

Ratios, Rates, and Proportions

A ratio, mostly expressed as a fraction, is a comparison of two quantities. The order of the numbers in a ratio is very important.

Example: If the number of boys in a classroom is 12 and the number of girls is 15, then:

The number of boys to girls could be written as:

$$12 \text{ to } 15 \text{ or } 12 : 15 \text{ or } \frac{12}{15}$$

and

The number of girls to boys could be written as:

$$15 \text{ to } 12 \text{ or } 15 : 12 \text{ or } \frac{15}{12}$$

Write each of the following as a ratio.

1. There are 14 job openings and 125 applicants. What is the ratio of applicants to job openings? **125 : 14**
2. A class has 15 girls. What is the ratio of boys to the whole class if the number of boys is 16? **16 : 31**
3. A box contains 6 blue, 4 red, and 10 yellow notebooks. What is the ratio of the red notebooks to the number of notebooks that aren't red? **4 : 16**
4. What is the ratio of fingers to hands in humans? **10 : 2**
5. One third of a school of 750 students rides the bus. What is the ratio of students who do not ride the bus to students who do? **500 : 250**

Rate

Rate is a ratio that compares quantities with different units. When a rate expresses a quantity per one unit of another quantity, it is called a unit rate.

Example: My father made a 130-miles trip in 2 hours; his unit rate was 65 miles/hour

6. Kim earned \$60 in 5 hours. What is the unit rate of her pay? **\$12/hour**
7. I bought 3 pounds of oranges for \$2.25. What is the unit price of oranges? **\$0.75/pound**
8. The unit rate of a powerful saw is 30 trees per hour. What the saw's unit rate per minute? **0.5 tree/minute**
9. My neighbor can eat 16 hot dogs in 120 seconds. What is his unit rate in hot dogs per minute? **8 hot dogs/minute**

Proportions

A proportion is made up of two equal ratios.

Example: $\frac{1}{2} = \frac{50}{100}$

In a proportion, if you multiply diagonally (cross multiply), you will get the same answer.

$$\begin{array}{ccc} \frac{1}{2} & \begin{array}{c} \swarrow \quad \searrow \\ \nearrow \quad \nwarrow \end{array} & \frac{50}{100} \\ 1 \cdot 100 & = & 50 \cdot 2 \\ 100 & = & 100 \end{array}$$

Important: If you cross multiply two ratios and don't get the same answer, then the ratios are not equal and do not form a proportion.

Use cross multiplication to determine whether each pair of the following ratios forms a proportion; write "P" or "NP". For the ratios that are equal, place an equal sign in the middle.

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| <p>10. $\frac{3}{8}, \frac{4}{9}$ 27 ≠ 32 ; NP</p> <p>12. $\frac{10}{168} = \frac{5}{84}$ P</p> <p>14. $\frac{4}{9}, \frac{3}{7}$ NP</p> <p>16. $\frac{9}{10} = \frac{12.6}{14}$ P</p> | <p>11. $\frac{4}{16} = \frac{5}{20}$ P</p> <p>13. $\frac{5}{11} = \frac{10}{22}$ P</p> <p>15. $\frac{10}{13} = \frac{9}{11.7}$ P</p> <p>17. $\frac{8}{9}, \frac{9}{10}$ NP</p> |
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