Mth 111 Final Outcomes **NAME**

After studying, place a checkmark next to those outcomes you feel you understand and/or are proficient with. Place a question mark next to those outcomes which you feel your skills/understanding is questionable. Turn in with your test.

To be successful in Mth 111 you should be able to …

Prerequisite Material

1. Solve a linear equation algebraically.
2. Solve a quadratic equation algebraically. (QF is adequate)
3. Graph a line from its equation without the aid of a graphing calculator.
4. Find the equation of a line from (a) two points, (b) slope and a point, (c) graph, (d) scatter plot (regression)
5. Graph a function using a graphing calculator and find its critical points (roots, extrema, y-intercept)
6. Use a graphing calculator to find where a function reaches a specific value. e.g. find x where f(x) = 10.
7. Apply the Rules of Exponents to simplify expressions. e.g. $(3x^2)^3 = 3^3 x^6$, $x^{-3} = 1/x^3$

Solve Equations Using the Graphing Calculator

1. Solve (a) f(t) = g(t) by the intersection method, (b) Solve f(t) = 0 by the root method, (c) Solve f(t) = k by tables.

Functions (include algebraic form, graphic form, tabular form)

1. Explain the concept of a function. i.e. What is a function? Is a relationship is a function. i.e. vertical line test
2. Understand function notation/vocabulary in algebraic, graphic and tabular sense. e.g. domain, range, f(x), f(g(x))
3. Evaluate functions with (a) a change of variable, (b) at a value, (c) with a new expression. $f(x) \rightarrow f(t)$, f(2), f(a + b)
4. Give the domain and range of a function from its algebraic, graphic or tabular form.
5. Give increasing or decreasing intervals.
6. Use appropriate notation to describe an interval. e.g. $[-1, \infty) \rightarrow -1 \leq x \leq \infty \rightarrow x \geq -1$
7. Graph piecewise functions.
8. Rewrite a piecewise graph in algebraic format.
9. Rewrite an implicit function in explicit form. i.e. $F(x,y) = 0 \rightarrow y = f(x)$.
10. Graph a function in a 'friendly' window. i.e. Find an appropriate window without relying on ZoomFit
11. Simplify the different quotient. i.e. Simplify $\frac{f(x + h) - f(x)}{h}$
12. Compute the average rate of change /avg slope. i.e. favg = $\frac{f(b) - f(a)}{b - a}$
13. Transform a function graphically. i.e. $y = f(x)$ vs. $y = \pm a\, f(b(\pm x \pm h)) \pm k$
14. Perform various operations among functions. e.g. f(x) + g(x), [f(x)][g(x)], f(g(x)), $f^2(x)$, etc.
15. Find the inverse of a function algebraically or graphically.
16. Determine if the inverse of a function is a function. i.e. Vertical/Horizontal Line test.
17. Show that $f(x) \circ f^{-1}(x) = f^{-1}(x) \circ f(x) = x$ algebraically.
18. Distinguish between $f^{-1}(x)$ vs. $[f(x)]^{-1}$

Mathematical Models

1. Identify the independent vs. the dependent variable.
2. Use a mathematical model given in an algebraic or graphic form to draw conclusions, make predictions and analyze behavior inherent in the model.

Quadratics

1. Graph a quadratic and identify the four critical points: roots, vertex and y-intercept.
2. Switch between the key quadratic forms:

   $y = ax^2 + bx + c \quad \leftrightarrow \quad y = a(x - h)^2 + k \quad \leftrightarrow \quad y = a(x - r_1)(x - r_2)$
3. Find the equation of a quadratic from:

   (a) two roots and a third point, (b) vertex and a third point, (c) three random points (regression OK)

Exponents and Exponential Equations (include algebraic form, graphic form, tabular form)

1. Analyze an exponential model in algebraic or graphic form.
   a) Analyze $P(t) = P_0e^{\pm kt}$
   b) Analyze $y = a\,b^t$, convert to a e^{kt}
2. Solve exponential equations algebraically. e.g. Solve for x: $3\,e^{mx + b} = 10$

Logarithms and Logarithmic Equations (include algebraic form, graphic form, tabular form)

1. Apply the Rules of Logarithms to simplify expressions. e.g. $\ln(4x) - \ln x = \ln 4$
2. Solve logarithmic equations algebraically. e.g. Solve for x: $\ln(mx + b)^2 = 10$

Exponential Applications

1. Solve problems involving half-life.
2. Solve problems involving exponential growth. e.g. population growth, time value of money, etc.

Modeling Applications

1. Create mathematical models based on logical reasoning and algebraic relations.
2. Create mathematical models based on regression choices.
3. Analyze mathematical models. e.g. Find the maximum population, find when a population goes extinct, etc.
4. Choose the appropriate function(s) associated with a graph.

Polynomials

1. Determine the roots and multiplicities for a polynomial in factored form. e.g. $P(x) = (x - 2)^2(x + 1)^3(x + 4)$
2. Determine if the graph of a polynomial, written in factored form, passes through (slices) or bounces off the x-axis at the roots. e.g. $P(x) = (x - 2)^2(x + 1)^3(x + 4)$
3. Write a polynomial function in factored form representing a given graph.
4. Determine the general shape of a polynomial (parabola, cubic, number of turns), written algebraically, from the degree and leading coefficient of the polynomial. e.g. $P(x) = -2x^5 + 3x^2 - x + 4$
5. Understand that irrational and complex roots occur in conjugate pairs.

Writing and Working in a Group

1. Effectively communicate mathematical concepts in writing using correct mathematical notation.
2. Work collaboratively with your peers on projects or activities to explore mathematical concepts.