

# Math 110 Common Final Exam

May 6, 2022

**Time:** 2 hours and 30 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 #:** \_\_\_\_\_

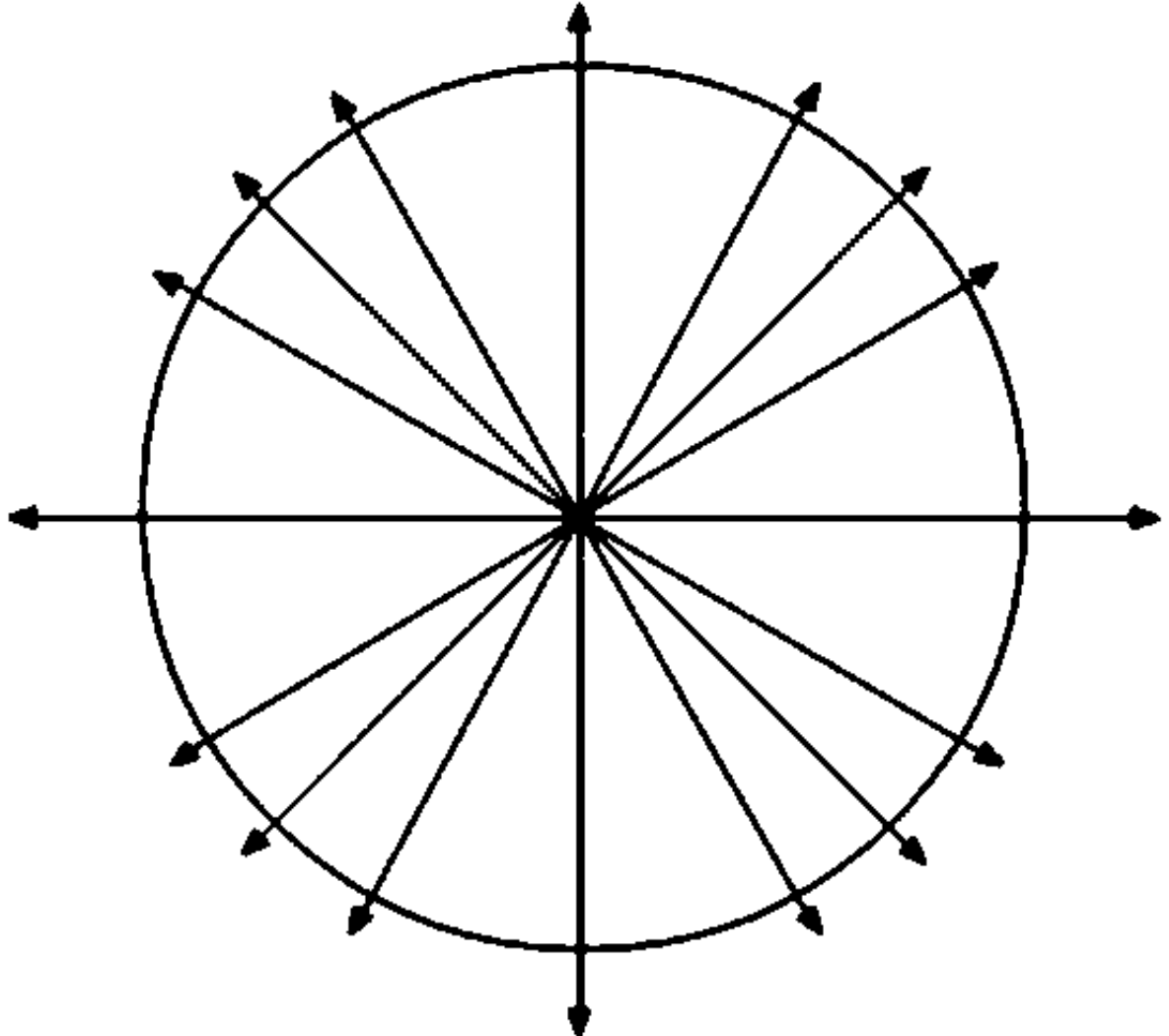
**Instructor/Section:** \_\_\_\_\_

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

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

Problem	Score
1	
2	
3	
4	
5	
6	
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8	
9	
10	
11	
12	

1. For all the special angles below, as well as the axes, list (8 points total)
  - a. All degrees
  - b. All radians
  - c. All coordinates



2. Solve the following equations. Be sure to identify any extraneous solutions and if there are no solutions, write "No Solutions" (3 pts each)

a.  $\left(\frac{1}{2}\right)^x \cdot \left(\frac{1}{8}\right)^{-3x-2} = 32$

b.  $\log 1 = \log(x^2 - 15)$

c.  $\log_3(4x^2 + 9) - \log_3 2 = 2$

3. Graph the polar equations  $r = -3\sin\theta$  and  $r = 1 - \sin\theta$  on the same polar graph. Clearly and accurately label any intersection points (full sets of coordinates). (5 points)

4. Simplify the following using partial fraction decomposition:  $\frac{x^3+4x+5}{x^2+3x+2}$  (5 pts)

5. Consider the function  $f(x) = \ln(x + 5) + 5$

a. Find the inverse of this function (4 pts)

b. Graph both the original function and its inverse on the **same coordinate plane**. Be sure to label any asymptotes and at least 1 identifying point for each graph. (3 pts)

6. Given the equation of the ellipse,  $16x^2 + y^2 + 96x - 2y + 129 = 0$  identify the coordinates of A) the center, B) the vertices, C) the endpoints of the minor axis, and D) the foci. Write your answers on the appropriate lines below. (2 pts each)

A: \_\_\_\_\_

B: \_\_\_\_\_

C: \_\_\_\_\_

D: \_\_\_\_\_

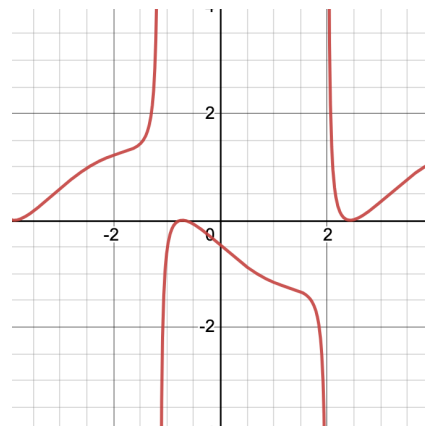
7. Evaluate the following limits; if the limit doesn't exist, write DNE and **state why**: (3 pts each)

a.  $\lim_{x \rightarrow -2} \sqrt{4x^2 - 3}$

b.  $\lim_{x \rightarrow 1} \frac{x^2 + x - 2}{x^2 - x}$

c.  $\lim_{c \rightarrow 0} \frac{\sqrt{5c+4}-2}{c}$

d.  $\lim_{x \rightarrow 2} \frac{\cos^2(x-4)}{\sin(x-2)}$  Graph pictured here →



8. Consider the function  $f(x) = x^3 - 12x$

a. Find an expression for the average rate of change by using the formula  $\frac{f(x+h)-f(x)}{h}$  (4 pts)

b. Find an expression for the instantaneous rate of change by taking the limit as  $h$  goes to 0 of your answer from part a. (3 pts)

c. Evaluate the instantaneous rate of change (answer from part b) at  $x = 2$  (2 pts)

9. Evaluate the following: (3 pts each)

a.  $\sec(-690^\circ)$

b. Sine, if the point on the terminal side of the angle  $\theta$  is  $(-3, \sqrt{7})$

c.  $\tan^{-1}\left(\cot\left(\frac{5\pi}{6}\right)\right)$

d.  $\sin(\arctan(x))$  in the first quadrant



10. Solve the following for all solutions belonging to the interval  $[0, 2\pi)$  (4 pts each)

a.  $\sin\left(x + \frac{\pi}{4}\right) + \sin\left(x - \frac{\pi}{4}\right) = -1$

b.  $0 = 3\sin\theta + 2 - \cos^2\theta + \sin^2\theta$

c.  $-\cos 3x = \cos 5x$

d.  $\cos 2\theta = \cos^2\theta$

11. Three unique numbers sum to 108. The smallest is half the size of the largest, while the middle is three quarters the size of the largest. Set up a system of three equations to solve for the three values. (5 pts)

12. For the following statements, write True or False; no work required: (1 pts each)

a. The range of  $y = \sin 3x$  is  $[-3, 3]$

b. If  $r = 5$  feet and  $\theta = 30^\circ$  then  $s = 5 \cdot 30 = 150$  feet

c.  $\sin 75^\circ = \sin 45^\circ + \sin 30^\circ$

d. The equation  $\sec x = \frac{1}{2}$  has 2 solutions in  $[0, 2\pi)$