

7.1 Warm-Up

Solve each equation

1. $\frac{3}{4} = \frac{x}{8}$

$$\frac{24}{4} = \frac{4x}{4} \quad x=6$$

2. $\frac{4}{5} = \frac{36}{y}$

$$\frac{4y}{4} = \frac{180}{4} \quad y=45$$

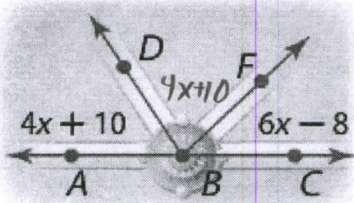
3. $\frac{3}{8} = \frac{6}{x+6}$

$$3x + 18 = 48$$

$$\frac{3x}{3} = \frac{30}{3} \quad x=10$$

4.

LANDSCAPING A landscape architect is planning to add sidewalks around a fountain as shown below. If \overrightarrow{BA} and \overrightarrow{BC} are opposite rays and \overrightarrow{BD} bisects $\angle ABF$, find $m\angle FBC$.



$$4x + 10 + 4x + 10 + 6x - 8 = 180$$

$$14x + 12 = 180$$

$$\frac{14x}{14} = \frac{168}{14} \quad x=12$$

$$4(12) + 10$$

$$48 + 10 = 58$$

$$6(12) - 8 = 72 - 8 = 64$$

$$\begin{aligned} \angle ABF &= 116 \\ \angle FBC &= 64 \end{aligned}$$

7.1 Ratios and Proportions

Target: Write ratios and proportions to help solve real world problems

1 Write and Use Ratios A **ratio** is a comparison of two quantities using division. The ratio of quantities a and b can be expressed as a to b , $a:b$, or $\frac{a}{b}$, where $b \neq 0$. Ratios are usually expressed in simplest form.

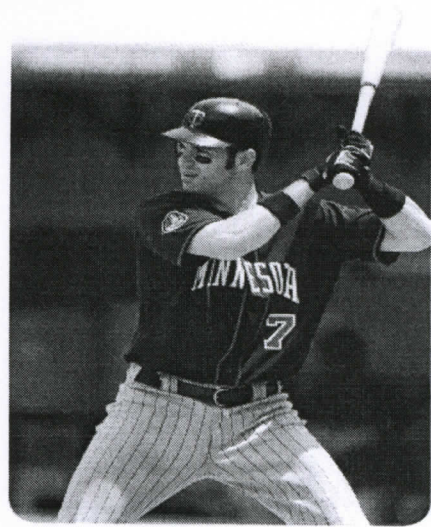
4:3

8:6

are Equivalent ratios \rightarrow have they same Scale

Real-World Example 1 Write and Simplify Ratios

SPORTS A baseball player's batting average is the ratio of the number of base hits to the number of at-bats, not including walks. Minnesota Twins' Joe Mauer had the highest batting average in Major League Baseball in 2006. If he had 521 official at-bats and 181 hits, find his batting average.



$$\frac{\text{\# of hits}}{\text{\# of Attempts}} = \frac{181}{521} \approx .347$$
$$1 \quad .347$$

Guided Practice

1. **SCHOOL** In Logan's high school, there are 190 teachers and 2650 students. What is the approximate student-teacher ratio at his school?

about 14:1

- 1a. **PETS** Out of a survey of 1000 households, 460 had at least one dog or cat as a pet. What is the ratio of pet owners to households?

23:50

- 1b. **SPORTS** Thirty girls tried out for 15 spots on the basketball team. What is the ratio of open spots to the number of girls competing?

1:2

Why is this important?

- Everything

Extended ratios can be used to compare three or more quantities. The expression $a:b:c$ means that the ratio of the first two quantities is $a:b$, the ratio of the last two quantities is $b:c$, and the ratio of the first and last quantities is $a:c$.

Example 2 Use Extended Ratios

The ratio of the measures of the angles in a triangle is 3:4:5. Find the measures of the angles.

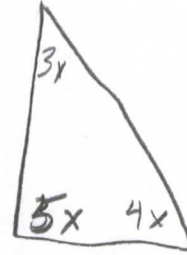
$$3x + 4x + 5x = 180$$

$$\frac{12x}{12} = \frac{180}{12}$$

$$x = 15$$

$$3(15) \quad 4(15) \quad 5(15)$$

$$45 + 60 + 75 = 180$$

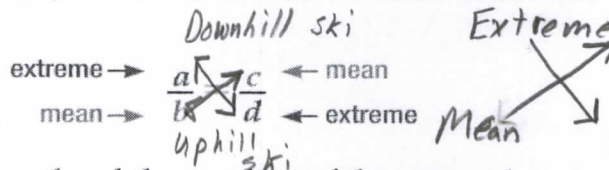


Guided Practice

2. In a triangle, the ratio of the measures of the sides is 2:2:3 and the perimeter is 392 inches. Find the length of the longest side of the triangle.

$$2x + 2x + 3x = 392 \quad \frac{7x}{7} = \frac{392}{7} \quad x = 56 \quad 3(56) = 168 \text{ in}$$

2 Use Properties of Proportions An equation stating that two ratios are equal is called a **proportion**. In the proportion $\frac{a}{b} = \frac{c}{d}$, the numbers a and d are called the **extremes** of the proportion, while the numbers b and c are called the **means** of the proportion.



The product of the extremes ad and the product of the means bc are called **cross products**.

Example 3 Use Cross Products to Solve Proportions

Solve each proportion.

a. $\frac{6}{x} = \frac{21}{31.5}$

$$\frac{21x}{21} = \frac{189.0}{21}$$

$$x = 9$$

b. $\frac{x+3}{2} = \frac{4x}{5}$

$$5x + 15 = 8x$$

$$\frac{15}{3} = \frac{3x}{3}$$

$$x = 5$$

Guided Practice

3A. $\frac{x}{4} = \frac{11}{6}$

$$\frac{6x}{6} = \frac{44}{6}$$

$$x = 7\frac{2}{6} = 7\frac{1}{3} = 7.3\bar{3}$$

3B. $\frac{-4}{7} = \frac{6}{2y+5}$

$$-8y + 20 = 42$$

$$-8y = 22 \quad y = -2\frac{7}{8} = -2.875$$

3C. $\frac{7}{z-1} = \frac{9}{z+4}$

$$7z + 28 = 9z - 9$$

$$28 = 2z - 9$$

$$\frac{37}{2} = \frac{2z}{2} \quad z = 18\frac{1}{2}$$

Proportions can be used to make predictions.

Real-World Example 4 Use Proportions to Make Predictions

CAR OWNERSHIP Fernando conducted a survey of 50 students driving to school and found that 28 owned cars. If 755 students drive to his school, predict the total number of students who own cars.

$$\frac{50}{28} = \frac{755}{x}$$

$$50x = 6090$$
$$\begin{array}{r} 6090 \\ +5100 \\ \hline 21140 \end{array}$$

$$\frac{50x}{50} = \frac{21140}{50} \quad x \approx 422$$

Guided Practice

4. **BIOLOGY** In an experiment, students netted butterflies, recorded the number with tags on their wings, and then released them. The students netted 48 butterflies and 3 of those had tagged wings. Predict the number of butterflies that would have tagged wings out of 100 netted.

$$\frac{48}{3} = \frac{100}{x}$$

$$\frac{48x}{48} = \frac{300}{48}$$

$$\begin{array}{r} 4 \\ 48 \overline{) 300} \\ \underline{288} \\ 12 \\ \underline{120} \\ 0 \end{array}$$

$$x \approx 6$$