**UT Math 1330 Submission for OTM Trigonometry – TMM 003**

**Learning Outcomes for Functions:**

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|  | Learning Outcome Description | Describe how the Courses or Programs address each outcome |
| 1.1 | \*  Represent trigonometric and inverse trigonometric functions verbally, numerically, graphically and algebraically; define the six trigonometric functions in terms of right triangles and the unit circle. | Students will graph the six basic trigonometric functions and their inverses, accurately specifying domains, ranges, asymptotes, symmetry, and intercepts. Students will identify properties of the trigonometric functions and their inverses with corresponding properties in the unit circle and in right triangles. |
| 1.2 | \*  Perform transformations of trigonometric and inverse trigonometric functions – translations, reflections and stretching and shrinking (amplitude, period and phase shift). | Students will rewrite algebraic expressions of functions in standard form for geometric transformations, then graph the functions by employing the sequence of transformations from a standard graph. Conversely students will recognize graphs as transformations of standard graphs and write algebraic expressions for them. |
| 1.3 | \*  Analyze the algebraic structure and graph of trigonometric and inverse trigonometric functions to determine intercepts, domain, range, intervals on which the function is increasing, decreasing or constant, asymptotes, whether the function is one-to-one, whether the graph has symmetry (even/odd), etc., and given the graph of a function to determine possible algebraic definitions. | Students will apply the analytical techniques above to sketch the graphs of more general trigonometric functions and their inverses. Conversely students will write algebraic expressions for trigonometric functions or their inverses given in graphical form. |
| 1.4 | \*  Use trigonometric and inverse trigonometric functions to model a variety of real-world problem-solving applications. | Given verbal and geometric descriptions of physical situations involving angle measure and proportionality students will reformulate the information in terms of trigonometric functions or their inverses and then solve the problem posed. |

**Learning Outcomes for Equations:**

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|  | Learning Outcome Description | Describe how the Courses or Programs address each outcome |
| 2.1 | \*  Solve a variety of trigonometric and inverse trigonometric equations, including those requiring the use of the fundamental trigonometric identities listed in (4.4), in degrees and radians for both special and non-special angles. Solve application problems that involve such equations. | Students will develop trigonometric identities, including the addition and subtraction formulas and their corollaries, and apply these to the solution of trigonometric equations. Some of these solutions will be expressed as standard angles, in degrees or radians. Others will require evaluation using a calculator. |

**Learning Outcomes for Angles/Triangles:**

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|  | Learning Outcome Description | Describe how the Courses or Programs address each outcome |
| 3.1 | \*  Express angles in both degree and radian measure. | Students will learn the standard angles, in both degrees and radians, arrayed around the unit circle. Students will change the expression of angles between degrees and radians. |
| 3.2 | \*  Solve right and oblique triangles in degrees and radians for both special and non-special angles, and solve application problems that involve right and oblique triangles. | Given drawings of triangles or verbal descriptions of physical situations students will employ the definitions of and relationships between the trigonometric ratios to solve for unknown sides or angles. |

**Learning Outcomes for Identities:**

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|  | Learning Outcome Description | Describe how the Courses or Programs address each outcome |
| 4.1 | \*  Verify trigonometric identities by algebraically manipulating trigonometric expressions using fundamental trigonometric identities, including the Pythagorean, sum and difference of angles, double-angle and half-angle identities. | Students will manipulate algebraic expressions of trigonometric functions to determine whether or not they represent identities or equations with discrete solutions. In the latter case they will solve the equations, as indicated above. In the former they will justify their derivation by appealing to known identities. |

**Learning Outcomes for Vectors:**

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|  | Learning Outcome Description | Describe how the Courses or Programs address each outcome |
| 5.1 | \*  Represent vectors graphically in both rectangular and polar coordinates and understand the conceptual and notational difference between a vector and a point in the plane. | Students will learn vectors as expressions of physical quantities that have both a magnitude and direction. They will be contrasted with the expression of location, as in the difference between position and displacement. |
| 5.2 | \*  Perform basic vector operations both graphically and algebraically – addition, subtraction and scalar multiplication. | Students will perform vector operations of addition, subtraction, and scalar multiplication, then sketch the results graphically. |
| 5.3 | \*  Solve application problems using vectors. | Students will solve problems concerning physical quantities such as displacement and resultant forces using vector algebra. |