West Virginia Mathematics

Transition Mathematics for Seniors

Adopted 2024

Transition Mathematics for Seniors

Number and Quantity – The Real Number System

1. Reason quantitatively and use units to solve problems. TM.NQR.1
    1. Use units to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. M.TMS.1
    2. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. M.TMS.2

Number and Quantity – The Complex Number System

1. Use complex numbers in polynomial identities and equations. TM.NQC.1
    3. Solve quadratic equations with real coefficients that have complex solutions. M.TMS.3

Algebra – Seeing Structure in Expressions

1. Interpret the structure of expressions. TM.AS.1

    4. Use the structure of quadratic and exponential expressions to identify ways to rewrite them. M.TMS.4

2. Write expressions in equivalent forms to solve problems. TM.AS.2

    5. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. M.TMS.5

    a. Factor a quadratic expression to reveal the zeros of the function it defines. M.TMS.5.A

    b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. M.TMS.5.B

3. Understand the connections between proportional relationship, lines, and linear equations. TM.AS.3

    6. Graph proportional relationships, interpreting the unit rates as the slope of the graph. Compare two different proportional relationships represented in different ways. M.TMS.6

    7. Explain (e.g., using similar triangles) why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b. M.TMS.7

    8. Solve linear equations in one variable. M.TMS.8

Algebra – Arithmetic with Polynomials and Rational Expressions

1. Perform arithmetic operations on polynomials. TM.AP.1

    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. M.TMS.9

Algebra – Creating Equations

1. Create equations that describe numbers or relationships. TM.ACE.1

    10. Create equations and inequalities in one variable, representing linear, exponential, quadratic, and simple rational relationships, and use them to solve problems. M.TMS.10

    11. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. M.TMS.11

    12. 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. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. M.TMS.12

    13. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. M.TMS.13

Algebra – Reasoning with Equations and Inequalities

1. Understand solving equations as a process of reasoning and explain the reasoning. TM.ARE.1

    14. Solve simple rational and radical equations in one variable and give examples showing how extraneous solutions may arise. M.TMS.14

2. Solve equations and inequalities in one variable. TM.ARE.2

    15. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. M.TMS.15

    16. 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. M.TMS.16

    17. Solve quadratic equations in one variable by inspection (e.g., $x^2 = 49$), taking square roots, factoring, completing the square, and the quadratic formula, as appropriate to the initial form of the equation. M.TMS.17

        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. M.TMS.17.A

        b. Recognize the concept of complex solutions when the quadratic formula gives complex solutions, and write them as $a \pm bi$ for real numbers a and b. M.TMS.17.B

3. Solve systems of equations. TM.ARE.3

    18. Understand and demonstrate ways to manipulate a system of two equations in two variables while preserving its solution set. M.TMS.18

    19. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. M.TMS.19

    20. Explain why the x-coordinates of the points where the graphs of the linear, polynomial, rational, absolute value, and exponential equations $y = f(x)$ and $y = g(x)$ intersect are the solution of the equation $f(x) = g(x)$; find the solution approximately (e.g., using technology to graph the functions, make tables of values, or find successive approximations). M.TMS.20

4. Represent and solve equations and inequalities graphically. TM.ARE.4

    21. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. M.TMS.21

    22. Graph the solutions to a linear inequality in two variables as a half-plane graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. M.TMS.22

Functions – Interpreting Functions

1. Understand the concept of a function and use function notation. `TM.F.1`

    23. Use multiple representations of linear and exponential functions to recognize that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. Develop function notation utilizing the definition of a function to represent situations both algebraically and graphically. `M.TMS.23`

2. Interpret functions that arise in applications in terms of the context. `TM.F.2`

    24. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. `M.TMS.24`

    25. Interpret the parameters in a linear or exponential function in terms of a context. `M.TMS.25`

    26. 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.
Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maxima and minima; symmetries; end behavior; and periodicity. `M.TMS.26`

    27. Distinguish between situations that can be modeled with linear functions and with exponential functions. `M.TMS.27`

3. Analyze functions using different representations. `TM.F.3`

    28. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. `M.TMS.28`

    29. Describe qualitatively the functional relationship between two quantities by analyzing a graph. `M.TMS.29`

    30. 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. `M.TMS.30`

    31. Graph linear, quadratic, and polynomial functions expressed symbolically and show key features of the graph. `M.TMS.31`

        a. For linear functions, focus intercepts. `M.TMS.31.A`

        b. For quadratic functions, focus on intercepts, maxima, minima, end behavior, and the relationship between coefficients and roots to represent in factored form. `M.TMS.31.B`

        c. For polynomial functions, focus on identifying zeros and showing end behavior. `M.TMS.31.C`

    32. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasingly linearly, quadratically, or (more generally) as a polynomial function. `M.TMS.32`

33. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. 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. `M.TMS.33`
34. Compare properties of two functions each represented in a different way, such as algebraically, graphically, numerically in tables, or by verbal descriptions. `M.TMS.34`

Functions - Building Functions

1. Build a function that models a relationship between two quantities. `TM.FB.1`
    35. Construct linear and exponential functions, including arithmetic and geometric sequences to model situations, given a graph, a description of a relationship, or given input-output pairs (include reading these from a table). `M.TMS.35`
    36. Write a function that describes a relationship between two quantities. `M.TMS.36`
        a. 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. `M.TMS.36.A`
        b. 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. `M.TMS.36.B`

Geometry – Geometric Measuring and Dimension

1. Explain volume formulas and use them to solve problems. `TM.GGM.1`
    37. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments. `M.TMS.37`
    38. Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures. `M.TMS.38`

Geometry – Expressing Geometric Properties with Equations

1. Use coordinates to prove simple geometric theorems algebraically. `TM.EG.1`
    39. Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point (0, 2). `M.TMS.39`
    40. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles. `M.TMS.40`

Geometry – Modeling with Geometry

1. Apply geometric concepts in modeling situations. `TM.MG.1`

    41. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with topographic grid systems based on ratios). `M.TMS.41`

Statistics and Probability - Interpreting Categorical & Quantitative Data

1. Summarize, represent, and interpret data on two categorical and quantitative variables. `TM.SP.1`

    42. Represent data on two quantitative variables on a scatter plot and describe how the variables are related. Interpret linear models. `M.TMS.42`

    43. Interpret the rate of change and the constant term of a linear model in the context of the data. Use technology to compute and interpret the correlation coefficient of a linear fit. `M.TMS.43`

    44. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. `M.TMS.44`

    45. 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. `M.TMS.45`

2. Summarize, represent, and interpret data on a single count or measurement variable. `TM.SP.2`

    46. Select applicable representations to display data on the real number line (e.g., dot plots, histograms, and box plots). `M.TMS.46`

    47. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation only as a tool to describe spread and not to explicitly find standard deviation) of two or more different data sets. `M.TMS.47`

    48. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). `M.TMS.48`

    49. Distinguish between correlation and causation. `M.TMS.49`

3. Understand and evaluate random processes underlying statistical experiments. `TM.SP.3`

    50. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. `M.TMS.50`