MATH 1316: STUDY GUIDE FOR FINAL

1. Topics you should know

Here are the topics you should understand for the final:

- The right triangle definitions of the six trig functions, and the unit circle definitions of the six trig functions.
- Using trig and inverse trig functions to solve a right triangle.
- How to determine what quadrant an angle is in, its reference angle, and how to tell whether two angles are coterminal. All this for both radians and degrees.
- How to convert between radians and degrees.
- Using the laws of sines and cosines to solve non-right triangles.
- Using trig to calculate distances, knowing other distances and angles.
- Basics of vectors, including what it means and how to add vectors, and how to convert between $\langle x, y\rangle$ component form and magnitude/direction form.
- How to get information from the graph of a trig function or a symbolic representation, and how to sketch a graph of sine or cosine functions.
- How to solve trig equations of the form $A\text{trig}(x) + B = C$, where trig is one of the six trig functions.
- How to use trig identities to calculate trig values and simplify expressions.

You should expect to see about 10 to 12 questions on the exam. You have two hours for the exam, and it's written with the intention that you should have plenty of time to finish and check your work.

2. Sheet of formulas and notes

For the exam, you are allowed to bring one sheet, front and back, for notes and formulas. (This should be standard size notebook or printer paper, so no funny business with bringing in a poster.) **Label your note sheet with your name and you must turn it in with your exam.** Here's some suggestions for what you might want to put on your formula sheet:

- The definitions of the trig functions.
- The law of cosines and law of sines.
- The formulas for converting between radians and degrees.
- A table of trig values for common angles, in both radians and degrees.
- The pythagorean identity.
- The angle sum, double angle, and half angle identities.
- Info about graphs of trig functions.
- Any definitions or methods you aren't 100% clear about.

3. Sample questions

Here are some sample questions, to give you an idea of the sorts of problems you should know how to solve. For the exam, calculators are allowed and for most questions you can either give exact answers or decimal approximations. For a few questions, however, I will ask only for exact answers.

(1) The two legs of a right triangle with angle α have length 2 and 4. Find all six trig functions of α.
(2) A right triangle has an angle of $25°$ and a hypotenuse of length 9. Find all angles and side lengths of the triangle.
(3) Simplify the expression $\sin^2(\tan^{-1}(2/9)) + \cos^2(\tan^{-1}(2/9))$ to not use any trig functions or inverse trig functions.
(4) You know that the angle α is in Quadrant 2 and that β is the reference angle for α. If you know that $\sin\beta = 1/\sqrt{5}$, determine $\sin\alpha$, $\cos\alpha$, and $\tan\alpha$.
(5) Consider the angle $19\pi/7$. What Quadrant is it in? Find the angle between 0 and 2π which is coterminal with it, and determine its reference angle.

(6) A triangle has a side of length 10 flanked by angles of measure 25° and 65°. Find all angles and side lengths of the triangle.
(7) A triangle has a 100° angle flanked by sides of length 3 and 6. Find all angles and side lengths of the triangle.
(8) A boat is traveling directly cross-river at 15 mph. At the same time, the current is pushing it directly downriver at 5 mph. Determine the direction of the boat, as an angle downriver from directly cross-river, and its overall speed.
(9) Consider the vector $\langle 4, 3\rangle$. Determine its magnitude and direction. (Give the direction as an angle in standard form.)
(10) Find three different solutions to the equation $\sqrt{3}\sin(2t) = \cos(2t)$.
(11) Find the general solution to the equation $2\cos(t/2) = -1$.
(12) The elevation of a buoy bobbing up and down with the waves is modeled by the equation $y(t) = 3\sin(\pi t/4) - 1$, where t is measured in seconds and $y(t)$ is the elevation above sea level in feet. (It's at low tide, whence the -1.) What is the amplitude, period, and horizontal shift of the buoy's movement? Sketch a graph of $y(t)$, showing one full period and identifying the maximum, minimum, and period.
(13) Consider the two angles 80° and $5\pi/11$, one given in degrees and the other in radians. Convert both to radians and determine which is larger.
(14) You know that $\sin(\alpha) = 1/3$ and $\cos(\beta) = 2/3$, where α and β are two angles in Quadrant 1. Determine $\sin(\alpha + \beta)$ and $\cos(\alpha + \beta)$.
(15) You know that α is in Quadrant 3 and that $\cos(\alpha) = -3/5$. Determine $\sin(\alpha)$ and $\tan(\alpha)$.
(16) Compute the exact value of $\sin(5\pi/12)$.
(17) Compute the exact value of $\cos(15^\circ)$.
(18) Simplify the expression $(\sin x + \cos x)^2$ to show it is equal to $1 + \sin(2x)$.