CURRICULUM CONNECTIONS

PRESCRIBED LEARNING OUTCOMES

A PATTERNS AND RELATIONS Patterns – *Geometric Sequences and Series*	*It is expected that students will:* A1 derive and apply expressions to represent general terms for geometric growth and to solve problems A2 derive and apply expressions to represent sums for geometric growth and to solve problems A3 estimate sums of expressions represented by infinite geometric processes where the common ratio, r, is $-1 < r < 1$
Variables and Equations Relations and Functions – *Logarithms and Exponents*	A4 solve exponential equations having bases that are powers of one another A5 solve and verify exponential and logarithmic equations A6 solve and verify exponential and logarithmic identities A13 change functions from exponential form to logarithmic form and vice versa A14 model, graph, and apply exponential functions to solve problems *Clarification: Students should be familiar with using base e in continuous growth and decay problems.* A15 model, graph, and apply logarithmic functions to solve problems
Variables and Equations Relations and Functions – *Trigonometry*	A7 distinguish between degree and radian measure, and solve problems using both A8 determine the exact and the approximate values of trigonometric ratios for any multiples of 0°, 30°, 45°, 60° and 90°, and 0 rad, $\frac{\pi}{6}$ rad, $\frac{\pi}{4}$ rad, $\frac{\pi}{3}$ rad, $\frac{\pi}{2}$ rad *Clarification: This includes negative angles and angles greater than 2π rad or 360 degrees.* A9 solve first and second degree trigonometric equations over a specified domain – *algebraically* – *graphically* *Clarification: It should be noted that equations could be solved over any specified domain,* ***not*** *restricted to* $0 \le x < 2\pi$. *This includes solutions to trigonometric equations involving multiple angles,* $k\theta$, *where* $k = \frac{1}{3}, \frac{1}{2}, 2, 3, 4, 5$. *Some solutions to trigonometric equations may involve the use of identities.*

A10 determine the general solutions to trigonometric equations where the domain is the set of real numbers

Clarification: It is expected that students will indicate that "n is an integer" when giving general solutions. This includes solutions to trigonometric equations involving multiple angles, $k\theta$, where $k = \frac{1}{3}, \frac{1}{2}, 2, 3, 4, 5$. Also, when asked to solve a trigonometric equation "over the set of real numbers", it is expected that students must use radian measure. Some solutions to trigonometric equations may involve the use of identities.

A11 analyze trigonometric identities
- *graphically*
- *algebraically for general cases*

Clarification: It should be noted that a numerical or graphical justification of an identity does not prove the identity.

A12 use sum, difference, and double angle identities for sine and cosine to verify and simplify trigonometric expressions

Clarification: It should be noted that a numerical or graphical justification of an identity does not prove the identity. It should also be noted that students should be able to combine reciprocal and rational identities with double angle identities; for example:

$$\tan 2\theta = \frac{\sin 2\theta}{\cos 2\theta}, \csc 2\theta = \frac{1}{\sin 2\theta}, \sec 2\theta = \frac{1}{\cos 2\theta}$$

A16 describe the three primary trigonometric functions as circular functions with reference to the unit circle and an angle in standard position

A17 sketch and analyze the graphs of sine, cosine and tangent functions, for
- *amplitude, if defined*
- *period*
- *domain and range*
- *asymptotes, if any*
- *behaviour under transformations*

Clarification: Graphs of the reciprocal trigonometric functions are analyzed in a similar manner to the graphs of the sine, cosine and tangent functions. Transformation on the graphs of reciprocal trigonometric functions are limited to horizontal and/or vertical expansions or compressions (i.e. no translations or reflections).

A18 use trigonometric functions to model and solve problems

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B SHAPE AND SPACE	*It is expected that students will:*
Transformations – *Transformations* *Clarification: Students need to be familiar with the term "invariant points" as points that are not altered by a transformation.*	B1 describe how vertical and horizontal translations of functions affect graphs and their related equations: $y = f(x-h)$ $y - k = f(x)$ B2 describe how compressions and expansions of functions affect graphs and their related equations: $y = af(x)$ $y = f(kx)$ B3 describe how reflections of functions in both axes and in the line $y = x$ affect graphs and their related equations: $y = f(-x)$ $y = -f(x)$ $y = f^{-1}(x)$ B4 using the graph and/or the equation of $f(x)$, describe and sketch $\frac{1}{f(x)}$ B5 using the graph and/or the equation of $f(x)$, describe and sketch $\lvert f(x)\rvert$. B6 describe and perform single transformations and combinations of transformations on functions and relations *Clarification: The absolute value of a function and the reciprocal of a function may also be combined with transformations.*

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C STATISTICS AND PROBABILITY Chance and Uncertainty – *Combinatorics*	*It is expected that students will:* C1 use the fundamental counting principle to determine the number of different ways to perform multi-step operations C2 use factorial notation to determine different ways of arranging n distinct objects in a sequence *Clarification: Factorial notation can also be used to determine different ways of arranging n objects, some of which are identical. Pathway problems can also provide an example of this use of factorial notation.* C3 determine the number of permutations of n different objects taken r at a time, and use this to solve problems C4 determine the number of combinations of n different objects taken r at a time, and use this to solve problems C5 solve problems, using the binomial theorem where the exponent n belongs to the set of natural numbers *Clarification: Irregular pathway questions are considered an application of the binomial theorem.*
C STATISTICS AND PROBABILITY Chance and Uncertainty – *Probability*	C5 solve problems, using the binomial theorem where the exponent n belongs to the set of natural numbers *Clarification: The binomial theorem can also be used to solve problems involving binomial **probability** distributions* C6 construct a sample space for up to three events C7 classify events as independent or dependent C8 solve problems, using the probabilities of mutually exclusive and complementary events C9 determine the conditional probability of two events C10 solve probability problems involving permutations, combinations, and conditional probability