



*Algebra 2 and Trigonometry* is the capstone course of the three units of credit required for a Regents diploma. This course is a continuation and extension of the two courses that preceded it. While developing the algebraic techniques that will be required of those students that continue their study of mathematics, this course is also intended to continue developing alternative solution strategies and algorithms. For example, technology can provide to many students the means to address a problem situation to which they might not otherwise have access. Within this course, the number system will be extended to include imaginary and complex numbers. The families of functions to be studied will include polynomial, absolute value, radical, trigonometric, exponential, and logarithmic functions. Problem situations involving direct and indirect variation will be solved. Problems resulting in systems of equations will be solved graphically and algebraically. Algebraic techniques will be developed to facilitate rewriting mathematical expressions into multiple equivalent forms. Data analysis will be extended to include measures of dispersion and the analysis of regression that model functions studied throughout this course. Associated correlation coefficients will be determined, using technology tools and interpreted as a measure of strength of the relationship. Arithmetic and geometric sequences will be expressed in multiple forms, and arithmetic and geometric series will be evaluated. Binomial experiments will provide the basis for the study of probability theory and the normal probability distribution will be analyzed and used as an approximation for these binomial experiments. Right triangle trigonometry will be expanded to include the investigation of circular functions. Problem situations requiring the use of trigonometric equations and identities will also be investigated.

## **CROSSWALK**

### **Comparison of 1999 Core Curriculum and 2005 Core Curriculum for High School Mathematics September 2005**

The following chart lists the concepts and skills in Algebra (2005 Core) and indicates where it was included in the 1999 Core.

## **ALGEBRA 2 and TRIGONOMETRY**

<b>Number Sense and Operations Strand</b>			
<b>2005 Core Curriculum</b>		<b>1999 Core Curriculum</b>	
<b>Performance Indicator</b>	<b>Concept/Skill</b>	<b>Key Idea</b>	<b>Concept/Skill</b>
A2.N.1	Evaluate numerical expressions with negative and/or fractional exponents, without the aid of a calculator (when the answers are rational numbers)	Math B – 3D	Evaluate expressions with fractional exponents
A2.N.2	Perform arithmetic operations with expressions containing irrational numbers in radical form	Math A – 3A	Operate with radicals: simplification, multiplication and division, and addition and subtraction
A2.N.3	Perform arithmetic operations with polynomial expressions containing rational coefficients	Math A – 3A	Addition and subtraction of polynomials: combining like terms Multiplication of polynomials Division of polynomials by monomials
A2.N.4	Perform arithmetic operations on irrational expressions	Math A – 3A	Operations with radicals
A2.N.5	Rationalize a denominator containing a radical expression	Math B – 2A	Rationalize denominators

2005 Core Curriculum		1999 Core Curriculum	
Performance Indicator	Concept/Skill	Key Idea	Concept/Skill
A2.N.6	Write square root of negative numbers in terms of $i$	Math B – 3D	Simplify square roots with negative radicands
A2.N.7	Simplify powers of $i$	Math B – 3D	Cyclic nature of the powers of $i$
A2.N.8	Determine the conjugate of a complex number		Implied by not directly stated
A2.N.9	Perform arithmetic operations on complex numbers	Math B – 3D	Basic arithmetic operations with complex numbers
A2.N.10	Know and apply sigma notation	Math B- 6F	Use of $\Sigma$ -notation

## ALGEBRA 2 and TRIGONOMETRY

<b>Algebra Strand</b>			
<b>2005 Core Curriculum</b>		<b>1999 Core Curriculum</b>	
<b>Performance Indicator</b>	<b>Concept/Skill</b>	<b>Key Idea</b>	<b>Concept/Skill</b>
A2.A.1	Solve absolute value equations and inequalities involving linear expressions in one variable	Math B- 7K	Solve equations using absolute values <ul style="list-style-type: none"> <li>• Absolute value inequalities</li> </ul>
A2.A.2	Use the discriminant to determine the nature of the roots of a quadratic equation	Math B – 7I	Determine from the discriminant of a quadratic equation whether the roots are imaginary, rational, or irrational
A2.A.3	Solve systems of equations involving one linear equation and one quadratic equation algebraically <i>Note: This includes rational equations that result in linear equations with extraneous roots.</i>	Math A – 7A  Math A – 7E	Algebraic solution of systems of linear equations, inequalities, and quadratic-linear pair by substitution method and addition-subtraction method  Solve systems of linear equations, inequalities, and quadratic-linear pair
A2.A.4	Solve quadratic inequalities in one and two variables, algebraically and graphically	Math B – 7K	Solve equations, using fractions, absolute values, and radicals <ul style="list-style-type: none"> <li>• Linear inequalities</li> <li>• Quadratic inequalities</li> </ul>
A2.A.5	Use direct and inverse variation to solve for unknown values		Not addressed
A2.A.6	Solve an application which results in an exponential function	Math B – 7E	Apply exponential functions in the solution of problems  Solve real-world problems by using linear, exponential, and quadratic functions
A2.A.7	Factor polynomial expressions completely		Not specifically addressed

<b>2005 Core Curriculum</b>		<b>1999 Core Curriculum</b>	
<b>Performance Indicator</b>	<b>Concept/Skill</b>	<b>Key Idea</b>	<b>Concept/Skill</b>
A2.A.8	Apply the rules of exponents to simplify expressions involving negative and/or fractional exponents	Math B – 4B	Manipulate symbolic representations to explore concepts at an abstract level <ul style="list-style-type: none"> <li>Use positive, negative, and zero exponents and be familiar with the laws used in working with expressions containing exponents</li> </ul>
A2.A.9	Rewrite algebraic expressions that contain negative exponents using only positive exponents	Math B – 4B	Manipulate symbolic representations to explore concepts at an abstract level <ul style="list-style-type: none"> <li>Use positive, negative, and zero exponents and be familiar with the laws used in working with expressions containing exponents</li> </ul>
A2.A.10	Rewrite algebraic expressions with fractional exponents as radical expressions		Not specifically addressed
A2.A.11	Rewrite algebraic expressions in radical form as expressions with fractional exponents		Not specifically addressed
A2.A.12	Evaluate exponential expressions, including those with base e		Not addressed
A2.A.13	Simplify radical expressions	Math A – 3A	Simplification of fractions
A2.A.14	Perform addition, subtraction, multiplication, and division of radical expressions	Math A – 3A	Operations with radicals: multiplication and division and addition and subtraction
A2.A.15	Rationalize denominators involving algebraic radical expressions	Math B – 2A	Rationalize denominators

2005 Core Curriculum		1999 Core Curriculum	
Performance Indicator	Concept/Skill	Key Idea	Concept/Skill
A2.A.16	Perform arithmetic operations with rational expressions and rename to lowest terms	Math B – 3A	Operations with fractions with polynomial denominators Add and subtract rational fractions with monomial and binomial denominators
A2.A.17	Simplify complex fractional expressions	Math A – 3A	Simplification of fractions – complex fractions not specifically named
A2.A.18	Evaluate logarithmic expressions in any base	Math B – 4B	Manipulate symbolic representations to explore concepts at an abstract level <ul style="list-style-type: none"> <li>• Rewrite the equality <math>\log_b a = c</math> as <math>a = b^c</math></li> <li>• Rewrite expressions involving exponents and logarithms</li> </ul>
A2.A.19	Apply the properties of logarithms to rewrite logarithmic expressions in equivalent forms	Math B – 4B  Math B – 7A	Manipulate symbolic representations to explore concepts at an abstract level <ul style="list-style-type: none"> <li>• Rewrite the equality <math>\log_b a = c</math> as <math>a = b^c</math></li> <li>• Rewrite expressions involving exponents and logarithms</li> </ul> Express exponential functions as logs
A2.A.20	Determine the sum and product of the roots of a quadratic equation by examining its coefficients		Not addressed
A2.A.21	Determine the quadratic equation, given the sum and product of its roots		Not addressed
A2.A.22	Solve radical equations	Math B – 7K	Solve equations using radicals <ul style="list-style-type: none"> <li>• Equations with radicals</li> </ul>
A2.A.23	Solve rational equations and inequalities	Math B – 7K	Solve fractional equations – no mention of inequalities

2005 Core Curriculum		1999 Core Curriculum	
Performance Indicator	Concept/Skill	Key Idea	Concept/Skill
A2.A.24	Know and apply the technique of completing the square		Not addressed
A2.A.25	Solve quadratic equations, using the quadratic formula		Not addressed
A2.A.26	Find the solution to polynomial equations of higher degree that can be solved using factoring and/or the quadratic formula		Not addressed
A2.A.27	Solve exponential equations with and without common bases		Not addressed
A2.A.28	Solve a logarithmic equation by rewriting as an exponential equation		Not addressed
A2.A.29	Identify an arithmetic or geometric sequence and find the formula for its <i>n</i> th term	Related to Math B – 4A	Represent problem situations symbolically by using sequences <ul style="list-style-type: none"> <li>• Use symbolic form to represent an explicit rule for a sequence</li> </ul>
A2.A.30	Determine the common difference in an arithmetic sequence	Related to Math B – 4A	Represent problem situations symbolically by using sequences <ul style="list-style-type: none"> <li>• Use symbolic form to represent an explicit rule for a sequence</li> </ul>
A2.A.31	Determine the common ratio in a geometric sequence	Related to Math B – 4A	Represent problem situations symbolically by using sequences <ul style="list-style-type: none"> <li>• Use symbolic form to represent an explicit rule for a sequence</li> </ul>

2005 Core Curriculum		1999 Core Curriculum	
Performance Indicator	Concept/Skill	Key Idea	Concept/Skill
A2.A.32	Determine a specified term of an arithmetic or geometric sequence	Related to Math B – 4A	Represent problem situations symbolically by using sequences <ul style="list-style-type: none"> <li>Use symbolic form to represent an explicit rule for a sequence</li> </ul>
A2.A.33	Specify terms of a sequence, given its recursive definition	Related to Math B – 4A	Represent problem situations symbolically by using sequences <ul style="list-style-type: none"> <li>Use symbolic form to represent an explicit rule for a sequence</li> </ul>
A2.A.34	Represent the sum of a series, using sigma notation	Related to Math B – 4A	Represent problem situations symbolically by using sequences <ul style="list-style-type: none"> <li>Use symbolic form to represent an explicit rule for a sequence</li> </ul>
A2.A.35	Determine the sum of the first $n$ terms of an arithmetic or geometric series	Related to Math B – 4A	Represent problem situations symbolically by using sequences <ul style="list-style-type: none"> <li>Use symbolic form to represent an explicit rule for a sequence</li> </ul>
A2.A.36	Apply the binomial theorem to expand a binomial and determine a specific term of a binomial expansion	Math B – 6F	Binomial Theorem
A2.A.37	Define a relation and function	Math B – 7A	Definition of a relation
A2.A.38	Determine when a relation is a function	Math B – 7A	Determining if a relation is a function
A2.A.39	Determine the domain and range of a function from its equation		Not directly addressed
A2.A.40	Write functions in functional notation		Not directly addressed
A2.A.41	Use functional notation to evaluate functions for given values in the domain	Math B – 7A	Notation for absolute value, composite functions

2005 Core Curriculum		1999 Core Curriculum	
Performance Indicator	Concept/Skill	Key Idea	Concept/Skill
A2.A.42	Find the composition of functions	Math B – 3B Math B – 3E Math B – 7J	3Develop an understanding of and use the composition of functions and transformations Evaluate and form the composition of functions Determine the value of compound functions
A2.A.43	Determine if a function is one-to-one, onto, or both		Not addressed
A2.A.44	Define the inverse of a function	Math B – 7A	Definition of inverse function
A2.A.45	Determine the inverse of a function and use composition to justify the result		Not directly addressed
A2.A.46	Perform transformations with functions and relations: $f(x + a)$ , $f(x) + a$ , $f(-x)$ , $-f(x)$ , $af(x)$	Math B – 7F	Apply and interpret transformations to functions <ul style="list-style-type: none"> <li>Use ideas of transformations to investigate the relationships between functions</li> </ul>
A2.A.47	Determine the center-radius form for the equation of a circle in standard form	Math B – 4L	Use algebraic relationships to analyze the conic sections
A2.A.48	Write the equation of a circle, given its center and a point on the circle	Math B- 4L	Use algebraic relationships to analyze the conic sections – not using a point on the circle
A2.A.49	Write the equation of a circle from its graph		Not directly addressed
A2.A.50	Approximate the solution to polynomial equations of higher degree by inspecting the graph		Note addressed
A2.A.51	Determine the domain and range of a function from its graph		Not directly addressed
A2.A.52	Identify relations and functions, using graphs	Implied in Math B –7A	Use function vocabulary and notation Determining if a relation is a function

2005 Core Curriculum		1999 Core Curriculum	
Performance Indicator	Concept/Skill	Key Idea	Concept/Skill
A2.A.53	Graph exponential functions of the form $y = b^x$ for positive values of $b$ , including $b = e$	Math B – 4J	Be able to sketch the effects of changing the value of $a$ in the function $y = a^x$ $B = e$ not addressed
A2.A.54	Graph logarithmic functions, using the inverse of the related exponential function	Math B – 7B	Represent and analyze logarithmic and exponential functions
A2.A.55	Express and apply the six trigonometric functions as ratios of the sides of right triangle	Math B – 5A	Use trigonometry as a method to measure indirectly <ul style="list-style-type: none"> <li>• Right triangle trigonometry</li> </ul>
A2.A.56	Know the exact and approximate values of the sine, cosine, and tangent of $0^\circ$ , $30^\circ$ , $45^\circ$ , $60^\circ$ , $90^\circ$ , $180^\circ$ , and $270^\circ$ angles	Math B – 5E	Determine the trigonometric functions in terms of the unit circle <ul style="list-style-type: none"> <li>• Special angles <math>30^\circ</math>, <math>45^\circ</math>, <math>60^\circ</math></li> </ul>
A2.A.57	Sketch and see the reference angle for angles in standard position	Math B – 5C Math B – 5E	Derive and apply formulas relating angle measure and arc degree measure in a circle <ul style="list-style-type: none"> <li>• Reference and conterminal angles</li> </ul> Reference angles
A2.A.58	Know and apply the co-function and reciprocal relationships between trigonometric ratios		Not directly addressed
A2.A.59	Use the reciprocal and co-function relationships to find the value of the secant, cosecant, and cotangent of $0^\circ$ , $30^\circ$ , $45^\circ$ , $60^\circ$ , $90^\circ$ , $180^\circ$ , and $270^\circ$ angles	Math B – 5E	Special angles $30^\circ$ , $45^\circ$ , $60^\circ$
A2.A.60	Sketch the unit circle and represent angles in standard position	Math B – 5E	Define the trigonometric functions in terms of the unit circle <ul style="list-style-type: none"> <li>• Sine, cosine, tangent, and their reciprocal functions on the unit circle</li> </ul>

2005 Core Curriculum		1999 Core Curriculum	
Performance Indicator	Concept/Skill	Key Idea	Concept/Skill
A2.A.61	Determine the length of an arc of a circle, given its radius and the measure of its central angle		Not addressed
A2.A.62	Find the value of trigonometric functions, if given a point on the terminal side of angle $\theta$	Application of 5E	Define the trigonometric functions in terms of the unit circle
A2.A.63	Restrict the domain of the sine, cosine, and tangent functions to ensure the existence of an inverse function		Not addressed
A2.A.64	Use inverse functions to find the measure of an angle, given its sine, cosine, or tangent		Not directly addressed
A2.A.65	Sketch the graph of the inverses of the sine, cosine, and tangent functions		Not addressed
A2.A.66	Determine the trigonometric functions of any angle, using technology		Technology not addressed
A2.A.67	Justify the Pythagorean identities	Math B – 7H	Apply axiomatic structure to algebra and geometry <ul style="list-style-type: none"> <li>Use the quotient identities, reciprocal identities, and the Pythagorean identities</li> </ul>
A2.A.68	Solve trigonometric equations for all values of the variable from $0^\circ$ to $360^\circ$	Math B – 7Q	Develop methods to solve trigonometric equations and verify trigonometric functions
A2.A.69	Determine amplitude, period, frequency, and phase shift, given the graph or equation of a periodic function		Not directly addressed
A2.A.70	Sketch and recognize one cycle of a function of the form $y = A\sin Bx$ or $y = A\cos Bx$		Not addressed
A2.A.71	Sketch and recognize the graphs of the functions $y = \sec(x)$ , $y = \csc(x)$ , $y = \tan(x)$ , and $y = \cot(x)$		Not addressed

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<b>Performance Indicator</b>	<b>Concept/Skill</b>	<b>Key Idea</b>	<b>Concept/Skill</b>
A2.A.72	Write the trigonometric function that is represented by a given periodic graph		Not addressed
A2.A.73	Solve for an unknown side of angle, using the Law of Sines or the Law of Cosines	Math B – 5F	Relate trigonometric relationships to general solutions of triangles <ul style="list-style-type: none"> <li>• Law of Sines</li> </ul>
A2.A.74	Determine the area of a triangle or a parallelogram, given the measure of two sides and the included angle	Math B – 5F	Relate trigonometric relationships to the area of a triangle <ul style="list-style-type: none"> <li>• Application of the sine function in the solution of the area of a triangle</li> </ul>
A2.A.75	Determine the solution(s) from the SSA situation (ambiguous case)	Math B- 5F	The ambiguous case
A2.A.76	Apply the angle sum and difference formulas for trigonometric functions	Math B – 5C	Derive and apply formulas relating angle measure and arc degree measure in a circle <ul style="list-style-type: none"> <li>• Sum and difference of two angles</li> </ul>
A2.A.77	Apply the double-angle and half-angle formulas for trigonometric functions	Math B – 5C	Derive and apply formulas relating angle measure and arc degree measure in a circle <ul style="list-style-type: none"> <li>• Double and half angles for sine and cosine</li> </ul>

## ALGEBRA 2 and TRIGONOMETRY

<b>Measurement Strand</b>			
<b>2005 Core Curriculum</b>		<b>1999 Core Curriculum</b>	
<b>Performance Indicator</b>	<b>Concept/Skill</b>	<b>Key Idea</b>	<b>Concept/Skill</b>
A2.M.1	Define radian measure	Math B - 4M Math B - 5E	Radian measure Radian measure
A2.M.2	Convert between radian and degree measures		Not specifically addressed

## ALGEBRA 2 and TRIGONOMETRY

<b>Statistics and Probability Strand</b>			
<b>2005 Core Curriculum</b>		<b>1999 Core Curriculum</b>	
<b>Performance Indicator</b>	<b>Concept/Skill</b>	<b>Key Idea</b>	<b>Concept/Skill</b>
A2.S.1	Understand the differences among various kinds of studies (e.g., survey, observation, controlled experiment)		Not directly addressed
A2.S.2	Determine factors which may affect the outcome of a survey		Not directly addressed
A2.S.3	Calculate measures of central tendency with group frequency distributions	Math A – 5D Math B – 6F	Use statistical methods including the measures of central tendency to describe and compare data Create and interpret applications of discrete and continuous probability distributions <ul style="list-style-type: none"> <li>• Measures of central tendencies</li> </ul>
A2.S.4	Calculate measures of dispersion (range, quartiles, interquartile range, standard deviation, variance) for both samples and populations	Math A - 5D Math B – 6F	Use statistical methods including the measures of central tendency to describe and compare data Create and interpret applications of discrete and continuous probability distributions <ul style="list-style-type: none"> <li>• Quartiles and percentiles</li> <li>• Range</li> <li>• Measures of dispersion</li> <li>• Variance using the calculator</li> <li>• Standard deviation using the calculator</li> </ul>

2005 Core Curriculum		1999 Core Curriculum	
Performance Indicator	Concept/Skill	Key Idea	Concept/Skill
A2.S.5	Know and apply the characteristics of the normal distribution	Math B – 5G Math B – 7P	Apply the normal curve and its properties to familiar contexts Use the normal curve to answer questions about data <ul style="list-style-type: none"> <li>• Standard deviation for grouped data</li> <li>• Measures of central tendency</li> </ul>
A2.S.6	Determine from a scatter plot whether a linear, logarithmic, exponential, or power regression model is most appropriate	Math B – 6E	Use curve fitting to fit data <ul style="list-style-type: none"> <li>• Linear, logarithmic, exponential, and power regressions from scatter plots</li> <li>• Linear correlation coefficient</li> </ul>
A2.S.7	Determine the function for the regression model, using appropriate technology, and use the regression function to interpolate and extrapolate from the data	Math B – 6G	Make predictions based on interpolations and extrapolations of data
A2.S.8	Interpret within the linear regression model the value of the correlation coefficient as a measure of the strength of the relationship	Math B – 6E	Use curve fitting to fit data <ul style="list-style-type: none"> <li>• Linear correlation coefficient</li> </ul>
A2.S.9	Differentiate between situations requiring permutations and those requiring combinations	Math A – 6D	Determine probabilities, using permutations and combinations
A2.S.10	Calculate the number of possible permutations $({}_nP_r)$ of $n$ items taken $r$ at a time	Math A – 6D	Determine probabilities, using permutations and combinations
A2.S.11	Calculate the number of possible combinations $({}_nC_r)$ of $n$ items taken $r$ at a time	Math A – 6D	Determine probabilities, using permutations and combinations

<b>2005 Core Curriculum</b>		<b>1999 Core Curriculum</b>	
<b>Performance Indicator</b>	<b>Concept/Skill</b>	<b>Key Idea</b>	<b>Concept/Skill</b>
A2.S.12	Use permutations, combinations, and the Fundamental Principle of Counting to determine the number of elements in a sample space and a specific subset (event)	Math A – 6D	Use the concept of random variable in computing probabilities <ul style="list-style-type: none"> <li>• Counting principle</li> <li>• Sample space</li> </ul>
A2.S.13	Calculate theoretical probabilities, including geometric applications	Math A – 6A	Theoretical versus empirical probability
A2.S.14	Calculate empirical probabilities	Math 7/8 – 6C Math A – 6A	Conduct and predict outcomes of experiments with independent events Theoretical versus empirical probability
A2.S.15	Know and apply the binomial probability formula to events involving the terms <i>exactly</i> , <i>at least</i> , and <i>at most</i>	Math B – 6C	Interpret probabilities in real-world situations <ul style="list-style-type: none"> <li>• Applications of the probability of exactly, at least, or at most <math>r</math> successes in <math>n</math> trials of a Bernoulli experiment</li> <li>• Simple applications of the binomial theorem</li> </ul>
A2.S.16	Use the normal distribution as an approximation for binomial probabilities	Math B – 6F	Create and interpret applications of discrete and continuous probability distributions <ul style="list-style-type: none"> <li>• Normal approximation for the binomial distribution</li> </ul>