Name: ___________________________ Math 9

Comparing & Ordering Rational Numbers

What is a "rational number"?

- A number that can be expressed as $\frac{a}{b}$ (a fraction), where a and b are integers (positive or negative numbers, no decimals) and $b \neq 0$
- In decimal form, rational numbers will have a **terminating** (ending) decimal or a **repeating** decimal. If the decimal does not end or repeat, it is not a rational number
- Examples: _________________________________
- Non-examples: __________________________________

Which of the following are rational numbers? Circle your answers.

$\frac{3}{4}$ -0.75 $\frac{-2}{17}$ $\sqrt{6}$ 0.625 $\sqrt{9}$ π

Comparing Rational Numbers

Which fraction is greater, $-\frac{3}{4}$ or $-\frac{2}{3}$?

Method 1- Use Equivalent Fractions

Write each fraction as an equivalent fraction using common denominators.

Common denominator of 4 and 3: ______

$-\frac{3}{4} =$

$-\frac{2}{3} =$

When the denominators are the same, compare the numerators:

Method 2- Use Decimals

Write each fraction as a decimal:

$-\frac{3}{4} =$

$-\frac{2}{3} =$

Compare and Order Rational Numbers

Compare and order the following rational numbers:

-1.2 $\frac{4}{5}$ $\frac{7}{8}$ $-0.\overline{5}$ $-\frac{7}{8}$

Method 1- Estimate	Method 2- Use Decimals
-1.2 is a little less than _____	-1.2 = -1.2
$\frac{4}{5}$ is a little less than _____	$\frac{4}{5}$ =
$\frac{7}{8}$ is a little less than _____	$\frac{7}{8}$ =
$-0.\overline{5}$ is a little less than _____	$-0.\overline{5} = -0.\overline{5}$
$-\frac{7}{8}$ is a little more than _____	$-\frac{7}{8}$ =
Estimated order:	Place numbers on a number line:

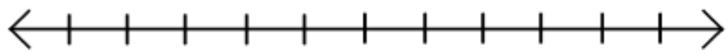
Numbers in ascending order (least to greatest): ____________________________

Numbers in descending order (greatest to least): ___________________________

Identify a Rational Number Between Two Given Rational Numbers

Identify a fraction between -0.6 and -0.7

Use a number line to identify -0.6 and -0.7



What number would you find if you counted from -0.6 to -0.7? _______

Convert the decimal to a fraction: _______________

A fraction between -0.6 and -0.7 is ____________

Show You Know

1. Which fraction is smaller, $-\frac{7}{10}$ or $-\frac{3}{5}$?

2. Compare the following rational numbers. Write them in ascending and descending order: $0.\overline{3}$ -0.6 $-\frac{3}{4}$ $1\frac{1}{5}$ -1

3. Identify a fraction between -2.4 and -2.5

★ **Key Ideas**

- Rational numbers can be ______________________________________
- They include ____
- Opposite rational numbers are ________________________________

  ____

Practice: pg. 51 # 4, 5, 7, 8, 12, 13, 14, 16, 19

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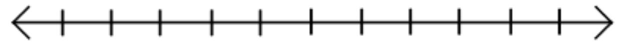
Problem Solving with Rational Numbers in Decimal Form

Add & Subtract Rational Numbers

Estimate and calculate:

a.) 2.65 + (-3.81)

Use a number line to help you estimate:



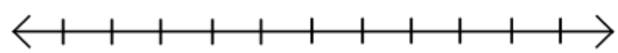
Calculate: Adding a negative number is the same as subtracting.

Determine the difference between 3.81 and 2.65

You are subtracting a larger number from a smaller number, so your answer should be ____________________

b.) -5.96 – (-6.83)

Use a number line to help you estimate:



Calculate: Subtracting a negative is the same as adding.

We can re-order the question to find the difference.

<u>Multiply & Divide Rational Numbers</u>

Estimate and calculate:

a.) 0.45 × (-1.2)

Estimate:

Calculate: Multiply the numbers without decimal points.

0.45 has two decimal places, -1.2 has one decimal place, so your answer has ______ decimal places.

Positive × Negative = ______________ so answer is _______________ b.) -2.3 ÷ (-0.25)

Estimate:

Calculate: Change number we are dividing by to a whole number by shifting decimal points of both numbers to the right.

Divide the numbers without decimal points.

Put the decimal point in the answer directly above the decimal point in the dividend (number being divided). Don't forget that we moved the decimal!

Negative ÷ Negative = _____________ so answer is ______________

Apply Operations with Rational Numbers in Decimal Form

Last Monday, the temperature at LAM decreased by 1.2°C/h for 3.5 h. It then decreased by 0.9°C/h for 1.5 h.

a.) What was the total decrease in temperature?

Write an expression to represent the word problem, then use BEDMAS

b.) What was the average rate of decrease in temperature?

Remember that a rate compares a quantity to 1 unit (km per hour, $ per soda, beats per minute for your heart rate)

Average rate of decrease = Total decrease ÷ total number of hours

Show You Know

1.) Estimate and calculate:

a. $-4.38 + 1.52$

b. $-1.25 - 3.55$

c. $-1.4(-2.6)$

d. $-2.76 \div 2.3$

2.) A hot-air balloon climbed at 0.8 m/s for 10 s. It then descended at 0.6 m/s for 6 s.

a. What was the overall change in altitude (height)?

b. What was the average rate of change in altitude?

Practice: pg. 60 # 5, 6, 8-14

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Problem Solving with Rational Numbers in Fraction Form

Add & Subtract Rational Numbers

Calculate:

a.) $\frac{2}{5}-\left(-\frac{1}{10}\right)$ Use a common denominator

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

Method 1- Rewrite as Improper Fractions	Method 2- Add the Integers and Add the Fractions

Multiply & Divide Rational Numbers

Calculate:

a.) $\frac{3}{4}\times\left(-\frac{2}{3}\right)$ Multiply numerators and multiply denominators.

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

"Dividing fractions is easy as pie, just flip the second and multiply!"

Apply Operations with Rational Numbers in Decimal Form

At the start of the week, Ms. Lindroos had $30 in her wallet. That week, she spent $\frac{1}{5}$ of the money at Starbucks, another $\frac{1}{2}$ at the movies and $\frac{1}{4}$ at Subway. How much money did Ms. Lindroos have left at the end of the week?

Represent the $30 at the beginning of the week with:

Represent the fractions of money spent with:

Calculate each dollar amount spent:

For Starbucks: For movies: For Subway:

Determine the total dollar amount spent:

Determine how much Ms. Lindroos has left:

Show You Know

1.) Calculate:

a. $-\frac{3}{4}-\frac{1}{5}$

b. $-2\frac{1}{2}+1\frac{9}{10}$

c. $-\frac{2}{5}\left(-\frac{1}{6}\right)$

d. $-2\frac{1}{8} \div 1\frac{1}{4}$

2.) Stefano had $46 is a bank account that he was not using. Each month for three months, the bank withdrew $\frac{1}{4}$ of this amount as a service fee. How much was left in the account after the last withdrawal?

Practice: pg. 68 # 5-10, 14, 18, 21

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Determining Square Roots of Rational Numbers- Part 1

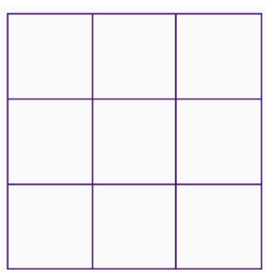
Think back to Math 8…

SQUARING a number and taking the SQUARE ROOT of a number are inverse (or reverse) operations. They "undo" each other.

$$3 \underset{\text{Square Root}}{\overset{\text{Square}}{\rightleftarrows}} 9$$

Example: 3 "squared" or $3^2 = 9$ because ______________________

The square root of 9 or $\sqrt{9} = 3$ because ______________



________ is the area of the square

________ is the side length of the square

Fill in Table #1:

Area of Square	Side Length as Square Root	Side Length of Square
25	$\sqrt{25}$	5
49		
64		
121		
144		

Important!!

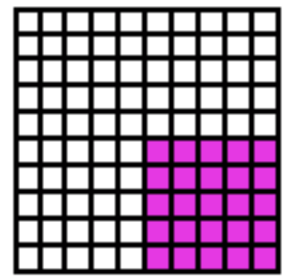
$\sqrt{25}$ and 5 represent the same number → 5!

$\sqrt{25}$ is NOT the same as 25

We can also find the square root of a fraction!

Look at this area model. ______ out of ______ squares are shaded.

We can write this as a fraction: _______



Are both the numerator and denominator square numbers? _____

Find the square root of the numerator: ________

Find the square root of the denominator: ________

This is your new fraction: _________ → as a decimal: ___________

<u>Fill in Table #2</u>

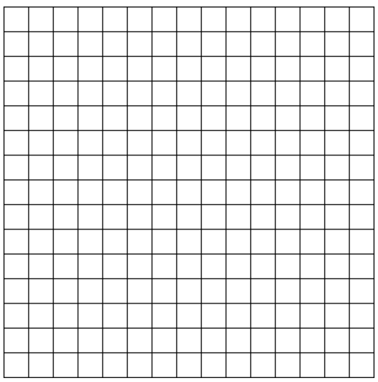
Area of Square	Side Length as Square Root	Side Length of Square
$\frac{25}{100}$	$\sqrt{\frac{25}{100}}$ or $\sqrt{0.25}$	0.5
$\frac{49}{100}$		
$\frac{64}{100}$		
$\frac{121}{100}$		
$\frac{144}{100}$		

These squares are bigger than the usual 10 x 10 squares. Since it is larger than the "whole" 100 squares, the decimal will be greater than 1.

Given the side length as a fraction, we can find the area of the square:

The side length of this square is $\frac{15}{10}$ (remember, usually our squares are 10 by 10 to make 100 squares in total. This one is bigger!)

To find the area of the square, we SQUARE the side length (multiply it by itself). The side length is $\frac{15}{10}$ units.



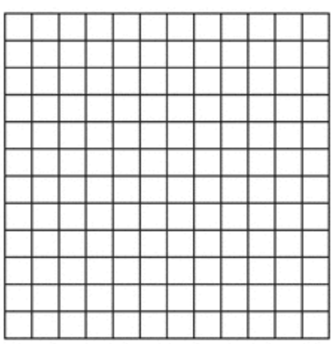
Area = $\left(\frac{15}{10}\right)^2$

=

=

The area is ______________________ square units.

Find the side length of this square, with an area of $\frac{144}{100}$ square units.



Side length = $\sqrt{\frac{144}{100}}$

=

=

The side length is _____________________ units.

- ★ A fraction in simplest form is a perfect square if it can be written as a product of two equal fractions.
- ★ When a decimal can be written as a fraction that is a perfect square, then the decimal is also a perfect square.
- ★ Perfect squares will have terminating (ending) or repeating decimals.

Show You Know

1. Find the number whose square root is:

a) $\frac{3}{8}$

b) 1.8

2. Is each fraction a perfect square?

a) $\frac{8}{18}$

b) $\frac{16}{5}$

c) $\frac{2}{9}$

3. Is each decimal a perfect square?

a) 6.25

b) 0.625

Practice: pg. 78 # 9-12, 15

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<u>Determining Square Roots of Rational Numbers- Part 2</u>

Between 1 and 100, how many perfect square numbers are there? ___________

That means there are __________ NON-perfect square numbers!

We can use our estimation skills to help us estimate the square root of a non-perfect square fraction. Here are three ways:

- Determine the approximate value of $\sqrt{\frac{8}{5}}$.

<u>METHOD #1</u>: Both the numerator and denominator are "next door" to perfect square numbers"

What perfect square numbers are the numerator and denominator close to?

Numerator: ________

Denominator: ________

So, the approximate value of $\sqrt{\frac{8}{5}}$ is _________.

- Determine the approximate value of $\sqrt{\frac{3}{10}}$.

<u>METHOD #2</u>: You can easily turn the fraction into a decimal without a calculator.

Write the fraction as a decimal. What perfect squares are on either side of the decimal?

Use your calculator to check your estimate. Is it a reasonable estimate?

NOTE: You should be able to estimate without your calculator. Only use your calculator to check that your estimate is reasonable. You should be able to show me how you got to your estimate!

- Determine the approximate value of $\sqrt{\frac{3}{7}}$.

METHOD #3: The numerator or denominator is not reeeeaaaally close to a perfect square number.

Numerator is close to 4, but denominator is in between 4 and 9.
Choose a fraction that is easier to work with:

We can use our estimation skills to find a number with a square root between two numbers:

Identify a decimal that has a square root between 10 and 11. Check your answer. (Hint: we are looking for the non-perfect square number, not just the square root)

- Pick a decimal between 10 and 11: ___________
- Square the decimal: _____________
- Use your calculator to check that the square root of the number is actually in between 10 and 11: _______________

Show You Know

1.) Estimate each square root:

a) $\sqrt{5.6}$ b) $\sqrt{\frac{9}{100}}$ c) $\sqrt{\frac{356}{10}}$

2.) Which of the following square roots are correct to the nearest tenth? Correct the square roots that are incorrect.

a) $\sqrt{0.09} \cong 0.3$ b) $\sqrt{1.7} \cong 0.4$

Practice: pg. 78 # 13- 18 (skip #15, we already did that), 21, 26