Ratio and Measurement Units

Unit 1 Lesson 8

Math 6

Students will be able to:

Convert measurements using ratio through multiplication or division.

Solve problems involving measurement conversions using the concept of ratio.

Key Vocabulary:

Customary Unit

Metric Unit

Conversion

Convert

Ratio

Proportion

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Converting Measurements Using Ratio

The concept of "ratio" and "proportion" are very helpful in converting measurements. These measurements include **customary units** such as feet, yard, inches, etc., and **metric units** such as meter, centimeter, millimeter, etc.

Converting Measurements Using Ratio

yard

inches

tablespoon   cup   pint   quart   gallon

ounce   pound
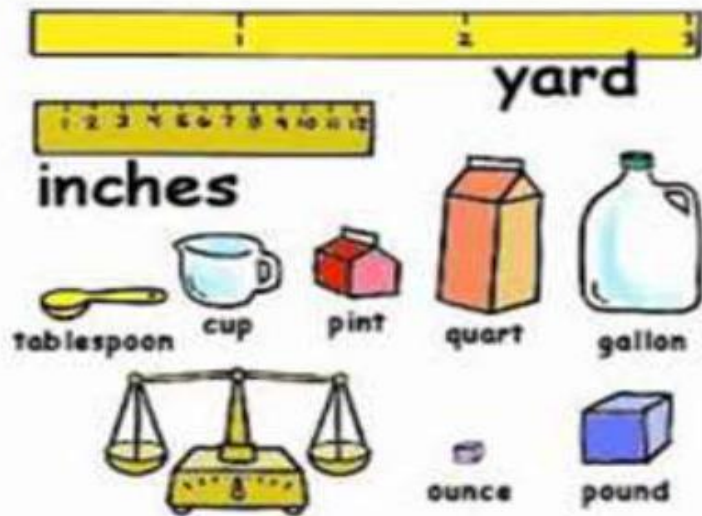
$$1m = 100cm = 1000mm$$

Table of Conversion

Refer to table to convert one unit to another.

Customary Units		
Length	**Weight**	**Capacity**
1 foot = 12 inches 1 yard = 3 feet 1 mile = 1760 yards	1 pound = 16 ounces 1 ton = 2000 pounds	1 cup = 8 fluid ounces 1 pint = 2 cups 1 quart = 2 pints 1 gallon = 4 quarts
Metric Measurements		
Length	**Mass**	**Capacity**
1 kilometer = 1000 meters 1 meter = 100 centimeters 1 centimeter = 10 millimeters	1 kilogram = 1000 grams 1 grams = 1000 milligrams	1 liter = 1000 milliliters

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Conversion Rules Using RATIO

Example: How many gallons is equivalent to 40 quarts?

Rule 1:   Determine the measurement or any information that you need to create a ratio.

Measurements involved: **gallon and quarts**

Ratio: $\dfrac{1\ gallon}{4\ quarts}$

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Conversion Rules Using RATIO

Rule 2:   Go back to the problem and set up an equivalent ratio. Take note that it is important to include the units to avoid confusion.

$$\frac{1 \ gallon}{4 \ quarts} = \frac{x \ gallons}{40 \ quarts}$$

→ This information is given in the problem. Be careful to set up the ratio properly so the units match up!!!

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Conversion Rules Using RATIO

Rule 3:   Multiply or divide to find what you're looking for.

Cross multiply the values.

$$\frac{1 \ gallon}{4 \ quarts} = \frac{x \ gallons}{40 \ quarts}$$

$4x = 40$

$X = 10$ Therefore, there are 10 gallons in 40 quarts.

Conversion Rules Using RATIO

Finding the scale factor can also help.

$$\frac{1 \ gallon}{4 \ quarts} = \frac{x \ gallons}{40 \ quarts}$$

$$\frac{1 \ gallon \times 10}{4 \ quarts \times 10} = \frac{10 \ gallons}{40 \ quarts}$$

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Ratio and Measurement Units

Sample Problem 1:

How many feet is 72 inches?

Solution:

Rule 1: $\dfrac{1\ foot}{12\ inches}$

Rule 2: $\dfrac{1\ foot}{12\ inches} = \dfrac{x\ foot}{72\ inches}$

Rule 3: $12x = 72$

$x = 6$

Therefore, 72 inches has 6 feet.

Converting Measurements Using A Conversion Factor

Consider the previous example "How many gallons is equivalent to 40 quarts?" with its conversion factor 4 quarts = 1 gallon, if we treat it as an equation and divide both sides by 4 quarts…here's what we get.

$$\frac{4\ quarts}{4\ quarts} = \frac{1\ gallon}{4\ quarts}$$

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Converting Measurements Using A Conversion Factor

Cancelling **4 quarts** gives us "1" on the left side of the equation and a ratio of **1 gallon is to 4 quarts** on the right side.

$$1 = \frac{1 \; gallon}{4 \; quarts}$$

Now, we can go back to the problem…

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How many gallons is equivalent to 40 quarts?

Rule 1: Multiply the unit we want to convert by 1. Remember that anything multiplied by 1 will never change its value.

40 quarts x 1

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How many gallons is equivalent to 40 quarts?

Rule 2: Replace "1" with the ratio that we obtained using the conversion factor. In this case, since $1 = \frac{1\ gallon}{4\ quarts}$, we'll replace **1** by the ratio $\frac{1\ gallon}{4\ quarts}$.

40 quarts x $\frac{1\ gallon}{4\ quarts}$

How many gallons is equivalent to 40 quarts?

Rule 3:   Cross out the measuring units that can be cancelled out

$$40 \text{ qu}\cancel{\text{arts}} \times \frac{1 \text{ } gallon}{4 \text{ } qu\cancel{arts}}$$

Rule 4:   Multiply or divide the remaining values

$$\frac{40 \text{ x } 1 \text{ } gallon}{4} = \textbf{10 gallons}$$

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Sample Problem 2:

How many feet does 132 inches have?

Use the conversion factor: 1 feet = 12 inches

Solution:

$$\frac{1\ feet}{12\ inches} = \frac{12\ inches}{12\ inches}$$

$$\frac{1\ feet}{12\ inches} = 1$$

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Sample Problem 2:

How many feet does 132 inches have?

Rule 1:   132 inches x 1

Rule 2: $132 \text{ inches} \times \dfrac{1\ feet}{12\ inches}$

Rule 3: $132 \text{ inches} \times \dfrac{1\ feet}{12\ inches}$

Rule 4: $\dfrac{132 \times 1\ feet}{12}$ = **11 feet**

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Solving Word Problems Using Raito to Convert Units

The methods above can be used to solve problems involving unit conversions.

Example:

Matt rode 4 kilometers on his bike while his sister rode 6,000 meters. Who rode the farthest (in kilometers)?

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Solution:

Since the problem requires us an answer in kilometers, we will convert the distance traveled by Matt's sister in kilometers. We know that 1 kilometer = 1000 meters.

Ratio and Measurement Units

Rule 1: $\dfrac{1\ kilometer}{1000\ meters}$

Rule 2: $\dfrac{1\ kilometer}{1000\ meters} = \dfrac{x\ kilometers}{6000\ meters}$

Rule 3:   1000x = 6000

x = 6 kilometers, therefore Matt's sister travelled the farthest.

Sample Problem 3:

Sam is cutting a piece of rope that measures 70 cm. Jenny is cutting a piece of rope that measures 900 mm. How long are the two pieces of ropes combined together in centimeters?

Ratio and Measurement Units

<mark>Solution:</mark> We know that 1 centimeter = 10 millimeters.

Rule 1: $\dfrac{1\ centimeter}{10\ millimeters}$

Rule 2: $\dfrac{1\ centimeter}{10\ millimeters} = \dfrac{x\ cenitmeters}{900\ millimeters}$

Rule 3:   10x = 900

x = 90 cm, Jenny's rope is 90 cm.

Adding the two pieces of rope gives us
70 cm + 90 cm = <mark>160cm</mark>

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