

Ratios.

Vocabulary

1.	ratio	[ˈreɪʃɪəʊ]	відношення
2.	proportion	[prəˈpɔːʃən]	пропорція
3.	proportional	[prəˈpɔːʃənəl]	пропорційнальний
4.	value	[ˈvæljuː]	значення
5.	to compare	[kəmˈpeɪə]	порівнювати
6.	direct	[dɪˈrekt]	прямий
7.	inverse	[ɪnˈvɜːs]	зворотний
8.	increase	[ˈɪnkriːs]	зростати, збільшувати
9.	to decrease	[ˈdiːkriːs]	зменшувати

* A **ratio** compares values.

A ratio says how much of one thing there is compared to another thing.

3 : 1



There are 3 blue squares to 1 yellow square

Ratios can be shown in different ways:

Using the ":" to separate the values: **3 : 1**

Instead of the ":" you can use the word "to": **3 to 1**

Or write it like a fraction: $\frac{3}{1}$

A ratio can be scaled up (установлений в масштабі):

3 : 1



Here the ratio is also 3 blue squares to 1 yellow square,
even though there are more squares.

- **Using Ratios**

The trick (прийом) with ratios is to always multiply or divide the numbers **by the same value**.

Example:

4 : 5 is the same as **4×2 : 5×2 = 8 : 10**

$\begin{array}{cc} 4 : 5 \\ \downarrow \times 2 \quad \downarrow \times 2 \\ 8 : 10 \end{array}$

• **"Part-to-Part" and "Part-to-Whole" Ratios**

The examples so far have been "*part-to-part*" (comparing one part to another part). But a ratio can also show a part compared to the **whole lot**.

Example: There are 5 pups, 2 are boys, and 3 are girls



Part-to-Part:

The ratio of boys to girls is **2:3** or $\frac{2}{3}$

The ratio of girls to boys is **3:2** or $\frac{3}{2}$

Part-to-Whole:

The ratio of boys to **all** pups is **2:5** or $\frac{2}{5}$

The ratio of girls to **all** pups is **3:5** or $\frac{3}{5}$

1. What is the ratio of purple frogs to yellow frogs?



- 4 to 6 6 to 4 2 to 4 6 to 2

2. What is the ratio of green cones to purple cones?

- 6 to 1 5 to 1 1 to 6 5 to 6

3. What is the ratio of blue paper clips to total paper clips?



- 4 to 6 2 to 4 6 to 2 2 to 6

4. What is the ratio of brown octagonal prisms to total octagonal prisms?

- 1 to 2 2 to 3 1 to 3 2 to 1

5. Complete the ratio table.

a)

5	6
<input type="text"/>	12
15	18
20	24
25	30

b)

1	3
2	6
3	<input type="text"/>
4	12
5	15

6. James's Pizzeria made 27 thin-crust pizzas and 22 thick-crust pizzas. What is the ratio of the number of thick-crust pizzas to the number of thin-crust pizzas?

- 27:49 22:27 49:27 22:44

7. There are 20 students sitting on the bleachers and 27 students sitting on the floor. What is the ratio of the number of students sitting on the floor to the number of students sitting on the bleachers?
- 27:20 47:20 27:47 20:27
8. 9 of the tables at Aldo's Italian Restaurant are full and the other 1 table is empty. What is the ratio of the number of full tables to the number of empty tables?
- 9:1 1:18 20:9 18:1
9. An amusement park sold 20 child tickets. The other 30 tickets it sold were adult tickets. What is the ratio of the number of child tickets to the number of adult tickets?
- 20:30 50:30 30:20 50:20
10. 8 students are going on a field trip and 25 students are staying at school. What is the ratio of the number of students who are staying at school to the number of students who are going on the field trip?
- 8:25 33:8 25:8 8:33

11. Are these ratios equivalent?

a) $\frac{1}{2}$ and $\frac{7}{12}$

- yes no

b) 4 and $\frac{8}{10}$

- yes no

c) **2:4** and **10:12**

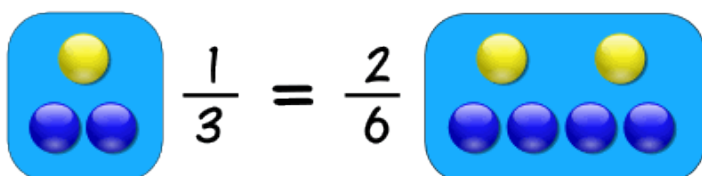
- yes no

d) **1 to 3** and **3 to 15**

- yes no

Proportion says that two **ratios** (or fractions) are **equal**.

Example:



So **1-out-of-3** is equal to **2-out-of-6**

The ratios are the same, so they are in proportion.

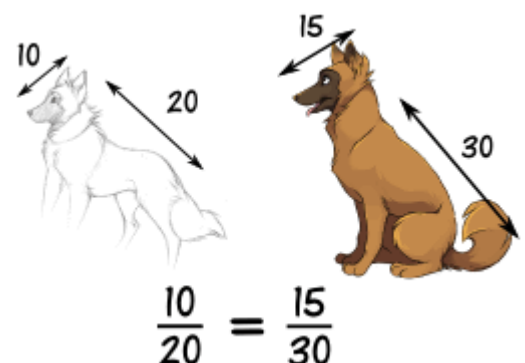
When things are "in proportion" then

their relative sizes are the same.

Here you can see that the ratios of head length to body length are the same in both drawings.

So they are **proportional**.

Making the head too long or short would look bad!



- Working With Proportions

NOW, how do we use this?

Example: you want to draw the dog's head, and would like to know how long it should be:

Let us write the proportion with the help of the 10/20 ratio from above:

$$\frac{?}{42} = \frac{10}{20}$$



Now we solve it using a special method:

$$\frac{?}{42} = \frac{10}{20}$$

? multiply (arrow from 10 to ?)
20 divide (arrow from 42 to 20)

Multiply across the known corners, then divide by the third number And you get this:

$$? = (42 \times 10) / 20 = 420 / 20 = 21$$

So you should draw the head **21** long.

- Using Proportions to Solve Percents

A percent is actually a ratio! Saying "25%" is actually saying "25 per 100":

$$25\% = \frac{25}{100}$$

We can use proportions to solve questions involving percents.

First, put what you know into this form:

$$\frac{\text{Part}}{\text{Whole}} = \frac{\text{Percent}}{100}$$

Example: what is 25% of 160 ?

The percent is 25, the whole is 160, and we want to find the "part":

$$\frac{\text{Part}}{160} = \frac{25}{100}$$

Find the Part:

Example: what is 25% of 160 (continued)?

$$\frac{\text{Part}}{160} = \frac{25}{100}$$

Multiply across the known corners, then divide by the third number:

$$\frac{\text{Part}}{160} = \frac{25}{100}$$

Part multiply (arrow from 25 to Part)
100 divide (arrow from 160 to 100)

$$\text{Part} = (160 \times 25) / 100 = 4000 / 100 = 40$$

Answer: 25% of 160 is 40.

Note: you could have also solved this by doing the divide first, like this:

$$\text{Part} = 160 \times (25 / 100) = 160 \times 0.25 = 40$$

Either method works fine.

We can also find a Percent:

Example: what is \$12 as a percent of \$80 ?

Fill in what you know:

$$\frac{\$12}{\$80} = \frac{\text{Percent}}{100}$$

Multiply across the known corners, then divide by the third number. This time the known corners are top left and bottom right:

$$\begin{array}{ccc} \$12 & \xrightarrow{\text{multiply}} & \text{Percent} \\ \text{divide } \$80 & & 100 \end{array}$$

$$\text{Percent} = (\$12 \times 100) / \$80 = 1200 / 80 = \mathbf{15\%}$$

Answer: \$12 is **15%** of \$80

12. Complete the following statement.

75% of \$4 = \$

55% of \$88 = \$

25% of \$60 = \$

13. Fill in the missing number to complete the proportion.

a)

$$\frac{2}{\boxed{}} = \frac{6}{12}$$

$$\frac{\boxed{}}{5} = \frac{3}{15}$$

b)

$$\frac{1}{2} = \frac{8}{\boxed{}}$$

$$\frac{4}{\boxed{}} = \frac{16}{20}$$

c)

$$\frac{\boxed{}}{3} = \frac{6}{18}$$

$$\frac{\boxed{}}{3} = \frac{12}{18}$$

14. Fill in the missing number to complete the proportion.

a) 2:1 = :4

b) 3 to 2 = to 8

c) to 3 = 8 to 12

15. Aaron took a total of 9 quizzes over the course of 3 weeks. After attending 6 weeks of school this quarter, how many quizzes will Aaron have taken in total? Solve using unit rates.

quizzes

16. Becky walked a total of 9 kilometers by making 3 trips to school. How many trips will Becky have to make in all to walk a total of 12 kilometers? Solve using unit rates.

trips

17. Mahiya prepared 12 kilograms of dough after working 6 hours. How many hours did Mahiya work if she prepared 16 kilograms of dough? Solve using unit rates.

hours

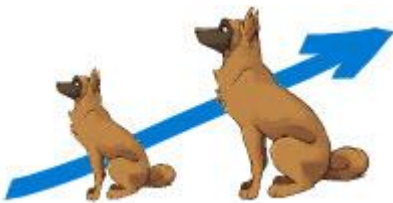
18. Kadisha read a total of 14 books over 7 months. After belonging to the book club for 8 months, how many books will Kadisha have read in all? Solve using unit rates.

books

19. Blake's graduation picnic will cost \$16 if it has 8 attendees (*учасник*). At most how many attendees can there be if Blake budgets a total of \$20 for his graduation picnic? Solve using unit rates.

attendees

• **Directly Proportional and Inversely Proportional**



Directly proportional: as one amount (кількість) **increases**, another amount increases at the same rate.

Inversely proportional: when one value **decreases** at the same rate that the other increases.

