

## Statewide Dual Credit Learning Objectives for Pre-Calculus (MATH 1730)

### **Overall Objectives:**

A. Can identify and apply appropriate techniques for solving math problems, and can verify the correctness of a solution.

B. Can use appropriate functional notation and concepts in solving problems and for explaining solutions.

### ***Learning Objectives***

1. Can apply various techniques, as appropriate, to simplify expressions and solve equations. This includes using exact symbolic (algebraic), approximation and graphical techniques

a) Solve quadratic equations for both real and complex roots.

b) Solve polynomial equations of degree  $> 2$  for both real and complex roots. Use synthetic division and other relevant results to identify and simplify the equation.

c) Solve equations involving absolute values, radical, rational, exponential or logarithmic expressions.

d) Identify equations that can't be solved directly and use graphical or other approximations.

e) Use the properties of logs and exponentials to simplify expressions involving logs and exponentials.

2. Can apply various techniques (algebraic and graphical) to solve inequalities involving polynomials (including degree  $> 2$ ), and absolute values, and can express answers using interval notation

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3. Can express properties and transformations of functions graphically, and can use a graph to determine function properties

a) On both the graph and the function can apply and identify the basic transformations:  $f(x-a)$ ,  $f(x+a)$ ,  $f(x)+a$ ,  $f(x)-a$ ,  $f(ax)$ ,  $af(x)$

b) From the function can identify graphical functional properties and vice versa: intercepts, asymptotes (vertical, horizontal, slant), domain, range, and end behavior.

c) From the graph can locate critical points and identify if each is a minimum, maximum or point of inflection, and locate intervals of increasing/decreasing

4. Can use functions to model behavior described by words and/or data

a) Identify and make appropriate models for situations involving for example, direct and inverse proportionality, average rate of change, exponential growth and decay, logarithmic relations, and periodic behavior.

b) Use appropriate units and function properties, like domain, as needed in function models. c) Interpret the solutions in terms of the original problem.

5. Can manipulate functions and identify their properties

a) Identify basic properties of functions (definition of function, domain, range, odd, even, asymptotic behavior)

b) 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)

c) Construct and evaluate inverse functions and use domain and/or range restriction appropriately.

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6. Can use trigonometric functions and identities to find specific results

a) 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.

b) Graph the six trigonometric functions and identify characteristics such as period, amplitude, phase shift, and asymptotes.

c) Use trigonometric identities to evaluate numerical values, simplify expressions and solve equations. (E.g. use sum/difference identities to evaluate  $\sin(\pi/12)$ , simplify  $(\sin(x) + \cos(x))^2$  ).

d) Apply multiple identities to simplify expressions and solve equations, including ones involving inverse functions.

e) Solve trigonometric equations by factoring, by using identities, and by graphing.

7. Can solve right triangle problems including applications

a) Solve right triangle problems involving angles of elevation and depression and angles using compass notation (e.g.  $30^\circ$  North) using trigonometric identities and rules.

b) Use the Law of Cosines and Sines for all triangle types.

c) Use vector concepts of magnitude and direction.

8. Can work with circles as a (Cartesian) conic section and in terms of its geometric and polar properties

a) Convert a quadratic equation into the equation of a circle or parabola using completion of squares.

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- b) Identify the center and radius of a circle, and can write and use the equation of a circle from its properties.
- c) Calculate basic geometric properties like area of a sector, arc length, and the relation between the area of a sector and the inscribed triangle.
- d) Relate, through the unit circle, polar coordinates to Cartesian coordinates and vice versa