

# Multiplying and Dividing Fractions

Multiply straight across. To divide, flip the second fraction and multiply, and here is why that works.

## × Multiplying

$$2/3 \times 4/5 = 8/15$$

### Multiply across

Numerator × numerator, denominator × denominator:  $2 \times 4 = 8$  and  $3 \times 5 = 15$ . No common denominator needed.

$$3/4 \text{ of } 20 = 15$$

### 'Of' means ×

$3/4 \times 20/1 = 60/4 = 15$ . In your head: divide by the denominator ( $20 \div 4 = 5$ ), then multiply by the numerator ( $5 \times 3 = 15$ ).

$$3/8 \times 4/9 = 1/6$$

### Cancel first

Divide 3 and 9 by 3, and 4 and 8 by 4, before multiplying:  $1/2 \times 1/3 = 1/6$ . Smaller numbers, fewer slips.

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

### Mixed numbers: go improper

Convert first:  $5/2 \times 4/3 = 20/6 = 10/3 = 3 \frac{1}{3}$ .

$$6 \times 1/2 = 3$$

### Multiplying can shrink

Multiplying a positive number by a proper fraction makes it smaller: you are taking part of it.

## ÷ Dividing

$$3/4 \div 2/5 = 3/4 \times 5/2$$

### Keep, change, flip

Keep the first fraction, change ÷ to ×, flip the second:  $3/4 \times 5/2 = 15/8 = 1 \frac{7}{8}$ . Only the second fraction flips.

$$2/5 \times 5/2 = 1$$

### The reciprocal

Flipping a fraction gives its reciprocal. A number times its reciprocal always makes 1. Zero has no reciprocal.

$$3 \div 1/2 = 6$$

### Why: how many fit?

Division asks how many fit. Each whole holds 2 halves, so 3 holds 6. Dividing by  $1/2$  is the same as multiplying by 2.

$$2/3 \div 4/9 = 3/2$$

### Why: make the divisor 1

Multiply both numbers by  $9/4$  (like  $12 \div 4 = 24 \div 8$ ).  $4/9$  becomes 1, leaving  $2/3 \times 9/4 = 18/12 = 3/2$ . That is keep-change-flip.

$$6 \div 3/4 = 8$$

### Whole numbers over 1

Write 6 as  $6/1$ , then flip and multiply:  $6/1 \times 4/3 = 24/3 = 8$ . Check:  $3/4$  fits into 6 eight times.

$$4 \div 1/4 = 16$$

### Dividing can grow

Dividing a positive number by a proper fraction makes it bigger: there are 16 quarters in 4.



### Sense-check the size

$3/4 \div 2/5$ : does  $2/5$  fit into  $3/4$  about twice? Just under, as  $2 \times 2/5 = 4/5$  is a bit more than  $3/4$ . So an answer just under 2, like  $1 \frac{7}{8}$ , makes sense.

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