

Multiplication of fraction by a number.

To multiply fraction by a number we need to multiply the numerator by a number:

$$\frac{2}{7} \cdot 3 = \frac{2}{7} + \frac{2}{7} + \frac{2}{7} = \frac{2 + 2 + 2}{7} = \frac{3 \cdot 2}{7} = \frac{6}{7} = 6:7$$

Multiplication of a fraction by a fraction.

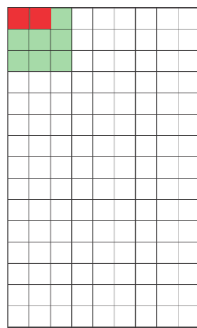
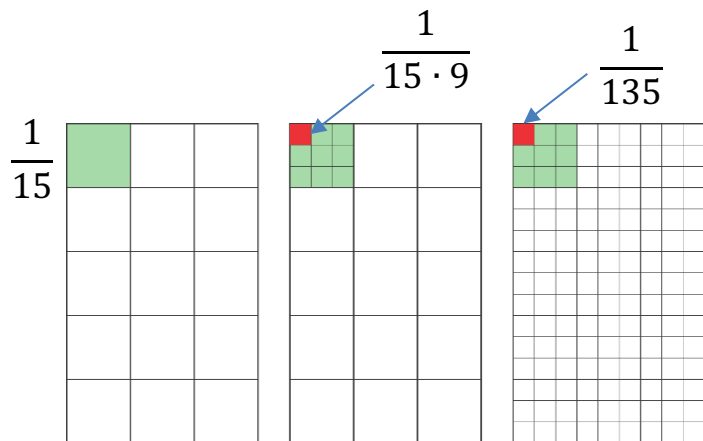
$\frac{1}{15}$ is a part of a whole divided into 15 equal small parts.

If we want to take $\frac{1}{9}$ part of this little $\frac{1}{15}$ chunk we have to divide it into 9 even smaller pieces, to find $\frac{1}{9}$ th of $\frac{1}{15}$ th.

$$\frac{1}{15} : 9 = \frac{1}{15} \cdot \frac{1}{9} = \frac{1}{15 \cdot 9} = \frac{1}{135}$$

If we need to take two small $\frac{1}{9}$ of $\frac{1}{15}$

$$\frac{1}{15} : 9 \cdot 2 = \frac{1}{15} \cdot \frac{2}{9} = \frac{1 \cdot 2}{15 \cdot 9} = \frac{2}{135}$$



To multiply two fractions, we need to multiply numerators, multiply denominators and reduce fraction, if possible.

Example:

$$\frac{3}{8} \cdot \frac{2}{3} = \frac{3 \cdot 2}{8 \cdot 3} = \frac{6}{24}$$

Can we reduce the fraction $\frac{6}{24}$?

$$\frac{6}{24} = \frac{1}{4}$$

So putting all together,

$$\frac{3}{8} \cdot \frac{2}{3} = \frac{3 \cdot 2}{8 \cdot 3} = \frac{6}{24} = \frac{1}{4}$$

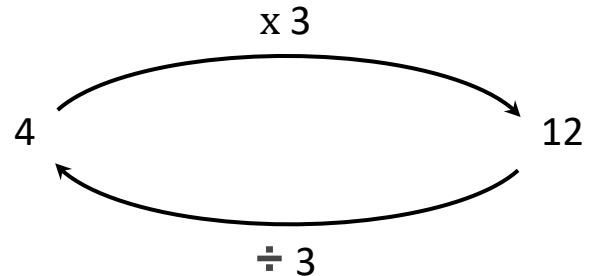
We could have also did it differently and reduce fraction on the go:

$$\frac{3}{8} \cdot \frac{2}{3} = \frac{3 \cdot 2}{8 \cdot 3} = \frac{3 \cdot 2}{4 \cdot 2 \cdot 3} = \frac{3}{4 \cdot 3} = \frac{1}{4}$$

Division of fractions.

Let's have a look at the example:

$$4 \times 3 = 12$$
$$12 \div 3 = 4$$

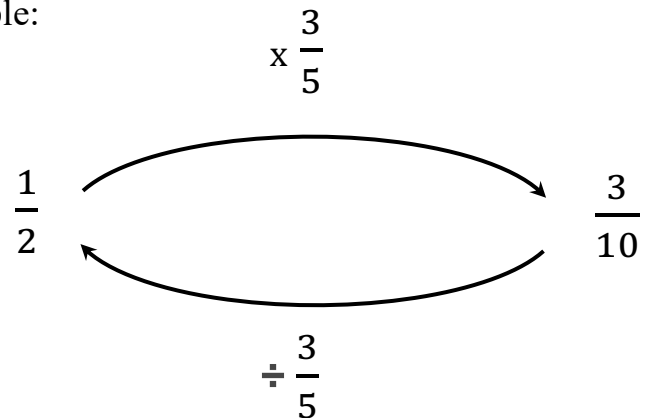


'Multiplying by 3' changes 4 to 12. But 'dividing by 3' changes 12 to 4 again.

We can use this idea to fractions. For example:

$$\frac{1}{2} \times \frac{3}{5} = \frac{3}{10}$$

$$\frac{3}{10} \div \frac{3}{5} = \frac{1}{2}$$



We can notice that the multiplication of $\frac{3}{10}$ by the fraction $\frac{5}{3}$ will bring exactly $\frac{1}{2}$:

$$\frac{3}{10} \times \frac{5}{3} = \frac{1}{2}$$

$\frac{5}{3}$ is an **inverse** fraction of $\frac{3}{5}$, they are also called **reciprocals** of each other.

To divide one fraction by another we need to multiply the dividend by the inverse (reciprocal) fraction.

Two fractions are reciprocals (or inverse) if their product is 1. Examples of reciprocals:

$$\frac{1}{4} \cdot \frac{4}{1} = 1 \quad \frac{3}{5} \cdot \frac{5}{3} = 1 \quad \frac{4}{7} \cdot \frac{7}{4} = 1$$

Let's solve a few problems with fractions:

1. Father is 42 years old. The son's age is $\frac{2}{7}$ of his father. How old is the son?
42:7 = 6 One seventh of the age of father is 6, $6 \cdot 2 = 12$, two sevenths is 12, son is 12 years old.

$$42:7 \cdot 2 = 42 \cdot \frac{1}{7} \cdot 2 = \frac{2}{7} \cdot 42 = 12$$

To find a part of a number, we need to multiply the part ($\frac{2}{7}$) by a number (42).

2. Peter solved 12 math problems, and it's $\frac{3}{5}$ of his assignment. How many problems Peter need to solve to do his assignment?

If 12 is $\frac{3}{5}$; one fifth will be 12:3, and then it needs to be multiple 5, to find out how much the whole assignment is.

$$12:3 \cdot 5 = \frac{12}{3} \cdot 5 = 12 \cdot \frac{5}{3} \quad \text{or} \quad 12:\frac{3}{5};$$

To find a number by its known part, we need to divide the known part by a fraction representing this part.



Homework

1. Evaluate:

$$a) \frac{3}{7} \cdot 2$$

$$b) 3 \cdot \frac{1}{6}$$

$$c) 9 \cdot \frac{5}{6}$$

$$d) \frac{1}{2} \cdot \frac{5}{6}$$

$$e) \frac{4}{3} \cdot \frac{5}{8}$$

2. There are 100 fourth graders in an elementary school. $\frac{3}{4}$ of them went to the field trip. How many students went to the field trip?
3. In the school cafeteria there are 12 tables. There are 10 seats at each table. At the lunch time $\frac{4}{5}$ of all seats were occupied by students. How many students were in the cafeteria?
4. There are 100 fourth graders in an SchoolNova school. 20 students took part in a math competition. What fraction of the students participated in the math competition?
5. 60 fourth graders like the “Harry Potter” movie. This is $\frac{3}{5}$ of the number of students in the 4th grade. How many students are there in the 4th grade?
6. Painter painted $\frac{2}{7}$ of the house in 4 days. How many days will take him to paint the whole house?

7. Evaluate:

$$a) \frac{3}{3} \div \frac{5}{7}$$

$$b) \frac{1}{4} \div \frac{1}{2}$$

$$c) \frac{3}{4} \div \frac{1}{2}$$

$$d) \frac{4}{9} \div \frac{8}{9}$$

$$e) 2 \div \frac{1}{7}$$

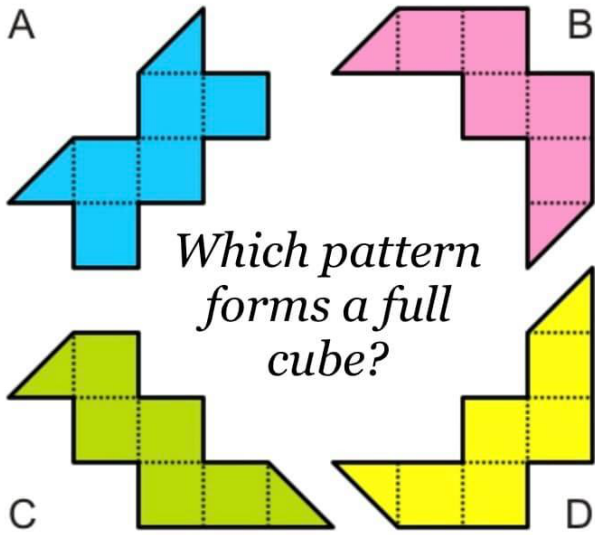
$$f) 4 \div \frac{3}{5}$$

$$g) \frac{2}{3} \div 4$$

$$h) \frac{10}{21} \div 5$$

8. a) $\frac{1}{7}$ of all students in the class is 4. How many students are there in the class?
- b) $\frac{2}{5}$ of all students in a class is 10. How many students are there in a class?

9.



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