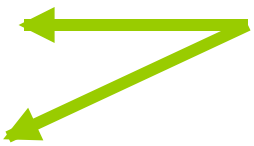
Ratios and Proportion

Ratios

- A ratio is just a fraction (always reduced) that shows a relationship between two things.
  - It can be written as a : b
  - or a to b
  - or a/b
- If a ratio is written in 2 different units, you have to convert them to the same unit – then reduce.
  - A simplified ratio does not have any units

Simplifying ratios



Here the units are the same
Just cancel and reduce

Simplifying ratios

Here the units are different
Change units then and reduce

1 lb = 16 oz change the bigger unit to smaller ones
(so change from pounds to ounces)

Leave your answer as a fraction

Simplifying ratios another way

Writing the units when comparing each unit of a rate is called ***unit analysis***.

You can multiply and divide units just like you would multiply and divide numbers. When solving problems involving rates, you can use unit analysis to determine the correct units for the answer.

Example: How many minutes are in 5 hours?

$$5 \text{ hours} \cdot \frac{60 \text{ minutes}}{1 \text{ hour}} = 300 \text{ minutes}$$

To solve this problem we need a unit rate that relates minutes to hours. Because there are 60 minutes in an hour, the unit rate we choose is 60 minutes per hour.

Solving Proportions

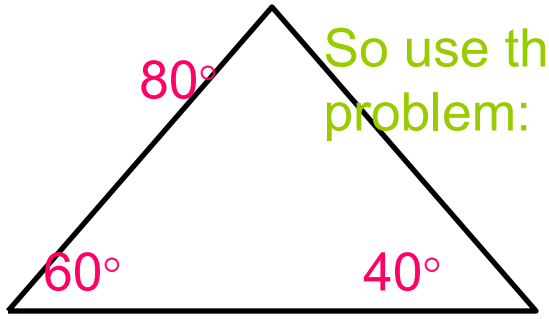
- When you solve proportions, you reduce first (if possible), then cross multiply (to get rid of the fraction).

Extended ratios

- An extended ratio happens when you compare more than two things
- For example: The ratios of the angles are 2 : 3 : 4

Find the measures of each angle

What do all the angles of a triangle add up to?



So use the ratios of the angles and create an algebra problem:

$2x + 3x + 4x = 180$

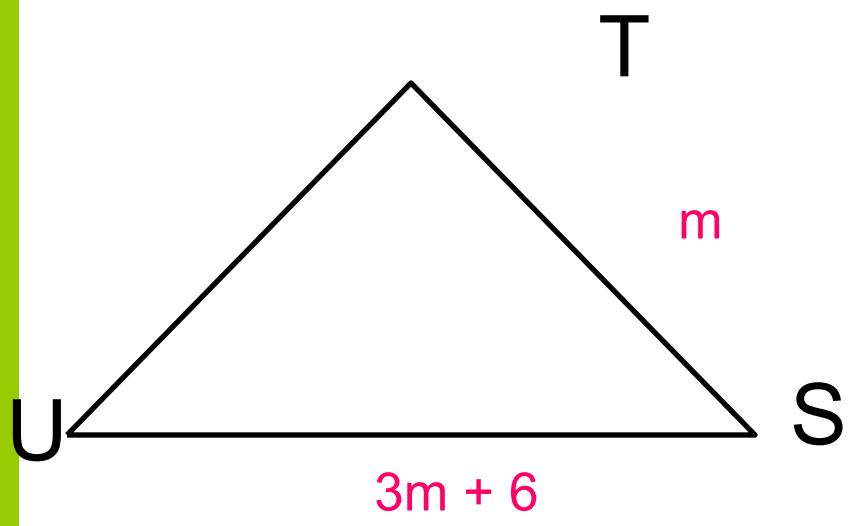
$9x = 180$

$x = 20$

Solving side lengths

- The ratio of two side lengths of a triangle is given. Solve for the variable.
- SU : ST is 4 : 1

What this means is $\frac{SU}{ST} = \frac{4}{1}$



$$\frac{(3m + 6)}{(m)} = \frac{4}{1}$$

$$1(3m + 6) = 4(m)$$

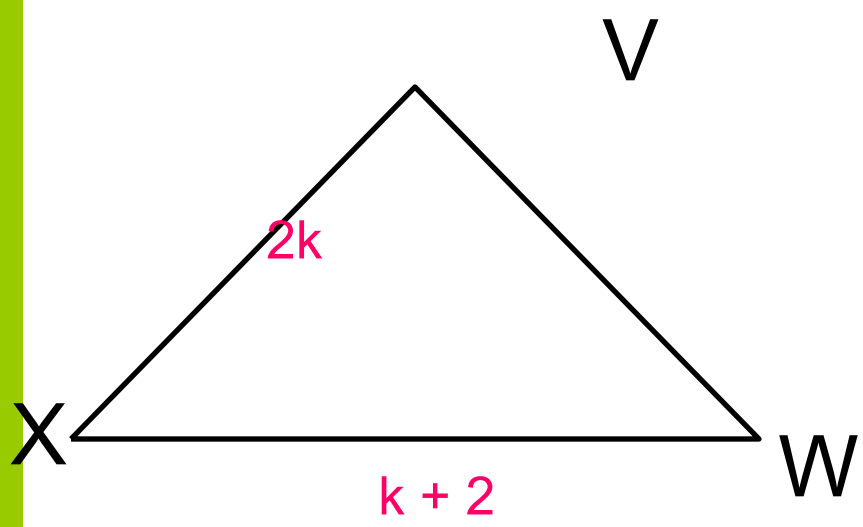
$$3m + 6 = 4m$$

$$6 = m$$

Solving side lengths

- The ratio of two side lengths of a triangle is given. Solve for the variable.
- WX : XV is 5 : 7

What this means is $\frac{WX}{XV} = \frac{5}{7}$



$$\frac{(k+2)}{(2k)} = \frac{5}{7}$$

$$7(k+2) = 5(2k)$$

$$7k + 14 = 10k$$

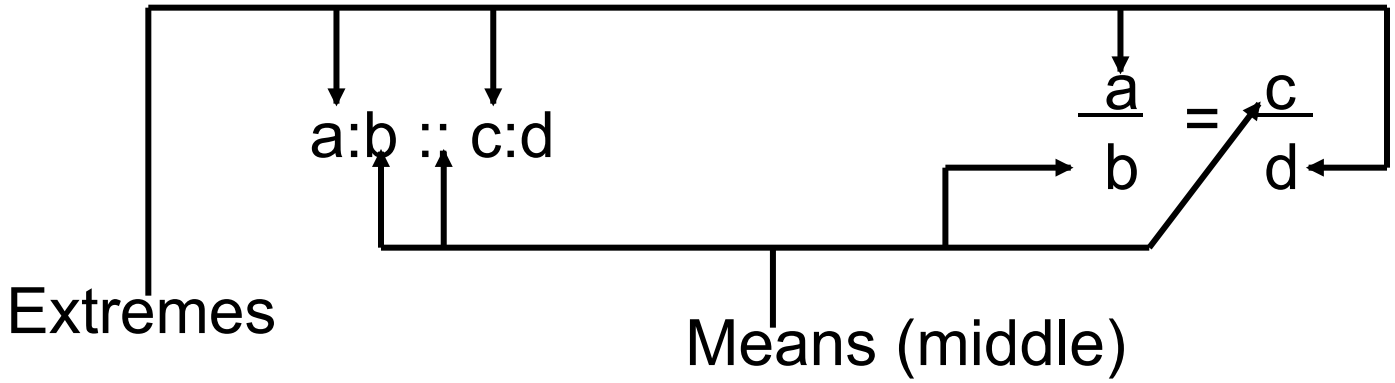
$$14 = 3k$$

$$4\,{}^{2}/_{3} = k$$

Proportions

- A proportion is created when you set two or more ratios equal to each other.

When Ratios are written in this order, *a* and *d* are the ***extremes***, or outside values, of the proportion, and *b* and *c* are the ***means***, or middle values, of the proportion.



www.klvx.org/ed_med_services/teacherline_new/pptfiles/4.1.Ratio.ppt

Proportion Properties

- To solve problems which require the use of a proportion we can use one of two properties.

The cross product property of proportions.

The product of the extremes equals the product of the means

The reciprocal property of proportions.

If two ratios are equal, then their reciprocals are equal.

Other Properties

- More properties that don't have special names:

Geometric Mean

- How do you find the mean of 2 numbers?

add them together and divide by 2

What is the (arithmetic) mean of 3 and 27?

- Geometric mean:
- The Rule: multiply and take the square root.

Find the geometric mean of 3 and 27?

Another Example

Find the geometric mean of 5 and 15? (no decimals)

Think of it as a fraction….

$\frac{5}{x} = \frac{x}{15}$

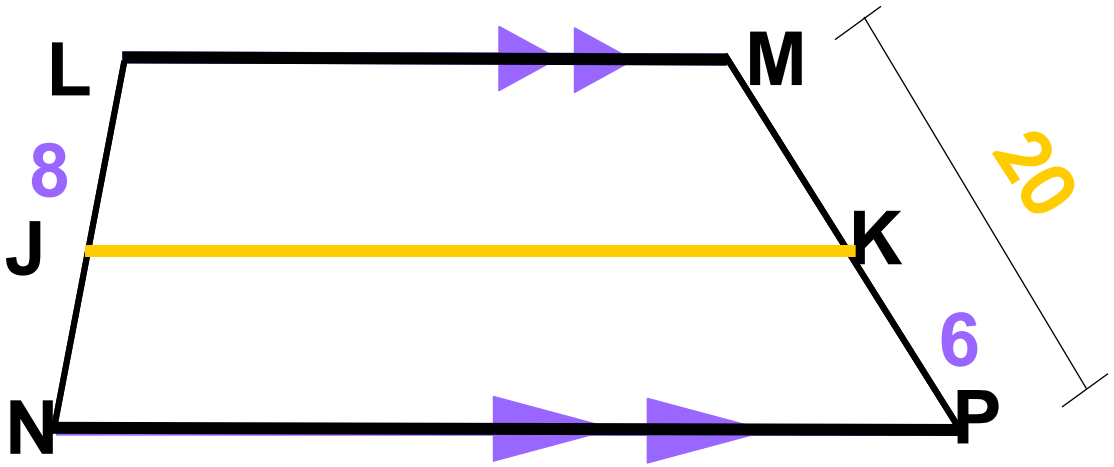
Then cross multiply…

$x^2 = 5 \cdot 15$

Then take the square root…

Proportions & Shapes

- Find JN if $\frac{LJ}{JN} = \frac{MK}{KP}$



$\frac{8}{JN} = \frac{20-6}{6}$

$\frac{8}{JN} = \frac{14}{6}$

$48 = 14(JN)$

$\frac{48}{14} = JN$

$3.4 = \frac{24}{7} = JN$

Ratios with coordinates

x_1, y_1 x_2, y_2 x_3, y_3

- The point (2, 8), (6, 18), and (8, y) are collinear. Find the value of y by solving the proportion.
- What does collinear mean?

$$\frac{18-8}{6-2} = \frac{y-18}{8-6}$$

$$\frac{10}{4} = \frac{y-18}{2}$$

Cross multiply…

$$10(2) = 4(y-18)$$

$$20 = 4y - 72$$

$$92 = 4y$$

$$23 = y$$

Word Problems

- Examples from 3.3
- 23. Scale drawing $\frac{1 \text{ inch}}{1.5\text{m}} = \frac{8 \text{ inches}}{x}$

Make sure that your units are in the same place on both sides (inches over meters on left and inches over meters on right).

Then cross multiply (leave off the units)…

$1(x) = 1.5(8)$

$x = 12$

Word Problems

- Examples from 3.3
- 24. Scale drawing $\frac{12 \text{ cups}}{3 \text{ loaves}} = \frac{x \text{ cups}}{2 \text{ loaves}}$

Make sure that your units are in the same place on both sides (inches over meters on left and inches over meters on right).

Then cross multiply (leave off the units)…

$12(2) = 3(x)$

$24 = 3x$

$8 = x$