Objective – Students will be able to identify patterns and find the missing terms of sequences.

Sequence- a set of numbers in a particular order. Each number is called a *term* of the sequence.

Arithmetic Sequence – is a sequence in which every term after the first is obtained by adding a fixed number.

Ex. 5, 10, 15, 20, 25, …

Ex. 2, 7, 12, 17, 22, …

Ex. 3, 11, 19, 27, 35, …

A strategy to use to find the next term in a sequence is to subtract the terms, notice $11 - 3 = 8$, $19 - 11 = 8$, $27 - 19 = 8$. That would suggest you are adding 8 to each term to find the next term.

Ex. 2, 3, 5, 8, 12, …

Ex. 1, 3, 7, 13, 21

Objective- The students will be able to compute and write numbers in exponential notation.

Exponent tells how many times the base is used as a factor.

$$\underset{\text{base}}{2}^{3} \text{ - exponent}$$

In the number 2^3, read 2 to the third power or 2 cubed, the 2 is called the base and the 3 is called the exponent.

Ex. $2^3 = 2 \times 2 \times 2$

Ex. $5^2 = 5 \times 5$

Ex. $6^4 = 6 \times 6 \times 6 \times 6$

To write an exponential in standard form, compute the products. i.e. $5^2 = 5 \times 5 = 25$

Special Case

Ex.
$10 = 10$
$10^2 = 100$
$10^3 = 1,000$
$10^4 = 10,000$

$10^6 = 1,000,000$

Do you see a pattern that would allow you to find the value of an exponential with base 10 quickly?

∆ - If a number does not have an exponent, it is understood to be ONE!

Ex. Write 81 with a base of 3.
$81 = 3^?$, $81 = 3 \times 3 \times 3 \times 3$, therefore $81 = 3^4$

Ex Write 125 with a base of 5.
$125 = 5^?$, $125 = 5 \times 5 \times 5$, therefore $125 = 5^3$

Objective- The students will learn the prefixes of the metric system and be able to convert within the English and metric systems.

Metric Prefixes

Kilo	**1000**
Hecto	**100**
Deka	**10**
Base	
Deci	**1/10**
Centi	**1/100**
Milli	**1/1000**

N.B. If the prefix ends in an "a" or "o", its greater than one. If the prefix ends in an "i", its less than one.

Ex. A dekameter is 10 meters. A kilometer is 1000 meters

Ex. A centimeter is 1/100 meter A millimeter is 1/1000 meter

Conversion Factors

10 decimeters = 1 meter 100 centimeters = 1 meter 1000 millimeters = 1 meter

Measurement – Conversions

Converting measures is as easy as multiplying by one. Why? Because you are multiplying by one to convert measurements.

To do conversions, you do need to know conversion factors such as 3 feet = 1 yard, 60 minutes = 1 hour, 16 ounces = 1 pound, and 4 quarts = 1 gallon, 100 cm = 1 m.

Ex. Convert 5 yards to feet.

To do this conversion I want to multiply the original measurement by one and at the same time introduce the new measurement (feet) into the problem.

In our case, we start off with 5 yards, I will multiply that by one in the form of a fraction $\frac{3 feet}{3 feet}$

5 yards x $\frac{3 feet}{3 feet}$, Notice, I am multiplying 5 yards by 1, since 3 feet divided by 3 feet is 1.

I also know that **3 feet is 1 yard**. Making that **substitution**, I have

5 yards x $\frac{3 feet}{1 yard}$.

I wrote yards in the denominator purposely so the labeling for yards divide out, so I am left with

$$5 \text{ ~~yards~~ x } \frac{3 \text{ feet}}{\text{~~1 yard~~}} = 15 \text{ feet.}$$

Example Convert 5 gallons to cups.

To do this, I will multiply 5 gallons by **one** using conversion factors I know that will cancel out the labeling until I have cups.

$$5 \text{ gallons x } \frac{4 quarts}{1 gallon} \text{ x } \frac{2 pints}{1 quart} \text{ x } \frac{2 cups}{1 pint} = 80 \text{ cups*}$$

Example Convert 3 days to seconds.

$$3 \text{ days x } \frac{24 hours}{1 day} \text{ x } \frac{60 minutes}{1 hour} \text{ x } \frac{60 seconds}{1 minute} = 259{,}200 \text{ seconds}$$

Example Convert 4 km to cm.

$$4 \text{ km x } \frac{1000m}{1km} \text{ x } \frac{100cm}{1m} = 40{,}0000 \text{ cm}$$

*N.B.
When multiplying by 1 in the examples, I am deliberately choosing the labeling in the denominators to cancel out the labeling in the numerators until I am left with the desired measurement.

Objective- The students will be able to convert numbers written in standard notation to scientific notation and back.

Scientific Notation

A number is written in scientific notation when it is written as a product of a number between one and ten and some power of ten.

Ex. 4.23×10^5

Converting Scientific Notation to Standard Form

To convert a number written in scientific notation to standard notation, the exponent tells you how many times to move the decimal point to the right or left.

Ex. Write 4.23×10^5 in standard notation.

The exponent 5 indicates you move the decimal point 5 places to the right.

$$4.23 \times 10^5 = 423{,}000$$

Ex. Write 5.4×10^7 in standard notation.

$$5.4 \times 10^7 = 54{,}000{,}000$$

Converting a Number in Standard Form to Scientific Notation

To convert a number to scientific notation, rewrite the number as a product of a number between one and ten and some power of ten.

Ex. Write 630 in scientific notation.

Rewriting 630 as a product, we have $6.3 \times 10^?$. How many places will I need to move the decimal point to get 630? 2 places.

$$630 = 6.3 \times 10^2$$

Ex. Write 735,000 in scientific notation.

Rewriting 735,000 as a product, we have $7.35 \times 10^?$
How many places will I need to move the decimal point to get 735,000? 5 places.

$$735{,}000 = 7.35 \times 10^5$$

Objective- The students will be able to evaluate an expression using the Order of Operations and the Properties of real Numbers.

The Order of Operations is just an agreement to compute problems the same way so everyone gets the same result – like wearing a wedding ring, driving on the right side of the road or listing sporting events.

<u>Order of Operations</u>

1. Parentheses
2. Exponents
3. Multiply/Divide
4. Add/Subtract

From left to right

Ex. Evaluate the following expressions.

a. $3 + 5 \times 2$

b. $4 + 24 \div 6 \times 2 + 1$

c. $8 \div (1 + 3) \times 5^2 - 2$

Properties of Real Numbers

The properties of real numbers are rules used to simplify expressions and compute numbers more readily.

Commutative Property – Addition	$a + b = b + a$	ORDER
Commutative Property – Multiplication	$a \times b = b \times a$	

Ex. $4 + 5 = 5 + 4$

Ex. $10 \times 7 = 7 \times 10$

Associative Property – Addition	$(a + b) + c = a + (b + c)$	GROUPING
Associative Property – Multiplication	$(a \times b) \times c = a \times (b \times c)$	

Ex. $(7 + 8) + 2 = 7 + (8 + 2)$

Ex $(13 \times 25) \times 4 = 13 \times (25 \times 4)$

Distributive Property $a \times (b + c) = a \times b + a \times c$ Distribute **<u>OVER</u>**-add/sub

Ex. $5 \times 23 = 5 \times (20 + 3)$
$= 5 \times 20 + 5 \times 3$
$= 100 + 15$
$= 115$

Ex. $25 \times 12 = 25 \times (10 + 2)$
$= 25 \times 10 + 25 \times 2$
$= 250 + 50$
$= 300$

Additive Property of Equality	if $a = b$, then $a + c = b + c$
Subtraction Property of Equality	if $a = b$, then $a – c = b – c$
Multiplication Property of Equality	if $a = b$, then $ac = bc$
Division property of Equality	if $a = b$, $c \neq 0$, then $a/c = b/c$

Identity – Addition	$a + 0 = a$
Identity – Multiplication	$a1 = 1$

Objective – The students will learn to translate English to math and math to English.

STATEMENT	ALGEBRA
twice as much as a number	$2x$
two less than a number	$x - 2$
five more than an unknown	$x + 5$
three more than twice a number	$2x + 3$
a number decreased by 6	$x - 6$
ten decreased by a number	$10 - x$
Tom's age 4 years from now	$x + 4$
Tom's age ten years ago	$x - 10$
number of cents in x quarters	$25x$
number of cents in 2x dimes	$10(2x)$
number of cents in x + 3 nickels	$5(x + 3)$
separate 15 into 2 parts	$x, 15 - x$
distance traveled in x hrs at 50 mph	$50x$
two consecutive integers	$x, x + 1$
two consecutive odd integers	$x, x + 2$
sum of a number and 30	$x + 30$
product of a number and 5	$5x$
quotient of a number and 7	$x \div 7$
four times as much	$4x$
two less than 3 times a number	$3x - 2$

Objective- The students will be able to combine like terms.

Place Value / Expanded Notation - Polynomials

672 = 6(100) + 7(10) + 2(1)
= 6 (10^2) + 7 (10) + 2(1)
= $6x^2 + 7x + 2$

Adding Horizontally, from Left to Right

To add horizontally, from left to right, group the hundreds, the tens, and the ones.

Ex. 241 + 352
= 2(100) + 4(10) +1(1) + 3(100) +5(10) + 2(1)
= (2 + 3)100 + (4 + 5)10 + (1 + 2) 1
= 5(100) + 9(10) + 3(1)
= 593

Combining Like Terms

To add polynomials, you ad from left to right, grouping like terms. That is, you add x^2 to x^2, x's to x's, and numbers to numbers.

Ex. $2x^2 + 4x + 1 + 3x^2 + 5x + 2$

$= (2 + 3)x^2 + (4 + 5)x + (1 + 2)1$
$= 5x^2 + 9x + 3$

Ex. 3a + 4b + 7c + 5a + 6b + 8c
= (3+5)a + (4 + 6)b + (7 + 8)c
= 8a + 10b + 15c

N.B. You combine like terms in algebra the same way you combine terms in arithmetic.

Objective- The students will be able to solve equations in the $ax + b = c$ format.

Solving Equations

The strategy for solving linear equations in one variable is to put the variables on one side of the equals sign and the numbers on the other side – by OPPOSITE OPERATION.

Before we get into solving equations, let's look at a gift wrapping analogy. When a present is wrapped, it is placed in a box, the cover put on, the box is wrapped in paper, and finally a ribbon is added to complete the project. To get the present out of the box, everything would be done in reverse order, performing the OPPOSITE OPERATION. That is first we would take off the ribbon, take the paper off, take the cover off, and finally take the present out of the box.

We will learn to solve equations in the $ax + b = c$ format. That requires that we "undo" an algebraic expression to isolate the variable. To accomplish this, we will use the Order of Operations in reverse, using the opposite operation is isolate the variable.

Order of Operations

From Left to Right in this order

1. Grouping
2. Exponentials
3. Multiply / Divide
4. Add / Subtract

EX. Solve for x; $4x - 2 = 10$

Notice the problem is in the $ax + b = c$ format. To solve the equation, we have to undo the expression $4x - 2$ by using the Order of Operations in reverse and using the OPPOSITE OPERATION. That means we have to get rid of any addition or subtraction first. How do you get rid of a minus 2?

$$4x - 2 = 10$$
$$4x - 2 + 2 = 10 + 2$$
$$4x = 12$$

Now, how do we get rid of a multiplication by 4? That's right, divide by 4. Therefore,

$$x = 3$$

Ex. Solve $5x + 3 = 43$

$5x + 3 - 3 = 43 - 3$ Subtract 3 from both sides

$5x = 40$

$x = 8$

Ex. Solve $3x + 6 = 27$

Using the Order of Operations in reverse, what operation do you get rid of first?

$3x + 6 = 27$

$3x + 6 - 6 = 27 - 6$

$3x = 21$

$x = 7$