Mastery Level (ML) Codes: 1=Standard should be taught in depth; 2=Students need a basic foundation; 3=If time permits

ML	Expectation:	Sample Problem / Explanation	Pacing	Assessment	Resources
The Number System					
8.NS Know that there are numbers that are not rational, and approximate them by rational numbers					
1	1. Know that numbers that are not rational are called irrational.				
1	2. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.				
1	3. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions.	What is the estimated value of π^2 ? By truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.			
Seeing Structure in Expressions					
A-SSE Interpret the structure of expressions					
1	1. Interpret expressions that represent a quantity in terms of its context. 1a. Interpret parts of an expression, such as terms, factors, and coefficients.				
1	1b. Interpret complicated expressions by viewing one or more of their parts as a single entity.	Interpret $P(1+r)^n$ as the product of P and a factor not depending on P.			
1	2. Use the structure of an expression to identify ways to rewrite it.	x^4-y^4 as $(x^2)^2-(y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2-y^2)(x^2+y^2)$			
A-SSE Write expressions in equivalent forms to solve problems					
1	3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. 3a. Factor a quadratic expression to reveal the zeros of the function it defines.				

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ML	Expectation:	Sample Problem / Explanation	Pacing	Assessment	Resources
1	3b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.				
1	3c. Use the properties of exponents to transform expressions for exponential functions.	The expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.			
2	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.	Calculate mortgage payments.			
Expressions and Equations					
8.EE Work with radicals and integer exponents					
1	1. Know and apply the properties of integer exponents to generate equivalent numerical expressions.	$3^2 x 3^{-5} = 3^{-3} = 1/3^3 = 1/27$			
1	2. Use square root and cube root symbols to represent solutions to equations of the form $x^2=p$ and $x^3=p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.				
Creating Equations					
A-CED Create equations that describe numbers or relationships					
1	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.				
1	2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.				

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ML	Expectation:	Sample Problem / Explanation	Pacing	Assessment	Resources
1	3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.	Represent inequalities describing nutritional and cost constraints on combination of different foods.			
2	4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	Rearrange Ohm's law V=IR to highlight resistance R.			
Functions					
8.F Define, evaluate, and compare functions					
1	1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.				
2	2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	Given a linear function represented by a table or values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.			
1	3. Interpret the equation y=mx+b as defining a linear function, whose graph is a straight line; give example of functions that are not linear.				
Use functions to model relationships between quantities					
1	4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x,y) values, including reading these from a table or from a graph.				
2	5. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.				

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Arithmetic with Polynomials and Rational Expressions					
A-APR Perform arithmetic operations on polynomials					
2	1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication.				
1	2. Add, subtract, and multiply polynomials.				
A-APR Understand the relationship between zeros and factors of polynomials					
2	3. 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).				
1	4. 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.				
A-APR Use polynomial identities to solve problems					
1	5. Prove polynomial identities and use them to describe numerical relationships.	The polynomial identity $(x^2+y^2)^2=(x^2-y^2)^2+(2xy)^2$ can be used to generate Pythagorean triples.			
3	6. 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	7. 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.				

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ML	Expectation:	Sample Problem / Explanation	Pacing	Assessment	Resources
3	8. 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.				
Reasoning with Equations and Inequalities					
A-REI Understand solving equations as a process of reasoning and explain the reasoning					
2	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.				
1	2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.				
A-REI Solve equations and inequalities in one variable					
1	3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.				
1	<u>4. Solve quadratic equations in one variable.</u> 4.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.				
1	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.				

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ML	Expectation:	Sample Problem / Explanation	Pacing	Assessment	Resources
A-REI Solve systems of equations					
1	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.				
1	6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.				
2	7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.	Find the points of intersection between the line $y=-3x$ and the circle $x^2+y^2=3$			
3	8. Represent a system of linear equations as a single matrix equation in a vector variable.				
3	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 3x3 or greater).				
A-REI Represent and solve equations and inequalities graphically					
1	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 cure (which could be a line).				
2	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.				

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ML	Expectation:	Sample Problem / Explanation	Pacing	Assessment	Resources
2	12. Graph the solutions to a linear inequality in two variables as a half-plane (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.				
Geometry					
8.G Understand and apply the Pythagorean Theorem					
1	1. Explain a proof of the Pythagorean Theorem and its converse.				
1	2. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.				
1	3. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.				