

Utah's Standards for Honors Mathematics Courses

7th Grade Mathematics

In addition to the core standards for 7th grade found at <http://schools.utah.gov/CURR/mathsec/Common-Core/7th-Grade-Common-Core.aspx>, 7th grade honors mathematics topics include:

- Research and analyze ancient number systems.
- Understand number systems and their applications using different bases.
- Examine the use of mathematics in creating codes.
- Recognize and appreciate patterns in nature, art, and mathematics.

Additional detail and guidance can be found at <http://schools.utah.gov/CURR/mathsec/Common-Core/7th-Grade-Honors.aspx>.

8th Grade mathematics

In addition to the core standards for 8th grade found at <http://schools.utah.gov/CURR/mathsec/Common-Core/8th-Grade-Common-Core.aspx>, 8th grade honors mathematics topics include:

- Understand the concepts and applications of fairness and apportionment.
- Examine different methods of voting.
- Understand sets and use set notation to communicate mathematical ideas.
- Use graphing techniques to model situations that extend beyond the coordinate plane.

Additional detail and guidance can be found at <http://schools.utah.gov/CURR/mathsec/Common-Core/8th-Grade-Common-Core/8th-Grade-Honors.aspx>.

Secondary Mathematics I

In addition to the core standards found at <http://schools.utah.gov/CURR/mathsec/Common-Core/Secondary-I.aspx>, 9th grade honors mathematics topics include:

- Understand and use logical reasoning to make and evaluate arguments.
- N.VM.1: Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., \mathbf{v} , $|\mathbf{v}|$, $\|\mathbf{v}\|$, v).
- N.VM.2: Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.
- N.VM.3: Solve problems involving velocity and other quantities that can be represented by vectors.
- N.VM.4.: Add and subtract vectors
- N.VM.5: Multiply a vector by a scalar.
- N.VM.6: Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
- N.VM.7: Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.
- N.VM.8: Add, subtract, and multiply matrices of appropriate dimensions.
- N.VM.9: Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.
- N.VM.10: Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.
- N.VM.11: Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.
- N.VM.12: Work with 2×2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.
- Represent average rate of change as the slope of the secant line.
- Solve systems of linear equations using matrices.

Detailed guidance can be found in the curriculum guides found at <http://schools.utah.gov/CURR/mathsec/Common-Core/Secondary-I.aspx>.

Secondary Mathematics II

In addition to the core standards found at http://schools.utah.gov/CURR/mathsec/Common-Core/CCSSSecondaryII_000.aspx, 10th grade honors mathematics topics include:

- Write radical expressions in equivalent forms.
- Solve polynomial and rational inequalities in one variable.
- N.CN.3 Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.
- N.CN.4 Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.
- N.CN.5 Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. For example, $(-1 + \sqrt{3}i)^3 = 8$ because $(-1 + \sqrt{3}i)$ has modulus 2 and argument 120° .
- N.CN.6 Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.
- A.REI.8 Represent a system of linear equations as a single matrix equation in a vector variable.
- A.REI.9 Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3×3 or greater).
- Write trigonometric expressions in equivalent forms to solve problems.
- Prove trigonometric identities using definitions, the Pythagorean Theorem, or other relationships.
- F.TF.9 Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.
- G.GPE.3 Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.
- G.GMD.2 Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

Secondary III (proposed)

In addition to the core standards found at http://schools.utah.gov/CURR/mathsec/Common-Core/CCSSSecondaryIII_000.aspx, 11th grade honors mathematics topics include:

- F.IF.7d Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- F.BF.1c 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.
- F.BF.4b Verify by composition that one function is the inverse of another.
- F.BF.4c Read values of an inverse function from a graph or a table, given that the function has an inverse.
- F.BF.4d Produce an invertible function from a non-invertible function by restricting the domain.
- F.BF.5 Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.
- F.TF.3 Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for x , where x is any real number.
- F.TF.4 Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.
- F.TF.6 Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.
- F.TF.7 Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. ★
- Find all solutions for equations involving trigonometric functions.
- Define and use polar coordinates and relate them to Cartesian coordinates.
- Represent complex numbers in rectangular and polar form, and convert between rectangular and polar form.
- Translate equations in Cartesian coordinates into polar coordinates and graph them in the polar coordinate plane.
- Multiply complex numbers in polar form and use DeMoivre's Theorem to find roots of complex numbers.
- Define a curve parametrically and draw parametric graphs.
- Discover and justify the formula for a finite arithmetic series.
- Discover and justify the formula for infinite geometric series.