

Math 110 Exam #3

November 18, 2015

Time: 1 hour and 25 minutes
Instructions: Show all work for full credit.
No outside materials or calculators allowed.
Extra Space: Use the backs of each sheet for extra space. Clearly label when doing so.

Name: _____

ID #: _____

Instructor/Section: _____

"I pledge by my honor that I have abided by the NJIT Academic Integrity Code."

_____ (Signature)

Problem(s) Score Total

Problem(s)	Score	Total

Relevant Formulas for this Exam:

$$\sin(A+B) = \sin(A)\cos(B) + \sin(B)\cos(A)$$

$$\sin(A-B) = \sin(A)\cos(B) - \sin(B)\cos(A)$$

$$\cos(A+B) = \cos(A)\cos(B) - \sin(A)\sin(B)$$

$$\cos(A-B) = \cos(A)\cos(B) + \sin(A)\sin(B)$$

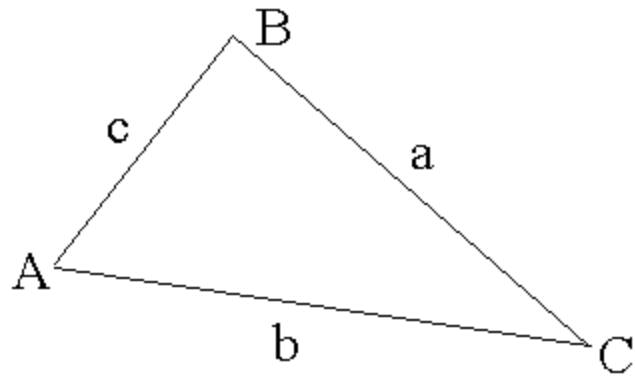
Given $\triangle ABC$ as shown:

$$\frac{\sin(A)}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{c}$$

$$a^2 = b^2 + c^2 - 2bc \cos(A)$$

$$b^2 = a^2 + c^2 - 2ac \cos(B)$$

$$c^2 = b^2 + a^2 - 2ab \cos(C)$$



1. Evaluate the following. **(12 pts):**

a. $\sin^{-1}\left(-\frac{1}{2}\right)$

b. $\cos^{-1}\left(-\frac{1}{2}\right)$

c. $\tan\left(-\frac{3\pi}{4}\right)$

2. Solve the following equation for x (and fully simplify the answer): $(2x)^{24} = 8^{16}$ **(5 points)**

3. Graph three periods of the following graph. Clearly show the location of all zeroes and asymptotes: **(6 points)**

a. $y = \tan(4x - \pi)$

b. Graph two periods of the following graph. Clearly show all quarter period points:
 $y = 3\cos(3\pi x)$ **(6 points)**

4. A wheel has radius of 4 inches. Point P on the rim of the wheel in its initial position has coordinates of $(3, \sqrt{7})$ relative to the center of the wheel. The wheel then rolls 19π inches to the left. Find the final coordinates of the point P after this rotation, relative to the center of the wheel. **(14 points)**

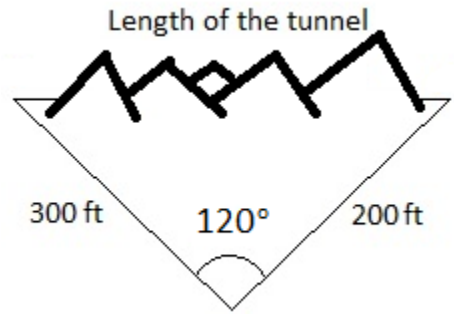
5. Suppose $\sin(\varphi) = 4/5$, with φ in Quadrant II.
- a) Evaluate: $\sin(2\varphi)$ **(6 points)**
 - b) In which quadrant does the angle 2φ lie? Carefully explain or prove your reasoning for this answer. **(4 points)**
 - c) Evaluate: $\tan(2\varphi)$ **(5 pts)**

6. Given $\triangle ABC$ such that $A = 60^\circ$, $C = 75^\circ$, and $b = 6$, solve the triangle for angle B, side a, and side c. Simplify and evaluate all trigonometric functions of 15° or 75° angles, and rationalize all answers. **(14 points)**

7a) Find all solutions of the trigonometric equation which has quadratic form:
 $2\cos^2\theta - \cos\theta - 1 = 0$. Express the solution in radians. **(8 points)**

7b) Find the solutions to the equation $\sin(\theta)\cos(3\theta) = \sqrt{2}\cos(3\theta)$ on the range $\theta = [0, \pi]$
Express the solution in radians **(8 points)**

8. To estimate the length of a tunnel set to be built through a mountain range, a surveyor makes the following measurements. He measures 300 feet along a straight line from the beginning of the tunnel to a point, turns 120° and then measures that it is 200 feet to the other end of the tunnel. Find the length of the tunnel and fully simplify your answer. **(6 points)**



9. Given the triangle pictured to the right, find the range of values that side length x can be such that angle θ will be an obtuse angle. **(6 points)**

