Finding the Constant of Proportionality

Apply the skill to decisions and designs

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QUICK REVIEW

In $y = kx$, divide output by input: $k = y/x$, not x/y. If 4 meters cost 10 dollars, $k = 10/4 = 2.5$ dollars per meter; the point $(1, 2.5)$ shows that rate.

Worked example

Example: the proportional pair is $(4, 6)$. Find k in $y = kx$ and the pair with $x = 1$.

1. $k = y/x = 6/4 = \frac{3}{2}$.
2. Substitute $x = 1$ into $y = kx$: $y = \frac{3}{2}(1) = \frac{3}{2}$, so the pair is $(1, \frac{3}{2})$.
3. Check the original pair: $\frac{3}{2}(4) = 6$.
Answer: $k = \frac{3}{2}$; $(1, \frac{3}{2})$.

Practice Problems

Show your thinking.

1. Fabric: 5 units cost \$30.00 proportionally. Find the per-unit constant and whether \$35.00 buys 6 units.

2. Read the displayed proportional table. Fruit: 4 units cost \$16.00 proportionally. Find the per-unit constant and whether \$19.00 buys 5 units.

x	y
4	16
8	32

3. A print job uses 4 m of ribbon per banner. State the constant with units and explain what 12 m permits.

4. Seed: 5 units cost \$30.00 proportionally. Find the per-unit constant and whether \$35.00 buys 6 units. Find how many units have total cost \$72.00, twice the cost \$36.00 of 6 units.

5. Juice: 6 units cost \$18.00 proportionally. Find the per-unit constant and whether \$20.00 buys 7 units. Compare the constant with 3: state the exact difference.

6. Wire: 8 units cost \$32.00 proportionally. Find the per-unit constant and whether \$35.00 buys 9 units. Explain why its reciprocal has different units.

7. Ink cartridges: 3 units cost \$21.00 proportionally. Find the per-unit constant and whether \$27.00 buys 4 units.

8. Ribbon spools: 4 units cost \$18.00 proportionally. Find the per-unit constant and whether \$21.50 buys 5 units.

9. Seed packets: a student uses $k = x/y = \frac{1}{4}$ for $(7, 28)$. Repair the rule and predict y at $x = 8$.

10. Refill bottles: the proportional pair is $(8, 30)$. Find k in $y = kx$ and the pair with $x = 1$.

Answer Key

1. $k = 6$ dollars per unit; no, short by \$1.00.
2. $k = 4$ dollars per unit; no, short by \$1.00.
3. $k = 4$ m per banner; 12 m makes 3 banners.
4. $k = 6$ dollars per unit; no, short by \$1.00. The doubled-output input is 12.
5. $k = 3$ dollars per unit; no, short by \$1.00. $k - 3 = 0$.
6. $k = 4$ dollars per unit; no, short by \$1.00. The reciprocal measures input per output instead.
7. $k = 7$ dollars per unit; no, short by \$1.00.
8. $k = \frac{9}{2}$ dollars per unit; no, short by \$1.00.
9. $k = 4$; $y = 32$.
10. $k = \frac{15}{4}$; $(1, \frac{15}{4})$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. $k = y/x = 30/5 = 6$.
2. Multiply the per-unit cost by 6: $6(6) = 36$ dollars.
3. Required 36 dollars minus budget 35 is 1 dollar.

Problem 2

1. $k = y/x = 16/4 = 4$.
2. Multiply the per-unit cost by 5: $4(5) = 20$ dollars.
3. Required 20 dollars minus budget 19 is 1 dollar.

Problem 3

1. Every banner takes 4 m, so the constant is 4 m per banner.
2. Divide the available ribbon by the amount per banner: $12 \div 4 = 3$ banners.
3. Check: 3 banners use $3(4) = 12$ m.

Problem 4

1. $k = y/x = 30/5 = 6$.
2. Multiply the per-unit cost by 6: $6(6) = 36$ dollars.
3. Required 36 dollars minus budget 35 is 1 dollar.
4. Double the specified output: $2(36) = 72$. Divide by the constant: $72 \div 6 = 12$. Check: $6(12) = 72$.

Problem 5

1. $k = y/x = 18/6 = 3$.
2. Multiply the per-unit cost by 7: $3(7) = 21$ dollars.
3. Required 21 dollars minus budget 20 is 1 dollar.
4. $k - 3 = 3 - 3 = 0$.

Problem 6

1. $k = y/x = 32/8 = 4$.
2. Multiply the per-unit cost by 9: $4(9) = 36$ dollars.
3. Required 36 dollars minus budget 35 is 1 dollar.
4. Reciprocal constant $= 8/32 = \frac{1}{4}$ input units per output unit.

Problem 7

1. $k = y/x = 21/3 = 7$.
2. Multiply the per-unit cost by 4: $7(4) = 28$ dollars.
3. Required 28 dollars minus budget 27 is 1 dollar.

Problem 8

1. $k = y/x = 18/4 = \frac{9}{2}$.
2. Multiply the per-unit cost by 5: $\frac{9}{2}(5) = \frac{45}{2}$ dollars.
3. Required $\frac{45}{2}$ dollars minus budget $\frac{43}{2}$ is 1 dollar.

Problem 9

1. $k = y/x = 28/7 = 4$.
2. The corrected rule is $y = 4x$; at $x = 8$, $y = 4(8) = 32$.
3. Check the original pair: $4(7) = 28$.

Problem 10

1. $k = y/x = 30/8 = \frac{15}{4}$.
2. Substitute $x = 1$ into $y = kx$: $y = \frac{15}{4}(1) = \frac{15}{4}$, so the pair is $(1, \frac{15}{4})$.
3. Check the original pair: $\frac{15}{4}(8) = 30$.

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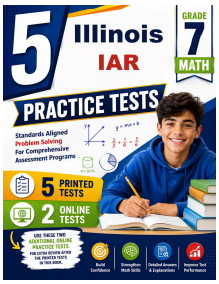

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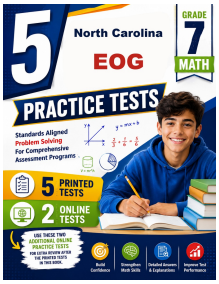

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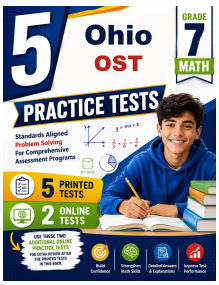

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