Math 110 Common Exam #1
September 28, 2016

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

Relevant Formulas for this Exam:

Circular motion and equations relating to a sector of a circle,
radius r (as shown to the right).

$s = r\theta$ (where s is the arc length as shown)

$v = r\omega$ (where v is velocity and ω is angular velocity)

$A = \frac{1}{2}r^2\theta$ (where A is the area of the sector cut out by θ)

1. (**9 pts**) Simplify completely (***assume all variables represent positive numbers***)

a) $\dfrac{\sqrt[3]{x^5}}{2x^2(16x^3)^{-\frac{1}{2}}}$

b) $(\sqrt{x}+y)(\sqrt{x}-y)$

c) $\dfrac{\sqrt{25x^4+25x^2}}{x^2+x}$

2. (**9 pts**) Find the exact value of the logarithmic expression.

a) $\log_4 80 - \log_4 5$

b) $\ln e^2 - \log_3 \sqrt{9} + \log 1$

c) $\log_3(\log_2 8)$

3. (6 pts) Let $\log_a 9 = 1.5$ and $\log_a 6 = 1.2$. Evaluate each of the following:

a) $\log_a(54)$

b) $\log_a\left(\dfrac{9}{a^2}\right)$

c) $\log_a \sqrt[4]{36}$

4. **(12 pts)** Solve the following equation for x. Be sure to check your answers.

a) $8(2^{6-2x}) + 9 = 25$

b) $\log_2(x^3) = 15$

c) $x^3 = x$

d) $\log_3(x + 1) + \log_3(2x) = \log_3(3x + 1)$

5. a) **(3 pts)** Write the expression in condensed form with a coefficient of 1:

$$\frac{1}{2}\log x - 2\log y - 3\log z$$

b) **(3 pts)** Write the expression in expanded form. (***Assume all variables represent positive numbers***)

$$\log_3\left[\frac{27\sqrt{x^2+1}}{(y+3)^5}\right]$$

6. **(8 pts)** Let θ be an acute angle such that $\cos\theta = \frac{2}{5}$. Find the exact values of $\sin\theta$, $\tan\theta$ and $\sec\theta$.

7. **(8 pts)** Suppose a certain right triangle is labeled as shown below. Given that $\tan\theta = 2$, find:
   a) the length of side x
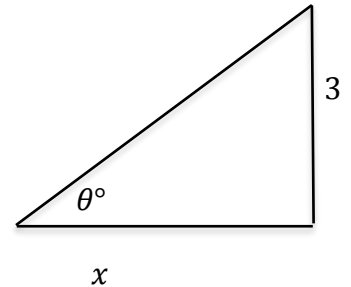
   b) $\cos\theta$

8. **(8 pts)** Suppose that $\sin\theta = \frac{4}{K}$ where 'K' is a nonzero constant. Find the exact values of $\cos\theta$, $\cot\theta$ and $\csc\theta$ in terms of 'K'.

9. **(8 pts)** At a distance of 400 feet from the base of a building, the angle of elevation to the top of a building is 45° and the angle of elevation to the top of an antenna on top of the building.is 60°. Find the height of the building and the height of the antenna. (***Refer to the figure below***).
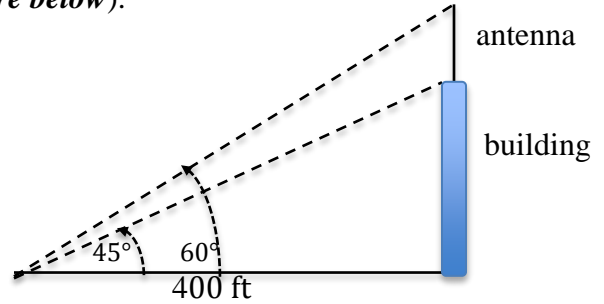

10. **(10 pts)** Given the 3 in. and 9 in. pulley system below,
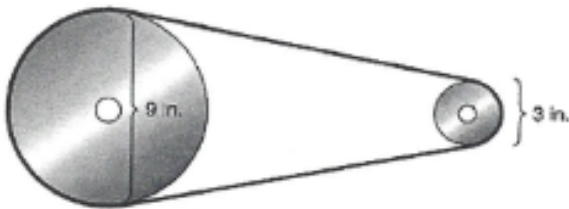
a) If the 3 in. wheel turns through an angle of 100°, find the angle (in degrees) that the 9 in.wheel turns through.

b) If the 3 in. wheel is spinning at a rate of 6 rpm, how many rpms is the 9 in. wheel making?

11. **(8 pts)** Given the function $y = \log_2(x - 2) + 1$, identify the domain, range and asymptote, if any. Then graph the function by making a table of values or using transformation. Be sure to label the asymptote on the graph.
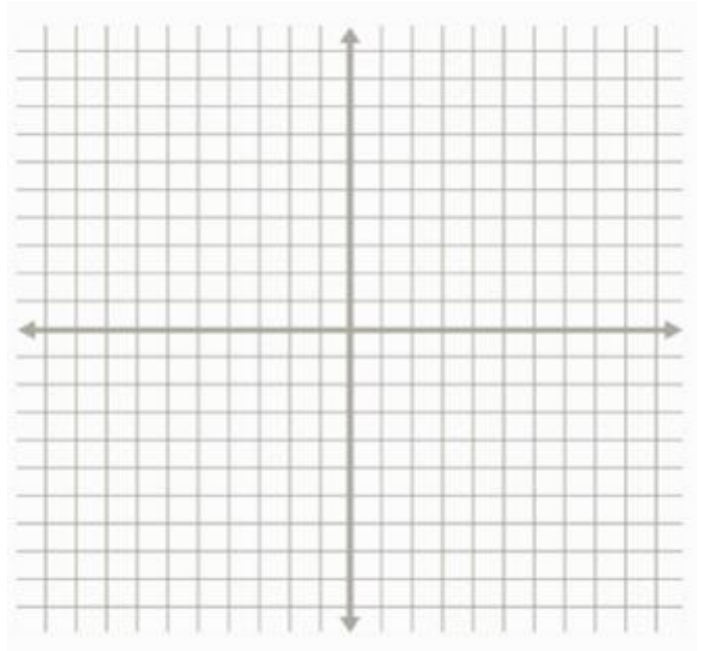
12. **(8 pts)** Given the function $y = -4^{-x} - 1$, identify the domain, range and asymptote, if any. Then graph the function by making a table of values or using transformation. Be sure to label the asymptote on the graph.