LCPS Math Analysis Yearly Overview and Scope and Sequence 2021-22

Math Analysis Yearly Overview 2021-22

Quarter 1	Investigating Functions Standards of Learning: MA.1, MA.2, MA.3, MA.4, MA.5	
Quarter 2	Matrices and Conics Standards of Learning: MA.6, MA.11	Analytical Geometry and Equations Standards of Learning: MA.7, MA.8, MA.9, MA.10
Quarter 3	Sequences, Series, and Mathematical Induction Standards of Learning: MA.12, MA.13, MA.14	Limits
Quarter 4	Differentiation	Applications of Derivatives

VDOE Process Goals
- To build new mathematical knowledge through
problem solving and to develop a repertoire of skills and strategies for solving a variety of problem types **(Problem Solving)**
- To communicate mathematical ideas coherently and clearly and to analyze and evaluate the mathematical thinking of others **(Communication)**
- To use logical reasoning in solving mathematical problems and to explain and justify mathematical ideas **(Reasoning)**
- To understand how mathematical ideas interconnect and build on one another and to use those connections to solve problems **(Connections)**
- To create and use a variety of representations in learning, doing, and communicating mathematics **(Representations)**

Math Analysis Scope and Sequence

The Loudoun County Public Schools Mathematics Scope and Sequence provides a broad overview of the content units, the quarter in which each unit is taught, and the sequence of the standards within each unit. Resources to support instruction are located in the [Mathematics Curriculum Schoology Groups](#).

[Curriculum Framework](#)**:** The Curriculum Framework contains the 2016 *Mathematics Standards of Learning*, guidance for Understanding the Standard, and Essential Knowledge and Skills for students. Students are expected to continue to connect and apply knowledge and skills from Standards of Learning presented in previous grades as they deepen their mathematical understanding. Assessment items may not and should not be a verbatim reflection of the information presented in the Curriculum Framework.

Prerequisite Knowledge: These standards are the supporting concepts for the grade level concept. The hyperlinks are to the Just In Time Quick Check documentation which includes teacher notes, instructional plans, formative assessments, and activities to support student learning.

[Just In Time Quick Checks](#): Just in Time Mathematics Quick Checks are formative assessments that align to the 2016 Mathematics Standards of Learning (SOL). They are designed to help teachers identify students with unfinished learning and assist in planning instruction to fill potential gaps "just in time." As new content is introduced throughout the school year, teachers can use these Quick Checks to identify and diagnose unfinished learning at grade level and/or to assess understanding of prerequisite knowledge that may be needed to access grade level content. Student gaps in mathematics understanding exist for a variety of reasons and these resources can be used to help get student mathematical learning back on track.

Essential Skills and Knowledge: This section provides a detailed expansion of the mathematics knowledge and skills that each student should know and be able to demonstrate. This is not meant to be an exhaustive list of student expectations.

Quarter 1

Investigating Functions

Curriculum Framework: MA.1, MA.2, MA.3, MA.4, MA.5

Prerequisite Knowledge	Essential Skills and Knowledge

AII.1b, AII.1c, AII.2, AII.3c AII.6a, AII.7a, AII.7b, AII.7c, AII.7d, AII.7e, AII.7f, AII.7g, AII.7h, AII.7i, AII.8	**MA. 1 Investigate and identify the properties of polynomial, rational, piecewise, and step functions and sketch the graphs of the functions.**
	● Identify a polynomial, rational, piecewise, and step function, given an equation or graph.
	● Given a graph or equation of a polynomial, rational, piecewise, or step function, identify:
	   o domain and range;
	   o zeros;
	   o intercepts;
	   o symmetry;
	   o asymptotes (horizontal, vertical, and oblique/slant);
	   o points of discontinuity;
	   o intervals for which the function is increasing, decreasing or constant;
	   o end behavior; and
	   o relative and/or absolute maximum and minimum points.
	● Sketch the graph of a polynomial, rational, piecewise, or step function.
	● Investigate and verify characteristics of a polynomial, rational, piecewise, and step function, using a graphing utility.
	● Rationalize the denominator of a rational function.

AII.1b, AII.6a, AII.7a, AII.7b, AII.7c, AII.7d, AII.7e, AII.7f,	**MA.2 Investigate and identify the characteristics of exponential and logarithmic functions to graph the function, solve equations, and solve practical problems.** ● Identify exponential functions from an equation or a graph. ● Identify logarithmic functions from an equation or a graph. ● Define e, and know its approximate value.

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All.7g, All.7h, All.7i	• Convert between equations written in logarithmic and exponential form. • Identify common and natural logarithms, given an equation or practical situation. • Use laws of exponents and logarithms to solve equations and simplify expressions. • Model practical problems, using exponential and logarithmic functions. • Graph exponential and logarithmic functions and identify asymptotes, end behavior, intercepts, domain, and range.
All.7j, All.7k	**MA.3 Apply compositions of functions and inverses of functions to practical situations and investigate and verify the domain and range of resulting functions.** • Determine the composition of functions algebraically and graphically. • Determine the inverse of a function algebraically and graphically. • Determine the domain and range of composite functions algebraically and graphically. • Determine the domain and range of the inverse of a function algebraically and graphically.
All.7i	**MA.5 Investigate and describe the continuity of functions.** • Describe continuity of a function. • Investigate the continuity of functions including absolute value, step, rational, and piecewise functions, using graphical and algebraic methods. • Classify types of discontinuity. • Prove continuity at a point, using the definition of limits.
All.7h	**MA.4 Determine the limit of an algebraic function, if it exists, as the variable approaches either a finite number or infinity.** • Verify estimates about the limit of a function using a graphing utility. • Determine the limit of a function algebraically and verify with a graphing utility. • Determine the limit of a function numerically and verify with a graphing utility. • Use limit notation when describing end behavior of a function.

Quarter 2

Matrices and Conics

Curriculum Framework: MA.6, MA.11

Prerequisite Knowledge	Essential Skills and Knowledge
A.4d, AII.4	**MA.11 The student will use matrices to organize data and will add and subtract matrices, multiply matrices, multiply matrices by a scalar, and use matrices to solve systems of equations.** ● Multiply matrices by a scalar. ● Add, subtract, and multiply matrices. ● Model problems with a system of no more than three linear equations. ● Express a system of linear equations as a matrix equation. ● Solve a system of equations using matrices. ● Determine the inverse of a two-by-two or three-by-three matrix using paper and pencil. ● Verify two matrices are inverses using matrix multiplication. ● Verify the commutative and associative properties for matrix addition and multiplication.
G.3d, G.12, AII.6b	**MA.6 Investigate, graph, and identify the properties of conic sections from equations in vertex and standard form.** ● Given a translation or rotation matrix, determine an equation for the transformed function or conic section. ● Investigate and verify graphs of transformed conic sections, using a graphing utility. ● Graph conic sections from equations written in vertex or standard form using transformations. ● Identify properties of conic sections.

Analytical Geometry and Equations

	Curriculum Framework: MA.7, MA.8, MA.9, MA.10
Prerequisite Knowledge	**Essential Skills and Knowledge**
AII.2	**MA.7 The student will perform operations with vectors in the coordinate plane and solve practical problems using vectors.** ● Use vector notation. ● Perform the operations of addition, subtraction, scalar multiplication, and inner (dot) product on vectors. ● Graph vectors and resultant vectors. ● Express complex numbers in vector notation. ● Identify properties of vector addition, scalar multiplication, and dot product. ● Determine the components of a vector. ● Determine the norm (magnitude) of a vector. ● Use vectors in simple geometric proofs. ● Solve problems, including practical problems, using vectors.
G.8a, G.8b, G.8c, T.5, T.6, T.7, T.8	**MA.8 The student will identify, create, and solve practical problems involving triangles.** ● Solve and create problems, including practical problems, using trigonometric functions. ● Solve and create problems, including practical problems, using the Pythagorean Theorem. ● Solve and create problems, including practical problems, using the Law of Sines and the Law of Cosines. ● Solve problems, including practical problems, where triangles are formed from vectors.
AII.2	**MA.9 The student will investigate and identify the characteristics of the graphs of polar equations.** ● Classify polar equations (rose, cardioid, limaçon, lemniscate, spiral, and circle), given the graph or the equation. ● Determine the effects of changes in the parameters of polar equations on the graph, using a graphing utility. ● Convert between complex numbers written in rectangular form and polar form. ● Determine and verify the intersection of the graphs of two polar equations, using a graphing utility.
	MA.10 Use parametric equations to model and solve practical problems ● Graph parametric equations. ● Use parametric equations to model practical problems, including motion over time.

	● Determine solutions to parametric equations graphically. ● Use a graphing utility to graph and analyze parametric equations.

Quarter 3

Sequences, Series, and Mathematical Induction

Curriculum Framework: MA.12, MA.13, MA.14

Prerequisite Knowledge	Essential Skills and Knowledge
	MA.14 Use mathematical induction to prove formulas and mathematical statements. ● Compare inductive and deductive reasoning. ● Prove formulas and mathematical statements, using mathematical induction.
	MA.12 Expand binomials having positive integral exponents. ● Expand binomials having positive integral exponents. ● Use the Binomial Theorem, the formula for combinations, and Pascal's Triangle to expand binomials.
All.5	**MA.13 Determine the sum of finite and infinite convergent series.** ● Use and interpret the notation: $\sum$, n, nth, and a_n. ● Derive the formulas associated with arithmetic and geometric sequences and series. ● Given the formula, determine the nth term, a_n, for an arithmetic or geometric sequence. ● Given the formula, determine the sum, S_n, if it exists, of an arithmetic or geometric series. ● Model and solve problems, using sequence and series information. ● Distinguish between a convergent and divergent series. ● Discuss convergent series in relation to the concept of a limit.

Limits

Prerequisite Knowledge	Essential Skills and Knowledge

MA.4, MA.5	

Quarter 4

Differentiation

Prerequisite Knowledge	Essential Skills and Knowledge

Applications of Derivatives

Prerequisite Knowledge	Essential Skills and Knowledge

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