

Unit Title: “Thinking with Mathematical Models”

Course: Middle School Mathematics

Subject Area: Mathematics

Time Frame: 20 days

Standards

| Middle School Mathematics Standards | Sunshine State Standards Benchmarks | NCEE New Standards |
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| <p>The student will:</p> <p>17.1 Collect data and record in tables.</p> <p>17.2 Construct coordinate graphs to represent data.</p> <p>17.3 Make predictions from data tables or graphs.</p> <p>17.4 Use patterns in data to find equations that model relationships between variables.</p> <p>17.5 Distinguish between linear and nonlinear relationships.</p> <p>17.6 Identify inverse relationships and describe their characteristics.</p> <p>17.7 Use intuitive ideas about rates of change to sketch graphs for or to match graphs to given situations and to create situations that fit given graphs.</p> | <p>MA.D.1.3.1 The student describes a wide-variety of patterns, relationships, and functions through models, such as manipulatives, tables, graphs, expressions, equations, and inequalities.</p> <p><i>Expectations</i> The student:</p> <ul style="list-style-type: none"> • Reads, analyzes, and describes graphs of linear relations. • Uses variables to represent unknown quantities in real-world problems. • Uses the information provided in a table, graph, or rule to determine if a function is linear and justifies reasoning. • Finds a function rule to describe tables of related input-output variables. • Predicts outcomes based upon function rules. <p>MA.D.1.3.2 The student creates and interprets tables,</p> | <p>The student:</p> <p>M3a Discovers, describes, and generalizes patterns, including linear, exponential, and simple quadratic relationships, i.e., those of the form $f(n) = n^2$ or $f(n) = cn^2$, for constant c, including $A = \pi r^2$, and represent them with variables and expressions.</p> <p>M3b Represents relationships with tables, graphs, in the coordinate plane, and verbal or symbolic rules.</p> <p>M3c Analyzes tables, graphs, and rules to determine functional relationships.</p> <p>M3d Finds solutions for unknown quantities in linear equations and in simple equations and inequalities.</p> |

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| | <p>graphs, equations, and verbal descriptions to explain cause-and-effect relationships.</p> <p><i>Expectations</i> The student:</p> <ul style="list-style-type: none"> • Interprets and creates tables and graphs (function tables). • Writes equations and inequalities to express relationships. • Graphs equations and inequalities to explain cause-and-effect relationships. • Interprets the meaning of the slope of a line from a graph depicting a real-world situation. <p>MA.D.2.3.1 The student represents and solves real-world problems graphically, with algebraic expressions, equations, and inequalities.</p> <p><i>Expectations</i> The student:</p> <ul style="list-style-type: none"> • Translates verbal expressions and sentences into algebraic expressions, equations, and inequalities. • Translates algebraic expressions, equations, or inequalities representing real-world relationships into verbal expressions or sentences. • Solves single- and multiple-step linear equations and inequalities in concrete or abstract form. | |

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| | <ul style="list-style-type: none"> • Graphs linear equations on the coordinate plane using tables of values. • Graphically displays real-world situations represented by algebraic equations or inequalities. • Evaluates algebraic expressions, equations, and inequalities by substituting integral values for variables and simplifying the results. • Simplifies algebraic expressions that represent real-world situations by combining like terms and applying the properties of real numbers. | |

Desired Results

| Enduring Understanding | Essential Questions | Knowledge and Skills |
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| <p>Students will understand</p> <ul style="list-style-type: none"> Algebraic models can be constructed to represent a given situation. By choosing appropriate variables, collecting and graphing data, and manipulating the variables to see how relationships are affected, mathematicians can predict outcomes. | <ul style="list-style-type: none"> What are the variables? How are they changing in relation to each other? How is an increase in the independent variable related to a change in the dependent variable? Where is the dependent variable value changing the most? The least? How can this change be seen in a table? Detected in a story? Observed in a graph? Read from a symbolic representation? Where does the graph cross the x-axis and the y-axis, and what is the significance of each intersection? Where does the dependent variable reach its greatest value and its least value? What is the significance of each location? | <p>Students will know</p> <ul style="list-style-type: none"> Key terms (e.g., Equation model, fulcrum, graph model, inverse relationship, linear relationship, mathematical model, relationship) <p>Students will be able to</p> <ul style="list-style-type: none"> Collect data from experiments and systematically record that data in tables. Construct coordinate graphs to represent data. Make predictions from data tables or graph models. Use patterns in data to find equations that model relationships between variables. Use tables, graphs, and equations to model linear and nonlinear relationships between variables. Identify inverse relationships and describe their characteristics. Use intuitive ideas about rates of change to sketch graphs for, and to match graphs to, given situations. Use intuitive ideas about rates of change to create stories that fit given graphs. |

Acceptable Evidence

| Performance Tasks | Quizzes, Test, and Work Samples | Observations and Dialogues |
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| <ul style="list-style-type: none"> • Linear Models Students conduct an experiment to investigate the relationship between the thickness and the strength of a bridge. They observe patterns in their tables and graphs, find equation models in the form $y = mx + b$ to describe experimental data, and make predictions based on their models. They interpret the slope and the y-intercept in terms of the experimental situations, and they graph lines given the slope and the y-intercept. They practice writing equations for lines given the graph of the line, the slope and y-intercept, the slope and the coordinates for one point on the line, and the coordinates of two points on the line. • Nonlinear Models Students observe patterns in situations where the value of one variable increases as the other decreases but not at a constant rates. The inverse relationships are modeled with nonlinear graphs. • More Nonlinear Models Students observe patterns in exponential growth and exponential decay relationships as modeled by graphs. Students first analyze the growth of an investment over time. Then, they conduct an experiment by pouring water from one glass into another so that each successive glass contains half as much water as the previous glass. • A World of Patterns Student concentrate on working with and interpreting graph models. Student use graphing calculators to further study graph models and equation models. | <p>Check-Up 1 Quiz A Check-Up 2 Quiz B Unit Test</p> | <p>Teacher observations of students during work on performance tasks. Accountable talk during work on performance tasks.</p> |