Algebra II – Mathematics III

Adopted 2024

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The Number System

1. Perform arithmetic operations with complex numbers. A2.NS.1
    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 representing real numbers. M.A2HS.1
    2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. M.A2HS.2

Expressions and Equations

1. Use complex numbers in polynomial identities and equations. A2.EE.1
    3. Solve quadratic equations with real coefficients that have complex solutions. M.A2HS.3
    4. Factor special case polynomials with real coefficients that produce complex zeros. M.A2HS.4
    5. Show that the Fundamental Theorem of Algebra is true for quadratic polynomials with real coefficients. M.A2HS.5
2. Interpret the structure of expressions. A2.EE.2
    6. Interpret expressions including rational and polynomial expressions that represent a quantity in terms of its context. M.A2HS.6
        a. Interpret parts of an expression, such as terms, factors, and coefficients. M.A2HS.6.A
        b. Interpret complicated expressions by viewing one or more of their parts as a single entity. M.A2HS.6.B
    7. Use the structure of expressions including polynomial and rational expressions to identify ways to rewrite them. M.A2HS.7
3. Write expressions in equivalent forms to solve problems. A2.EE.3
    8. Derive the formula for the sum of a finite geometric and use the formula to solve problems. M.A2HS.8
4. Perform arithmetic operations on polynomials. A2.EE.4
    9. Recognize 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. Perform operations on polynomials with degree higher than two. M.A2HS.9

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5. Understand the relationship between zeros and factors of polynomials. A2.EE.5

    10. Apply the Remainder Theorem to polynomial functions. M.A2HS.10

    11. 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. M.A2HS.11

6. Use polynomial identities to solve problems. A2.EE.6

    12. Prove polynomial identities and use them to describe numerical relationships. M.A2HS.12

    13. Apply the Binomial Theorem for the expansion of (x + y)ⁿ in powers of x and y for a positive integer n with coefficients determined, for example, by Pascal's Triangle. M.A2HS.13

7. Rewrite rational expressions. A2.EE.7

    14. Rewrite simple rational expressions in different forms; write a(x)/b(x) in different forms using inspection, long division, synthetic division, or, for the more complicated examples, a computer algebra system. M.A2HS.14

    15. Recognize that rational expressions form a system analogous to the rational numbers, namely, they are closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. M.A2HS.15

8. Understand solving equations as a process of reasoning and explain the reasoning. A2.EE.8

    16. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise M.A2HS.16

9. Represent and solve equations and inequalities graphically. A2.EE.9

    17. Explain why the x-coordinates of the points where the graphs of the linear, polynomial, rational, absolute value, exponential, and logarithmic 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). M.A2HS.17

10. Solve systems of equations. A2.EE.10

    18. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. M.A2HS.18

Functions

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1. Create equations that describe numbers or relationships. A2.F.1

    19. Create equations and inequalities in one variable, representing linear, quadratic, simple rational, and exponential relationships, and use them to solve problems. M.A2HS.19

    20. Create equations in two or more variables, representing linear, exponential, and quadratic relationships, between quantities. M.A2HS.20

    21. Represent constraints by linear, exponential, or quadratic equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. M.A2HS.21

2. Interpret functions that arise in applications in terms of a context. A2.F.2

    22. Select 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. Relate the domain of a function to its graph based on the behavior of data and context, and where applicable, to the quantitative relationship it describes. Key features include intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maxima and minima; symmetries; and end behavior. M.A2HS.22

    23. Select a model function based on behavior of data and context to calculate and interpret the average rate of change of linear, exponential, quadratic, and model functions based on behavior of data and context (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. M.A2HS.23

3. Analyze functions using different representations. A2.F.3

    24. Graph quadratic, polynomial, square root, cube root, piecewise-defined functions, including step functions and absolute value functions, exponential, and logarithmic functions expressed symbolically and show key features of the graph. Use applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate. M.A2HS.24

        a. For polynomial functions, focus on identifying zeros and showing end behavior. M.A2HS.24.A

        b. For exponential and logarithmic functions, focus on showing intercepts and end behavior. M.A2HS.24.B

    25. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function focusing on applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate. M.A2HS.25

    26. Compare properties of two functions each represented in a different way, such as algebraically, graphically, numerically in tables, or by verbal descriptions. Focus on applications and how key features relate to characteristics of a situation. M.A2HS.26

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4. Build a function that models a relationship between two quantities. A2.F.4
    27. Write a function that describes a relationship between two quantities. Combine standard function types using arithmetic operations. M.A2HS.27
5. Build new functions from existing functions. A2.F.5
    28. Identify the effect on the graph of replacing f(x) by f(x) + k, k f(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. Observe the effect of multiple transformations on a single graph and the common effect of each transformation across function types and use transformations to model situations. M.A2HS.28
    29. Find inverse functions for simple polynomial, simple rational, simple radical, and use simple exponential functions. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. Consider situations where the domain of the function must be restricted in order for the inverse to exist. M.A2HS.29
6. Construct and compare linear, quadratic, and exponential models and solve problems. A2.F.6
    30. For exponential models, express as a logarithm the solution to a•b^{ct} = d, where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. M.A2HS.30

Statistics and Probability

1. Summarize, represent, and interpret data on a single count or measurement variable. A2.SP.1
    31. 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. M.A2HS.31
2. Understand and evaluate random processes underlying statistical experiments. A2.SP.2
    32. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. Compare theoretical and empirical results to evaluate the effectiveness. M.A2HS.32
    33. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. M.A2HS.33

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3. Make inferences and justify conclusions from sample surveys, experiments, and observational studies. A2.SP.3

    34. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. M.A2HS.34

    35. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error using simulation models for random sampling. Informally develop the concepts of statistical significance and variability. M.A2HS.35

    36. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. Recognize that some unlikely results can occur solely through randomness inherent in the system and "statistical significance" represents this likelihood. Make use of statistics as a way of dealing with, not eliminating, this inherent randomness. M.A2HS.36

    37. Evaluate reports based on data. Focus on data collection and how conclusions can be drawn from data. M.A2HS.37

4. Use probability to evaluate outcomes of decisions. A2.SP.4

    38. Use probabilities to make fair decisions, including situations involving quality control, false positive, and false negative results. M.A2HS.38

    39. Analyze decisions and strategies using probability concepts, including situations involving quality control, false positive, and false negative results. M.A2HS.39