

## Math II EOY

Evidence Statement Key	Evidence Statement Text	Clarifications	MP	Calculator
N-RN.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.	None	7	Item Specific
N-RN.3	Apply properties of rational and irrational numbers to identify rational and irrational numbers.	i) For rational solutions, exact values are required. For irrational solutions, exact or decimal approximations may be required. Simplifying or rewriting radicals is not required.	6	No
N-CN.1	Know there is a complex number $i$ such that $i^2 = -1$ , and every complex number has the form $a + bi$ with $a$ and $b$ real.	None	7	Item Specific
N-CN.2	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	None	6, 7	No
N-CN.7	Solve quadratic equations with real coefficients that have complex solutions.	i) Tasks are limited to equations with non-real solutions.	5	Item Specific
A-SSE.1-2	Interpret quadratic expressions that represent a quantity in terms of its context. ★ a) Interpret parts of an expression, such as terms, factors, and coefficients. b) Interpret complicated expressions by viewing one or more of their parts as a single entity.	i) See illustrations for A-SSE.1 at <a href="http://illustrativemathematics.org">http://illustrativemathematics.org</a> , e.g., <a href="http://illustrativemathematics.org/illustrations/90">http://illustrativemathematics.org/illustrations/90</a>	7	Neutral
A-SSE.2-2	Use the structure of quadratic or exponential expressions, including related numerical expressions to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i>	i) Examples: Recognize $53^2 - 47^2$ as a difference of squares and see an opportunity to rewrite it in the easier-to-evaluate form $(53+47)(53-47)$ . See an opportunity to rewrite $a^2 + 9a + 14$ as $(a+7)(a+2)$ .	7	Neutral
A-SSE.2-5	Use the structure of a quadratic or exponential expression to rewrite it, in a case where two or more rewriting steps are required.	i) Example: Factor completely $x^2 - 1 + (x-1)^2$ . (A first iteration might give $(x+1)(x-1) + (x-1)^2$ , which could be rewritten as $(x-1)(x+1+x-1)$ on the way to factoring completely as $2x(x-1)$ . Or the student might first expand as $x^2 - 1 + x^2 - 2x + 1$ , rewriting as $2x^2 - 2x$ then factoring as $2x(x-1)$ . ii) Tasks do not have a context.	7, 1	Neutral

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A-SSE.3a	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a) Factor a quadratic expression to reveal the zeros of the function it defines.	None	7	Neutral
A-SSE.3b	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. b) Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.	None	7	Neutral
A.SSE.3c-1	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression, where exponentials are limited to integer exponents. ★ c) Use the properties of exponents to transform expressions for exponential functions. <i>For example the expression <math>1.15^t</math> can be rewritten as <math>\left(1.15^{\frac{1}{12}}\right)^{12t} \approx 1.012^{12t}</math> to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</i>	i) Tasks have a context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation.	1, 2, 4, 7	Neutral
A-SSE.3c-2	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression, where exponentials are limited to rational or real exponents. ★ c) Use the properties of exponents to transform expressions for exponential functions. <i>For example the expression <math>1.15^t</math> can be rewritten as <math>\left(1.15^{\frac{1}{12}}\right)^{12t} \approx 1.012^{12t}</math> to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</i>	i) Tasks have a context. As described in the standard, there is an interplay between mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation.	1, 2, 4, 7	Neutral

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A-APR.1-1	Add, subtract, and multiply polynomials.	i) The “understand” part of the standard is not assessed here; it is assessed under Sub-claim C.	-	Neutral
A-CED.4-2	Rearrange formulas that are quadratic in the quantity of interest to highlight the quantity of interest, using the same reasoning as in solving equations.	i) Tasks have a context.	2, 6, 7	Neutral
A-REI.4a-1	Solve quadratic equations in one variable. a) Use the method of completing the square to transform any quadratic equation in $x$ into an equation of the form $(x - p)^2 = q$ that has the same solutions.	i) The derivation part of the standard is not assessed here; it is assessed under Sub-claim C.	1, 7	Item Specific
A-REI.4b-1	Solve quadratic equations in one variable. b) Solve quadratic equations with rational number coefficients 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.	i) Tasks should exhibit variety in initial forms. Examples of quadratic equations with real solutions: $t^2 = 49$ , $3a^2 = 4$ , $7 = x^2$ , $r^2 = 0$ , $\frac{1}{2}y^2 = \frac{1}{5}$ , $y^2 - 8y + 15 = 0$ , $2x^2 - 16x + 30 = 0$ , $2p = p^2 + 1$ , $t^2 = 4t$ , $7x^2 + 5x - 3 = 0$ , $\frac{3}{4}c(c - 1) = c$ , $(3x - 2)^2 = 6x - 4$ ii) Methods are not explicitly assessed; strategy is assessed indirectly by presenting students with a variety of initial forms. iii) For rational solutions, exact values are required. For irrational solutions, exact or decimal approximations may be required. Simplifying or rewriting radicals is not required. iv) Prompts integrate mathematical practices by not indicating that the equation is quadratic. (E.g., “Find all real solutions of the equation $t^2 = 4t$ ”...not, “Solve the quadratic equation $t^2 = 4t$ .”)	7, 5	Item Specific
A-REI.4b-2	Solve quadratic equations in one variable. b) Recognize when the quadratic formula gives complex solutions.	i) Tasks involve recognizing an equation with complex solutions, e.g., “Which of the following equations has no real solutions?” with one of the options being a quadratic equation with non-real solutions. ii) Writing solutions in the form $a \pm bi$ is not assessed here. (N-CN.7.)	7, 5	Neutral

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A-REI.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$ .	i) Tasks have thin context or no context.	1	Item Specific
A.Int.1	Solve equations that require seeing structure in expressions.	i) Tasks do not have a context. ii) Equations simplify considerably after appropriate algebraic manipulations are performed. For example, if $24 + 10x - x^2 = p - (x - 5)^2$ , then find the value of $p$ ; solve $(3x - 2)^2 = 6x - 4$ .	7, 1	No
F-IF.4-4	For a quadratic or exponential 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. <i>Key features include; intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; end behavior; and symmetries.</i>	i) See illustrations for F-IF.4 at <a href="http://illustrativemathematics.org">http://illustrativemathematics.org</a> , e.g., <a href="http://illustrativemathematics.org/illustrations/649">http://illustrativemathematics.org/illustrations/649</a> , <a href="http://illustrativemathematics.org/illustrations/637">http://illustrativemathematics.org/illustrations/637</a> , <a href="http://illustrativemathematics.org/illustrations/639">http://illustrativemathematics.org/illustrations/639</a>	6, 4	Item Specific
F-IF.5-2	Relate the domain of a function to a graph and, where applicable, to the quantitative relationship it describes, limiting to quadratic functions. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble <math>n</math> engines in a factory, then the positive integers would be an appropriate domain for this function.</i>	i) Tasks have a real-world context.	2	Neutral
F-IF.6-4	Calculate and interpret the average rate of change of a quadratic or exponential function (presented symbolically or as a table) over a specified interval. ★	i) Tasks have a context.	1, 4, 5, 7	Item Specific
F-IF.6-9	Estimate the rate of change from a graph utilizing quadratic and/or exponential functions. ★	i) Tasks have a context.	1, 4, 5, 7	Item Specific
F-IF.7a-2	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ a) Graph quadratic functions and show intercepts, maxima, and minima.	None	1, 5, 6	Item Specific

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F-IF.7b	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. b) Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.	None	1, 5, 6	Item Specific
F-IF.7e-1	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. e) Graph exponential functions, showing intercepts and end behavior.	None	1, 5, 6	Item Specific
F-IF.8a	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a) Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.	i) Tasks have a context.	2	Yes
F-IF.8b	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. b) Use the properties of exponents to interpret expressions for exponential functions. <i>For example, identify percent rate of change in functions such as <math>y = (1.02)^t</math>, <math>y = (0.97)^t</math>, <math>y = (1.01)^{12t}</math>, <math>y = (1.2)^{\frac{t}{10}}</math>, and classify them as representing exponential growth or decay.</i>	None	7	Neutral
F-IF.9-4	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). <i>For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</i> Function types are limited to quadratic and exponential functions.	i) Tasks may or may not have a context.	1, 3, 5, 6, 8	Item Specific

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F-BF.1b-1	Represent arithmetic combinations of standard function types algebraically.	i) Tasks may or may not have a context. ii) For example, given $f(x) = e^x$ and $g(x) = 5$ , write an expression for $h(x) = 2f(-3x) + g(x)$ . iii) More substantial work along these lines occurs in Sub-claim D.	-	Neutral
F-BF.3-1	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 limiting the function types to linear and quadratic functions.	i) Tasks do not involve recognizing even and odd functions. ii) Experimenting with cases and illustrating an explanation are not assessed here.	3, 5, 7	Item Specific
F-BF.3-4	Identify the effect on the graph of a quadratic function 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 using technology.	i) Illustrating an explanation is not assessed here. (See Sub-claim D.)	5, 3, 8	Item Specific
F-Int.1-4	Give a verbal description of a quadratic or exponential functional dependence, write an expression for the function and demonstrate various knowledge and skills articulated in the Functions category in relation to this function.	i) Given a verbal description of a functional dependence, the student would be required to write an expression for the function and then, e.g., identify a natural domain for the function given the situation; use a graphing tool to graph several input-output pairs; select applicable features of the function, such as linear, increasing, decreasing, quadratic, nonlinear; and find an input value leading to a given output value. e.g., a functional dependence might be described as follows: “The area of a square is a function of the length of its diagonal.” The student would be asked to create an expression such as $f(x) = \left(\frac{1}{2}\right)x^2$ for this function. The natural domain for the function would be the positive real numbers. The function is increasing and nonlinear. And so on.	1, 2, 8	Neutral

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G-SRT.1a	Verify experimentally the properties of dilations given by a center and a scale factor: a) A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.	None	1, 3, 5, 8	Neutral
G-SRT.1b	Verify experimentally the properties of dilations given by a center and a scale factor: b) The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	None	1, 3, 5, 8	Neutral
G-SRT.2	Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar.	i) The “explain” part of standard G-SRT.2 is not assessed here. See Sub-claim C for this aspect of the standard.	7	Neutral
G-SRT.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	i) For example, find a missing angle or side in a triangle.	7	Neutral
G-SRT.6	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.	i) Trigonometric ratios include sine, cosine, tangent, cotangent, secant and cosecant	7	Neutral
G-SRT.7-2	Use the relationship between the sine and cosine of complementary angles.	i) The “explain” part of standard G-SRT.7 is not assessed here. See Sub-claim C for this aspect of the standard.	7	Neutral
G-SRT.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. ★	i) Tasks have multiple steps. ii) Tasks have a context.	1, 2, 5, 6, 4	Neutral
G-GMD.1	Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. <i>Use dissection arguments, Cavalieri’s principle, and informal limit arguments.</i>	None	3, 6, 7	Neutral
G-GMD.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ★	None	4	Item Specific
S-CP.Int.1	Solve multi-step contextual word problems with degree of difficulty appropriate to the course, requiring application of course-level knowledge and skills articulated in S-CP.	None	1, 2, 5, 6, 4	Yes
S-ID.Int.2	Solve multi-step contextual word problems with degree of difficulty appropriate to the course, requiring application of course-level knowledge and skills articulated in S-ID, excluding normal distributions and limiting function fitting to quadratic functions.	None	1, 2, 5, 6, 4	Yes

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S-ID.6a-1	Solve multi-step contextual word problems with degree of difficulty appropriate to the course, requiring application of course-level knowledge and skills articulated in S-ID.6a, excluding normal distributions and limiting function fitting to exponential functions.	None	1, 2, 5, 6, 4	Yes
HS-Int.1	Solve multi-step contextual problems with degree of difficulty appropriate to the course by constructing quadratic function models and/or writing and solving quadratic equations.	<p>i) A scenario might be described and illustrated with graphics (or even with animations in some cases).</p> <p>ii) Solutions may be given in the form of decimal approximations. For rational solutions, exact values are required. For irrational solutions, exact or decimal approximations may be required. Simplifying or rewriting radicals is not required.</p> <p>iii) Some examples:</p> <p style="padding-left: 20px;">A company sells steel rods that are painted gold. The steel rods are cylindrical in shape and 6 cm long. Gold paint costs \$0.15 per square inch. Find the maximum diameter of a steel rod if the cost of painting a single steel rod must be \$0.20 or less. You may answer in units of centimeters or inches. Give an answer accurate to the nearest hundredth of a unit.</p> <p style="padding-left: 20px;">As an employee at the Gizmo Company, you must decide how much to charge for a gizmo. Assume that if the price of a single gizmo is set at <math>P</math> dollars, then the company will sell <math>1000 - 0.2P</math> gizmos per year. Write an expression for the amount of money the company will take in each year if the price of a single gizmo is set at <math>P</math> dollars. What price should the company set in order to take in as much money as possible each year? How much money will the company make per year in this case? How many gizmos will the company sell per year? (Students might use graphical and/or algebraic methods to solve the problem.)</p> <p style="padding-left: 20px;">At <math>t = 0</math>, a car driving on a straight road at a constant speed passes a telephone pole. From then on, the car's distance from the telephone pole is given by <math>C(t) = 30t</math>, where <math>t</math> is in seconds and <math>C</math> is in meters. Also at <math>t = 0</math>, a motorcycle pulls out onto the road, driving in the same direction, initially 90 m ahead of the car. From then on, the motorcycle's distance from the telephone pole is given by <math>M(t) = 90 + 2.5t^2</math>, where <math>t</math> is in seconds and <math>M</math> is in meters. At what time <math>t</math> does the car catch up to the motorcycle? Find the answer by setting <math>C</math> and <math>M</math> equal. How far are the car and the motorcycle from the telephone pole when this happens? (Students might use graphical and/or algebraic methods to solve the problem.)</p>	1, 2, 5, 6, 4	Yes

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HS-Int.2	Solve multi-step mathematical problems with degree of difficulty appropriate to the course that require analyzing quadratic functions and/or writing and solving quadratic equations.	i) Tasks do not have a context. ii) Exact answers may be required or decimal approximations may be given. Students might choose to take advantage of the graphing utility to find approximate answers or clarify the situation at hand. For rational solutions, exact values are required. For irrational solutions, exact or decimal approximations may be required. Simplifying or rewriting radicals is not required. iii) Some examples: Given the function $f(x) = x^2 + x$ , find all values of $k$ such that $f(3-k) = f(3)$ . (Exact answers are required.) Find a value of $c$ so that the equation $2x^2 - cx + 1 = 0$ has a double root. Give an answer accurate to the tenths place.	1, 5, 6	Yes