WAKE COUNTY PUBLIC SCHOOL SYSTEM

High School Programs

Math III UNIT 2 OVERVIEW: Modeling with 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
• Create equations in two or more variables to represent relationships between quantities. • Solve systems of linear equations exactly, i.e. algebraically. • Solve systems of linear equations approximately by graphing the functions using technology and estimating solutions, making tables of values, or finding successive approximations. • 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). • Graph the solutions to a linear inequality in two variables as a half- plane (excluding the boundary in the case of a strict inequality). • Graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. • Represent constraints by systems of linear equations and/or inequalities based on a modeling context. • Interpret solutions of linear systems as viable or non-viable options in a modeling context. • Identify the feasible region for a set of constraints. • Use the Corner Principle and the Objective Function to determine the optimum solution for a set of constraints in a modeling context. • Write arithmetic sequences both recursively using formal notation and with an explicit formula and use them to model situations. • Translate between recursive and explicit forms of an arithmetic sequence. • Identify the coefficients and constants of a function and interpret them in a contextual situation. • For a linear function that models a relationship between two quantities, interpret the slope and y-intercept of the graph and table forms of the function in context. • Relate the domain of a linear function to its graph and, when given a context, to the quantitative relationship it describes. • Evaluate linear functions for inputs in their domains. • Interpret statements that use function notation in terms of a context. • Write a linear function that describes the relationship between two quantities. • Prove theorems about lines and angles: ○ Vertical angles are congruent.	✓ Constraint ✓ Objective Function ✓ Feasible Region ✓ Viable option ✓ Non-viable option ✓ Corner Principle ✓ Recursive form ✓ Explicit form ✓ Common difference ✓ Slope ✓ Y-intercept ✓ Arithmetic sequence ✓ Arithmetic series ✓ Domain ✓ Range ✓ Function notation ✓ System of equations ✓ Boundary line ✓ Vertical angles ✓ Transversal ✓ Parallel lines ✓ Alternate interior angles ✓ Corresponding angles ✓ Parallelogram ✓ Rectangle ✓ Diagonal ✓ Geometric construction ✓ Compass ✓ Bisect ✓ Segment bisector ✓ Angle bisector ✓ Perpendicular lines

Math III UNIT 2 OVERVIEW: Modeling with Linear Functions

○ When a transversal crosses parallel lines, alternate interior angles are congruent. ○ When a transversal crosses parallel lines, corresponding angles are congruent. ○ Points on a perpendicular bisector of a line segment are exactly equidistant from the segment's endpoints. • Prove theorems about parallelograms. ○ Opposite sides are congruent. ○ Opposite angles are congruent. ○ The diagonals of a parallelogram bisect each other. ○ Rectangles are parallelograms with congruent diagonals. • Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). ○ Copy a segment. ○ Copy an angle. ○ Bisect a segment. ○ Bisect an angle. ○ Construct perpendicular lines, including the perpendicular bisector of a line segment. ○ Construct a line parallel to a given line through a point not on the line. • Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).	✓ Perpendicular bisector ✓ Typographic grid system

Key Standards Addressed Connections to Common Core/NC Essential Standards	**Where This Unit Fits** Connections to prior and future learning
Note: Many standards appear in multiple units and courses. The concepts in bold are the focus for this unit. Notes in italics provide clarification for some standards. **A-CED.1** Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from **linear** and quadratic functions, and simple rational and exponential functions.* **A-CED.3** Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example,*	**Coming into this unit, students should have a strong foundation in:** ✓ Creating equations that describe numbers or relationships ✓ Understanding that solving equations algebraically is a process of reasoning ✓ Solving systems of two-variable equations algebraically, graphically (including using technology), and by making tables ✓ Representing the solution set of two-variable inequalities or system of inequalities graphically ✓ Writing arithmetic sequences both recursively (in NOW-NEXT form) and explicitly

Math III UNIT 2 OVERVIEW: Modeling with Linear Functions

represent inequalities describing nutritional and cost constraints on combinations of different foods.

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.

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.
Bring in formal recursive function notation.

G-CO.1 Know precise definitions of angle, circle, **perpendicular line, parallel line**, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

G-CO.9 Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.*

G-CO.11 Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.*

- ✓ Knowing the definitions of geometric terms such as angle, line segment, perpendicular lines, parallel lines, vertical angles, and congruent figures

This unit builds to the following future skills and concepts:

Advanced Functions & Modeling

2.02a Use piecewise-defined functions to model and solve problems using tables, graphs, and algebraic properties.

2.05 Use recursively-defined functions to model and solve problems.

Discrete Math

3.01 Use recursively-defined functions to model and solve problems.

Higher level math courses explore the properties of power, exponential, polynomial, and rational functions. Students will apply the concepts learned about linear functions to these other types.

Math III UNIT 2 OVERVIEW: Modeling with Linear Functions

G-CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.* **G-MG.3** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).	

Additional Resources

Materials to support understanding and enrichment

- ✓ Graphing Linear Inequalities (Khan Academy)
- ✓ Graphing Linear Inequalities (Purple Math)
- ✓ Solving Problems with Linear Inequalities
- ✓ Solving Systems of Inequalities by Graphing (Virtual Nerd)
- ✓ Graphing Systems of Inequalities (Khan Academy)
- ✓ Solving Problems with Systems of Inequalities
- ✓ Linear Programming
- ✓ Arithmetic Sequences and Sums
- ✓ Recursive v. Explicit
- ✓ Geometric Construction Cookbook
- ✓ Theorems about Parallelograms
- ✓ Theorems about Lines and Angles
- ✓ Detailed Tutorial of Solving a System of Equations
- ✓ Solving Systems by Graphing
- ✓ Solving Systems by Elimination
- ✓ Solving Systems using Intersection on Graphing Calculator
- ✓ Graphing Linear Inequalities on the Graphing Calculator
- ✓ Graphing Calculator Tutorials