Writing Equations for Proportional Relationships

Spot mistakes, reason, and work backward

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 5 L at a constant rate. Let x count pitchers and y measure L. Ari writes $y = 5x$. Repair the coefficient, then solve for x when $y = 10$.

2. 3 tickets cost 15 dollars at a constant rate. Let x count tickets and y measure dollars. Ari writes $y = 15x$. Repair the coefficient, then solve for x when $y = 25$. Relate the coefficient in your equation to both table rows.

input	output
3	15
6	30

3. 4 banners need 14 m of ribbon at a constant rate. Let x count banners and y measure m of ribbon. Ari writes $y = 14x$. Repair the coefficient, then solve for x when $y = 21$. State the units of the constant and explain what it measures.

4. 5 bags hold $\frac{35}{4}$ kg of feed at a constant rate. Let x count bags and y measure kg of feed. Ari writes $y = \frac{35}{4}x$. Repair the coefficient, then solve for x when $y = \frac{49}{4}$. How many bags hold twice as much feed as 7 bags?

5. 6 packs hold 18 kg of paper at a constant rate. Let x count packs and y measure kg of paper. Ari writes $y = 18x$. Repair the coefficient, then solve for x when $y = 24$. Write the rule with input and output interchanged.

6. 8 batches use 18 L of paint at a constant rate. Let x count batches and y measure L of paint. Ari writes $y = 18x$. Repair the coefficient, then solve for x when $y = \frac{45}{2}$. Does adding 1 to the right side preserve proportionality? Explain using zero input.

7. Fabric order: a student proposes $y = \frac{7}{2}x + 1$ for the pair $(4, 14)$. Repair the equation and test zero input.

8. Juice cartons: write an inverse equation for input x in terms of output y, using the proportional pair $(6, 15)$. Check the given output.

9. Tile packs: find the proportional coefficient from $(5, 35)$, then recover the input giving output 70.

10. Paint batches: $(8, 12)$ is a proportional pair. Write $y = kx$ and predict the output at input 10.

Answer Key

1. $y = \frac{5}{2}x$; 4 pitchers.
2. $y = 5x$; 5 tickets.
3. $y = \frac{7}{2}x$; 6 banners. Input: banners; output: meters of ribbon; rate $\frac{7}{2}$ m per banner.
4. $y = \frac{7}{4}x$; 7 bags. The doubled amount needs 14 bags.
5. $y = 3x$; 8 packs. Reverse rule $x = \frac{1}{3}y$.
6. $y = \frac{9}{4}x$; 10 batches. No; zero input would produce 1, not 0.
7. $y = \frac{7}{2}x$; at zero input the output is 0.
8. $x = \frac{2}{5}y$.
9. $y = 7x$; input 10.
10. $y = \frac{3}{2}x$; predicted output 15.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Divide by the pitcher count: $5 \div 2 = \frac{5}{2}$ L per pitcher.
2. The constant multiplies the input: $y = \frac{5}{2}x$.
3. Divide the target by the rate: $10 \div (\frac{5}{2}) = 4$ pitchers.

Problem 2

1. Divide by the ticket count: $15 \div 3 = 5$ dollars per ticket.
2. The constant multiplies the input: $y = 5x$.
3. Divide the target by the rate: $25 \div (5) = 5$ tickets.
4. Both table ratios are $15/3 = 30/6 = 5$.

Problem 3

1. Divide by the banner count: $14 \div 4 = \frac{7}{2}$ m of ribbon per banner.
2. The constant multiplies the input: $y = \frac{7}{2}x$.
3. Divide the target by the rate: $21 \div (\frac{7}{2}) = 6$ banners.
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: $\frac{35}{4} \div 5 = \frac{7}{4}$ kg of feed per bag.
2. The constant multiplies the input: $y = \frac{7}{4}x$.
3. Divide the target by the rate: $\frac{49}{4} \div (\frac{7}{4}) = 7$ bags.
4. Seven bags hold $\frac{49}{4}$ kg; twice that is $\frac{49}{2}$ kg. Divide: $\frac{49}{2} \div (\frac{7}{4}) = 14$ bags.

Problem 5

1. Divide by the pack count: $18 \div 6 = 3$ kg of paper per pack.
2. The constant multiplies the input: $y = 3x$.
3. Divide the target by the rate: $24 \div (3) = 8$ packs.
4. Divide by 3: $x = y/3 = \frac{1}{3}y$.

Problem 6

1. Divide by the batch count: $18 \div 8 = \frac{9}{4}$ L of paint per batch.
2. The constant multiplies the input: $y = \frac{9}{4}x$.
3. Divide the target by the rate: $\frac{45}{2} \div (\frac{9}{4}) = 10$ batches.
4. $\frac{9}{4}(0) + 1 = 1 \neq 0$.

Problem 7

1. Coefficient $k = 14/4 = \frac{7}{2}$.
2. The proportional equation is $y = \frac{7}{2}x$.
3. The proposed rule gives $14 + 1 = 15$ at input 4, not 14. Removing 1 also gives $\frac{7}{2}(0) = 0$.

Problem 8

1. Coefficient $k = 15/6 = \frac{5}{2}$.
2. The proportional equation is $y = \frac{5}{2}x$.
3. Divide by the coefficient: $x = y/(\frac{5}{2}) = \frac{2}{5}y$. Check $\frac{2}{5}(15) = 6$.

Problem 9

1. Coefficient $k = 35/5 = 7$.
2. The proportional equation is $y = 7x$.
3. Input $= 70 \div (7) = 10$; check $7(10) = 70$.

Problem 10

1. Coefficient $k = 12/8 = \frac{3}{2}$.
2. The proportional equation is $y = \frac{3}{2}x$.
3. At input 10 the output is $\frac{3}{2}(10) = 15$.

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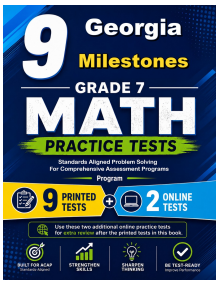

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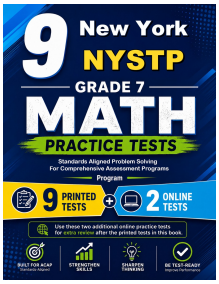

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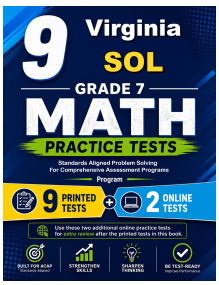

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