**ABGS MIDDLE SCHOOL Unit Planner**

# ALGEBRA 1

## *UNIT 4 – Functions*

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| **Teacher (s)** | T. Moran<br>N. Davis<br>D. Topping | **Subject Group and Discipline** | Advanced 8<br>Algebra 1 | | |
| **Unit Title** | Unit 4<br>Functions | **MYP Year** | 4 | **Unit Duration** | **2 – 3 WEEKS** |

### *INQUIRY? Establishing the purpose of the unit*

| Key Concept | Related Concept(s) | Global Context |
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| Relationships | Representation<br>Patterns<br>Model | Identities and Relationship |

| Statement of Inquiry |
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| **Conceptual Understanding**: Representations and models of real-life situations are affected by changing patterns.<br>**Statement of Inquiry**: Relationships and identities of functions can be represented using equations, patterns, graphs, tables and models. |
| **Inquiry Questions** |
| **Factual**: What is a function and how are they represented?<br>**Conceptual**: How are you able to identify the relationships between functions?<br>**Debatable**: How do you apply what you have learned in functions to other aspects of your life? |

| MYP OBJECTIVES | |
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| **NYS Next Generation Standards** | **IB Objectives** |
| **NY-8. F.1**: Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.<br>***Notes:*** **Function notation is not required in Grade 8.**<br>The terms domain and range may be introduced at this level; however, these terms are formally introduced in Algebra I (AI-F.IF.1).<br>**NY-8. F.2**; Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).<br>***e.g., Given a linear function represented by a table of values and a linear function represented by an algebraic equation, determine which function has the greater rate of change.***<br>***Note:*** **Function notation is not required in Grade 8.**<br>**NY-8. F.3**: Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line. Recognize examples of functions that are linear and non-linear.<br>***e.g., The function $A=S^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4), and (3,9), which are not on a straight line*.**<br>***Note*: Function notation is not required in Grade 8.**<br>**NY-8. F.4:** Construct a function to model a learning relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of | **Objective A: Knowing and Understanding**<br>i: Students select appropriate mathematics when solving problems in both familiar and unfamiliar situations.<br>ii: Students apply the selected mathematics successfully when solving problems.<br>iii: Students solve problems correctly in a variety of contexts.<br>**Objective C: Communicating**<br>i. Students use appropriate mathematical language (notation, symbols and terminology) in both oral and written explanations.<br>ii. Students use appropriate forms of mathematical representation to present information.<br>iii. Students move between different forms of mathematical representation.<br>iv: Students communicate complete and coherent mathematical lines of reasoning.<br>v: Students organize information using a logical structure.<br>**Objective D: Applying mathematics in real-life context.**<br>i: Students identify relevant elements of authentic real-life situations. |

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| a linear function in terms of the situation it models, and in terms of its graph or a table of values.<br>***Note*: Function notation is not required in Grade 8.**<br>**NY-8.F.5**: Describe qualitatively the functional relationship between two quantities by analyzing a graph. Sketch a graph that exhibits the qualitative features of a function that has been described in a real-world context.<br>***e.g., where the function is increasing or decreasing or when the function is linear or non-linear.***<br>***Note:* Function notation is not required in Grade 8.**<br>**AI-F.IF.1**: Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).<br>Note:<br>➢ **Domain and range can be expressed using inequalities, set builder notation, verbal description, and interval notations for functions of subsets of real numbers to the real numbers**.<br>**AI-F.IF.2**: Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.<br>**AI-F.IF.3**: Recognize that a sequence is a function whose domain is a subset of the integers.<br>★ (Shared standard with Algebra II)<br>***Notes***:<br>➢ **Sequences (arithmetic and geometric) will be written explicitly and only in subscript notation.** | ii: Students select appropriate mathematical strategies when solving real-life situations.<br><br>iii: Students apply the selected mathematical strategies successfully to reach a solution.<br><br>iv: Students explain the degree of accuracy of a solution.<br><br>v: Students explain whether a solution makes sense in the context of the authentic real-life situation. |

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| ➢ **Work with geometric sequences may involve an exponential equation/formula of the form an = $ar^{n-1}$, where a is the first term and r is the common ratio.**<br>**AI-F.BF.1**: Write a function that describes a relationship between two quantities.<br>★ (Shared standard with Algebra II)<br>**AI-F.BF.1a**: Determine a function from context. Define a sequence explicitly or steps for calculation from a context.<br>★ (Shared standard with Algebra II)<br>***Notes:***<br>➢ **Algebra I tasks are limited to linear, quadratic and exponential functions of the form f(x) = $ab^x$ where a > 0 and b > 0 (b ≠ 1).**<br>➢ **Work with geometric sequences may involve an exponential equation/formula of the form an = arn-1, where a is the first term and r is the common ratio.**<br>➢ **Sequences will be written explicitly and only in subscript notation**<br>**AI-F.IF.4**: For a function that models a relationship between two quantities<br>**i) interpret key features of graphs and tables in terms of the quantities; and**<br>**ii) sketch graphs showing key features given a verbal description of the relationship.**<br>★ (Shared standard with Algebra II)<br>***Notes***:<br>➢ **Algebra I key features include the following: intercepts, zeros; intervals where the function is increasing,** | |

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| **decreasing, positive, or negative; maxima, minima; and symmetries.**<br>➢ **Tasks have a real-world context and are limited to the following functions: linear, quadratic, square root, piece-wise defined (including step and absolute value), and exponential functions of the form f(x) =$ab^x$ where a > 0 and b > 0 (b≠1).**<br>**AI-F.IF.5**: Determine the domain of a function from its graph and, where applicable, identify the appropriate domain for a function in context<br>**AI-F.IF.6**: Calculate and interpret the average rate of change of a function over a specified interval.<br>★ (Shared standard with Algebra II)<br>***Notes:***<br>➢ **Functions may be presented by function notation, a table of values, or graphically.**<br>➢ **Algebra I tasks have a real-world context and are limited to the following functions: linear, quadratic, square root, piecewise defined (including step and absolute value), and exponential functions of the form f(x) = $ab^x$ where a > 0 and b > 0, (b ≠ 1).**<br>**AI-F.IF.7**: Graph functions and show key features of the graph by hand and by using technology where appropriate.<br>★ (Shared standard with Algebra II)<br>**AI-F.IF.7a**: Graph linear, quadratic, and exponential functions and show key features.<br>***Notes***:<br>➢ **Algebra I key features include the following: intercepts, zeros; intervals where the function is increasing,** | |

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| **decreasing, positive, or negative; maxima, minima; and symmetries.**<br>➢ **Exponential functions are of the form f(x) = a(b)x where a > 0 and b > 0 (b ≠ 1).**<br>➢ **Graphing linear functions is a fluency recommendation for Algebra I. Students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope. Such fluency can support them in solving less routine mathematical problems involving linearity; as well as modeling linear phenomena.**<br>**AI-F.IF.7b**: Graph square root, and piecewise-defined functions, including step functions and absolute value functions and show key features.<br>***Note***:<br>**Algebra I key features include the following: intercepts, zeros; intervals where the function is increasing, decreasing, positive, or negative; maxima, minima; and symmetries**<br>**AI-F.IF.8**: Write a function in different but equivalent forms to reveal and explain different properties of the function.<br>★ (Shared standard with Algebra II)<br>**AI-F.IF.8a**: For a quadratic function, use an algebraic process to find zeros, maxima, minima, and symmetry of the graph, and interpret these in terms of context.<br>***Note*:**<br>**Algebraic processes include but not limited to factoring, completing the square, use of the quadratic formula, and the use of the axis of symmetry.** | |

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| **AI-F.IF.9**: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).<br>★ (Shared standard with Algebra II)<br>***Note*:**<br>**Algebra I tasks are limited to the following functions: linear, quadratic, square root, piecewise defined (including step and absolute value), and exponential functions of the form f(x) = $ab^x$ where a > 0 and b > 0 (b ≠ 1).** | |

| Summative Assessment | Relationship Between Summative Assessment Task and Statement of Inquiry |
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| **Goal**: Students will use their current knowledge of functions to compare population changes during the Great Migration North. They will choose the migration changes from either the states of South Carolina to New York or Mississippi to Illinois. Time periods to use will be the 1920's through 1950's. Additionally, students will use their knowledge of the United States History to identify key historical events that contributed to any drastic variations in population estimates.<br>**Role**: You are a census director.<br>**Audience**: Community Developers and Politicians<br>**Situation**: Create a graph of a function that describes the population of the state pre and after the migration north. Create a different graph to compare the destination state pre and after the migration. The projects` directions say that you can choose any state but must discuss one important historical event that directly impacted that states` population. You decide to research census information for your states and create a function to model the population decrease (decay) and growth. | Relationships and identities of functions can be determined through the use of equations, patterns, graphs, tables and models. |

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| Using this function, you can show your U.S. History teacher how you can predict populations in the future.<br><br>1. Students will be able to create graphs of functions.<br>2. Write the equation of the graph of the function.<br>3. Calculate the rate of change in the population decrease and growth for their chosen states.<br>4. Predict the number of representatives for Congress that the states lost or gain because of this migration. | |

| **Approaches to Learning (ATL)** |
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| Thinking: Use prioritization and order of precedence in problem-solving.<br>Communication: Organize and interpret data using both analogue and digital tools.<br>Research: Use a variety of technologies and media platforms, including social media and online networks to source information |

## *ACTION: Teaching and learning through inquiry*

| **Content** | **Learning Process** |
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| Find the domain and range from a set of ordered pairs.<br>Find the domain and range from a graph.<br>Function Notation<br>Differentiate between a relation and a function.<br>Define the vertical line test.<br>Use mapping diagram to describe a relation or a function.<br>Recognize the family of functions by their table of values, graphs and/or equation.<br>Define interval notation.<br>Evaluate functions for their domain(s). | **Learning Experiences and Teaching Strategies**<br>Direct Instruction<br>Partner Work for Practice<br>Group Collaboration<br>Modeling<br>Problem Solving<br>Practice Problems at the Board<br>Think-Pair-Share |

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| Calculate the domain of a function given the range.<br>Describe the key features of a function; linear, quadratic, exponential, absolute value, square root and/or cube.<br>Differentiate between exponential growth and exponential decay.<br>Graph linear and non-linear functions from a table of values or an equation.<br>Write an arithmetic sequence.<br>Write a geometric sequence.<br>Create equation of a function.<br>Compare Functions using a table of value or a graph.<br>Determine the average rate of change of non-linear functions. | |
| **VOCABULARY**<br>Domain, Range, Interval Notation, Function Notation, Exponential Growth, Exponential Decay, Linear Function, Quadratic Function, Absolute Value Function, Square Root Function, Cube Function, Piece-wise Function, Step Function, **Key Features** such as, increasing, decreasing, maxima, minima, positive or negative, symmetries, x- and y-intercepts. Relation, Function, Vertical Line Test, Restrictions on the Domain, Arithmetic Sequence, Geometric Sequence, Average Rate of Change | **Formative Assessment**<br>Quizzes<br>Tests<br>Homework<br>Classwork<br>**Differentiation**<br>Technology<br>Graphing calculator<br>Tiered worksheet |

| **Resources** | | |
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| Teacher Created Worksheets<br>Math Textbook<br>Brain-Pop<br>Teachers Pay Teachers<br>Dan Mayer videos | Computer Based Worksheets & Activities<br>Delta Math<br>www.jmap.org<br>Kahn Academy | Algebra Teachers' Activity Book<br>IXL<br>Problem-Attic<br>Kendrick Krause (YouTube) |

***REFLECTION: Considering the planning, process and impact of the inquiry***

| Prior to Teaching the Unit | During Teaching | After Teaching the Unit |
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| Why do we think that the unit or the selection of topics will be interesting?<br>What do students already know, and what can they do?<br>What have students encountered in this discipline before?<br>What does my experience tell me about what to expect in this unit?<br>What attributes of the learning profile does this unit offer students opportunities to develop?<br>What potential interdisciplinary connections can we identify?<br>What do we know about my students' preferences and patterns of interaction?<br>Are there any possible opportunities for meaningful service learning?<br>What in the unit might be inspiring for community or personal projects?<br>Could we develop authentic opportunities for service learning?<br>How can we use my students' multilingualism as a resource for learning? | Why do we think that the unit or the selection of topics will be interesting?<br>What do students already know, and what can they do?<br>What have students encountered in this discipline before?<br>What does my experience tell me about what to expect in this unit?<br>What attributes of the learning profile does this unit offer students opportunities to develop?<br>What potential interdisciplinary connections can we identify?<br>What do we know about my students' preferences and patterns of interaction?<br>Are there any possible opportunities for meaningful service learning?<br>What in the unit might be inspiring for community or personal projects?<br>Could we develop authentic opportunities for service learning?<br>How can we use my students' multilingualism as a resource for learning? | What were the learning outcomes of this unit?<br>How well did the summative assessment task serve to distinguish levels of achievement? Was the task sufficiently complex to allow students to reach the highest levels?<br>What evidence of learning can we identify? What artefacts of learning should we document?<br>Which teaching strategies were effective? Why?<br>What was surprising?<br>What student-initiated action did we notice?<br>What will we do differently next time?<br>How will we build on our experience to plan the next unit?<br>How effectively did we differentiate learning in this unit?<br>What can students carry forward from this unit to the unit? to the next year/ level of study?<br>Which subject groups could we work with next time?<br>What did we learn from standardizing the assessment? |