Finding the Constant of Proportionality

Explore ideas and representations

Name _____ **Date** _____ **Score** _____ / 10

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: the proportional pair is $(3, 18)$. Find k in $y = kx$ and the pair with $x = 1$.

2. Read the displayed proportional table. Fruit: the proportional pair is $(4, 12)$. Find k in $y = kx$ and the pair with $x = 1$.

x	y
4	12
8	24

3. The equation is $y = 4x$. Find its constant and explain the meaning of $(1, 4)$.

4. Seed: the proportional pair is $(5, 20)$. Find k in $y = kx$ and the pair with $x = 1$. Find the input giving output 40, twice the known output 20 at input 5.

5. Juice: the proportional pair is $(6, 12)$. Find k in $y = kx$ and the pair with $x = 1$. Compare the constant with 3: state the exact difference.

6. Wire: the proportional pair is $(8, 24)$. Find k in $y = kx$ and the pair with $x = 1$. Explain why its reciprocal has different units.

7. Ink cartridges: the proportional pair is $(3, 21)$. Find k in $y = kx$ and the pair with $x = 1$.

8. Ribbon spools: a student uses $k = x/y = \frac{2}{9}$ for $(4, 18)$. Repair the rule and predict y at $x = 5$.

9. Seed packets: the proportional pair is $(7, 28)$. Find k in $y = kx$ and the pair with $x = 1$.

10. Refill bottles: 8 units cost $30.00 proportionally. Find the per-unit constant and whether $32.75 buys 9 units.

Answer Key

1. $k = 6$; $(1, 6)$.
2. $k = 3$; $(1, 3)$.
3. $k = 4$ output units per input; 12 output units correspond to 3 inputs.
4. $k = 4$; $(1, 4)$. The doubled-output input is 10.
5. $k = 2$; $(1, 2)$. $k - 3 = -1$.
6. $k = 3$; $(1, 3)$. The reciprocal measures input per output instead.
7. $k = 7$; $(1, 7)$.
8. $k = \frac{9}{2}$; $y = \frac{45}{2}$.
9. $k = 4$; $(1, 4)$.
10. $k = \frac{15}{4}$ dollars per unit; no, short by $1.00.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. $k = y/x = 18/3 = 6$.
2. Substitute $x = 1$ into $y = kx$: $y = 6(1) = 6$, so the pair is $(1, 6)$.
3. Check the original pair: $6(3) = 18$.

Problem 2

1. $k = y/x = 12/4 = 3$.
2. Substitute $x = 1$ into $y = kx$: $y = 3(1) = 3$, so the pair is $(1, 3)$.
3. Check the original pair: $3(4) = 12$.

Problem 3

1. $y/x = 4/1 = 4$ at $(1, 4)$.
2. At $(3, 12)$, $y/x = 12/3 = 4$ also.
3. The number 4 stays fixed while x changes; $12/4 = 3$ inputs.

Problem 4

1. $k = y/x = 20/5 = 4$.
2. Substitute $x = 1$ into $y = kx$: $y = 4(1) = 4$, so the pair is $(1, 4)$.
3. Check the original pair: $4(5) = 20$.
4. Double the specified output: $2(20) = 40$. Divide by the constant: $40 \div 4 = 10$. Check: $4(10) = 40$.

Problem 5

1. $k = y/x = 12/6 = 2$.
2. Substitute $x = 1$ into $y = kx$: $y = 2(1) = 2$, so the pair is $(1, 2)$.
3. Check the original pair: $2(6) = 12$.
4. $k - 3 = 2 - 3 = -1$.

Problem 6

1. $k = y/x = 24/8 = 3$.
2. Substitute $x = 1$ into $y = kx$: $y = 3(1) = 3$, so the pair is $(1, 3)$.
3. Check the original pair: $3(8) = 24$.
4. Reciprocal constant $= 8/24 = \frac{1}{3}$ input units per output unit.

Problem 7

1. $k = y/x = 21/3 = 7$.
2. Substitute $x = 1$ into $y = kx$: $y = 7(1) = 7$, so the pair is $(1, 7)$.
3. Check the original pair: $7(3) = 21$.

Problem 8

1. $k = y/x = 18/4 = \frac{9}{2}$.
2. The corrected rule is $y = \frac{9}{2}x$; at $x = 5$, $y = \frac{9}{2}(5) = \frac{45}{2}$.
3. Check the original pair: $\frac{9}{2}(4) = 18$.

Problem 9

1. $k = y/x = 28/7 = 4$.
2. Substitute $x = 1$ into $y = kx$: $y = 4(1) = 4$, so the pair is $(1, 4)$.
3. Check the original pair: $4(7) = 28$.

Problem 10

1. $k = y/x = 30/8 = \frac{15}{4}$.
2. Multiply the per-unit cost by 9: $\frac{15}{4}(9) = \frac{135}{4}$ dollars.
3. Required $\frac{135}{4}$ dollars minus budget $\frac{131}{4}$ is 1 dollar.

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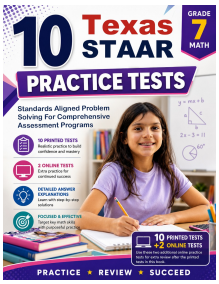

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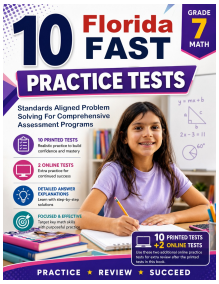

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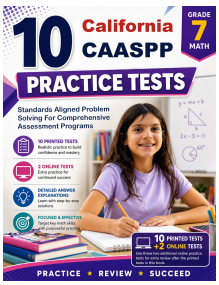

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