"/> | 20. <input type="text" value="-2"/> |
| 8. <input type="text" value="2"/> | 21. <input type="text" value="3 miles per hour"/> |
| 9. <input type="text" value="-3"/> | 22. <input type="text" value="2"/> |
| 10. <input type="text" value="0"/> | 23. <input type="text" value="60 mph"/> |
| 11. <input type="text" value="undefined"/> | 24. <input type="text" value="0.4 cm/day"/> |
| 12. <input type="text" value="2"/> | 25. <input type="text" value="-60 gallons per hour"/> |
| 13. <input type="text" value="5/2"/> | 26. <input type="text" value="1/3"/> |

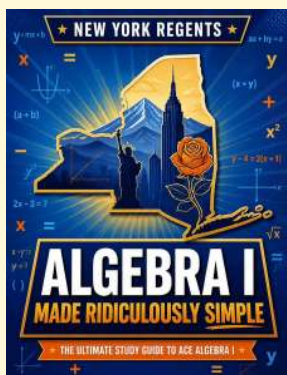
Step-by-Step Tutor Notes

1. Use the clue in the question first, then let the arithmetic finish the job.
 $m = \frac{8-2}{3-1} = \frac{6}{2} = 3$. So the answer is 3.
2. Focus on the main idea of the problem, then simplify carefully. $m = \frac{13-5}{4-0} = \frac{8}{4} = 2$. So the answer is 2.
3. Line up the two changes first; that keeps the rate from getting mixed up.
 $m = \frac{2-4}{2-(-1)} = \frac{-6}{3} = -2$. Going down — negative slope. So the requested value is -2 .
4. Compare the change in output to the change in input, because slope is a rate of change. x doesn't change, so the denominator is 0. Vertical line — slope is undefined. So the requested value is undefined.
5. Compare the change in output to the change in input, because slope is a rate of change. y doesn't change. Horizontal line — slope is 0. So the requested value is 0.
6. Line up the two changes first; that keeps the rate from getting mixed up.
 $m = \frac{15-0}{5-0} = 3$. Lines through the origin: slope is just y/x . So the requested value is 3.
7. Take it one clear step at a time and keep the original question in mind.
 $m = \frac{7-1}{4-1} = \frac{6}{3} = 2$. So the answer is 2.
8. Start with the definition the problem is testing, then apply it directly. $m = \frac{6-(-2)}{1-(-3)} = \frac{8}{4} = 2$. So the answer is 2.
9. This is a good place to slow down, check the notation, and simplify cleanly.
 $m = \frac{8-(-1)}{2-5} = \frac{9}{-3} = -3$. Watch the signs. So the answer is -3 .
10. Compare the change in output to the change in input, because slope is a rate of change. Same y — horizontal line, slope 0. So the requested value is 0.
11. Line up the two changes first; that keeps the rate from getting mixed up. Same x — vertical line, slope undefined. So the requested value is undefined.
12. This is a good place to slow down, check the notation, and simplify cleanly.
 $m = \frac{3-(-3)}{2-(-1)} = \frac{6}{3} = 2$. So the answer is 2.
13. Compare the change in output to the change in input, because slope is a rate of change. Slope = rise/run = $\frac{10}{4} = \frac{5}{2}$. So the requested value is $\frac{5}{2}$.
14. Start with the definition the problem is testing, then apply it directly. $\frac{6}{3} = 2$. So the answer is 2.
15. Take it one clear step at a time and keep the original question in mind.
 $m = \frac{11-2}{10-7} = \frac{9}{3} = 3$. So the answer is 3.
16. Use the clue in the question first, then let the arithmetic finish the job.
 $\frac{11-5}{3-1} = \frac{6}{2} = 3$. So the answer is 3.
17. This is a good place to slow down, check the notation, and simplify cleanly.
 $m = \frac{0-8}{4-0} = -2$. Falling line. So the answer is -2 .
18. Line up the two changes first; that keeps the rate from getting mixed up.
 $m = \frac{5-1}{4-(-4)} = \frac{4}{8} = \frac{1}{2}$. Gentle slope. So the requested value is $\frac{1}{2}$.
19. Think of slope as the amount the output changes for each 1-unit change in the input. Horizontal — y stays at -2 , so slope is 0. So the requested value is 0.
20. Use the clue in the question first, then let the arithmetic finish the job.
 $m = \frac{2-10}{5-1} = \frac{-8}{4} = -2$. So the answer is -2 .
21. Line up the two changes first; that keeps the rate from getting mixed up. The miles increase by 3 each hour, so the rate is 3 miles per hour. So the requested value is 3 miles per hour.
22. Think of slope as the amount the output changes for each 1-unit change in the input. The line rises 6 while running 3, so the rate is $6/3 = 2$. So the requested value is 2.
23. Rate = distance/time = $\frac{180}{3} = 60$ mph. That's the slope of the (time, distance) line.
24. $\frac{2}{5} = 0.4$ cm per day. That's the slope of the (days, height) line.
25. Change: $760 - 1000 = -240$ gal over 4 hours. Rate = $\frac{-240}{4} = -60$ gallons per hour. Negative because the volume is decreasing.
26. Line up the two changes first; that keeps the rate from getting mixed up. Slope = $\frac{4}{12} = \frac{1}{3}$. Roofers call this a 4:12 pitch. So the requested value is $\frac{1}{3}$.



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