

Using a Linear Model

Name: _____

Date: _____

Score: _____ / 24

Q Quick Review

Once you have a linear model $y = mx + b$ for real data, you can use it to make predictions and interpret it. To **predict**, substitute a value of x and compute y . The **slope** m is a *rate*: it tells how much y changes for each 1-unit increase in x (and its sign tells the direction). The **y -intercept** b is the *starting value* of y when $x = 0$. Always keep the real-world units in mind — a slope might be “dollars per hour” or “cm per week.” Predictions inside the data range are usually trustworthy; far outside it, be cautious.

◇ **Example:** A pool is filling by the model $y = 15x + 40$, where x is minutes and y is gallons. Interpret the slope and intercept, and predict the water after 20 minutes.

⇒ Let's read the model like a sentence. The slope is 15, so the pool gains 15 **gallons every minute** — that is the filling rate. The intercept is 40, so when $x = 0$ (before we start timing) there were already 40 **gallons** in the pool. To predict the water after 20 minutes, substitute $x = 20$: $y = 15(20) + 40 = 300 + 40 = 340$. So we expect about 340 gallons.

Answer: slope = 15 gal/min, intercept = 40 gal; $y = 340$

PRACTICE

Use each linear model to predict or interpret. Show your substitution.

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|--|-------|--|-------|
| 1. $y = 3x + 2$, find y when $x = 10$ | _____ | 11. $y = 2x + 1$, find x when $y = 15$ | _____ |
| 2. $y = 5x + 3$, find y when $x = 6$ | _____ | 12. $y = 3x - 5$, find x when $y = 16$ | _____ |
| 3. $y = 2x + 1$, find y when $x = 8$ | _____ | 13. $y = -x + 12$, find x when $y = 4$ | _____ |
| 4. $y = -2x + 20$, find y when $x = 7$ | _____ | 14. In $y = 8x + 50$, what does the slope 8 mean? | _____ |
| 5. $y = 4x - 1$, find y when $x = 9$ | _____ | 15. In $y = 8x + 50$, what does 50 mean? | _____ |
| 6. $y = 10x$, find y when $x = 12$ | _____ | 16. $y = 1.5x + 2$, find y when $x = 10$ | _____ |
| 7. $y = 6x + 5$, find y when $x = 0$ | _____ | 17. $y = -4x + 100$, find y when $x = 15$ | _____ |
| 8. $y = -3x + 30$, find y when $x = 10$ | _____ | 18. $y = 5x + 3$, find x when $y = 28$ | _____ |
| 9. $y = 7x + 4$, find y when $x = 5$ | _____ | 19. $y = 12x + 60$, find y when $x = 4$ | _____ |
| 10. $y = \frac{1}{2}x + 6$, find y when $x = 8$ | _____ | 20. $y = -2x + 9$, find x when $y = 1$ | _____ |

◆ Word Problems

21. A plumber charges by $y = 45x + 60$, where x is hours and y is dollars. What does each number mean, and what is the cost of a 3-hour job? _____
22. A snowpack melts by $y = -3x + 48$, where x is days and y is depth in inches. After how many days will the snow be gone? _____
23. A reading app models pages read as $y = 25x + 10$, where x is days. Predict the total pages after 2 weeks. _____
24. A car's value follows $y = -1500x + 24000$, where x is years owned. In how many years will the car be worth \$9000? _____



Answer Keys

- | | |
|--|---|
| 1. <input type="text" value="32"/> | 13. <input type="text" value="x = 8"/> |
| 2. <input type="text" value="33"/> | 14. <input type="text" value="y rises 8 per unit x"/> |
| 3. <input type="text" value="17"/> | 15. <input type="text" value="starting value of y at x = 0"/> |
| 4. <input type="text" value="6"/> | 16. <input type="text" value="17"/> |
| 5. <input type="text" value="35"/> | 17. <input type="text" value="40"/> |
| 6. <input type="text" value="120"/> | 18. <input type="text" value="x = 5"/> |
| 7. <input type="text" value="5"/> | 19. <input type="text" value="108"/> |
| 8. <input type="text" value="0"/> | 20. <input type="text" value="x = 4"/> |
| 9. <input type="text" value="39"/> | 21. <input type="text" value="\$60 service fee, \$45 per hour; y = \$195"/> |
| 10. <input type="text" value="10"/> | 22. <input type="text" value="16 days"/> |
| 11. <input type="text" value="x = 7"/> | 23. <input type="text" value="360 pages"/> |
| 12. <input type="text" value="x = 7"/> | 24. <input type="text" value="10 years"/> |

Step-by-Step Explanations

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| <p>1. Substitute: $y = 3(10) + 2 = 30 + 2 = 32$.</p> <p>2. Substitute: $y = 5(6) + 3 = 30 + 3 = 33$.</p> <p>3. Substitute: $y = 2(8) + 1 = 16 + 1 = 17$.</p> <p>4. Substitute: $y = -2(7) + 20 = -14 + 20 = 6$.</p> <p>5. Substitute: $y = 4(9) - 1 = 36 - 1 = 35$.</p> <p>6. Substitute: $y = 10(12) = 120$.</p> <p>7. At $x = 0$, $y = 6(0) + 5 = 5$ — that is just the y-intercept.</p> <p>8. Substitute: $y = -3(10) + 30 = -30 + 30 = 0$.</p> <p>9. Substitute: $y = 7(5) + 4 = 35 + 4 = 39$.</p> <p>10. Substitute: $y = \frac{1}{2}(8) + 6 = 4 + 6 = 10$.</p> <p>11. Set $2x + 1 = 15$, so $2x = 14$ and $x = 7$.</p> <p>12. Set $3x - 5 = 16$, so $3x = 21$ and $x = 7$.</p> <p>13. Set $-x + 12 = 4$, so $-x = -8$ and $x = 8$.</p> <p>14. The slope is the rate of change: y goes up by 8 for every 1-unit increase in x.</p> | <p>15. The y-intercept 50 is the value of y when $x = 0$ — the starting amount.</p> <p>16. Substitute: $y = 1.5(10) + 2 = 15 + 2 = 17$.</p> <p>17. Substitute: $y = -4(15) + 100 = -60 + 100 = 40$.</p> <p>18. Set $5x + 3 = 28$, so $5x = 25$ and $x = 5$.</p> <p>19. Substitute: $y = 12(4) + 60 = 48 + 60 = 108$.</p> <p>20. Set $-2x + 9 = 1$, so $-2x = -8$ and $x = 4$.</p> <p>21. The intercept \$60 is a flat service fee charged before any work, and the slope \$45 is the hourly rate. For 3 hours: $y = 45(3) + 60 = 135 + 60 = 195$ dollars.</p> <p>22. The snow is gone when $y = 0$: set $-3x + 48 = 0$, so $3x = 48$ and $x = 16$ days. The slope -3 means it melts 3 inches per day.</p> <p>23. Two weeks is $x = 14$ days. Substitute: $y = 25(14) + 10 = 350 + 10 = 360$ pages. The slope 25 is pages per day.</p> <p>24. Set $-1500x + 24000 = 9000$, so $-1500x = -15000$ and $x = 10$ years. The slope -1500 means it loses \$1500 of value each year.</p> |
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