WAKE COUNTY PUBLIC SCHOOL SYSTEM

Middle School Programs
Building Healthy Core Learning
Common Core Math I, Unit 4

Math I UNIT 4 OVERVIEW: Linear Functions

Unit Outcomes At the end of this unit, your student should be able to:	**Key Vocabulary** Terms to deepen the student's understanding
✓ Identify and interpret rate of change and the initial value of a function in terms of the situation it models ✓ Construct and interpret a linear function given a graph, verbal description, a table or a set of ordered pairs ✓ Compare two different linear functions represented in different forms. ✓ Prove that linear functions grow by equal differences over equal intervals ✓ Construct a linear function from two quantities ✓ Create a NOW-NEXT equation to describe an arithmetic sequence ✓ Determine if a function is a linear function ✓ Transform a linear function expressed in recursive form into explicit form and vice versa ✓ Write arithmetic sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms ✓ Create a linear model for bivariate data ✓ Use the equation of a linear model to make predictions about the data	✓ Constant of Variation ✓ Direct Variation ✓ Function ✓ Line of Best Fit ✓ Linear ✓ Linear Equation ✓ Linear Function ✓ Non-linear ✓ Now-Next ✓ Rate of Change ✓ Scatterplot ✓ Slope ✓ Slope-Intercept Form ✓ Standard Form ✓ X-Intercept/Y-Intercept
Key Standards Addressed Connections to Common Core/NC Essential Standards	**Where This Unit Fits** Connections to prior and future learning
8.F.2 - Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). **8.F.3** - Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line. **8.F.4** - Construct a function to model a linear relationship between two quantities and determine the rate of change and initial value of the function. **8.SP.1**-Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. **8.SP.2** -Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. **8.SP.3-**Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.	**Coming into this unit, students should have a strong foundation in:** ✓ Operations with integers ✓ Solving one variable equations ✓ Plotting points on a coordinate plane ✓ Estimating rate of change ✓ Identifying key features of a function from a graph **This unit builds to the following future skills and concepts:** ✓ Solving quadratic, & exponential equations ✓ Solving systems of equations and inequalities through graphing, substitution and elimination ✓ Graphing and analyzing more complex functions (including inverse, step, exponential, absolute value, trigonometric and logarithmic functions) ✓ Using regression lines to predict linear, quadratic and exponential models

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N-Q.1 - Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **A-SSE.1** - Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret P(1+r)n as the product of P and a factor not depending on P. Note: At this level, limit to linear expressions, exponential expressions with integer exponents and quadratic expressions.* **A-SSE.2** - Use the structure of an expression to identify ways to rewrite it. *For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2).* **A-CED.2** - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. *Note: At this level, focus on linear, exponential and quadratic. Limit to situations that involve evaluating exponential functions for integer inputs.* **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). *Note: At this level, focus on linear and exponential equations.* **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. *Note: At this level, the focus is linear and exponential functions.* **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. Note: At this level, focus on linear, exponential and quadratic functions; no end behavior or periodicity.*	

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F-IF.5- Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function. Note: At this level, focus on linear and exponential functions.*

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. *Note: At this level, focus on linear functions and exponential functions whose domain is a subset of the integers.*

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.

a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

F-IF.9 - Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum. Note: At this level, focus on linear, exponential, and quadratic functions.*

F-BF.1- Write a function that describes a relationship between two quantities.

a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. Note: At this level, limit to addition or subtraction of constant to linear, exponential or quadratic functions or addition of linear functions to linear or quadratic functions.*

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. *Note: At this level, formal recursive notation is not used. Instead, use of informal recursive notation (such as NEXT = NOW + 5 starting at 3) is intended.*

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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. **F-LE.1** - Distinguish between situations that can be modeled with linear functions and with exponential functions a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. **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). **F-LE.5** - Interpret the parameters in a linear or exponential function in terms of a context.	
Additional Resources Materials to support understanding and enrichment	**"Learning Checks"** Questions Parents Can Use to Assess Understanding
✓ Teaching videos made by Wake County teachers ✓ WCPSS YouTube Channel – Math Playlist ✓ Linear equations (overview) ✓ Graphing linear equations (practice) ✓ Writing linear equations from graphs (practice) ✓ Arithmetic sequences (overview) ✓ Linear regression (overview) ✓ Writing arithmetic sequences (practice) ✓ Linear equations (formative assessment) ✓ Arithmetic sequences (formative assessment)	✓ Why is the concept of "linear function" important in mathematics? ✓ How are the key features identified, described, and interpreted from different representations of linear functions? ✓ Why is a constant rate of change the key characteristic of a linear function? ✓ How is a constant rate of change revealed in different representations of a linear function (graph, table, equation, and verbal forms)?

*** Please note**, the unit guides are a work in progress. If you have feedback or suggestions on improvement, please feel free to contact wakemiddle@wcpss.net.