

# Statewide Dual Credit Learning Objectives

## Precalculus

### Topic 1: Equations

- 1a Apply various techniques, as appropriate, to simplify expressions and solve equations. This includes using exact symbolic (algebraic), approximation and graphical techniques. includes using exact symbolic (algebraic), approximation and graphical techniques.
- 1b Solve quadratic equations for both real and complex roots.
- 1c Solve polynomial equations of degree  $> 2$  for both real and complex roots.
- 1d For factorable polynomial expressions, create factored forms via factoring by grouping, use synthetic division, or polynomial long division.
- 1e Solve equations involving absolute values exponential or logarithmic expressions and differentiate extraneous solutions from true solutions.
- 1f Identify equations that cannot be solved directly and use graphical or other approximations.
- 1g Use the properties of logarithms and exponentials to simplify expressions involving logs and exponentials.
- 1h Evaluate expressions containing powers of zero, negative exponents, or rational powers.
- 1i Expand the order of operations to include applying logarithmic, radical, and trigonometric functions, and evaluate expressions that feature those functions.

### Topic 2: Inequalities

- 2a Apply various techniques (algebraic and graphical) to solve inequalities involving polynomials (including degree  $> 2$ ), and absolute values, and can express answers using interval notation.
- 2b Use algebra techniques to determine the intervals on which a function  $f(x)$  is positive, negative, or zero.
- 2c Express solution sets using interval notation and set builder notation.

### Topic 3: Functions

- 3a Express properties and transformations of functions graphically and use a graph to determine function properties.
- 3b Identify the basic function transformations[  $f(x-a)$ ,  $f(x+a)$ ,  $f(x)+a$ ,  $f(x)-a$ ,  $f(ax)$ ,  $af(x)$ ], and apply those transformations to the graph of the function or to its equation.
- 3c Using either the function equation or the graph of the function, identify the function's intercepts, asymptotes (vertical, horizontal, slant), domain, range, even/odd symmetry, and end behavior.
- 3d Using the graph of a function, identify its critical points and determine if each critical point is a minimum, maximum or neither, and locate intervals of increase/ decrease.
- 3e Manipulate functions as elements to get new functions via addition, subtraction, multiplication, division, and composition and can simplify the resulting expression (e.g., difference quotient).
- 3f Construct and evaluate inverse functions and use domain and/or range restriction appropriately.

### Topic 4: Trigonometric Functions

- 4a Relate values on the unit circle to trig function values, and vice-versa, with numerical values at specific angles ( $0$ ,  $\pi/6$ ,  $\pi/4$ ,  $\pi/3$ ,  $\pi/2$ ) and their periodic extensions.
- 4b Graph the six trigonometric functions and identify characteristics such as period, amplitude, phase shift, and asymptotes.
- 4c Use trigonometric identities to evaluate numerical values, simplify expressions and solve equations. For example, use sum/difference identities to evaluate  $\cos(\pi/12)$ .
- 6e Apply multiple identities to simplify expressions and solve equations, including ones involving inverse functions.
- 6f Solve trigonometric equations by factoring, by using identities, and by graphing.

### Topic 5: Geometry

- 5a Identify missing side lengths or interior angles of a right triangle using the Pythagorean Theorem and/or trigonometric techniques.
- 5b Solve for missing characteristics of any triangle using the Law of Sines or the Law of Cosines.
- 5c Determine the magnitude and direction of a vector given its  $i$ ,  $j$  components, or vice versa.
- 5d Using the completion of squares, convert the general forms of equations for parabolas or circles into their standard forms.
- 5e Identify the center and radius of a circle by comparing an equation to the standard form equation for a circle (provided on formula sheet).
- 5f Calculate basic geometric properties like area of a sector, arc length, and the relation between the area of a sector and the inscribed triangle.
- 5g Relate, through the unit circle, polar coordinates to Cartesian coordinates and vice versa.

## **Topic 6: Models and Applications**

- 6a Create functions that model given conditions for objects in constant velocity, free fall, simple harmonic motion, or constant angular velocity.
- 6b Using right triangles, model applications involving angles of elevation, angles of depression, bearings, and headings, and employ trigonometric techniques to solve the model.
- 6c Identify or create appropriate models for situations involving direct and inverse proportionality, average rate of change, exponential growth and decay, logarithmic relations, and periodic behavior.
- 6d Use appropriate units for a model.
- 6e Interpret the solutions in terms of the original problem.