Graphing Proportional Relationships

Name: _____	Date: _____	Score: _____ / 24

Quick Review

A **proportional relationship** connects two quantities so that their ratio is always the same. You can write it as $y = kx$, where k is the **constant of proportionality** — the number you multiply x by to get y. To find k from a point (x, y), just divide: $k = \frac{y}{x}$. When you graph $y = kx$, you always get a *straight line through the origin* $(0, 0)$, and k is the **slope** of that line — the steepness. The bigger k is, the steeper the line climbs.

◇ **Example:** A car travels 150 miles in 3 hours at a steady speed. Find the constant of proportionality and write the equation. ⇒ The two quantities here are distance y and time x, and a steady speed means they are proportional. To find k, divide distance by time: $k = \frac{150}{3} = 50$. That 50 is the speed in miles per hour — it tells us how many miles the car covers each hour. Now we just slot k into $y = kx$ to get $y = 50x$. The graph would be a straight line through the origin rising 50 for every 1 hour.

Answer: $k = 50, \quad y = 50x$

PRACTICE

Find the constant of proportionality k, or use $y = kx$ as needed.

1. $y = kx$ through $(1, 4)$; $k = ?$ _____
2. $y = kx$ through $(1, 9)$; $k = ?$ _____
3. $y = kx$ through $(2, 10)$; $k = ?$ _____
4. $y = kx$ through $(3, 21)$; $k = ?$ _____
5. $y = kx$ through $(4, 12)$; $k = ?$ _____
6. $y = kx$ through $(5, 40)$; $k = ?$ _____
7. $y = kx$ through $(6, 9)$; $k = ?$ _____
8. $y = kx$ through $(8, 2)$; $k = ?$ _____
9. $k = 6,\ x = 7;\ y = ?$ _____
10. $k = 2.5,\ x = 8;\ y = ?$ _____
11. $k = 11,\ x = 4;\ y = ?$ _____
12. $k = \frac{2}{3},\ x = 9;\ y = ?$ _____
13. $k = 5,\ y = 35;\ x = ?$ _____
14. $k = 9,\ y = 63;\ x = ?$ _____
15. $k = 4,\ y = 30;\ x = ?$ _____
16. Is $y = 3x$ proportional? _____
17. Is $y = 2x + 5$ proportional? _____
18. $y = kx$ through $(10, 4)$; $k = ?$ _____
19. Slope of $y = 7x$ _____
20. Unit rate: $\$18$ for 3 lb _____

Word Problems

21. A printer prints 36 pages in 4 minutes at a steady rate. Write an equation relating pages y to minutes x, and find how many pages it prints in 9 minutes. _____
22. At a market, 5 apples cost $\$2$. The cost is proportional to the number of apples. How much do 20 apples cost? _____
23. A cyclist rides at a constant speed and covers 24 km in 2 hours. Two graphs are compared: cyclist A has $y = 12x$ and cyclist B covers 24 km in 2 hours. Who is faster, or are they the same? _____
24. A faucet fills a tub proportionally, putting in 7 gallons every 2 minutes. How long does it take to fill a 35-gallon tub? _____

Answer Keys

1. $k = 4$
2. $k = 9$
3. $k = 5$
4. $k = 7$
5. $k = 3$
6. $k = 8$
7. $k = \frac{3}{2}$
8. $k = \frac{1}{4}$
9. $y = 42$
10. $y = 20$
11. $y = 44$
12. $y = 6$
13. $x = 7$
14. $x = 7$
15. $x = \frac{15}{2}$
16. yes
17. no
18. $k = \frac{2}{5}$
19. 7
20. \$6 per lb
21. $y = 9x;\ 81$ pages
22. \$8
23. the same speed
24. 10 minutes

Step-by-Step Explanations

1. With $x = 1$, the value of y *is* the constant: $k = \frac{4}{1} = 4$.
2. At $x = 1$, $k = \frac{9}{1} = 9$. The point $(1, k)$ always reveals k.
3. Divide y by x: $k = \frac{10}{2} = 5$.
4. $k = \frac{21}{3} = 7$, the same ratio every time.
5. $k = \frac{12}{4} = 3$ — y is always three times x.
6. $k = \frac{40}{5} = 8$.
7. $k = \frac{9}{6} = \frac{3}{2}$ — k can be a fraction.
8. $k = \frac{2}{8} = \frac{1}{4}$, a value less than 1.
9. Use $y = kx$: $y = 6 \times 7 = 42$.
10. $y = 2.5 \times 8 = 20$.
11. $y = 11 \times 4 = 44$.
12. $y = \frac{2}{3} \times 9 = 6$.
13. From $y = kx$, divide: $x = \frac{35}{5} = 7$.
14. $x = \frac{63}{9} = 7$.
15. $x = \frac{30}{4} = \frac{15}{2}$.
16. It has the form $y = kx$ with $k = 3$ and passes through $(0, 0)$, so yes.
17. The $+5$ shifts the line off the origin, so it is *not* proportional.
18. $k = \frac{4}{10} = \frac{2}{5}$.
19. In $y = kx$, the constant k *is* the slope, so the slope is 7.
20. Divide cost by weight: $\frac{18}{3} = 6$ dollars per pound.
21. The rate is $k = \frac{36}{4} = 9$ pages per minute, so $y = 9x$. In 9 minutes: $y = 9 \times 9 = 81$ pages.
22. The unit cost is $k = \frac{2}{5} = 0.40$ dollars per apple. For 20 apples: $0.40 \times 20 = \$8$.
23. Cyclist B's rate is $\frac{24}{2} = 12$ km/h, the same k as cyclist A's $y = 12x$. Equal constants mean equal speeds.
24. The rate is $\frac{7}{2} = 3.5$ gallons per minute. Time $= \frac{35}{3.5} = 10$ minutes.

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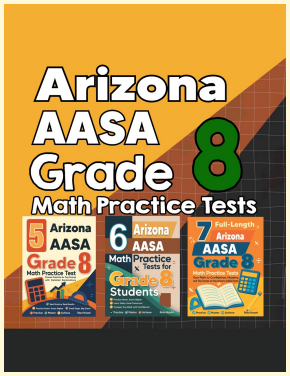

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