

# Lesson 5.2:

# Proportions

## Essential Question

How can proportions help you decide when things are “fair”?

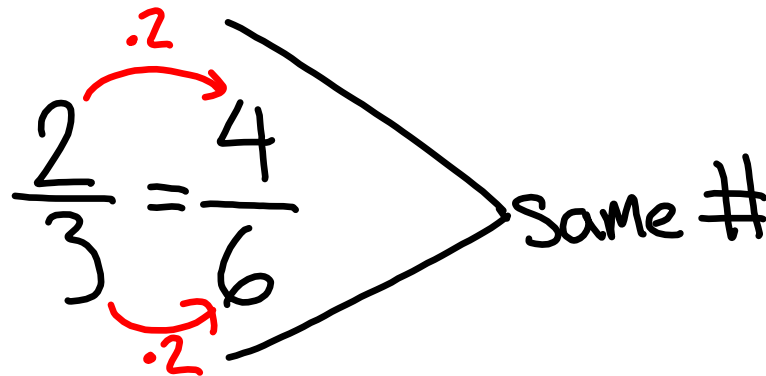
## 5.2 Notes

Get out your spiral notebooks!

 **Key Idea**
**Proportions**

**Words** A **proportion** is an equation stating that two ratios are equivalent. Two quantities that form a proportion are **proportional**.

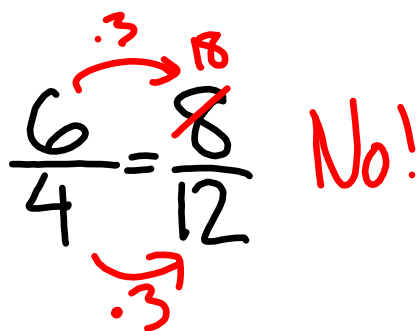
**Numbers**  $\frac{2}{3} = \frac{4}{6}$  The proportion is read "2 is to 3 as 4 is to 6."



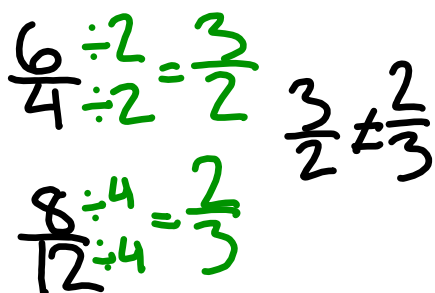
$$\frac{2}{3} = \frac{4}{6} \quad \text{Same \#}$$

**Example 1:**

Tell whether  $\frac{6}{4}$  and  $\frac{8}{12}$  form a proportion.



$$\frac{6}{4} = \frac{8}{12} \quad \text{No!}$$



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

$$\frac{8}{12} \div 4 = \frac{2}{3}$$

$$\frac{3}{2} \neq \frac{2}{3}$$

We can also look and see that  $\frac{6}{4} > 1$  and  $\frac{8}{12} < 1$ , so it's not possible for them to be equal.

**Example 2:**

Tell whether x and y are proportional.

x	y
$\frac{1}{2}$	3
1	6
$\frac{3}{2}$	9
2	12

a)  $\frac{\frac{1}{2} \cdot 2}{3 \cdot 2} = \frac{1}{6} \checkmark$

b)  $\frac{1}{6} \checkmark$

c)  $\frac{\frac{3}{2} \cdot 2}{9 \cdot 2} = \frac{3}{18} \div 3 = \frac{1}{6} \checkmark$

d)  $\frac{2 \div 2}{12 \div 2} = \frac{1}{6} \checkmark$

a)  
b)  
c)  
d)

Yes!

Tell whether the ratios form a proportion.

1.  $\frac{25}{20}, \frac{15}{12}$

$\frac{25 \div 5}{20 \div 5} = \frac{5}{4}$   
 $\frac{15 \div 3}{12 \div 3} = \frac{5}{4}$  Yes!

2.  $\frac{10}{3}, \frac{5}{6}$

$\frac{10 \div 2}{3 \div 2} = \frac{5}{6}$  No!

3.  $\frac{4}{6}, \frac{18}{24}$

$\frac{4 \cdot 4}{6 \cdot 4} = \frac{16}{24}$  No!

4. Tell whether x and y are proportional.

Birdhouses Built, x	1	2	4	6
Nails Used, y	12	24	48	72

$\frac{1}{12} = \frac{2}{24} = \frac{4}{48} = \frac{6}{72}$

Yes!

## Key Ideas

### Cross Products

In the proportion  $\frac{a}{b} = \frac{c}{d}$ , the products  $a \cdot d$  and  $b \cdot c$  are called **cross products**.

### Cross Products Property

**Words** The cross products of a proportion are equal.

#### Numbers

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

$$2 \cdot 6 = 3 \cdot 4$$

#### Algebra

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

$$ad = bc,$$

where  $b \neq 0$  and  $d \neq 0$

### Example 3:

You swim your first 4 laps in 2.4 minutes.  $\frac{\text{laps}}{\text{mins}}$

You complete 16 laps in 12 minutes.

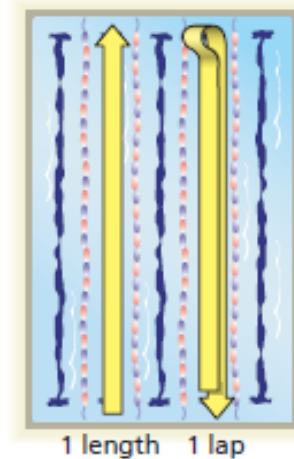
Is the number of laps proportional to your time?

~~$$\frac{4}{2.4} = \frac{16}{12}$$~~

$$4 \cdot 12 \stackrel{?}{=} 2.4 \cdot 16$$

$$48 \neq 38.4$$

No!



5. You read the first 20 pages of a book in 25 minutes. You read 36 pages in 45 minutes. Is the number of pages read proportional to your time?

$$\frac{20}{25} = \frac{36}{45}$$

$$20 \cdot 45 \stackrel{?}{=} 25 \cdot 36$$

$$900 \stackrel{\checkmark}{=} 900$$

Yes!

Can you think of a reason why your swimming rate is not proportional to time, but your reading rate is?

You get tired when you swim more (or you might start slow and speed up), but that usually doesn't happen when you read.