

Math 9
Section 3.4-3.5 Multiplication and Division of Rational Numbers

Multiplying and dividing rational numbers has the same rules as for multiplying and dividing integers. That is,

1. The product or quotient of two rational numbers with the **same** signs is **positive**.
2. The product or quotient of two rational numbers with **different** signs is **negative**.

For instance,

$(+3) \times (+3) = (+9)$		$\frac{+8}{+2} = +4$	$\frac{-8}{-2} = +4$
$(-3) \times (-3) = (+9)$			
$(+3) \times (-3) = (-9)$	and	$\frac{+8}{-4} = -2$	$\frac{-8}{+4} = -2$
$(-3) \times (+3) = (-9)$			

Review:

To multiply to fractions:

1. Multiply the numerators.
2. Multiply the denominators.

To divide fractions, multiply by the **reciprocal**.

Ex: $(+4) \times (+9) = \square$	$\square \times -4 = -20$
$2 \times 9 = \square$	$(+4) \times (-4) = \square$
$-4 \times \square = 12$	$(-2) \times 4 = \square$

Ex: $10 \div 5 = \square$	$-8 \div 4 = \square$
$(-14) \div (-2) = \square$	$\square \div (-4) = (-16)$
$(+20) \div (+5) = \square$	$(+36) \div \square = -9$

$$\frac{-10}{-5} = \square \qquad \frac{\square}{5} = 8 \qquad \frac{-44}{\square} = -4$$

Ex: (a) $(-2) \times (-4) \times (3) = \square$

(b) $\frac{(-4)(+3)}{2} = \frac{(-12)}{2} = -6$

(c) $\frac{(-5)(-4)}{(-2)(5)} = -\frac{20}{10} = -2$

Multiplication of fractions/ decimals

Ex: (a) $\left(-\frac{2}{3}\right) \times \left(\frac{3}{4}\right)$

Step 1: get the sign of the answer $(-) \times (+) = (-)$

Step 2: rewrite the problem without signs

Step 3: simplify before you multiply

$$\begin{array}{c} 1 \\ \left(-\frac{2}{3}\right) \end{array} \times \begin{array}{c} 1 \\ \left(\frac{3}{4}\right) \end{array} = \frac{1}{2}$$

1 2

Final answer: $-\frac{1}{2}$

(b) $\left(-\frac{4}{9}\right) \times \left(-\frac{3}{20}\right)$ $(-) \times (-) = (+)$

$$\begin{array}{c} 1 \\ \left(\frac{4}{9}\right) \end{array} \times \begin{array}{c} 1 \\ \left(\frac{3}{20}\right) \end{array} \quad : \text{ simplify before multiply}$$

3 5

$$= \frac{1}{15}$$

EX: 2 (a)

$$\begin{aligned} & \left(-2\frac{1}{3}\right) \times \left(-3\frac{1}{2}\right) \\ &= \frac{-7}{3} \times \frac{-7}{2} \\ &= \frac{49}{6} = 8\frac{1}{6} \end{aligned}$$

(b)

$$\begin{aligned} & \left(-3\frac{1}{3}\right) \times \left(1\frac{1}{4}\right) \\ &= \frac{-10}{3} \times \frac{5}{4} \\ &= \left(-\frac{25}{6}\right) = -4\frac{1}{6} \end{aligned}$$

EX. 3 (a) $\left(-\frac{4}{7}\right) \times 6$

$$\begin{aligned} &= \left(-\frac{4}{7}\right) \times \left(\frac{6}{1}\right) \\ &= -\frac{24}{7} = -3\frac{3}{7} \end{aligned}$$

(b) $\left(-2\frac{1}{3}\right) \times (-2)$

$$\begin{aligned} &= \frac{7}{3} \times \frac{2}{1} \\ &= \frac{14}{3} = 4\frac{2}{3} \end{aligned}$$

EX: 4 (a) $(-4.7) \times (+2.3) = -10.81$

(b) $(-3.72) \times (-5.9) = 21.948$

EX: 5 A plane seats 480 people and is $\frac{3}{4}$ full. How many people are on the plane?

$$480 \times \frac{3}{4} = \frac{1440}{4} = 360$$

Division of fractions/decimals

EX: 6

$$(a) \left(-\frac{5}{7}\right) \div \left(-\frac{15}{28}\right)$$

$$(-) \div (-) = (+)$$

$$= \left(\frac{5}{7}\right) \div \left(\frac{15}{28}\right)$$

step 1 : multiply by the reciprocal

$$= \left(\frac{5}{7}\right) \times \left(\frac{28}{15}\right)$$

step 2: reduce/simplify before multiplying

$$= \frac{1}{1} \left(\frac{5}{7}\right) \times \left(\frac{28}{15}\right) \frac{4}{3} = \frac{4}{3} = 1\frac{1}{3}$$

$$(b) \left(-\frac{3}{5}\right) \div \left(-\frac{18}{10}\right) \quad (-) \times (-) = (+)$$

$$= \frac{1}{1} \left(-\frac{3}{5}\right) \times \frac{10}{6} = \frac{2}{6} = \frac{1}{3}$$

EX: 7 (a)

$$\begin{aligned} & \left(-2\frac{1}{4}\right) \div \left(1\frac{1}{2}\right) \\ &= \frac{-9}{4} \div \frac{3}{2} \\ &= \frac{-9}{4} \times \frac{2}{3} \\ &= -\frac{3}{2} \end{aligned}$$

(b)

$$\begin{aligned} & \frac{-3}{4} \div (-2) \\ &= \frac{-3}{4} \times \frac{-1}{2} \\ &= \frac{3}{8} \end{aligned}$$

(c)

$$\begin{aligned} & \left(-\frac{3}{4}\right)^2 \\ &= \left(-\frac{3}{4}\right) \times \left(-\frac{3}{4}\right) \\ &= \frac{9}{16} \end{aligned}$$

Example 8: If a car travels 12.5 km on 1 liter of gas. How many litres of gas does it use to travel 100 km?

$$100 \div 12.5 = 8$$

It takes 8L of gas to ravel 100km.