Simple Unit Rate

• A printer can print 45 pages in 3 minutes. At this constant rate, how many pages can the printer print in 10 minutes?

Solution:
First, find the unit rate (pages per minute):

$$\text{Rate} = \frac{45 \text{ pages}}{3 \text{ minutes}} = 15 \text{ pages/minute}$$

Now, multiply the unit rate by the target time:

$$15 \text{ pages/minute} \times 10 \text{ minutes} = 150 \text{ pages}$$

Final Answer: 150

• A car travels 150 miles in 3 hours. At the same rate, how many miles will it travel in 5 hours?

A. 200

B. 225

C. 250

D. 275

Solution:
First find the unit rate:

$$\text{Speed} = \frac{150 \text{ miles}}{3 \text{ hours}} = 50 \text{ mph}$$

Then multiply by 5 hours:

$$50 \times 5 = 250 \text{ miles}$$

Answer: C) 250

Part-to-Whole Ratio

• The ratio of boys to girls in a certain class is 3 to 4. If there are 28 students in the class in total, how many of them are girls?

Solution:
The ratio is $3:4$. The "total parts" in the ratio is $3+4=7$. To find how many students represent one "part," divide the total students by the total parts:

$$\frac{28}{7} = 4 \text{ students per part}$$

Since girls represent 4 parts of the ratio:

$$4 \text{ parts} \times 4 \text{ students/part} = 16 \text{ girls}$$

Final Answer: 16

• The ratio of boys to girls in a class is $3:4$. If there are 28 students in total, how many boys are in the class?

A. 8

B. 10

C. 12

D. 16

Solution Let the number of boys $= 3k$ and girls $= 4k$.

$$3k + 4k = 28 \implies 7k = 28 \implies k = 4$$

$$\text{Boys} = 3k = 3(4) = 12$$

Answer: C) 12

Direct and Inverse Proportion with Variables

• If x is directly proportional to y, and $x = 12$ when $y = 4$, what is the value of x when $y = 7$?

Solution:
Direct proportion is defined by the equation $x = ky$, where k is a constant. First, solve for k using the given values:

$$12 = k(4) \implies k = 3$$

Now, use the constant to find the new x:

$$x = 3(7) = 21$$

Final Answer: 21

• If 5 workers can complete a job in 12 days, how many days will it take 8 workers to complete the same job, assuming all workers work at the same rate?

A. 6.5

B. 7

C. 7.5

D. 8

Solution

Total work = workers × days = $5 \times 12 = 60$ worker-days.
With 8 workers:

$$d = \frac{60}{8} = 7.5 \text{ days}$$

Answer: C) 7.5

Rate and Time (Distance Formula)

• A car travels at a constant speed of 65 miles per hour. How many miles will the car travel in 180 minutes?

Solution:
First, convert the time from minutes to hours so the units match the rate:

$$180 \text{ minutes} = \frac{180}{60} = 3 \text{ hours}$$

Use the formula Distance = Rate × Time:

$$D = 65 \text{ mph} \times 3 \text{ hours} = 195 \text{ miles}$$

Final Answer: 195

• A machine produces 120 widgets in 4 hours. How long (in hours) will it take the same machine to produce 450 widgets?

A. 12

B. 13.5

C. 15

D. 16.5

Solution
Rate of production:

$$\frac{120 \text{ widgets}}{4 \text{ hours}} = 30 \text{ widgets/hour}$$

Time needed:

$$t = \frac{450 \text{ widgets}}{30 \text{ widgets/hour}} = 15 \text{ hours}$$

Answer: C) 15

Proportion

• If 3 pounds of apples cost \$4.50, what is the cost, in dollars, of 7 pounds of apples?

Solution:
Set up a proportion:

$$\frac{\$4.50}{3 \text{ lbs}} = \frac{x}{7 \text{ lbs}}$$

Cross-multiply to solve for x:

$$3x = 4.50 \times 7$$

$$3x = 31.50$$

$$x = \frac{31.50}{3} = 10.50$$

Final Answer: 10.50

• A recipe requires 3 cups of flour for every 2 cups of sugar. If a baker uses 9 cups of flour, how many cups of sugar are needed?

A. 4

B. 5

C. 6

D. 7

Solution
Set up a proportion:

$$\frac{3 \text{ cups flour}}{2 \text{ cups sugar}} = \frac{9 \text{ cups flour}}{x \text{ cups sugar}}$$

Cross-multiply:

$$3x = 18 \implies x = 6$$

Answer: C) 6

• A recipe for 12 muffins requires 2 cups of flour. How many cups of flour are needed to make 30 muffins?

Solution:
Set up a proportion:

$$\frac{2 \text{ cups}}{12 \text{ muffins}} = \frac{x \text{ cups}}{30 \text{ muffins}}$$

Simplify the first fraction:

$$\frac{1}{6} = \frac{x}{30}$$
$$6x = 30 \implies x = 5$$

Final Answer: 5

• A map uses a scale of 1 inch = 50 miles. Two cities are 3.5 inches apart on the map. What is the actual distance, in miles, between the two cities?

A. 150

B. 165

C. 175

D. 200

Solution Set up a proportion:

$$\frac{1 \text{ inch}}{50 \text{ miles}} = \frac{3.5 \text{ inches}}{d \text{ miles}}$$
$$d = 3.5 \times 50 = 175 \text{ miles}$$

Answer: C) 175

Double Ratios

• The ratio of a to b is 2:3, and the ratio of b to c is 6:5. What is the ratio of a to c?

Solution:
To compare a and c, we must make the "b" value the same in both ratios. Ratio 1: $a : b = 2 : 3$ Ratio 2: $b : c = 6 : 5$ Multiply Ratio 1 by 2 so that b becomes 6:

$$a : b = (2 \times 2) : (3 \times 2) = 4 : 6$$

Now we have $a : b = 4 : 6$ and $b : c = 6 : 5$. Since b is the same, we can combine them:

$$a : b : c = 4 : 6 : 5$$

The ratio $a : c$ is 4:5.
Final Answer: 4:5

Population Density Rate

• A city has a population of 120,000 people and an area of 40 square miles. What is the population density in people per square mile?

Solution:
Population density is a rate calculated as:

$$\text{Density} = \frac{\text{Total Population}}{\text{Total Area}}$$

$$\text{Density} = \frac{120,000}{40} = 3,000$$

Final Answer: 3,000

Algebraic Proportion

• If $\frac{3}{x} = \frac{7}{x+8}$, what is the value of x?

Solution:
Cross-multiply to solve for x:

$$3(x + 8) = 7x$$

$$3x + 24 = 7x$$

Subtract $3x$ from both sides:

$$24 = 4x$$

$$x = 6$$

Final Answer: 6

Unit Conversion Rate

• A faucet leaks at a rate of 2 cups per hour. If there are 16 cups in 1 gallon, how many gallons of water will leak from the faucet in 24 hours?

Solution:
First, find the total number of cups leaked in 24 hours:

$$2 \text{ cups/hour} \times 24 \text{ hours} = 48 \text{ cups}$$

Next, convert cups to gallons:

$$\frac{48 \text{ cups}}{16 \text{ cups/gallon}} = 3 \text{ gallons}$$

Final Answer: 3

• A store sells juice in two sizes. A 12-ounce bottle costs \$1.80, and a 20-ounce bottle costs \$2.60. Which size is a better value, and what is the difference in price per ounce?

Solution

Price per ounce for the 12-oz bottle:

$$\frac{\$1.80}{12} = \$0.15 \text{ per oz}$$

Price per ounce for the 20-oz bottle:

$$\frac{\$2.60}{20} = \$0.13 \text{ per oz}$$

The 20-oz bottle is a better value. The difference is:

$$\$0.15 - \$0.13 = \$0.02 \text{ per ounce}$$

Answer: The 20-oz bottle; it costs \$0.02 less per ounce.

Problems adapted from the College Board SAT Question Bank and released SAT practice tests.