

PROPORTION

Lesson 3 Advanced Proportion Word Problems

1. PROPORTION WORD PROBLEMS WITH EXPRESSION ANSWERS

Example 1: The price of generic all purpose flour is 4 bags of flour for \$5. Which expression shows the cost of buying 50 bags of flour?

- A. $\$5 \times 4 \div 50$ B. $4 \times 50 \div \$5$ C. $\$5 \times 50 \div 4$
D. $4 + 50 \times \$5$ E. $50 \div \$5 + 4$

Notice that the answer choices are expressions, not the actual cost of 50 bags of flour. Set up a proportion, then determine the cross multiplication problem that would solve it. That cross multiplication expression will be the answer.

$$\frac{\text{bags of flour}}{\$} \quad \frac{4}{5} = \frac{50}{x}$$

The cross multiplication expression is:
 $\$5 \times 50 \div 4$ or $50 \times \$5 \div 4$

Answer: C. $\$5 \times 50 \div 4$

Important: You might also see the multiple choice answers written with all or part of the expression in fraction form. Let's look at the different forms you might see.

Remember – you can think of the fraction bar as a division sign.

Start with the two cross multiplication expressions.

$$\$5 \times 50 \div 4 \quad \text{or} \quad 50 \times \$5 \div 4$$

Notice that both are divided by 4, so fraction form answers will have 4 on the bottom of the fraction, and either $\$5 \times 50$ or $50 \times \$5$ on the top of the fraction.

Now look at the fraction form variations you might see.

$$\textcircled{A} \frac{\$5 \times 50}{4} \quad \textcircled{B} \frac{50 \times \$5}{4} \quad \textcircled{C} \$5 \times \frac{50}{4} \quad \textcircled{D} \frac{50}{4} \times \$5 \quad \textcircled{E} 50 \times \frac{\$5}{4} \quad \textcircled{F} \frac{\$5}{4} \times 50$$

Notice that they all have 4 on the bottom and either $\$5 \times 50$ or $50 \times \$5$ on top.

In \textcircled{A} & \textcircled{B} you can clearly see 4 on the bottom and either $\$5 \times 50$ or $50 \times \$5$ on the top.

If you think of the others as $\textcircled{C} \frac{\$5}{1} \times \frac{50}{4}$ $\textcircled{D} \frac{50}{4} \times \frac{\$5}{1}$ $\textcircled{E} \frac{50}{1} \times \frac{\$5}{4}$ $\textcircled{F} \frac{\$5}{4} \times \frac{50}{1}$
you can see they all have 4 on the bottom and either $\$5 \times 50$ or $50 \times \$5$ on the top.

This can be confusing. Carefully review Example 2 and Example 3 to see how to quickly scan multiple choice answers for the correct fraction.

Look at Example 4 for a different method to determine the correct expression answer to a proportion problem.

Example 2: An art student spends 12 hours painting every 4 days. Which expression shows how many hours the student will spend painting in 18 days?

- A. $\frac{18}{12} \times 4$ B. $\frac{12+18}{4}$ C. $\frac{12}{4} + 18$ D. $\frac{18}{4} \times 12$ E. $\frac{18}{4} + 12$

$$\frac{\text{hours}}{\text{days}} \quad \frac{12}{4} = \frac{x}{18}$$

The cross multiplication expression is:

$$18 \times 12 \div 4 \quad \text{or} \quad 12 \times 18 \div 4$$

All the answer choices are in fraction form.

The cross multiplication expressions are both $\div 4$, so the correct fraction will have 4 on the bottom and either 18×12 or 12×18 on the top.

Think of answer D. as $\frac{18}{4} \times \frac{12}{1}$ and you can see 18×12 on top and 4 on the bottom.

Answer: D. $\frac{18}{4} \times 12$

Example 3: A clerk can process 200 application forms in $6\frac{1}{2}$ hours. Which expression could be used to calculate the number of forms he could process in 18 hours?

- A. $\frac{6\frac{1}{2}}{200} \times 18$ B. $\frac{200 \div 18}{6\frac{1}{2}}$ C. $\frac{200}{6\frac{1}{2}} + 18$ D. $\frac{18}{6\frac{1}{2}} \div 200$ E. $\frac{200}{6\frac{1}{2}} \times 18$

$$\frac{\text{hours}}{\text{forms}} \quad \frac{6\frac{1}{2}}{200} = \frac{18}{x}$$

The cross multiplication expression is:

$$200 \times 18 \div 6\frac{1}{2} \quad \text{or} \quad 18 \times 200 \div 6\frac{1}{2}$$

All the answer choices are in fraction form.

The cross multiplication expressions are both $\div 6\frac{1}{2}$, so the correct fraction will have $6\frac{1}{2}$ on the bottom and either 200×18 or 18×200 on the top.

Think of answer E. as $\frac{200}{6\frac{1}{2}} \times \frac{18}{1}$ and you can see 200×18 on top and $6\frac{1}{2}$ on the bottom.

Answer: E. $\frac{200}{6\frac{1}{2}} \times 18$

Example 4: A manufacturing process uses 50 liters of acid for every 6 grams of carbon. Which expression shows how many grams of carbon are needed for 275 liters of acid?

- A. $\frac{50}{6} \times 275$ B. $\frac{6}{275} \times 50$ C. $\frac{6}{50} + 275$ D. $\frac{6}{50} \times 275$ E. $\frac{275 \div 6}{50}$

$$\frac{\text{liters of acid}}{\text{grams of carbon}} \quad \frac{50}{6} = \frac{275}{x} \quad \text{The cross multiplication expression is:}$$
$$6 \times 275 \div 50 \quad \text{or} \quad 275 \times 6 \div 50$$

Just like the last two examples, all the answer choices are in fraction form. You could determine the cross multiplication expression, and then scan the answers for the correct fraction, as was just done in Examples 2 & 3.

A different method is to calculate the value of the cross multiplication expression, and then calculate the value of each multiple choice answer until you find a match.

Remember, the question in the problem is “how many grams of carbon are needed,” and the value of the cross multiplication expression answers that question. So, when you find the multiple choice answer that calculates to the same number as the cross multiplication expression, you will have found the correct answer to the problem.

Calculate the value of the cross multiplication expression: $6 \times 275 \div 50 = 33$

Try A. $\frac{50}{6} \times 275 = 2,291.67$ **Does not** = 33, so **is not** equal to $6 \times 275 \div 50$.

(Reminder – to calculate the value of a fraction on the calculator, enter top number \div bottom number. $\frac{50}{6}$ is entered as $50 \div 6$.)

Try B. $\frac{6}{275} \times 50 = 1.09$ **Does not** = 33, so **is not** equal to $6 \times 275 \div 50$.

Try C. $\frac{6}{50} + 275 = 275.12$ **Does not** = 33, so **is not** equal to $6 \times 275 \div 50$.

Try D. $\frac{6}{50} \times 275 = 33$ **Does** = 33, so **is** equal to $6 \times 275 \div 50$.

Answer: D. $\frac{6}{50} \times 275$

For this type of problem, use which ever method you like the best, the Calculation Method just shown, or the Scan For Correct Fraction Method, shown in Examples 2 & 3.

Example 5: 400 likely voters were surveyed and asked which of 4 different candidates they planned to vote for in an upcoming election. The results are shown in the chart below. Based on these survey results, which expression would you use to predict the number of votes Grayson would receive in an election where 75,000 people voted?

- A. $\frac{75,000}{400} + 92$ B. $\frac{4}{400} \times 75,000$ C. $75,000 \div 400$
 D. $\frac{400}{4} \times 75,000$ E. $\frac{92 \times 75,000}{400}$

Candidate	Votes per 400 Voters Surveyed
Rowan	120
Sanchez	38
Grayson	92
Harris	129
Not Sure	71

In this problem, get the first ratio of the proportion from information on the Grayson line of the chart.

$$\frac{\text{votes}}{\text{number of voters}} = \frac{92}{400} = \frac{x}{75,000}$$

The cross multiplication expression is:
 $92 \times 75,000 \div 400$ or $75,000 \times 92 \div 400$

All the answer choices are in fraction form, so you must figure out which of the answer choices is the same as one of your cross multiplication expressions. Use either the scan for correct fraction method or the calculation method.

Method One – Scan answers choices for the correct fraction.

The cross multiplication expressions are both $\div 400$, so the correct fraction will have 400 on the bottom and either $92 \times 75,000$ or $75,000 \times 92$ on top.

Answer: E. $\frac{92 \times 75,000}{400}$

Method Two – Calculation. Calculate the value of the cross multiplication expression, and then calculate the value of each multiple choice answer until you find a match.

Cross multiplication expression: $92 \times 75,000 \div 400 = 17,250$

Try A. $\frac{75,000}{400} + 92 = 279.5$ **Does not** = 17,250, so **is not** correct.

Try B. $\frac{4}{400} \times 75,000 = 750$ **Does not** = 17,250, so **is not** correct.

Try C. $75,000 \div 400 = 187.5$ **Does not** = 17,250, so **is not** correct.

Try D. $\frac{400}{4} \times 75,000 = 7,500,000$ **Does not** = 17,250, so **is not** correct.

Try E. $\frac{92 \times 75,000}{400} = 17,250$ **Does** = 17,250, so **is** correct.

Answer: E. $\frac{92 \times 75,000}{400}$

Example 6: If \$2.79 is the price of a 20-ounce bag of candy, which of the expressions below could be used to calculate the cost per ounce of the candy?

- A. $20 \times \$2.79$ B. $\$2.79 \div 20$ C. $20 - \$2.79$ D. $20 \div \$2.79$ E. $20 + \$2.79$

You may see right off that you need to divide the price by the number of ounces to get the price per ounce. **Answer: B. $\$2.79 \div 20$**

If you don't see that, you still might know that you have to divide, but aren't sure whether answer B or answer D is correct. Or, you might know you have to either multiply or divide, but aren't sure which to do.

Set up a proportion to determine the correct expression.

$$\frac{\text{ounces}}{\$} = \frac{20}{2.79} = \frac{1}{x}$$

The cross multiplication expression is:

$$\$2.79 \times 1 \div 20 \quad \text{or} \quad 1 \times \$2.79 \div 20$$

It can be shortened to $\$2.79 \div 20$ because $\$2.79 \times 1$ is the same as $\$2.79$.

Answer: B. $\$2.79 \div 20$

NOTE – Per ounce means for 1 ounce, so use the number 1 in your proportion.

TIP – When you come across problems where you can't decide which way a division calculation goes, or whether to multiply or divide, in many cases setting up a proportion will help you find the answer.

Practice One *Answers – p. 11*

1. A machine produces 400 switches in 3 hours. At the same rate of production, which expression shows how long will it take for the machine to produce 900 switches?

- A. $\frac{900}{400} + 3$ B. $\frac{900}{400} \div 3$ C. $\frac{400}{3} \times 900$ D. $\frac{900}{400} \times 3$ E. $\frac{400 \times 3}{900}$

2. A family has driven 225 miles in 4 ½ hours. If they continue driving at the same rate, which expression shows how long it will take to drive the next 400 miles of their trip?

- A. $\frac{225}{400} \times 4.5$ B. $\frac{4.5}{225} + 400$ C. $\frac{400}{225} + 4.5$ D. $\frac{400}{4.5} \times 225$ E. $\frac{400 \times 4.5}{225}$

3. Which expression below can be used to find the cost of a single marble if a bag of 75 marbles is sold for \$5.75?

- A. $75 \times \$5.75$ B. $\$5.75 \div 75$ C. $75 - \$5.75$
D. $75 \div \$5.75$ E. $75 + \$5.75$

4. If 3 bottles of shampoo cost \$5, which expression shows how much 8 bottles of shampoo will cost?

- A. $8 \times \$5 \div 3$ B. $\$5 \times 3 \div 8$ C. $(3 + 8) \times \$5$ D. $(3 + 8) \div \$5$ E. $8 \times 3 \div \$5$

5. A person can type 1,950 words in 30 minutes. At the same rate, which expression shows how many words per minute the person can type?

- A. $1,950 \div 30$ B. $30 \div 1,950$ C. $1,950 - 30$ D. $1,950 \times 30$ E. $1,950 + 30$

6. Langley Party Supply is having a sale on bulk packages of paper plates. Each package of 200 paper plates is on sale for \$1.79. Which of the following expressions could be used to calculate the cost in dollars of 1,800 paper plates?

- A. $\frac{1,800}{\$1.79} \times 200$ B. $\frac{\$1.79 + 1,800}{200}$ C. $\frac{\$1.79}{200} \times 1,800$
D. $\frac{1,800 \div \$1.79}{200}$ E. $\frac{\$1.79}{1,800} \times 200$

7. A company has placed an ad on several different websites. The number of purchases made by people who click on the ad is shown in the chart below. If the ad that is on ebay produces about 350,000 clicks, which expression shows about how many purchases the company can expect from those clicks?

- A. $\frac{350,000 + 180}{6,000}$ B. $350,000 \div 180$ C. $\frac{180}{6,000} \times 350,000$
D. $\frac{350,000}{180} \times 6,000$ E. $\frac{180}{350,000} \times 6,000$

Website	Purchases per 6,000 Clicks
Etsy	120
Amazon	150
Ebay	180
Google	240
Yahoo	275

2. MULTI-STEP AND TRICKY PROPORTION WORD PROBLEMS

Example 1: A machine that is run 6 days per week is operating at 80% efficiency and producing 56 units per day. Once it is tuned up it will run at 90% efficiency. How many more units per week will the machine produce after the tune up?

- A. 63 B. 7 C. 336 D. 378 E. 42

$$\frac{\text{units per day}}{\% \text{ efficiency}} \quad \frac{56}{80} = \frac{x}{90} \quad 56 \times 90 \div 80 = x = 63 \text{ units per day}$$

You have calculated the number of units per day the machine will make after the tune up, but that is not what the problem asks for. The problem asks “how many more units per week.”

First calculate how many more units per day the machine will produce.

$$63 - 56 = 7 \text{ more units per day}$$

Next, multiply times the 6 days per week that the machine is run.

$$7 \text{ units per day} \times 6 \text{ days per week} = 42 \text{ more units per week.}$$

Answer: E. 42

What to look out for: Extra steps may be needed before or after you form your proportion, *and*, make sure you are answering the question that is asked.

Example 2: There are 750 cds for sale at the local rummage sale. If you can buy 3 cds for \$3.49, how much will 27 cds cost?

- A. \$10.47 B. \$83.33 C. \$31.41 D. \$23.21 E. \$27.78

$$\frac{\text{cost}}{\text{number of cds}} \quad \frac{3.49}{3} = \frac{x}{27} \quad \$3.49 \times 27 \div 3 = x = \$31.41$$

Answer: C. \$31.41

What about the 750 cds? How does that come into the problem? It doesn't. The number of cds that there are to choose from does not affect the cost of the cds.

What to look out for: Extra numbers that you don't need.

Example 3: The directions on a lemonade mix package say to mix 3 teaspoons of lemonade powder with 1 liter of water. Which of the following combinations of powder and water would produce lemonade with the correct concentration?

- A. $\frac{1}{4}$ tsp powder & 4 liters water B. $\frac{1}{2}$ tsp powder & $1\frac{1}{2}$ liters water
C. 4 tsp powder & 2 liters water D. $1\frac{1}{2}$ tsp powder & $\frac{1}{2}$ liter water
E. 1 tsp powder & 3 liters water

In this type of problem, the question provides the first ratio of a proportion, and the answer choices provide five possibilities for the second ratio of the proportion. Remember that both ratios in a proportion are equal so both will simplify to the same number.

Step 1 – Simplify the first ratio of the proportion, which is given in the problem.

You are given: $\frac{\text{tsp of powder}}{\text{liters of water}} = \frac{3}{1}$ Divide to simplify: $3 \div 1 = 3$

Step 2 – Find one of the answer choices that also simplifies to 3 and you will have found the other half of your proportion.

Try A. $\frac{\text{powder}}{\text{water}} = \frac{\frac{1}{4}}{4}$ $0.25 \div 4 = 0.0625$
Does not simplify to 3, so answer A. $\frac{1}{4}$ **is not** correct.

Try B. $\frac{\text{powder}}{\text{water}} = \frac{\frac{1}{2}}{1\frac{1}{2}}$ $0.5 \div 1.5 = 0.33$
Does not simplify to 3, so answer B. $\frac{1}{2}$ **is not** correct.

Try C. $\frac{\text{powder}}{\text{water}} = \frac{4}{2}$ $4 \div 2 = 2$
Does not simplify to 3, so answer C. $\frac{4}{2}$ **is not** correct.

Try D. $\frac{\text{powder}}{\text{water}} = \frac{1\frac{1}{2}}{\frac{1}{2}}$ $1.5 \div 0.5 = 3$
Does simplify to 3, so answer D. $\frac{1\frac{1}{2}}{\frac{1}{2}}$ **is** correct.
Answer: D. $1\frac{1}{2}$ tsp powder & $\frac{1}{2}$ liter water

NOTE – It is usually easier to simplify using decimals, as shown above, but you could also use the abc key to enter the fractions that are given.

What to look out for: A problem where you are given the first ratio of a proportion and need to choose the correct second ratio. This is different from all of the other proportion problems you have seen where you are given three of the four parts of a proportion and need to calculate the one missing part.

Example 4: The legend on a map of Italy shows a scale of 3.2 kilometers (km) in actual distance = 2 centimeters (cm) on the map. Which expression below gives the best estimate of the distance across a lake if the distance measures 9.6 cm on the map?

- A. $\frac{3}{2} \times 9$ B. $\frac{2}{3} \times 9$ C. $\frac{10}{4} \times 2$ D. $\frac{3}{2} \times 10$ E. $\frac{2}{3} \times 10$

Notice that the question asks for the best estimate. That means that the numbers in your proportion need to be rounded up or down. First, set up the proportion with the numbers given in the problem. Then, round them up or down.

Remember, when rounding, 5 or greater rounds up, and 4 or less rounds down.

9.6 rounds up to 10 because 6 is greater than 5.

3.2 rounds down to 3 because 2 is less than 5.

$$\frac{\text{actual km}}{\text{cm on map}} \quad \frac{3.2}{2} = \frac{x}{9.6} \quad \rightarrow \quad \frac{3}{2} = \frac{x}{10} \quad \text{The cross multiplication expression is:}$$
$$3 \times 10 \div 2 \quad \text{or} \quad 10 \times 3 \div 2$$

All the answer choices are in fraction form, so you must figure out which of the answer choices is the same as one of your cross multiplication expressions. Use either the scan for correct fraction method or the calculation method.

Method One – Scan answers choices for the correct fraction.

The cross multiplication expressions are both $\div 2$, so the correct fraction will have 2 on the bottom and either 3×10 or 10×3 on top.

Think of answer D. as $\frac{3}{2} \times \frac{10}{1}$ and you can see 3×10 on top and 2 on the bottom.

Answer: D. $\frac{3}{2} \times 10$

Method Two – Calculation. Calculate the value of the cross multiplication expression, and then calculate the value of each multiple choice answer until you find a match.

Cross multiplication expression: $3 \times 10 \div 2 = 15$

Try A. $\frac{3}{2} \times 9 = 13.5$ **Does not** = 15, so **is not** correct.

Try B. $\frac{2}{3} \times 9 = 6$ **Does not** = 15, so **is not** correct.

Try C. $\frac{10}{4} \times 2 = 5$ **Does not** = 15, so **is not** correct.

Try D. $\frac{3}{2} \times 10 = 15$ **Does** = 15, so **is** correct.

Answer: D. $\frac{3}{2} \times 10$

What to look out for: Problems that ask for the best estimate. Round numbers up or down before forming your cross multiplication expression.

Practice Two*Answers – p. 16*

1. A home recipe for a cleaning liquid calls for $\frac{3}{4}$ ounce of ammonia (NH_4) for every 3 cups of water (H_2O). Which combination below will make the cleaning liquid with the correct concentration?

- A. $\frac{1}{4}$ ounce ammonia & 4 cups water B. $\frac{1}{2}$ ounce ammonia & 4 cups water
C. $1\frac{1}{4}$ ounces ammonia & 6 cups water D. $1\frac{1}{2}$ ounces ammonia & 6 cups water
E. $1\frac{3}{4}$ ounces ammonia & 5 cups water

2. Marie charges \$10 per hour to babysit 2 children and \$12 per hour to babysit 3 children. How much will she charge to babysit for 4 hours and thirty minutes if a family has 3 children?

- A. \$45 B. \$51.6 C. \$43 D. \$16.45 E. \$54

3. Notebooks are on sale at \$3.29 for a 4-pack. If each of the 5 Dawson children needs 8 notebooks for school, how much will all of the notebooks cost?

- A. \$6.58 B. \$32.90 C. \$48.63 D. \$16.45 E. \$26.32

4. Every 4 days, Ayala spends $\frac{1}{2}$ hour grooming her dog. Which combination below shows the same relationship between days and grooming time?

- A. 8 days & $\frac{1}{4}$ hour of grooming B. 9 days & $\frac{3}{4}$ hours grooming
C. 12 days & $1\frac{1}{2}$ hours of grooming D. 5 days & $\frac{1}{4}$ hour grooming
E. 7 days & 1 hour of grooming

5. On a map of Europe where the scale reads 1.8 centimeters (cm) = 20 kilometers (km), two towns are measured to be 12.6 centimeters apart. Choose the expression below that gives the best estimate of how many kilometers there are between the two towns.

- A. $\frac{20}{2} \times 12$ B. $\frac{20}{13} \times 2$ C. $\frac{13}{2} \times 20$ D. $\frac{2}{12} \times 20$ E. $\frac{13}{1} \times 20$

ANSWER KEY Lesson 3 Advanced Proportion Word Problems

Practice One

1. A machine produces 400 switches in 3 hours. At the same rate of production, which expression shows how long will it take for the machine to produce 900 switches?

- A. $\frac{900}{400} + 3$ B. $\frac{900}{400} \div 3$ C. $\frac{400}{3} \times 900$ **D. $\frac{900}{400} \times 3$** E. $\frac{400 \times 3}{900}$

$$\frac{\text{switches}}{\text{hours}} \quad \frac{400}{3} = \frac{900}{x}$$

The cross multiplication expression is:

$$3 \times 900 \div 400 \quad \text{or} \quad 900 \times 3 \div 400$$

All the answer choices are in fraction form, so you must figure out which of the answer choices is the same as one of your cross multiplication expressions. Use either the scan for correct fraction method or the calculation method.

Method One – Scan answers choices for the correct fraction.

The cross multiplication expressions are both $\div 400$, so the correct fraction will have 400 on the bottom and either 3×900 or 900×3 on top.

Think of answer D. as $\frac{900}{400} \times \frac{3}{1}$ and you can see 900×3 on top and 400 on the bottom.

Answer: D. $\frac{900}{400} \times 3$

Method Two – Calculation. Calculate the value of the cross multiplication expression, and then calculate the value of each multiple choice answer until you find a match.

Cross multiplication expression: $3 \times 900 \div 400 = 6.75$

Try A. $\frac{900}{400} + 3 = 5.25$ **Does not** = 6.75, so **is not** correct.

Try B. $\frac{900}{400} \div 3 = 0.75$ **Does not** = 6.75, so **is not** correct.

Try C. $\frac{400}{3} \times 900 = 120,000$ **Does not** = 6.75, so **is not** correct.

Try D. $\frac{900}{400} \times 3 = 6.75$ **Does** = 6.75, so **is** correct.

Answer: D. $\frac{900}{400} \times 3$

2. A family has driven 225 miles in 4 ½ hours. If they continue driving at the same rate, which expression shows how long it will take to drive the next 400 miles of their trip?

- A. $\frac{225}{400} \times 4.5$ B. $\frac{4.5}{225} + 400$ C. $\frac{400}{225} + 4.5$ D. $\frac{400}{4.5} \times 225$ E. $\frac{400 \times 4.5}{225}$

$$\frac{\text{miles}}{\text{hours}} \frac{225}{4.5} = \frac{400}{x}$$

The cross multiplication expression is:

$$400 \times 4.5 \div 225 \quad \text{or} \quad 4.5 \times 400 \div 225$$

All the answer choices are in fraction form, so you must figure out which of the answer choices is the same as one of your cross multiplication expressions. Use either the scan for correct fraction method or the calculation method.

Method One – Scan answers choices for the correct fraction.

The cross multiplication expressions are both $\div 225$, so the correct fraction will have 225 on the bottom and either 400×4.5 or 4.5×400 on top.

Answer: E. $\frac{400 \times 4.5}{225}$

Method Two – Calculation. Calculate the value of the cross multiplication expression, and then calculate the value of each multiple choice answer until you find a match.

Cross multiplication expression: $4.5 \times 400 \div 225 = 8$

Try A. $\frac{225}{400} \times 4.5 = 2.53$ **Does not = 8, so is not correct.**

Try B. $\frac{4.5}{225} + 400 = 400$ **Does not = 8, so is not correct.**

Try C. $\frac{400}{225} + 4.5 = 6.28$ **Does not = 8, so is not correct.**

Try D. $\frac{400}{4.5} \times 225 = 20,000$ **Does not = 8, so is not correct.**

Try E. $\frac{400 \times 4.5}{225} = 8$ **Does = 8, so is correct.**

Answer: E. $\frac{400 \times 4.5}{225}$

3. Which expression below can be used to find the cost of a single marble if a bag of 75 marbles is sold for \$5.75?

A. $75 \times \$5.75$

B. $\$5.75 \div 75$

C. $75 - \$5.75$

D. $75 \div \$5.75$

E. $75 + \$5.75$

$$\frac{\text{marbles}}{\$} \quad \frac{75}{5.75} = \frac{1}{x}$$

The cross multiplication expression is:

$$\$5.75 \times 1 \div 75 \quad \text{or} \quad 1 \times \$5.75 \div 75$$

It can be shortened to $\$5.75 \div 75$ because $\$5.75 \times 1$ is the same as $\$5.75$.

Answer: B. $\$5.75 \div 75$

Note that the problem says “a single marble.” This is 1 marble, so use 1 in your proportion, even though the number 1 is not stated in the problem. It could also have said “per marble,” “each marble,” or “a marble.” These also mean 1 marble.

4. If 3 bottles of shampoo cost \$5, which expression shows how much 8 bottles of shampoo will cost?

A. $8 \times \$5 \div 3$

B. $\$5 \times 3 \div 8$

C. $(3 + 8) \times \$5$

D. $(3 + 8) \div \$5$

E. $8 \times 3 \div \$5$

$$\frac{\text{bottles}}{\$} \quad \frac{3}{5} = \frac{8}{x}$$

The cross multiplication expression is:

$$\$5 \times 8 \div 3 \quad \text{or} \quad 8 \times \$5 \div 3 \quad \text{Answer: A. } 8 \times \$5 \div 3$$

5. A person can type 1,950 words in 30 minutes. At the same rate, which expression shows how many words per minute the person can type?

A. $1,950 \div 30$

B. $30 \div 1,950$

C. $1,950 - 30$

D. $1,950 \times 30$

E. $1,950 + 30$

$$\frac{\text{words}}{\text{minutes}} \quad \frac{1,950}{30} = \frac{x}{1}$$

The cross multiplication expression is:

$$1,950 \times 1 \div 30 \quad \text{or} \quad 1 \times 1,950 \div 30$$

It can be shortened to $1,950 \div 30$ because $1,950 \times 1$ is the same as 1,950.

Answer: A. $1,950 \div 30$

The time given and the time asked for in the question are both in minutes, so no time conversion is needed.

Note that the problem says “per minute.” You have to recognize that this is 1 minute, and use the number 1 in your proportion, even though the number 1 is not stated.

6. Langley Party Supply is having a sale on bulk packages of paper plates. Each package of 200 paper plates is on sale for \$1.79. Which of the following expressions could be used to calculate the cost in dollars of 1,800 paper plates?

A. $\frac{1,800}{\$1.79} \times 200$

B. $\frac{\$1.79 + 1,800}{200}$

C. $\frac{\$1.79}{200} \times 1,800$

D. $\frac{1,800 \div \$1.79}{200}$

E. $\frac{\$1.79}{1,800} \times 200$

$$\frac{\text{plates}}{\$} \frac{200}{1.79} = \frac{1,800}{x}$$

The cross multiplication expression is:

$$\$1.79 \times 1,800 \div 200 \quad \text{or} \quad 1,800 \times \$1.79 \div 200$$

All the answer choices are in fraction form, so you must figure out which of the answer choices is the same as one of your cross multiplication expressions. Use either the scan for correct fraction method or the calculation method.

Method One – Scan answers choices for the correct fraction.

The cross multiplication expressions are both $\div 200$, so the correct fraction will have 200 on the bottom and either $\$1.79 \times 1,800$ or $1,800 \times \$1.79$ on top.

Think of answer C. as $\frac{\$1.79}{200} \times \frac{1,800}{1}$ and you can see $\$1.79 \times 1,800$ on top and 200 on the bottom.

Answer: C. $\frac{\$1.79}{200} \times 1,800$

Method Two – Calculation. Calculate the value of the cross multiplication expression, and then calculate the value of each multiple choice answer until you find a match.

Cross multiplication expression: $\$1.79 \times 1,800 \div 200 = \16.11

Try A. $\frac{1,800}{\$1.79} \times 200 = \$201,117$

Does not = \$16.11, so **is not** correct.

Try B. $\frac{\$1.79 + 1,800}{200} = \9.09

Does not = \$16.11, so **is not** correct.

Try C. $\frac{\$1.79}{200} \times 1,800 = \16.11

Does = \$16.11, so **is** correct.

Answer: C. $\frac{\$1.79}{200} \times 1,800$

SHORTCUT – You may have noticed that 1,800 plates is 9 times as big as 200 plates, so the price will also be 9 times as big. $9 \times \$1.79 = \16.11 . Check multiple choice answers for a match, as just shown in method two.

7. A company has placed an ad on several different websites. The number of purchases made by people who click on the ad is shown in the chart below. If the ad that is on ebay produces about 350,000 clicks, which expression shows about how many purchases the company can expect from those clicks?

A. $\frac{350,000 + 180}{6,000}$

B. $350,000 \div 180$

C. $\frac{180}{6,000} \times 350,000$

D. $\frac{350,000}{180} \times 6,000$

E. $\frac{180}{350,000} \times 6,000$

Website	Purchases per 6,000 Clicks
Etsy	120
Amazon	150
Ebay	180
Google	240
Yahoo	275

$$\frac{\text{purchases}}{\text{number of clicks}} = \frac{180}{6,000} = \frac{x}{350,000}$$

The cross multiplication expression is:

$$180 \times 350,000 \div 6,000 \quad \text{or} \\ 350,000 \times 180 \div 6,000$$

All the answer choices are in fraction form, so you must figure out which of the answer choices is the same as one of your cross multiplication expressions. Use either the scan for correct fraction method or the calculation method.

Method One – Scan answers choices for the correct fraction.

The cross multiplication expressions are both $\div 6,000$, so the correct fraction will have 6,000 on the bottom and either $180 \times 350,000$ or $350,000 \times 180$ on top.

Think of answer C. as $\frac{180}{6,000} \times \frac{350,000}{1}$ and you can see $180 \times 350,000$ on top and 6,000 on the bottom.

Answer: C. $\frac{180}{6,000} \times 350,000$

Method Two – Calculation. Calculate the value of the cross multiplication expression, and then calculate the value of each multiple choice answer until you find a match.

Cross multiplication expression: $180 \times 350,000 \div 6,000 = 10,500$

Try A. $\frac{350,000 + 180}{6,000} = 58$

Does not = 10,500, so **is not** correct.

Try B. $350,000 \div 180 = 1944$

Does not = 10,500, so **is not** correct.

Try C. $\frac{180}{6,000} \times 350,000 = 10,500$

Does = 10,500, so **is** correct.

Answer: C. $\frac{180}{6,000} \times 350,000$

Practice Two

1. A home recipe for a cleaning liquid calls for $\frac{3}{4}$ ounce of ammonia (NH₄) for every 3 cups of water (H₂O). Which combination below will make the cleaning liquid with the correct concentration?

- A. $\frac{1}{4}$ ounce ammonia & 4 cups water B. $\frac{1}{2}$ ounce ammonia & 4 cups water
C. $1\frac{1}{4}$ ounces ammonia & 6 cups water **D. $1\frac{1}{2}$ ounces ammonia & 6 cups water**
E. $1\frac{3}{4}$ ounces ammonia & 5 cups water

In this type of problem, the question provides the first ratio of a proportion, and the answer choices are five possibilities for the second ratio of the proportion. Remember that both ratios in a proportion are equal so both will simplify to the same number.

Step 1 – Simplify the first ratio of the proportion that is given in the problem.

$$\text{You are given: } \frac{\text{oz of NH}_4}{\text{cups of H}_2\text{O}} = \frac{\frac{3}{4}}{3} \quad 0.75 \div 3 = 0.25$$

Step 2 – Find one of the answer choices that also simplifies to 0.25 and you will have found the other half of your proportion.

Try A. $\frac{\text{NH}_4}{\text{H}_2\text{O}} = \frac{\frac{1}{4}}{4} \quad 0.25 \div 4 = 0.0625$ **Does not** simplify to 0.25, so **is not** correct.

Try B. $\frac{\text{NH}_4}{\text{H}_2\text{O}} = \frac{\frac{1}{2}}{4} \quad 0.5 \div 4 = 0.125$ **Does not** simplify to 0.25, so **is not** correct.

Try C. $\frac{\text{NH}_4}{\text{H}_2\text{O}} = \frac{1\frac{1}{4}}{6} \quad 1.25 \div 6 = 0.2083$ **Does not** simplify to 0.25, so **is not** correct.

Try D. $\frac{\text{NH}_4}{\text{H}_2\text{O}} = \frac{1\frac{1}{2}}{6} \quad 1.5 \div 6 = 0.25$ **Does** simplify to 0.25, so **is** correct.

Answer: D. $1\frac{1}{2}$ ounces ammonia & 6 cups water

2. Marie charges \$10 per hour to babysit 2 children and \$12 per hour to babysit 3 children. How much will she charge to babysit for 4 hours and thirty minutes if a family has 3 children?

- A. \$45 B. \$51.6 C. \$43 D. \$16.45 **E. \$54**

The related values are \$ and number of hours. The \$10 per hour for 2 children is extra information that is not needed to solve the problem. Choose the \$12 rate because the family has 3 children. Convert 4 hours thirty minutes to 4.5 hours.

You may recognize that this is a multiplication problem:

$$\text{\$12 per hour} \times 4.5 \text{ hours} = \text{\$54.}$$

If you don't see that and are not sure what to do, set up a proportion.

$$\frac{\text{Hours}}{\text{\$}} = \frac{1}{12} = \frac{4.5}{x} \quad \$12 \times 4.5 \div 1 = x = \$54 \quad \text{Answer: E. \$54}$$

3. Notebooks are on sale at \$3.29 for a 4-pack. If each of the 5 Dawson children needs 8 notebooks for school, how much will all of the notebooks cost?

- A. \$6.58 **B. \$32.90** C. \$48.63 D. \$16.45 E. \$26.32

$$\frac{\text{notebooks}}{\text{cost in \$}} \quad \frac{4}{3.29} = \frac{40}{x} \quad 40 \times \$3.29 \div 4 = x = \$32.90 \quad \text{Answer: B. \$32.90}$$

Calculate the total number of notebooks needed in order to get the number for the second ratio. 5 children x 8 notebooks per child = 40 total notebooks.

The two related values are number of notebooks and cost. That is the relationship given in the problem (4 notebooks for \$3.29) and it is also what is asked for in the question (all of the notebooks for how many \$).

SHORTCUT – You may have noticed 40 notebooks are needed, and 40 is 10 times bigger than a 4-pack of notebooks, so the price will also be 10 times bigger.

$$10 \times \$3.29 = \$32.90. \quad \text{Answer: B. \$32.90}$$

4. Every 4 days, Ayala spends $\frac{1}{2}$ hour grooming her dog. Which combination below shows the same relationship between days and grooming time?

- A. 8 days & $\frac{1}{4}$ hour of grooming B. 9 days & $\frac{3}{4}$ hours grooming
C. 12 days & 1 $\frac{1}{2}$ hours of grooming D. 5 days & $\frac{1}{4}$ hour grooming
E. 7 days & 1 hour of grooming

In this type of problem, the question provides the first ratio of a proportion, and the answer choices provide five possibilities for the second ratio of the proportion. Remember that both ratios in a proportion are equal so both will simplify to the same number.

Step 1 – Simplify the first ratio of the proportion that is given in the problem.

$$\text{You are given: } \frac{\text{days}}{\text{grooming hrs}} \quad \frac{4}{\frac{1}{2}} \quad 4 \div 0.5 = 8$$

Step 2 – Find one of the answer choices that also simplifies to 8 and you will have found the other half of your proportion.

$$\text{Try A. } \frac{\text{days}}{\text{hrs}} \quad \frac{8}{\frac{1}{4}} \quad 8 \div 0.25 = 32 \quad \text{Does not simplify to 8, so is not correct.}$$

$$\text{Try B. } \frac{\text{days}}{\text{hrs}} \quad \frac{9}{\frac{3}{4}} \quad 9 \div 0.75 = 12 \quad \text{Does not simplify to 8, so is not correct.}$$

$$\text{Try C. } \frac{\text{days}}{\text{hrs}} \quad \frac{12}{1 \frac{1}{2}} \quad 12 \div 1.5 = 8 \quad \text{Does simplify to 8, so is correct.}$$

Answer: C. 12 days & 1 $\frac{1}{2}$ hours of grooming

5. On a map of Europe where the scale reads 1.8 centimeters (cm) = 20 kilometers (km), two towns are measured to be 12.6 centimeters apart. Choose the expression below that gives the best estimate of how many kilometers there are between the two towns.

- A. $\frac{20}{2} \times 12$ B. $\frac{20}{13} \times 2$ C. $\frac{13}{2} \times 20$ D. $\frac{2}{12} \times 20$ E. $\frac{13}{1} \times 20$

The problem asks for the best estimate, so numbers will be rounded.

12.6 cm rounds up to 13 cm.

1.8 cm rounds up to 2 cm.

$$\frac{\text{actual km}}{\text{cm on map}} \frac{20}{1.8} = \frac{x}{12.6} \rightarrow \frac{20}{2} = \frac{x}{13} \quad \text{The cross multiplication expression is:}$$

$$13 \times 20 \div 2 \quad \text{or} \quad 20 \times 13 \div 2$$

All the answer choices are in fraction form, so you must figure out which of the answer choices is the same as one of your cross multiplication expressions. Use either the scan for correct fraction method or the calculation method.

Method One – Scan answers choices for the correct fraction.

The cross multiplication expressions are both $\div 2$, so the correct fraction will have 2 on the bottom and either 13×20 or 20×13 on top.

Think of answer C. as $\frac{13}{2} \times \frac{20}{1}$ and you can see 13×20 on top and 2 on the bottom.

Answer: C. $\frac{13}{2} \times 20$

Method Two – Calculation. Calculate the value of the cross multiplication expression, and then calculate the value of each multiple choice answer until you find a match.

Cross multiplication expression: $13 \times 20 \div 2 = 130$

Try A. $\frac{20}{2} \times 12 = 120$ **Does not** = 130, so **is not** correct.

Try B. $\frac{20}{13} \times 2 = 3.08$ **Does not** = 130, so **is not** correct.

Try C. $\frac{13}{2} \times 20 = 130$ **Does** = 130, so **is** correct.

Answer: C. $\frac{13}{2} \times 20$