

7.1 Ratios and Rates

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For a time, the Boston Symphony Orchestra was made up of 95 musicians.

Violins	29	Violas	12
Cellos	10	Basses	9
Flutes	5	Trumpets	3
Double reeds	8	Percussion	5
Clarinets	4	Harp	1
Horns	6	Trombones	3

You can compare the different groups by using ratios. A **ratio** is a comparison of two quantities using division.

ratio $\frac{1}{3}$

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For example, you can use a ratio to compare the number of violins (29) with the number of violas (12). This ratio can be written in three ways.

Terms \leftarrow $\frac{29}{12}$ 29 to 12 29:12

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Notice that the ratio of **violins** to violas, $\frac{29}{12}$ is different from the ratio of violas to **violins**, $\frac{12}{29}$. The order of the terms is important.

Ratios can be written to compare a part to a part, a part to the whole, or the whole to a part.

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Reading Math

Read the ratio $\frac{29}{12}$ as "twenty-nine to twelve."

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Use the table to write the ratio.

Animals at the Vet	
Cats	5
Dogs	7
Rabbits	2

3 ways

cats to rabbits

$\frac{5}{2}$ 5 to 2 5:2

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Use the table to write the ratio.

Animals at the Vet	
Cats	5
Dogs	7
Rabbits	2

+14

dogs to total number of pets

$\frac{7}{14}$ 7 to 14 7:14
 $\frac{1}{2}$

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Use the table to write the ratio.

Animals at the Vet	
Cats	5
Dogs	7
Rabbits	+ 2

total number of pets to cats

$$\frac{14}{5} \quad 14 \text{ to } 5 \quad 14:5$$

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Use the table to write the ratio.

Animals at the Vet	
Birds	6
Hamsters	9
Snakes	+ 3

birds to total number of pets

$$\frac{6}{18} \quad \frac{1}{3} \quad 1 \text{ to } 3 \quad 1:3$$

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Use the table to write the ratio.

Animals at the Vet	
Birds	6
Hamsters	9
Snakes	3

snakes to birds

$$\frac{3}{6} = \frac{1}{2} \quad 1 \text{ to } 2 \quad 1:2$$

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Use the table to write the ratio.

Animals at the Vet	
Birds	6
Hamsters	9
Snakes	+ 3

total number of pets to hamsters

$$\frac{18}{9} = \frac{2}{1} \quad 2 \text{ to } 1 \quad 2:1$$

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Equivalent ratios are ratios that name the same comparison. You can find an equivalent ratio by multiplying or dividing both terms of a ratio by the same number.

$$\frac{1}{3} = \frac{2}{6}$$

$$\frac{10}{15} = \frac{2}{3}$$

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Write three equivalent ratios to compare the number of diamonds to the number of spades in the pattern.

number of diamonds / number of spades = $\frac{3}{6}$ *There are 3 diamonds and 6 spades.*

$\frac{3}{6} = \frac{3 \div 3}{6 \div 3} = \frac{1}{2}$ *There is 1 diamond for every 2 spades.*

$\frac{3}{6} = \frac{3 \cdot 3}{6 \cdot 3} = \frac{9}{18}$ *If you triple the pattern, there will be 9 diamonds for 18 spades.*

So $\frac{3}{6}$, $\frac{1}{2}$, and $\frac{9}{18}$ are equivalent ratios.

$$\frac{3}{6} = \frac{1}{2} = \frac{9}{18}$$

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Write three equivalent ratios to compare the number of triangles to the number of hearts in the pattern.



$\frac{\text{number of triangles}}{\text{number of hearts}} = \frac{3}{9}$ *There are 3 triangles and 9 hearts.*

$$\frac{3}{9} = \frac{1}{3} = \frac{6}{18}$$

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