Equations, Inequalities, and Functions

Interactive Math Notebook Activities and Scaffolded Notes

- What is a rational number?
- Multiplying and Dividing Integers
- Rational Numbers on the Number Line
- Graphing Inequalities on the Number Line
- Reviewing Inequalities
- Solving Inequalities Using the Addition Principle
- Solving Inequalities Using the Subtraction Principle
- Using the Addition and Subtraction Principles to Get the X-Terms on One Side of the Inequality
- Solving Inequalities Using the Multiplication Principle
- Solving Inequalities Using the Division Principle
- Solving Multi-Step Inequalities
- What is an absolute value?
- Absolute Value Equations
- Absolute Value Inequalities
- Solving Different Types of Absolute Value Equations
- Solving Different Types of Absolute Value Inequalities
- Relations and Functions
- Substituting Values in the Function
- Organizing Values of a Function Using a Table

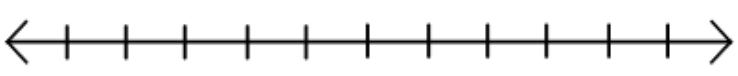
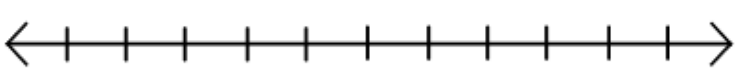
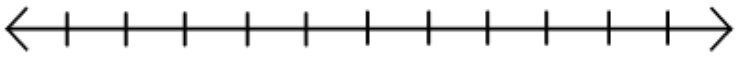
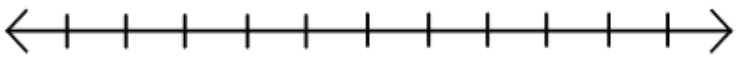
Scaffolded Notes

What is a rational number?	Is an integer a rational number?
	Is a mixed number a rational number?
	Is a decimal a rational number?
	Is a repeating decimal a rational number?

Multiplying and Dividing Integers
Give an example for each situation.

Positive x Positive = _____	Positive ÷ Positive = _____
Positive x Negative = _____	Positive ÷ Negative = _____
Negative x Positive = _____	Negative ÷ Positive = _____
Negative x Negative = _____	Negative ÷ Negative = _____

Rational Numbers on the Number Line

Locate the number ____ on the number line. 	Locate the number ____ on the number line. 
Locate the number ____ on the number line. 	Locate the number ____ on the number line. 

What is a rational number?

Any number that can be written as a fraction of two integers and placed on the number line.

Is an integer a rational number?
Yes, any integer can be written as a fraction with a denominator of 1.

Is a mixed number a rational number?
Yes, you can change a mixed number into an improper fraction.

Is a decimal a rational number?
Yes, as long as the decimal terminates.

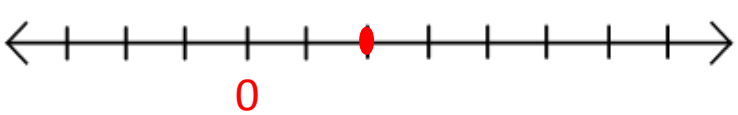
Is a repeating decimal a rational number?
No, terminating decimals do not end so they are in a different number classification.

Multiplying and Dividing Integers
Give an example for each situation.

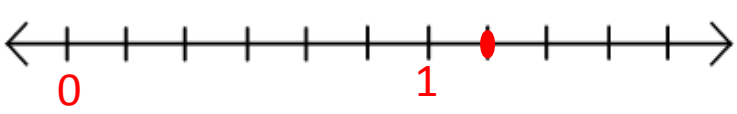
Positive x Positive = Positive $5 \times 6 = 30$	Positive ÷ Positive = Positive $36 \div 3 = 12$
Positive x Negative = Negative $5 \times -6 = -30$	Positive ÷ Negative = Negative $36 \div -3 = -12$
Negative x Positive = Negative $-5 \times 6 = -30$	Negative ÷ Positive = Negative $-36 \div 3 = -12$
Negative x Negative = Positive $-5 \times -6 = 30$	Negative ÷ Negative = Positive $-36 \div -3 = 12$

Rational Numbers on the Number Line

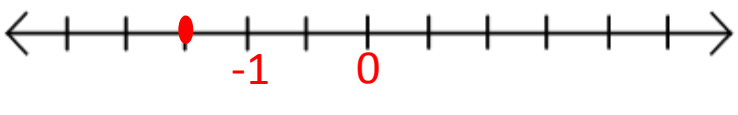
Locate the number $\frac{2}{3}$ on the number line.



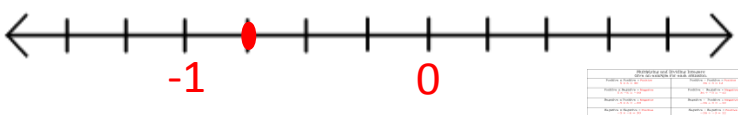
Locate the number $\frac{7}{6}$ on the number line.



Locate the number $-\frac{3}{2}$ on the number line.



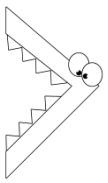
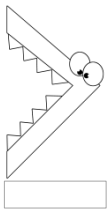
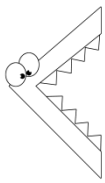
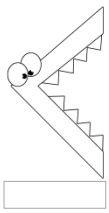
Locate the number $-\frac{3}{4}$ on the number line.



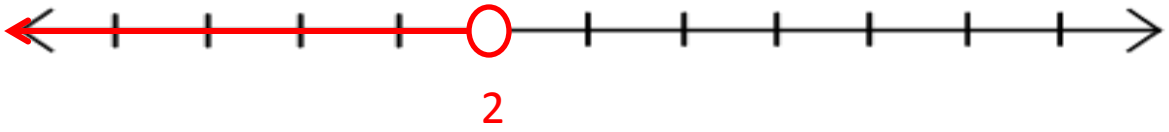
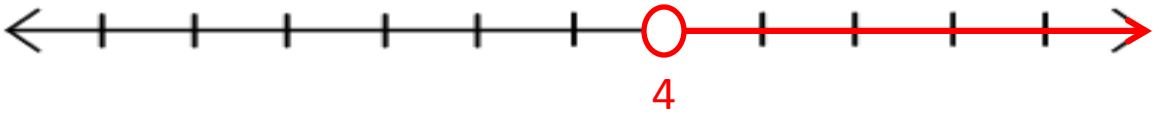
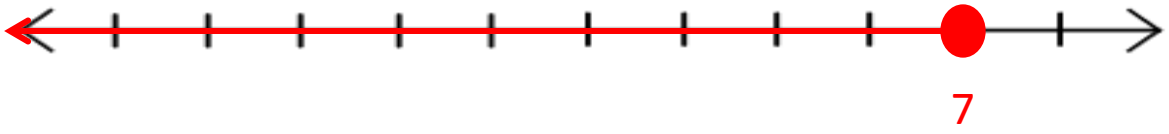
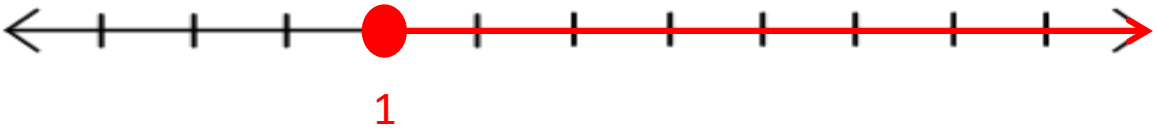
Graphing Inequalities on the Number Line

Graph all of the rational numbers which are less than 2.	
Graph all of the rational numbers which are greater than 4.	
Graph all of the rational numbers which are less than or equal to 7.	
Graph all of the rational numbers which are greater than or equal to 1.	

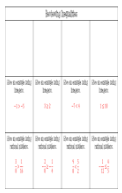
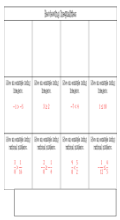
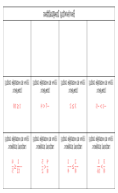
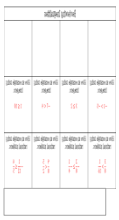
Reviewing Inequalities

 means _____ _____ _____ _____	 means _____ _____ _____ _____	 means _____ _____ _____ _____	 means _____ _____ _____ _____
Give an example using integers.	Give an example using integers.	Give an example using integers.	Give an example using integers.
Give an example using rational numbers.	Give an example using rational numbers.	Give an example using rational numbers.	Give an example using rational numbers.

Graphing Inequalities on the Number Line

Graph all of the rational numbers which are less than 2.	
Graph all of the rational numbers which are greater than 4.	
Graph all of the rational numbers which are less than or equal to 7.	
Graph all of the rational numbers which are greater than or equal to 1.	

Reviewing Inequalities

 means Greater Than	 means Greater Than or Equal to	 means Less Than	 means Less Than or Equal to
Give an example using integers. $-1 > -5$	Give an example using integers. $3 \geq 2$	Give an example using integers. $-7 < 4$	Give an example using integers. $1 \leq 10$
Give an example using rational numbers. $\frac{3}{8} > \frac{1}{16}$	Give an example using rational numbers. $-\frac{2}{8} \geq -\frac{1}{4}$	Give an example using rational numbers. $\frac{9}{8} < \frac{5}{2}$	Give an example using rational numbers. $-\frac{1}{12} \leq \frac{4}{5}$

The Addition Principle for Inequalities	
Step 1: Write your inequality.	
Step 2: Can you combine like terms? If not, we need to get rid of the number that is not attached to the variable.	
Step 3: What is the value of x?	

The Subtraction Principle for Inequalities	
Step 1: Write your equation.	
Step 2: Can you combine like terms? If not, we need to get rid of the number that is not attached to the variable.	
Step 3: What is the value of x?	

Using the Addition and Subtraction Principles to Get the X-Terms on One Side of the Inequality

For each of the following equations, there are x-terms on both sides of the equal sign. Your goal will be to get all of the x-terms on one side of the equation and all of the number terms on the other. Then, solve for your x-term.

$6x + 10 > 5x + 25$	$3x + 12 \leq 2x + 17$	$7x - 15 \geq 7 + 6x$
$x - 4 + 11 < 26$	$5x - 6 \leq 4x + 1$	$2x + 1 > x - 4$

The Addition Principle for Inequalities	
Step 1: Write your inequality.	$x - 4 < 12$
Step 2: Can you combine like terms? If not, we need to get rid of the number that is not attached to the variable.	$x - 4 < 12$ +4 +4 $x < 16$
Step 3: What is the value of x?	x is any number that is less than 16

The Subtraction Principle for Inequalities	
Step 1: Write your equation.	$11 + x \geq 1$
Step 2: Can you combine like terms? If not, we need to get rid of the number that is not attached to the variable.	$11 + x \geq 1$ -11 -11 $x \geq -10$
Step 3: What is the value of x?	x is any number greater or equal to -10

Using the Addition and Subtraction Principles to Get the X-Terms on One Side of the Inequality

For each of the following equations, there are x-terms on both sides of the equal sign. Your goal will be to get all of the x-terms on one side of the equation and all of the number terms on the other. Then, solve for your x-term.

$6x + 10 > 5x + 25$ $6x > 5x + 15$ $x > 15$	$3x + 12 \leq 2x + 17$ $3x \leq 2x + 5$ $x \leq 5$	$7x - 15 \geq 7 + 6x$ $7x \geq 22 + 6x$ $x \geq 22$
$x - 4 + 11 < 26$ $x + 7 < 26$ $x < 19$	$5x - 6 \leq 4x + 1$ $5x \leq 4x + 7$ $x \leq 7$	$2x + 1 > x - 4$ $2x > x - 5$ $x > -5$

The Multiplication Principle for Inequalities

Step 1: Write your inequality.	Multiplying by a Positive Number	Multiplying by a Negative Number
Step 2: Using multiplication cancels out division. If you need to get rid of division by a number you will use multiplication. Remember, if you do something to one side of the equation, you have to do it to the other too. Now, this is important, if you have to multiply by a negative number you will need to flip the inequality sign.		
Step 3: What is the value of x?		

The Division Principle for Inequalities

Step 1: Write your inequality.	Dividing by a Positive Number	Dividing by a Negative Number
Step 2: Using division cancels out multiplication. If you need to get rid of multiplication by a number you will use division. Remember, if you do something to one side of the equation, you have to do it to the other too. Now, this is important, if you have to divide by a negative number you will need to flip the inequality sign.		
Step 3: What is the value of x?		

Solving Multi-Step Inequalities

Use all of the properties of inequalities that you have learned to solve the problems below. Remember, if you have to use multiplication or division by a negative number you will need to flip the inequality sign.

$\frac{x+15}{2} < -5$	$\frac{x-6}{-10} \geq -4$	$-2x + 15 < 7$
$5x + 1 \leq -44$	$\frac{x}{-7} + 5 \leq 12$	$\frac{x}{2} - 10 < -19$

The Multiplication Principle for Inequalities

Step 1: Write your inequality.	Multiplying by a Positive Number $\frac{x}{3} < 7$	Multiplying by a Negative Number $\frac{x}{-6} < 2$
Step 2: Using multiplication cancels out division. If you need to get rid of division by a number you will use multiplication. Remember, if you do something to one side of the equation, you have to do it to the other too. Now, this is important, if you have to multiply by a negative number you will need to flip the inequality sign.	$\frac{x}{3} < 7$ $3 \cdot \frac{x}{3} < 7 \cdot 3$ $x < 21$	$\frac{x}{-6} < 2$ $(-6) \cdot \frac{x}{-6} > 2 \cdot (-6)$ $x > -12$
Step 3: What is the value of x?	x is any number less than 21	x is any number greater than -12

The Division Principle for Inequalities

Step 1: Write your inequality.	Dividing by a Positive Number $11x \leq 44$	Dividing by a Negative Number $-9x \geq -54$
Step 2: Using division cancels out multiplication. If you need to get rid of multiplication by a number you will use division. Remember, if you do something to one side of the equation, you have to do it to the other too. Now, this is important, if you have to divide by a negative number you will need to flip the inequality sign.	$11x \leq 44$ $\frac{11x}{11} \leq \frac{44}{11}$ $x \leq 4$	$-9x \geq -54$ $\frac{-9x}{-9} \leq \frac{-54}{-9}$ $x \leq 6$
Step 3: What is the value of x?	x is any number less than or equal to 4	x is any number less than or equal to 6

Solving Multi-Step Inequalities

Use all of the properties of inequalities that you have learned to solve the problems below. Remember, if you have to use multiplication or division by a negative number you will need to flip the inequality sign.

$\frac{x+15}{2} < -5$

$2 \cdot \frac{x+15}{2} < -5 \cdot 2$

$x + 15 < -10$

-15 -15

$x < -25$

$\frac{x-6}{-10} \geq -4$

$-10 \cdot \frac{x-6}{-10} \geq -4 \cdot (-10)$

$x - 6 \leq 40$

+6 +6

$x \leq 46$

$-2x + 15 < 7$

$-2x + 15 < 7$

-15 -15

$\frac{-2x}{-2} < \frac{-8}{-2}$

$x > 4$

$5x + 1 \leq -44$

$5x + 1 \leq -44$

-1 -1

$\frac{5x}{5} \leq \frac{-45}{5}$

$x \leq -9$

$\frac{x}{-7} + 5 \leq 12$

$-7 \cdot \frac{x}{-7} + 5 \leq 12 \cdot (-7)$

$x + 5 \geq -84$

-5 -5

$x \geq -89$

$\frac{x}{2} - 10 < -19$

$\frac{x}{2} - 10 < -19$

+10 +10

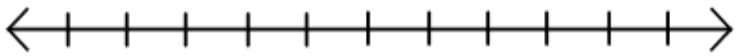
$2 \cdot \frac{x}{2} < -9 \cdot 2$

$x < -18$

What is an absolute value?

Give an example with symbols.

Illustrate absolute value using a number line.



Absolute Value Equations

Step 1: Write your equation.		
Step 2: Simplify the absolute value equation so that the absolute value is on one side of the equation and everything else is on the other side of the equation.		
Step 3: First, set the expression that is inside of your absolute value equal to what is on the other side of the equation. Then, set the expression that is inside of your absolute value equal to the opposite of what is on the other side of the equation. Solve each equation.		
Step 4: Check your solutions.		

Absolute Value Inequalities

Step 1: Write your inequality.		
Step 2: Simplify the absolute value inequality so that the absolute value is on one side of the inequality sign and everything else is on the other side of the inequality sign.		
Step 3: First, rewrite the inequality just as it its without the absolute value symbols. Then, rewrite the inequality without the absolute value symbols, but this time, flip the inequality symbol and change the number that is on the opposite side of the inequality to its opposite. Solve each inequality.		
Step 4: Check your solutions.		

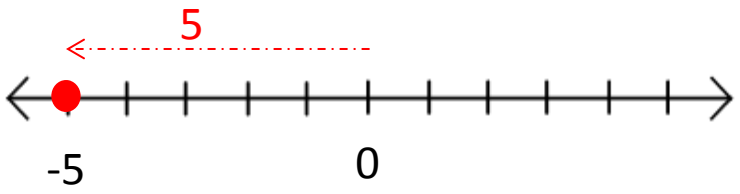
What is an absolute value?

The distance from zero to the number on a number line

Give an example with symbols.

$|-5| = 5$

Illustrate absolute value using a number line.



Absolute Value Equations

Step 1: Write your equation.	$2\|x+5\| = 14$	
Step 2: Simplify the absolute value equation so that the absolute value is on one side of the equation and everything else is on the other side of the equation.	$\frac{2\|x+5\|}{2} = \frac{14}{2}$ $\|x+5\| = 7$	
Step 3: First, set the expression that is inside of your absolute value equal to what is on the other side of the equation. Then, set the expression that is inside of your absolute value equal to the opposite of what is on the other side of the equation. Solve each equation.	$x+5=7$ -5 -5 $x=2$	$x+5=-7$ -5 -5 $x=-12$
Step 4: Check your solutions.	$2\|2+5\| = 14$ $2\|7\| = 14$ $\|7\| = 7$ $7 = 7$	$2\|-12+5\| = 14$ $2\|-7\| = 14$ $\|-7\| = 7$ $7 = 7$

Absolute Value Inequalities

Step 1: Write your inequality.	$\|x\| - 6 > 1$	
Step 2: Simplify the absolute value inequality so that the absolute value is on one side of the inequality sign and everything else is on the other side of the inequality sign.	$\|x\| - 6 > 1$ +6 +6 $\|x\| > 7$	
Step 3: First, rewrite the inequality just as it its without the absolute value symbols. Then, rewrite the inequality without the absolute value symbols, but this time, flip the inequality symbol and change the number that is on the opposite side of the inequality to its opposite. Solve each inequality.	$x > 7$	$x < -7$
Step 4: Check your solutions.	$\|8\| - 6 > 1$ $8 - 6 > 1$ $2 > 1$	$\|-8\| - 6 > 1$ $8 - 6 > 1$ $2 > 1$

Solving Different Types of Absolute Value Equations

Solve an absolute value equation with a variable inside of the absolute value.		Solve an absolute value equation with a variable inside of the absolute value and addition on the outside of the absolute value.	
Solve an absolute value equation with a binomial in the absolute value.		Solve an absolute value equation with a binomial in the absolute value and subtraction on the outside of the absolute value.	
Solve an absolute value equation with division inside of the absolute value.		Solve an absolute value equation with a variable inside of the absolute value and multiplication and addition on the outside of the absolute value.	

Solving Different Types of Absolute Value Inequalities

Solve an absolute value inequality with a variable inside of the absolute value.		Solve an absolute value inequality with a variable inside of the absolute value and addition on the outside of the absolute value.	
Solve an absolute value inequality with a binomial in the absolute value.		Solve an absolute value inequality with a binomial in the absolute value and subtraction on the outside of the absolute value.	
Solve an absolute value inequality with division inside of the absolute value.		Solve an absolute value inequality with a variable inside of the absolute value and multiplication and addition on the outside of the absolute value.	

Solving Different Types of Absolute Value Equations

Solve an absolute value equation with a variable inside of the absolute value.	$\lvert x\rvert = 4$ $x = 4 \quad x = -4$	Solve an absolute value equation with a variable inside of the absolute value and addition on the outside of the absolute value.	$\lvert x\rvert + 7 = 17$ $\lvert x\rvert = 10$ $x = 10 \quad x = -10$
Solve an absolute value equation with a binomial in the absolute value.	$\lvert x + 1\rvert = -2$ $x + 1 = -2 \quad x + 1 = 2$ $x = -3 \quad x = 1$ But, neither of these solutions work when you check your answers so there is no solution.	Solve an absolute value equation with a binomial in the absolute value and subtraction on the outside of the absolute value.	$\lvert x + 9\rvert - 5 = 13$ $\lvert x + 9\rvert = 18$ $x + 9 = 18 \quad x + 9 = -18$ $x = 9 \quad x = -27$
Solve an absolute value equation with division inside of the absolute value.	$\left\lvert \frac{x}{2}\right\rvert = 5$ $\frac{x}{2} = 5 \quad \frac{x}{2} = -5$ $x = 10 \quad x = -10$	Solve an absolute value equation with a variable inside of the absolute value and multiplication and addition on the outside of the absolute value.	$5\lvert x\rvert + 7 = 6$ $5\lvert x\rvert = -1$ $\lvert x\rvert = -\frac{1}{5}$ $x = -\frac{1}{5} \quad x = \frac{1}{5}$ But, neither of these solutions work when you check your answers so there is no solution.

Solving Different Types of Absolute Value Inequalities

Solve an absolute value inequality with a variable inside of the absolute value.	$\lvert x\rvert > 12$ $x > 12 \quad x < -12$	Solve an absolute value inequality with a variable inside of the absolute value and addition on the outside of the absolute value.	$\lvert x\rvert + 4 \leq 9$ $\lvert x\rvert \leq 5$ $x \leq 5 \quad x \geq -5$
Solve an absolute value inequality with a binomial in the absolute value.	$\lvert x + 5\rvert > 7$ $x + 5 > 7 \quad x + 5 < -7$ $x > 2 \quad x < -12$	Solve an absolute value inequality with a binomial in the absolute value and subtraction on the outside of the absolute value.	$\lvert x - 2\rvert - 8 > -2$ $\lvert x - 2\rvert > 6$ $x - 2 > 6 \quad x - 2 < -6$ $x > 8 \quad x < -4$
Solve an absolute value inequality with division inside of the absolute value.	$\left\lvert \frac{x}{3}\right\rvert \leq 8$ $\frac{x}{3} > 8 \quad \frac{x}{3} < -8$ $3 \cdot \frac{x}{3} > 8 \cdot 3 \quad 3 \cdot \frac{x}{3} < -8 \cdot 3$ $x > 24 \quad x < -24$	Solve an absolute value inequality with a variable inside of the absolute value and multiplication and addition on the outside of the absolute value.	$3\lvert x + 1\rvert + 4 \geq 1$ $3\lvert x + 1\rvert \geq -3$ $\lvert x + 1\rvert \geq -1$ $x + 1 \geq -1 \quad x + 1 \leq 1$ $x \geq -2 \quad x \leq 0$ But, neither of these solutions work when you check your answers so there is no solution.

What is a relation?	What is a function?
Give an example.	Give an example.

Substituting Values in the Function

Replace the x-value with the given number and simplify the expression.

Write your function here.

Substitute a negative integer into your function and simplify.

Substitute a positive integer into your function and simplify.

Substitute a rational number into your function and simplify.

Substitute a zero into your function and simplify.

Organizing Values of a Function Using a Table

Substitute the x-values into the function and simplify. Put your final answers in the table.

f(x) =		
x		f(x)
-5		
-2		
-1		
0		
1		
2		
5		
c		

Scratch Paper

What is a relation?	What is a function?
A set of ordered pairs.	A relation in which exactly one element of the range is paired with each element of the domain.
Give an example. (1,2) , (-3,4) , (7,9) (8,9)	Give an example. (1,2) , (-3,4) , (7,9)

Substituting Values in the Function

Replace the x-value with the given number and simplify the expression.

Write your function here.

$f(x) = 3x + 18$

Substitute a negative integer into your function and simplify.

$f(-2) = 3(-2) + 18$

$f(-2) = -6 + 18$

$f(-2) = 12$

Substitute a positive integer into your function and simplify.

$f(4) = 3(4) + 18$

$f(4) = 12 + 18$

$f(4) = 30$

Substitute a rational number into your function and simplify.

$f\left(\frac{1}{3}\right) = 3\left(\frac{1}{3}\right) + 18$

$f\left(\frac{1}{3}\right) = 1 + 18$

$f\left(\frac{1}{3}\right) = 19$

Substitute a zero into your function and simplify.

$f(0) = 3(0) + 18$

$f(0) = 0 + 18$

$f(0) = 18$

Organizing Values of a Function Using a Table

Substitute the x-values into the function and simplify. Put your final answers in the table.

f(x) = $x^2 - 2$		
x	$x^2 - 2$	f(x)
-5	$(-5)^2 - 2$	23
-2	$(-2)^2 - 2$	2
-I	$(-1)^2 - 2$	-1
0	$(0)^2 - 2$	-2
I	$(1)^2 - 2$	-1
2	$(2)^2 - 2$	2
5	$(5)^2 - 2$	23
c	$(c)^2 - 2$	$c^2 - 2$

Scratch Paper

Interactive Math Notebook Review Activities

Positive ÷ Positive	Positive ÷ Negative	Negative ÷ Positive	Negative ÷ Negative
Positive x Positive	Positive x Negative	Negative x Positive	Negative x Negative

Directions:

1. Cut along the bold lines and fold along the dotted lines.
2. When you fold along the dotted line you will have a mini-book.
3. Flip up each flap and write your examples in the inside pages.
4. Insert your finished book into your math notebook.

Rational Numbers

Define

Give some examples.

Show a rational number on a number line.

Glue this flap into your math journal.

Inequalities on a Number Line

Graph $x > 2$.

Graph $x \geq 1$.

Graph $x < 4$.

Graph $x \leq 0$.

Glue this flap into your math journal.

Solving Inequalities

Solving an Inequality Using the Addition Principle

Solving an Inequality Using the Subtraction Principle

Solving an Inequality Using the Multiplication Principle

Solving an Inequality Using the Division Principle

Directions:

1. Cut along the bold lines and fold along the dotted lines.
2. Use a little bit of glue underneath the top flap to insert the flap book into your math notebook.
3. Flip up each flap and write your examples directly onto your math notebook page.

Relations and Functions

Relations
Define and give an example.

Functions
Define and give an example.

1. Cut along the bold lines and fold along the dotted lines.
2. Write your examples inside of the folds.
3. Insert your finished matchbook into your math notebook.

Solving Absolute Value Equations

Step 1: Write your equation.

Step 2: Simplify the absolute value equation so that the absolute value is on one side of the equation and everything else is on the other side of the equation.

Step 3: First, set the expression that is inside of your absolute value equal to what is on the other side of the equation. Then, set the expression that is inside of your absolute value equal to the opposite of what is on the other side of the equation. Solve each equation.

Step 4: Check your solutions.

Glue this flap into your math journal.

Solving Absolute Value Inequalities

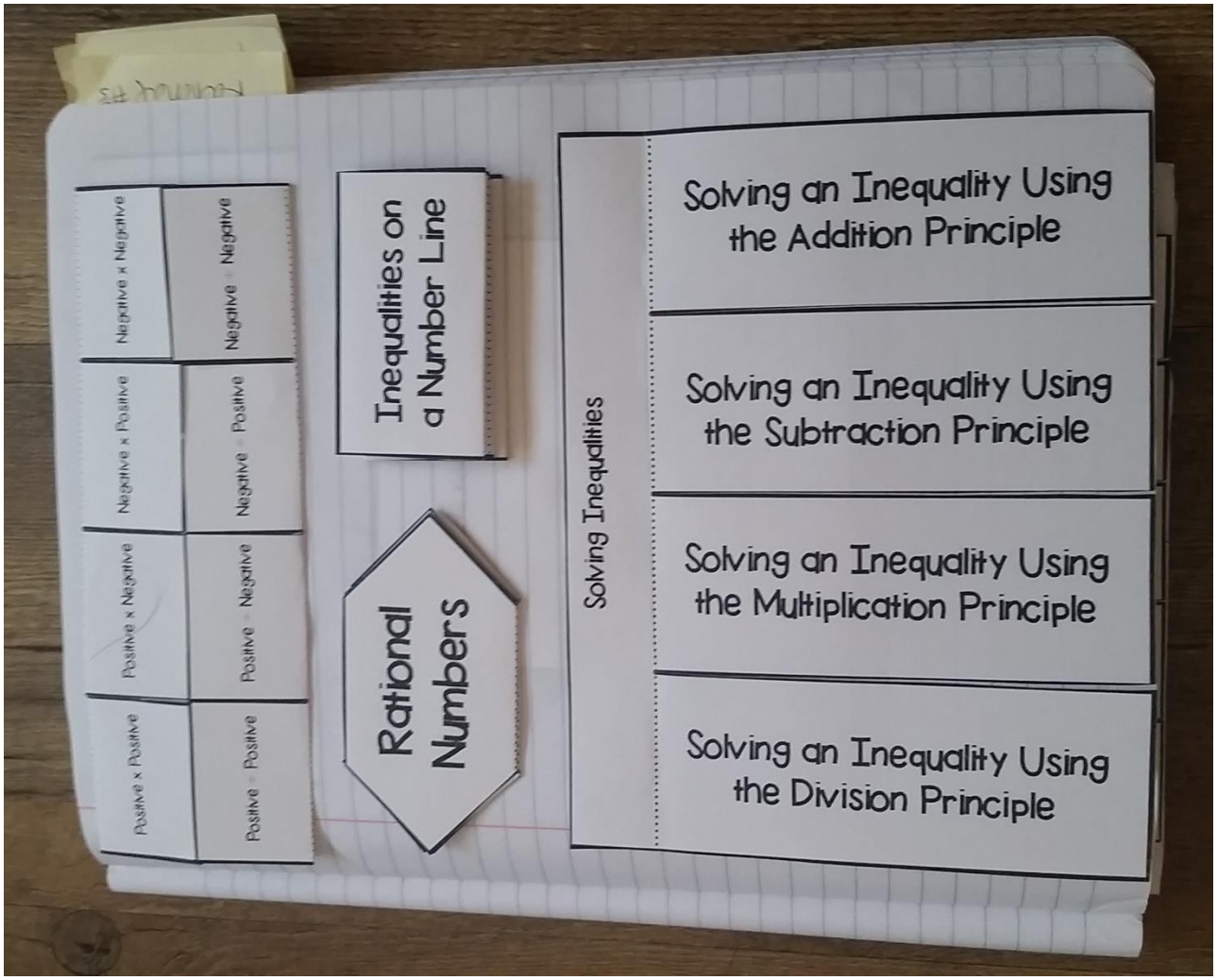
Step 1: Write your inequality.

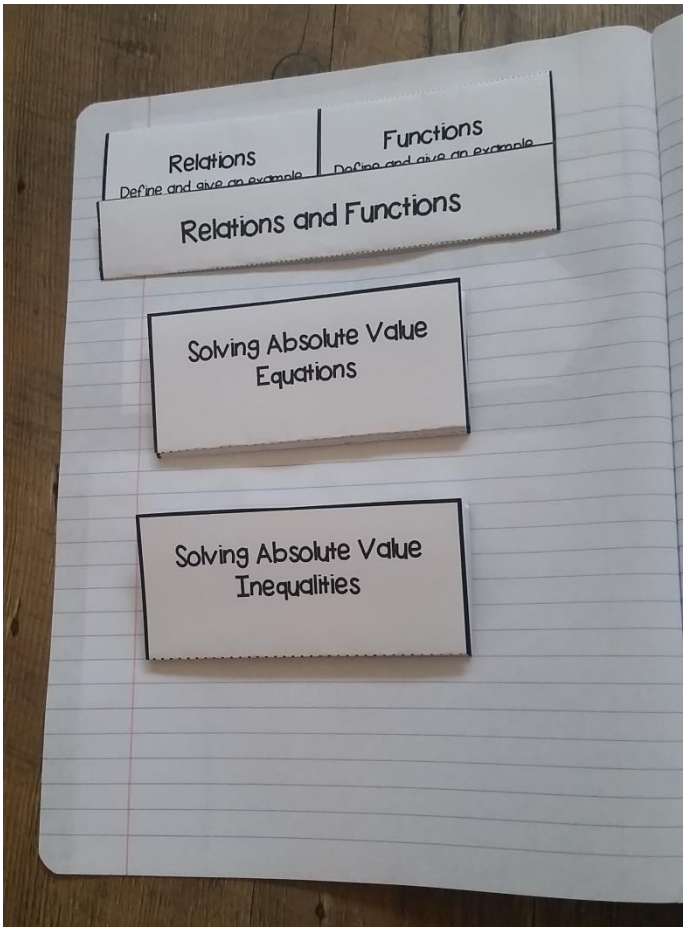
Step 2: Simplify the absolute value inequality so that the absolute value is on one side of the inequality sign and everything else is on the other side of the inequality sign.

Step 3: First, rewrite the inequality just as it its without the absolute value symbols. Then, rewrite the inequality without the absolute value symbols, but this time, flip the inequality symbol and change the number that is on the opposite side of the inequality to its opposite. Solve each inequality.

Step 4: Check your solutions.

Glue this flap into your math journal.


Negative x Negative
Negative ÷ Negative
Negative x Positive
Negative ÷ Positive
Positive x Negative
Positive ÷ Negative
Positive x Positive
Positive ÷ Positive
Inequalities on a Number Line
Rational Numbers
Solving Inequalities
Solving an Inequality Using the Addition Principle
Solving an Inequality Using the Subtraction Principle
Solving an Inequality Using the Multiplication Principle
Solving an Inequality Using the Division Principle


Relations
Define and give an example
Functions
Relations and Functions
Solving Absolute Value Equations
Solving Absolute Value Inequalities

INB SAMPLES

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