

**Chapter 3 Rational Numbers****Name:** \_\_\_\_\_What You'll Learn:

- Identify positive and negative decimals and fractions as rational numbers
- Compare and order rational numbers
- Add, subtract, multiply, and divide rational numbers
- Solve problems that involve rational numbers
- Apply the order of operations with rational numbers

**Key Words**

Fraction

Equivalent Fraction

Numerator

Denominator

Common Denominator

Multiple

Common Multiple

Integer

Decimal

Repeating Decimal

Terminating Decimal

Rational Number

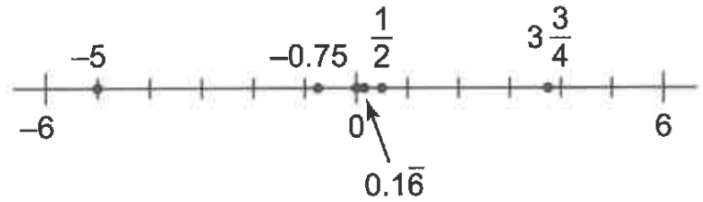
Reciprocal

### 3.1 What is a Rational Number?

#### What is a Rational Number?

Rational Numbers include:

- Integers
- Positive and negative fractions
- Positive and negative mixed numbers
- Repeating and terminating decimals



Basically, a Rational Number is any number that can be written in the form  $\frac{m}{n}$ , where  $m$  and  $n$  are both integers but  $n \neq 0$ . (Commonly known as a “fraction”)

**Ex 1)** Which of the following numbers are rational?  
Defend your answer.

a).  $\frac{-1}{4} \longrightarrow$

b).  $\sqrt{9} \longrightarrow$

c).  $\frac{-4}{-9} \longrightarrow$

d).  $\sqrt{75} \longrightarrow$

e).  $\pi \longrightarrow$

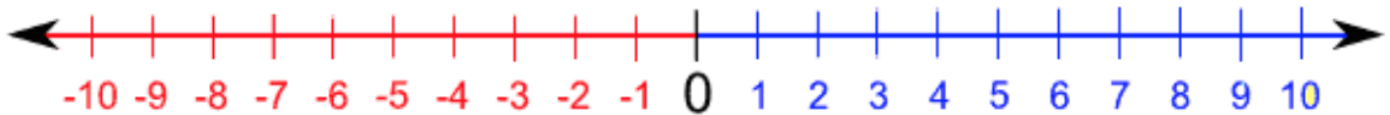
Practice Your Skills: Complete Pg 101 #6 and 12ace

Compare and Order Rational Numbers

Use  $>$ ,  $<$ , **or**  $=$  between each pair of numbers to show which rational number is greater or if they are equal.

$\frac{4}{7} \quad \frac{5}{9}$ <p>You need to get a common denominator to compare.</p>	$\frac{-3}{8} \quad \frac{-5}{8}$ <p>They already have a common denominator, so look at the numerators. The fraction with the larger numerator is larger.</p> <p><b>Be careful with negatives!</b></p>
$\frac{2}{7} \quad \frac{2}{9}$ <p>For positive fractions that have the same numerator, the fraction with the smaller denominator is the greater fraction. <i>You can still get common denominator and compare!</i></p>	$\frac{-2}{7} \quad \frac{-2}{9}$ <p>For negative fractions that have the same numerator, the fraction with the larger denominator is the greater fraction. <i>You can still get common denominator and compare!</i></p>
$\frac{-3}{4} \quad \frac{3}{4}$ <p>These fractions are called “opposites.”</p>	$\frac{-7}{8} \quad \frac{7}{-8}$ <p>Calculation tip: Put the negative sign with the numerator.</p>
$\frac{-10}{4} \quad -2.8$	

**Ex 2)** Place these rational numbers in *descending* order:  $\frac{-3}{4}$  ,  $0.5$  ,  $-1.8$  ,  $-5$  ,  $\frac{7}{3}$  ,  $2$  ,  $-3.\bar{3}$  ,  $1\frac{3}{4}$



Writing a Rational Number Between Two Given Numbers

**Ex 3)** Identify a decimal between each pair of rational numbers.

a)  $\frac{-1}{2}$  and  $\frac{-1}{4}$

b)  $-0.25$  and  $-0.26$

**Ex 4)** Identify a fraction between each pair of rational numbers.

a)  $\frac{-2}{3}$  and  $\frac{-3}{4}$

b)  $\frac{5}{2}$  and  $\frac{7}{3}$

### 3.2 Adding Rational Numbers

Adding Integers: Use a number line or “snorkeling” to add the following integers

**a)**  $(-1) + (+2) =$

**b)**  $(-2) + (-6) =$

**c)**  $(-7) + (+4) =$

**Try These!**

**d)**  $(-2) + (-1)$

**e)**  $(-6) + (-4)$

**f)**  $8 + (-12)$

**g)**  $5 + (-19)$

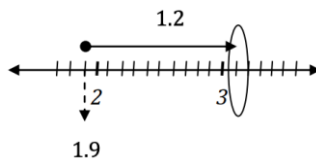
**h)**  $(-5) + 3 + (-9)$

**i)**  $7 + (-2) + (-7) + 4$

Adding Decimals

**a)** Add using a number line:  $(-1.3) + (+2.1)$

**b)** Write an addition equation for:



**Try These!**

**c)**  $2.4 + (-1.7)$

**d)**  $(-3.5) + 6.3$

**e)**  $(-4.1) + (-3.1)$

**f)**  $0.67 + (-0.83)$

**g)**  $-1.5 + 1.25$

**h)**  $-0.583 + 0.625$

Adding Fractions

a)  $\frac{-7}{9} + \frac{5}{9}$

b)  $\frac{2}{5}$  and  $\frac{-3}{5}$

c)  $\frac{-7}{8}$  and  $\frac{3}{4}$

d)  $-3\frac{1}{3}$  and  $2\frac{5}{6}$

**Try These!**

e)  $1\frac{1}{2}$  and  $(-2\frac{1}{3})$

f)  $\frac{3}{8}$  and  $\frac{7}{6}$

g)  $\frac{-3}{2}$  and  $\frac{1}{6}$

Addition Word Problem

1) Peter estimates that it takes him  $\frac{1}{4}h$  to prepare enough dough,  $\frac{1}{10}h$  to grate the cheese,  $\frac{1}{3}h$  to prepare the toppings, and  $\frac{2}{5}h$  to bake the pizza.

a) What fraction of time did it take Peter to prepare the pizza?

b) What was the actual time (in hours and minutes) that it took him to prepare the pizza?

**3.3 Subtracting Rational Numbers**

To subtract rational numbers we **ADD THE OPPOSITE**. Every subtraction problem can be written as an addition problem.

Subtracting Integers

a)  $5 - 3$

b)  $7 - (-4)$

c)  $-4 - (-2) - 3$

Subtracting Decimals

a)  $0.23 - (-1.46)$

b)  $(-1.39) - 2.41$

Subtracting Fractions

- We still need common denominators to subtract fractions
- We still need to change mixed numbers to improper fractions

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

b)  $-1\frac{1}{4} - (-2\frac{2}{3})$

**Try These!**

a)  $(-8.93) - 1.25$

b)  $3.34 - (-1.16)$

c)  $\frac{-4}{5} - (\frac{-1}{2})$

d)  $1\frac{1}{6} - \frac{3}{4}$

Subtraction Word Problems

1) The temperature in St. John's is  $6.5^{\circ}\text{C}$ . In Corner Brook it is  $8^{\circ}\text{C}$  colder. What is the temperature in Corner Brook?

2) A piece of pipe is 146.3 cm long. A piece 13.7 cm is cut off. How long is the remaining piece?

3) A person climbs  $12\frac{2}{3}$  meters above the water to the top of a cliff. He dives into the water and reaches  $-3\frac{1}{6}$  meters below the surface. What is the difference in these heights?

Subtraction Equations: Determine the missing number in each subtraction equation.

a)  $2.5 - \square = 3.8$

b)  $\square - \frac{-3}{10} = \frac{2}{5}$



## 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!

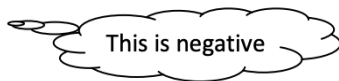
a)  $(-6) \times (-3) =$

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

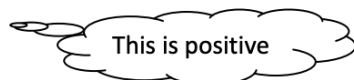
Multiplying Decimals

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 signs until your final answer.

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



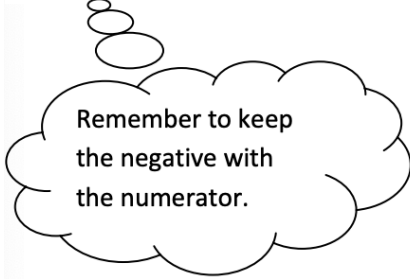
b)  $(-2.6) \times (-3.25) =$



Multiplying Fractions

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

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



b)  $2\frac{1}{4} \times \left(-\frac{2}{3}\right)$

c)  $3 \times \frac{5}{8}$

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

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

**When multiplying fractions, ALWAYS reduce to lowest terms!**

So far, we have multiplied and then reduced at the end... but there is another way!  
You can simplify the fractions first before you multiply.

Determine each product:

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

\*\* 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.  $\frac{\cancel{11}}{7} \times \frac{-21}{\cancel{44}} \implies \frac{-1}{7} \times \frac{-21}{4}$

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

Now try  $\frac{-21}{7}$ . Can this reduce? Yes.  $\frac{-1}{\cancel{7}} \times \frac{\cancel{-21}}{4} \implies \frac{-1}{1} \times \frac{-3}{4} = \frac{3}{4}$   
in lowest terms  $\nearrow$

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

c)  $\frac{9}{16} \times \frac{14}{3}$

Final Challenge Question: How would you find this product?

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

**3.4 Assignment:** \_\_\_\_\_

**3.5 Dividing Rational Numbers**Dividing Integers

a)  $(-15) \div (-5)$

b)  $\frac{(-18)}{9}$

Dividing Decimals

a)  $(-5.1) \div 3$

b)  $\frac{(-7.5)}{(-5)}$

c)  $(-10.5) \div 0.25$

**Try These!**

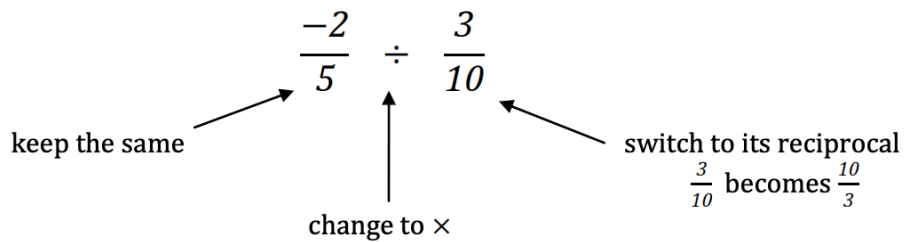
1.  $(-20.4) \div (-6)$

2.  $8.42 \div (-2)$

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

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

When dividing fractions, keep the first fraction the same and multiply the reciprocal of the second fraction. (Flip the 2<sup>nd</sup> fraction and multiply)



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

Still reduce to lowest terms

Calculate the following quotients. Remember to reduce answers to simplest form when possible.

a)  $\frac{3}{4} \div -\frac{9}{8}$

b)  $1\frac{1}{4} \div (-3)$

c)  $16 \div \frac{-4}{5}$

d)  $\frac{-2}{9} \div -\frac{4}{7}$

3.5 Assignment: \_\_\_\_\_

**3.6 Order of Operations with Rational Numbers**

B	Do the operations in brackets first
E	Next, evaluate any exponents
D } M }	Then, divide and multiply in order from left to right
A } S }	Finally, add and subtract in order from left to right

**Order of Operations Practice Questions**

a)  $(-2.4) \div 1.2 \times 0.2$

b)  $(-3.4 + 0.6) + 4^2 \times 0.2$

c)  $\left(\frac{3}{4} - \frac{7}{8}\right) \div \left(-\frac{5}{16}\right)$

d)  $\left(-\frac{2}{3}\right) \times \frac{1}{6} + \frac{1}{2}$

e)  $\left(2\frac{1}{3}\right) + \left(1\frac{1}{4}\right) \times \left(-\frac{2}{3}\right)$

**3.6 Assignment:** Pg 140 # \_\_\_\_\_  
**Ch. 3 Review Assignment:** \_\_\_\_\_