

# 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.

- |   |  |
|---|--|
| 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

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