Course Title:	**Algebra 2**
Head of Department:	Bassam Raychouni (bassam@greenwood.sh.ae)
Teacher(s) + e-mail:	Not offered this year
Cycle/Division:	High School
Grade Level:	**11**
Credit Unit:	1
Duration:	one year
Course Prerequisites:	Algebra I

Department's Vision:	• Produce the highest standards of excellence in teaching mathematics to prepare students to flourish and fulfill personal ambitions and career goals in an increasingly technological society.
Department's Mission:	• Develop students' abilities to become mathematical thinkers, lifelong learners, and link learning to life through problem solving and utilizing the high-tech resources.

COURSE DESCRIPTION:

Unit 3: Polynomial Functions, Expressions, and Equations
- *Polynomial Functions*
- *Polynomials*

Unit 4: Rational Functions, Expressions, and Equations
- *Rational Functions*
- *Rational Expressions and Equations*

Unit 5: Radical Functions, Expressions, and Equations
- *Radical Functions*
- *Radical Expressions and Equations*

Unit 6: Exponential and Logarithmic Functions and Equations
- *Sequences and Series*
- *Exponential Functions*
- *Modeling with Exponential and Other Functions*
- *Logarithmic Functions*
- *Logarithmic Properties and Exponential Equations*

Unit 7: Trigonometric Functions
- *Graphing Trigonometric Functions*

GENERAL COURSE LEARNING OBJECTIVES:

- Interpret the structure of expressions.
- Write expressions in equivalent forms to solve problems.
- Perform arithmetic operations on polynomials
- Understand the relationship between zeros and factors of polynomials.
- Use polynomial identities to solve problems.
- Rewrite rational expressions.
- Create equations that describe numbers or relationships.
- Understand solving equations as a process of reasoning and explain the reasoning.
- Solve equations and inequalities in one variable.
- Solve systems of equations.
- Represent and solve equations and inequalities graphically.
- Understand the concept of a function and use function notation.
- Interpret functions that arise in applications in terms of the context.
- Analyze functions using different representations.
- Build a function that models a relationship between two quantities.
- Build new functions from existing functions.
- Interpret expressions for functions in terms of the situation they model.
- Model periodic phenomena with trigonometric functions

I.

STANDARDS/BENCHMARKS:

❖ Algebra: Seeing Structure in Expressions A-SSE

Interpret the structure of expressions

1. Interpret expressions that represent a quantity in terms of its context.★

a. Interpret parts of an expression, such as terms, factors, and coefficients.

b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)n as the product of P and a factor not depending on P.

2. Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2).

Write expressions in equivalent forms to solve problems

3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★

a. Factor a quadratic expression to reveal the zeros of the function it

defines.
b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
c. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be rewritten as (1.151/12)12t ≈ 1.01212t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.
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.★

- Arithmetic with Polynomials and Rational Expressions A -APR

Perform arithmetic operations on polynomials
1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
Understand the relationship between zeros and factors of polynomials
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).
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 polynomial identities to solve problems
4. Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity (x2 + y2)2 = (x2 – y2)2 + (2xy)2 can be used to generate Pythagorean triples.
5. (+) Know and apply the Binomial Theorem for the expansion of (x + y)n in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.1
Rewrite rational expressions
6. Rewrite simple rational expressions in different forms; 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), using inspection, long division, or, for the more complicated examples, a computer algebra system.
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.

- Creating Equations★ A -CED

Create equations that describe numbers or relationships

1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.
4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R.

- Reasoning with Equations and Inequalities A -RE I

Understand solving equations as a process of reasoning and explain the reasoning
1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
Solve equations and inequalities in one variable
3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
4. Solve quadratic equations in one variable.
a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)2 = q$ that has the same solutions. Derive the quadratic formula from this form.
b. Solve quadratic equations by inspection (e.g., for $x2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.
Solve systems of equations
5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
7. Solve a simple system consisting of a linear equation and a quadratic

equation in two variables algebraically and graphically. For example, find the points of intersection between the line y = –3x and the circle x2 + y2 = 3.
8. (+) Represent a system of linear equations as a single matrix equation in a vector variable.
9. (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).
Represent and solve equations and inequalities graphically
10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
11. Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.★
12. Graph the solutions to a linear inequality in two variables as a halfplane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

- ❖ Functions: Interpreting Functions F-IF

Understand the concept of a function and use function notation
1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).
2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.
Interpret functions that arise in applications in terms of the context
4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums

and minimums; symmetries; end behavior; and periodicity.★
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.★
6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★
Analyze functions using different representations
7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★
a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
b. 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 or decay
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 quadratic function and an algebraic expression for another, say which has the larger maximum.
Building Functions F-BF
Build a function that models a relationship between two quantities
1. Write a function that describes a relationship between two quantities.★
a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
b. Combine standard function types using arithmetic operations. For

example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.
c. (+) 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.
2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.★
Build new functions from existing functions
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.
4. Find inverse functions.
a. 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 x3 or f(x) = (x+1)/(x–1) for x ≠1.
b. (+) Verify by composition that one function is the inverse of another.
c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.
d. (+) Produce an invertible function from a non-invertible function by restricting the domain.
5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.
Linear, Quadratic, and Exponential Models★ F -LE
Construct and compare linear, quadratic, and exponential models and solve problems
1. Distinguish between situations that can be modeled with linear functions and with exponential functions.
a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or

two input-output pairs (include reading these from a table).
3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
4. For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
Interpret expressions for functions in terms of the situation they model
5. Interpret the parameters in a linear or exponential function in terms of a context.

- ❖ Trigonometric Functions F-TF

Extend the domain of trigonometric functions using the unit circle
1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for □/3, □/4 and □/6, and use the unit circle to express the values of sine, cosine, and tangent for □–x, □+x, and 2□–x in terms of their values for x, where x is any real number.
4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.
Model periodic phenomena with trigonometric functions
5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.★
6. (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.
7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.★
Prove and apply trigonometric identities
8. Prove the Pythagorean identity sin2(θ) + cos2(θ) = 1 and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) and the quadrant of the angle.
9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

II.

RESOURCES:

- ✓ Pencils, green pens, scissors, glue, geometry tool box, and Math folder with transparent pocket sheets.
- ✓ Holt Algebra 2 and Geometry text book.
- ✓ Online resources
- ✓ HMH attached resources CD'S (lesson tutorial videos, power point presentations, one stop planer,…..)
- ✓ Internet.
- ✓ E-games and links
- ✓ Teacher's Handouts

III.

COURSE OUTLINE:

Semester 1:

Chapter's #	Chapter	Lesson(s)
Module 5	Polynomial Functions	• 5.1: Graphing Cubic Functions. • 5.2: Graphing Polynomial Functions.

Module 7	Polynomials	• 7.1: Finding Rational Solutions of Polynomial Equations. • 7.2 Finding Complex Solutions of Polynomial Equations.
Module 8	Rational Functions	• 8.1: Graphing Simple Rational Functions. • 8.2: Graphing More Complicated Rational Functions.
Module 9	Rational Expressions and Equations.	• 9.1: Adding and Subtracting Rational Expressions. • 9.2: Multiplying and Dividing Rational Expressions. • 9.3: Solving Rational Equations.
Module 10	Radical Functions	• 10.1: Inverses of Simple Quadratic and Cubic Functions • 10.2: Graphing Square Root Functions • 10.3: Graphing Cube Root Functions
Module 11	Radical Expressions and Equations	• 11.1 Radical Expressions and Rational Exponents • 11.2: Simplifying Radical Expressions • 11.3: Solving Radical Equations
Module 12	Sequences and Series	• 12.1: Arithmetic Sequences • 12.2 Geometric Sequences • 12.3: Geometric Series

Semester 2:

Chapter's #	Chapter	Lesson(s)
Module 13	Exponential Functions	• 13.1: Exponential Growth Functions • 13.2: Exponential Decay Function • 13.3: The Base e • 13.4: Compound Interest.

Module 14	Modeling with Exponential and Other Functions 14.1: Fitting Exponential Functions to Data 14.2: Choosing Among Linear, Quadratic, and Exponential Models	• 14.1: Fitting Exponential Functions to Data • 14.2: Choosing Among Linear, Quadratic, and Exponential Models
Module 15	Logarithmic Functions	• 15.2: Graphing Logarithmic Functions
Module 16	Logarithmic Properties and Exponential Equations	• 16.2: Solving Exponential Equations
Module 17	Unit Circle Definition of Trigonometric Functions	• 17.1: Angles of Rotation and Radian Measure • 17.2: Defining and Evaluating the Basic Trigonometric Functions • 17.3: Using a Pythagorean Identity
Module 18	Graphing Trigonometric Functions	• 18.1: Stretching, Compressing, and Reflecting Sine and Cosine Graphs • 18.2: Stretching, Compressing and Reflecting Tangent Graphs • 18.3: Translating Trigonometric Graphs • 18.4: Fitting Sine Functions to Data

IV.

GRADING:

Grading Policy/ Assessment Tools:

- 1st The students will be provided with study guides or mock tests on the school website in the students portal, based on our curriculum manual, bench marks and objectives before every quiz, test, or exam.
- 2nd The students will be tested based on what they have practiced at home from the study guides or mock tests mentioned before.
- 3rd The evaluation will be based on what objectives did the students achieve, and in what objectives do they need help, through the detailed report that will be sent to the parents once during the semester and once again with the report card.

- Tests and quizzes will comprise the majority of the student's grade. There will be one major test given at the end of each chapter.
- Warm-up problems for review, textbook assignments, worksheets, etc. will comprise the majority of the daily work.
- Home Works and Assignments will provide students with the opportunity to practice the concepts explained in class and in the text.
- Students will apply the learned Math concepts in their daily lives through Sample Performance Indicators which will be prepared at home and done in class.
- Students will solve a higher-order thinking word problem on weekly basis (Problem of the Week).
- Students will keep a math notebook. In this notebook students will record responses to daily warm-up problems, lesson activities, post-lesson wrap-ups, review work, and daily textbook assignments.
- Class work is evaluated through participation, worksheets, class activities and group work done in the class.
- Passing mark 60 %

Grade Distribution:

Semester -1-		**Semester -2-**		**Final Exam**
Assessment	***Points/Weight***	***Assessment***	***Points/Weight***	
Class Work	15%	Class Work	15%	**Mid-Year / Final Exam 30%** **Total 100**
Homework	5%	Homework	5%	
Quizzes	30 %	Quizzes .	30 %	
Project Based Learning	10%	Project Based Learning	10%	
POP Quizzes	5 %	POP Quizzes	5 %	
MAP (Based on students results)	5%	MAP (Based on students results)	5%	

Cross-Curricular Project(s):

- ICT integration week
- Term projects-integrate Science with math (other subjects if applicable)