

Slope as a Rate of Change

Name: _____ Date: _____ Score: _____ / 24

Q Quick Review

Slope measures how steep a line is — how fast y changes as x changes. We find it with the formula $m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$, the change in y divided by the change in x . A *positive* slope climbs to the right; a *negative* slope falls. A **horizontal** line has slope 0, and a **vertical** line has an undefined slope. In real life, slope is a **rate of change** — like miles per hour or dollars per day.

◇ **Example:** Find the slope of the line through (2, 3) and (6, 11).
 ⇒ Slope is just rise over run, so we track how much y and x each change between the two points. The change in y is $11 - 3 = 8$ (that's the rise), and the change in x is $6 - 2 = 4$ (that's the run). Now divide: $m = \frac{8}{4} = 2$. A slope of 2 means every time x goes up by 1, y goes up by 2. Tip: pick a starting point and subtract in the *same order* for both top and bottom.

Answer: $m = 2$

PRACTICE

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

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| 1. (0, 0) and (1, 5) _____ | 11. (-2, -3) and (2, 5) _____ |
| 2. (1, 2) and (3, 8) _____ | 12. (0, 0) and (6, 4) _____ |
| 3. (2, 1) and (5, 7) _____ | 13. (1, 1) and (5, 3) _____ |
| 4. (0, 4) and (4, 12) _____ | 14. (2, 7) and (8, 4) _____ |
| 5. (1, 1) and (4, 10) _____ | 15. (-3, 4) and (3, 4) _____ |
| 6. (3, 5) and (7, 5) _____ | 16. (5, -2) and (5, 9) _____ |
| 7. (2, 8) and (2, 1) _____ | 17. (-4, 1) and (0, 9) _____ |
| 8. (0, 6) and (3, 0) _____ | 18. (1, -5) and (4, 4) _____ |
| 9. (1, 9) and (4, 3) _____ | 19. (0, 10) and (5, 0) _____ |
| 10. (-1, 2) and (3, 10) _____ | 20. (-2, 6) and (4, -3) _____ |

◆ Word Problems

21. A plant was 4 cm tall on day 2 and 16 cm tall on day 8. Find the growth rate (slope) in centimeters per day. _____
22. A candle is 20 cm tall after burning for 1 hour and 8 cm tall after 5 hours. Find the slope and explain what it means. _____
23. A taxi charges a flat fee plus a per-mile rate. The total is \$8 at 2 miles and \$20 at 8 miles. Find the per-mile rate (slope). _____
24. A savings account had \$150 in week 0 and \$390 in week 8, growing by the same amount each week. Find the weekly savings rate. _____



Answer Keys

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| 1. $m = 5$ | 13. $m = \frac{1}{2}$ |
| 2. $m = 3$ | 14. $m = -\frac{1}{2}$ |
| 3. $m = 2$ | 15. $m = 0$ |
| 4. $m = 2$ | 16. undefined |
| 5. $m = 3$ | 17. $m = 2$ |
| 6. $m = 0$ | 18. $m = 3$ |
| 7. undefined | 19. $m = -2$ |
| 8. $m = -2$ | 20. $m = -\frac{3}{2}$ |
| 9. $m = -2$ | 21. 2 cm per day |
| 10. $m = 2$ | 22. $m = -3$ cm per hour |
| 11. $m = 2$ | 23. \$2 per mile |
| 12. $m = \frac{2}{3}$ | 24. \$30 per week |

Step-by-Step Explanations

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| <p>1. Rise = $5 - 0 = 5$, run = $1 - 0 = 1$, so $m = \frac{5}{1} = 5$.</p> <p>2. Rise = $8 - 2 = 6$, run = $3 - 1 = 2$, so $m = \frac{6}{2} = 3$.</p> <p>3. Rise = $7 - 1 = 6$, run = $5 - 2 = 3$, so $m = \frac{6}{3} = 2$.</p> <p>4. Rise = $12 - 4 = 8$, run = $4 - 0 = 4$, so $m = 2$.</p> <p>5. Rise = $10 - 1 = 9$, run = $4 - 1 = 3$, so $m = 3$.</p> <p>6. The y-values are equal, so rise = 0. A flat line has slope 0.</p> <p>7. The x-values are equal, so the run is 0. Dividing by 0 is undefined.</p> <p>8. Rise = $0 - 6 = -6$, run = $3 - 0 = 3$, so $m = -2$ (line falls).</p> <p>9. Rise = $3 - 9 = -6$, run = $4 - 1 = 3$, so $m = -2$.</p> <p>10. Rise = $10 - 2 = 8$, run = $3 - (-1) = 4$, so $m = 2$.</p> <p>11. Rise = $5 - (-3) = 8$, run = $2 - (-2) = 4$, so $m = 2$.</p> <p>12. Rise = 4, run = 6, so $m = \frac{4}{6} = \frac{2}{3}$.</p> <p>13. Rise = $3 - 1 = 2$, run = $5 - 1 = 4$, so $m = \frac{2}{4} = \frac{1}{2}$.</p> <p>14. Rise = $4 - 7 = -3$, run = $8 - 2 = 6$, so $m = -\frac{1}{2}$.</p> | <p>15. Same y-value both times, so rise = 0 and $m = 0$.</p> <p>16. Same x-value means run = 0; the slope is undefined (vertical).</p> <p>17. Rise = $9 - 1 = 8$, run = $0 - (-4) = 4$, so $m = 2$.</p> <p>18. Rise = $4 - (-5) = 9$, run = $4 - 1 = 3$, so $m = 3$.</p> <p>19. Rise = $0 - 10 = -10$, run = $5 - 0 = 5$, so $m = -2$.</p> <p>20. Rise = $-3 - 6 = -9$, run = $4 - (-2) = 6$, so $m = -\frac{9}{6} = -\frac{3}{2}$.</p> <p>21. Rise = $16 - 4 = 12$ cm, run = $8 - 2 = 6$ days, so the rate is $\frac{12}{6} = 2$ cm per day.</p> <p>22. Rise = $8 - 20 = -12$, run = $5 - 1 = 4$, so $m = -3$. The candle shortens by 3 cm each hour.</p> <p>23. Rise = $20 - 8 = 12$ dollars, run = $8 - 2 = 6$ miles, so the rate is $\frac{12}{6} = \\$2$ per mile.</p> <p>24. Rise = $390 - 150 = 240$ dollars, run = $8 - 0 = 8$ weeks, so $\frac{240}{8} = \\$30$ per week.</p> |
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