Approved Feb 2016

Algebra 3
Unit 1: Systems and Matrices

Pacing: 6 weeks A/B Block Schedule

Mathematical Practices
Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning. *Practices in bold are to be emphasized in the unit.* **1. Make sense of problems and persevere in solving them.** 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. **4. Model with mathematics.** **5. Use appropriate tools strategically.** 6. Attend to precision. **7. Look for and make use of structure.** 8. Look for and express regularity in repeated reasoning.
Standards Overview
Graph and solve systems of equations using a variety of function families: linear, quadratic, absolute value, and square root functions. Solve systems of two and three using matrices. Use systems and matrices to solve real world problems.

Algebra 3
Unit 1: Systems and Matrices

<table>
<tr><th>Priority and Supporting CCSS</th><th>Explanations and Examples*</th></tr>
<tr><td>A-CED 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...</td><td>Example: Given two sets of data that can be modeled with linear functions, find the intersection of the two trend lines, if it exists, and interpret the solution. For instance, if these trends continue, when will the women catch the men and what percentage of women will be earning $50,000 - $74,999?
<table>
<tr><th>Number of years since 2000</th><th>% of men earning $50,000 - $74,999</th><th>% of women earning $50,000 - $74,999</th></tr>
<tr><td>3</td><td>20.2</td><td>13.3</td></tr>
<tr><td>4</td><td>20.5</td><td>14.2</td></tr>
<tr><td>5</td><td>20.7</td><td>15.1</td></tr>
</table>
</td></tr>
<tr><td>A-REI 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.</td><td>Example:
Given that the sum of two numbers is 10 and their difference is 4, what are the numbers? Explain how your answer can be deduced from the fact that they two numbers, x and y, satisfy the equations $x + y = 10$ and $x – y = 4$.</td></tr>
</table>

Algebra 3
Unit 1: Systems and Matrices

Priority and Supporting **CCSS**	**Explanations and Examples***
A-REI 6. Solve systems of equations exactly and approximately (e.g., with graphs).	.The system solution methods can include but are not limited to graphical, elimination/linear combination, substitution, and modeling. Systems can be written algebraically or can be represented in context. Students may use graphing calculators, programs, or applets to model and find approximate solutions for systems of equations. Examples: Solve the system of equations: $x+ y = 11$ and $3x – y = 5$. Use a second method to check your answer. Your class is planning to raise money for a class trip to Washington, DC, by selling your own version of Connecticut Trail Mix. You find you can purchase a mixture of dried fruit for $3.25 per pound and a nut mixture for $5.50 per pound. The class plans to combine the dried fruit and nuts to make a mixture that costs $4.00 per pound, which will be sold at a higher price to make a profit. You anticipate you will need 180 pounds of trail mix. How many pounds of dried fruit and how many pounds of mixed nuts do you need?
A-REI 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 ...functions.*	Students need to understand that numerical solution methods (data in a table used to approximate an algebraic function) and graphical solution methods may produce approximate solutions, and algebraic solution methods produce precise solutions that can be represented graphically or numerically. Students may use graphing calculators or programs to generate tables of values, graph, or solve a variety of functions.
N-VM.C.6 Use matrices to solve systems of two and three variables.	

Algebra 3
Unit 1: Systems and Matrices

Concepts What Students Need to Know	Skills What Students Need To Be Able To Do	Bloom's Taxonomy Levels
• Systems of equations (2 variable)	• Solve (systems using graphs)	3
• Solution to a system of equations	• Solve (systems using algebraic methods)	3
• Graphing method	• Interpret (solutions)	2
• Substitution method	• Solve	3
• Systems of equations (3 variable)	• Write and solve	3
• Matrices	• Use	2
• Graphing Calculator features		

Essential Questions
What does the number of solutions (none, one or infinite) of a system of equations represent? What are the advantages and disadvantages of solving a system of equations graphically versus algebraically?
Corresponding Big Ideas
A system of equations is an algebraic way to compare two or more functions that model a situation. Matrices can be used to facilitate the solving of systems involving two- and three-variables.

Algebra 3
Unit 1: Systems and Matrices

Standardized Assessment Correlations (State, College and Career)
CollegeBoard PSAT and SAT

Vocabulary
System of equations, intersection, no solution, infinitely many solutions, substitution method, graphing method, standard form, coefficients, augmented matrix (matrices), dimensions, rows, columns

Learning Activities

Topic		**CCSS**
Systems of Equations • Find exact solution(s) by substitution method • Find approximate solution using graphing • Explain why the x coordinate of the point of intersection is the solution to the equation f(x)=g(x) • Interpret solutions of systems (one solution, no solutions, infinitely many solutions) • Write and solve systems of equations to model real world situations • Set up and solve matrices of 2 • Set up and solve systems of 3 by elimination and substitution methods	Text: **College Algebra** p. 486 **Algebra 2** p. 225, 241	CC.9-12.A.CED.3 CC.9-12.A.REI.6 CC.9-12.A.REI.5 CC9.12.A.REI.11 CC9.12.N.VMC.6

• Set up and solve matrices of 3 • Use graphing calculator to solve matrices of 2 and 3	p. 181	

Unit Assessments
Section quizzes, End-of-Unit Test

Application

Algebra 3
Unit 1: Systems and Matrices

1.Find the equation of the parabola that passes through the points $(-1, 9)$, $(1, 5)$, and $(2, 12)$.

Recalling that a parabola has a quadratic as its equation, I know that I am looking for an equation of the form $ax^2 + bx + c = y$. Also, I know that points are of the form (x, y). Plugging in the three points in the general equation for a quadratic, I get a system of three equations, where the variables stand for the unknown coefficients of that quadratic:

$$a(-1)^2 + b(-1) + c = 9$$
$$a(1)^2 + b(1) + c = 5$$
$$a(2)^2 + b(2) + c = 12$$

Simplifying the three equations, I get:

$$1a - b + c = 9$$
$$1a + b + c = 5$$
$$4a + 2b + c = 12$$

Setting up and solving a matrix of three, the result is that $a = 3$, $b = -2$, and $c = 4$, so the equation is:

$$\mathbf{y = 3x^2 - 2x + 4}$$

2.)Marina had $24,500 to invest. She divided the money into three different accounts. At the end of the year, she had made $1,300 in interest. The annual yield on each of the three accounts was 4%, 5.5%, and 6%. If the amount of money in the 4% account was four times the amount of money in the 5.5% account, how much had she placed in each account?

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Unit 1: Systems and Matrices

3.) The currents running through an electrical system are given by the following system of equations. The three currents, I1, I2, and I3, are measured in amps. Solve the system to find the currents in this circuit.

$I_1 + 2I_2 - I_3 = 0.425$
$3I_1 - I_2 + 2I_3 = 2.225$
$5I_1 + I_2 + 2I_3 = 3.775$

4.)
In the position function for vertical height, $s(t) = ½at^2 + v_0t + s_0$, s(t)represents height in meters and t represents time in seconds.

(a) Find the position function for a volleyball served at an initial height of one meter, with height of 6.275 meters ½ second after serve, and height of 9.1 meters one second after serve.
(b) How long until the ball hits the ground on the other side of the net if everyone on that team completely misses it?

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Algebra 3
Unit 2: Polynomial and Inverse Functions

Pacing: 6 weeks A/B Block Schedule

Mathematical Practices
Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning. *Practices in bold are to be emphasized in the unit.* 1. Make sense of problems and persevere in solving them. 2. **Reason abstractly and quantitatively.** 3. Construct viable arguments and critique the reasoning of others. 4. **Model with mathematics.** 5. Use appropriate tools strategically. 6. Attend to precision. 7. **Look for and make use of structure.** 8. Look for and express regularity in repeated reasoning.
Standards Overview
Analyze functions using features of their equations and their parent graphs. **Use technology to verify and interpret the key features of a function's graph.**

Algebra 3
Unit 2: Polynomial and Inverse Functions

CC.9-12.N.CN.7 Solve quadratic equations with real coefficients that have complex solutions.	Examples: ● Within which number system can $x^2 = -2$ be solved? Explain how you know. ● Solve $x^2 + 2x + 2 = 0$ over the complex numbers. ● Find all solutions of $2x^2 + 5 = 2x$ and express them in the form $a + bi$.
CC.9-12.N.CN.1 Know there is a complex number i such that $i^2 = \sqrt{-1}$, and every complex number has the form $a + bi$ with a and b real.	
CC.9-12.N.CN.8 (+) Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$.	
CC.9-12.N.CN.9 (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials	Examples: ● How many zeros does $-2x^2 + 3x - 8$ have? Find all the zeros and explain, orally or in written format, your answer in terms of the Fundamental Theorem of Algebra. ● How many complex zeros does the following polynomial have? How do you know? $p(x) = (x^2 - 3)(x^2 + 2)(x - 3)(2x - 1)$

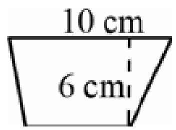
Algebra 3
Unit 2: Polynomial and Inverse Functions

CC.9-12.A.REI.4b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), 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	Students should solve by factoring, completing the square, and using the quadratic formula. The zero product property is used to explain why the factors are set equal to zero. Students should relate the value of the discriminant to the type of root to expect. A natural extension would be to relate the type of solutions to $ax2 + bx + c = 0$ to the behavior of the graph of $y = ax^2 + bx + c$. **Value of Discriminant** / **Nature of Roots** / **Nature of Graph**: $b^2 – 4ac = 0$ / 1 real roots / intersects x-axis once $b^2 – 4ac > 0$ / 2 real roots / intersects x-axis twice $b^2 – 4ac < 0$ / 2 complex roots / does not intersect x-axis ● Are the roots of $2x^2 + 5 = 2x$ real or complex? How many roots does it have? Find all solutions of the equation. ● What is the nature of the roots of $x^2 + 6x + 10 = 0$? Solve the equation using the quadratic formula and completing the square. How are the two methods related?
CC.9-12.A.CED.1 Create equations in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*	Equations can represent real world and mathematical problems. Include equations and inequalities that arise when comparing the values of two different functions, such as one describing linear growth and one describing exponential growth.

Nested table (within the right cell of the first row):

Value of Discriminant	Nature of Roots	Nature of Graph
$b^2 – 4ac = 0$	1 real roots	intersects x-axis once
$b^2 – 4ac > 0$	2 real roots	intersects x-axis twice
$b^2 – 4ac < 0$	2 complex roots	does not intersect x-axis

Algebra 3
Unit 2: Polynomial and Inverse Functions

<table>
<tr><th></th><th></th></tr>
<tr><td></td><td>Examples:
Given that the following trapezoid has area 54 cm^2, set up an equation to find the length of the base, and solve the equation.


Lava coming from the eruption of a volcano follows a parabolic path. The height *h* in feet of a piece of lava *t* seconds after it is ejected from the volcano is given by $h(t) = -t^2 + 16t + 936$. After how many seconds does the lava reach its maximum height of 1000 feet?</td></tr>
<tr><td>CC.9-12.A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</td><td></td></tr>
<tr><td>CC.9-12.A.REI.4 Solve quadratic equations in one variable</td><td>Students should solve by factoring, completing the square, and using the quadratic formula. The zero product property is used to explain why the factors are set equal to zero. Students should relate the value of the discriminant to the type of root to expect. A natural extension would be to relate the type of solutions to *ax*2 + *bx* + *c* = 0 to the behavior of the graph of $y = ax^2 + bx + c$.
<table>
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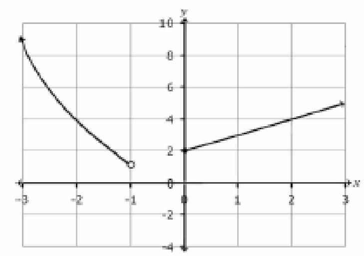
Algebra 3
Unit 2: Polynomial and Inverse Functions

	$b^2 - 4ac < 0$ | 2 complex roots | does not intersect x-axis ● Are the roots of $2x^2 + 5 = 2x$ real or complex? How many roots does it have? Find all solutions of the equation. ● What is the nature of the roots of $x^2 + 6x + 10 = 0$? Solve the equation using the quadratic formula and completing the square. How are the two methods related?
CC.9-12.F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*	Key characteristics include but are not limited to maxima, minima, intercepts, symmetry, end behavior, and asymptotes. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to graph functions. continued on next page

Algebra 3
Unit 2: Polynomial and Inverse Functions

	Examples: • Describe key characteristics of the graph of $f(x) = \lvert x - 3 \rvert + 5$. • Sketch the graph and identify the key characteristics of the function described below. $F(x) = \begin{cases} x+2 \text{ for } x \geq 0 \\ -x^2 \text{ for } x < -1 \end{cases}$  • Graph the function $f(x) = 2^x$ by creating a table of values. Identify the key characteristics of the graph. • Graph $f(x) = 2 \tan x - 1$. Describe its domain, range, intercepts, and asymptotes. • Draw the graph of $f(x) = \sin x$ and $f(x) = \cos x$. What are the similarities and differences between the two graphs?
CC.9-12.F.IF.7c Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior	Students should extract the greatest common factor (whether a constant, a variable, or a combination of each). If the remaining expression is quadratic, students should factor the expression further. Example: Factor $x^3 - 2x^2 - 35x$

Algebra 3
Unit 2: Polynomial and Inverse Functions

CC.9-12.A.APR.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.	
CC.9-12.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 $p(x)$.	The Remainder theorem says that if a polynomial $p(x)$ is divided by $x – a$, then the remainder is the constant $p(a)$. That is, $p(x)=q(x)(x-a)+p(a)$. So if p(a) = 0 then p(x) = q(x)(x-a). ● Let $p(x)=x^5 -3x^4 +8x^2 -9x+30$. Evaluate p(-2). What does your answer tell you about the factors of p(x)? [Answer: p(-2) = 0 so x+2 is a factor.]
CC.9-12.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	Graphing calculators or programs can be used to generate graphs of polynomial functions. Example: Factor the expression $x^3 + 4x^2 –59x –126$ and explain how your answer can be used to solve the equation $x^3 + 4x^2 –59x –126 = 0$. Explain why the solutions to this equation are the same as the x-intercepts of the graph of the function $f(x) = x^3 + 4x^2 –59x =126$.
CC.9-12.F.IF.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.*	Students may be given graphs to interpret or produce graphs given an expression or table for the function, by hand or using technology. Examples: ● A rocket is launched from 180 feet above the ground at time $t = 0$. The function that models this situation is given by $h = – 16t2 + 96t + 180$, where t is measured in seconds and h is height above the ground measured in feet.

Algebra 3
Unit 2: Polynomial and Inverse Functions

	o What is a reasonable domain restriction for *t* in this context? o Determine the height of the rocket two seconds after it was launched. o Determine the maximum height obtained by the rocket. o Determine the time when the rocket is 100 feet above the ground. o Determine the time at which the rocket hits the ground. o How would you refine your answer to the first question based on your response to the second and fifth questions? ● Compare the graphs of $y = 3x^2$ and $y = 3x^3$. Let $R(x) = \frac{2}{\sqrt{x-2}}$. ● Find the domain of $R(x)$. Also find the range, zeros, and asymptotes of $R(x)$. ● Let $f(x) = 5x^3 - x^2 - 5x + 1$. Graph the function and identify end behavior and any intervals of constancy, increase, and decrease. ● It started raining lightly at 5am, then the rainfall became heavier at 7am. By 10am the storm was over, with a total rainfall of 3 inches. It didn't rain for the rest of the day. Sketch a possible graph for the number of inches of rain as a function of time, from midnight to midday.

Algebra 3
Unit 2: Polynomial and Inverse Functions

CC.9-12.F.BF.4b (+) Verify by composition that one function is the inverse of another. **CC.9-12.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.**	Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model functions. Examples: ● For the function $h(x) = (x - 2)^3$, defined on the domain of all real numbers, find the inverse function if it exists or explain why it doesn't exist. ● Graph $h(x)$ and $h^{-1}(x)$ and explain how they relate to each other graphically. Find a domain for $f(x) = 3x^2 + 12x - 8$ on which it has an inverse. Explain why it is necessary to restrict the domain of the function.
CC.9-12.F.BF.4c (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.	
CC.9-12.F.BF.4d (+) Produce an invertible function from a non-invertible function by restricting the domain.	

Algebra 3
Unit 2: Polynomial and Inverse Functions

Concepts What Students Need to Know	Skills What Students Need To Be Able To Do	Bloom's Taxonomy Levels
● Quadratic equations Real coefficients Complex solutions	● Solve ● Create	3 4
● Polynomial functions that model data ● Real world problems	● Use tech to find a model to fit data ● Solve (real world problems)	3 4
● Inverse functions	● Write (inverse functions and attend to domain e.g. restrictions) ● Solve	4 3

Essential Questions
How can our knowledge of simple functions (linear, quadratic, cubic) help to make sense of higher degree polynomials? How can the features of a polynomial graph help us to answer questions about real world data?

Corresponding Big Ideas
Composite functions can be used to verify whether functions are inverses of each other.

Standardized Assessment Correlations (State, College and Career)
CollegeBoard PSAT and SAT

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Algebra 3
Unit 2: Polynomial and Inverse Functions

Vocabulary
Dependent variable, independent variable, function notation, evaluate, domain, range, interval notation, positive/negative/increasing/decreasing/constant (where the function is), x-intercept, y-intercept, local max/min, degree, end-behavior, zeroes, multiplicity, composite functions, one-to-one, inverse function, vertical line test (VLT), horizontal line test (HLT). symmetry

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Algebra 3
Unit 2: Polynomial and Inverse Functions

Learning Activities		
Topic	**Source(s)**	**CCSS**
Information from or about the graph of a function	PC Text 2.2	CC.9-12.F.IF.4
Properties of Functions • Graphically • Algebraically	Section 2.3	CC.9-12.F.IF.4
Polynomial Models • Link knowledge of quadratics and cubic functions to higher degree polynomials using end-behaviors, real zeroes, and multiplicity. • Build models from data using the graphing calculator.	Section 4.1	CC.9-12.F.IF.7
Composite Functions $f(g(x) = (f \circ g)(x)$ • Evaluate (table, graph, explicit rules) • Find a composite function and its domain • Show that two composites are equal • Find components of a composite	Section 5.1	CC.9-12.F.BF.1c (+) CC.9-12.F.BF.4b (+)

Algebra 3
Unit 2: Polynomial and Inverse Functions

One-to-One Functions; Inverses • Determine 1-1 (mappings, ordered pairs, graphs HLT) • Find the inverse (mappings, ordered pairs, verify inverse function using compositions)	PC Text 5.2	CC.9-12.F.BF.4c (+) CC.9-12.F.BF.4d (+)
Inverses • Graphing (symmetry over the line y = x) • Find the inverse defined by an equation. *(May verify algebraically using compositions.)*	PC Text 5.2	CC.9-12.F.BF.4c (+) CC.9-12.F.BF.4d (+)

Unit Assessments **The items developed for this section can be used during the course of instruction when deemed appropriate by the teacher.**
Section quizzes, End-of-Unit Test

Algebra 3
Unit 2: Polynomial and Inverse Functions

Application

The following data represents the percentage of families in the United States whose income is below the poverty level.

Year	t = 1 for 1990	Percent below Poverty Level, P
1990	0	10.9
1991	1	11.5
1992	2	11.9
1993	3	12.3
1994	4	11.6
1995	5	10.8
1996	6	11.0
1997	7	10.3
1998	8	10.0
1999	9	9.3
2000	10	8.7
2001	11	9.2
2002	12	9.6
2003	13	10.0
2004	14	10.2

1. With a graphing calculator, draw a scatter plot of the data.

2. Using the scatter plot, what is the **minimum** degree of a polynomial that might model this data? **Explain** how you know this.

3. Find the polynomial function that models the data. Round all coefficients to the nearest **ten-thousands** and write the equation below, use function notation, P(t).

4. On your calculator graph the function and the data together. The function model shows a range of $(-\infty, \infty)$. Is this reasonable expectation of the data? Explain.

5. Using your function model, find P(23). Explain the meaning of your answer in context to the application. Does this seem reasonable?

6. Find the regression function one degree higher than the one you choose. Graph it on the scatter plot. Why is this function a better fit?

7. Using your new function model, find P(23). Is this a more reasonable answer than in #5? Explain.

Algebra 3
Unit 2: Polynomial and Inverse Functions

Consider the function $C(p) = 350 + 16p$ that models the total cost of catering based on the number of people.

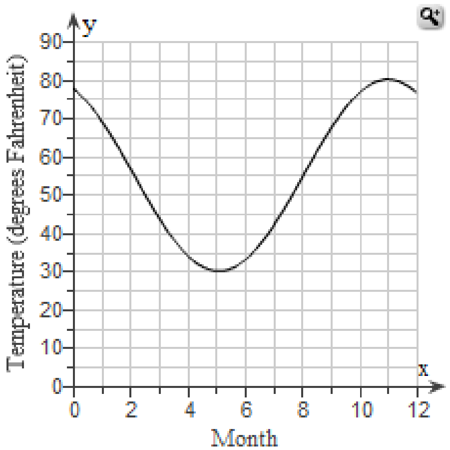
a. Find the total cost of serving 150 people.

b. Transform the given function to write a new function modelling the number of people served based on the total cost.

c. Use the function to find the number people based on a total cost of $1,790.

Algebra 3
Unit 2: Polynomial and Inverse Functions

In the graph below, the monthly average temperature in degrees Fahrenheit from January to December in a city is modeled by a polynomial function f, where x = 1 corresponds to January and x = 12 to December. Complete parts **(a)** and **(b)**.



a.) What is the local minimum? ___________
Explain what it means in context to the application.

b.) What is the local maximum? ____________
Explain what it means in context to the application.

c.) On what time interval(s) does the function increase: ___________________________; decrease: ___________________________

Algebra 3
Unit 3: Exponential and Logarithmic Functions

Pacing: 6 weeks A/B Block Schedule

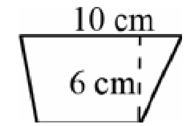
Mathematical Practices
Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning. *Practices in bold are to be emphasized in the unit.* 1. **Make sense of problems and persevere in solving them.** 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. **Model with mathematics.** 5. Use appropriate tools strategically. 6. Attend to precision. 7. **Look for and make use of structure.** 8. Look for and express regularity in repeated reasoning.
Standards Overview
Analyze functions using different representations. **Construct and compare exponential and logarithmic functions.** **Write exponential and logarithmic models to represent real life situations and use the models to solve problems.**

Priority and Supporting **CCSS**	**Explanations and Examples***
CC.9-12.F.IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.	Ex. Quadratic equations may be written in the equivalent forms. One form may be preferred to describe the graph of the function – vertex form $f(x) = ax^2 + bx + c$ $f(x) = a(x-h)^2 - k$

Algebra 3
Unit 3: Exponential and Logarithmic Functions

Priority and Supporting **CCSS**	**Explanations and Examples***
CC.9-12.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 or decay	
CC.9-12.A.SSE.1 Interpret expressions that represent a quantity in terms of its context.*	Students should understand the vocabulary for the parts that make up the whole expression and be able to identify those parts and interpret there meaning in terms of a context.
CC.9-12.A.SSE.1b 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*	
CC.9-12.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.*	Example: ● In February, the Bezanson family starts saving for a trip to Australia in September. The Bezanson's expect their vacation to cost $5375. They start with $525. Each month they plan to deposit 20% more than the previous month. Will they have enough money for their trip?
CC.9-12.A.CED.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.*	Equations can represent real world and mathematical problems. Include equations and inequalities that arise when comparing the values of two different functions, such as one describing linear growth and one describing exponential growth. Examples:

Algebra 3
Unit 3: Exponential and Logarithmic Functions

Priority and Supporting **CCSS**	**Explanations and Examples***
	• Given that the following trapezoid has area 54 cm^2, set up an equation to find the length of the base, and solve the equation.  Lava coming from the eruption of a volcano follows a parabolic path. The height *h* in feet of a piece of lava *t* seconds after it is ejected from the volcano is given by $h(t)= -t^2 + 16t + 936$. After how many seconds does the lava reach its maximum height of 1000 feet?
CC.9-12.F.BF.1 Write a function that describes a relationship between two quantities.* CC.9-12.F.BF.1b 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	Students will analyze a given problem to determine the function expressed by identifying patterns in the function's rate of change. They will specify intervals of increase, decrease, constancy, and, if possible, relate them to the function's description in words or graphically. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model functions. Examples: ● You buy a \$10,000 car with an annual interest rate of 6 percent compounded annually and make monthly payments of \$250. Express the amount remaining to be paid off as a function of the number of months, using a recursion equation. ● A cup of coffee is initially at a temperature of 93º F. The difference between its temperature and the room temperature of 68º F decreases by 9% each minute. Write a function describing the temperature of the coffee as a function of time.

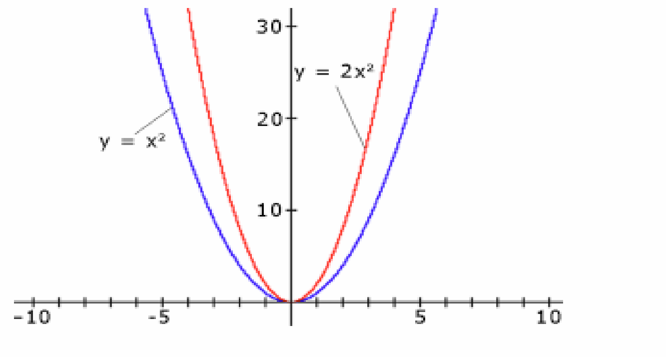
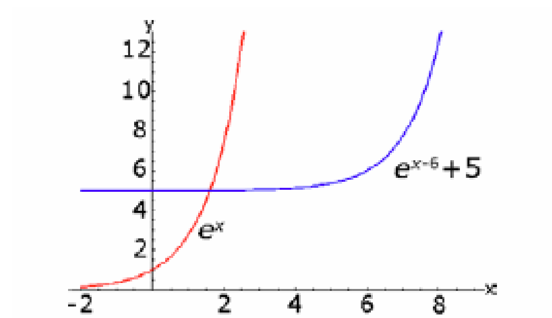
Algebra 3
Unit 3: Exponential and Logarithmic Functions

Priority and Supporting **CCSS**	**Explanations and Examples***
	● The radius of a circular oil slick after *t* hours is given in feet by $r = 10t^2 – 0.5t$, for $0 \leq t \leq 10$. Find the area of the oil slick as a function of time.
CC.9-12.A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	
CC.9-12.F.IF.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.*	Students may be given graphs to interpret or produce graphs given an expression or table for the function, by hand or using technology. Examples: ● A rocket is launched from 180 feet above the ground at time $t = 0$. The function that models this situation is given by $h = – 16t2 + 96t + 180$, where *t* is measured in seconds and *h* is height above the ground measured in feet. o What is a reasonable domain restriction for *t* in this context? o Determine the height of the rocket two seconds after it was launched. o Determine the maximum height obtained by the rocket. o Determine the time when the rocket is 100 feet above the ground. o Determine the time at which the rocket hits the ground. o How would you refine your answer to the first question based on your

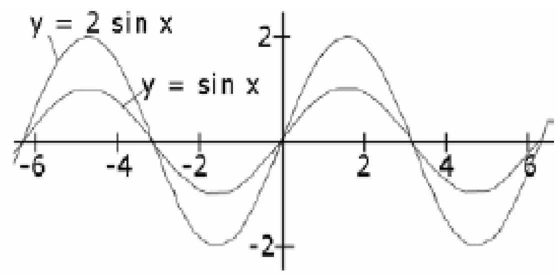
Algebra 3
Unit 3: Exponential and Logarithmic Functions

Priority and Supporting **CCSS**	**Explanations and Examples***
	response to the second and fifth questions? • Compare the graphs of $y = 3x^2$ and $y = 3x^3$. • Let $R(x) = \frac{2}{\sqrt{x-2}}$. Find the domain of $R(x)$. Also find the range, zeros, and asymptotes of $R(x)$. • Let $f(x) = 5x^3 - x^2 - 5x + 1$. Graph the function and identify end behavior and any intervals of constancy, increase, and decrease. • It started raining lightly at 5am, then the rainfall became heavier at 7am. By 10am the storm was over, with a total rainfall of 3 inches. It didn't rain for the rest of the day. Sketch a possible graph for the number of inches of rain as a function of time, from midnight to midday.
CC.9-12.F.BF.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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	Students will apply transformations to functions and recognize functions as even and odd. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to graph functions. Examples: • Is $f(x) = x^3 - 3x^2 + 2x + 1$ even, odd, or neither? Explain your answer orally or in written format. • Compare the shape and position of the graphs of $f(x) = x^2$ and $g(x) = 2x^2$, and explain the differences in terms of the algebraic expressions for the function

Algebra 3
Unit 3: Exponential and Logarithmic Functions

Priority and Supporting **CCSS**	**Explanations and Examples***
	 • De n the shape an • Compare the shape and position of the graphs of $f(x) = e^x$ to $g(x) = e^{x-6} + 5$, and explain the differences, orally or in written format, in terms of the algebraic expressions for the functions 

Algebra 3
Unit 3: Exponential and Logarithmic Functions

Priority and Supporting **CCSS**	**Explanations and Examples***
	• Describe the effect of varying the parameters *a, h,* and *k* on the shape and position of the graph $f(x) = ab^{(x + h)} + k$., orally or in written format. What effect do values between 0 and 1 have? What effect do negative values have? • Compare the shape and position of the graphs of $y = \sin x$ to $y = 2 \sin x$. • 
CC.9-12.A.REI.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.*	Students need to understand that numerical solution methods (data in a table used to approximate an algebraic function) and graphical solution methods may produce approximate solutions, and algebraic solution methods produce precise solutions that can be represented graphically or numerically. Students may use graphing calculators or programs to generate tables of values, graph, or solve a variety of functions. Example: ● Given the following equations determine the *x* value that results in an

Algebra 3
Unit 3: Exponential and Logarithmic Functions

Priority and Supporting **CCSS**	**Explanations and Examples***
	equal output for both functions. $f(x) = 3x - 2$ $g(x) = (x + 3)^2 - 1$
CC.9-12.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.	Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to analyze exponential models and evaluate logarithms. Example: • Solve 200 *e*0.04*t* = 450 for *t*. Solution: We first isolate the exponential part by dividing both sides of the equation by 200. $e^{0.04t} = 2.25$ Now we take the natural logarithm of both sides. $ln\ e^{0.04t} = ln\ 2.25$ The left hand side simplifies to 0.04*t*, by logarithmic identity 1. $0.04t = ln\ 2.25$ Lastly, divide both sides by 0.04 $t = ln\ (2.25) / 0.04$ $t \approx 20.3$

Algebra 3
Unit 3: Exponential and Logarithmic Functions

Priority and Supporting **CCSS**	**Explanations and Examples***
CC.9-12.F.BF.5 (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.	Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to solve problems involving logarithms and exponents. Example: ● Find the inverse of $f(x) = 3(10)^{2x}$.

Concepts **What Students Need to Know**	**Skills** **What Students Need To Be Able To Do**	**Bloom's Taxonomy Levels**
● Equivalent forms of expression ● Properties of exponents ● Exponential growth or decay	● Write (function to model) ● Use (properties of exponents) ● Interpret / Classify (grown or decay)	4 3 4
● Functions (expressed symbolically) Exponential Logarithmic	● Graph	3
● Key Features Intercepts intervals *increasing or decreasing* *positive or negative* end behavior / asymptotes ● Technology (graphing complicated functions)	● Show (key features / intercepts / end behavior) ● Use (technology)	4 3

Approved Feb 2016

Algebra 3

Unit 3: Exponential and Logarithmic Functions

Concepts What Students Need to Know	Skills What Students Need To Be Able To Do	Bloom's Taxonomy Levels
• Exponential / logarithmic form	• Express (as logarithm)	3
• Logarithm	• Evaluate (logarithm)	2

Essential Questions
When does a function best model a situation?
Corresponding Big Ideas
Lines, exponential functions, and parabolas each describe a specific pattern of change.

Standardized Assessment Correlations (State, College and Career)
CollegeBoard PSAT and SAT

Vocabulary
Exponential, growth factor, growth rate, base, power, logarithm, common log, correlation coefficient

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Algebra 3
Unit 3: Exponential and Logarithmic Functions

Learning Activities		
Topic	**Source(s)**	**CCSS**
Exponential Function • Write an exponential function to model a real life situation • Use a model equation to make a prediction • Use the graphing calculator to estimate • Write an exponential function given a graph • Analyze a written function to determine whether it represents growth or decay (equation, table) • Describe an exponential function as a transformation from its parent graph • Graph an exponential equation as a transformation from its parent graph • Solve exponentials • Evaluate exponentials Logarithmic Function • Define as the inverse of an exponential • Write a logarithmic function to model a real life situation • Use a model equation to make a prediction • Write a logarithmic function given a graph • Describe a logarithmic function as a transformation from its parent graph • Graph a logarithmic equation as a transformation from its parent graph or as the inverse of its related exponential	Algebra 2 Text section 8.1 PC text section 5.3 Department generated worksheets Department generated worksheets Algebra 2 Text section 8.5	**CC.9-12.A.CED.1** **CC.9-12.F.IF.8b** **CC.9-12.F.BF.3 I** **CC.9-12.F.IF.7e** **CC.9-12.F.IF.8** **CC.9-12.F.LE.4** **CC.9-12.A.CED.1** **CC.9-12.F.IF.7e**

• Solve logarithmic equations • Evaluate logarithmic functions		

Unit Assessments **The items developed for this section can be used during the course of instruction when deemed appropriate by the teacher.**
Quizzes, calculator projects, identical unit assessment

Algebra 3
Unit 3: Exponential and Logarithmic Functions

Application

*Using the graphing calculator, enter the data using the STAT menu and use the STAT: Calc option to determine best model to fit the data. Use your knowledge of the shapes of function family graphs to choose the model to try. Use **r** and **r^2** to choose the best model.*

Find a function that best fits the relation between the age and average total cholesterol for adult males at various ages.

Age	**Total Cholesterol**
27	189
40	205
50	215
60	210
70	210
80	194

Function family: ___________________________ r = ______________; r^2 = ________________ Equation: ____________________________

The wind speed s (in miles per hour) near the center of a tornado is related to the distance d (in miles) the tornado travels by the equation $s = 93 \log d + 65$.

On March 18, 1925, a tornado whose wind speed was about 280 miles per hour struck the Midwest. How far did the tornado travel?

Jonas purchased a new car for $15,000. Each year the value of the car depreciates by 30% of its value the previous year. In how many years will the car be worth $500?

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Algebra 3
Unit 4: Applications of Trigonometry

Pacing: 6 weeks A/B Block Schedule

Mathematical Practices
Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning. *Practices in bold are to be emphasized in the unit.* 1. **Make sense of problems and persevere in solving them.** 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. **Model with mathematics.** 5. **Use appropriate tools strategically.** 6. **Attend to precision.** 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.
Standards Overview
Define trigonometric ratios and solve problems involving right triangles. (+)Apply trigonometry to general triangles using laws of sines and cosines. (+) indicates additional mathematics that students should learn in order to take advanced courses such as calculus, advanced statistics, or discrete mathematics Use trigonometry to solve triangles. Review solving right triangles using trig ratios. Use the Laws of Sines and Cosines, to solve non-right triangles. Use trigonometry to find the area of triangles for which a height is not given.

Algebra 3
Unit 4: Applications of Trigonometry

Priority and Supporting **CCSS**	**Explanations and Examples***
CC.9-12.G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.*	To use the Pythagorean Theorem and its Converse To use sine, cosine, and tangent ratios to determine side lengths in right triangles To use inverse functions to determine angle measures in right triangles To use angles of elevation and depression to solve problems To find the area of a triangle using trigonometry
CC.9-12.G.SRT.9 (+) Derive the formula A = 1/2absin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.	To find the area of any triangle (formula derived using law of sines)
CC.9-12.G.SRT.11 (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles.	To use the Law of Sines and Law of Cosines in finding the measures of sides and angles of a triangle

Algebra 3
Unit 4: Applications of Trigonometry

Concepts What Students Need to Know	Skills What Students Need To Be Able To Do	Bloom's Taxonomy Levels
• Pythagorean Theorem	• Write model equation and solve	
• Six Trigonometric Ratios	• Know • Use to write model equations and solve	
• Law of Sines	• Know • Use to write model equations and solve • Analyze diagram to know when to apply	
• Law of Cosines	• Know • Use to write model equations and solve • Analyze diagram to know when to apply	
• Area of Triangle $Area = \frac{1}{2}bh$; $Area = \frac{1}{2}bc\sin A$; Heron's Formula: $Area = \sqrt{s(s-a)(s-b)(s-c)}$, where $s = \frac{1}{2}(a+b+c)$	• Analyze diagram information to select appropriate area formula	

Algebra 3
Unit 4: Applications of Trigonometry

Essential Questions
How might the features of one figure be useful when solving problems about a similar figure?
Corresponding Big Ideas
Similarity and the properties of similar triangles allow for the application of trigonometric ratios to real-world situations.
Standardized Assessment Correlations (State, College and Career)
CollegeBoard PSAT and SAT

Vocabulary
Pythagorean Theorem, trigonometric ratios, inverse trigonometric functions, law of sines, law of cosines, Heron's formula

Algebra 3
Unit 4: Applications of Trigonometry

Learning Activities		
Topic	**Source(s)**	**CCSS**
• Review six trigonometric functions (Sine, cosine, tangent, cosecant, secant, cotangent) • Review solving right triangles using Pythagorean Thm and trig ratios (applications)	Algebra 2 text: Section 14.3	G-SRT6, G-SRT7 and G-SRT8 G-SRT4 and G-SRT8
• Law of Sines	Section 14.4	G-SRT10, G-SRT11
• Law of Cosines	Section 14.5	
• Area of Triangles (include Heron's Formula)	Section 14.4	G-SRT9

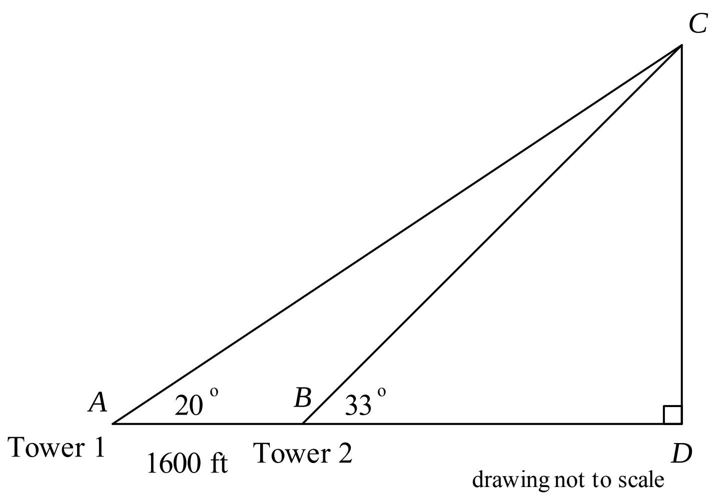
Unit Assessments The items developed for this section can be used during the course of instruction when deemed appropriate by the teacher.
Section Quizzes, End-of-Unit Test

Algebra 3
Unit 4: Applications of Trigonometry

Application

A famous golfer tees off on a long, straight 455 yard par 4 and slices his drive 13° to the right of the line from tee to the hole. If the drive went 283 yards, how many yards will the golfer's second shot have to be to reach the hole?

A plane is located at *C* on the diagram. There are two towers located at *A* and *B*. The distance between the towers is 1,600 feet, and the angles of elevation are given.

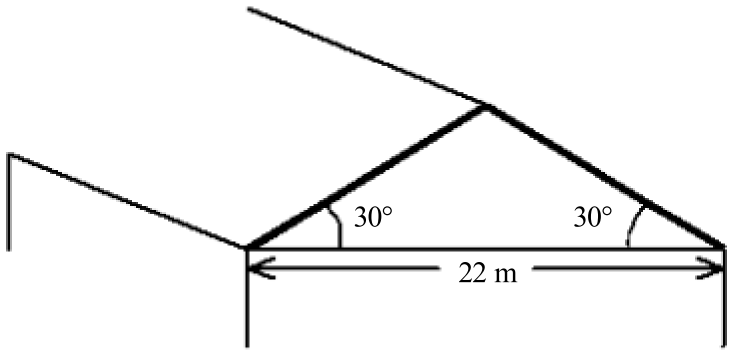


a. Find *BC*, the distance from Tower 2 to the plane, to the nearest foot.

b. Find *CD*, the height of the plane from the ground, to the nearest foot.

Algebra 3
Unit 4: Applications of Trigonometry

A farmer is estimating the surface area of his barn to find how much paint he needs to buy. One part of the barn is triangular as shown.



a. The darkened sides in the figure are the edges of the roof. This trim will be painted white. Find the length of each of these two sides of the triangle.

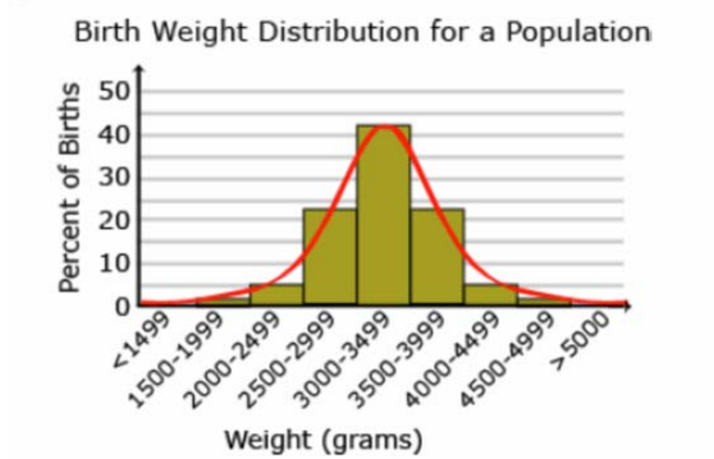
b. The triangular surface will be painted red. Find the area of the triangle.

Algebra 3
Unit 5: Statistics

Pacing: 8 weeks A/B Block Schedule

Mathematical Practices
Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning. *Practices in bold are to be emphasized in the unit.* 1. Make sense of problems and persevere in solving them. 2. **Reason abstractly and quantitatively.** 3. **Construct viable arguments and critique the reasoning of others.** 4. **Model with mathematics.** 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. **Look for and express regularity in repeated reasoning.**
Standards Overview
Summarize, represent, and interpret data on a single count or measurement variable Summarize, represent, and interpret data on two categorical and quantitative variables. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages.

Algebra 3
Unit 5: Statistics

Priority and Supporting **CCSS**	**Explanations and Examples***
CC.9-12.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.	Students may use spreadsheets, graphing calculators, statistical software and tables to analyze the fit between a data set and normal distributions and estimate areas under the curve. Examples: ● The bar graph below gives the birth weight of a population of 100 chimpanzees. The line shows how the weights are normally distributed about the mean, 3250 grams. Estimate the percent of baby chimps weighing 3000-3999 grams.  ● Determine which situation(s) is best modeled by a normal distribution. Explain your reasoning. o Annual income of a household in the U.S. o Weight of babies born in one year in the U.S.

Algebra 3
Unit 5: Statistics

Priority and Supporting **CCSS**	**Explanations and Examples***
CC.9-12.S.IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	
CC.9-12.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?	Possible data-generating processes include (but are not limited to): flipping coins, spinning spinners, rolling a number cube, and simulations using the random number generators. Students may use graphing calculators, spreadsheet programs, or applets to conduct simulations and quickly perform large numbers of trials. The law of large numbers states that as the sample size increases, the experimental probability will approach the theoretical probability. Comparison of data from repetitions of the same experiment is part of the model building verification process. Example: ● Have multiple groups flip coins. One group flips a coin 5 times, one group flips a coin 20 times, and one group flips a coin 100 times. Which group's results will most likely approach the theoretical probability?
CC.9-12.S.IC.6 Evaluate reports based on data.	Explanations can include but are not limited to sample size, biased survey sample, interval scale, unlabeled scale, uneven scale, and outliers that distort the line-of-best-fit. In a pictogram the symbol scale used can also be a source of distortion. As a strategy, collect reports published in the media and ask students to consider the source of the data, the design of the study, and the way the

Algebra 3
Unit 5: Statistics

Priority and Supporting **CCSS**	**Explanations and Examples***
	data are analyzed and displayed. Example: ● A reporter used the two data sets below to calculate the mean housing price in Arizona as $629,000. Why is this calculation not representative of the typical housing price in Arizona? o King River area {1.2 million, 242000, 265500, 140000, 281000, 265000, 211000} o Toby Ranch homes {5million, 154000, 250000, 250000, 200000, 160000, 190000}
S-ID 1 Represent data with plots on the real number line (dot plots, histograms, and box plots).	Students may compare and contrast the advantage of each of these representations.
S-ID 2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	Students may use spreadsheets, graphing calculators and statistical software for calculations, summaries, and comparisons of data sets. Example: Given a set of test scores: 99, 96, 94, 93, 90, 88, 86, 77, 70, 68, find the mean, median and standard deviation. Explain how the values vary about the mean and median. What information does this give the teacher?

Algebra 3
Unit 5: Statistics

Priority and Supporting **CCSS**	**Explanations and Examples***
S-ID 3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	Example: After the 2009-2010 NBA season LeBron James switched teams from the Cleveland Cavaliers to the Miami Heat, and he remained the top scorer (in points per game) in his first year in Miami. Compare team statistics for Cleveland (2009-2010) and Miami (2010-2011) for all players who averaged at least 10 minutes per game. Using the 1.5 X IQR rule, determine for which team and year James's performance may be considered an outlier.
S-ID5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data(including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.	

Algebra 3
Unit 5: Statistics

Concepts What Students Need to Know	Skills What Students Need To Be Able To Do	Bloom's Taxonomy Levels
• Data (Who, What, When, Where, Why)	• Identify • Interpret • Classify (Categorical, Quantitative)	1 2 1
• Measures of central tendency (mean, median, mode)	• Calculate (mean, median, mode, interquartile range) • Use (statistics to infer)	1 3
• Measures of spread (range, interquartile range, standard deviation) • Outlier • Histogram • Box plot • Correlation	• Use (technology to find standard deviation) • Interpret (correlation) • Identify (outliers)	3 2 4
• Normal Distribution • Population percentages • Appropriate use of normal approx • Calculators, spreadsheets, tables • Area under normal curve • Inference • Population parameters	• Fit (normal distribution) • Estimate (population percentages) • Recognize (inappropriate usage) • Use (technology) • Estimate (area under normal) • Make (inferences based on data)	3 3 4 3 3 4
• Sample survey data • Population mean / proportion	• Use (data to make inference) • Estimate (population parameters)	4 4

Algebra 3
Unit 5: Statistics

Essential Questions
How can the properties of data be communicated to showcase its important features?
Corresponding Big Ideas
Statisticians summarize, represent and interpret categorical and quantitative data in different ways since one method can reveal or create a different impression than another.

Standardized Assessment Correlations (State, College and Career)
Collegeboard PSAT and SAT

Vocabulary
Population, sample, variable, quantitative variable, categorical variable, relative frequency, contingency table, marginal distribution, conditional distribution, histogram, symmetrical data, skewed data, outlier value, mean, median, interquartile range, standard deviation, Normal model, z-score

Algebra 3
Unit 5: Statistics

Learning Activities		
Topic	**Source(s)**	**CCSS**
Define Data – 5 W's	Stats in Your World text	
Categorical Data		
Create a relative frequency table		**CC.9-12.S.IC.1**
Analyze data displays		CC.9-12.S.IC.2
Calculate marginal distributions from a contingency table		
Calculate conditional distribution from a contingency table		S-ID5
Determine whether variables are dependent/independent		CC.9-12.S.IC.6
		S-ID 3
Quantitative Data		
Create histogram by hand and with calculator		
Discuss shape, center, spread		
Calculate range, median, quartiles and interquartile range		
Calculate population percentages based on quartile info		S-ID 1
		S-ID 2
Mean, Median, Standard Deviation, IQR (Interquartile range)		**S-ID 3**
Calculate		
Determine most appropriate measure based on data info		
		CC.9-12.S.ID.4
Normal Distribution		**S-ID 2**
Determine whether a data set is normal		**S-ID 3**
Z-Scores		
Calculate		**CC.9-12.S.ID.4**
Use scores to compare data		

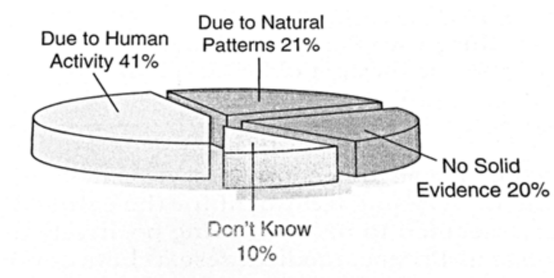
Algebra 3
Unit 5: Statistics

Normal Model 68-95-99.7 model Sketch with deviations identified Calculate percentages of a population Calculate z-scores for a given population percentage		

Unit Assessments **The items developed for this section can be used during the course of instruction when deemed appropriate by the teacher.**
Section Quizzes, End-of-Unit Test

Application

The Pew Research Center for the People and the Press (http://people-press.org) has asked a representative sample of U.S. adults about global warming, repeating the question over time. In January, 2007 the responses reflected an increased belief that global warming is real and due to human activity. Below is a display of the percentages of respondents choosing each of the major alternatives offered, list two errors in the display.



Algebra 3
Unit 5: Statistics

A town's January high temperatures average 36°F with a standard deviation of 8°, while in July the mean high temperature is 75°F and the standard deviation is 10°. In which month is it more unusual to have a day with a high temperature of 55°? Show work and explain your answer.
Companies who design furniture for elementary school classrooms produce a variety of sizes for kids of different ages. Suppose the heights of kindergarten children can be described by a Normal model with a mean of 39.2 inches and a standard deviation of 1.9 inches. a. Calculate the z-score for a child's height of 42 inches. b. Calculate the z-score for a child's height of 35 inches. c. Use your calculator to determine the percent of children whose heights fall 35 and 42 inches. Write down the calculator "operation" as your work. d. What percent of kindergarten children should the company expect to be less than 35 inches tall? Again use your calculator and write down the "operation" as your work. e. Use your calculator and find the z-score for the lowest 20% of the children's heights. Find the height that corresponds to this z-score, then sketch and shade in the normal curve showing this 20%. Clearly label your graph. f. Use your calculator and find the z-score for the highest 4% of the children's heights. Find the height that corresponds to this z-score, then sketch and shade in the normal curve showing this 4%. Clearly label your graph.

Approved Feb 2016

Algebra 3
Unit 6: Probability and Counting

Pacing: 3 weeks A/B Block Schedule

Mathematical Practices
Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning. *Practices in bold are to be emphasized in the unit.* 1. **Make sense of problems and persevere in solving them.** 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. **Model with mathematics.** 5. **Use appropriate tools strategically.** 6. Attend to precision. 7. **Look for and make use of structure.** 8. Look for and express regularity in repeated reasoning.
Standards Overview
Use permutations and combinations to compute probabilities of compound events.

Algebra 3
Unit 6: Probability and Counting

Priority and Supporting **CCSS**	**Explanations and Examples***
CC.9-12.S-CP.9 **(+)** Use permutations and combinations to compute probabilities of compound events and solve problems	${}_nP_r = \frac{n!}{(n-r)!}$ ${}_nC_r = \frac{n!}{(n-r)!r!}$
CC.9-12.MD.1 (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space	

Concepts **What Students Need to Know**	**Skills** **What Students Need To Be Able To Do**	**Bloom's Taxonomy Levels**
Sample Space	Create	
Probability	Calculate	
Counting principle	Understand	
Permutation	Identify	
	Calculate	
Combination	Identify	
	Calculate	

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Algebra 3
Unit 6: Probability and Counting

Essential Questions
In what ways does one event impact the probability of another event occurring? How is probability used to make informed decisions about uncertain events?
Corresponding Big Ideas
Probability provides a process to determine the likelihood of events and determine whether the occurrence of one evnt makes some other result more or less likely. The rules of probability can lead to more valid and reliable predictions about the likelihood of an event occurring.
Standardized Assessment Correlations **(State, College and Career)**
CollegeBoard PSAT and SAT

Vocabulary
Probability, random selection, sample space, outcome, factorial (!), counting principle, permutation, combination,

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Learning Activities		
Topic	**Source(s)**	**CCSS**
• Create sample space • Calculate probability • Determine whether written scenario represents a permutation or combination • Select the appropriate formula to accurately calculate the count of a permutation and/or combination	Stats in Your World Chapter 13 p. 284	CC9-12.CP.9

Unit Assessments **The items developed for this section can be used during the course of instruction when deemed appropriate by the teacher.**
Section quizzes, End-of-Unit Test