

LESSON

5-4

Problem Solving***Solving Proportions***

Use the ratios in the table to answer each question. Round to the nearest tenth.

| Body Part | <u>Body Part</u> <u>Height</u> |
|--------------------|-----------------------------------|
| Femur | $\frac{1}{4}$ |
| Tibia | $\frac{1}{5}$ |
| Hand span | $\frac{2}{17}$ |
| Arm span | $\frac{1}{1}$ |
| Head circumference | $\frac{1}{3}$ |

- Which body part is the same length as the person's height?

- If a person's tibia is 13 inches, how tall would you expect the person to be?

- If a person's hand span is 8.5 inches, about how tall would you expect the person to be?

- If a femur is 18 inches long, how many feet tall would you expect the person to be?

- What would you expect the head circumference to be of a person who is 5.5 feet tall?

- What would you expect the hand span to be of a person who is 5 feet tall?

Choose the letter for the best answer.

- Five milliliters of a children's medicine contains 400 mg of the drug amoxicillin. How many mg of amoxicillin does 25 mL contain?
A 0.3 mg **C** 2000 mg
B 80 mg **D** 2500 mg
- Vladimir Radmanovic of the Seattle Supersonics makes, on average, about 2 three-pointers for every 5 he shoots. If he attempts 10 three-pointers in a game, how many would you expect him to make?
F 4 **H** 8
G 5 **J** 25
- In 2002, a 30-second commercial during the Super Bowl cost an average of \$1,900,000. At this rate, how much would a 45-second commercial cost?
A \$1,266,666 **C** \$3,500,000
B \$2,850,000 **D** \$4,000,000
- A medicine for dogs indicates that the medicine should be administered in the ratio 2 teaspoons per 5 lb, based on the weight of the dog. How much should be given to a 70 lb dog?
F 5 teaspoons **H** 14 teaspoons
G 12 teaspoons **J** 28 teaspoons

LESSON 5-4 Reteach

Solving Proportions

In a proportion, the **cross products** are equal.

These ratios are proportional, since their cross products are equal.

$$\frac{7}{14} \pm \frac{8}{16}$$

$$7 \times 16 \stackrel{?}{=} 14 \times 8$$

$$112 = 112$$

These ratios are not proportional, since their cross products are not equal.

$$\frac{4}{9} \pm \frac{2}{3}$$

$$4 \times 3 \stackrel{?}{=} 9 \times 2$$

$$12 \neq 18$$

Complete to tell if the ratios are proportional.

1. $\frac{15}{45} \pm \frac{6}{18}$ 2. $\frac{75}{100} \pm \frac{4}{8}$ 3. $\frac{7}{2} \pm \frac{21}{6}$

$$15 \times 18 \stackrel{?}{=} 45 \times 6$$

$$270 = 270$$

$$75 \times 8 \stackrel{?}{=} 100 \times 4$$

$$600 \neq 400$$

$$7 \times 6 \stackrel{?}{=} 2 \times 21$$

$$42 = 42$$

The ratios are in proportion. The ratios are not in proportion. The ratios are in proportion.

To solve for one member of a proportion, set the cross products equal.

$$\frac{n}{32} = \frac{9}{16}$$

$$16n = 32 \times 9$$

$$\frac{16n}{16} = \frac{288}{16}$$

$$n = 18$$

To check the result, substitute and see if the ratios are equivalent.

$$\frac{18}{32} \pm \frac{9}{16}$$

$$\frac{18 \div 2}{32 \div 2} \pm \frac{9}{16}$$

$$\frac{9}{16} \pm \frac{9}{16}$$

$$\frac{9}{16} = \frac{9}{16}$$

Solve and check.

4. $\frac{8}{24} = \frac{2}{n}$

$$8n = 24 \times 2$$

$$8n = 48$$

$$\frac{8n}{8} = \frac{48}{8}$$

$$n = 6$$

Check: $\frac{8}{24} \pm \frac{2}{6}$

$$\frac{8 \div 8}{24 \div 8} \pm \frac{2 \div 2}{6 \div 2}$$

$$\frac{1}{3} \pm \frac{1}{3}$$

$$\frac{1}{3} = \frac{1}{3}$$

LESSON 5-4 Challenge

Meanwhile . . .

In a proportion, there are 4 terms.

The 1st and 4th are called **extremes**. The 2nd and 3rd are called **means**.

$$\frac{1st \text{ (extreme)}}{2nd \text{ (mean)}} = \frac{3rd \text{ (mean)}}{4th \text{ (extreme)}}$$

When the means of a proportion are equal, either is a **mean proportional**.

$$\frac{2}{6} = \frac{6}{18}$$

6 is the mean proportional between 2 and 18.

To find the mean proportional m between 4 and 25:

$$\frac{4}{m} = \frac{m}{25}$$

$$m^2 = 100$$

$$m = \sqrt{100} = 10$$

Check by showing equal ratios.

$$\frac{4}{10} \pm \frac{10}{25}$$

$$\frac{4 \div 2}{10 \div 2} \pm \frac{10 \div 5}{25 \div 5}$$

$$\frac{2}{5} \pm \frac{2}{5}$$

$$\frac{2}{5} = \frac{2}{5}$$

Find the mean proportional m between each pair of numbers. Check by showing equal ratios.

1. 4 and 9 2. 0.3 and 1.2 3. $\frac{1}{2}$ and $\frac{1}{8}$

$$\frac{4}{m} = \frac{m}{9}$$

$$m^2 = 36$$

$$m = \sqrt{36} = 6$$

$$\text{Check: } \frac{4}{6} \pm \frac{6}{9}$$

$$\frac{4 \div 2}{6 \div 2} \pm \frac{6 \div 3}{9 \div 3}$$

$$\frac{2}{3} \pm \frac{2}{3}$$

$$\frac{2}{3} = \frac{2}{3}$$

$$\frac{0.3}{m} = \frac{m}{1.2}$$

$$m^2 = 0.36$$

$$m = \sqrt{0.36} = 0.6$$

$$\text{Check: } \frac{0.3}{0.6} \pm \frac{0.6}{1.2}$$

$$\frac{0.3 \times 10}{0.6 \times 10} \pm \frac{0.6 \times 10}{1.2 \times 10}$$

$$\frac{3 \div 3}{6 \div 3} \pm \frac{6 \div 6}{12 \div 6}$$

$$\frac{1}{2} \pm \frac{1}{2}$$

$$\frac{1}{2} = \frac{1}{2}$$

$$\frac{\frac{1}{2}}{m} = \frac{m}{\frac{1}{8}}$$

$$m^2 = \frac{1}{16}$$

$$m = \sqrt{\frac{1}{16}} = \frac{1}{4}$$

$$\text{Check: } \frac{\frac{1}{2}}{\frac{1}{4}} \pm \frac{\frac{1}{4}}{\frac{1}{8}}$$

$$\frac{1}{2} \times \frac{4}{1} \pm \frac{1}{4} \times \frac{8}{1}$$

$$2 \pm 2$$

$$2 = 2$$

LESSON 5-4 Problem Solving

Solving Proportions

Use the ratios in the table to answer each question. Round to the nearest tenth.

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|--------------------|------------------|
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| Tibia | $\frac{1}{5}$ |
| Hand span | $\frac{2}{17}$ |
| Arm span | $\frac{1}{1}$ |
| Head circumference | $\frac{1}{3}$ |

1. Which body part is the same length as the person's height?
arm span

2. If a person's tibia is 13 inches, how tall would you expect the person to be?
65 inches

3. If a person's hand span is 8.5 inches, about how tall would you expect the person to be?
72.3 inches

5. What would you expect the head circumference to be of a person who is 5.5 feet tall?
1.8 feet

4. If a femur is 18 inches long, how many feet tall would you expect the person to be?
6 feet

6. What would you expect the hand span to be of a person who is 5 feet tall?
0.6 feet

Choose the letter for the best answer.

7. Five milliliters of a children's medicine contains 400 mg of the drug amoxicillin. How many mg of amoxicillin does 25 mL contain?
A 0.3 mg C 2000 mg
B 80 mg D 2500 mg

8. Vladimir Radmanovic of the Seattle Supersonics makes, on average, about 2 three-pointers for every 5 he shoots. If he attempts 10 three-pointers in a game, how many would you expect him to make?
F 4 H 8
G 5 J 25

9. In 2002, a 30-second commercial during the Super Bowl cost an average of \$1,900,000. At this rate, how much would a 45-second commercial cost?
A \$1,266,666 C \$3,500,000
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10. A medicine for dogs indicates that the medicine should be administered in the ratio 2 teaspoons per 5 lb, based on the weight of the dog. How much should be given to a 70 lb dog?
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LESSON 5-4 Reading Strategies

Analyze Information

Ratios that are equivalent are proportional or in **proportion**. You can find if the ratios are equivalent by multiplying the cross products. If the cross products are equal, the ratios are in proportion.

The cross products are equal. In proportion
These ratios are in proportion.

$$\frac{4}{5} \times \frac{12}{15} \quad 5 \times 12 = 60$$

$$4 \times 15 = 60$$

$$\frac{4}{5} = \frac{12}{15}$$

The cross products are not equal. Not in proportion
The ratios are not in proportion.

$$\frac{3}{12} \times \frac{4}{9} \quad 4 \times 12 = 48$$

$$3 \times 9 = 27$$

$$\frac{3}{12} \neq \frac{4}{9}$$

Answer each question.

1. How can you tell if the ratios in a proportion are equal?
The cross products will be equal.

2. How can you tell if the ratios are not in proportion?
The cross products are not equal.

Check cross products to tell if the two ratios are equal and form a proportion. Write yes or no. Show your work.

3. $\frac{5}{10}$ and $\frac{2}{5}$ no 4. $\frac{2}{5}$ and $\frac{4}{10}$ yes

5. $\frac{3}{9}$ and $\frac{5}{12}$ no 6. $\frac{3}{8}$ and $\frac{9}{24}$ yes

7. $\frac{3}{10}$ and $\frac{9}{21}$ no 8. $\frac{3}{5}$ and $\frac{15}{25}$ yes

9. $\frac{2}{7}$ and $\frac{4}{5}$ no 10. $\frac{2}{3}$ and $\frac{8}{12}$ yes