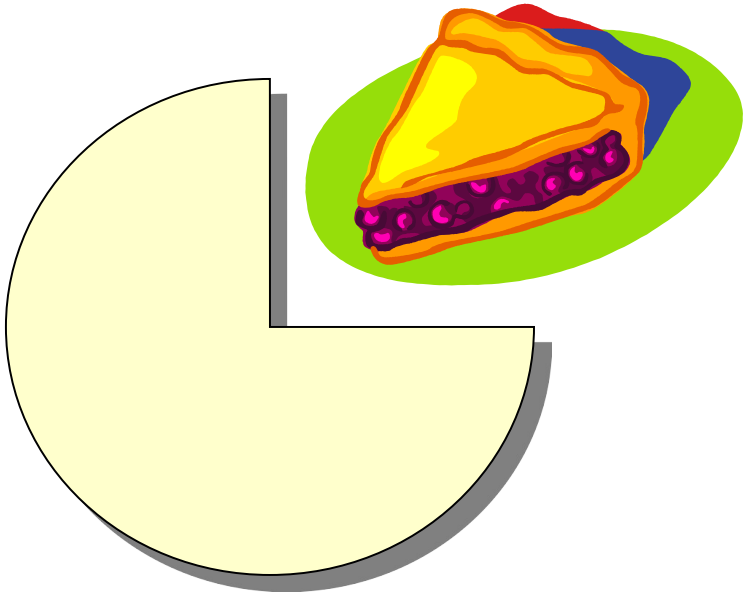
Ratios and Proportions



Outline:

- **Ratios!**
  - What is a Ratio?
  - How to Use Ratios?
  - How to Simplify?
  - **Proportions!**
  - What is a proportion?
  - Properties of proportions?
  - How to use proportions?
- **Mysterious Problems…**

What is a Ratio?

- A ratio is a comparison of two numbers.
- Ratios can be written in three different ways:

a to b

a:b

$\frac{a}{b}$

Because a ratio is a fraction, b can not be zero

Ratios are expressed in simplest form

How to Use Ratios?

- The ratio of boys and girls in the class is 12 to 11.

This means, for every 12 boys you can find 11 girls

- b
- gi

There could be 120 b
ls…a huge class

- The ratio of [illegible] of this rectangle is 4 to 1.

What is the ratio if the rectangle is 8cm long and 2cm wide?
Still 4 to 1, because for every 4cm, you can find 1cm to match

How many dogs and cats do I have? We don't know, all we know is if they'd start a fight, each dog has to fight 2 cats.

The ratio of cats and dogs at my home is 2 to

-

How to simplify ratios?

- The ratios we saw on last slide were all simplified. How was it done?

Ratios can be expressed in fraction form.. $\frac{a}{b}$

This allows us to do math on them.

The ratio of boys and girls in the class is $\frac{12}{11}$

The ratio of the rectangle $\frac{4}{1}$

The ratio of cats and dogs in my house is $\frac{2}{1}$

How to simplify ratios?

- Now I tell you I have 12 cats and 6 dogs. Can you simplify the ratio of cats and dogs to 2 to 1?

$$\frac{12}{6} = \frac{12/6}{6/6} = \frac{2}{1}$$

Divide both numerator and denominator by their Greatest Common Factor 6.

How to simplify ratios?

A person's arm is 80cm, he is 2m tall.

Find the ratio of the length of his arm to his total height

To compare them, we need to convert both numbers into the same unit … either cm or m

- **Let's try *cm* first!**

$$\frac{arm}{heigh} = \frac{80cm}{2m} = \frac{80cm}{200cm}$$

$$= \frac{80}{200} = \frac{2}{5}$$

Once we have the same units, we can simplify them.

How to simplify ratios?

- **Let's try *m* now!**

$$\frac{arm}{heigh} = \frac{80cm}{2m} = \frac{0.8m}{2m}$$

Once we have the same units, they simplify to 1.

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

To make both numbers integers, we multiplied both numerator and denominator by 10

How to simplify ratios?

- If the numerator and denominator do not have the same units it may be easier to convert to the smaller unit so we don't have to work with decimals...

3cm/12m = 3cm/1200cm = 1/400

2kg/15g = 2000g/15g = 400/3

5ft/70in = (5*12)in / 70 in = 60in/70in = 6/7

2g/8g = 1/4

Of course, if they are already in the same units, we don't have to worry about converting. Good deal☺

More examples...

$$\frac{8}{24} = \frac{1}{3}$$

$$\frac{12}{50} = \frac{6}{25}$$

$$\frac{40}{200} = \frac{1}{5}$$

$$\frac{27}{18} = \frac{3}{2}$$

$$\frac{27}{9} = \frac{3}{1}$$

Now, on to proportions!

What is a proportion?

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

A proportion is an equation that equates two ratios

The ratio of dogs and cats was 3/2

The ratio of dogs and cats now is 6/4=3/2

So we have a proportion $\frac{3}{2} = \frac{6}{4}$

Properties of a proportion?

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

Cross Product Property

2x6=12

3x4 = 12

3x4 = 2x6

Properties of a proportion?

- **Cross Product Property**

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



$$ad = bc$$

means

extremes

Properties of a proportion?

Let's make sense of the Cross Product Pro

For any numbers a, b, c, d:

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

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

$$ad=bc$$

Properties of a proportion?

- **Reciprocal Property**

If $\frac{3}{2}=\frac{6}{4}$

Then $\frac{2}{3}=\frac{4}{6}$

Can you see it? If yes, can you think of why it works?

How about an example?

$$\frac{7}{2} = \frac{x}{6}$$

Solve for x:

$7(6) = 2x$ ← Cross Product Property

$42 = 2x$

$21 = x$

How about another example?

$\frac{7}{2} = \frac{12}{x}$ Solve for x:

$7x = 2(12)$ — Cross Product Property

$7x = 24$

$x = \frac{24}{7}$

Can you solve it using Reciprocal Property? If yes, would it be easier?

Can you solve this one?

$$\frac{7}{x-1} = \frac{3}{x}$$ Solve for x:

$7x = (x-1)3$ ← Cross Product Property

$7x = 3x - 3$

$4x = -3$

$x = -\frac{3}{4}$

Again, Reciprocal Property?

Now you know enough about properties, let's solve the Mysterious problems!

If your car gets 30 miles/gallon, how many gallons of gas do you need to commute to school everyday?



5 miles to home

5 miles to school



Let x be the number gallons we need for a day:

$$\frac{30\,miles}{1\,gal} = \frac{(5+5)\,miles}{x_gal} \Rightarrow \frac{30}{1} = \frac{10}{x}$$

Can you solve it from here?

$$x = \frac{1}{3} \text{ Gal}$$



5 miles to home

5 miles to school



So you use up 1/3 gallon a day. How many gallons would you use for a week?

Let t be the number of gallons we need for a week:

$$\frac{1/3\,gal}{1\,day} = \frac{t_\,gal}{5\,days} \rightarrow \frac{1/3}{1} = \frac{t}{5}$$

What property is this?

$$\frac{1}{3} = \frac{t}{5} \rightarrow 1(5) = 3t \rightarrow t = \frac{5}{3}\,\text{Gal}$$

So you use up 5/3 gallons a week (which is about 1.67 gallons). Consider if the price of gas is 3.69 dollars/gal, how much would it cost for a week?

Let s be the sum of cost for a week:

$$\frac{3.69\,dollars}{1\,gallon} = \frac{s_dollars}{1.67\,gallon} \Rightarrow \frac{3.69}{1} = \frac{s}{1.67}$$

$3.69(1.67) = 1s \Rightarrow$ s = 6.16 dollars

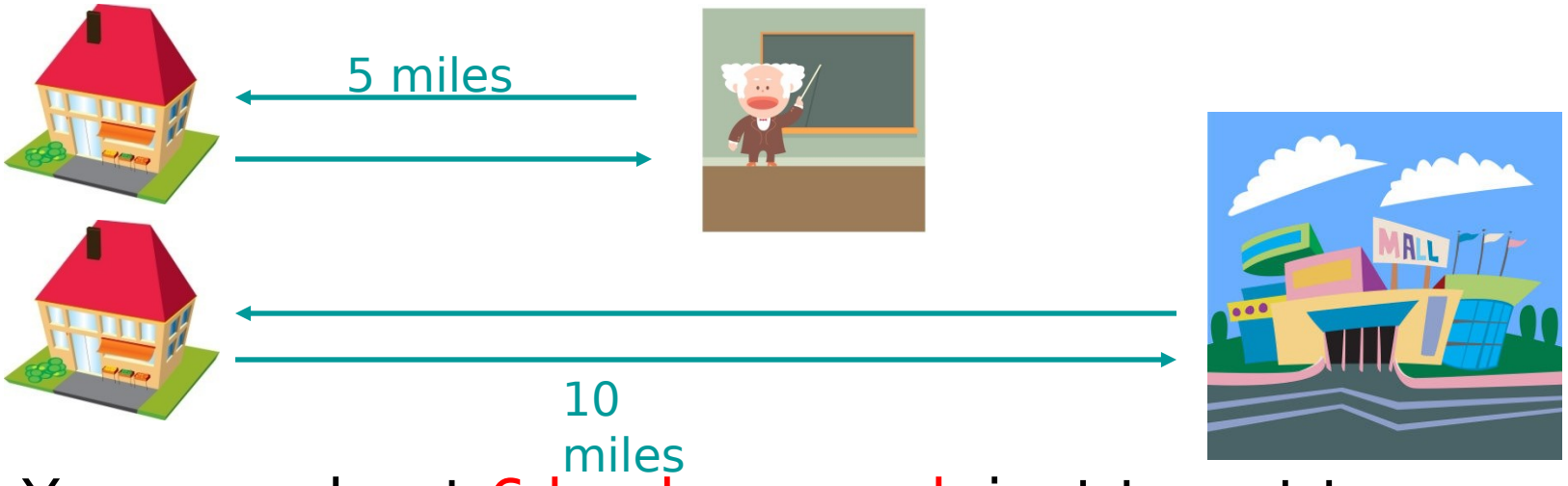


5 miles to home

5 miles to school



So what do you think?



You pay about 6 bucks a week just to get to school! What about weekends?
If you travel twice as much on weekends, say drive 10 miles to the Mall and 10 miles back, how many gallons do you need now? How much would it cost totally? How much would it

Think proportionally! . . . It's all about proportions!


Thank
YOU!


GOOD
LUCK!