Constant of Proportionality (k)

Name: _____	Date: _____	Score: _____ / 18

Every proportional relationship has a magic number hiding inside it: the **constant of proportionality**, k. It tells you how many units of y you get for each 1 unit of x, so $k = \frac{y}{x}$. Once you know k, you can write the equation $y = kx$ and predict *any* value in the relationship—that is real mathematical power! The best part is that k always has a concrete meaning, like dollars per item or miles per gallon, so it connects the math to the real world.

Key Concepts & Quick Review

From a table: $k = \frac{y}{x}$ (same for every row). **From an equation:** $y = kx \Rightarrow k$ is the coefficient of x.

Given k, find y: multiply $k \times x$. **Given k, find x:** divide $y \div k$. Larger k means a steeper graph.

x	y
2	6
4	12

$\xrightarrow{y \div x}$ $k = 6 \div 2 = 3$, $y = 3x$

k tells how much y there is for each 1 unit of x.

Examples

① A table shows: $(2, 7)$, $(4, 14)$, $(6, 21)$, $(8, 28)$. Find k and write the equation.

Think It Through: To find the constant of proportionality, divide y by x in the table. Each pair gives the same value: $\frac{7}{2} = 3.5$, $\frac{14}{4} = 3.5$, $\frac{21}{6} = 3.5$, and $\frac{28}{8} = 3.5$. Since the ratio is always 3.5, that is the constant k. A proportional relationship with constant k is written as $y = kx$, so the equation is $y = 3.5x$.

Answer: $k = 3.5$; $y = 3.5x$

② A car's fuel economy is proportional: it uses $2.5\,gal$ for every $50\,mi$ driven. Find k (miles per gallon), write the equation for total miles y given gallons x, and find how far the car travels on $11\,gal$.

Think It Through: The constant of proportionality here is miles per gallon, so divide miles by gallons: $\frac{50}{2.5} = 20$. That means the car travels $20\,mi$ for each gallon of gas. Using $y = kx$, the equation becomes $y = 20x$, where x is gallons and y is miles. For $11\,gal$, substitute $x = 11$ and get $y = 20 \times 11 = 220$ miles. The units help you decide which quantity goes on top when finding k.

Answer: $k = 20$ *mpg;* $220\,mi$ *on* $11\,gal$

Practice Problems

Find the constant of proportionality k, or use the given k to find the missing value.

1. In the proportional relationship $y = kx$, _____ use $y = 12$ and $x = 3$ to find k.
2. In the proportional relationship $y = kx$, _____ use $y = 35$ and $x = 5$ to find k.
3. In the proportional relationship $y = kx$, _____ use $y = 48$ and $x = 8$ to find k.
4. In the proportional relationship $y = kx$, _____ use $y = 2.4$ and $x = 4$ to find k.
5. In the proportional relationship $y = kx$, _____ use $y = \frac{3}{2}$ and $x = 3$ to find k.
6. In the proportional relationship $y = kx$, _____ use $y = 9$ and $x = 6$ to find k.
7. In the proportional relationship $y = kx$, _____ use $k = 4$ and $x = 7$ to find y.
8. In the proportional relationship $y = kx$, _____ use $k = 2.5$ and $x = 6$ to find y.
9. In the proportional relationship $y = kx$, _____ use $k = \frac{1}{3}$ and $x = 9$ to find y.
10. In the proportional relationship $y = kx$, _____ use $k = 5$ and $y = 40$ to find x.
11. In the proportional relationship $y = kx$, _____ use $k = 0.6$ and $y = 4.8$ to find x.
12. In the proportional relationship $y = kx$, _____ use $k = \frac{3}{4}$ and $y = 9$ to find x.
13. In the proportional relationship $y = kx$, _____ use $y = 7.2$ and $x = 9$ to find k.
14. In the proportional relationship $y = kx$, _____ use $y = 100$ and $x = 25$ to find k.
15. In the proportional relationship $y = kx$, _____ use $k = 1.5$ and $x = 10$ to find y.

Study Tips

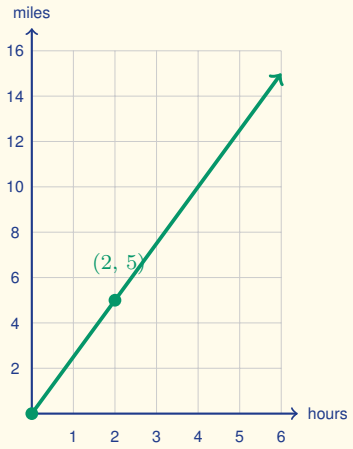
- k is always $\frac{y}{x}$ — **dependent over independent**. Put the output quantity on top.
- On a graph, k is the **slope** of the line through the origin. A steeper line means a larger k.
- The unit of k tells you the **real-world rate**: if x is hours and y is miles, then k is miles per hour.

Word Problems

16. A baker uses $\frac{3}{2}$ cups of sugar for every 2 dozen cookies baked. Find k (cups per dozen), write the equation, and determine how many cups of sugar are needed to bake 10 dozen cookies. _____

17. Two painters work at proportional rates. Painter A completes $\frac{3}{4}$ of a room per hour. Painter B completes 45 square feet per hour, and each room is $90\ sq\ ft$. Find k for each painter in rooms per hour and determine who paints faster. _____

18. This graph shows distance versus time for a runner. Read the marked lattice point off the graph, find the constant of proportionality k (the runner's speed), state the equation $y = kx$, and use it to predict the distance after 7 hours.


miles
16
14
12
10
8
6
4
2
(2, 5)
hours
1
2
3
4
5
6

Answer Keys

1) 4
2) 7
3) 6
4) 0.6
5) $\frac{1}{2}$
6) 1.5
7) 28
8) 15
9) 3
10) 8
11) 8
12) 12
13) 0.8
14) 4
15) 15
16) $k = \frac{3}{4}$ cup/dozen; $y = \frac{3}{4}x$; 7.5 cups
17) Painter A: 0.75 room/hr; Painter B: 0.5 room/hr; Painter A
18) Point $(2, 5)$; $k = 2.5\ mph$; $y = 2.5x$; $17.5\ mi$

Step-by-Step Explanations

Strategy: For Solving Real-World Problems with Rational Numbers, sort the quantities by what they mean before choosing operations. A labeled setup helps students see which numbers are being combined and why.

Practice 1: $\frac{3}{4} \times (-8) + \frac{1}{2} =$ **Answer:** $-\frac{11}{2}$

For the first worked item, choose the rule named by the topic, substitute carefully, and simplify one line at a time.

Practice 15: $-1\frac{2}{3} \div \frac{5}{9} + (-0.2) =$ **Answer:** $-\frac{16}{5}$

Near the end of this topic, choose the rule named by the topic, substitute carefully, and simplify one line at a time.

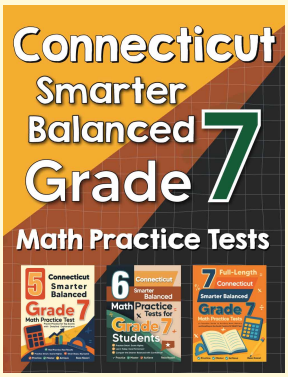
Word-problem notes:

16. Answer: Week 2 loss: $-\$168.20$; week 3: $\$630.75$; total: $\$883.05$; overall profit.
Week 1 is a profit of \$420.50. Week 2 is a loss equal to $\frac{2}{5}$ of that, so compute $420.50 \times \frac{2}{5} = 168.20$ and record it as $-\$168.20$. Week 3 is $1\frac{1}{2} = \frac{3}{2}$ times week 1, so $420.50 \times \frac{3}{2} = 630.75$. Now combine the three weeks: $420.50 - 168.20 + 630.75 = 883.05$. Because the total is positive, the business made an overall profit of \$883.05. The signs tell the story of profit versus loss.

17. Answer: 8 intervals; change $= 8 \times (-\frac{3}{8}) = -3°$C; final $= -6.5°$C; yes, still above $-8°$C.
First count how many quarter-minute intervals fit into $2\ min$: $2 \div \frac{1}{4} = 8$. Each interval changes the temperature by $-\frac{3}{8}°$C, so the total change is $8 \times \left(-\frac{3}{8}\right) = -3°$C. Add that change to the starting temperature: $-3.5 + (-3) = -6.5°$C. Finally, compare $-6.5°$C to the lower limit of $-8°$C. Since $-6.5 > -8$, the reaction is still within bounds. This last comparison step matters just as much as the arithmetic.

Want Even More Practice?

Check Out Our Other Connecticut Smarter Balanced Test Books!



Connecticut Smarter Balanced Grade 7 Math Preparation Bundle

18 full-length practice tests across three books (5 + 6 + 7)

No repeated questions—maximum practice value!

18 Tests!
3 Books
One Bundle

Important: All our test books contain **unique, completely different tests** from each other! Each book offers fresh practice questions—no repeats!

5 Practice Tests

- ✓ 5 complete practice tests with detailed explanations
- ✓ Perfect foundation for Smarter Balanced test preparation
- ✓ Builds confidence and test-taking skills
- ✓ High-quality questions aligned with state standards

Start your practice journey!

6 Practice Tests

- ✓ 6 complete practice tests with detailed explanations
- ✓ **Unique tests**—different from the 5 tests book
- ✓ Perfect for more practice after mastering 5 tests
- ✓ Builds even more confidence and test-taking skills
- ✓ Same high-quality questions aligned with standards

Take your practice to the next level!

7 Practice Tests

- ✓ 7 complete practice tests for maximum preparation
- ✓ **Unique tests**—different from 5 and 6 tests books
- ✓ The most comprehensive practice for Grade 7
- ✓ Ideal for students aiming for top scores
- ✓ Extensive practice builds mastery and confidence

Go all the way with comprehensive practice!