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| Stage 1 – Desired Results |
| **Established Goal(s):**Math 10C – Relations and Functions (**RF8)****General Outcome**: Develop algebraic and graphical reasoning through the study of relations.**Specific Outcome**: Represent a linear function, using function notation. |
| **Big Idea(s):** * Algebraic reasoning is a process of describing and analyzing generalized mathematical relationships and change using words and symbols.
* Comparing mathematical relationships, for example, algebraically, numerically, verbally, or pictorially/concretely, helps us see that there are classes of relationships with common characteristics and helps us describe each member of the class.
* The same algebraic expression or equation can be related to different real-world situations, and different algebraic expressions or equations can describe the same real-world situation.
* Many equivalent representations can describe the same situation or generalization. Each representation may give a different insight into certain characteristics of the situation or generalization.
* Limited information about a mathematical relationship sometimes, but not always, allows us to predict other information about that relationship.
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| **Enduring Understanding(s):***Students will understand that...** Relationships can be interpreted and explained in a variety of ways.
 | **Essential Question(s):*** What would be the best way to represent a particular relationship?
* What are the limits of mathematical representation?
* What are the advantages of function notation?
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| *Students will know...** Terminology
* Notation
* Function Notation
* Domain
* Range
* Input
* Output
* Independent Variable
* Dependent Variable
* Ordered Pair
 | *Students will be able to...** I can express an equation in *y=* form using function notation and vice versa.
* I can evaluate a function given inputs.
* I can determine the input of a function given the output.
* I can determine the range of a function given the domain, and vice versa.
* I can represent linear functions using words, ordered pairs, tables of values, and graphs.
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| Stage 2 – Assessment Evidence |
| **Performance Task(s):** | **Other Evidence:*** Formative Assessments
* Check Ups
* Strand Exam
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| Stage 3 – Learning Plan |
| **Learning Activities:****Activity 1:** What is notation?* Ask students to describe what the word “notation” means.
* After taking several responses or ideas from the class, share the following definition of notation

Notation: A system of figures or symbols used in a specialized field to represent numbers, quantities, tones, or values.* Share the following information with the class.

Many fields of study use a special notation to record and communicate information that is specific to that field. For example, musicians use a special notation to indicate the notes and tempo of a musical composition. Chemists use a special notation of symbols to indicate types of hazardous materials. Mathematicians also use various notations to record mathematical relationships. Today we will learn about Function Notation.**Activity 2:** Function Notation* Share the following information with students.

Function notation is a special way to record information that helps to link the inputs and outputs of a function. It is important to remember that the actual mathematics involved is exactly the same as you have previously seen, just the notation, or the way we write the relationships is different. Functions are usually denoted by a cursive letter (usually an f, g, or h) followed by the variable in brackets. For example: $f\left(x\right), g\left(s\right), h(m)$. Some variables are of course, more commonly used, but more times than not, you will see functions written as $f\left(x\right)$. The variable inside the bracket is used to represent the inputs and the entire term is used to represent the output.Let’s compare how we would have communicated information about relations before, to how we would communicate the same information using function notation.* Have students create a chart similar to the one below to help them see how to record information using function notation.

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| --- | --- | --- |
|  | What we have done in the past: | Using function notation: |
| Writing an equation: | $$y=2x-5$$$$s=2r^{2}$$ | $$f\left(x\right)=2x-5$$$$k\left(r\right)=2r^{2}$$Notice – we now only use one variable instead of 2.Notice – the variable used on the right side of the equation must always match the variable in the brackets. |
| Which is the input and which is the output? | In $y=2x-5$, *y* is the output, and *x*  is the input.In $s=2r^{2}$, *s* is the output, and *r* is the input. Notice, there is a variable for the input and a different variable for the output. | In $f\left(x\right)=2x-5$, $f(x)$ is the output, and *x* is the input.In $k\left(r\right)=2r^{2}$, $k(r)$ is the output, and *r* is the input.Notice, there is only one variable for the input. The output is represented by the entire function notation. |
| Solving for an unknown output: | Evaluate $y=2x-5$ for *x*=3.Substitute 3 into the equation for *x* then solve.$$y=2\left(3\right)-5$$$$y=1$$Notice – the last line shows only the output. | Determine $f\left(3\right)$ for $f\left(x\right)=2x-5$.Substitute 3 into the equation for *x* then solve.$$f(3)=2\left(3\right)-5$$$$f(3)=1$$Notice – the last line here shows both the input **and** output (input was 3, output was 1).Notice – in the initial $f\left(3\right)$, the variable that is usually in the brackets has been replaced with a 3, telling us that the input is 3, and that the variable throughout the entire equation should be replaced with the 3. |
| Solving for an unknown input: | Solve $y=2x-5$ for *y*=-9.Substitute -9 into the equation for y then solve.$$y=2x-5$$$$-9=2x-5$$$$-4=2x$$$$-2=x$$ | Solve $f\left(x\right)=2x-5 $if $f\left(x\right)=-9$.Substitute -9 into the equation for $f\left(x\right)$then solve.$$f\left(x\right)=2x-5$$$$-9=2x-5$$$$4=2x$$$$-2=x$$ |
| Recording inputs and outputs: | When x=3, y=1. We can write this input/output relationship using the ordered pair (3, 1).When x=-2, y=-9. We write this input/output relationship using the ordered pair (-2,-9). | $$f\left(3\right)=1$$We can write this input/output relationship using the ordered pair (3, 1).$$f\left(-2\right)=-9$$We can write this input/output relationship using the ordered pair (-2, -9). |
| Recording inputs and outputs in a table of values: |

|  |  |
| --- | --- |
| *x* | *y* |
| 3 | 1 |
| -2 | -9 |

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|  |  |
| --- | --- |
| *x* | $$f(x)$$ |
| 3 | 1 |
| -2 | -9 |

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| Using a graph to determine inputs and outputs: | Determine the missing coordinate.(?, -1) Notice – the output is given and the input is missing.Find the point on the graph where y=-1, determine the associated x-value is 2.(2, -1)Determine the missing coordinate.(0, ?)Notice – the missing coordinate is the output.Find the point on the graph where x=0 and determine that the associated y-value is -5.(0, -5) | Find x if $f\left(x\right)=-1$Notice – the output is given and input is missing.Find the point on the graph where y=-1, determine the associated x-value is 2.$$f\left(2\right)=-1$$Determine $f(0)$Notice – the input is given and the output is missing.Find the point on the graph where x=0 and determine that the associated y-value is -5.$$f\left(0\right)=-5$$ |

**Activity 3:** Summing it all Up* The diagram and online resource listed below can be used to review function notation.
	+ A good step-by-step overview of function notation can be found at <http://www.scs.sk.ca/hch/harbidge/Math%20A30/Unit_2/Lesson_1/function_notation.htm>
	+ The diagram below can be used to display and discuss the relationship between inputs and outputs in the context of function notation.
* Formative Assessment Options:
	+ Bonnie Uses: *Algebra with Pizazz* Page 176
	+ McGraw Hill:
	+ Pearson:
	+ Parallel Question / Exit Question

Create a function of your own. Choose two inputs for your function, evaluate the output, and record the input/output relationship using function notation. Choose two outputs, evaluate the inputs, and record the input/output relationship using function notation.**Problem Solving Activities:*** A performance task for this lesson has not yet been created.
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| **Reflections**: (Things to change within this lesson plan before using it again.) |