

Mathematics

Learning Outcomes

Algebra 1

Students will

Standard #

VARIABLES AND EXPRESSIONS

10.P.1 Determine and extend patterns from geometric or numerical sequences.

10.N.2 Solve problems using the order of operations.

10.P.4 Write expressions using variables.

10.N.1 Demonstrate an understanding of the properties of the real number system.

NUMBER SENSE AND OPERATIONS

10.N.1 Understand how integers and rational numbers are positioned on the number line.

10.N.1 Solve problems involving operations on integers.

10.N.1 Solve problems involving operations on rational numbers.

12.N.2 Simplify radical expressions.

LINEAR EQUATIONS

10.P.7 Use linear equations to model real-world data.

10.P.6 Solve multi-step linear equations.

10.P.6 Set up and solve proportions in the appropriate context.

GRAPHING

10.P.2 Demonstrate an understanding of the makeup of the coordinate plane, including quadrants, origin, and ordered pairs.

10.P.2 Graph relations.

10.P.2 Determine slope from two ordered pairs.

10.P.2 Use the different forms that a linear equation can take.

Learning Outcomes **Algebra 1 *Continued***

Students will

Standard #

GRAPHING *Continued*

10.P.2 Graph linear functions.

10.P.2 Determine a linear equation from a graph.

10.P.2 Determine a linear equation from a variety of combinations of given information.

10.D.2 Model linear data using a line of best fit.

10.P.6 Solve and graph inequalities in one variable.

SYSTEMS OF EQUATIONS

10.P.8 Use several methods of solving linear systems (including graphing, substitution, and elimination).

10.P.8 Use systems of equations to model and solve real-world problems.

POLYNOMIALS

10.P.3 Simplify expressions involving exponents.

10.P.3 Solve problems involving addition, subtraction, and multiplication of polynomials.

10.P.4 Factor trinomials and special polynomials, including differences of squares and perfect square trinomials.

10.P.5 Solve equations using factoring and the zero product property.

Mathematics Learning Outcomes Geometry

Students will

Standard #

SPATIAL SENSE AND CLASSIFICATION

10.G.2 Draw and interpret geometric figures.

10.G.9 Draw and interpret properties of figures acted upon by translation, reflection, rotation, and

scaling.

10.G.1 Identify geometric objects by their symmetry.

10.G.2 Classify figures in terms of congruence and similarity.

PROBLEM SOLVING

10.G.4 Apply congruence and similarity to find missing parts of geometric figures.

10.G.8 Develop and explain geometric interpretations and applications of slope.

10.G.1 Recognize and apply components and properties of polygons.

10.G.6 Use the properties of special right triangles to solve problems.

12.G.1, 5 Know the definition of the sine, cosine, and tangent and apply to problem solving.

10.G.8 Apply the slope, midpoint, and distance formulas.

10.M.1, Apply the formulas for area, circumference, chords, arcs, and tangents of a circle.

12.G.5

10.M.2 Apply the formulas for surface area and volume of three-dimensional solids.

PROOF

Logically deduce properties of (and relationships between) figures based on given assumptions.

Apply two-column, paragraph, and indirect proofs to developing and defending theorems.

Understand and follow proof by mathematical induction.

Mathematics Learning Outcomes Algebra 2

Students will

Standard #

MODELING AND PREDICTING

10.D.1 Represent real-world situations and problems in a variety of mathematical formats, such as equations, spread sheets, or graphs.

10.D.2 Use mathematical tools to make predictions based on given models.

10.N.4 Make judgments about the reliability of their predictions.

12.D.2 Use box and whisker plots, mean, median, mode, and quartiles to analyze data sets.

12.D.3 Construct lines of best fit and use the resulting equations to interpolate and extrapolate beyond the given data

REAL NUMBERS, EQUATIONS, AND INEQUALITIES

10.N.1 Classify types of numbers in the real number system.

10.P.6 Solve equations and inequalities using the properties of real numbers.

FUNCTIONS AND GRAPHS

10.P.1 Demonstrate an understanding of the correspondence between relations and functions and know how to represent these graphically.

10.P.7 Recognize a variety of types of functions and the types of symmetries that are characteristic of each.

10.G.7 Manipulate functions and relations on the xy-plane.

SYSTEMS OF LINEAR EQUATIONS

10.P.8 Use a variety of methods for solving systems of linear equations.

12.P.9 Perform matrix operations on matrices.

Learning Outcomes

Algebra 2 *Continued*

Students will

Standard #

POLYNOMIALS AND FACTORING

10.P.3 Simplify polynomials and perform operations on polynomials.

10.P.4 Factor polynomials using a variety of mathematical tools.

10.P.5 Demonstrate an understanding of why factoring is integral to solving polynomial equations.

QUADRATIC FUNCTIONS AND EQUATIONS

10.P.1 Identify the characteristics of graphs of quadratic functions.

10.P.5 Use the quadratic formula to solve a variety of problems.

10.P.7 Recognize how quadratic functions can be used in solving real-world problems.

SEQUENCES AND SERIES

12.P.2 Identify arithmetic and geometric sequences and series.

12.P.2 Determine successive terms in arithmetic and geometric sequences.

INEQUALITIES IN TWO VARIABLES

12.N.2 Graph linear and quadratic inequalities.

EXPONENTS AND RADICALS

12.N.2 Simplify algebraic expression with integer and rational exponents.

12.N.2 Demonstrate an understanding of the relation between rational exponents and radicals.

12.N.1 Perform arithmetic operations on complex numbers.

Mathematics Learning Outcomes Mathematical Analysis

Students will

Standard #

LINEAR AND QUADRATIC FUNCTIONS

12.P.11 Demonstrate an understanding of how linear and quadratic functions can be used to model a set of data.

10.P.2,7 Graph linear and quadratic functions.

12.P.8 Use quadratic functions to maximize or minimize profit or area.

12.P.5 Demonstrate an understanding of the relationship between solutions and roots of a function.

POLYNOMIAL FUNCTIONS

12.P.6 Identify polynomial functions.

12.P.8 Calculate the zeros of polynomial functions.

12.P.12 Find the maxima and minima of polynomial functions.

12.P.6 Demonstrate an understanding of the relationship between aspects of a polynomial function (roots, double roots, sign of leading coefficient) and the graph of the function.

EXPONENTIAL AND LOGARITHMIC FUNCTIONS

12.P.6 Recognize the form of an exponential function.

12.P.11 Demonstrate an understanding of the kinds of data that can be modeled by an exponential function.

12.P.11 Use exponential functions to model data and answer real-world questions based on that model

12.P.8 Find the inverse of exponential functions.

Learning Outcomes **Mathematical Analysis *Continued***

Students will

Standard #

SEQUENCES AND SERIES

12.P.2 Find terms in an arithmetic or geometric sequence.

12.P.2 Find sums of arithmetic or geometric series.

12.P.2 Use arithmetic and geometric sequences and series to model real-world situations.

COMBINATORICS

12.D.6 Calculate the number of permutations or combinations of a given number of items, including restrictions.

12.D.7 Find the probability of an event occurring using combinations and permutations to establish the sample space.

LIMITS

Find the limit of a function as the independent variable approaches a value.

Use limits as an aid in graphing rational functions.

Mathematics Learning Outcomes Trigonometry

Students will

Standard #

ANGLES, ARCS, AND SECTORS

12.G.5 Find lengths of arcs and area of sectors.

12.G.5 Convert angle measures between radians and degrees.

TRIGONOMETRIC FUNCTIONS

12.G.1 Know the definition of the six trigonometric functions.

12.P.4 Demonstrate an understanding of the periodic nature of all trigonometric functions and their inverses.

12.P.13 Graph trigonometric functions and their inverses with dilations and translations.

IDENTITIES, EQUATIONS, AND APPLICATIONS OF SINE WAVES

12.D.2 Understand what kinds of data can be modeled by sine waves.

12.P.8 Solve equations involving trigonometric functions.

12.G.2 Prove trigonometric identities.

12.P.8 Know the trigonometric addition formulas and how to use them to solve problems.

TRIANGLE TRIGONOMETRY

12.P.4 Demonstrate an understanding of the relationship between trigonometric functions and similar triangles.

12.G.5 Find side lengths, angle measures, and areas of triangles using trigonometry.

POLAR COORDINATES

Demonstrate an understanding of the definition of the polar coordinates.

Convert rectangular coordinates to polar form.

Graph equations in polar form.

Mathematics Learning Outcomes Calculus

Students will

Standard #

LIMITS AND CONTINUITY

Demonstrate an understanding of the definition of ‘limit’ and ‘continuity’ from a conceptual, graphical, and analytic standpoint.

Find limits of a variety of functions.

Use limits to help graph rational functions.

DERIVATIVES, AND THE TECHNIQUES OF DIFFERENTIATION

Calculate derivatives numerically, analytically, and geometrically.

Use the rules of differentiation, including the chain rule, to find the derivatives of a variety of functions.

APPLICATION OF DERIVATIVES

12.P.12 Demonstrate an understanding of the relationship between the derivative and the slope of the tangent to a curve.

12.P.12 Demonstrate an understanding of when and how the rate of change of a quantity relates to the

derivative.

Model and solve general extremum problems using the techniques of differentiation.

Solve exponential and logarithmic equations.

INTEGRALS AND THE TECHNIQUES OF INTEGRATION

Demonstrate an understanding of the different forms of the definition of the integral and how they are related.

Calculate integrals numerically, analytically, and geometrically.

Know the fundamental theorem of calculus and how it relates to the integral in its roles as anti-derivative and as accumulator.

Learning Outcomes **Calculus *Continued***

Students will

Standard #

THE CALCULUS OF TRANSCENDENTAL FUNCTIONS

Determine whether or not a given function is transcendental.

Know the definition of an exponential function and a logarithmic function.

Find the integrals and derivatives of transcendental functions.

Use exponential functions to model real-world problems.

Mathematics
Learning Outcomes
Advanced Topics in Mathematics*

Students will

Standard #

Demonstrate the habits of mind characteristic of a mathematician, including the posing of conjectures, searching for patterns, and exploring ideas with technology.

Solve problems in a variety of areas of mathematics (for example, number theory, topology, linear programming, fractal geometry).

Demonstrate an understanding of the nature of the field of mathematics and the history of its development.

NUMBER THEORY

10.N.1 Demonstrate an understanding of the fundamental properties of the integers.

10.P.1 Find patterns in sequences of integers (i.e., primes, perfect numbers, Mersenne numbers, digital roots).

Understand how prime numbers are used in cryptography systems.

FRACTAL GEOMETRY

Draw and interpret figures in fractal geometry.

Demonstrate an understanding of how fractal geometry describes the natural world.

Calculate the fractal dimension of an object.

Perform operations on complex numbers.

Plot points in the complex plane.

Apply recursive functions to complex numbers.

HISTORY OF MATHEMATICS

Demonstrate an understanding of how much mathematics is known today and of how and when this knowledge came about.

Learning Outcomes

Advanced Topics in Mathematics *Continued*

Students will

Standard #

TOPOLOGY

Determine whether two objects are topologically equivalent.

Demonstrate an understanding of the components and characteristics of a network (i.e., vertices, edges, faces, circuits, vertex degree, trees).

Determine the traversibility of a network.

Apply Euler's Formula to solving network theory problems.

Represent a three-dimensional or two-dimensional diagram with a network of vertices and edges.

Enumerate all possible trees, rooted trees, or irreducible trees with given numbers of edges.

*This course does not have a set curriculum or textbook. The first three outcomes help to describe the content of the course. The outcomes that follow apply to the course as it is taught this year. However, the content of the course is subject to change, depending on the teacher.

Mathematics Learning Outcomes Statistics

Students will

Standard #

INTRODUCTION TO STATISTICS

Understand the general nature of statistics, and the nature of data.

Distinguish between a parameter and a statistic.

Recognize the importance of good sampling methods in general and recognize the importance of a simple random sample.

DESCRIBING, EXPLORING, AND COMPARING DATA

Summarize data by constructing a frequency table or relative frequency table.

AI.D.1 Visually display the nature of the distribution by constructing a histogram, dotplot, stem- and- leaf plot, pie chart, or Pareto chart.

AI.D.1 Calculate measures of center by finding the mean, median, mode, and midrange.

PC.D.4 Calculate measures of variation by finding the standard deviation, variance, and range.

Compare individual values by using z scores, quartiles, deciles, or percentiles.

Investigate and explore the spread of data, the center of the data, and the range of values by constructing a boxplot and understand and interpret the results of these tables, graphs, and measures.

Demonstrate an understanding of how to use technology (TI-83 calculators and STATDISK software) to calculate the measures learned in this chapter.

Mathematics **Learning Outcomes** **Statistics *Continued***

Students will

Standard # _

CORRELATION AND REGRESSION

A.I.D.2 Construct scatter diagrams and draw a line of best fit

A.I.D.2 Use technology (TI-83 calculators and STATDISK to calculate lines of best fit and correlation coefficients.

PC.D.2 Predict the value of a variable, given some value of the other variable.

PROBABILITY

A.II.D.2 Understand the basic concepts of probability theory, and be able to determine the probability of

an event occurring.

Use the Addition Rule and the Multiplication rule to determine the probability of two or more simple events.

Use simulations to estimate the probability of events occurring.

PROBABILITY DISTRIBUTIONS

P.C.D.3 Understand the concept of a probability distribution, and the concept of a random variable.

P.C.D.3 Understand the characteristics of the binomial probability distribution and of the Poisson probability distribution.

Use the range rule of thumb to determine whether or not outcomes are unusual.

Use technology (TI-83 calculators and STATDISK) to calculate probabilities with these probability distributions.

Mathematics **Learning Outcomes** **Statistics *Continued***

Students will

Standard #

NORMAL PROBABILITY DISTRIBUTIONS

P.C.D.3 Understand the nature of the normal probability distribution.

P.C.D.3 Use technology to calculate areas (probabilities) with the normal distribution.

Convert normal probability distributions to the standard normal probability distribution.

Understand the impact of sample size on the sample mean.

Use the normal distribution to approximate a binomial distribution.

Determine if sample data appear to come from a population that has a normal distribution.

ESTIMATES AND SAMPLE SIZES

Calculate point estimates for population means, proportions, and variances.

Calculate confidence intervals for population means and proportions.

Calculate the sample size necessary to obtain a given confidence interval for a point estimate.

Use technology to make all of the calculations shown above.

Mathematics

Learning Outcomes

Statistics *Continued*

Students will

Standard # _

HYPOTHESIS TESTING

Test claims about population parameters (the mean and proportion) with the P-value method.

Use technology to test these claims.

INFERENCES FROM TWO SAMPLES

Test inferences about the means of two independent populations (with large samples) and of population data consisting of matched pairs.

Test inferences about the proportions of two independent samples.

Use technology to perform all of these tests.