

Proportional vs. Non-Proportional Relationships

Name: _____ Date: _____ Score: _____ / 24

Q Quick Review

Two quantities have a **proportional relationship** when their ratio is always the *same* — in other words, $\frac{y}{x}$ gives a **constant** value for every pair. For example, (1, 3), (2, 6), (4, 12) are proportional because $\frac{3}{1} = \frac{6}{2} = \frac{12}{4} = 3$ every time. If the ratios are *not* all equal, the relationship is **non-proportional**. On a graph, proportional relationships form a straight line *through the origin* (0, 0). To test a table, just check whether every $\frac{y}{x}$ matches.

◊ **Example:** Is the relationship in this table proportional? (2, 6), (3, 9), (5, 15).

⇒ To test for a proportional relationship, find the ratio $\frac{y}{x}$ for every pair and see if they all match. For (2, 6): $\frac{6}{2} = 3$. For (3, 9): $\frac{9}{3} = 3$. For (5, 15): $\frac{15}{5} = 3$. Every ratio equals 3, so the quantities are proportional, with a constant ratio of 3.

Answer: Yes, proportional (constant ratio 3)

PRACTICE

Decide whether each relationship is proportional. Answer Yes or No.

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| 1. Pairs (1, 2), (2, 4), (3, 6) _____ | 11. Pairs (1, 6), (3, 18), (5, 30) _____ |
| 2. Pairs (1, 3), (2, 6), (4, 12) _____ | 12. Pairs (2, 3), (4, 6), (6, 10) _____ |
| 3. Pairs (1, 2), (2, 5), (3, 8) _____ | 13. Pairs (5, 10), (7, 14), (9, 18) _____ |
| 4. Pairs (2, 10), (3, 15), (4, 20) _____ | 14. Pairs (1, 0), (2, 1), (3, 2) _____ |
| 5. Pairs (1, 4), (2, 8), (5, 20) _____ | 15. Pairs (2, 8), (3, 12), (7, 28) _____ |
| 6. Pairs (1, 1), (2, 3), (3, 5) _____ | 16. Pairs (1, 7), (2, 14), (4, 28) _____ |
| 7. Pairs (3, 9), (5, 15), (6, 18) _____ | 17. Pairs (3, 3), (5, 7), (7, 11) _____ |
| 8. Pairs (2, 7), (4, 14), (6, 21) _____ | 18. Pairs (2, 12), (4, 24), (5, 30) _____ |
| 9. Pairs (1, 5), (2, 9), (3, 13) _____ | 19. Line through (0, 0) and (4, 12): proportional? _____ |
| 10. Pairs (4, 8), (6, 12), (10, 20) _____ | 20. Line through (0, 2) and (3, 8): proportional? _____ |

◆ Word Problems

21. A taxi charges \$2 per mile with no starting fee. The cost for 3 miles is \$6, for 5 miles is \$10, and for 8 miles is \$16. Is the cost proportional to the miles? _____
22. A gym charges a \$10 sign-up fee plus \$5 per month. The total for 1 month is \$15, for 2 months is \$20, and for 3 months is \$25. Is the total cost proportional to the months? _____
23. A recipe makes pancakes using 2 cups of mix for every batch. 1 batch uses 2 cups, 3 batches use 6 cups, and 5 batches use 10 cups. Is the amount of mix proportional to the number of batches? _____
24. A plant is 4 inches tall when measuring begins, then grows. After 1 week it is 6 inches, after 2 weeks 8 inches, and after 3 weeks 10 inches. Is the height proportional to the number of weeks? _____



Answer Keys

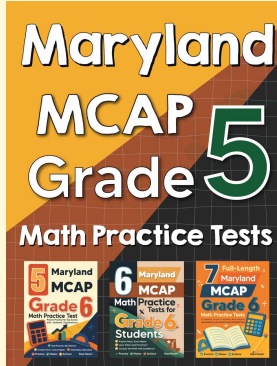
- | | |
|----------------------------------|---|
| 1. <input type="checkbox"/> Yes | 13. <input type="checkbox"/> Yes |
| 2. <input type="checkbox"/> Yes | 14. <input type="checkbox"/> No |
| 3. <input type="checkbox"/> No | 15. <input type="checkbox"/> Yes |
| 4. <input type="checkbox"/> Yes | 16. <input type="checkbox"/> Yes |
| 5. <input type="checkbox"/> Yes | 17. <input type="checkbox"/> No |
| 6. <input type="checkbox"/> No | 18. <input type="checkbox"/> Yes |
| 7. <input type="checkbox"/> Yes | 19. <input type="checkbox"/> Yes |
| 8. <input type="checkbox"/> Yes | 20. <input type="checkbox"/> No |
| 9. <input type="checkbox"/> No | 21. <input type="checkbox"/> Yes, proportional |
| 10. <input type="checkbox"/> Yes | 22. <input type="checkbox"/> No, non-proportional |
| 11. <input type="checkbox"/> Yes | 23. <input type="checkbox"/> Yes, proportional |
| 12. <input type="checkbox"/> No | 24. <input type="checkbox"/> No, non-proportional |

Step-by-Step Explanations

- | | |
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| <p>1. Each ratio $\frac{y}{x}$ equals 2, so it is proportional.</p> <p>2. Each ratio equals 3, so it is proportional.</p> <p>3. $\frac{2}{1} = 2$ but $\frac{5}{2} = 2.5$ — ratios differ, so no.</p> <p>4. Each ratio equals 5, so it is proportional.</p> <p>5. Each ratio equals 4, so it is proportional.</p> <p>6. $\frac{1}{1} = 1$ but $\frac{3}{2} = 1.5$ — ratios differ, so no.</p> <p>7. Each ratio equals 3, so it is proportional.</p> <p>8. Each ratio equals 3.5, so it is proportional.</p> <p>9. $\frac{5}{1} = 5$ but $\frac{9}{2} = 4.5$ — ratios differ, so no.</p> <p>10. Each ratio equals 2, so it is proportional.</p> <p>11. Each ratio equals 6, so it is proportional.</p> <p>12. $\frac{3}{2} = 1.5$ but $\frac{10}{6} \approx 1.67$ — so no.</p> <p>13. Each ratio equals 2, so it is proportional.</p> | <p>14. $\frac{0}{1} = 0$ but $\frac{1}{2} = 0.5$ — ratios differ, so no.</p> <p>15. Each ratio equals 4, so it is proportional.</p> <p>16. Each ratio equals 7, so it is proportional.</p> <p>17. $\frac{3}{3} = 1$ but $\frac{7}{5} = 1.4$ — ratios differ, so no.</p> <p>18. Each ratio equals 6, so it is proportional.</p> <p>19. It passes through the origin with constant ratio 3, so yes.</p> <p>20. It does not pass through the origin, so it is non-proportional.</p> <p>21. Each ratio $\frac{\text{cost}}{\text{miles}}$ equals 2: $\frac{6}{3}$, $\frac{10}{5}$, $\frac{16}{8}$ are all 2. With no starting fee, the graph passes through the origin.</p> <p>22. $\frac{15}{1} = 15$ but $\frac{20}{2} = 10$ — the ratios are not equal. The sign-up fee means the graph does not pass through the origin.</p> <p>23. Each ratio $\frac{\text{cups}}{\text{batches}}$ equals 2: $\frac{2}{1}$, $\frac{6}{3}$, $\frac{10}{5}$ are all 2.</p> <p>24. $\frac{6}{1} = 6$ but $\frac{8}{2} = 4$ — the ratios differ. The plant started at 4 inches, not 0, so the graph misses the origin.</p> |
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