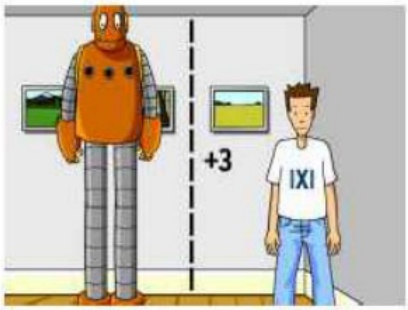
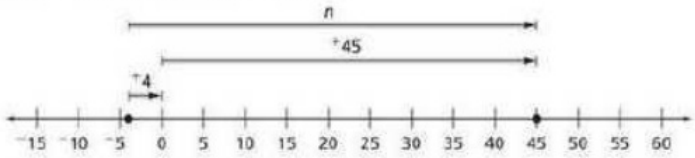
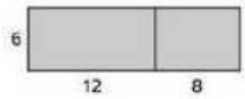
Operations on Rational Numbers



Day	Topic	Homework	IXL	Grade
1	Exploring Signs Part I	Worksheet 1	7.E.1	
2	Exploring Signs Part II	Worksheet 2	7.E.3	
3	Adding Signed Numbers Using Number Lines	Worksheet 3	7.E.5	
4	Adding Signed Numbers – Algorithm Start exploring Subtraction	Worksheet 4	7.G.1	
5	Subtracting Signed Numbers	Worksheet 5	7.G.3	
6	More on Subtraction	Study for quiz	7.G.9	
7	Quiz	Worksheet 6	7.G.10	
8	Multiplication	Worksheet 7	7.G.12	
9	Division	Worksheet 8	7.G.13	
10	Mixed numbers and Decimals	Worksheet 9	7.H.5	
11	Real Life	Worksheet 10	7.H.6	
12	Practice	Review Packet	7.H.8	
13	Review	Study for Test		
14	Unit Test	none		

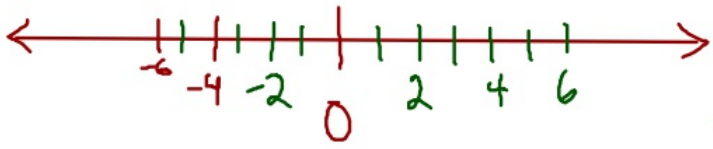
Name: _____

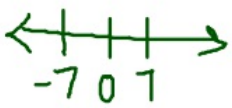
Important Concepts	Examples
Negative Numbers Some subsets of the positive and negative numbers have special names.	The set of the whole numbers and their opposites is called **integers.** Examples include: $-4, -3, -2, -1, 0, 1, 2, 3, 4$ The positive and negative integers and fractions are **rational numbers.** Examples include: $-2, -1.5, -1\frac{2}{3}, -1, -\frac{3}{4}, -\frac{1}{2}, 0, \frac{1}{2}, \frac{3}{4}, 1, 2, 2.5, 2\frac{3}{4}$
Addition and Subtraction Students model and symbolize problems to develop meaning and skill in addition and subtraction before developing algorithms. The **colored chip model** requires an understanding of opposites. The **number line model** helps make the connection to rational numbers as quantities. Sometimes it is helpful to restate an addition problem as a subtraction or a subtraction problem as an addition.	One color chip (black) represents positive numbers and another color (red) represents negative numbers. **Julia's Chip Board**  *Tate owes his sister, Julia, $6 for helping him cut the lawn. He earns $4 delivering papers. Is Tate "in the red" or "in the black"?* Black and red chips on a board represent income and expenses. The result is that he is "in the red" 2 dollars or has $^-2$ dollars. This problem may be represented with the number sentence $^-6 + 4 = ^-2$. The number line below models a temperature change from $^-4°$F to $^+45°$F. The sign of the change shows the direction of the change. $^-4° + n° = ^+45°$ or $^-4° + {}^+49° = {}^+45°$  When calculating $^+12 + {}^-8$, the result is the same as if you subtracted $^+8$ in the problem $^+12 - {}^+8$. When calculating $^+5 - {}^-7$, the result is the same as if you added $^+7$ in the problem $^+5 + {}^+7$.
Multiplication Multiplication can be explored by counting occurrences of fixed-size movement along the number line.	*If a runner passes the 0 point running to the left at 6 meters per second, where will he be 8 seconds later?* This can be represented as 8 jumps of $^-6$ on the number line. $^-6 + {}^-6 + {}^-6 + {}^-6 + {}^-6 + {}^-6 + {}^-6 + {}^-6 = {}^-48$ or $8 \times {}^-6 = {}^-48$
Division A multiplication fact can be used to write two related division facts.	You know that $5 \times {}^-2 = {}^-10$. You can write related division sentences: $^-10 \div {}^-2 = 5$ and $^-10 \div 5 = {}^-2$. By developing division based on its relationship to multiplication, students can determine the sign (positive or negative) of the answer to a division problem.
Order of Operations Mathematicians have established rules for the order in which operations $(+, -, \times, \div)$ should be carried out.	1. Compute any expressions within parentheses. 2. Compute any exponents. 3. Do all multiplication and division in order from left to right. 4. Do all addition and subtraction in order from left to right. $3 + 4 \times (6 + 2) \times 5 - 7^2 + 6 \div 3 =$ $3 + 4 \times 3 \times 5 - 7^2 + 6 \div 3 =$ $3 + 4 \times 3 \times 5 - 49 + 6 \div 3 =$ $3 + 60 - 49 + 2 =$ $63 - 49 + 2 =$ $14 + 2 = 16$
Commutative Property This property does not hold for subtraction or division.	The order of addends does not matter. $5 + 4 = 4 + 5$ $\quad -2 + 3 = 3 + (-2)$ The order of factors does not matter. $5 \times 4 = 4 \times 5$ $\quad -2 \times 3 = 3 \times (-2)$ Order does matter in subtraction. $5 - 4 \neq 4 - 5$ $\quad -2 - 3 \neq 3 - (-2)$ Order does matter in division. $5 \div 4 \neq 4 \div 5$ $\quad -2 \div 3 \neq 3 \div (-2)$
Distributive Property This property is introduced and modeled through finding areas of rectangles.	This property shows that multiplication *distributes* over addition. $6 \times (12 + 8) = (6 \times 12) + (6 \times 8)$ 

Date: 9/11/18 Day 1 **Exploring Signs Part I**

Problem 1

Darnell thinks that –4 is less than –6 because 4 is smaller than 6, and –4 is closer to 0 than –6 is. Draw a number line to show the numbers 0, –4, and –6. Then explain why Darnell is incorrect.





Guiding Questions

- What happens to the size of numbers when you move to the right on a number line? To the left?

  increase decrease

- What integer is directly to the right of 0? Directly to the left?

  1 -1

- Are –4 and –6 to the right or left of 0 on the number line?

  left

- Which number, –4 or –6, is farther to the left of 0?

  –6

- What is an example of a number that is less than –6? Greater than –4?

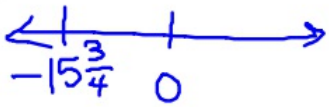
  -15 -10 -9 -7 -3 0 -2 -1 3

Problem 2

For each situation described below, draw a number line and represent the situation as a point on the number line.

a. Deposit of $75

b. 15 ¾ feet below sea level



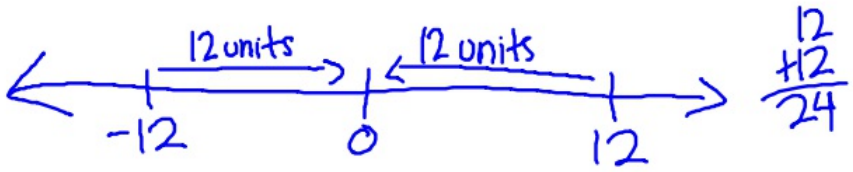
c. Temperature of 25˚C

d. 12 degrees below 0 on the Celsius scale

e. Withdrawal of $120

Problem 3

Jessica says she's thinking of two numbers. They are 24 units apart on the number line, and they are opposites. What are the two numbers? Prove it!



12 and -12

Problem 4

absolute value of 3. distance from 0.

You start on a number line at 5 and then move some distance. Your ending location can be represented by |3|

.

a. What are two different locations you could be at on the number line? Show this on a number line.

b. For each location, how far did you travel to get there?

→ -3 travel 8 units

→ 3 travel 2 units

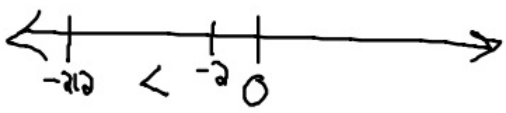
Problem 5

Which inequalities are correct? Select all that apply. For the inequalities that are true, show the comparison on a number line.

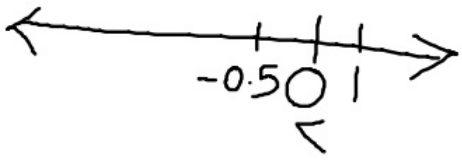
a. −2<−212

b. −2>−212

-212 < -2



c. 1>−0.5



d. −1>−0.5

e. 3.4<−4

Date: 9/12/18 Day 2 Exploring Signs Part II

Signed Numbers in Real Life

Temperature

Take a close look at the thermometer to the right. What do you notice? (Brainstorm!)

75°F 23°C

Red

F & C are included

has +/−

F counts by 20 & C counts by 10

"Temprite" brand

Bookkeeping

Before the advent of the computer, bookkeeping was done by actual bookkeepers. The bookkeeper would record every financial transaction the company made in a journal. The transaction didn't just need to be entered into the journal but also copied to other ledgers, for example, the company's general ledger.

The expression 'in the red' derives from the practice of using red ink to denote debt or losses on financial balance sheets. Likewise, businesses that are financially solvent are described as 'in the black'.

1904			Dr.	Cr.
Jan. 2	Papered two rooms,		11 25	
12	Polished and varnished office chair,		3 75	
23	By cash,			8 —
31	Balance forward to Page 14,			7 —
			15 —	15

Do you use "signed numbers" in real life anywhere?

money

temperature

golf

Chip Boards

We are going to copy the idea of the bookkeepers and use red chips to denote negative numbers and black chips to denote positive numbers.

We will explore separate from our notes.

Be sure to take notes on any observations you make while we are exploring.

To find the value of the field, match black/red pairs. The value of the field is the total chips remaining.

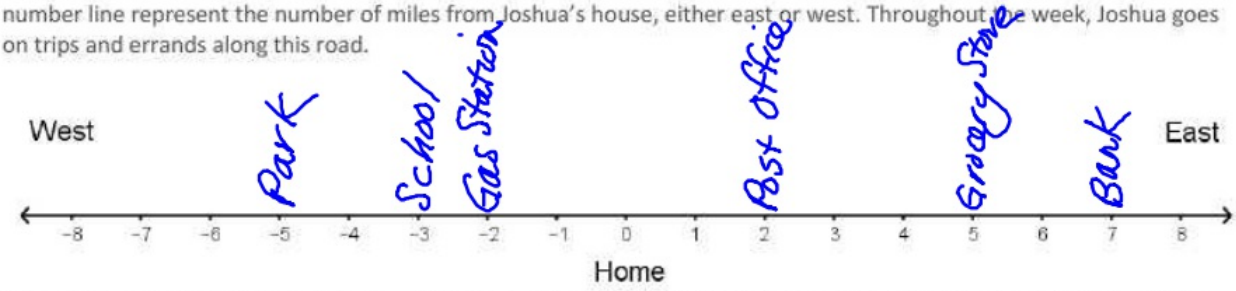
If red ⟹ negative

If black ⟹ positive

Date: 9/13/18 Day 3 Adding Signed Numbers Using Number Lines

Problem 1

The number line below represents the road that Joshua lives on, with his home located at point 0. The numbers on the number line represent the number of miles from Joshua's house, either east or west. Throughout the week, Joshua goes on trips and errands along this road.



For each day described in the chart, model Joshua's trip and determine where on the number line he ends up each day. Write an addition equation to represent it.

Day	Trip	Addition Equation
Sun	5 miles east to the grocery store, then 2 miles east to the bank	+5 + +2 = +7
Mon	5 miles east to the grocery store, then 3 miles west to the post office	+5 + -3 = +2
Tues	5 miles east to the grocery store, then 8 miles west to the school	5 + -8 = -3
Wed	3 miles west to the school, then 2 miles west to the park	-3 + -2 = -5
Thu	3 miles west to the school, then 1 mile east to the gas station	-3 + 1 = -2
Fri	3 miles west to the school, then 10 miles east to the bank	-3 + 10 = 7
Sat	5 miles west to the park, then 5 miles east to home	-5 + 5 = 0

5 + 2 = 7
5 + -3 = 2

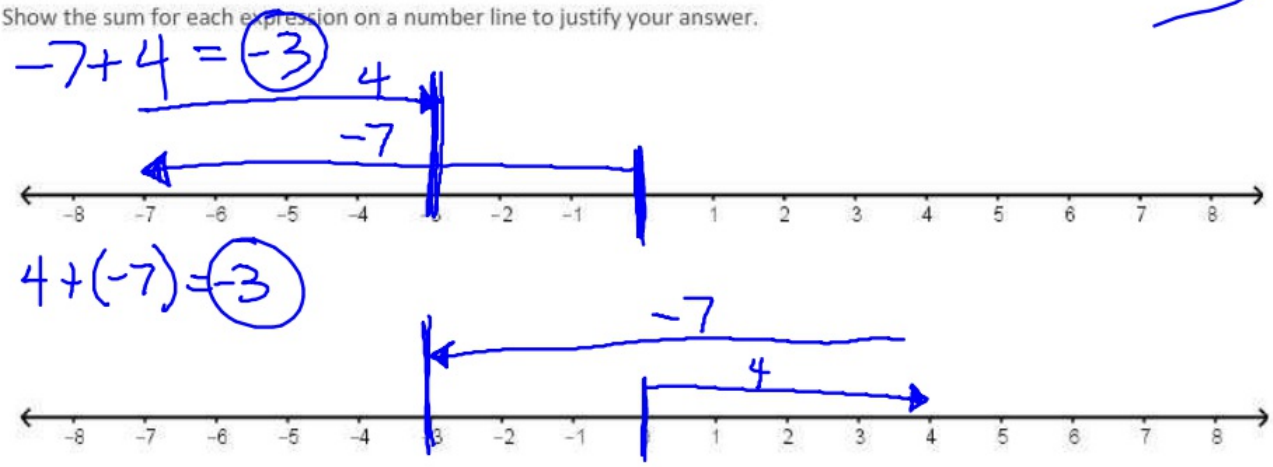
Guiding Questions

- For each trip, where do you start? 0
- If Joshua travels 5 miles east from home, where on the number line is he? +5
- What direction would Joshua have traveled if he started at home and ended up at -4? West
- How do you represent 5 miles east as an integer? What about 3 miles west? +5 -3
- What connections do you see between the number line, the addition equation, and the description of each trip? each stop is part of the addition problem
- At what point on the number line is each stop located (the grocery store, bank, post office, school, park, gas station)?
- If time allows: Write an addition equation to represent a new trip for Joshua. Swap with a partner and then model the trip and write a trip description.

Problem 2
Is −7+4 equivalent to 4+(−7) ?

Commutative Property

Show the sum for each expression on a number line to justify your answer.



Guiding Questions

- For each number, how do you know how far to move on the number line (not considering direction)? What term do you know that describes this?

−6 | 6 | Absolute value of the number is the distance travelled

- For each number, how do you know which direction to move on the number line?

+ / −

- Does the order of the numbers matter if they have signs? Create an example to explore this idea.

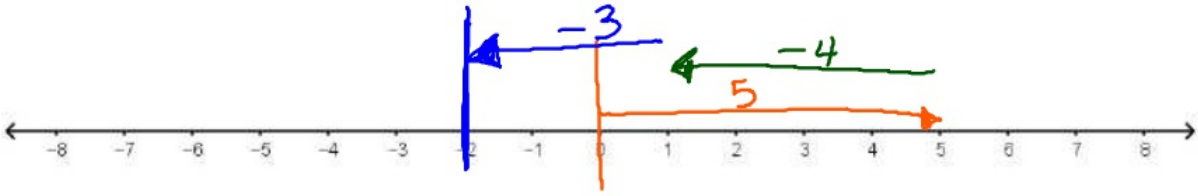
No (See above)

- What is your conclusion—is addition of integers commutative? Test your answer out with a few examples. Be sure to draw number lines to model your problems.

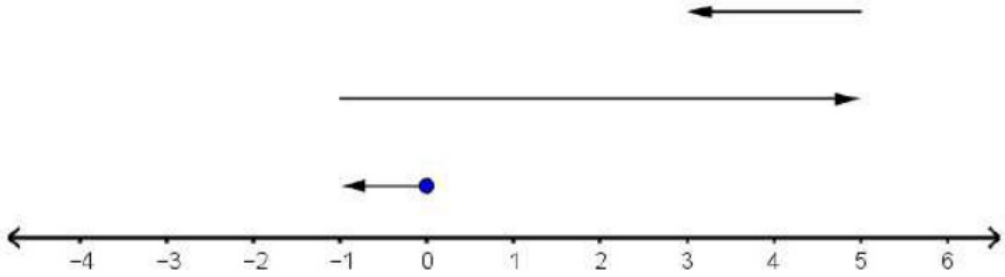
Problem 3

In part a, model the addition problem on the number line to find the sum. In part b, write an addition equation to represent what is shown on the number line.

a) $5+(-4)+(-3) = -2$



b. Equation: $-1+6+-2=3$



Guiding Questions

- Where on the number line should you start in each problem?

  0

- For part a, how long will each arrow be to represent each addend?

  Absolute Value of number

- For part a, which direction will each arrow go?

  +/—

- For part b, how long is each arrow and in what direction?

- For part b, what does "5" represent? Why is "5" not an addend in the addition problem?

Date: 9/14/18 Day 4 Addition Algorithm

There must be an easier way to add signed numbers than using chip boards or number lines. Brainstorm your ideas below. We will create an official algorithm as a class.

$2+3=5$

$-2+3=1$

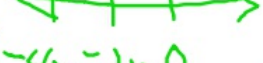
$212+-403=-191$

$-212+403=191$

Algorithm

- If the signs are the same, add the absolute values & keep the sign
- If the signs are different, subtract the absolute values & keep the sign of the bigger absolute value

$-212+-403=$



$$\begin{array}{r} 403 \\ -212 \\ \hline 191 \end{array} \qquad \begin{array}{r} 403 \\ +212 \\ \hline 615 \end{array}$$

Ex.

$-19.25+7.50=-11.75$

$-5.50+-1.20=-6.70$

$$\begin{array}{r} 19.25 \\ -7.50 \\ \hline 11.75 \end{array}$$

If you add a pos., move R on number line

If you add a neg., move L on number line.

$+63++48=+111$

$-63++48=-15$

$+63+-48=+15$

$-63+-48=-111$

$$\begin{array}{r} 63 \\ -48 \\ \hline 15 \end{array} \qquad \begin{array}{r} 63 \\ +48 \\ \hline 111 \end{array}$$

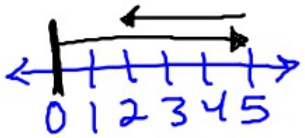
$|-63|>|48|$

$5-3=2$
$3-5=-2$
$-3-5=-8$
$-5-3=-8$

$5-(-3)=+8$
$3-(-5)=+8$
$-3-(-5)=+2$
$-5-(-3)=-2$

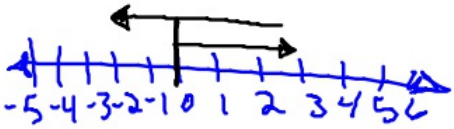
Start exploring subtraction with chip boards. What trouble do you run into?

Explore with some number lines. Do you have the same trouble? Do you have any other trouble?

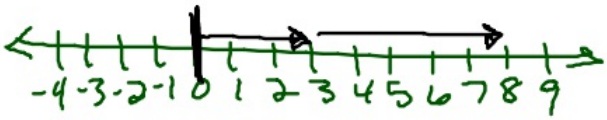


$5-3=2$

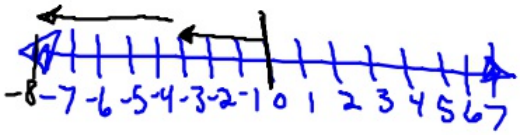
$5-(-3)=8$



$3-5=-2$

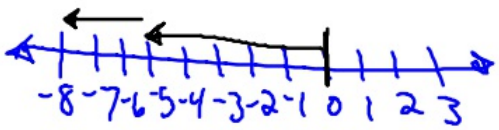


$3-(-5)=8$



$-3-5=-8$

The two negatives Cancel eachother out.



$-5-3=-8$

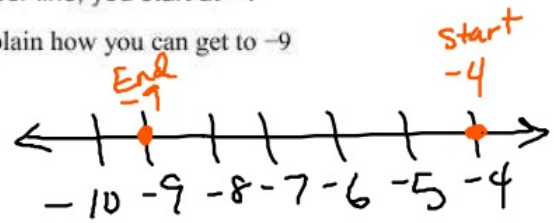
I'm not going to not cross the street.

Caroline takes away what I owe her so now I have more money.

Date: 9/17/18 Day 5 Subtracting Signed numbers – Let's Explore More!

On a number line, you start at −4

- Explain how you can get to −9



$-4-5=-9$

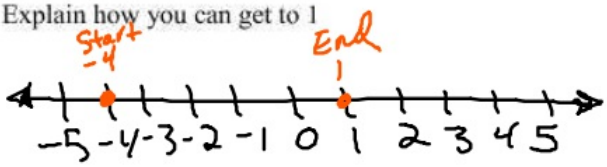
$-4+-5=-9$

- Write an addition problem and a subtraction problem to represent this.

Subtracting + and Adding − gives the same result (move left on N.L.)

On a number line, you start at −4

- Explain how you can get to 1



$-4+5=1$

$-4--5=1$

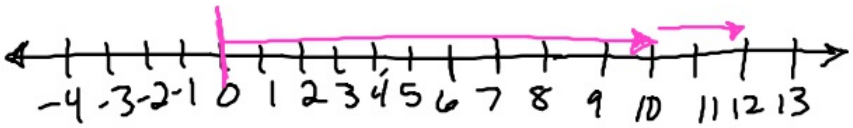
- Write an addition problem and a subtraction problem to represent this.

Adding + and Subtracting − give the same result (move right on N.L.)

Model each of the following problems using a chip board and a number line.

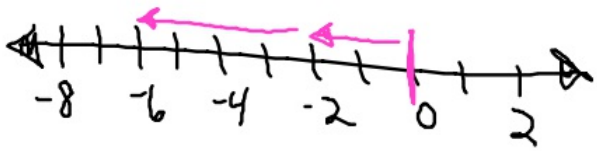
-3 – (-7) = 4

10 – (-2) = 12



5 – 8 = -3

-2 – 4 = -6



Date: 9/18/18 Day 6 More Subtraction

There must be an easier way to subtract signed numbers than using chip boards or number lines. Brainstorm your ideas below. We will create an official algorithm as a class.

$7-3=4$ (7+-3) $5-8=-3$ (5+-8) $-3-4=-7$ (-3+-4) $-3-2=-5$ (-3+-2)

$-8--2=-6$ (-8+2) $-5--10=5$ (-5+10) $7--11=18$ (7+11) $9--1=10$ (9+1)

+ pos = − neg

+ neg = − pos

Changed the problem to adding the opposite Then add

Be sure you know what each of the following terms means
Absolute value
Opposite
Signed number
Rational number
Algorithm
Additive inverse

Rational Numbers – any number that can be written as a fraction

3:2 3 to 2 $\frac{3}{2}$

Ex: $\frac{11}{7}$ 10 $.\overline{6}=\frac{2}{3}$ $.\overline{45}=\frac{5}{9}$ 7.5

Non Ex: 4.121221222... (ellipse)

Additive Inverse: the amount you add to a number to get a sum of 0 (opposite)

$-7 \rightarrow 7$

$14.2 \rightarrow -14.2$

$-1{,}000{,}000 \rightarrow 1{,}000{,}000$

Date: 9/20/18 **Day 8** **Multiplication**

Evaluate.

5 x 4 = 20	
5 x 3 = 15	
5 x 2 = 10	
5 x 1 = 5	
5 x 0 = 0	
5x-1=-5	
5x-2=-10	
5x-3=-15	

pos x pos = pos
pos x neg = neg
neg x pos = neg
neg x neg = pos

8 x 4 = 32	
8 x 3 = 24	
8 x 2 = 16	
8 x 1 = 8	
8 x 0 = 0	
8x-1=-8	
8x-2=-16	
8x-3=-24	

-5 x 4 = -20	
-5 x 3 = -15	
-5 x 2 = -10	
-5 x 1 = -5	
-5 x 0 = 0	
-5x-1= 5	
-5x-2= 10	
-5x-3=15	

Shoes

+ • + = +
+ • − = −
− • + = −
− • − = +

-8 x 4 = -32	
-8 x 3 = -24	
-8 x 2 = -16	
-8 x 1 = -8	
-8 x 0 = 0	
-8x-1= 8	
-8x-2= 16	
-8x-3=24	

$-3 \cdot -2 \cdot -1 = -6$

$-\frac{3}{4} \cdot \frac{1}{2} \cdot \frac{1}{7}$

$-\frac{3}{8} \cdot \frac{1}{7} = -\frac{3}{56}$

Date: 9/21/18 **Day 9** **Division**

Fact Families

10 x 2 = 20

$2 \times 10 = 20$

$\frac{20}{2} = 10$

$\frac{20}{10} = 2$

Shoes

$\frac{pos}{pos} = pos$

$\frac{pos}{neg} = neg$

$\frac{neg}{pos} = neg$

$\frac{neg}{neg} = pos$

-3 x 4 = -12

$4 \cdot -3 = -12$

$\frac{-12}{-3} = 4$

$\frac{-12}{4} = -3$

-8 x -6 = 48

$\frac{48}{-6} = -8$

$-6 \cdot -8 = 48$

$\frac{48}{-8} = -6$

9 x -10 = -90

$\frac{-90}{-10} = 9$

$-10 \cdot 9 = -90$

$\frac{-90}{9} = -10$

Subtraction: Change to adding the opposite

$17 - {}^{-}3 = 17 + {}^{+}3 = 20$

$-10 - {}^{+}4 = -10 + {}^{-}4 = -14$

$-24 - {}^{-}18 = -24 + {}^{+}18 = -6$

Date: 9/24/18 Day 10 Mixed Numbers and Decimals

Evaluate.

1) $-3\frac{1}{5} + 4\frac{7}{10} =$ $1\frac{1}{2}$

$4\frac{7}{10} = 4\frac{7}{10}$

$-3\frac{1}{5} = 3\frac{2}{10}$

$1\frac{5}{10} = 1\frac{1}{2}$

2) $8\frac{3}{4} - \left(-2\frac{3}{4}\right) =$ $11\frac{1}{2}$

$8\frac{3}{4}$

$+2\frac{3}{4}$

$10\frac{6}{4} = 11\frac{2}{4} = 11\frac{1}{2}$

3) $3\frac{1}{8} \cdot \left(-2\frac{2}{5}\right) =$ $-\frac{15}{2}$ OR $-7\frac{1}{2}$

$3\frac{1}{8} \cdot 2\frac{2}{5} = \frac{25}{8} \cdot \frac{12}{5} = \frac{15}{2}$

4) $-9\frac{1}{2} \div -3\frac{4}{5} =$ $\frac{5}{2}$ OR $2\frac{1}{2}$

$9\frac{1}{2} \div 3\frac{4}{5}$

$\frac{19}{2} \div \frac{19}{5}$

$\frac{19}{2} \cdot \frac{5}{19} = \frac{5}{2}$ OR $2\frac{1}{2}$

5) $(-5.25) + (-4.8) =$ -10.05

5.25

$+4.80$

10.05

6) $(-9.1) - (+2.3) =$ -11.4

9.1

$+2.3$

11.4

7) $(-1.7)(-6) =$ 10.2

1.7

$\times 6$

10.2

8) $\frac{1.2}{-0.4} = -3$

$\frac{1.2}{-.4} \cdot \frac{10}{10} = \frac{12}{-4} = -3$

$3.$

$4\overline{)12}$

-12

0

Date: _____ Day 11 Real Life