Grade 12 Pre-Calculus Mathematics (2000)	Grade 12 Pre-Calculus Mathematics (2009)
Distinguish between degree and radian measure, and solve problems, using both (A-1)	12P.T.1. Demonstrate an understanding of angles in standard position, expressed in degrees and radians. [C, CN, ME, R, V]
Describe the three primary trigonometric functions and their reciprocal functions as circular functions with reference to the unit circle and an angle in standard position (A-2)	12P.T.2. Develop and apply the equation of the unit circle. [CN, R, V]
	12P.T.3. Solve problems, using the six trigonometric ratios for angles expressed in radians and degrees. [C, ME, PS, R, T, V]
Determine the exact values of trigonometric ratios for any multiples of 0°, 30°, 45°, 60°, and 90° as well as 0, $\frac{\pi}{6}$, $\frac{\pi}{4}$, $\frac{\pi}{3}$, and $\frac{\pi}{2}$ (A-3)	12P.T.3. Solve problems, using the six trigonometric ratios for angles expressed in radians and degrees. [C, ME, PS, R, T, V]
Solve first and second degree trigonometric equations over specified domains (A-4)	12P.T.5. Solve, algebraically and graphically, first and second degree trigonometric equations with the domain expressed in degrees and radians. [C, CN, PS, R, T, V]
Determine the general solutions to trigonometric equations where the domain is the set of real numbers (A-5)	12P.T.5. Solve, algebraically and graphically, first and second degree trigonometric equations with the domain expressed in degrees and radians. [C, CN, PS, R, T, V]
Draw (using technology), sketch, and analyze the graphs of sine, cosine, and tangent functions and their inverses for • Domain and range • Amplitude, if appropriate • Period, if appropriate • Asymptotes, if any • Intercepts (A-6)	12P.T.4. Graph and analyze the trigonometric functions sine, cosine and tangent to solve problems. [C, CN, PS, T, V] 12P.R.6. Demonstrate an understanding of inverses of relations. [C, CN, R, V]
Describe how various translations of functions affect graphs and their related equations: • $y = f(x-h)$ • $y - k = f(x)$ or $y = f(x) + k$ (B -1)	12P.R.2. Demonstrate an understanding of the effects of horizontal and vertical translations on the graphs of functions and their related equations. [C, CN, R, V]
Describe how various stretches or compressions of functions affect graphs and their related equations: • $y = af(x)$ • $y = f(bx)$ (B-2)	12P.R.3. Demonstrate an understanding of the effects of horizontal and vertical compressions and stretches on the graphs of functions and their related equations. [C, CN, R, V]

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R: Reasoning   T: Technology   V: Visualization

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Describe how reflections of functions in both axes and in the line $y = x$ affect graphs and their related equations: • $y = f(-x)$ • $y = -f(x)$ • $y = f^{-1}(x)$ (B-3)	12P.R.5. Demonstrate an understanding of the effects of reflections on the graphs of functions and their related equations, including reflections through the: • x-axis • y-axis • line $y = x$. [C, CN, R, V] 12P.R.6. Demonstrate an understanding of inverses of relations. [C, CN, R, V]
Using the graph and/or the equation of $f(x)$, describe and sketch $\dfrac{1}{f(x)}$ (B-4)	12P.R.14. Graph and analyze rational functions (limited to numerators and denominators that are monomials, binomials or trinomials). [C, CN, R, T, V]
Using the graph and/or the equation of $f(x)$, describe and sketch $\lvert f(x) \rvert$ (B-5)	
Describe and perform single transformations and combinations of transformations on functions and relations (B-6)	12P.R.4. Apply translations, compressions and stretches to the graphs and equations of functions. [C, CN, R, V]
Model and solve problems using trigonometric functions (B-7)	12P.T.4. Graph and analyze the trigonometric functions sine, cosine and tangent to solve problems. [C, CN, PS, T, V]
Analyze trigonometric identities graphically and verify them algebraically (C-1)	12P.T.6. Prove trigonometric identities, using: • reciprocal identities • quotient identities • Pythagorean identities • sum or difference identities (restricted to sine, cosine and tangent) • double-angle identities (restricted to sine, cosine and tangent). [C, R, T, V]
Use sum, difference, and double angle identities for sine, cosine, and tangent to verify and simplify trigonometric expressions (C-2)	12P.T.6. Prove trigonometric identities, using: • reciprocal identities • quotient identities • Pythagorean identities • sum or difference identities (restricted to sine, cosine and tangent) • double-angle identities (restricted to sine, cosine and tangent). [C, R, T, V]
Graph and analyze exponential functions **(D-1)**	12P.R.9. Graph and analyze exponential and logarithmic functions. [C, CN, T, V]
Solve exponential equations having bases that are powers of one another (D-2)	12P.R.10. Solve problems that involve exponential and logarithmic equations. [C, CN, PS, R]

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Define logarithm and change exponential statements to equivalent logarithmic statements and vice versa (D-3)	12P.R.7. Demonstrate an understanding of logarithms. [C, CN, ME, R]
Graph and analyze logarithmic functions (D-4)	12P.R.7. Demonstrate an understanding of logarithms. [C, CN, ME, R] 12P.R.9. Graph and analyze exponential and logarithmic functions. [C, CN, T, V]
Simplify and expand logarithmic expressions using the laws of logarithms (D-5)	12P.R.8. Demonstrate an understanding of the product, quotient and power laws of logarithms. [C, CN, R, T]
Solve and verify exponential and logarithmic equations (D-6)	12P.R.10. Solve problems that involve exponential and logarithmic equations. [C, CN, PS, R]
Use the concept of base e in analyzing problems involving exponential and logarithmic functions (D-7)	12P.R.10. Solve problems that involve exponential and logarithmic equations. [C, CN, PS, R]
Model, and apply exponential and logarithmic functions (D-8)	12P.R.9. Graph and analyze exponential and logarithmic functions. [C, CN, T, V]
Use factorial notation and the fundamental counting principle for solving problems (E-1)	12P.P.1 Apply the fundamental counting principle to solve problems. [C, CN, PS, R, V]
Determine the number of permutations of n different objects taken r at a time, and use this to solve problems (E-2)	12P.P.2. Determine the number of permutations of n elements taken r at a time to solve problems. [C, PS, R, V]
Determine the number of combinations of n different objects taken r at a time, and use this to solve problems (E-3)	12P.P.3. Determine the number of combinations of n different elements taken r at a time to solve problems. [C, PS, R, V]
Solve problems, using the binomial theorem for $(a+b)^N$ where N belongs to the set of natural numbers (E-4)	12P.P.4. Expand powers of a binomial in a variety of ways, including using the binomial theorem (restricted to exponents that are natural numbers). [C, CN, R, V]
Classify conic sections according to shape or according to a given equation in general or standard (completed square) form (vertical or horizontal axis of symmetry only) (F-1)	
Convert a given equation of a conic section from general to standard form and vice versa (F-2)	
Sketch and analyze the graphs of conic sections for: - domain and range - asymptotes, if any - centre - vertices axes of symmetry (F-3)	

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Construct a sample space for two or three events (G-1)	
Solve problems involving the probabilities of independent and dependent events (G-2)	
Solve problems using the probabilities of mutually exclusive and complementary events (G-3)	
Determine the conditional probability of two events (G-4)	
Solve probability problems involving • permutations, combinations • conditional probability (G-5)	
Derive and apply expressions to represent general terms for geometric growth (H-1)	
Solve problems involving finite geometric series (H-2)	
Apply infinite geometric processes to solve problems (H-3)	
Find the population standard deviation of a data set or probability distribution, using technology (I-1)	
Use z-scores and z-score tables to solve problems (I-2)	
Use the normal distribution and the normal approximation to the binomial distribution to solve problems involving confidence intervals for large samples (I-3)	
	12P.R.1. Demonstrate an understanding of operations on, and compositions of, functions. [CN, R, T, V]
	12P.R.11. Demonstrate an understanding of factoring polynomials of degree greater than 2 (limited to polynomials of degree ≤ 5 with integral coefficients). [C, CN, ME]
	12P.R.12. Graph and analyze polynomial functions (limited to polynomial functions of degree ≤ 5). [C, CN, PS, T, V]
	12P.R.13. Graph and analyze radical functions (limited to functions involving one radical). [C, CN, R, T, V]

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