

5.1 Introduction to Ratios

OBJECTIVES

- a Find fraction notation for ratios.
- b Simplify ratios.

Ratio

A ratio is the quotient of two quantities.

For every 50 chicks raised, 3 die within the first two days. The ratio of the number of chicks that die to the number raised is shown by fraction notation $\frac{3}{50}$, or by the notation 3:50.

num (pointing to 3)
Denominator (pointing to 50)

Ratio Notation

The ratio of a to b is given by the fraction notation $\frac{a}{b}$, where a is the numerator and b is the denominator, or by the colon notation $a : b$.

a Find fraction notation for ratios.

EXAMPLE A Find the ratio of 5 to 6.

Solution

The ratio is $\frac{5}{6}$ or 5:6

a Find fraction notation for ratios.

EXAMPLE B Find the ratio of 25.6 to 100.

Solution

The ratio is $\frac{25.6}{100}$.

$\frac{25.6}{100}$ or 25.6 : 100

a Find fraction notation for ratios.

EXAMPLE C Pet Ownership

For every 5 people having a dog for a pet 2 others have a cat. What is the ratio of dog owners to cat owners?

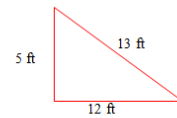
Solution

The ratio is $\frac{5}{2}$.

$\frac{\text{dog owners}}{\text{cat owners}} = \frac{5}{2}$

a Find fraction notation for ratios.

EXAMPLE D Triangle Proportions



Refer to the triangle.

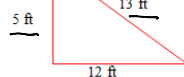
- a) What is the ratio of the length of the shortest side to the length of the longest side?
- b) What is the ratio of the length of the longest side to the length of the shortest side?

Short side
longest side

longest side
Short side

a Find fraction notation for ratios.

EXAMPLE D Triangle Proportions



Solution

a) $\frac{\text{Length of the shortest side}}{\text{Length of the longest side}} = \frac{5 \text{ ft}}{13 \text{ ft}} = \frac{5}{13}$

b) $\frac{\text{Length of the longest side}}{\text{Length of the shortest side}} = \frac{13 \text{ ft}}{5 \text{ ft}} = \frac{13}{5}$

b Simplify ratios.

Sometimes a ratio can be simplified. This provides one method of finding other pairs of numbers with the same ratio.

We write the ratio in fraction notation and then simplify:

$$\frac{20}{15} = \frac{5 \cdot 4}{5 \cdot 3} = \frac{5}{5} \cdot \frac{4}{3} = \frac{4}{3}$$

Simplified form does not contain decimals.

~~$\frac{20}{15}$~~ $\rightarrow \frac{4}{3}$ ✓

$20 \cdot 3 = 4 \cdot 15$
 $60 = 60$

b Simplify ratios.

EXAMPLE E Simplify a Ratio

Find the ratio of 6 to 8. Then simplify and find two other numbers in the same ratio.

Solution

We write the ratio in fraction notation and then simplify:

$$\frac{6}{8} = \frac{2 \cdot 3}{2 \cdot 4} = \frac{2}{2} \cdot \frac{3}{4} = \frac{3}{4}$$

$\frac{6}{8} = \frac{3}{4}$

b Simplify ratios.

EXAMPLE F Simplify Decimal Ratio

Write the ratio of 3.6 to 7.2. Then simplify and find two other numbers in the same ratio.

b Simplify ratios.

EXAMPLE F Simplify Decimal Ratio

Solution

Write the ratio.

$$\frac{3.6}{7.2}$$

Multiply by $\frac{10}{10}$ or 1 to clear the decimals

$\frac{3.6}{7.2} \rightarrow \frac{1}{2}$

$1 \cdot 1 = 1 \cdot (7.2)$

$$\overline{8} = 4$$

$$6.4 = 8 \cdot 3$$

$$24 = 24 \checkmark$$

$$\frac{3.6}{7.2}$$

Multiply by $\frac{10}{10}$ or 1, to clear the decimals.

$$\frac{3.6 \cdot 10}{7.2 \cdot 10} = \frac{36}{72} = \frac{36 \cdot 1}{36 \cdot 2} = \frac{1}{2}$$

The ratio 3.6 to 7.2 is equivalent to the ratio 1:2.

$$2(3.6) = 1(7.2)$$

$$7.2 = 7.2$$

5.2 Rates and Unit Prices

OBJECTIVES

- a Give the ratio of two different measures as a rate.
- b Find unit prices and use them to compare purchases.

- a Give the ratio of two different measures as a rate.

A 2005 Kia Sportage EX 4WD can go 414 miles on 18 gallons of gasoline. Let's consider the ratio of miles to gallons:

$$\frac{414 \text{ mi}}{18 \text{ gal}} = \frac{414 \text{ miles}}{18 \text{ gallons}} = \frac{23 \text{ miles}}{1 \text{ gallon}}$$

= 23 miles per gallon = 23 mpg.

"per" means division, or "for each."

Rate

When a ratio is used to compare two different kinds of measure, we call it a **rate**.

- a Give the ratio of two different measures as a rate.

EXAMPLE B Rate of Pay

A student lifeguard working at a community pool earned \$3762 for working 12 weeks one summer. What was the rate per week?

Solution

The rate of pay is the ratio of money earned per length of time worked, or

$$\frac{\$3762}{12 \text{ weeks}} = 313.50 \frac{\text{dollars}}{\text{week}}, \text{ or } \$313.50 \text{ per week.}$$

- b Find unit prices and use them to compare purchases.

EXAMPLE C Unit Price of Flour

A baker buys 25 lb of flour for \$74.75. What is the rate or unit price in dollars per pound?

Solution

Since we are asked for the rate in dollars per pound, the monetary amount must be in the numerator.

$$\text{Unit Price} = \frac{\text{Price}}{\text{Number of units}} = \frac{\$74.75}{25 \text{ lb}}$$

- a Give the ratio of two different measures as a rate.

The ratio

$$\frac{414 \text{ mi}}{18 \text{ gal}} \text{ or } \frac{23 \text{ mi}}{1 \text{ gal}}, \text{ or } 23 \text{ mpg}$$

is called a rate.

- a Give the ratio of two different measures as a rate.

EXAMPLE A Rate of Fertilizer Application

It takes 1 quart 32 ounces of fertilizer to cover 6400 square feet of tall fescue grass. What is the rate in ounces per square foot?

Solution

$$\frac{32 \text{ oz}}{6400 \text{ sq ft}} = \frac{1 \text{ oz}}{200 \text{ sq ft}}, \text{ or } 0.005 \frac{\text{oz}}{\text{sq ft}}$$

$$\frac{32 \text{ ounces}}{6400 \text{ sq. ft}}$$

Unit Price

A **unit price**, or **unit rate**, is the ratio of price to the number of units.

- b Find unit prices and use them to compare purchases.

EXAMPLE C Unit Price of Flour

Solution

$$\text{Unit Price} = \frac{\text{Price}}{\text{Number of units}} = \frac{\$74.75}{25 \text{ lb}}$$

$$= \frac{74.75 \text{ dollars}}{25 \text{ lb}} = 2.99 \text{ dollars per pound } (\$2.99/\text{lb})$$

b Find unit prices and use them to compare purchases.

Unit prices often vary with the size of the item being sold.

Many factors can contribute to determining unit pricing in food, such as variations in store pricing and special discounts.

b Find unit prices and use them to compare purchases.

EXAMPLE D Finding the Best Bargain

$$\frac{\$6.29}{32 \text{ oz}} = \frac{629 \text{ cents}}{32 \text{ oz}} = \frac{629 \text{ cents}}{32 \text{ oz}} \approx 19.656 \text{ cents per ounce}$$

Size	Price	Unit Price
8 oz	\$1.99	24.875 ¢/oz
12 oz	\$2.99	24.917 ¢/oz
16 oz	\$3.49	21.813 ¢/oz
32 oz	\$6.29	19.656 ¢/oz

Based on unit price alone the 32-oz size is the best buy.

b Find unit prices and use them to compare purchases.

EXAMPLE D Finding the Best Bargain

Find the unit price of a 32 oz bottle of household cleaner and then decide which is the best purchase based on the unit price per ounce.

Size	Price	Unit Price
8 oz	\$1.99	24.875 ¢/oz
12 oz	\$2.99	24.917 ¢/oz
16 oz	\$3.49	21.813 ¢/oz
32 oz	\$6.29	6.29/32 ¢/oz



(continued)

per division
 numerator per denominator
 to for a ratio
 numerator to denominator