Ninth Grade Correlation Benchmarks and Indicators Mathematics

Number, Number Sense and Operations Standard

A. Use scientific notation to express large numbers and numbers less than one.

B. Identify subsets of the real number system.

C. Apply properties of operations and the real number system and justify when they hold for a set of numbers.

1. Identify and justify whether properties (closure, identity, inverse, communicative and associative) hold for a given set and operations; e.g., even integers and multiplication.

D. Connect physical, verbal and symbolic representations of integers, rational numbers and irrational numbers.

E. Compare, order and determine equivalent forms of real numbers.

2. Compare, order and determine equivalent forms for rational and irrational numbers.

F. Explain the effects of operations on the magnitude of quantities.

3. Explain the affects of operations such as multiplication or division and of computing powers and roots on the magnitude of quantities.

G. Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.

_____4. Demonstrate fluency in computations using real numbers.

H. Find the square root of perfect squares, and approximate the square root on non-perfect squares.

I. Estimate, compute and solve problems involving scientific notation, square roots and numbers with integer exponents.

5. Estimate the solutions for problem situations involving square and cube roots.

Measurement Standard

A. Solve increasingly complex non-routine measurement problems and check for reasonableness of results.

B. Use formulas to find surface area and volume for specified three-dimensional objects accurate to a specified level of precision.

C. Apply indirect measurement techniques, tools and formulas, as appropriate, to find perimeter, circumference and area of circles, triangles, quadrilaterals and composite shapes, and to find volume prisms, cylinders, and pyramids.

D. Use proportional reasoning and apply direct measurement techniques, including right triangle trigonometry and properties of similar triangles, to solve problems involving measurement and rates.

- 1. Convert rates within the same measurement system; e.g., miles per hour to feet per second; kilometers per hour to meters per second.
 - 2. Use unit analysis to check computations involving measurement.
 - 3. Use the ratio of lengths in similar two-dimensional figures or three-dimensional objects to calculate the ratio of their areas or volumes respectively.

- 4. Use scale drawings and right triangle trigonometry to solve problems that include unknown distances and angle measures.
 - 5. Solve problems involving unit conversion for situations involving distances, areas, volumes and rates within the same measurement system.

E. Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.

F. Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions.

Geometry and Spatial Sense Standard

A. Formally define geometric figures.

B. Describe and apply the properties of similar and congruent figures; and justify conjectures involving similarity and congruence.

C. Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines and parallel lines.

D. Use coordinate geometry to represent and examine the properties of geometric figures.

E. Draw and construct representations of two- and three-dimensional geometric objects using a variety of tools, such as straightedge, compass and technology.

F. Represent and model transformations in a coordinate plane and describe the results.

G. Prove or disprove conjectures and solve problems involving two-dimensional and three-dimensional objects represented within a coordinate system.

3. Analyze two-dimensional figures in a coordinate plane; e.g., use slope and distance formulas to show that a quadrilateral is a parallelogram.

H. Establish the validity of conjectures about geometric objects, their properties and relationships by counter-example, inductive and deductive reasoning, and critiquing arguments made by others.

I. Use right triangle trigonometric relationships to determine lengths and angle measures.

1. Define the basic trigonometric ratios in right triangles; sine, cosine, and tangent.

2. Apply proportional and right triangle trigonometric ratios to solve problems involving missing lengths and angle measures in similar figures.

Patterns, Functions and Algebra Standard

A. Generalize and explain patterns and sequences in order to find the next term and the nth term.

2. Generalize patterns using functions or relationships (linear, quadratic and exponential), and freely translate among tabular, graphical and symbolic representations.

B. Identify and classify functions as linear or nonlinear, and contrast their properties using tables, graphs or equations.

1. Define function with ordered pairs in which each domain element is assigned exactly one range element.

3. Describe problem situations (linear, quadratic and exponential) by using tabular, graphical and symbolic representations.

C. Translate information from one representation (words, table, graph or equation) to another representation of a relation or function.

2. Generalize patterns using functions or relationships (linear, quadratic, and exponential), and freely translate among tabular, graphical and symbolic representations.

D. Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations.

- 7. Use formulas to solve problems involving exponential growth and decay.
- 11. Add, subtract, multiply and divide monomials and polynomials (division of polynomials by monomials only).
- 12. Simplify rational expressions by eliminating common factors and applying properties of integer exponents.

E. Analyze and compare functions and their graphs using attributes, such as rates of changes, intercepts and zeros.

4. Demonstrate the relationships among zeros of a function, roots of equations, and solutions of equations graphically and in words.

5. Describe and compare characteristics of the following families of functions; linear, quadratic and exponential functions; e.g., general shape, number of roots, domain, range, rate of change, maximum or minimum.

F. Solve and graph linear equations and inequalities.

- 6. Write and use equivalent forms of equations and inequalities in problem situations; e.g., changing a linear equation to the slope-intercept form.
 - _____8. Find linear equations that represent lines that pass through a given set of ordered pairs, and find linear equations that represent lines parallel or perpendicular to a given line through a specific point.

G. Solve quadratic equations with real roots by graphing, formula and factoring.

_____10. Solve quadratic equations with real roots by factoring, graphing, using the quadratic formula and with technology.

H. Solve systems of linear equations involving two variables graphically and symbolically.

9. Solve and interpret the meaning of 2 by 2 systems of linear equations graphically, by subtraction and by elimination, with and without technology.

I. Model and solve problem situations involving direct and inverse variation.

- _____13. Model and solve problems involving direct and inverse variation using proportional reasoning.
 - 14. Describe the relationship between slope and the graph of a direct variation and inverse variation.

J. Describe and interpret rates of change from graphical and numerical data.

_____15. Describe how a change in the value of a constant in a linear or quadratic equation affects the related graphs.

Data Analysis and Probability Standard

A. Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatterplot, measures of center and variability.

- 1. Classify data as univariate (single variable) or bivariate (two variables) and as quantitative (measurement) or qualitative (categorical) data.
- 2. Create a scatterplot for a set of bivariate data, sketch the line of best fit, and interpret slope of the line of best fit.
- 3. Analyze and interpret frequency distributions based on spread, symmetry, skewness, clusters, and outliers.

B. Evaluate different graphical representations of the same data to determine which is the most appropriate representation for an identified purpose.

C. Compare the characteristics of the mean, median and mode for a given set of data, and explain which measure of center best represents the data.

D. find, use and interpret measures of center and spread, such as mean and quartiles, and use those measures to compare and draw conclusions about sets of data.

E. Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis.

4. Describe and compare various types of studies (survey, observations, experiment), and identify possible misuses of statistical data.

F. Construct convincing arguments based on analysis of data and interpretation of graphs.

6. Make inferences about relationships in bivariant data, and recognize the difference between evidence of relationship (correlation) and causation.

G. Describe sampling methods and analyze the effects of method chosen on how well the resulting sample represents the population.

5. Describe characteristics and limitations of sampling methods, and analyze the effects of random versus biased sampling; determine and justify whether the sample is likely to be representative of the population.

H. Use counting techniques, such as permutations and combinations, to determine the total number of options and possible outcomes.

7. Use counting techniques and the fundamental counting principle to determine the total number of possible outcomes of mathematical situations.

I. Design an experiment to test a theoretical probability, and record and explain results.

8. Describe, create and analyze a sample space and use it to calculate probability.

J. Compute probabilities and compound events, independent events, and simple dependent events.

9. Identify situations involving independent and dependent events and explain differences between and common misconceptions about probabilities associated with these events.

K. Make predictions based on theoretical probabilities and experimental results.

10. Use theoretical and experimental probability, including simulations or random numbers, to estimate probabilities and to solve problems dealing with uncertainty; e.g., compound events, independent events, simple dependent events.