UNIT 5: LINEAR FUNCTIONS

Part A: Video Tutorial Section

Videos 1 and 2:

https://www.youtube.com/watch?v=fyROLkZc75E **(Domain & Range of a Function)**

https://www.youtube.com/watch?v=za0QJRZ-yQ4 **(Domain & Range of a Function)**

Videos 3 and 4:

https://www.youtube.com/watch?v=HCbp4joHC6Y **(Finding Domain and Range Using a Graphic Calculator)**

https://www.youtube.com/watch?v=qUchnqqOOJI **(How to Visualize Domain and range on a Graphing Calculator)**

Video 5 and 6:

https://www.youtube.com/watch?v=k8Tepq7avjg **(Discrete & Continuous Domains)**

https://www.youtube.com/watch?v=6Db_SzXvfA4 **(More Examples of Discrete & Continuous Domains)**

Videos 7 and 8:

https://www.youtube.com/watch?v=52tpYl2tTqk **(Linear Functions Patterns)**

https://www.youtube.com/watch?v=83JvfBcJ0Yw **(Linear Functions Patterns)**

Videos 9 and 10:

https://www.youtube.com/watch?v=ryv0VIIRb5E **(Function Notation)**

https://www.youtube.com/watch?v=EmTvdKkAUtE **(Function Notation)**

Videos 11 and 12:

https://www.youtube.com/watch?v=bNZ-MOh-VEM **(Comparing Linear & Nonlinear Functions)**

https://www.youtube.com/watch?v=1J4JFtEtkrc **(Comparing Linear & Nonlinear Functions)**

Videos: 13 and 14

https://www.youtube.com/watch?v=lj_X9JVSF8k **(Arithmetic Sequences)**

https://www.youtube.com/watch?v=_cooC3yG_p0 **(Arithmetic Sequences)**

Part B : Hints and Explanations

Important Vocabulary Students Must Understand!

domain	**is all possible input values**
range	**is all possible output values**
independent variable	**the input values are the independent variable, because it can be any value in the domain**
dependent variable	**the output values are the dependent variable, because the output depends upon what you put in**
relation	**pairs inputs with outputs. Again, a function exists when the relation pairs exactly one output with each input**
discreet domain	**is a set of input values the consists of only certain numbers in an interval**
continuous domain	**is a set of input values that consists of ALL numbers in an interval**
linear function	**a function whose graph is a non-vertical line and can be written as $y = mx + b$**
piecewise function	**a function defined by two or more equations. Each "piece" of the function applies to a different part of its domain (input or x-values)**
absolute value function	**the graph of this function will be a V that opens upward or downward.**
nonlinear function	**a nonlinear function does NOT have a constant rate of change, therefore the graph is NOT a line.**
sequence	**an ordered list of numbers**
term	**each number in a sequence**
arithmetic sequence	**the difference between the terms is the same.**

function notation	**f (x) = mx + b**

Hint: Alphabetically domain comes before range. Remember d before r. You must input before you can output. Alphabetically x before y.

Domain = input = x-values
Range = output = y-values

Hint: You can use the mnemonic DRY MIX

Dependent = results = y-axis DRY

Manipulate = independent = x-axis MIX

Relation –pairs inputs with outputs. Again, a function exists when the relation pairs exactly one output with each input.

Ex: This set of ordered pairs is NOT a function, because the x-value 0 has two y-values.

(-2,3) (-1,4) (0,5) (0,6) (1,7)

The above relation is not a function!

This set of ordered pairs IS a function, because each x-value has only one y-value.

(-9,0) (-2,5) (5,10) (12, 10)

Even though 5 and 12 have the same y-values, the relation is a function. Each x-value has only one v-value.

Discrete domain – is a set of input values the consists of only certain numbers in an interval

Ex: Integers from 1 to 5 The domain would be 1,2,3,4,5

Continuous domain – is a set of input values that consists of ALL numbers in an interval

Ex: all numbers from 1 to 5 The domain would include not only 1,2,3,4,5 but any fractional or decimal in between those integers.

Linear Function – a function whose graph is a non-vertical line and can be written as **y = mx +b**

When graphing a linear function or when using a table to solve a linear function, the student must find the slope (see Unit 2) and the y-intercept (see Unit 2).

Recall the formula for slope is:

$$\text{Slope} = \frac{\text{Change in Y}}{\text{Change in X}}$$

To find the y-intercept, make the x-value zero (make the input zero, the output will be the y-intercept).

Function Notation: By naming a linear function f, you can write **y = mx +b** as

$f(x) = mx + b$

The notation **$f(x)$** is another name for y.

When solving an equation such as

$f(x) = -4x + 7$ when $x = 2$

The input is 2. So the equation becomes

$f(2) = -4(2) + 7$ When the student solves the equation $x = 2$ and $f(x) = -1$

The student may see $g(x)$ or $h(x)$. These still represent the y-value of the equation.

Piecewise Function – a function defined by two or more equations. Each "piece" of the function applies to a different part of its domain (input or x-values)

As the student graphs the piecewise functions, he may want to review Unit 3 graphing multi-step inequalities and compound inequalities.

To graph a piecewise function –

1. the student may create a table for each equation (see Unit 1 – solving linear equations)
2. The student graphs the ordered pairs for each function – note one table/line at a time!

3. Recall that in an inequality the "end cap" is an open circle if only the < or > symbol is used. The end cap circle is solid if the inequality stated includes the equal sign.

Absolute value function: the graph of this function will be a V that opens upward or downward.

Absolute value is the distance a number is from zero on a number line. Therefore, the absolute value of a positive number, such as 2 is equal to or the same as the absolute value of a –2.

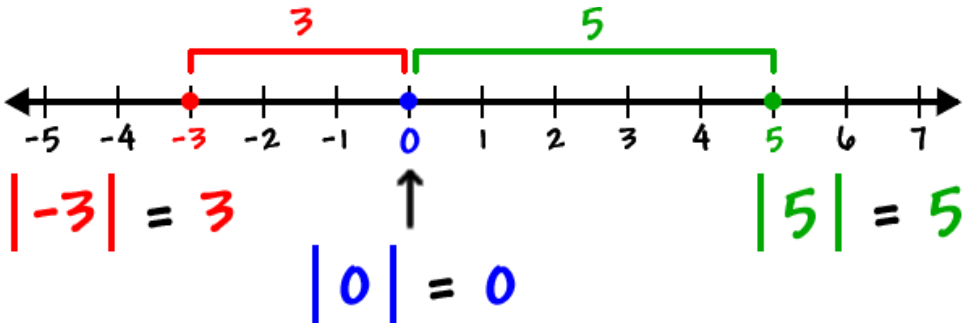


Image from *"Cool Math.com"*

When graphing the absolute value of a number, the graph is a V because each point is the same distance from the y-axis for a simple function.

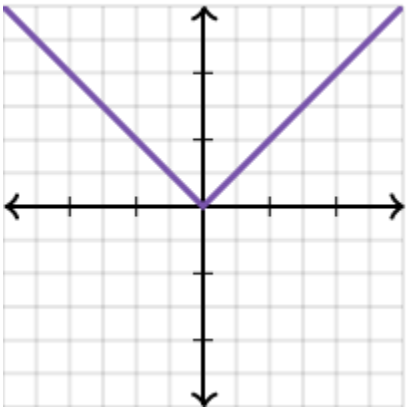


Image from *"Kahn Acadamy"*

Nonlinear Function: a nonlinear function does **NOT** have a constant rate of change, therefore the graph is **NOT** a line.

A nonlinear function cannot be written in slope-intercept form.

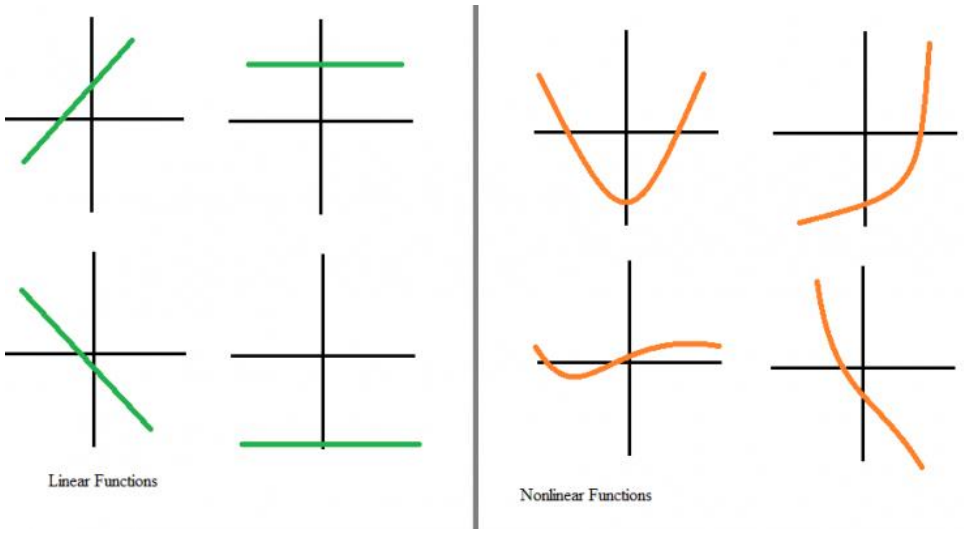


Image from : *"Cloudnames"*

Sequence: an ordered list of numbers.

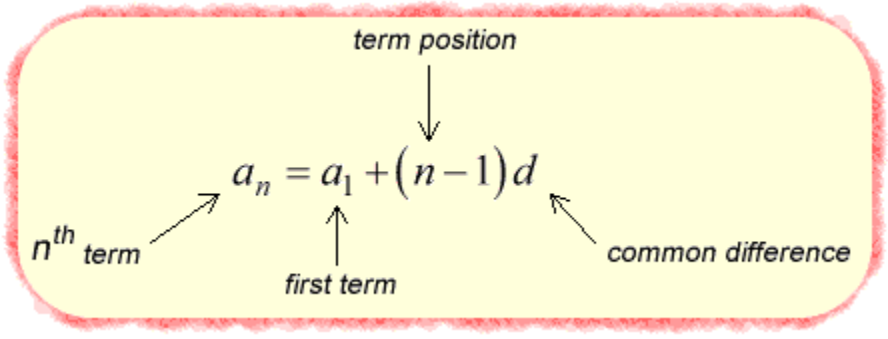
Term: each number in a sequence

Each term has a specific position in a sequence

Arithmetic Sequence: the difference between the terms is the same.

Ex: 5, 10, 15, 20,... In this example the difference is +5. The three dots indicate that the sequence goes on forever. The difference is called the **common difference.** Each term in the sequence is found by adding that difference.

It is possible to find any successive term in a sequence by continuing to add the common difference until you reach the desired term. The formula for finding any desired term is represented below.



The *n*th term refers to the desired term. If you wanted to find the 50^{th} term in a sequence with a difference of 2, with a first term of 4 the student would write an equation as

Write $a_n = 4 + (n - 1)\,2$

Simplify $= 2n + 2$

Use that equation to solve:

$a_{50} = 2(50) + 2$

Simplify $a_{50} = 100 + 2 = 102$

If you were to count be 2s, beginning at 4, the 50^{th} number you would say would be 104.

An arithmetic sequence will graph similar to a linear function with the common difference acting as the slope. Arithmetic sequences are discrete and linear functions are continuous. That is, arithmetic sequences are only those distinct point on the graph while linear functions are all points infinitely represented by the line.