

Precalculus MOTR Math 150

Precalculus is intended to prepare students for fields of study that would require a high level of algebraic and trigonometric reasoning or Calculus. Topics include the foundational principles of functions, the analysis of functions, algebraic reasoning, geometric reasoning, and trigonometry.

I	Foundation of Functions	
	Students will use multiple representations of different function types to investigate quantities and describe relationships between quantities. Specifically, students will be able to:	
I.A	Use multiple representations of functions to interpret and describe properties of functions.	
	I.A.1	Effectively communicate using function notation.
	I.A.2	Identify the following functions: linear, quadratic exponential, logarithmic, rational, radical, polynomial, piecewise and absolute value given the graph or the equation.
	I.A.3	Identify domains and ranges in multiple contexts.
	I.A.4	Identify from the graph the local maximums and minimums.
	I.A.5	Determine whether a graph has symmetry and whether a function is even or odd.
I.B	Use multiple representations of functions to describe how two quantities change together.	
	I.B.1	Determine intervals on which a function is increasing, decreasing and constant.
	I.B.2	Identify constant rates of change.
	I.B.3	Determine average rates of change.
	I.B.4	Simplify the difference quotient of various types of functions.

II	Analysis of Functions	
	Students will describe characteristics of different function types and convert between different representations and algebraic forms to analyze and solve meaningful problems. Specifically, students will be able to:	
II.A	Create, use and interpret linear equations and convert between forms as appropriate.	
	II.A.1	Identify important values (i.e. slope and intercepts) from multiple representations.
	II.A.2	Determine equations of lines.
II.B	Create, use and interpret exponential and logarithmic equations and convert between forms as appropriate.	
	II.B.1	Apply the inverse relationship between exponential and logarithmic functions.
	II.B.2	Graph exponential and logarithmic functions.
	II.B.3	Recognize similarities and differences between linear and exponential functions.
	II.B.4	Solve applications involving base e .
	II.B.5	Interpret half-life and doubling time to create decay and growth models.
	II.B.6	Describe long term behavior of exponential models.
II.C	Create, graph, apply and interpret polynomial, power and rational functions.	
	II.C.1	Find roots, determine end behavior and graph polynomial functions.
	II.C.2	Graph rational functions and find vertical, horizontal and oblique asymptotes.
II.D	Construct, use and describe transformations, operations, compositions and inverses of functions.	
	II.D.1	Describe how the graph of a function can be the result of vertical and horizontal shifts, stretches, compressions and reflections of the graph of a basic function.
	II.D.2	Perform arithmetic operations with functions and describe the domain.
	II.D.3	Create new functions by composing basic functions and describe the domain.
	II.D.4	Decompose a composite function into basic functions.
	II.D.5	Determine if a function is one-to-one, and if so, find the inverse and describe its domain and range.

III	Algebraic Reasoning	
	Students will identify and apply algebraic reasoning to write equivalent expressions, solve equations and solve inequalities. Specifically, students will be able to:	
	III.A	Use algebraic techniques to simplify and expand expressions.
	III.A.1	Apply properties to exponents and logarithms.
	III.A.2	Simplify and factor expressions involving rational exponents.
	III.B	Use algebraic reasoning to solve equations.
	III.B.1	Solve quadratic equations by factoring, the square root property, completing the square and the quadratic formula.
	III.B.2	Solve polynomial, radical, rational, exponential and logarithmic equations.
	III.B.3	Determine complex roots of polynomials.
III.B.4	Solve equations using rational exponents.	
III.B.5	Solve and apply systems of linear and non-linear equations.	
III.B.6	Solve quadratic, absolute value, polynomial and rational inequalities.	

IV	Trigonometry	
	Students will model and solve meaningful problems using trigonometric functions and their properties. Specifically, students will be able to:	
	IV.A	Demonstrate an understanding of the properties of angles and of the basic trigonometric functions.
	IV.A.1	Understand the definition of radian measure and be able to convert between radians and degrees.
	IV.A.2	Apply the concepts of radian measure to arc length.
	IV.A.3	Interpret sine and cosine as coordinates on a unit circle.
	IV.A.4	Understand definitions of sine, cosine, tangent, cotangent, secant and cosecant.
	IV.A.5	Apply right triangle trigonometry in real-world contexts and on the rectangular coordinate system.
	IV.A.6	Immediately recall the values of $\sin\theta$, $\cos\theta$, $\tan\theta$, $\sec\theta$, $\csc\theta$ and $\cot\theta$ for the special angles.
	IV.B	Use and verify trigonometric identities.
	IV.B.1	Use the Pythagorean identity (and its variations).
	IV.B.2	Use double and half-angle identities.
	IV.B.3	Use angle addition and subtraction formulas to convert and simplify trigonometric expressions.
	IV.B.4	Use common identities to verify a variety of trig identities.
	IV.C	Identify important properties of the graphs of trigonometric functions.
	IV.C.1	Identify amplitude, period, frequency, phase shift (domain shift) and vertical and horizontal shifts and stretches.
	IV.C.2	Graph trigonometric functions.
	IV.D	Solve equations involving trigonometric functions.
	IV.D.1	Use identities, properties and factoring to simplify and solve a trigonometric equation.
	IV.D.2	Find general solutions to a trigonometric equation as well as solutions within a given interval.
	IV.E	Solve for missing lengths or angles of oblique triangles.
	IV.E.1	Apply the Law of Sines and the Law of Cosines.
	IV.F	Use and describe inverse trigonometric functions.
	IV.F.1	Evaluate inverse trigonometric functions.
	IV.F.2	Solve equations using inverse trigonometric functions.
	IV.F.3	Describe domain and range of inverse trigonometric functions.
	IV.G	Use Vectors in 2-Dimensional Space.
IV.G.1	Find the magnitude and direction for a vector given its initial point and its terminal point.	
IV.G.2	Find the horizontal and vertical components of a vector given its magnitude and direction.	
IV.G.3	Perform vector operations.	