Geometry 7.1
Write ratios*   *7th grade standard
Write and solve proportions
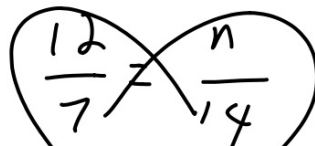ratio
extended ratio
proportion
extremes/means
cross product

$$\frac{d}{e} \qquad \frac{12 \text{ dog}}{7 \text{ cats}} \qquad 12:7$$

$$\frac{12}{7} = \frac{n}{14}$$

$$168 = 7n \qquad n = 24$$

The aspect ratio of a television or computer screen is the screen's width divided by its height. A standard television screen has an aspect ratio of $\frac{4}{3}$ or 4:3, while a high definition television screen (HDTV) has an aspect ratio of 16:9.

🌐 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.

$$\frac{H}{B} = \frac{181}{521} \approx 0.347$$

$$\frac{a}{b} \qquad a : b$$

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 $a:c$.

$$\boxed{a:b:c} \qquad a \cdot x \qquad b \cdot x \qquad c \cdot x$$

$$\frac{a}{b} \qquad \frac{b}{c} \qquad \frac{a}{c}$$

Angle sum?

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.

$$3x + 4x + 5x = 180$$
$$12x = 180$$
$$x = 15$$

45
60
75

WB prac. 7.1

Sum of sides?

2. In a triangle, the ratio of the measures of the sides is 3:3:8 and the perimeter is 392 inches. Find the length of the longest side of the triangle.

$$3x + 3x + 8x = 392$$

224 in

$$\frac{14x}{14} = \frac{392}{14}$$

$$x = 28$$

a:b = c:d

extreme ➤ $\dfrac{a}{b} = \dfrac{c}{d}$ ← mean

mean ➤ ← extreme

$\dfrac{a}{b} = \dfrac{c}{d}$

$a : b = c : d$

$a \cdot d = b \cdot c$

KeyConcept Cross Products Property

Words   In a proportion, the product of the extremes equals the product of the means.

Symbols If $\dfrac{a}{b} = \dfrac{c}{d}$ when $b \neq 0$ and $d \neq 0$, then $ad = bc$.

Example If $\dfrac{4}{10} = \dfrac{6}{15}$, then $4 \cdot 15 = 10 \cdot 6$.

Reminder: the fraction bar is also a grouping symbol!

Example 3 Use Cross Products to Solve Proportions

Solve each proportion.

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

b. $\dfrac{(x+3)}{2} = \dfrac{4x}{5}$

$\dfrac{8}{2} = \dfrac{20}{5}$

$21x = 189$

$\dfrac{21x}{21} = \dfrac{189}{21}$

$x = 9$

$5(x+3) = 8x$

$5x + 15 = 8x$

$\underline{-5x \qquad\qquad -5x}$

$15 = 3x$

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

$x = 5$

GuidedPractice

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

$$\dfrac{-6x}{-6} = \dfrac{44}{-6}$$

$$x = -\dfrac{22}{3}$$

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

$$-8y - 20 = 42$$

$$-8y = 62$$

$$y = -\dfrac{62}{8}$$

$$y = \dfrac{-31}{4}$$

3C. $\dfrac{7}{(z-1)} = \dfrac{9}{(z+4)}$

$$9(z-1) = 7(z+4)$$

$$\frac{28\,c}{50\,t}$$

$$\frac{22\,n}{50\,t}$$

Consistent order

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.

$$\frac{28\;c}{50\;t} = \frac{?\;c}{755\;t}$$

approx. 423

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

$$50\,x = 21,140$$

$$x = 422.8$$

GuidedPractice

$$\frac{3+}{48 \quad n}$$

$$\frac{45 \ not \ t}{48}$$

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.

$$\frac{3t}{48n} = \frac{?}{100n}$$

$$\frac{3}{48} = \frac{x}{100} \qquad 48x = 300$$

$$x = 6.25$$

approx 6

$$a:b = c:d$$

Equivalent forms of a proportion all have identical cross products.

KeyConcept Equivalent Proportions

Symbols   The following proportions are equivalent.

$$\frac{a}{b} = \frac{c}{d}, \quad \frac{b}{a} = \frac{d}{c}, \quad \frac{a}{c} = \frac{b}{d}, \quad \frac{c}{a} = \frac{d}{b}$$

$$\frac{b}{a} = \frac{d}{c}$$

$$\boxed{\frac{a}{b} = \frac{c}{d}}$$

$$\frac{a}{c} = \frac{b}{d}$$

$$\frac{d}{b} = \frac{c}{a}$$

Are the cross products still the same?