Section 1.1: Variables in Algebra

**Variable**: a letter that is used to represent one or more numbers  
(*The most popular one is “x”*)

**Variable Values**: the number you substitute in for a variable  
Ex: Let $x = 4$...then $3x = 3(4) = ___$

**Variable Expression**: a collection of numbers, variables, and operations  
Ex: $4y$, $8s + 1$, $3x - 4$, $7xy$, etc.

*Expressions DO NOT have ____________ signs*

**Evaluating the Expression**: replacing each variable in the expression with a number

Ex: If $x = 3$......  
$6x =$  
Ex: if $y = 9$.....  
$3y - 4 =$

**Write the Variable Expression → Substitute Values for Variables → Simplify the Numerical Expression**

Ex 1: Let $x = 4$ and $y = -3$  Evaluate $2x + 4y$  
Ex 2: Let $p = -6$ and $r = 2$  Evaluate $-3pr$

Ex 3: Let $y = 7$ and $z = -1$  Evaluate $5y - z$

**Simple Interest Formula**: $I = PRT$

$I$ = Interest Earned  
$P =$ ________________ Amount (amount of $ you invest at the start)  
$R =$ The Interest Rate Earned (*Rate is ALWAYS plugged in as a ________________)  
$T =$ Time Period (in ________________)

*If you know the principle amount, interest rate, and time period, you can calculate the interest earned!*

Ex 1: $P =$ $1000$, $r =$ $4\%$, $t =$ 3 years  
$I =$

Ex 2: $P =$ $2500$, $r =$ $6\%$, $t =$ 5 years  
$I =$

**Unit Analysis**: Can help determine if your model is correct by showing how the units cancel

*You always need to know the ______________________ ______________________ to do unit analysis!*

Ex: 12 in = 1 ft  16 oz = 1 lb
Ex 1: Change 125 lbs to Kg (2.2 lbs = 1 kg)  

Ex 2: 100cm to inches (2.54cm = 1 inch)  

Ex 3: 7632 ft into miles (5280 ft = 1 mile)  

Average Speed = distance/time  
Find the average speed for the following:  
Ex 1: A 4-wheeler travels 58 miles in 2 hours  
Ex 2: In 10 seconds a runner goes 85 feet  

Section 1.2: Exponents and Powers  

Power: an expression where a number is raised to an exponent  
Power = ____________  

Base: the number being multiplied times ____________  

Exponent: how many times you multiply the base times itself  

*Which key do you use on your calculator to quickly evaluate powers???*  

Examples:  
“Four to the third power”  
“Six to the fourth power”  
“Two to the sixth power”  
“Ten to the second power”  
“Five to the third power”  

*Also said “Ten squared”*  
*Also said “Five cubed”*  

What is any base raised to the “zero power”?  
ALWAYS = _______ Try it!  

3^0 = 7^0 = (-2)^0 = -2^0 =  

Examples: Evaluate when x = 3  

x^3 = x^5 = x^{10} =  

Grouping Symbols: (brackets or parentheses) indicate the order in which operations should be performed  

*Remember PEMDAS.....In the Order of Operations, Parentheses come first!*  
1) P → ________________ (grouping symbols) first....always follow PEMDAS within () too!  
2) E → ________________ (from left to right)  
3) MD → Multiplication and ________________ (from left to right)  
4) AS → Addition and ________________ (from left to right)  

Examples: Evaluate when x = 3 and y = 4  

(x + y)^2 = (x^2) + (y^2) = 3xy^2 = (3xy)^2 =
Section 1.3: Order of Operations

**Order of Operations** - the order to evaluate expressions with more than one operation

**PEMDAS** - (Parentheses, Exponents, Multiplication, Division, Addition, Subtraction)
Then LEFT → RIGHT

1) Parentheses (grouping symbols) first
2) Exponents (powers)
3) Multiplication/Division from left to right
4) Addition/Subtraction from left to right

**Ex 1:** \(2 \cdot 3^2 \div 3\)

**Ex 2:** \(4 - (3 - 5)^2 \div 2\)

**Ex 3:** \([4 + (6 - 3)^2 - 9 \div 3]\)

**Examples with Substitution:** Let \(x = 3\)

**Ex 4:** \(2x - 6 \div 2\)

**Ex 5:** \((2x)^2 - 20 \div (2 + x)\)

**Examples With Fraction Bars:**
- Simplify the top and bottom using PEMDAS, and divide top by bottom or simplify fraction as the last step

**Ex 6:** \(\frac{3 + (4 - 2)^3 \div 8}{[20 - (2 - 4)^2 \cdot 4]}\)

**Ex 7:** Let \(x = 2\) \(\frac{3x - 6 + x + 7}{8 - x + (3 + x) \div 5}\)
**Section 1.4: Equations and Inequalities**

**Equation:** Two expressions with an ________________ sign (=) between them.

**Solution of an Equation:** If a given value for a variable makes an equation ________________, it is a solution!

*Solving an equation means Finding ALL Solutions!*

*To check a solution, plug the value in for the variable and simplify both sides of the equation. If the two sides are equal, the value IS a solution!*

Ex 1: Is 3 a solution to the equation $3x - 2 = 7$ ?

Ex 2: Is -1 a solution to the equation $4x - 5 = x + 3$ ?

**Using Mental Math Questions:**

Ex 3: $x + 4 = 7$ “What number added to 4 is 7?”

Ex 4: $3x = 12$ “Three times what number is 12?”

Ex 5: $x^2 = 25$ “What number squared is 25?”

**Inequality Symbols:** like an equation, an inequality symbol can be placed between two mathematical expressions.

*Substitute in values for the variable, simplify, and determine whether or not the given variable makes the inequality true!

< is “____________ than”  
$\leq$ is “____________ than or _____________ to”

> is “_______________ than”  
$\geq$ is “_______________ than or _____________ to”

Ex 6: Is -2 a solution to the inequality $3x - 4 > 5$ ?

Ex 7: Is 4 a solution to the inequality $2x - 3 \leq 9$ ?
### Changing Phrases Into Algebraic Expressions:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Verbal Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addition</td>
<td></td>
</tr>
<tr>
<td>Subtraction</td>
<td></td>
</tr>
<tr>
<td>Multiplication</td>
<td></td>
</tr>
<tr>
<td>Division</td>
<td></td>
</tr>
</tbody>
</table>

*The “unknown number” is your variable, usually called x

*“is” means equals…..that is where you put the = in an equation

<table>
<thead>
<tr>
<th>Operation</th>
<th>Verbal Phrase</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addition</td>
<td>The <em>sum</em> of 6 and a number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eight <em>more than</em> a number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A number <em>plus</em> 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A number <em>increased by</em> 7</td>
<td></td>
</tr>
<tr>
<td>Subtraction</td>
<td>The <em>difference of</em> 5 and a number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Four <em>less than</em> a number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seven <em>minus</em> a number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A number <em>decreased by</em> nine</td>
<td></td>
</tr>
</tbody>
</table>
### Multiplication

<table>
<thead>
<tr>
<th>Verbal Phrase</th>
<th>Algebraic Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The product of 9 and a number</td>
<td></td>
</tr>
<tr>
<td>Ten times a number</td>
<td></td>
</tr>
<tr>
<td>A number multiplied by 3</td>
<td></td>
</tr>
</tbody>
</table>

### Division

<table>
<thead>
<tr>
<th>Verbal Phrase</th>
<th>Algebraic Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The quotient of a number and 4</td>
<td></td>
</tr>
<tr>
<td>Seven divided by a number</td>
<td></td>
</tr>
</tbody>
</table>

### Translating Word Statements Into Algebraic Equations

<table>
<thead>
<tr>
<th>Verbal Phrase</th>
<th>Algebraic Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seven more than the product of eight and a number is thirty-one.</td>
<td></td>
</tr>
<tr>
<td>Six less than four times a number is ten.</td>
<td></td>
</tr>
<tr>
<td>Five more than the quotient of twenty and a number is seven.</td>
<td></td>
</tr>
<tr>
<td>Eight multiplied by a number then decreased by three is twenty-nine.</td>
<td></td>
</tr>
<tr>
<td>Nine times the difference between a number and four is fifty-four</td>
<td></td>
</tr>
<tr>
<td>The sum of a number and six, multiplied by two is twenty-eight</td>
<td></td>
</tr>
</tbody>
</table>
What is data?

**Data**: information, facts, or numbers that ______________________ something

What are some graphical representations we use to display or analyze data?

**Bar Graph**: _______________ or _________________ bars used to represent different pieces of data

**Line Graph**: Data is represented by __________, which may or may not be connected into a __________

*How do you know when to connect the points in a line graph and when NOT to?*

1) A Graph shows number of cd’s purchased vs. cost (Not connected)
2) A Graph shows Time vs. number of miles biked (Connected)

*Have students come up with their own examples of graphs that should have connected points or not*
Section 1.7: An Introduction to Functions

**Function**: a rule that establishes a relationship between _____ quantities

**Input**: The number you “put in” (the x-values)

**Output**: The number you “get out” (the y-values)

*In order to be a function, for every input there must be exactly ________ output!*

Are the following tables functions?

<table>
<thead>
<tr>
<th>X</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
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<tr>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>3</td>
<td>19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

**Domain**: The collection of all the ________ values

**Range**: The collection of all the ______________ values

**Tables Should Have:**
- Title
- Row Labels (horizontal)
- Column Labels (vertical)
- Key (if needed)

**Graphs Should Have:**
- Title
- X-axis Label (horizontal)
- Y-axis Label (vertical)
- Key (if needed)
- Scale with __________ __________________

**Example**: Make a table for and graph the following function:

\[ y = 250 + 20x \]

Domain: \( \{0 \leq x \leq 5\} \)

<table>
<thead>
<tr>
<th>Input (x values)</th>
<th>Output (y values)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>