PROPORTION
Lesson 2   Beginning Proportion Word Problems

1. BASIC PROPORTION WORD PROBLEMS

Proportion word problems are solved by setting up a proportion where three of the parts are known based on information in the word problem, and then using cross multiplication to solve for the missing fourth part.

Example 1: Lena spends 15 hours practicing her violin over a period of 12 days. At the same rate, how many hours does she practice in 45 days?

A. 18   B. 57   C. 56.25   D. 36   E. 45.5

Step 1 – Determine the two related values and make a ratio out of the words. You will often find the two related values in the sentence that asks the question. In this problem, hours of practice and number of days are the two related values.

$$\frac{\text{hours of practice}}{\text{days}}$$

Step 2 – Write a ratio using the relationship given in the problem. The problem tells you that 15 hours of practice goes with 12 days, so these two numbers will form the first ratio. Make sure they are in the same order as the word ratio, with hours on top and days on bottom. It doesn't matter which value is on top of the ratio and which value is on the bottom of the ratio, but you must keep the same order throughout the problem.

$$\frac{\text{hours of practice}}{\text{days}} \quad \frac{15}{12}$$

Step 3 – Write a second ratio using x for the unknown, and information from the problem for the other part of the ratio. The question asks how many hours of practice go with 45 days, so, hours of practice is the unknown x that you need to figure out, and it goes with 45 days. x goes on top with hours. 45 goes on the bottom with days.

$$\frac{\text{hours of practice}}{\text{days}} \quad \frac{15}{12} = \frac{x}{45}$$

Step 4 – Solve for x using cross multiplication.   **15 x 45 ÷ 12 = x = 56.25**

Answer: C. 56.25 hours of practice

Important – When forming the first ratio, be sure to choose the two values that the problem tells you are related. In the above problem, 15 hours of practice is related to 12 days. 15 hours of practice **is not** related to 45, the other days number.

Example 2: Joanne is catering a large wedding. She knows from experience that she needs 90 appetizers to serve 35 guests. If the wedding will have 225 guests, how many appetizers should she prepare?

A. 3,150   B. 579   C. 87.5   D. 3,375   E. 759

Step 1 – The word ratio is: $\dfrac{\text{guests}}{\text{appetizers}}$

Step 2 – The relationship given in the problem is 90 appetizers for 35 guests so these two numbers make up the first ratio. 90 goes on the bottom with the word appetizers and 35 goes on the top with the word guests.

$$\frac{\text{guests}}{\text{appetizers}}\quad \frac{35}{90}$$

Step 3 – For the second ratio, the number of appetizers is the unknown value, x, and it goes with 225 guests. These two related values make up the second ratio. 225 goes on top with guests, and x goes on the bottom with appetizers.

$$\frac{\text{guests}}{\text{appetizers}}\ \frac{35}{90}=\frac{225}{x}$$

Step 4 – Solve with cross multiplication.   **90 x 225 ÷ 35 = x = 578.57**

Answer: B. 579 appetizers

Important – When forming the first ratio, be sure to choose the two values that the problem tells you are related. In this problem, 90 appetizers is related to 35 guests. 90 appetizers **is not** related to 225, the other guests number.

Important – Take the time to write out the word ratio before forming the number ratios. It will help you keep the correct numbers on the top and bottom of the proportion.

Example 3: The cost of carpeting is directly proportional to the size of the area being carpeted. If it costs $16 to carpet 3 square yards, how much will it cost to carpet 525 square yards?

A. $98.44   B. $175   C. $8,400   D. $32.81   E. $2,800

This is another way of wording a proportion problem, and it is solved the same way as the first two examples. The two related values are cost in $ and size in square yards. The first ratio shows the given relationship of $16 for 3 square yards. The second ratio shows the unknown cost that goes with 525 square yards.

$$\frac{\text{cost in \$}}{\text{size in square yards}} \qquad \frac{16}{3} = \frac{x}{525} \qquad 525 \text{ x } \$16 \div 3 = x = \$2,800 \quad \textbf{Answer: E. \$2,800}$$

Important – When forming the first ratio, be sure to choose the two values that the problem tells you are related. In this problem, $16 is related to 3 square yards. $16 **is not** related to 525, the other square yards number.

Example 4: The number of graduates per 250 freshmen at state colleges is shown in the chart below.

State	Graduates per 250 freshmen
Delaware	145
New York	95
Georgia	70
Tennessee	53
Idaho	38

A state college located in New York has a freshman class of 1,200 students. What would you predict for the approximate number of graduates from that class?

A. 13   B. 155   C. 950   D. 456   E. 645

The two related values are number of graduates and number of freshmen, and in this problem, you have to pull the correct numbers from the chart to get your first ratio. The question is about a New York college, so use the information from the New York line in the chart.

$$\frac{\text{graduates}}{\text{freshmen}} \quad \frac{95}{250} = \frac{x}{1,200}$$

Solve with cross multiplication.   95 x 1,200 ÷ 250 = x = 456

Answer: D. 456 graduates

It is important to write your word ratio before forming your number ratios. This will help you keep the correct numbers on the top and bottom of the proportion.

1. Remco has canned tomato sauce on sale for 5 cans for $2. How much would it cost to buy 35 cans of sauce?

A. $20   B. $9   C. $14   D. $87.50   E. $45

2. A warehouse currently stores 5,200 manufactured units using 65% of its storage capacity. How many units can it store when using 100% of its storage capacity?

A. 3,380   B. 8,000   C. 338,000   D. 800   E. 80,000

3. A case of candy containing 300 pieces is on sale for $5.99. How much will 24,000 pieces of candy cost?

A. $47.92   B. $1,797.00   C. $4,006.67   D. $400.67   E. $479.20

4. The weight of a shipment of granola bars is directly proportional to the number of packages in the shipment. If 8 packages of granola bars weigh 5 pounds, what is the weight in pounds of a shipment of 300 packages?

A. 480   B. 187.5   C. 1,500   D. 2,400   E. 1,875

5. To make Powerzone cleaning solution, the directions say to use ½ cup of Powerzone powder for 20 ounces of water. How many cups of powder will be used with 70 ounces of water?

A. 1 ¾   B. 1 ¼   C. 25   D. 10   E. 1 ½

6. A factory that manufactures a patented metal alloy produces 327 liters of liquid waste for every 2 million kilograms of the alloy that are made. How many liters of liquid waste are produced when 6.5 million kilograms of alloy are made?

A. 2,125.5   B. 100.62   C. 654   D. 1,062.75   E. 2,779.50

7. The annual employee turnover rate for different industries is shown on the chart below. If a company in industry C has 175 employees, what do you predict for that company's turnover number each year?

A. 1,250   B. 25   C. 7   D. 3   E. 105

Industry	Annual Turnover Per 500 Employees
Industry A	145
Industry B	95
Industry C	70
Industry D	53
Industry E	38

2. PROPORTION WORD PROBLEMS USING MAPS & SCALE DIAGRAMS

Example 1: Smithville and Tarrytown are 4 ½ inches apart on a map where the scale reads 5 miles = ½ inch. How many miles apart are the two towns?

A. 45   B. 22.5   C. 25   D. 2.5   E. 54

Scale problems like this compare the real distance between two points with the much smaller distance between the two points that is shown on a map or diagram. In most cases, the two related values in a scale problem will be the two scale measurements.

Step 1 – In this problem, the two related values are inches on the map and miles of real distance, so this is the word ratio.

Step 2 – ½ inch on the map = 5 miles in real distance, so this is the first ratio of the proportion.

Step 3 – 4 ½ inches on the map goes with the unknown, which is the real distance between the two towns, so 4 ½ and x make up the second ratio of the proportion.

$$\frac{\text{miles of real distance}}{\text{inches on the map}} \qquad \frac{5}{\tfrac{1}{2}} = \frac{x}{4\,\tfrac{1}{2}} \qquad 5 \text{ x } 4\,\tfrac{1}{2} \div \tfrac{1}{2} = x = 45$$

Answer: A. 45 miles apart

Important – When forming the first ratio, be sure to choose the two values that the problem tells you are related. In this problem, 5 miles is related to ½ inch.
5 miles **is not** related to 4 ½, the other inches number.

TIP – It is usually easier to enter the fractions ¼, ½, and ¾ as decimals than it is to enter them as fractions using the abc key. So, ½ can be entered as 0.5 and 4 ½ can be entered as 4.5 .

Example 2: Dean Contracting Co. has created a blueprint for a grocery store they have been hired to build. The store will be 270 feet long and 180 feet wide, and each inch on the blueprint equals 6 feet of actual distance. What are the length and width of the store on the blueprint?

A. 1620 inches x 1080 inches   B. 22.5 inches x 15 inches
C. 450 inches x 300 inches   D. 45 inches x 30 inches
E. 270 inches x 180 inches

Notice that you will have to do two proportions, one to figure out the length, and one to figure out the width. Another signal that two calculations are needed is that the answer choices all have two measurements.

The two related values in this problem are the two scale measurements, inches and feet. The relationship that is given is "each inch on the blueprint equals 6 feet of actual distance." You have to recognize that "each inch" means 1 inch, so use the number 1 in your proportions even though the number 1 is not stated.

LENGTH: The unknown in the length calculation is the number of inches on the blueprint that will represent 270 feet of actual length of the grocery store.

$$\frac{\text{actual feet}}{\text{inches on blueprint}} \qquad \frac{6}{1} = \frac{270}{x} \qquad 270 \text{ x } 1 \div 6 = x = 45 \qquad \text{Length} = \textbf{45 inches}$$

WIDTH: The unknown in the width calculation is the number of inches on the blueprint that will represent 180 feet of actual width of the grocery store.

$$\frac{\text{actual feet}}{\text{inches on blueprint}} \qquad \frac{6}{1} = \frac{180}{x} \qquad 180 \text{ x } 1 \div 6 = x = 30 \qquad \text{Width} = \textbf{30 inches}$$

Answer: D. 45 inches x 30 inches

SHORTCUT – You may have recognized this problem as a pair of division problems:
Length is $270 \div 6 = 45$ inches.   Width is $180 \div 6 = 30$ inches.

If you see that just from reading the problem, great. It is a faster way to solve the problem. If you don't see that right off, and are not sure how to solve the problem, set up two proportions as just shown.

Sometimes when the number relationships are simple, you can solve proportion word problems by just multiplying or dividing without setting up the proportion. If you can see this when reading a problem, that is fine and will save some time. When in doubt, take the time to set up the proportion.

1. The distance between Leo's house and his daughter's college is 325 kilometers (km), and on a map that shows both locations, 3 centimeters (cm) equals 25 kilometers (km). On the map, how many centimeters apart are Leo's house and the college?

A. 13   B. 39   C. 100   D. 75   E. 117

2. The distance on a local map between Rob's house and his job is 5 inches. If 2 inches represents 3 miles on the map, how many miles is Rob's house from his job?

A. 7.5   B. 75   C. 3.3   D. 15   E. 10

3. A detailed diagram of an airplane is drawn to scale, with each inch on the diagram equivalent to 5 feet of length on the airplane. If the wingspan is 25 inches long on the diagram, how many feet long is the actual wingspan of the airplane?

A. 5   B. 30   C. 125   D. 152   E. 20

4. A new hotel ballroom will measure 60 meters long and 42 meters wide, and a scale model will be built to use in mapping out different floor plan arrangements. Each centimeter (cm) on the scale model is equal to 2 meters (m) of actual distance. What will the length and width of the ballroom be on the scale model?

A. 120 cm by 84 cm   B. 60 cm by 42 cm   C. 58 cm by 40 cm
D. 30 cm by 30 cm   E. 30 cm by 21 cm

5. Kayla is painting a large wall mural and will plan out the design and colors on a grid. The mural will be 40 feet long and 15 feet wide. 5 feet on the mural is equivalent to 3 units on the grid. What are the dimensions of the mural on the grid?

A. 24 units by 9 units   B. 67 units by 25 units   C. 13 units by 8 units
D. 120 units by 45 units   E. 120 units by 75 units

3. PROPORTION WORD PROBLEMS USING TIME

Memorize these time conversions if you don't already know them.
> 60 minutes = 1 hour
> 45 minutes = ¾ hour or 0.75 hour
> 30 minutes = ½ hour or 0.50 hour
> 15 minutes = ¼ hour or 0.25 hour

Example 1: Sandy can process 16 invoices every 30 minutes. How many invoices can she process in 4 hours and 45 minutes?
A. 152   B. 71   C. 76   D. 480   E. 142

The two related values are invoices and time. 16 invoices goes with 30 minutes, so this will make up the first ratio. The unknown, x, is the number of invoices that goes with 4 hours and 45 minutes, so this will be the second ratio.

Before forming the proportion, you must convert both of the times given to be in the same unit, either minutes or hours.

To Use Minutes:
The first time, 30 minutes, is already in minutes, so no conversion is needed.
Use 30 minutes.

The second time, 4 hours and 45 minutes, must be converted to minutes.
Multiply 4 hours times 60 minutes per hour = 240 minutes, then add the 45 minutes for a total of 285 minutes.

$$\frac{\text{minutes}}{\text{invoices}} \quad \frac{30}{16} = \frac{285}{x}$$

16 x 285 ÷ 30 = x = 152   **Answer: A. 152 invoices**

To Use Hours:
30 minutes, is the same as ½ hour, also written as 0.5 hour. Use 0.5 hours.

45 minutes is the same as ¾ hour, also written as 0.75 hour, so 4 hours and 45 minutes would be written as 4.75 hours.

$$\frac{\text{hours}}{\text{invoices}} \quad \frac{0.5}{16} = \frac{4.75}{x}$$

16 x 4.75 ÷ 0.5 = x = 152   **Answer: A. 152 invoices**

Be careful when doing calculations with time.
Common mistakes that could be made doing this problem:
> 4 hours and 45 minutes is 4 ¾ hours, or 4.75 hours. It **is not** 4.45 hours.
> 30 minutes is ½ hour, or 0.5 hour. It **is not** 0.3 hour.

Example 2: A restaurant worker can dice 3 bags of onions in 45 minutes. How many hours will it take to dice 9 bags of onions?

A. 2 hours   B. 2 hours 15 minutes   C. 36 hours

D. 5 hours   E. 2 hours 25 minutes

$$\frac{\text{hours}}{\text{bags of onions}} \quad \frac{0.75}{3} = \frac{x}{9}$$

$9 \times 0.75 \div 3 = x = 2.25$ hours

Answer: B. 2 hours 15 minutes

Note that you have to convert 45 minutes to 0.75 hours at the beginning of the problem, and also convert the .25 part of your answer to 15 minutes at the end of the problem.

Common mistakes that could be made doing this problem:
    45 minutes is 0.75 hours. It **is not** 0.45 hours
    2.25 hours is 2 hours 15 minutes. It **is not** 2 hours 25 minutes.

You could also do the problem in minutes, and convert to hours at the end.

$$\frac{\text{minutes}}{\text{bags of onions}} \quad \frac{45}{3} = \frac{x}{9}$$

$9 \times 45 \div 3 = x = 135$ minutes

135 minutes $\div$ 60 minutes per hour $= 2.25$ hours

Answer: B. 2 hours 15 minutes

SHORTCUT – You may have noticed that 9 bags of onions is 3 times bigger than the 3 bags of onions given in the problem, so the desired time will also have to be 3 times bigger than 45 minutes given in the problem.

3 x 45 = 135 minutes
135 minutes $\div$ 60 minutes per hour $= 2.25$ hours → 2 hours 15 minutes.

If you see that right off, it is a faster way to solve this problem. If you don't see that, use a proportion, as just shown.

Example 3: Lara has set her company's theft prevention system to scan a certain location 340 times per hour. How many scans of this location are made in 15 minutes?

A. 23   B. 58   C. 88   D. 34   E. 85

$$\frac{\text{minutes}}{\text{scans}} \quad \frac{60}{340} = \frac{15}{x}$$ 15 x 340 ÷ 60 = x = 85   **Answer: E. 85 scans**

OR

$$\frac{\text{hours}}{\text{scans}} \quad \frac{1}{340} = \frac{0.25}{x}$$ 0.25 x 340 ÷ 1 = x = 85   **Answer: E. 85 scans**

Note that the problem says 340 times per hour. This means 340 times in 1 hour, so use 1 hour, or 60 minutes in your proportion.

SHORTCUT – You may have noticed that there are four 15 minute times periods in 1 hour, so you could divide the 340 scans by 4 to solve this problem.   340 ÷ 4 = 85 If you see that right off, it is a faster way to solve this problem. If you don't see that, use a proportion, as just shown.

Practice Three   *Answers – p. 15*

1. It takes a team of 8 workers 2 hours and 15 minutes to clean 12 apartments. How many apartments can the team clean in 9 hours?

A. 50   B. 48   C. 43   D. 45   E. 24

2. Ebony charges $11 per hour to babysit 2 children. If Mrs. Parks needs a sitter for 3 hours and 15 minutes for her 2 children, how much will she have to pay Ebony?

A. $34.65   B. $69.30   C. $35.75   D. $71.50   E. $37.55

3. Celine can make 36 party favors per hour. How many party favors can she make in 45 minutes?

A. 16   B. 1,620   C. 81   D. 27   E. 72

4. How many hours will it take to correct 20 essays if the teacher can correct 2 essays every 15 minutes?

A. 150 hours   B. 2 hours 50 minutes   C. 1 hour 30 minutes
D. 130 hours   E. 2 hours 30 minutes

ANSWER KEY   Lesson 2 Beginning Proportion Word Problems

Practice One

1. Remco has canned tomato sauce on sale for 5 cans for $2. How much would it cost to buy 35 cans of sauce?

A. $20   B. $9   **C. $14**   D. $87.50   E. $45

$$\frac{\text{number of cans}}{\$} \qquad \frac{5}{2} = \frac{35}{x} \qquad \$2 \text{ x } 35 \div 5 = x = \$14 \qquad \textbf{Answer: C. \$14}$$

OR

$$\frac{\$}{\text{number of cans}} \qquad \frac{2}{5} = \frac{x}{35} \qquad \$2 \text{ x } 35 \div 5 = x = \$14 \qquad \textbf{Answer: C. \$14}$$

Both ways are correct and produce the same cross multiplication problem and the same answer. It doesn't matter which value is chosen for the top and bottom of the proportion, as long as it is the same throughout the problem.

The rest of the problems in the Answer Key will only show the proportion set up one way. As long as your proportion produces the same cross multiplication problem and the same answer, it is correct.

NOTE – The cross multiplication problem above is $2 x 35 ÷ 5 = *x*.
         It could also have been written as 35 x $2 ÷ 5 = *x*.
         $2 x 35 is the same as 35 x $2. It doesn't matter in which order
         you multiply the two diagonal numbers.

2. A warehouse currently stores 5,200 manufactured units using 65% of its storage capacity. How many units can it store when using 100% of its storage capacity?

A. 3,380   **B. 8,000**   C. 338,000   D. 800   E. 80,000

$$\frac{\% \text{ storage capacity}}{\text{units stored}} \qquad \frac{65}{5,200} = \frac{100}{x} \qquad 100 \text{ x } 5,200 \div 65 = x = 8,000$$

Answer: B. 8,000 units

3. A case of candy containing 300 pieces is on sale for $5.99. How much will 24,000 pieces of candy cost?

A. $47.92   B. $1,797.00   C. $4,006.67   D. $400.67   **E. $479.20**

$$\frac{\$}{\text{pieces of candy}} \qquad \frac{5.99}{300} = \frac{x}{24,000} \qquad \$5.99 \text{ x } 24,000 \div 300 = x = \$479.20$$

Answer: E. $479.20

4. The weight of a shipment of granola bars is directly proportional to the number of packages in the shipment. If 8 packages of granola bars weigh 5 pounds, what is the weight in pounds of a shipment of 300 packages?

A. 480   **B. 187.5**   C. 1,500   D. 2,400   E. 1,875

$$\frac{\text{packages}}{\text{pounds}} \qquad \frac{8}{5} = \frac{300}{x} \qquad 5 \times 300 \div 8 = x = 187.5 \quad \textbf{Answer: B. 187.5 Pounds}$$

5. To make Powerzone cleaning solution, the directions say to use ½ cup of Powerzone powder for 20 ounces of water. How many cups of powder will be used with 70 ounces of water?

A. 1 ¾   B. 1 ¼   C. 25   D. 10   E. 1 ½

$$\frac{\text{cups of powder}}{\text{ounces of water}} \qquad \frac{½}{20} = \frac{x}{70} \qquad 70 \times ½ \div 20 = x = 1.75 \quad \textbf{Answer: A. 1 ¾ cups}$$

NOTE – You will probably get 1.75 on your calculator. Your answer choices are expressed in fractions, so the .75 part of your answer needs to be converted to a fraction. You should know that .75 = ¾, just like in money, 75 cents is the same as 3 quarters.

TIP – Memorize these fraction/decimal conversions if you don't already know them.

¾ = 0.75

½ = 0.50

¼ = 0.25

6. A factory that manufactures a patented metal alloy produces 327 liters of liquid waste for every 2 million kilograms of the alloy that are made. How many liters of liquid waste are produced when 6.5 million kilograms of alloy are made?

A. 2,125.5   B. 100.62   C. 654   **D. 1,062.75**   E. 2,779.50

$$\frac{\text{liters of waste}}{\text{million kilograms of alloy}} \qquad \frac{327}{2} = \frac{x}{6.5} \qquad 6.5 \times 327 \div 2 = x = 1,062.75$$

Answer: D. 1,062.75 liters

7. The annual employee turnover rate for different industries is shown on the chart below. If a company in industry C has 175 employees, what do you predict for that company's turnover number each year?

A. 1,250   **B. 25**   C. 7   D. 3   E. 105

Industry	Annual Turnover Per 500 Employees
Industry A	145
Industry B	95
Industry C	70
Industry D	53
Industry E	38

$$\frac{\text{annual turnover}}{\text{number of employees}} \qquad \frac{70}{500} = \frac{x}{175}$$

70 x 175 ÷ 500 = x = 24.5 → rounds to 25

Answer: B. 25 employees

NOTE – the term "turnover" means the number of employees that leave a company within a certain period of time.

$\boxed{\textit{Practice Two}}$

1. The distance between Leo's house and his daughter's college is 325 kilometers (km), and on a map that shows both locations, 3 centimeters (cm) equals 25 kilometers (km). On the map, how many centimeters apart are Leo's house and the college?

A. 13   **B. 39**   C. 100   D. 75   E. 117

$$\frac{\text{actual distance in km}}{\text{cm on map}} \qquad \frac{25}{3} = \frac{325}{x}$$

325 x 3 ÷ 25 = x = 39

Answer: B. 39 centimeters

2. The distance on a local map between Rob's house and his job is 5 inches. If 2 inches represents 3 miles on the map, how many miles is Rob's house from his job?

A. 7.5   B. 75   C. 3.3   D. 15   E. 10

$$\frac{\text{inches on map}}{\text{actual miles}} \qquad \frac{2}{3} = \frac{5}{x}$$

3 x 5 ÷ 2 = x = 7.5   **Answer: A. 7.5 miles**

3. A detailed diagram of an airplane is drawn to scale, with each inch on the diagram equivalent to 5 feet of length on the airplane. If the wingspan is 25 inches long on the diagram, how many feet long is the actual wingspan of the airplane?

A. 5   B. 30   **C. 125**   D. 152   E. 20

$$\frac{\text{inches on diagram}}{\text{actual feet}} \qquad \frac{1}{5} = \frac{25}{x}$$

25 x 5 ÷ 1 = x = 125   **Answer: C. 125 feet**

4. A new hotel ballroom will measure 60 meters long and 42 meters wide, and a scale model will be built to use in mapping out different floor plan arrangements. Each centimeter (cm) on the scale model is equal to 2 meters (m) of actual distance. What will the length and width of the ballroom be on the scale model?

A. 120 cm by 84 cm
B. 60 cm by 42 cm
C. 58 cm by 40 cm
D. 30 cm by 30 cm
E. 30 cm by 21 cm

LENGTH: $\dfrac{\text{cm on model}}{\text{actual m}}$ $\dfrac{1}{2} = \dfrac{x}{60}$ $60 \times 1 \div 2 = x = 30$ **Length = 30 cm**

WIDTH: $\dfrac{\text{cm on model}}{\text{actual m}}$ $\dfrac{1}{2} = \dfrac{x}{42}$ $42 \times 1 \div 2 = x = 21$ **Width = 21 cm**

Answer: E. 30 cm by 21 cm

The two related values are 1 cm on the model and 2 m of actual distance. Note that it says each cm in the problem, not 1 cm. You have to realize that each means 1 even though the number 1 is not stated.

5. Kayla is painting a large wall mural and will plan out the design and colors on a grid. The mural will be 40 feet long and 15 feet wide. 5 feet on the mural is equivalent to 3 units on the grid. What are the dimensions of the mural on the grid?

A. 24 units by 9 units
B. 67 units by 25 units
C. 13 units by 8 units
D. 120 units by 45 units
E. 120 units by 75 units

LENGTH: $\dfrac{\text{units on grid}}{\text{actual feet}}$ $\dfrac{3}{5} = \dfrac{x}{40}$ $3 \times 40 \div 5 = x = 24$ **Length = 24 units**

WIDTH: $\dfrac{\text{units on grid}}{\text{actual feet}}$ $\dfrac{3}{5} = \dfrac{x}{15}$ $3 \times 15 \div 5 = x = 9$ **Width = 9 units**

Answer: A. 24 units by 9 units

A common mistake in problems like this is to use length and width as the two related values for the first ratio of the proportion. Remember that in scale problems, the two related values are almost always the two scale measurements, which in this problem are units on the grid and actual feet.

1. It takes a team of 8 workers 2 hours and 15 minutes to clean 12 apartments. How many apartments can the team clean in 9 hours?

A. 50   **B. 48**   C. 43   D. 45   E. 24

First, convert 2 hours and 15 minutes to 2.25 hours.
Note that the value 8 workers is extra information and is not part of the calculation.

$$\frac{hours}{apartments} \quad \frac{2.25}{12} = \frac{9}{x} \qquad 12 \times 9 \div 2.25 = x = 48 \quad \textbf{Answer: B. 48 apartments}$$

2. Ebony charges \$11 per hour to babysit 2 children. If Mrs. Parks needs a sitter for 3 hours and 15 minutes for her 2 children, how much will she have to pay Ebony?

A. \$34.65   B. \$69.30   **C. \$35.75**   D. \$71.50   E. \$37.55

First, convert 3 hours 15 minutes to 3.25 hours. You may recognize that this problem can be solved by multiplying \$11 per hour times 3.25 hours.
\$11 x 3.25 = **\$35.75**

If you're not sure what to do, set up a proportion. Note that \$11 per hour means \$11 for 1 hour. Also note that the number of children is extra information and does not enter into the calculation.

$$\frac{\$}{hours} \quad \frac{11}{1} = \frac{x}{3.25} \qquad \$11 \times 3.25 \div 1 = x = \$35.75 \qquad \textbf{Answer: C. \$35.75}$$

3. Celine can make 36 party favors per hour. How many party favors can she make in 45 minutes?

A. 16   B. 1,620   C. 81   **D. 27**   E. 72

| Solve using hours: | **OR** | Solve using minutes: |

$$\frac{party\ favors}{hours} \quad \frac{36}{1} = \frac{x}{0.75}$$

$$36 \times 0.75 \div 1 = x = 27$$

Answer: D. 27 party favors

$$\frac{party\ favors}{minutes} \quad \frac{36}{60} = \frac{x}{45}$$

$$36 \times 45 \div 60 = x = 27$$

Answer: D. 27 party favors

4. How many hours will it take to correct 20 essays if the teacher can correct 2 essays every 15 minutes?

A. 150 hours   B. 2 hours 50 minutes   C. 1 hour 30 minutes

D. 130 hours   **E. 2 hours 30 minutes**

Note that you are given minutes, but the answer is asked for in hours.
Convert the 15 minutes to 0.25 hours and then set up the proportion.
Convert the .5 part of the 2.5 answer to 30 minutes.

$$\frac{\text{hours}}{\text{essays}} \quad \frac{0.25}{2} = \frac{x}{20}$$ 20 x 0.25 ÷ 2 = x = 2.5   **Answer: E. 2 hours 30 minutes**

CAREFUL – 2.5 hours is 2 hours 30 minutes; **it is not** 2 hours 50 minutes

Think about it – You could also solve this without setting up a proportion by mapping out 15 minutes for every 2 essays, until you reach the desired total of 20 essays.

2 essays   →   15 minutes ⌉
2 essays   →   15 minutes │
2 essays   →   15 minutes ├── 4 x 15 minutes = 1 hour
2 essays   →   15 minutes ⌋
2 essays   →   15 minutes ⌉
2 essays   →   15 minutes │
2 essays   →   15 minutes ├── 4 x 15 minutes = 1 hour
2 essays   →   15 minutes ⌋
2 essays   →   15 minutes ⌉── 2 x 15 minutes = 30 minutes
2 essays   →   15 minutes ⌋

Total of
20 essays   ⟶   Total of 2 hours 30 mintues