TASC Mathematics Blueprint

- ✓ High Emphasis
- ❖ Medium Emphasis
- o Low Emphasis

FUNCTIONS – 26%

Interpreting Functions – 10%

- ✓ Understand 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. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).

- ✓ Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

- ✓ For 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 the following: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maxima and minima; symmetries; end behavior; and periodicity.

- ✓ Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.

- ✓ Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

- ✓ Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and by using technology for more complicated cases. Graph linear and quadratic functions and show intercepts, maxima, and minima.

- ✓ Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and by using technology for more complicated cases. Graph

square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

- ✓ Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)t, y = (0.97)t, y = (1.01)12t, and y = (1.2)t/10, and classify them as representing exponential growth or decay.

- ❖ 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.

- o Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and by using technology for more complicated cases. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

- o Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

<u>Building Functions – 8%</u>

- o Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.

- o Write a function that describes a relationship between two quantities. 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.

- o Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

<u>Linear, Quadratic, and Exponential Models- 8%</u>

- ❖ Distinguish between situations that can be modeled with linear functions and with exponential functions. Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.

ALGEBRA – 26%

Reasoning with Equations and Inequalities – 8%

- ✓ 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.

- ✓ Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

- ✓ 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.

- ✓ Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, using 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 ± bi for real numbers *a* and *b*.

- ✓ 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 curve (which could be a line).

- ✓ 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.

- ❖ 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 $x^2 + y^2 = 3$.

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

- o Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Creating Equations – 6%

- ✓ Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, as well as simple rational and exponential functions.

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

- ✓ 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. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

- o Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R.

Arithmetic with Polynomials and Rational Expressions – 6%

- ✓ Understand that polynomials form a system analogous to the integers, namely, that they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

- ✓ 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.

Seeing Structure in Expressions – 6%

- ✓ Interpret expressions that represent a quantity in terms of its context.
- o Use the structure of an expression to identify ways to rewrite it.
- o Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

GEOMETRY – 23%

Modeling with Geometry – 7%

- ✓ Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).

- o Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

- o Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Geometric Measurement and Dimension – 6%

- ✓ Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

Congruence – 5%

- ❖ Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

- o Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

Similarity, Right Triangles, and Trigonometry – 5%

- ❖ Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

- ❖ Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

Number and Quantity – 13%

Quantities – 10%

- ❖ Use units as a way 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.

- ❖ Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

The Real Number System – 3%

- ✓ Rewrite expressions involving radicals and rational exponents using the properties of exponents.

- o Explain why the sum or product of rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

Statistics and Probability – 12%

Interpreting Categorical and Quantitative Data – 6%

- Represent data with plots on the real number line (dot plots, histograms, and box plots).

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

- 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.

- Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

- Distinguish between correlation and causation.

Making Inferences and Justifying Conclusions – 3%

- Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

Conditional Probability and Rules of Probability – 3%

- Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e. g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.

- Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.

- Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.