

# Math 110 Common Exam #1

February 15, 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 have abided by the NJIT Academic Integrity Code.”*

\_\_\_\_\_ (Signature)

Problem(s)	Score	Total

Relevant Formulas for this Exam:

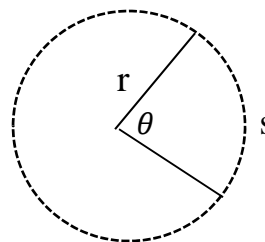
Circular motion and equations relating to a sector of a circle, radius  $r$  (as shown to the right).

$$s = r\theta$$

$$v = r\omega$$

$$A = \frac{1}{2}r^2\theta$$

$$P = P_0e^{kt}$$



1. (12 pts) Find the exact value of the following expression.

a)  $\ln \sqrt[3]{e^2}$

b)  $\log_2 \sqrt[3]{8} - \log 100$

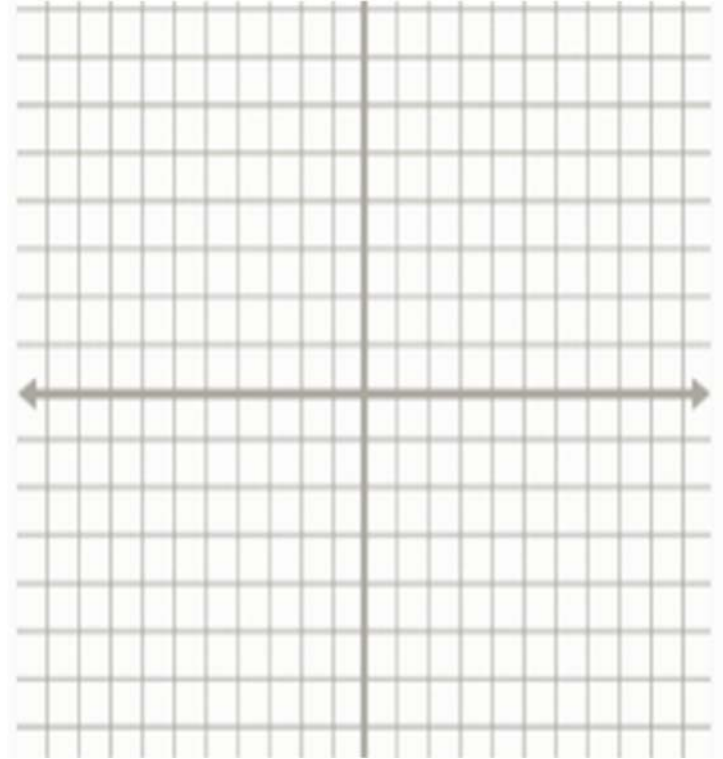
c)  $\log_2 \left[ \sin \left( \frac{\pi}{6} \right) \right]$

d)  $4\cos^2(45^\circ) + 4\sin^2(45^\circ) - e^{\ln 4}$

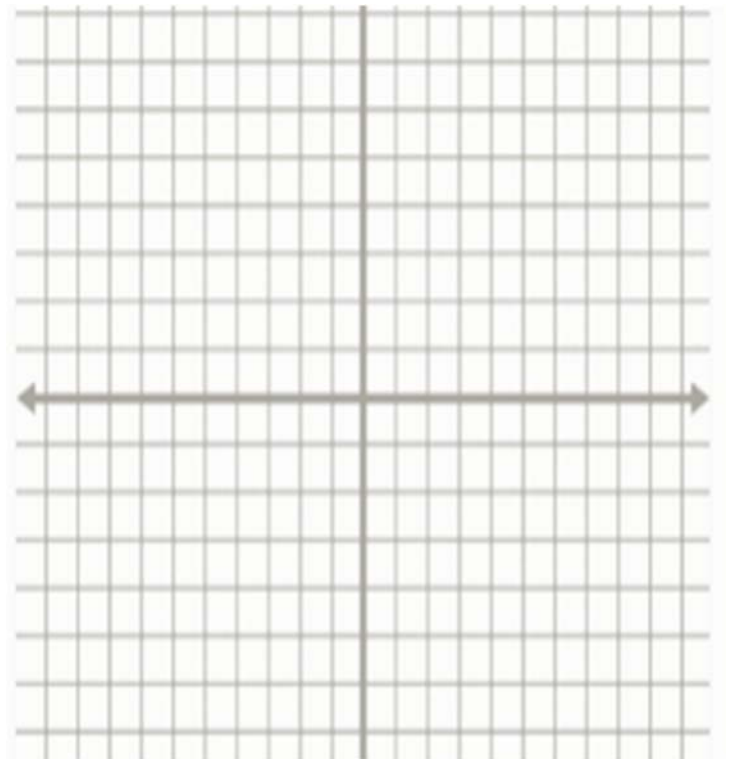
2. a) **(5 pts)** Given that  $\tan \theta = \frac{4}{3}$ , with  $\theta$  in Quadrant I, find the exact values of  $\cos \theta$  and  $\csc \theta$ .

b) **(5 pts)** Suppose a metal block is cooling so that its temperature  $T$ (in  $^{\circ}\text{C}$ ) is given by  $T = 400 \cdot 2^{-2t}$ , where  $t$  is given in hours. How long has the block been cooling if its temperature is now  $100^{\circ}\text{C}$  ?

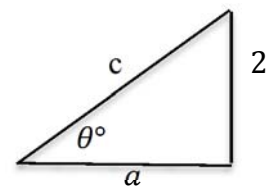
3. a) **(5 pts)** Graph the function  $y = 2^{-x} - 2$  on the set of axes below by making a table of values or using transformation. Be sure to label the asymptote on the graph, if any exists.



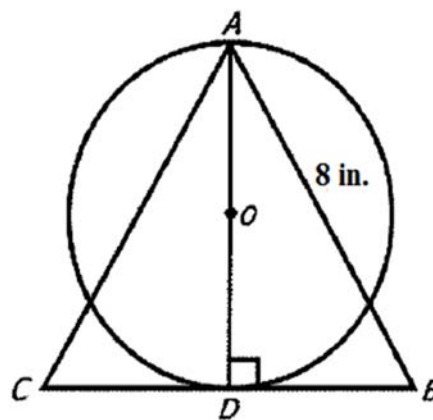
- b) **(5 pts)** Graph the function  $y = -\log_2(x - 3)$ , on the set of axes below by making a table of values or using transformation. Be sure to label the asymptote on the graph, if any exists.



4. a) (4 pts) Given the right triangle as labeled below, if  $\tan \theta = \frac{1}{3}$ , find the lengths of side 'a' and 'c'.



b) (6 pts) Find the area of the equilateral triangle  $\Delta ABC$  and the area of the circle shown below.



5. Given a 4 in. wheel and 7 in. wheel pulley system, find the following. (*Do Not Use Ratios*).

a) (5 pts) If the 4 in. wheel turns through an angle of  $150^\circ$ , find the angle (in degrees) that the 7 in. wheel turns through.

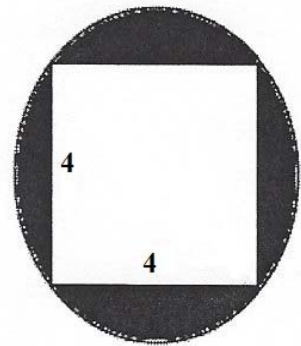
b) (5 pts) If the 7 in. wheel is spinning at a rate of 6 rpms, how many rpms is the 4 in. wheel making?

6. (8 pts) Given  $\log_a 8 = -2$  and  $\log_a 3 = 4$ , evaluate the following:

$\log_a(24)$	$\log_a(64)$	$\log_a(\sqrt[4]{3})$	$\log_a(8a^2)$

7. a) **(6 pts)** Suppose that  $\sin \theta = \frac{3}{x}$  where 'x' is a nonzero constant. Find the values of the other 5 trig. functions in terms of 'x'. (*Do not rationalize the denominator*)

- b) **(5 pts)** Given the square (4 feet by 4 feet) inscribed in the circle as shown below, find the area of the shaded region.



8. (20 pts) Solve the following equation for all solutions, making sure all answers are in the domain of the original problem.

a)  $\log_5(x) + \log_5(x+1) = \log_5(2x)$

b)  $3(2^x) = 42$  (You may leave your answer in logarithmic form)

c)  $x^{5/6}(x^{1/3})^2 = 27$

d)  $\log_4(x) - \log_4(x-1) = \cos\left(\frac{\pi}{3}\right)$

e)  $e^x + 2e^{-x} = 3$



9. a) (2 pts) Simplify completely (*assume all variables represent positive numbers*)

$$\frac{\sqrt{9x^2 - 9}}{3x - 3}$$

b) (3 pts) Simplify completely (*using positive exponents only*)

$$\frac{y^{-2} \sqrt{x^7}}{(2y^2)^3 x^{3/2}}$$

c) (4 pts) Solve the following equation. Fully simplify your answer.

$$\frac{1}{2}x^2 = 1 - 2x$$