Algebra II (IMRA)

Subject: Mathematics
Grade: 10
Expectations: 55
Breakouts: 233

(a) Introduction.

1. The desire to achieve educational excellence is the driving force behind the Texas essential knowledge and skills for mathematics, guided by the college and career readiness standards. By embedding statistics, probability, and finance, while focusing on fluency and solid understanding, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.

2. The process standards describe ways in which students are expected to engage in the content. The placement of the

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(xvi)   communicate [mathematical reasoning's] implications using multiple representations, including language as appropriate

(E)   create and use representations to organize, record, and communicate mathematical ideas;

      (i)   create representations to organize mathematical ideas

      (ii)   create representations to record mathematical ideas

      (iii)   create representations to communicate mathematical ideas

      (iv)   use representations to organize mathematical ideas

      (v)   use representations to record mathematical ideas

      (vi)   use representations to communicate mathematical ideas

(F)   analyze mathematical relationships to connect and communicate mathematical ideas; and

      (i)   analyze mathematical relationships to connect mathematical ideas

      (ii)   analyze mathematical relationships to communicate mathematical ideas

(G)   display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

      (i)   display, explain, or justify mathematical ideas using precise mathematical language in written or oral communication

      (ii)   display, explain, or justify mathematical arguments using precise mathematical language in written or oral communication

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(2)   Attributes of functions and their inverses. The student applies mathematical processes to understand that functions have distinct key attributes and understand the relationship between a function and its inverse. The student is expected to:

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(A)   graph the *functions* $f(x)=x$, $f(x)=1/x$, $f(x)=x^3$, $f(x)=\sqrt[3]{x}$, $f(x)=b^x$, $f(x)=|x|$, and $f(x)=\log_b(x)$ where b is 2, 10, and e, and, when applicable, analyze the key attributes such as domain, range, intercepts, symmetries, asymptotic behavior, and maximum and minimum given an interval

      (i)   graph the function $f(x)=x$, and, when applicable, analyze the key attributes

      (ii)   graph the function $f(x)=1/x$, and, when applicable, analyze the key attributes

      (iii)   graph the function $f(x)=x^3$, and, when applicable, analyze the key attributes

      (iv)   graph the function $f(x)=\sqrt[3]{x}$, and, when applicable, analyze the key attributes

      (v)   graph the function $f(x)=b^x$ where b is 2, and, when applicable, analyze the key attributes

      (vi)   graph the function $f(x)=b^x$ where b is *10*, and, when applicable, analyze the key attributes

      (vii)   graph the function $f(x)=b^x$ where b is e, and, when applicable, analyze the key attributes

      (viii)   graph the function $f(x)=|x|$, and, when applicable, analyze the key attributes

      (ix)   graph the function $f(x)=\log_b(x)$ where b is 2, and, when applicable, analyze the key attributes

      (x)   graph the function $f(x)=\log_b(x)$ where b is 10, and, when applicable, analyze the key attributes

      (xi)   graph the function $f(x)=\log_b(x)$ where b is e, and, when applicable, analyze the key attributes

(B)   graph and write the inverse of a function using notation such as $f^{-1}(x)$

      (i)   graph the inverse of a function using notation

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(ii)   write the inverse of a function using notation

(C)   describe and analyze the relationship between a function and its inverse (quadratic and square root, logarithmic and exponential), including the restriction(s) on domain, which will restrict its range; and

    (i)   describe the relationship between a function and its inverse (quadratic and square root), including the restriction(s) on domain, which will restrict its range

    (ii)   describe the relationship between a function and its inverse (logarithmic and exponential), including the restriction(s) on domain, which will restrict its range

    (iii)   analyze the relationship between a function and its inverse (quadratic and square root), including the restriction(s) on domain, which will restrict its range

    (iv)   analyze the relationship between a function and its inverse (logarithmic and exponential), including the restriction(s) on domain, which will restrict its range

(D)   use the composition of two functions, including the necessary restrictions on the domain, to determine if the functions are inverses of each other.

    (i)   use the composition of two functions, including the necessary restrictions on the domain, to determine if the functions are inverses of each other

(3) Systems of equations and inequalities. The student applies mathematical processes to formulate systems of equations and inequalities, use a variety of methods to solve, and analyze reasonableness of solutions. The student is expected to:

(A)   formulate systems of equations, including systems consisting of three linear equations in three variables and systems consisting of two equations, the first linear and the second quadratic;

    (i)   formulate systems of equations, including systems consisting of three linear equations in three variables

    (ii)   formulate systems of equations, including systems consisting of two equations, the first linear and the second quadratic

(B)   solve systems of three linear equations in three variables by using Gaussian elimination, technology with matrices, and substitution;

    (i)   solve systems of three linear equations in three variables by using Gaussian elimination

    (ii)   solve systems of three linear equations in three variables by using technology with matrices

    (iii)   solve systems of three linear equations in three variables by using substitution

(C)   solve, algebraically, systems of two equations in two variables consisting of a linear equation and a quadratic equation;

    (i)   solve, algebraically, systems of two equations in two variables consisting of a linear equation and a quadratic equation

(D)   determine the reasonableness of solutions to systems of a linear equation and a quadratic equation in two variables;

    (i)   determine the reasonableness of solutions to systems of a linear equation and a quadratic equation in two variables

(E)   formulate systems of at least two linear inequalities in two variables;

    (i)   formulate systems of at least two linear inequalities in two variables

(F)   solve systems of two or more linear inequalities in two variables; and

(xiv)   determine the effects on the key attributes on the graph of $f(x) = b^x$ where b is 2 when $f(x)$ is replaced by $f(x - c)$ for specific negative real values of c

(xv)   determine the effects on the key attributes on the graph of $f(x) = b^x$ where b is 10 when $f(x)$ is replaced by $f(x - c)$ for specific positive real values of c

(xvi)   determine the effects on the key attributes on the graph of $f(x) = b^x$ where b is 10 when $f(x)$ is replaced by $f(x - c)$

(xxxiv)   determine the effects on the key attributes on the graph of $f(x) = \log_b(x)$ where b is 10 when $f(x)$ is replaced by $f(x - c)$ for specific negative real values of c

  (xxxv)   determine the effects on the key attributes on the graph of $f(x) = \log_b(x)$ where b is e when $f(x)$ is replaced by $f(x - c)$ for specific positive real values of c

  (xxxvi) determine the effects on the key attributes on the graph of $f(x) = \log_b(x)$ where b is e when $f(x)$ is replaced by $f(x - c)$ for specific negative real values of c

(B) formulate exponential and logarithmic equations that model real-world situations, including exponential relationships written in recursive notation;

  (i)   formulate exponential equations that model real-world situations, including exponential relationships written in recursive notation

  (ii) formulate logarithmic equations that model real-world situations

(C) rewrite exponential equations as their corresponding logarithmic equations and logarithmic equations as their corresponding exponential equations;

  (i)   rewrite exponential equations as their corresponding logarithmic equations

  (ii) rewrite logarithmic equations as their corresponding exponential equations

(D) solve exponential equations of the form $y = ab^x$ where a is a nonzero real number and b is greater than zero and not equal to one and single logarithmic equations having real solutions; and

  (i)   solve exponential equations of the form $y = ab^x$ where a is a nonzero real number and b is greater than zero and not equal to one

  (ii) solve single logarithmic equations having real solutions

(E) determine the reasonableness of a solution to a logarithmic equation.

  (i)   determine the reasonableness of a solution to a logarithmic equation

(6) Cubic, cube root, absolute value and rational functions, equations, and inequalities. The student applies mathematical processes to understand that cubic, cube root, absolute value and rational functions, equations, and inequalities can be used to model situations, solve problems, and make predictions. The student is expected to:

(A) analyze the effect on the graphs of $f(x) = x^3$ and $f(x) = \sqrt[3]{x}$ when $f(x)$ is replaced by $af(x)$, $f(bx)$, $f(x - c)$, and $f(x) + d$ for specific positive and negative real values of a, b, c, and d

  (i)   analyze the effect on the graphs of $f(x) = x^3$ when $f(x)$ is replaced by $af(x)$ for specific positive real values of a

  (ii)   analyze the effect on the graphs of $f(x) = x^3$ when $f(x)$ is replaced by $af(x)$ for specific negative real values of a

  (iii) analyze the effect on the graphs of $f(x) = x^3$ when $f(x)$ is replaced by $f(bx)$ for specific positive real values of b

  (iv)   analyze the effect on the graphs of $f(x) = x^3$ when $f(x)$ is replaced by $f(bx)$ for specific negative real values of b

  (v)   analyze the effect on the graphs of $f(x) = x^3$ when $f(x)$ is replaced by $f(x - c)$ for specific positive real values of c

  (vi)   analyze the effect on the graphs of $f(x) = x^3$ when $f(x)$ is replaced by $f(x - c)$ for specific negative real values of c

(vii)   represent range set notation

    (L) formulate and solve equations involving inverse variation.

        (i)   formulate equations involving inverse variation

        (ii)   solve equations involving inverse variation

(7) Number and algebraic methods. The student applies mathematical processes to simplify and perform operations on expressions and to solve equations. The student is expected to:

    (A) add, subtract, and multiply complex numbers;

        (i)   add complex numbers

        (ii)   subtract complex numbers

        (iii)   multiply complex numbers

    (B) add, subtract, and multiply polynomials;

        (i)   add polynomials

        (ii)   subtract polynomials

        (iii)   multiply polynomials

    (C) determine the quotient of a polynomial of degree three and of degree four when divided by a polynomial of degree one and of degree two;

        (i)   determine the quotient of a polynomial of degree three when divided by a polynomial of degree one

        (ii)   determine the quotient of a polynomial of degree three when divided by a polynomial of degree two

        (iii)   determine the quotient of a polynomial of degree four when divided by a polynomial of degree one

        (iv)   determine the quotient of a polynomial of degree four when divided by a polynomial of degree two

    (D) determine the linear factors of a polynomial function of degree three and of degree four using algebraic methods;

        (i)   determine the linear factors of a polynomial function of degree three using algebraic methods

        (ii)   determine the linear factors of a polynomial function of degree four using algebraic methods

    (E) determine linear and quadratic factors of a polynomial expression of degree three and of degree four, including factoring the sum and difference of two cubes and factoring by grouping;

        (i)   determine linear factors of a polynomial expression of degree three including factoring the sum of two cubes

        (ii)   determine linear factors of a polynomial expression of degree three including factoring the difference of two cubes

        (iii)   determine linear factors of a polynomial expression of degree three including factoring by grouping

        (iv)   determine linear factors of a polynomial expression of degree four, including factoring by grouping

        (v)   determine quadratic factors of a polynomial expression of degree three including factoring the sum of two cubes

        (vi)   determine quadratic factors of a polynomial expression of degree three including factoring the difference of two cubes

(vii)   determine quadratic factors of a polynomial expression of degree three including factoring by grouping

(viii) determine quadratic factors of a polynomial expression of degree four, including factoring by grouping

(F) determine the sum, difference, product, and quotient of rational expressions with integral exponents of degree one and of degree two;

(i)   determine the sum of rational expressions with integral exponents of degree one

(ii)   determine the sum of rational expressions with integral exponents of degree two

(iii) determine the sum of rational expressions with integral exponents of degree one and degree two

(iv)   determine the difference of rational expressions with integral exponents of degree one

(v)   determine the difference of rational expressions with integral exponents of degree two

(vi)   determine the difference of rational expressions with integral exponents of degree one and of degree two

(vii) determine the product of rational expressions with integral exponents of degree one

(viii) determine the product of rational expressions with integral exponents of degree two

(ix)   determine the product of rational expressions with integral exponents of degree one and of degree two

(x)   determine the quotient of rational expressions with integral exponents of degree one

(B) use regression methods available through technology to write a linear function, a quadratic function, and an exponential function from a given set of data; and

    (i)   use regression methods available through technology to write a linear function from a given set of data

    (ii)   use regression methods available through technology to write a quadratic function from a given set of data

    (iii)   use regression methods available through technology to write an exponential function from a given set of data

(C) predict and make decisions and critical judgments from a given set of data using linear, quadratic, and exponential models.

    (i)   predict from a given set of data using linear models

    (ii)   predict from a given set of data using quadratic models

    (iii)   predict from a given set of data using exponential models

    (iv)   make decisions from a given set of data using linear models

    (v)   make decisions from a given set of data using quadratic models

    (vi)   make decisions from a given set of data using exponential models

    (vii)   make critical judgments from a given set of data using linear models

    (viii) make critical judgments from a given set of data using quadratic models

    (ix)   make critical judgments from a given set of data using exponential models