Writing Equations for Proportional Relationships

Explore ideas and representations

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

QUICK REVIEW

Name the input and output, find $k = y/x$, then write $y = kx$. For 3 bags holding 12 kg, $k = 12/3 = 4$ kg per bag and $m = 4b$; 5 bags hold 20 kg.

Worked example

6 identical pens cost 9 dollars. Write cost C in terms of pen count p.

1. $k = 9/6 = 3/2$ dollars per pen.
2. Cost equals unit price times count, so $C = \frac{3}{2}p$.
3. Check: $\frac{3}{2}(6) = 9$ dollars.
Answer: $C = \frac{3}{2}p$.

Practice Problems

Show your thinking.

1. 2 pitchers hold 3 L at a constant rate. Let x count pitchers and y measure L. Write $y = kx$ and find y for $x = 4$.

2. 3 tickets cost 12 dollars at a constant rate. Let x count tickets and y measure dollars. Write $y = kx$ and find y for $x = 5$. Relate the coefficient in your equation to both table rows.

input	output
3	12
6	24

3. 4 banners need 10 m of ribbon at a constant rate. Let x count banners and y measure m of ribbon. Write $y = kx$ and find y for $x = 6$. State the units of the constant and explain what it measures.

4. 5 bags hold $\frac{15}{4}$ kg of feed at a constant rate. Let x count bags and y measure kg of feed. Write $y = kx$ and find y for $x = 7$. How many bags hold twice as much feed as 7 bags?

5. 6 packs hold 12 kg of paper at a constant rate. Let x count packs and y measure kg of paper. Write $y = kx$ and find y for $x = 8$. Write the rule with input and output interchanged.

6. 8 batches use 10 L of paint at a constant rate. Let x count batches and y measure L of paint. Write $y = kx$ and find y for $x = 10$. Does adding 1 to the right side preserve proportionality? Explain using zero input.

7. Fabric order: $(4, 14)$ is a proportional pair. Write $y = kx$ and predict the output at input 6.

8. Juice cartons: find the proportional coefficient from $(6, 15)$, then recover the input giving output 30.

9. Tile packs: a student proposes $y = 7x + 1$ for the pair $(5, 35)$. Repair the equation and test zero input.

10. Paint batches: write an inverse equation for input x in terms of output y, using the proportional pair $(8, 12)$. Check the given output.

Answer Key

1. $y = \frac{3}{2}x$; 6 L.
2. $y = 4x$; 20 dollars.
3. $y = \frac{5}{2}x$; 15 m of ribbon. Input: banners; output: meters of ribbon; rate $\frac{5}{2}$ m per banner.
4. $y = \frac{3}{4}x$; $\frac{21}{4}$ kg of feed. The doubled amount needs 14 bags.
5. $y = 2x$; 16 kg of paper. Reverse rule $x = \frac{1}{2}y$.
6. $y = \frac{5}{4}x$; $\frac{25}{2}$ L of paint. No; zero input would produce 1, not 0.
7. $y = \frac{7}{2}x$; predicted output 21.
8. $y = \frac{5}{2}x$; input 12.
9. $y = 7x$; at zero input the output is 0.
10. $x = \frac{2}{3}y$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Divide by the pitcher count: $3 \div 2 = \frac{3}{2}$ L per pitcher.
2. The constant multiplies the input: $y = \frac{3}{2}x$.
3. For 4 pitchers, multiply: $\frac{3}{2}(4) = 6$ L.

Problem 2

1. Divide by the ticket count: $12 \div 3 = 4$ dollars per ticket.
2. The constant multiplies the input: $y = 4x$.
3. For 5 tickets, multiply: $4(5) = 20$ dollars.
4. Both table ratios are $12/3 = 24/6 = 4$.

Problem 3

1. Divide by the banner count: $10 \div 4 = \frac{5}{2}$ m of ribbon per banner.
2. The constant multiplies the input: $y = \frac{5}{2}x$.
3. For 6 banners, multiply: $\frac{5}{2}(6) = 15$ m of ribbon.
4. Since the input counts banners and the output measures meters, the rate is meters per banner.

Problem 4

1. Divide by the bag count: $\frac{15}{4} \div 5 = \frac{3}{4}$ kg of feed per bag.
2. The constant multiplies the input: $y = \frac{3}{4}x$.
3. For 7 bags, multiply: $\frac{3}{4}(7) = \frac{21}{4}$ kg of feed.
4. Seven bags hold $\frac{21}{4}$ kg; twice that is $\frac{21}{2}$ kg. Divide: $\frac{21}{2} \div (\frac{3}{4}) = 14$ bags.

Problem 5

1. Divide by the pack count: $12 \div 6 = 2$ kg of paper per pack.
2. The constant multiplies the input: $y = 2x$.
3. For 8 packs, multiply: $2(8) = 16$ kg of paper.
4. Divide by 2: $x = y/2 = \frac{1}{2}y$.

Problem 6

1. Divide by the batch count: $10 \div 8 = \frac{5}{4}$ L of paint per batch.
2. The constant multiplies the input: $y = \frac{5}{4}x$.
3. For 10 batches, multiply: $\frac{5}{4}(10) = \frac{25}{2}$ L of paint.
4. $\frac{5}{4}(0) + 1 = 1 \neq 0$.

Problem 7

1. Coefficient $k = 14/4 = \frac{7}{2}$.
2. The proportional equation is $y = \frac{7}{2}x$.
3. At input 6 the output is $\frac{7}{2}(6) = 21$.

Problem 8

1. Coefficient $k = 15/6 = \frac{5}{2}$.
2. The proportional equation is $y = \frac{5}{2}x$.
3. Input $= 30 \div (\frac{5}{2}) = 12$; check $\frac{5}{2}(12) = 30$.

Problem 9

1. Coefficient $k = 35/5 = 7$.
2. The proportional equation is $y = 7x$.
3. The proposed rule gives $35 + 1 = 36$ at input 5, not 35. Removing 1 also gives $7(0) = 0$.

Problem 10

1. Coefficient $k = 12/8 = \frac{3}{2}$.
2. The proportional equation is $y = \frac{3}{2}x$.
3. Divide by the coefficient: $x = y/(\frac{3}{2}) = \frac{2}{3}y$. Check $\frac{2}{3}(12) = 8$.

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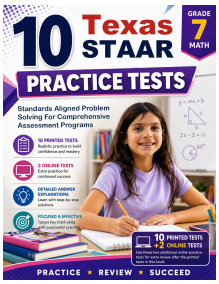

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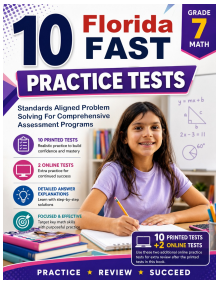

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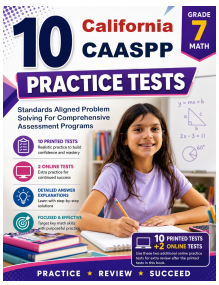

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