Proportional vs. Non-Proportional Relationships

Name: _____	Date: _____	Score: _____ / 24

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 $(1,2)$, $(2,4)$, $(3,6)$ _____
2. Pairs $(1,3)$, $(2,6)$, $(4,12)$ _____
3. Pairs $(1,2)$, $(2,5)$, $(3,8)$ _____
4. Pairs $(2,10)$, $(3,15)$, $(4,20)$ _____
5. Pairs $(1,4)$, $(2,8)$, $(5,20)$ _____
6. Pairs $(1,1)$, $(2,3)$, $(3,5)$ _____
7. Pairs $(3,9)$, $(5,15)$, $(6,18)$ _____
8. Pairs $(2,7)$, $(4,14)$, $(6,21)$ _____
9. Pairs $(1,5)$, $(2,9)$, $(3,13)$ _____
10. Pairs $(4,8)$, $(6,12)$, $(10,20)$ _____
11. Pairs $(1,6)$, $(3,18)$, $(5,30)$ _____
12. Pairs $(2,3)$, $(4,6)$, $(6,10)$ _____
13. Pairs $(5,10)$, $(7,14)$, $(9,18)$ _____
14. Pairs $(1,0)$, $(2,1)$, $(3,2)$ _____
15. Pairs $(2,8)$, $(3,12)$, $(7,28)$ _____
16. Pairs $(1,7)$, $(2,14)$, $(4,28)$ _____
17. Pairs $(3,3)$, $(5,7)$, $(7,11)$ _____
18. Pairs $(2,12)$, $(4,24)$, $(5,30)$ _____
19. Line through $(0,0)$ and $(4,12)$: proportional? _____
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.	Yes	**13.**	Yes
2.	Yes	**14.**	No
3.	No	**15.**	Yes
4.	Yes	**16.**	Yes
5.	Yes	**17.**	No
6.	No	**18.**	Yes
7.	Yes	**19.**	Yes
8.	Yes	**20.**	No
9.	No	**21.**	Yes, proportional
10.	Yes	**22.**	No, non-proportional
11.	Yes	**23.**	Yes, proportional
12.	No	**24.**	No, non-proportional

Step-by-Step Explanations

1. Each ratio $\frac{y}{x}$ equals 2, so it is proportional.
2. Each ratio equals 3, so it is proportional.
3. $\frac{2}{1} = 2$ but $\frac{5}{2} = 2.5$ — ratios differ, so no.
4. Each ratio equals 5, so it is proportional.
5. Each ratio equals 4, so it is proportional.
6. $\frac{1}{1} = 1$ but $\frac{3}{2} = 1.5$ — ratios differ, so no.
7. Each ratio equals 3, so it is proportional.
8. Each ratio equals 3.5, so it is proportional.
9. $\frac{5}{1} = 5$ but $\frac{9}{2} = 4.5$ — ratios differ, so no.
10. Each ratio equals 2, so it is proportional.
11. Each ratio equals 6, so it is proportional.
12. $\frac{3}{2} = 1.5$ but $\frac{10}{6} \approx 1.67$ — so no.
13. Each ratio equals 2, so it is proportional.
14. $\frac{0}{1} = 0$ but $\frac{1}{2} = 0.5$ — ratios differ, so no.
15. Each ratio equals 4, so it is proportional.
16. Each ratio equals 7, so it is proportional.
17. $\frac{3}{3} = 1$ but $\frac{7}{5} = 1.4$ — ratios differ, so no.
18. Each ratio equals 6, so it is proportional.
19. It passes through the origin with constant ratio 3, so yes.
20. It does not pass through the origin, so it is non-proportional.
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.
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.
23. Each ratio $\frac{\text{cups}}{\text{batches}}$ equals 2: $\frac{2}{1}, \frac{6}{3}, \frac{10}{5}$ are all 2.
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.

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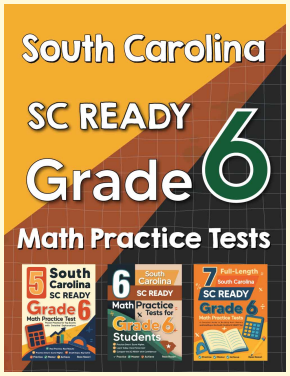

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