Math 110 Common Exam III
April 19, 2017

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 will abide by the
NJIT Academic Integrity Code."*

_____ (Signature)

Problem(s)	Score	Total

Relevant Formulas for this Exam

Given $\triangle ABC$ as shown to the right:

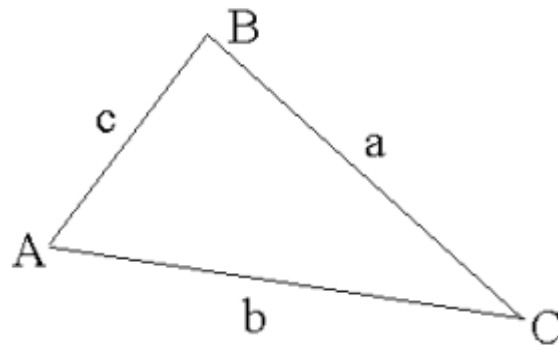$$\frac{\sin(A)}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{c}$$

$$a^2 = b^2 + c^2 - 2bc\cos(A)$$
$$b^2 = a^2 + c^2 - 2ac\cos(B)$$
$$c^2 = b^2 + a^2 - 2ab\cos(C)$$

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}, \text{ where } s = \frac{a+b+c}{2}$$

$$\text{Area} = \frac{1}{2}ab\sin C$$

Show all your work. Simplify and reduce all answers as much as possible. Rationalize all denominators.

1. a) **(5 pts)** Solve the following system of linear equations using any method discussed in class.

$$\begin{cases} 2x + 3y = 6 \\ -3x - y = 5 \end{cases}$$

b) **(10 pts)** Solve the following system of linear equations by Substitution or Elimination. *Note: If you use the Substitution Method, start with the first equation and isolate for x in terms of y and z, then substitute for x in the other two equations.*

$$\begin{cases} x - 3y + 2z = 14 \\ 2x + 5y - z = -9 \\ -3x - y + 2z = 2 \end{cases}$$

2. **(10 pts)** A line passing through the center of a circle intersects diagonally the diameter with the endpoints $P(0,2)$ *and* $Q(6,8)$ on the circle as shown below.

a) Find the equation of the line in the $y = mx + b$ form.
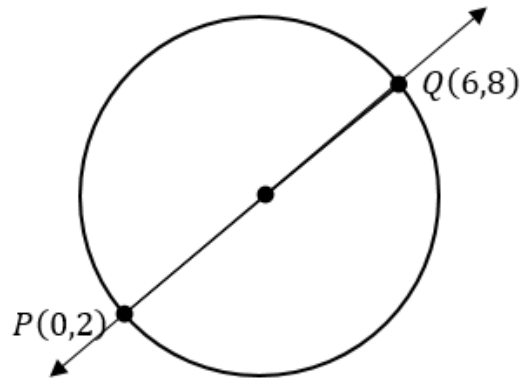
b) Find the equation of the circle in Standard Form.

3. **(5 pts)** To approximate the length of a marsh a surveyor walks 10 yds from point A to point B, then turns through 60° and walks 5 yds to point C. Find the length $\overline{AC}$ across the marsh. Refer to the figure below.
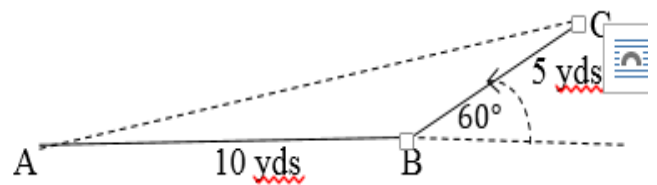
4. a) **(7 pts)** Suppose a triangle $\triangle ABC$ has a side 'b' with a length of 4 in. while $\angle C = 30°$ and $\angle A = 120°$. Use this information to solve for $\angle B$, side 'c' and side 'a'.

b) **(7 pts)** Suppose a triangle ABC has side lengths of: $a = \sqrt{13}$, $b = 2$ and $c = \sqrt{3}$. Solve the triangle for $\angle A$ in degrees.

c) **(7 pts)** Suppose a triangle ABC has side lengths of $a = 2, b = 3$ and $c = 4$, find the area of the triangle.

5. **(12 pts)** Solve the following trigonometric equation for x over the given interval.
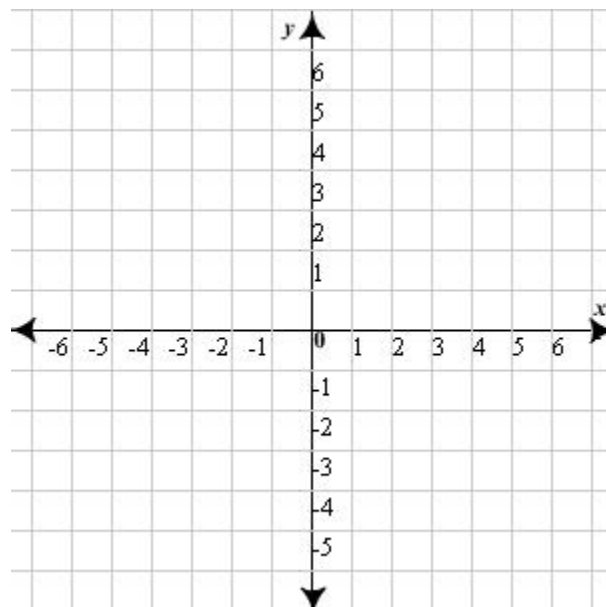
a) $2\cos^2(x) - 3\sin(x) = 3$,   *for all possible values of x (in radians)*
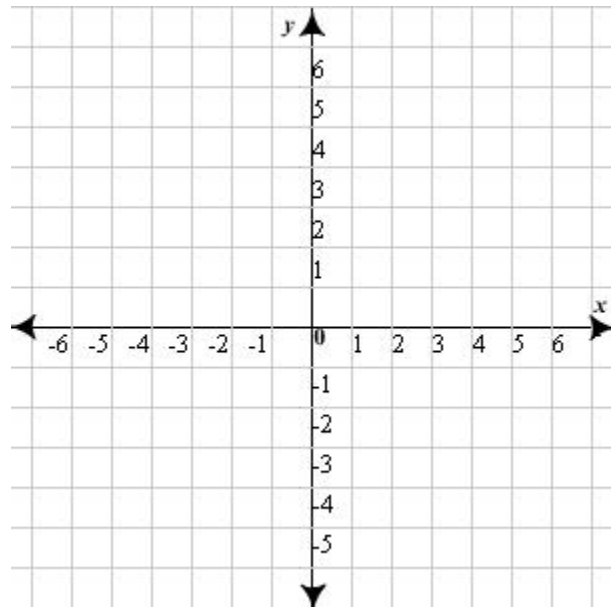
b) $2\cos(3x) + 1 = 2$,   *in the interval* $[0, 2\pi)$
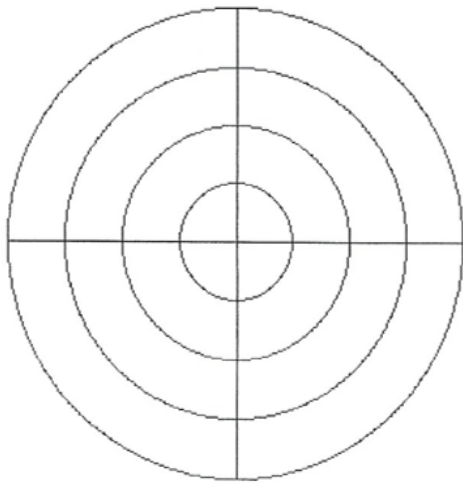
6. **a) (5 pts)** Write the equation in standard form: $9x^2 + 4y^2 - 18x + 8y - 23 = 0$.

b) (10 pts) Graph the following equation of the ellipse on the axis given below. Find and label the center, the vertices and the focal points.

$$\frac{(x+1)^2}{25} + \frac{(y-3)^2}{4} = 1$$

7. **(10 pts)** Sketch the graph of the polar curve: $r = 1 - \cos\theta$ on either of the axes below.

8. a) **(3 pts)** Convert the rectangular coordinates $\left(-3, 3\sqrt{3}\right)$ to polar coordinates with $r > 0$ and $0 \leq \theta < 2\pi$.

b) **(3 pts)** Convert the equation in polar form to rectangular form: $r^2 \sin(2\theta) = 4$.

9. **(6 pts)** Graph the piecewise function: $f(x) = \begin{cases} e^x + 2, & if \ x \le 0 \\ 2 - 2x, & if \ 0 < x \le 1 \\ \ln(x), & if \ x > 1 \end{cases}$ on the set of axes below.