|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Standards-Based Lesson** | | | | | **Monday, December 2 – Friday, February 6** | | |
| **Accelerated Coordinate Algebra/ Analytic Geometry A** | | | | | | | |
| Teacher: Elliott | | | Unit 3: Linear and Exponential Functions | | | | |
| **STANDARDS – CCGPS** | | | | | | | |
| **Represent and solve equations and inequalities graphically**   * **MCC912.A.REI.10** Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). *(Focus on linear and exponential equations and be able to adapt and apply that learning to other types of equations in future courses.)* * **MCC9**‐**12.A.REI.11** Explain why the *x*‐coordinates of the points where the graphs of the equations *y* = *f*(*x*) and *y* = *g*(*x*) intersect are the solutions of the equation *f*(*x*) = *g*(*x*); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where *f*(*x*) and/or *g*(*x*) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.   **Understand the concept of a function and use function notation**   * **MCC9**‐**12.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*). *(Draw examples from linear and exponential functions.)* * **MCC9**‐**12.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. *(Draw examples from linear and exponential functions.)* * **MCC9**‐**12.F.IF.3** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *(Draw connection to F.BF.2, which requires students to write arithmetic and geometric sequences.)*   **Interpret functions that arise in applications in terms of the context**   * **MCC9**‐**12.F.IF.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. *(Focus on linear and exponential functions.)* * **MCC9**‐**12.F.IF.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *(Focus on linear and exponential functions.)* * **MCC9**‐**12.F.IF.6** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. *(Focus on linear functions and intervals for exponential functions whose domain is a subset of the integers.)*   **Analyze functions using different representations**   * **MCC9**‐**12.F.IF.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. *(Focus on linear and exponential functions. Include comparisons of two functions presented algebraically.)* * **MCC9**‐**12.F.IF.7a** Graph linear and quadratic functions and show intercepts, maxima, and minima. * **MCC9**‐**12.F.IF.7e** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. * **MCC9**‐**12.F.IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *(Focus on linear and exponential functions. Include comparisons of two functions presented algebraically.)*   **Build a function that models a relationship between two quantities**   * **MCC9**‐**12.F.BF.1** Write a function that describes a relationship between two quantities. ★ *(Limit to linear and exponential functions.)* * **MCC9**‐**12.F.BF.1a** Determine an explicit expression, a recursive process, or steps for calculation from a context. *(Limit to linear and exponential functions.)* * **MCC9**‐**12.F.BF.1b** Combine standard function types using arithmetic operations. *(Limit to linear and exponential functions.)* * **MCC9**‐**12.F.BF.2** Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.   **Build new functions from existing functions**   * **MCC9**‐**12.F.BF.3** Identify the effect on the graph of replacing *f*(*x*) by *f*(*x*) + *k*, *k f*(*x*), *f*(*kx*), and *f*(*x* + *k*) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. *(Focus on vertical translations of graphs of linear and exponential functions. Relate the vertical translation of a linear function to its y*‐*intercept.)*   **Construct and compare linear, quadratic, and exponential models and solve problems**   * **MCC9**‐**12.F.LE.1** Distinguish between situations that can be modeled with linear functions and with exponential functions. * **MCC9**‐**12.F.LE.1a** Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. * **MCC9**‐**12.F.LE.1b** Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. * **MCC9**‐**12.F.LE.1c** Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. * **MCC9**‐**12.F.LE.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input‐output pairs (include reading these from a table). * **MCC9**‐**12.F.LE.3** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.   **Interpret expressions for functions in terms of the situation they model**   * **MCC9**‐**12.F.LE.5** Interpret the parameters in a linear or exponential function in terms of a context. ★ *(Limit exponential functions to those of the form f(x) = bx + k.)* | | | | | | | |
| **OBJECTIVES: Students will know… or Students will be able to…** | | | | | | | |
| * Represent and solve linear equations and inequalities graphically using real-world contexts. * Use function notation. * Interpret linear and exponential functions that arise in applications in terms of the context. * Analyze linear and exponential functions and model how different representations may be used based on the situation presented. * Build a function to model a relationship between two quantities. * Create new functions from existing functions. * Construct and compare linear and exponential models and solve problems. * Interpret expressions for functions in terms of the situation they model. | | | | | | | |
| **ESSENTIAL QUESTIONS** | | | | | | | |
| * How do I use graphs to represent and solve real-world equations and inequalities? * Why is the concept of a functions important and how do I use function notation to show a variety of situations modeled by functions? * How do I interpret functions that arise in applications in terms of context? * How do I use different representations to analyze linear and exponential functions? * How do I build a linear or exponential function that models a relationship between two quantities? * How do I build new functions from existing functions? * How can we use real-world situations to construct and compare linear and exponential models and solve problems? * How do I interpret expressions for functions in terms of the situation they model? | | | | | | | |
| **VOCABULARY** | | | | | | | |
| * **Arithmetic Sequence.** A sequence of numbers in which the difference between any two consecutive terms is the same. * **Average Rate of Change.** The change in the value of a quantity by the elapsed time. For a function, this is the change in the *y*-value divided by the change in the *x*-value for two distinct points on the graph. * **Coefficient.** A number multiplied by a variable in an algebraic expression. * **Constant Rate of Change.** Withrespect to the variable *x* of a linear function *y* = *f*(*x*), the constant rate of change is the slope of its graph. * **Continuous.** Describes a connected set of numbers, such as an interval. * **Discrete.** A set with elements that are disconnected. * **Domain.** The set of *x*-coordinates of the set of points on a graph; the set of *x*-coordinates of a given set of ordered pairs. The value that is the input in a function or relation. * **End Behaviors.** The appearance of a graph as it is followed farther and farther in either direction. * **Explicit Expression.** A formula that allows direct computation of any term for a sequence a1, a2, a3, . . . , an, . . . . * **Exponential Function.** A nonlinear function in which the independent value is an exponent in the function, as in *y* = *abx*. * **Exponential Model.** An exponential function representing real-world phenomena. The model also represents patterns found in graphs and/or data. * **Expression.** Any mathematical calculation or formula combining numbers and/or variables using sums, differences, products, quotients including fractions, exponents, roots, logarithms, functions, or other mathematical operations. * **Even Function.** A function with a graph that is symmetric with respect to the *y*-axis. A function is only even if and only if *f*(–*x*) = *f*(*x*). * **Factor.** For any number *x*, the numbers that can be evenly divided into *x* are called factors of *x*. For example, the number 20 has the factors 1, 2, 4, 5, 10, and 20. * **Geometric Sequence.** A sequence of numbers in which the ratio between any two consecutive terms is the same. In other words, you multiply by the same number each time to get the next term in the sequence. This fixed number is called the common ratio for the sequence. * **Interval Notation.** A notation representing an interval as a pair of numbers. The numbers are the endpoints of the interval. Parentheses and/or brackets are used to show whether the endpoints are excluded or included. * **Linear Function.** Afunction with a constant rate of change and a straight line graph. * **Linear Model.** A linear function representing real-world phenomena. The model also represents patterns found in graphs and/or data. * **Odd Function.** A function with a graph that is symmetric with respect to the origin. A function is odd if and only if *f*(–*x*) = –*f*(*x*). * **Parameter.** The independent variable or variables in a system of equations with more than one dependent variable. * **Range.** Theset of all possible outputs of a function. * **Recursive Formula.** A formula that requires the computation of all previous terms to find the value of *an*. * **Slope.** The ratio of the vertical and horizontal changes between two points on a surface or a line. * **Term.** A value in a sequence--the first value in a sequence is the 1st term, the second value is the 2nd term, and so on; a term is also any of the monomials that make up a polynomial. * **Vertical Translation.** A shift in which a plane figure moves vertically. * ***X*-intercept.** The point where a line meets or crosses the *x*-axis * ***Y*-intercept.** The point where a line meets or crosses the *y*-axis | | | | | | | |
| **PRE-ASSESSMENT** | | | | | | | |
| * Unit Pre-Assessment (USA Test Prep) | | | | | | | |
| **PRIOR TO ACTIVATION (CRCT/EOCT PRACTICE)** | | | | | | | |
| **Bell Ringer -**   * Students complete questions independently * Have students compare answers and work with their table buddies. * Assist students as needed. * Review Bell Ringer   **Sources:**   * [Holt (7th Grade) CRCT Countdown](file:///C:\Users\noreen.elliott\Documents\2013-2014%20Coordinate%20Algebra\Math%207\countdown_to_crct.doc) * Wach (7th Grade) Warm-ups * [Holt (](file:///C:\Users\noreen.elliott\Documents\2013-2014%20Coordinate%20Algebra\Math%207\countdown_to_crct.doc)8[th Grade) CRCT Countdown](file:///C:\Users\noreen.elliott\Documents\2013-2014%20Coordinate%20Algebra\Math%207\countdown_to_crct.doc) * Wach (8th Grade Warm-ups) | | | | | | | |
|  | | | | | | | |
| **LESSON** | | | | | | | |
|  | **Topic** | **Activate** | | **Instruction** | | **Practice/Application** | **Assignment** |
| **Mon 12/2** | Graphing the set of all solutions | Intro PowerPoint 3.1.1 | | Lesson 3.1.1 – PowerPoint and Guided Practice | | Practice 3.1.1 | Practice Packet p 2 (1-8)  Finish Practice 3.1.1 and PBT |
| **Tue 12/3** | Intersecting graphs | Intro PowerPoint 3.1.2 | | Lesson 3.1.2 – PowerPoint and Guided Practice | | Practice 3.1.2 | Practice Packet p3 (9-17)  Finish Practice 3.1.2 and PBT |
| **Wed 12/4** | Domain and range | Intro PowerPoint 3.1.3 | | Lesson 3.1.3 – PowerPoint and Guided Practice | | Practice 3.1.3 | Practice Packet pp. 5 and 6  Finish Practice 3.1.3 and PBT |
| **Thu 12/5** | Function notation and evaluating functions | Intro PowerPoint 3.1.4 | | Lesson 3.1.4 – PowerPoint and Guided Practice | | Practice 3.1.4 | Practice Packet pp 7 and 8Finish Practice 3.1.4 and PBT |
| **Fri 12/6** | Sequences as functions | Intro PowerPoint 3.2.1 | | Lesson 3.2.1 – PowerPoint and Guided Practice | | Practice 3.2.1 | Finish Practice 3.2.1 and PBT |
|  |  |  | |  | |  |  |
| **Mon 12/9** | Benchmark (Data Director) | | | | | | |
| **Tue 12/10** | Review and complete quiz 3.1 and 3.2 |  | |  | | Review Stations |  |
| **Wed 12/11** | Review for semester final |  | |  | | Review questions/stations | Review for Final |
| **Thu 12/12** | Review for semester final |  | |  | | Review questions/stations | Review for Final |
| **Fri 12/13** | Semester final |  | |  | |  |  |
|  |  | | |  | |  |  |
| **Mon 12/16** | Finals in other classes | | | | | | |
| **Tues 12/17** | Test Corrections from Friday’s Final | | | | | | |
| Winter Break Wed 12 /18 through Friday, 1/3 | | | | | | | |
|  |  | | |  | |  |  |
| **Mon 1/6** | Identifying key features of linear and exponential graphs | Intro PowerPoint 3.3.1 | | Lesson 3.3.1 – PowerPoint and Guided Practice | | Practice 3.3.1 | Practice Packet pp 9-12  Finish Practice 3.3.1 and PBT  GaDOE “Functioning Wall” |
| **Tue 1/7** | Proving average rate of change | Intro PowerPoint 3.3.2 | | Lesson 3.3.2 – PowerPoint and Guided Practice | | Practice 3.3.2 | Practice Packet pp 13-16  Finish Practice 3.3.2 and PBT |
| **Wed 1/8** | Recognizing average rate of change | Intro PowerPoint 3.3.3 | | Lesson 3.3.3 – PowerPoint and Guided Practice | | Practice 3.3.3 | Practice Packet pp 17--19  Finish Practice 3.3.3 and PBT |
| **Thu 1/9** | Graphing linear equations | Intro PowerPoint 3.4.1 | | |  |  |  | | --- | --- | --- | | Lesson 3.1.1 – PowerPoint and Guided Practice | Lesson 3.4.1 – PowerPoint and  Guided Practice | Finish Practice 3.1.1 and PBT | | | Practice 3.4.1 | Finish Practice 3.4.1 and PBT |
| **Fri 1/10** | Graphing exponential functions | Intro PowerPoint 3.4.2 | | Lesson 3.4.2 – PowerPoint and Guided Practice | | Practice 3.4.2 | Finish Practice 3.4.2 and PBT |
|  |  |  | |  | |  |  |
| **Mon 1/13** | Review and complete quiz 3.3 and 3.4 |  | |  | | Review Stations |  |
| **Tue 1/14** | Jekyll Trip | | | | | | |
| **Wed 1/15** | Jekyll Trip | | | | | | |
| **Thu 1/16** | Jekyll Trip | | | | | | |
| **Fri 1/17** | Jekyll Trip | | | | | | |
|  |  |  | |  | |  |  |
| **Mon 1/20** | Holiday | | | | | | |
| **Tue 1/21** | Comparing linear functions | Intro PowerPoint 3.5.1 | | Lesson 3.5.1 – PowerPoint and Guided Practice | | Practice 3.5.1 | Finish Practice 3.5.1 and PBT |
| **Wed 1/22** | Writing Test | | | | | | |
| **Thu 1/23** | Comparing exponential functions | Intro PowerPoint 3.5.2 | | |  |  |  | | --- | --- | --- | | Lesson 3.1.1 – PowerPoint and Guided Practice | Practice 3.5.2 | Finish Practice 3.1.1 and PBT | | | Practice 3.5.2 | Finish Practice 3.5.2 and PBT |
| **Fri 1/24** | Comparing linear to exponential functions | Intro PowerPoint 3.5.3 | | Lesson 3.5.3 – PowerPoint and Guided Practice | | Practice 3.5.3 | Practice Packet 20-24  Finish Practice 3.5.3 and PBT |
|  |  | | |  | |  |  |
| **Mon 1/27** | Building functions from context | Intro PowerPoint 3.6.1 | | Lesson 3.6.1 – PowerPoint and Guided Practice | | Practice 3.6.1 | Finish Practice 3.6.1 and PBT  GaDOE “Talk is Cheap” |
| **Tue 1/28** | Constructing functions from graphs and tables | Intro PowerPoint 3.6.2 | | Lesson 3.6.2 – PowerPoint and Guided Practice | | Practice 3.6.2 | Finish Practice 3.6.2 and PBT |
| **Wed 1/29** | Review and quiz for 3.5 and 3.6 |  | |  | | Review Stations |  |
| **Thu 1/30** | Operating on functions | Intro PowerPoint 3.7.1 | | Lesson 3.7.1 – PowerPoint and Guided Practice | | Practice 3.7.1 | Finish Practice 3.7.1 and PBT  GaDOE “Building and Combining Functions” |
| **Fri 1/31** | Transformations of linear and exponential functions | Intro PowerPoint 3.7.2 | | Lesson 3.7.2 – PowerPoint and Guided Practice | | Practice 3.7.2 | Finish Practice 3.7.2 and PBT  GaDOE “High Functioning” |
|  |  |  | |  | |  |  |
| **Mon 2/3** | Arithmetic sequences | Intro PowerPoint 3.8.1 | | Lesson 3.8.1 – PowerPoint and Guided Practice | | Practice 3.8.1 | Practice Packet pp 25-30  Finish Practice 3.8.1 and PBT  GaDOE “Community Service, Sequences, and Functions” |
| **Tue 2/4** | Geometric sequences | Intro PowerPoint 3.8.2 | | Lesson 3.6.2 – PowerPoint and Guided Practice | | Practice 3.8.2 | Practice Packet pp 31-36Finish Practice 3.8.2 and PBT |
| **Wed 2/5** | Interpreting Parameters | Intro PowerPoint 3.9.1 | | Lesson 3.9.1 – PowerPoint and Guided Practice | | Practice 3.9.1 | Finish Practice 3.9.1 and PBT  GaDOE “You’re Toast, Dude” |
| **Thu 2/5** | Review and quiz 3.7, 3.8, and 3.9 |  | |  | | Review Stations |  |
| **Fri 2/6** | Unit 3 Test |  | |  | |  |  |
| **DIFFERENTIATED INSTRUCTION** | | | | | | | |
| Specific accommodations:   * All quizzes and tests are designed for not more than half the period so that each student has time to complete the assessments within class. * Students work in pairs and small groups on in-class work. * Board buddies help individuals gain confidence explaining their work to the class. * Methods of Instruction include:   + iPads (USA Test Prep)   + Stations   + Direct instruction (teacher led)   + OnLine resources (Georgia Virtual School, Henrico site, Kuta Software site, and others)   + Small group, buddies, and independent work | | | | | | | |
| **ASSESSMENT/EVALUATION** | | | | | | | |
| * Observation, questioning of students while they are working * Completion of guided practice activity * Homework explanations and homework quizzes * Completion of USA Test Prep Activities | | | | | | | |
| **CLOSURE** | | | | | | | |
| * Review day’s concepts and vocabulary * Remind students to review their unit notes | | | | | | | |