

Pre-Calculus

Strand	Common Curriculum Goal	Standard	Unit Name	Course Topic Description
MA.CM.CE Calculations and Estimations	Understand numbers, ways of representing numbers, relationships among numbers, and number systems	MA.CM.CE.01 Compare real numbers		
		MA.CM.CE.02 Order and compare numbers expressed in scientific notation to each other and to other forms of real numbers		
		MA.CM.CE.03 Recognize that the set of real numbers contains the set of irrational numbers and the set of rational numbers and know the difference between them		
		MA.CM.CE.04 Locate real numbers on a number line (including approximations of irrational numbers)		
		MA.CM.CE.05 Apply equivalent forms of real numbers to solve problems		
MA.CM.CE Calculations and Estimations	Compute fluently and make reasonable estimates	MA.CM.CE.06 Compute with real numbers, including absolute value and numbers expressed in scientific notation		
		MA.CM.CE.07 Compute with integer exponents and whole number roots		
		MA.CM.CE.08 Mentally multiply and divide by powers of 10 to estimate results of computations involving numbers expressed in scientific notation		
		MA.CM.CE.09 Develop and use strategies to estimate the results of real number computations, determine the amount of error, and judge the reasonableness of results		
		MA.CM.CE.10 Estimate the results of computations with integer powers and roots of real numbers.		
MA.CM.CE Calculations and Estimations	Understand meanings of operations and how they relate to one another	MA.CM.CE.11 Recognize that taking the n th root of a number corresponds to prime factorization		
		MA.CM.CE.12 Use the inverse operations of n th power and n th root to solve problems and check solutions		
		MA.CM.CE.13 Apply the associative, commutative, and distributive properties to simplify computations with real		



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		numbers		
		MA.CM.CE.14 Use properties of numbers to demonstrate whether assertions are true or false		
MA.CM.SP Statistics and Probability	Select and use appropriate statistical methods to analyze data	MA.CM.SP.01 Estimate from a graph or a set of data the mean and standard deviation of a normal distribution and draw conclusions about the distribution of data using measures of center and spread (e.g., analyze a variety of summary statistics and graphical displays)		
		MA.CM.SP.02 Analyze bivariate data and identify the type of function (linear, quadratic, exponential) that could be used to model the data		
MA.CM.SP Statistics and Probability	Understand and apply basic concepts of probability	MA.CM.SP.03 Compute the probability of a compound event (e.g., toss a coin three times to find the probability of two heads)		
		MA.CM.SP.04 Determine probabilities of dependent and independent events (e.g., use colored marbles with and without replacement)		
		MA.CM.SP.05 Use conditional probability to solve problems (e.g., from a sample set for the roll of two tetrahedral die; given that a sum is even, what is the probability that the sum is 6?)		
		MA.CM.SP.06 Determine all possible outcomes of a particular event or all possible arrangements of objects in a given set by applying counting strategies, combinations, and permutations		
MA.CM.SP Statistics and Probability	Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them	MA.CM.SP.07 Determine appropriate designs for simulations (surveys, observational studies, and experiments) and modeling to study a problem and construct empirical probability distributions to represent results		
		MA.CM.SP.08 Use matrices, histograms, scatter plots, stem-and-leaf plots, and box-and whisker-plots to interpret data		

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		MA.CM.SP.09 Identify examples of populations that are normally distributed		
MA.CM.SP Statistics and Probability	Develop and evaluate inferences and predictions that are based on data	MA.CM.SP.10 Make inferences and predictions from data in histograms, scatter plots, and parallel box plots		
		MA.CM.SP.11 Make predictions about populations based on reported sample statistics		
		MA.CM.SP.12 Understand that inferences about a population drawn from a sample involve uncertainty and that the role of statistics is to measure that uncertainty		
MA.CM.AR Algebraic Relationships	Understand patterns, relations, and functions	MA.CM.AR.01 Represent and generalize sequences resulting from linear, quadratic, and exponential relationships using recursive or explicit formulas, tables of values, and graphs	Discrete Mathematics	Sequences and Series: Terms, Sums, and Limits
		MA.CM.AR.02 Produce a valid conjecture using inductive reasoning by generalizing from a pattern of observations	Discrete Mathematics	Sequences and Series: Convergence, Divergence, and Applications
		MA.CM.AR.03 Evaluate and make a table for two-variable formulas and match a graph or table of values to its formula		
		MA.CM.AR.04 Identify independent and dependent variables and determine the domain and range of a function in a problem situation		
MA.CM.AR Algebraic Relationships	Represent and analyze mathematical situations and structures using algebraic symbols	MA.CM.AR.05 Algebraically represent situations and solve problems involving quadratic and exponential equations, including exponential growth and decay	Exponential and Logarithmic Functions	Properties and Graphs
		MA.CM.AR.06 Use graphs to solve non-linear equations, including quadratics		
		MA.CM.AR.07 Represent and solve systems of linear equations with two variables using simultaneous equations and by graphing.		
		MA.CM.AR.08 Recognize and generate equivalent forms for algebraic expressions, including combining like terms		

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		and expanding binomials		
		MA.CM.AR.09 Evaluate algebraic expressions and formulas by substituting real numbers		
		MA.CM.AR.10 Translate between and interpret quadratic and exponential relationships represented by words, symbols, tables, and graphs		
		MA.CM.AR.11 Determine and interpret maxima or minima and zeros of quadratic functions, and linear functions where $y = \text{constant}$		
		MA.CM.AR.12 Graph linear inequalities in two variables		
		MA.CM.AR.13 Graph quadratic and exponential equations	Exponential and Logarithmic Functions	Properties and Graphs
		MA.CM.AR.14 Analyze how changing a parameter (i.e., k , b) in a quadratic or exponential function of the form $y=k^x+b$, $y=kx^2+b$, or $y=k(x+b)^2$ affects its graph	Exponential and Logarithmic Functions	Properties and Graphs
MA.CM.AR Algebraic Relationships	Use mathematical models to represent and understand quantitative relationships	MA.CM.AR.15 Model situations, make predictions and inferences, and solve problems using linear, quadratic, and exponential functions	Exponential and Logarithmic Functions	Values and Applications
		MA.CM.AR.16 Determine when data represented in a table or graph represents a linear, quadratic, or exponential relationship	Exponential and Logarithmic Functions	Values and Applications
MA.CM.AR Algebraic Relationships	Analyze change in various contexts	MA.CM.AR.17 Approximate and interpret rates of change in graphical and numeric data	Exponential and Logarithmic Functions	Values and Applications
		MA.CM.AR.18 Analyze the nature of change of each variable in a non-linear relationship as suggested by a table of values, a graph, or a formula	Exponential and Logarithmic Functions	Values and Applications
MA.CM.ME Measurement	Understand measurable attributes of objects and the units, systems and processes of measurement	MA.CM.ME.01 Determine the appropriate units, scales, and tools for problem situations involving measurement		
		MA.CM.ME.02 Solve problems involving unit conversions (e.g., mile per hour to feet per second) given the unit equivalencies.		

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	Apply appropriate techniques, tools, and formulas to determine measurements	MA.CM.ME.03 Determine the precision of a given measuring tool (e.g., 1 degree for a standard protractor)		
		MA.CM.ME.04 Develop and use strategies and formulas for calculating surface area and volume of cones and spheres		
		MA.CM.ME.05 Use formulas to solve problems involving finding missing dimensions given perimeter, area, surface area, and volume of polygons, circles, prisms, pyramids, cones, cylinders, and spheres		
		MA.CM.ME.06 Develop and understand, and use the formula for determining arc length (e.g., portion of a circle).		
		MA.CM.ME.07 Determine perimeter and area of shapes of circles and polygons (annulus, etc.) in context		
		MA.CM.ME.08 Determine the surface area and volume of a complex figure composed of a combination of two or more geometric figures or a figure derived from a regular solid (e.g., hemisphere, frustum of a cone)		
		MA.CM.ME.09 Compare and contrast the formulas for surface area and volume of cylinders and cones		
		MA.CM.ME.10 Determine a shape that has minimum or maximum perimeter, area, surface area, or volume under specified conditions		
		MA.CM.ME.11 Make and use scale drawings and models to solve problems		
MA.CM.GE Geometry	Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships	MA.CM.GM.01 Determine defining properties that characterize classes of three-dimensional figures and their component parts		
		MA.CM.GM.02 Recognize and represent three-dimensional figures and their component parts		
		MA.CM.GM.03 Justify and use theorems involving the angles formed by parallel lines cut by a transversal		

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		MA.CM.GM.04 Develop, understand, and apply properties of circles and of inscribed and circumscribed polygons		
		MA.CM.GM.05 Use measures of sides and of interior and exterior angles of polygons to classify figures and solve problems		
		MA.CM.GM.06 Prove congruence of two triangles or their corresponding component parts		
		MA.CM.GM.07 Determine the measures of corresponding angles, sides, and corresponding parts of congruent and similar figures		
		MA.CM.GM.08 Use angle, side length, and triangle inequality relationships to solve problems		
		MA.CM.GM.09 Use trigonometric functions, and angle and side relationships of special right triangles (30- 60-right triangles and isosceles right triangles) to solve for an unknown length and determine distances and solve problems		
		MA.CM.GM.10 Investigate relationships among chords, secants, tangents, inscribed angles, and inscribed and circumscribed polygons of circles		
		MA.CM.GM.11 Construct and judge the validity of a logical argument and give counterexamples to disprove a statement		
		MA.CM.GM.12 Justify and use theorems involving the properties of triangles, quadrilaterals, circles, and their component parts to verify congruence and similarity		
MA.CM.GE Geometry	Use visualization, spatial reasoning, and geometric modeling to solve problems	MA.CM.GM.13 Model, sketch, label and where appropriate construct cones and spheres, and basic elements of geometric figures (e.g., altitudes, midpoints, medians, angle bisectors, and perpendicular bisectors) using compass and straightedge or technology		
		MA.CM.GM.14 Describe how two or more objects are related in space (e.g., skew lines, the possible ways three		



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		planes might intersect)		
		MA.CM.GM.15 Make a model of a three-dimensional figure from a two-dimensional drawing and make a two-dimensional representation of a three-dimensional object through scale drawings, perspective drawings, blueprints, or computer simulations		
		MA.CM.GM.16 Recognize representations of three-dimensional objects from different perspectives and identify cross-sections of three-dimensional objects		
MA.CM.GE Geometry	Specify locations and describe spatial relationships using coordinate geometry and other representational systems	MA.CM.GM.17 Determine the relative placement (e.g., intersecting, parallel, perpendicular) of two lines on a coordinate plane given the algebraic equations representing them		
		MA.CM.GM.18 Calculate slope, distance and midpoint between points with an emphasis on practical applications (use coordinate formulas)	Conics, Polar Coordinates, and Complex Numbers	Conics: Circles, Ellipses, Hyperbolas, and Parabolas
MA.CM.GE Geometry	Apply transformations and use symmetry to analyze mathematical situations	MA.CM.GM.19 Use coordinate geometry to determine whether a figure is symmetrical with respect to a line or a point		
		MA.CM.GM.20 Determine whether a given pair of figures on a coordinate plane represent a translation, reflection, rotation, and/or dilation	Conics, Polar Coordinates, and Complex Numbers	Parametric Equations
		MA.CM.GM.21 Determine the image of a figure on a coordinate graph under translations, reflections, and rotations	Conics, Polar Coordinates, and Complex Numbers	Parametric Equations
		MA.CM.GM.22 Given a figure and its image on a coordinate graph, determine the translation vector or locate the axis of reflection	Conics, Polar Coordinates, and Complex Numbers	Parametric Equations
		MA.CM.GM.23 Determine the coordinates of and draw the dilation of a figure on a coordinate graph		
		MA.CM.GM.24 Analyze the congruence, similarity, and line or rotational symmetry of figures using transformations		

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MA.CM.PS Mathematical Problem Solving	Select, apply, and translate among mathematical representations to solve problems.	MA.CM.PS.01 Interpret the concepts of a problem-solving task and translate them into mathematics	Exponential and Logarithmic Functions	Values and Applications
MA.CM.PS Mathematical Problem Solving	Apply and adapt a variety of appropriate strategies to solve problems.	MA.CM.PS.01 Choose strategies that can work and then carry out the strategies chosen	Exponential and Logarithmic Functions	Values and Applications
MA.CM.PS Mathematical Problem Solving	Monitor and reflect on the process of mathematical problem solving.	MA.CM.PS.03 Produce identifiable evidence of a second look at the concepts/strategies/calculations to defend a solution	Discrete Mathematics	Sequences and Series: Convergence, Divergence, and Applications
MA.CM.PS Mathematical Problem Solving	Communicate mathematical thinking coherently and clearly. Use the language of mathematics to express mathematical ideas precisely.	MA.CM.PS.04 Use pictures, symbols, and/or vocabulary to convey the path to the identified solution	Conics, Polar Coordinates, and Complex Numbers	Polar Coordinates and Complex Numbers
MA.CM.PS Mathematical Problem Solving	Accurately solve problems that arise in mathematics and other contexts.	MA.CM.PS.05 Accurately solve problems using mathematics	Exponential and Logarithmic Functions	Properties and Graphs