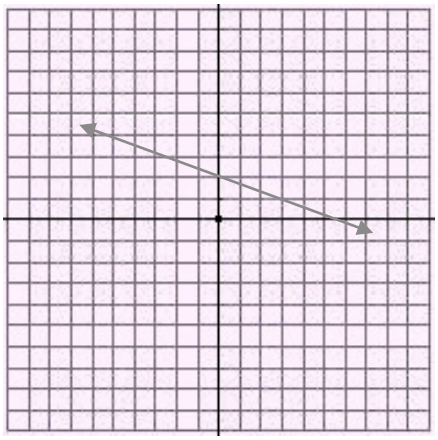
ALGEBRA 2 CURRICULUM 2017-2018

Content: Unit 1: Review of important Algebra 1 topics **Duration:** Aug/September≈ 5 weeks

Essential Question:	• How do you write, solve, graph, and interpret linear equations and inequalities to model relationships between quantities?
Skill:	• Review of solving multi-step equations. • Graph an equation of a line given a point and slope. • Write the equation of a line given a graph. • Write and graph equations in slope intercept form and point-slope form.
Instructional/Engagement Activities	• Solve 4(3x + 3) = 4x – 11 • Graph a line with slope of -3/4 and y-intercept of -2  • Graph y = $\frac{5}{7}x - 8$ • Write the following in point-slope form: A(-2, 3) slope = 4.
Assessment:	• (Optional) Quiz on solving equations and inequalities • (Optional) Quiz on writing and graphing linear equations. • Common assessment at the end of algebra 1 review.
Resources:	• Equations and Inequalities (see Algebra I Glencoe chapter 2 and chapter 5.3). • Algebra II Glencoe section 1.3, 1.5, and 1.6. • Graphing and writing equations (see section 4.1-4.3). • Supplemental worksheets found on network drive (see Algebra Supplements(Keystone Review))

Standards:	• CC.2.2.8.B.3
Vocabulary:	**Slope, y-intercept, slope-intercept and point-slope form, distribute, inequality vs equality.**

Content: Unit 2 Quadratic Equations

Duration: October/November/December/January≈ 8 weeks

Essential Question:	• How do you factor a quadratic expression? • How can you identify the proper technique to factoring a quadratic? • What are the advantages of a quadratic function in vertex form? • What are the advantages of a quadratic function in standard form? • How are the real solutions of a quadratic equation related to the graph of the related quadratic function? • How is any quadratic function related to the parent function $y = x^2$?
Skill:	• Graph a quadratic function in standard and vertex form. • Solve a quadratic equation by factoring including trinomials with a leading coefficient that is not equal to 1 (trinomials, difference of squares, GCF, guess and check, and grouping). • Use the Quadratic Formula to solve a quadratic equation. • Add, subtract, and multiply complex numbers. • Use a complex conjugate to divide complex numbers. • Use the discriminant to find the number of x-intercepts/real solutions/zeros/roots. • Complete the square to solve quadratic equations or to convert from standard to vertex form. • Find complex solutions to a quadratic using the quadratic formula, and simplify all solutions accordingly.
Instructional/Engagement Activities	• Graph $y = x^2$ and any graph in the form of $f(x) = a(x-h)^2 + k$ by manipulating $a, h,$ and k (i.e. transformation rules). • Graph quadratics in the form of $y = ax^2 + bx + c$ by finding the coordinates of the vertex, equation of the line of symmetry, and intercepts. • Convert $y = 2x^2 + 20x + 7$ to vertex form. • Solve: $x^2 + 5x - 6 = 0,\ 2x^2 + 10x + 12 = 0,\ 3x^2 + 10x + 8 = 0,\quad x^2 - 36 = 0,\ 3(x-4)^2 = 27$ • Solve using the quadratic formula: $-x^2 - 3x + 11$. • How many real solutions does the following have: $x^2 + 7x - 15 = 0,$ $5x^2 + 6x + 4 = 0$. • Simplify the following: $\sqrt{-18},\ \ (4-3i) + (-4+3i), (5-3i) - (-2+4i)$ • Multiply: $3i(-5+2i),\ \ (-1+2i)(3-4i)$ • Divide: $\frac{9+12i}{3i},\ \frac{2+3i}{1-4i}$
Assessment:	• Quiz on factoring (including solving using zero-product property). • Quiz on complex numbers and operations • Quiz on solving quadratics by completing the square, using the formula, and graphing. • Quiz on transformations and converting standard form to vertex • Common assessment on section 5.l-5.4 • Common assessment on section 5.5-5.7
Resources	Glencoe Algebra II chapter 5 and Algebra II worksheet supplements.

Standards:	CC.2.3.HS.A.10 – Translate between the geometric description and the equation for a conic section. CC.2.2.HS.C.1 – Use the concept and notation of functions to interpret and apply them in terms of their context. CC.2.2.HS.C.2 – Graph and analyze functions, and use their properties to make connections between the different representations. CC.2.2.HS.C.3 – Write functions or sequences that model relationships between two quantities. CC.2.2.HS.C.5 – Construct and compare linear, quadratic, and exponential models to solve problems. CC.2.2.HS.C.6 – Interpret functions in terms of the situations they model. CC.2.2.HS.D.1 – Interpret the structure of expressions to represent a quantity in terms of its context. CC.2.2.HS.D.2 – Write expressions in equivalent forms to solve problems. CC.2.2.HS.D.7 – Create and graph equations or inequalities to describe numbers or relationships CC.2.2.HS.D.8 – Apply inverse operations to solve equations or formulas for a given variable CC.2.2.HS.D.9 – Use reasoning to solve equations and justify the solution method CC.2.2.HS.D.10 – Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically. CC.2.1.HS.F.4 – Use units as a way to understand problems and to guide the solution of multi-step problems. CC.2.1.HS.F.6 – Extend the knowledge of arithmetic operations to the complex numbers. CC.2.1.HS.F.7 Apply concepts of complex numbers in quadratic equations to solve problems.
Vocabulary:	**Complex Conjugate, Complex Number, Imaginary Number**, **Pure Imaginary Number**, **Quadratic, vertex, axis of symmetry, reflection, transformation, translation, rotation, max/min, parabola.**

Content: Unit 3 Polynomial Equations

Duration: January/February ≈ 4 weeks

Essential Question:

- How do you simplify expressions using the properties of exponents?
- What technique do you use to divide polynomials? (long division/synthetic)
- What does the degree tell you about its related polynomial function?
- How does one interpret and identify polynomial functions and their graphs?
- How does one solve polynomial equations?
- How does one determine if a binomial is a factor of a polynomial?

Skill:

- Use the properties of exponents to simplify expressions.
- Given the graph of a polynomial function, or using a graphing utility, locate and describe the turning points and zeros (relative/local maxima, relative/local minima).
- Given the equation of a polynomial function, classify it by its degree, describe its end-behavior, state the maximum/minimum number of turning points, and state the maximum/minimum number of x-intercepts.
- Quickly graph a polynomial function given its zeros and max/mins.
- State the multiplicity of each zero, and describe how the graph behaves at each zero (bounce, cross).
- If given the root $x = a$, write the factor $(x - a)$.
- Use the Conjugate Root Theorem.
- Use the Factor Theorem.
- Write the polynomial in standard form given the roots or zeros and their multiplicity.
- Solve a polynomial equation using factoring techniques (including grouping, GCF, sum/differences of cubes).
- Divide polynomials using long division and synthetic division.
- Use the Remainder Theorem.
- Determine the possible rational roots of a polynomial function using the Rational Roots Theorem.
- Graph a polynomial function that is not in factored form.

Instructional/Engagement Activities

- Given the following graph, state the end-behavior, intervals of increasing/decreasing, turning points, and zeros.

- Given the following polynomial, $y = -2x^4 + 8x^3 + 14x - 1$: state the degree, maximum and minimum number of turning points, maximum and minimum number of x-intercepts, and end-behavior.
- Given that a polynomial has the zeros $x = 3, x = -1, x = 0, x = 3$, write the polynomial in factored form and then graph the polynomial.
- Given that a polynomial has zeros at $x = 5i, x = 2$, write the polynomial in factored form.
- Graph the polynomial $y = (x - 3)(x + 1)^2(x)^3$ using a graphing calculator.
- Write the polynomial in factored form and then graph $y = x^3 - 2x^2 - 15x$
- Determine if $x - 3$ is a factor of $x^5 - 2x^3 - x^2 + 2$
- Solve $y = x^3 + 2x^2 - 3x - 6$
- Solve $y = x^3 + 64$
- Given the polynomial, $y = 3x^3 + 7x^2 + 6x - 8$: Use technology to determine

	the possible real roots; Use technology to find one real root; Use long division or synthetic division to completely factor the polynomial and state all possible roots (both real and imaginary).
Assessment:	• Common assessment chapter 6 • Quiz 6.1-6.4 and 6.5.6
Resources:	Glencoe Algebra II chapter 6 and Algebra II worksheet supplements
Standards:	CC.2.2.HS.C.1 – Use the concept and notation of functions to interpret and apply them in terms of their context. CC.2.2.HS.C.6 – Interpret functions in terms of the situations they model. CC.2.2.HS.D.1 – Interpret the structure of expressions to represent quantities in terms of its context CC.2.2.HS.D.2 – Write expressions in equivalent forms to solve problems. CC.2.2.HS.D.3 – Extend the knowledge of arithmetic operations and apply to polynomials. CC.2.2.HS.D.4 – Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs. CC.2.2.HS.D.5 – Use polynomial identities to solve problems. CC.2.2.HS.D.7 – Create and graph equations or inequalities to describe numbers or relationships. CC.2.2.HS.D.9 – Use reasoning to solve equations and justify the solution method CC.2.1.HS.F.4 – Use units as a way to understand problems and to guide the solution of multi-step problems. A2.2.1.1.1, A2.2.1.1.3, A2.2.1.1.4, A2.1.2.2.1, A2.1.2.2.2, A2.2.2.1.1 A2.1.2.2.1, A2.2.2.1.4 Common Core: Graph functions expressed symbolically and show key features of the graph by hand in simple cases. Graph polynomial functions, identifying zeros and asymptotes and show end behavior. Common Core: Observe using graphs or tables that a quantity increasing exponentially eventually exceeds a graph increasing linearly. Common Core: Know and understand the relationship between zeros and factors. Common Core: Rewrite simple rational expressions in different forms: write $\frac{a(x)}{b(x)}$ in the form $q(x) + \frac{r(x)}{b(x)}$ using long division or other methods.

Vocabulary:	**Simplify, Degree, Leading coefficient, Synthetic division/substitution, end-behavior, Trinomial, Binomial, Monomial, Polynomial, Root, Zero, Absolute max/min, Remainder Theorem, Cubic function, Factor Theorem**

Comments: At your discretion, include some topics from 6.6 and 6.7 using p's and q's and synthetic division to find roots of polynomials. Omit synthetic substitution at teacher discretion.

Content: Unit 4 Rational Functions and Relations **Duration:** March ≈ 4 weeks

Essential Question:

- How does one perform operations on rational expressions?

Skill:

- Simplify rational expressions.
- Multiply and divide rational expressions.
- Add and subtract rational expressions.
- Find the LCD of a rational expression.
- Use LCD to add and subtract rational expressions
- Use LCD to simplify complex fraction.
- Solve rational equations
- Determine restricted values

Instructional/Engagement Activities

- Simplify and state any restrictions on the variable: $\frac{x^2-x-6}{x^2+x-2}$
- Simplify and state any restrictions on the variable: $\frac{x^2+7x+10}{x^2-3x-10}$
- Multiply: $\frac{x^2+x+6}{x-5} \cdot \frac{x^2-25}{x^2+4x+3}$
- Divide: $\frac{x^2}{x^2+2x+1} \div \frac{3x}{x^2-1}$
- Add: $\frac{5y+2}{xy^2} + \frac{2x-4}{4xy}$
- Add: $\frac{x}{x-1} + \frac{2x-1}{x^2-3x+2}$
- Subtract: $\frac{x+2}{x^2-2x} - \frac{x+2}{2x-4}$
- Simplify: $\frac{x}{\frac{1}{x}+\frac{1}{y}}$
- Simplify: $\frac{\frac{x-2}{x}+\frac{2}{x+1}}{\frac{3}{x-1}-\frac{1}{x+1}}$
- Solve: $\frac{2}{x+3} = \frac{x-3}{2}$

Assessment:	• Solve: $\frac{x}{x-3}+\frac{x}{x+3}=\frac{2}{x^2-9}$ • Solve: $\frac{x-1}{x^2+3x+2}+\frac{2x}{x+2}=\frac{x-1}{x+1}$ • Quiz section 9.1, 9.2 and 9.6 (common assessment)
Resources:	Glencoe Algebra II chapter 9.1.2.6 and Algebra II worksheet supplements
Standards:	CC.2.2.HS.D.9 – Use reasoning to solve equations and justify the solution method. CC.2.2.HS.D.10 – Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically. CC.2.1.HS.F.1 – Apply and extend the properties of exponents to solve problems with rational exponents. CC.2.1.HS.F.7- Apply concepts of complex numbers in polynomial identities and quadratic equations to solve problem. A2.1.2.1.1, A.2.1.2.1.2, A.2.1.2.1.3, A.2.1.2.1.4, A2.1.3.2.2, A2.1.3.1.2
Vocabulary:	**Rational expression, complex fraction, LCD, LCM, rational equation, rational.**

Comments: Weighted averages and inequalities can be omitted. Quiz at teacher discretion.

Content: Unit 5 Operations of Functions **Duration:** April (2 weeks)

Essential Question:

- How does one calculate the sum, difference, product, and quotient of a function?
- How does one find the composition of a function?
- Is the inverse of a function always a function?
- How are a function and its inverse function related?

Skill:

- Given a table of values of a function, give the table of values that corresponds to the inverse.
- Find the inverse of a relation or a function graphically.
- Find the inverse of a relation or a function algebraically.
- Use the horizontal line test to determine if a function's inverse is a function.
- Given the equation of a quadratic function, find the inverse, and then sketch the original function, its inverse, and restrict the domain accordingly.
- Show that the domain of a function is the range of its inverse and that the range of a function is the domain of its inverse.

Instructional/Engagement Activities

- What is the inverse of relation *s*? Then graph *s* and its inverse.

Relation *s*

x	*y*
0	−1
2	0
3	2
4	3

- Find the inverse of y = $x^2 - 1$ then graph both relations
- Find the inverse function of $f(x) = \sqrt{x-2}$. Give the domain of the function and its inverse. Graph both functions.
- Find the inverse, domain and range of the function of its inverse. Determine whether the inverse is a function: $y = (7-x)^2$.

Assessment:

Quiz section 7.1 and 7.2 operations on functions and inverse functions (common assessment)

Resources:

Glencoe Algebra II chapter 7.1.2 and Algebra II worksheet supplements

Standards:	CC.2.2.HS.C.1 – Use the concept and notation of functions to interpret and apply them in terms of their context. CC.2.2.HS.C.3 – Write functions or sequences that model relationships between two quantities. CC.2.2.HS.C.4 – Interpret the effects transformations have on functions and find the inverses of functions. CC.2.2.HS.D.2 – Write expressions in equivalent forms to solve problems. A2.2.1.1.3, A2.2.1.1.3, A2.2.1.1.3
Vocabulary:	**Inverse Function**, **Inverse Relation**, **Identity Function, One-to-One function**.

Comments:

Content: Unit 6 Radical Functions and Expressions **Duration:** April/May (4 weeks)

Essential Question:	• How does one graph and interpret a square root function? • How does one solve a radical equation and check for extraneous solutions?
Skill:	• Identify domain and range of a radical function and graph. • Simplify radical expressions. • Solve radical equations. • Add, subtract, multiply and divide radical expressions. • Rationalize the denominator. • Evaluate and simplify expressions using rational exponents
Example problems:	• Simplify radicals of the form $\sqrt{8}\ and\ \sqrt[3]{54}, \sqrt{25x^2}$. • Perform the indicated operation. Write in simplest form: $\frac{\sqrt[4]{x^3}}{\sqrt[8]{x^2}}, \sqrt{3} \cdot \sqrt[4]{3}$ • Simplify: $2\sqrt{8} + 3\sqrt{12}.$ • Simplify: $\frac{3+\sqrt{6}}{2-\sqrt{5}}$. • Simplify: $216^{\frac{1}{3}},\ 7^{\frac{1}{2}} \cdot 7^{\frac{1}{2}}, 5^{\frac{1}{4}} \cdot 125^{\frac{1}{4}}$ • Write in radical form: $3x^{\frac{1}{2}}, (5x)^{\frac{1}{2}}, \left(-8x\sqrt{xy}\right)^{\frac{2}{3}}$ • Write with rational exponents: $\sqrt{5x^3y^{10}z}$ • Solve: $3 + \sqrt{2x-3} = 8, 1 - 2\sqrt{x+2} = 9,\ \sqrt{x^2+21x} = 14, \sqrt{3x} = \sqrt{x+6}, \sqrt{3x+2} - \sqrt{2x+7} = 0, \sqrt{3x+1} - \sqrt{x+1} = 2, 2(x+3)^{\frac{2}{3}} = 8$ • Graph and write the domain and range of f (x) = $\sqrt{x-1} + 3$. • Graph and write the domain and range of $f(x) = \sqrt[3]{x+3} - 1$
Assessment:	• Quiz section 7.3 and 7.4 (Square Root functions and nth root expressions). • Quiz 7.5-7.7 (Operations with radicals, rational exponents and radical equations).
Resources:	Glencoe Algebra II chapter 7.3-7.7 and Algebra II worksheet supplements
Standards:	C.C.2.2.8.B.1 – Apply concepts of radicals and integer exponents to generate equivalent expressions. C.C.2.2.8.B.1 – Use reasoning to solve equations and justify the solution method. C.C.2.2.HS.D.10 Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

Vocabulary:	**Simplest Form, Rational Equation, Rational Expression.**

Comments: For time constraints, section 7.3-7.7 should precede 7.1.2.

Content: Unit 7: Exponentials and Logarithms

Duration: May/June ≈ 4 weeks

Essential Question:

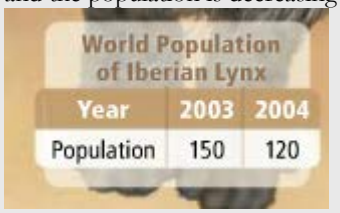
- How does one graph, solve, and apply an exponential/logarithmic function?
- How does one apply the properties of exponential/logarithmic expressions to simplifying?

Skill:

- Given the equation of an exponential function, sketch the graph showing the correct horizontal asymptote.
- Use transformation rules to graph exponential functions.
- Solve exponential and logarithm equations
- Identify exponential growth and exponential decay given the equation or the graph.
- Write exponential functions to model real-world exponential growth and decay situations.
- Write and evaluate logarithmic functions
- Graph logarithmic functions
- Condense logarithmic expression into a single logarithm
- Expand a single logarithm
- Use the Change of Base Formula to evaluate logarithmic expressions
- Use Euler's number to model real-world situations.

Example Problems

- Graph the following: $y = 3^x, y = 3^{-x}, y = 3^x + 2, y = 3^{x-2}$
- Without graphing, determine whether the function represents exponential growth or decay: $y = 129(1.63)^x$.
- Suppose you deposit $200 in a savings account that pays an annual rate of 4%. How much will be in the account after 3 years?
- If the annual rate of change is +70%, what is the growth factor?
- If the annual rate of change is -0.1%, what is the decay factor?
- The table shows the world population of the Iberian Lynx in 2003 and 2004. If this trend continues and the population is decreasing exponentially, how many Iberian Lynx will there be in 2014?



World Population of Iberian Lynx		
Year	2003	2004
Population	150	120

- Solve for x: $3^{x+7} = 3^{21}$
- Solve for x: $2^{4x+1} = 16$
- Solve for x: $\left(\frac{4}{25}\right)^{x+1} = \left(\frac{2}{5}\right)^{\frac{1}{2}x-11}$
- Solve for x: $3^x = 7$
- Solve for x: $2^{x+1} = 5^{4x-3}$
- Solve for x: $e^{7x+1} = 15$
- Solve for x: $\log(3x + 1) = 2$
- Solve for x: $\log(x - 3) + \log(x) = 1$
- Solve for x: $\log_3(x^2) = \log_3 16$
- Solve for x: $\ln(x + 1) - \ln x = 2$
- Solve for x: $\log(x - 3) - \log 2 = \log 15$
- Write the following in logarithmic form: $10^2 = 100,\ 81 = 3^4,\ \frac{8}{27} = \left(\frac{2}{3}\right)^3$

- Evaluate the following: $\log_8 32, \log_5 125, \log_{64} \frac{1}{32}$
- Graph $y = \log_2 x$, $y = \log_2(x-3)$
- Condense into a single logarithm: $3\log_2 x + \frac{1}{2}\log_2 y - \log_2 z$
- Expand: $\log \frac{x^3\sqrt{y}}{z^5}$
- Evaluate using the Change of Base Formula: $\log_2 7$
- Suppose you won a contest at the start of 5th grade that deposited $3000 in an account that pays 5% annual interest compounded continuously. How much will you have in the account 4 years later?

Assessment:

- Quiz section 8.1 and 8.2 (Exponential functions and equations).
- Quiz section 8.3 and 8.4 (Logarithmic functions and equations).
- Quiz section 8.5-8.7 (Logarithmic and exponential properties).
- Common Assessment Chapter 8

Resources: Glencoe Algebra II chapter 8.1-8.8 and Algebra II worksheet supplements

Standards:

CC.2.2.HS.C.1 – Use the concept and notation of functions to interpret and apply them in terms of their context.
CC.2.2.HS.C.2 – Graph and analyze functions and use their properties to make connections between the different representations.
CC.2.2.HS.C.3 – Write functions or sequences that model relationships between two quantities
CC.2.2.HS.C.4 – Interpret the effects transformations have on functions and find the inverses of functions.
CC.2.2.HS.C.5 –Construct and compare linear, quadratic, and exponential models to solve problems.
CC.2.2.HS.C.6 – Interpret functions in terms of the situations they model.
CC.2.2.HS.D.2 – Write expressions in equivalent forms to solve problems.
CC.2.2.HS.D.7 – Create and graph equations or inequalities to describe numbers or relationships
CC.2.2.HS.D.10 – Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.
CC.2.1.HS.F.4 – Use units as a way to understand problems and to guide the solution of multi-step problems.
A2.2.1.1.1, A2.2.1.1.3, A2.1.1.4, A2.2.1.1.4, A2.2.1.1.1, A2.2.2.2.1, A2.1.3.1.3,, A2.1.3.1.4.A.2.1.2.1.4, A2.2.2.1.2, A2.1.3.1.3, A2.1.3.1.4

Vocabulary: **Exponential Function**, **Exponential Growth**, **Exponential Decay, Asymptote, Common Logarithm**, **Logarithm, Logarithmic Function**, **Natural Logarithm, Growth/Decay Factor, Exponential Equation, Compound Interest, Logarithmic Equation, Change of Base, Natural Base e (Eulers), Continuous Growth/Decay.**

Comments: Optional exponential and logarithmic inequalities (see 8.2 and 8.4).