Section 3.4: Multiplying Rational Numbers

When multiplying or dividing rational numbers, the rules for the positive and negative signs are the same as with integers.

Multiplying and Dividing

+ and + = +	same signs is POSITIVE
− and − = +	
− and + = −	opposite signs is NEGATIVE
+ and − = −	

Multiplying Integers

*** Be careful of the signs.

a). $(-6) \times (-3) = 18$

b). $20 \times (-2) = -40$

Multiplying Decimals

To multiply decimals without a calculator, line-up the last decimal place. The number with the most digits should go on top. Don't worry about the sign until your final answer.

a). $(-1.5) \times 1.8 = ?$

This is negative

Workings:
$$\begin{array}{r} 1.5 \\ \times\ 1.8 \\ \hline 120 \\ +\ 150 \\ \hline 2.70 \end{array}$$

Move the decimal in two places in the final answer.

$$\begin{array}{r} 1.5 \\ \times\ 1.8 \end{array}$$

Answer: -2.70

b). $(-2.6) \times (-3.25) =$

This is positive

Workings:
$$\begin{array}{r} 3.25 \\ \times\ 2.6 \\ \hline 1950 \\ +\ 6500 \\ \hline 8.450 \end{array}$$

Move the decimal in three places in the final answer.

$$\begin{array}{r} 3.25 \\ \times\ 2.6 \end{array}$$

Answer : $+8.450$

Multiplying Fractions

To multiply fractions, multiply straight across. $\frac{\text{Numerator} \times \text{Numerator}}{\text{Denominator} \times \text{Denominator}}$

a). $\left(-\frac{2}{5}\right) \times \frac{3}{8} = \frac{-2 \times 3}{5 \times 8} = \frac{-6}{40}$

Remember to keep the negative with the numerator.

Reduce Lowest terms $\frac{-6^{\div 2}}{40^{\div 2}} = \frac{-3}{20}$

b). $2\frac{1}{4} \times \left(-\frac{2}{3}\right)$ ** change mixed numbers to improper.

$\frac{9}{4} \times \frac{-2}{3} = \frac{-18}{12} = \frac{-3}{2}$ in lowest terms

c). $3 \times \frac{5}{8}$ change $3 = \frac{3}{1}$ $\frac{3}{1} \times \frac{5}{8} = \frac{15}{8}$

** when multiplying a fraction by a whole number, write the whole number as a fraction over one.

d). $\frac{3}{5} \times ? = \frac{-6}{25}$

Missing Fraction: $\frac{-2}{5}$

Challenge

e). $? \times \frac{1}{3} = \frac{1}{4}$

Missing fraction: $\frac{3}{4}$

Try using an equivalent fraction and a denominator of 12 in the answer.

$$\_\_ \times \frac{1}{3} = \frac{3}{12}$$

Always reduce answers to lowest terms.

The most common way is to multiply first then simplify the answer.

There is another way!

You can simplify the fractions first before you multiply.

Examples.

Determine each product. Be sure to simplify your answer.

$$\frac{-11}{7} \times \frac{-21}{44}$$

** it would be easier to reduce first before multiplying since the numbers are so big.

** because we are multiplying, you can reduce either numerator with either denominator.

Can $\frac{-11}{7}$ reduce? No, so try the other denominator.

Now try $\frac{-11}{44}$. Can this reduce? Yes. $\frac{\cancel{-11}^{\,-1}}{7} \times \frac{-21}{\cancel{44}_{\,4}} \Longrightarrow \frac{-1}{7} \times \frac{-21}{4}$

Can $\frac{-21}{4}$ reduce ? No, so try the other denominator.

Now try $\frac{-21}{7}$. Can this reduce? Yes. $\frac{-1}{\cancel{7}_{\,1}} \times \frac{\cancel{-21}^{\,-3}}{4} \Longrightarrow \frac{-1}{1} \times \frac{-3}{4} = \frac{3}{4}$

in lowest terms

If you are uncomfortable with this way you can always multiply first and reduce the final answer.

$$\frac{-11}{7} \times \frac{-21}{44} = \frac{231}{308} \qquad \frac{231^{\,\div 77}}{308_{\,\div 77}} = \frac{3}{4}$$

Try These! Simplify first, then multiply.

a). $\frac{8}{3} \times \frac{-7}{4}$

b). $\frac{9}{16} \times \frac{14}{3}$

Answers:

a). $\frac{8}{3} \times \frac{-7}{4} = \frac{\cancel{8}^{2}}{3} \times \frac{-7}{\cancel{4}_{1}} = \frac{2}{3} \times \frac{-7}{1} = \frac{-14}{3}$

b). $\frac{9}{16} \times \frac{14}{3} = \frac{\cancel{9}^{3}}{\cancel{16}_{8}} \times \frac{\cancel{14}^{7}}{\cancel{3}_{1}} = \frac{3}{8} \times \frac{7}{1} = \frac{21}{8}$

How would you complete this question?

$0.75 \times \frac{-1}{8}$

You could change 0.75 to a fraction $\frac{75}{100} = \frac{3}{4}$

OR

You could change $\frac{-1}{8}$ to a decimal -0.125

Answer: $0.75 \times (-0.125) = -0.09375$

Or

$\frac{3}{4} \times \frac{-1}{8} = \frac{-3}{32}$

Section 3.5: Dividing Rational Numbers

Dividing Integers

a). $(-15) \div (-5) = 3$ b). $\frac{(-18)}{9} = -2$

÷	−	+
−	+	−
+	−	+

*** remember the rules with the signs!!!

Dividing Decimals

a). $(-5.1) \div 3$ ⟹

$$3\overline{)5.1}\quad 1.7$$
$$\underline{-3}$$
$$21$$
$$\underline{-21}$$
$$0$$

Answer: -1.7

b). $\frac{(-7.5)}{-5}$ ⟹

$$5\overline{)7.5}\quad 1.5$$
$$\underline{-5}$$
$$25$$
$$\underline{-25}$$
$$0$$

Answer: 1.5

c). $(-10.5) \div 0.25$ ⟹ $0.25\overline{)10.5}$ ⟹ $25\overline{)1050.}$

$$25\overline{)1050.}\quad 42$$
$$\underline{-100}$$
$$50$$
$$\underline{-50}$$
$$0$$

You MUST move the decimal two places 0.25 becomes 25
Therefore the 10.5 must also be adjusted and become 1050.

Answer: -42 Don't forget to go back and look at the sign!

Try These!

1. $(-20.4) \div (-6)$

2). $8.42 \div (-2)$

3. $\frac{-138}{6}$

4. $(-0.25) \div (-0.3)$

Answers: 1. 3.4 2. -4.21 3. -23 4. $0.8\overline{3}$

Dividing Fractions

When dividing fractions, keep the first fraction the same and multiply by the reciprocal of the second fraction.

$$\frac{-2}{5} \div \frac{3}{10}$$

keep the same

change to ×

switch to its reciprocal

$\frac{3}{10}$ becomes $\frac{10}{3}$

$$\frac{-2}{5} \div \frac{3}{10} = \frac{-2}{5} \times \frac{10}{3} = \frac{-20}{15} = \frac{-4}{3}$$

Still reduce to lowest terms

Examples: Calculate. Reduce answers to simplest form where possible.

1. $\frac{3}{4} \div -\frac{9}{8} = \frac{3}{4} \times \frac{-8}{9} = \frac{-24}{36} = \frac{-24^{\div 12}}{36_{\div 12}} = \frac{-2}{3}$

2. $1\frac{1}{4} \div (-3) = \frac{5}{4} \div \frac{-3}{1} = \frac{5}{4} \times \frac{-1}{3} = \frac{-5}{12}$

*** remember to change mixed numbers to improper fractions and to write whole numbers as fractions over one.

3. $16 \div \frac{-4}{5} = \frac{16}{1} \times \frac{-5}{4} = \frac{16^{\,4}}{1} \times \frac{-5}{4_{\,1}} = \frac{-20}{1} = -20$

Try These!

4. $\frac{-2}{9} \div -\frac{4}{7}$

5. $2\frac{1}{2} \div \frac{25}{14}$

6. $\frac{8}{11} \div -4$

Answers: . 4. $\frac{7}{18}$ 5. $\frac{7}{5}$ 6. $\frac{-2}{11}$