Concepts

Place Value, Signed Numbers, Symbols, Absolute Values, Adding and Subtracting Integers, Problem Solving, Multiplying and Dividing Integers, Exponents and Order of Operations

Concepts

- Place Values

hundred-trillions	ten-trillions	trillions	,	hundred=billions	ten-billions	billions	,	hundred-millions	ten-millions	millions	,	hundred-thousands	ten-thousands	thousands	,	hundreds	tens	ones
								5	6	7	,	2	1	3	,	5	2	9

Writing the number in words becomes:

five hundred sixty seven million, two hundred thirteen thousand, five hundred twenty nine

Place Values

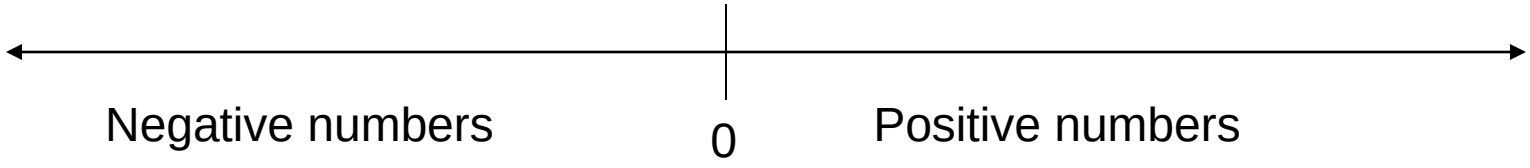
- Writing numbers based on place value
  - 23,543 – twenty three thousand five hundred forty three
  - 1,213,506 – one million two hundred thirteen thousand five hundred six
  - 257,001 – two hundred fifty seven thousand one
  - 3,936,927,312 – three trillion nine hundred thirty six million nine hundred twenty seven thousand three hundred twelve
- **Note**: Never use the word “and” when writing whole number place values.

Place Values

- Writing words into digits:
  - Five hundred twenty billion, six hundred forty three million, three hundred fifty seven thousand, four hundred twelve
    - 520,643,357,412
  - Six billion, five hundred million, twenty seven
    - 6,500,000,027

Intro to Signed Numbers

- A number that is written without any sign in front of it is *understood* to be a positive number (3 is the same as +3).
- A number that is written with a minus sign in front of it is considered to be a negative number (-5).



Using < or > Symbols

- Look at the number line to determine which symbol to use.
  - < means “less than”
  - > means “greater than”
- 0 __ 2
  - Look at the number line, 0 is to the left of 2 which means that 0 is less than 2 or **0 < 2**.
- 7 __ -2
  - Look at the number line; 7 is to the right of -2 which means that 7 is greater than -2 or **7 > -2**.

Absolute Value

- The ***absolute value*** of a number is the number of “units” or “distance” a number is from 0 on the number line. The symbols used to show absolute value are | |.
  - The |-3| would be 3 because -3 is three units from 0 on the number line. It is positive because we can think of it as a “distance” from 0 and *distance can never be negative*.

Adding Integers

- When adding two integers with the same signs, add the numbers together and keep the sign
  - 7 + 4 = 11
- When adding two integers with opposite signs you will subtract the numbers and keep the sign of the larger number.
  - -7 + 2 = -5

Changing Subtraction to Addition

- When you have a problem like $-8-(-7)$ you will change the subtraction sign outside the parentheses to a positive AND change the sign of the number inside parentheses to its opposite sign.

$$-8-(-7)=-8+(+7)=-8+7=-1$$

Examples

$$^{-}8 + {}^{-}5 = {}^{-}13$$

$$^{-}4 + 4 = 0$$

$$^{-}16 + 19 = 3$$

$$24 - 7 = 17$$

$$^{-}11 + {}^{-}7 + 5 + ({}^{-}4) = {}^{-}17$$

$$^{-}12 - 12 + 20 - (-4) = 0$$

Subtracting Integers

- To subtract two numbers, you will need to follow two steps:
  - Change the subtraction sign to a plus sign
  - Change the sign of the number following the subtraction sign to its opposite

$$3 - {}^{-}10$$

$$3 + {}^{-}10$$

$$3 + {}^{+}10$$

$$3 + 10$$

$$13$$

Change the subtraction sign to addition

Change the negative sign to its opposite

Now add the numbers following the sign rules.

Example

$$3 - {}^{-}3 - 10 - {}^{-}7$$

$$3 + {}^{+}3 + {}^{-}10 + {}^{+}7$$

$$3 + 3 + {}^{-}10 + 7$$

$$6 + {}^{-}10 + 7$$

$$-4 + 7$$

$$3$$

Change the subtraction signs to addition and change the sign of the numbers that follow the subtraction signs to their opposite. The same holds true if the minus sign was outside parentheses.

Add the numbers using the rules for adding and subtracting signed numbers.

Problem Solving

- Rounding
  - Locate the place to which the number is to be rounded. Draw a line under that place.
  - Look at the digit to the right of that number and if it is 4 or less, do not change the number to the left. If it is 5 or more, round up the number to the left.
  - Change all digits to the right of that number to zero
    - Example:
      Round 125,375 to ten thousands. 1<u>2</u>5,375 will change to 130,000
      Round 256,234 to thousands. 25<u>6</u>,234 will become 256,000

Problem Solving

- Estimating
  - Front end rounding
    - Use front end rounding when estimating answers. Front end rounding means you will round your answers to the first number listed.
      - Example: $450 becomes $500
        Example: $102 becomes $100

Multiplying Integers

- Signed number rules for multiplying
  - When multiplying numbers with the same sign, your answer will be positive.
  - When multiplying numbers with different signs, your answer will be negative.
    - Example: -7 x -5 = 35
    - Example: 9 x 12 = 108
    - Example: -8(9) = -72

Properties of Multiplication

- Any number multiplied by 0 is 0.
- Any number multiplied by 1 is the original number.
- Commutative Property: The order of the factors does not affect the order.
- Associative Property: Changing the grouping of the numbers does not change the answer.
- Distributive Property: Multiplication distributes over addition and subtraction.

Dividing Integers

- Signed number rules for dividing
  - When dividing numbers with the same sign, your answer will be positive.
  - When dividing numbers with different signs, your answer will be negative.
    - Example: -7÷ -5 = 35
    - Example: 24 ÷ 12 = 2
    - Example: -63/9 = -7

Properties of Division

- Any nonzero number divided by itself is 1.
- Any number divided by is the number.
- Zero divided by any nonzero number is 0.
- Division by 0 is undefined.

Exponents and Order of Operations

- Exponents can be one of those math areas where we make mistakes. There are two parts to an exponent: the Base and the Exponent

  5^2 means we multiply the base – which is 5 – by itself 2 times or 5 x 5 = 25

  3^4 means we multiply the base – which is 3 – by itself 4 times or 3 x 3 x 3 x 3 = 81

  Note: Never multiply the base by the exponent. You'll get a wrong answer every time!

PEMDAS

- Best remembered as "**Please Excuse My Dear Aunt Sally**"
  - **P**arentheses
  - **E**xponents
  - **M**ultiplication
  - **D**ivision
  - **A**ddition
  - **S**ubtraction

Working left to right

Order of Operations (cont'd)

- $6 / 3 + 5^2$ (exponents first)
  $6 / 3 + 25$ (division next)
  $2 + 25$ (addition next)
  27

- Notice that there are no equal signs in the problem. Start each step of the Order of Operations on a new line. Being neat and orderly will be a huge help!