Algebra 2 ELT Overview

Essential Learning Target	*Standards*	*Prerequisite Skill*
1. I can use the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers (N.CN.2)	**Perform arithmetic operations with complex numbers.** **MGSE9-12.N.CN.2** Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	***MGSE9-12.N.RN.2*** *I can simplify expressions that involve radicals.*
2. I can use conjugates to divide complex numbers. (N.CN.3)	**Perform arithmetic operations with complex numbers.** **MGSE9-12.N.CN.3** Find the conjugate of a complex number; use the conjugate to find the ~~absolute value (modulus) and~~ quotient of complex numbers.	***MGSE7.NS.1d*** ***MGSE7.NS.2c*** *I can add, subtract, multiply, and divide integers.*
3. I can determine complex solutions of quadratic equations by taking square roots, completing the square, and using the quadratic formula. (N.CN.7)	**Use complex numbers in polynomial identities and equations.** **MGSE9-12.N.CN.7** Solve quadratic equations with real coefficients that have complex solutions by (but not limited to) square roots, completing the square, and the quadratic formula.	***MGSE9-12.A.REI.4*** *I can solve quadratic equations in one variable by factoring, taking square roots, completing the square, or using the quadratic formula.*
4. I can add, subtract, and multiply polynomial expressions. (A.APR.1)	**Perform arithmetic operations on polynomials** **MGSE9-12.A.APR.1** Add, subtract, and multiply polynomials; understand that polynomials form a system analogous to the integers in that they are closed under these operations.	***MGSE7.EE.1*** *I can add, subtract, factor, and multiply linear expressions*
5. I can divide polynomial expressions using synthetic and long division. (A.APR.6)	**Rewrite rational expressions** **MGSE9-12.A.APR.6** Rewrite simple rational expressions in different forms using inspection, long division, or a computer algebra system; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x).	***MGSE6.NS.2*** *I can divide multi-digit numbers using the standard algorithm.*
6. I can find the zeros of a polynomial function using the Fundamental Theorem of Algebra, the Remainder Theorem, factoring, and technology.(A.APR.2-3)	**Understand the relationship between zeros and factors of polynomials** **MGSE9-12.A.APR.2** Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x). **MGSE9-12.A.APR.3** Identify zeros of polynomials when suitable factorizations are available, ~~and use the zeros to construct a rough graph of the function defined by the polynomial.~~ **Use complex numbers in polynomial identities and equations.** **MGSE9-12.N.CN.8** Extend polynomial identities to include factoring with complex numbers. *For example, rewrite $x^2 + 4$ as $(x + 2i)(x – 2i)$.*	***MGSE9-12.F.IF.2*** *I can evaluate functions at any given point.*

	MGSE9-12.N.CN.9 Use the Fundamental Theorem of Algebra to find all roots of a polynomial equation **Represent and solve equations and inequalities graphically** **MGSE9-12.A.REI.11** Using graphs, tables, or successive approximations, show that the solution to the equation f(x) = g(x) is the x-value where the y-values of f(x) and g(x) are the same.	
7. I can graph polynomial functions using zeros, key features, and transformations of parent graphs. (F.IF.7)	**MGSE9-12.F.IF.7** Graph functions expressed algebraically and show key features of the graph both by hand and by using technology. **Interpret functions that arise in applications in terms of the context** **MGSE9-12.F.IF.4** Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; ~~and periodicity~~. **Build new functions from existing functions** **MGSE9-12.F.BF.3** Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them	***MGSE9-12.F.IF.7a*** *I can graph linear and quadratic functions.*
8. I can compare properties of two polynomial functions represented in different ways (verbally, algebraically, numerically, or graphically). (F.IF.9)	**Analyze functions using different representations** **MGSE9-12.F.IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one function and an algebraic expression for another, say which has the larger maximum.*	***MGSE8.F.2*** *I can compare properties of two linear functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).*
9. I can use properties of exponents to translate between radical and exponential forms of polynomial expressions (N.RN.2)	**Extend the properties of exponents to rational exponents.** **MGSE9-12.N.RN.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents.	***MGSE8.EE.1*** *I can simplify expressions involving integer exponents.*
10. I can find the key features of and then graph the following family of functions (F.IF.7b) ● Square root ● Cube root ● Piecewise step ● Absolute value	**Analyze functions using different representations** **MGSE9-12.F.IF.7b** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. **Interpret functions that arise in applications in terms of the context** **MGSE9-12.F.IF.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it	***MGSE9-12.F.IF.5*** *I can identify the domain of a function from its graph.*

	describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* **Analyze functions using different representations** **MGSE9-12.F.IF.7** Graph functions expressed algebraically and show key features of the graph both by hand and by using technology. **Build new functions from existing functions** **MGSE9-12.F.BF.3** Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.	
11. I can find the key features (zeros, asymptotes, end behavior) of and then graph rational functions (F.IF.7d)	**Analyze functions using different representations** **MGSE9-12.F.IF.7d** Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. **Interpret functions that arise in applications in terms of the context** **MGSE9-12.F.IF.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* **Analyze functions using different representations** **MGSE9-12.F.IF.7** Graph functions expressed algebraically and show key features of the graph both by hand and by using technology. **Build new functions from existing functions** **MGSE9-12.F.BF.3** Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.	***MGSE9-12.F.BF.3*** *I can determine the effect of vertical and horizontal translations, and reflections over the x-axis on the parent graph of quadratic functions.*
12. I can add, subtract, multiply, and divide rational expressions. (A.APR.7)	**Rewrite rational expressions** **MGSE9-12.A.APR.7** Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.	***MGSE7.NS.1d*** ***MGSE7.NS.2c*** *I can add, subtract, multiply, and divide fractions.*
13. I can solve rational and radical equations in one variable and determine extraneous solutions. (A.REI.2)	**Understand solving equations as a process of reasoning and explain the reasoning** **MGSE9-12.A.REI.2** Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	***MGSE9-12.A.REI.1*** *I can apply order of operations and inverse operations (SVU) to solve linear equations.*

14. I can compose functions and determine the meaning of that composition.	**Build a function that models a relationship between two quantities** **MGSE9-12.F.BF.1c** Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* **MGSE9-12.F.BF.1** Write a function that describes a relationship between two quantities. **MGSE9-12.F.BF.1b** Combine standard function types using arithmetic operations in contextual situations (Adding, subtracting, and multiplying functions of different types).	***MGSE9-12.F.IF.1*** *I can represent functions using graphs, tables, or equations.*
15. I can determine the inverse of a function and verify by composition that one function is the inverse of the other. (F.BF.4, 4b)	**Build new functions from existing functions**. **MGSE9-12.F.BF.4** Find inverse functions. **MGSE9-12.F.BF.4a** Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, $f(x) = 2(x^3)$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$. **MGSE9-12.F.BF.4b** Verify by composition that one function is the inverse of another. **MGSE9-12.F.BF.4c** Read values of an inverse function from a graph or a table, given that the function has an inverse.	***MGSE5.OA.1*** *I can simplify expressions using the order of operations.*
16. I can solve exponential and logarithmic equations. (F.BF.5)	**Build new functions from existing functions** **MGSE9-12.F.BF.5** Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.	***MGSE6.EE.1*** *I can evaluate numerical expressions involving whole-number exponents.*
17. I can use exponential and logarithmic equations to solve real world problems. (F.BF.5)	**Build new functions from existing functions** **MGSE9-12.F.BF.5** Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents **Analyze functions using different representations** **MGSE9-12.F.IF.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. **MGSE9-12.F.IF.8b** Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{(12t)}$, $y = (1.2)^{(t/10)}$, *and classify them as representing exponential growth and decay.* **Write expressions in equivalent forms to solve problems** **MGSE9-12.A.SSE.4** Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.* **Create equations that describe numbers or relationships** **MGSE9-12.A.CED.1** Create equations and inequalities in one variable and use them to solve problems. Include equations arising from ~~linear, quadratic, simple rational, and~~ exponential functions ~~(integer inputs only)~~. **MGSE9-12.A.CED.2** Create ~~linear, quadratic, and~~ exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with	***MGSE9-12.F.LE.2*** *I can use exponential functions to solve problems.*

	labels and scales. (*The phrase "in two or more variables" refers to formulas like the compound interest formula, in which* $A = P(1 + r/n)^{nt}$ *has multiple variables.*) **MGSE9-12.A.CED.4** Rearrange formulas to highlight a quantity of interest using the same reasoning as in solving equations. *Examples: Rearrange Ohm's law* $V = IR$ *to highlight resistance R; Rearrange area of a circle formula* $A = \pi r^2$ *to highlight the radius r.* **Construct and compare linear, quadratic, and exponential models and solve problems** **MGSE9-12.F.LE.4** For exponential models, express as a logarithm the solution to $ab^{(ct)} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. **Write expressions in equivalent forms to solve problems** **MGSE9-12.A.SSE.3c** Use the properties of exponents to transform expressions for exponential functions. *For example, the expression* 1.15^t*, where t is in years, can be rewritten as* $[1.15^{(1/12)}]^{(12t)} \approx 1.012^{(12t)}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*	
18. I can graph logarithmic functions showing intercepts, and end behavior. (F.IF.7e)	**Analyze functions using different representations** **MGSE9-12.F.IF.7e** Graph exponential and logarithmic functions, showing intercepts and end behavior, ~~and trigonometric functions, showing period, midline, and amplitude.~~	*MGSE9-12.F.BF.3* *I can determine the effect of vertical and horizontal translations, and reflections over the x-axis on the parent graph of exponential functions.*
19. I can make inferences about population parameters based on appropriate sampling methods and sound statistical reasoning. (S.IC.1)	**Understand and evaluate random processes underlying statistical experiments** **MGSE9-12.S.IC.1** Understand statistics as a process for making inferences about population parameters based on a random sample from that population. **MGSE9-12.S.IC.2** Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0. 5. Would a result of 5 tails in a row cause you to question the model?* **Make inferences and justify conclusions from sample surveys, experiments, and observational studies** **MGSE9-12.S.IC.3** Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. **MGSE9-12.S.IC.4** Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. **MGSE9-12.S.IC.5** Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. **MGSE9-12.S.IC.6** Evaluate reports based on data. *For example, determining quantitative or categorical data; collection methods; biases or flaws in data.*	*MGSE7.SP.1* *I can examine sample size and sampling methods to determine if they produce representative samples that support valid inferences.*
20. I can estimate population percentages based on mean, standard deviation, and	**Summarize, represent, and interpret data on a single count or measurement variable**	*MGSE6.SP.2* *I can describe a statistical data set*

distribution.(S.ID.4)	**MGSE9-12.S.ID.4** Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. **MGSE9-12.S.ID.2** Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, ~~mean absolute deviation~~, standard deviation) of two or more different data sets.	*using center, spread, and shape.*