PRINT Name: ___________________________ UM ID: ___________ HW ID: ______

Discussion section #: __________

Multiple Choice Total Points: ___ out of 65

Free Response Total Points: ___ out of 60

Total Points: ___ out of 125 = ___%

Sign your name below to certify that you did this exam by yourself:

Signature: ____________________________________________

This booklet contains 13 pages, including this cover page. Check to see if any are missing.

While doing this exam, you may not use books or notes or any electronic device other than a scientific calculator.

Instructions for the machine-graded part of the exam:

You MUST use a soft pencil (No. 1 or No. 2) to answer this part. Do not fold or tear the answer sheet. DO NOT MAKE ANY STRAY MARKS ON THE ANSWER SHEET. When you have decided on a correct answer, circle the answer in this booklet and blacken completely the corresponding circle on the answer sheet. If you erase something, do so completely. Each question has a correct answer. If you mark two answers, the question will be counted as wrong. There is no penalty for guessing. Each problem is worth 5 points and there is no partial credit for this part of the exam.

Note that either you or the School of Mathematics may request a re-grade of the machine graded part of this exam. All re-grades will be based on responses in this exam booklet and not on the machine graded response sheet. Any problem for which the answer is not indicated in this exam booklet, or which has no relevant accompanying calculations will be counted as wrong on the re-grade. Therefore work and answers must be clearly shown in this exam booklet.

Instructions for the hand-graded part of the exam:

SHOW ALL WORK. Unsupported answers will receive no credit. Partial credit is possible.

After you finish both parts of the exam:

Hand in this exam booklet and your GENERAL PURPOSE ANSWER SHEET. Have your ID card in your hand when turning in your exam so the proctor can check it.
For the multiple choice part of the exam, work each problem in the space provided, circle the letter of your answer on this exam paper, and then fill in the appropriate circle on the answer sheet.

1. Find the center of the circle \( x^2 + y^2 - 6x + 2y - 6 = 0 \)
   a. \((3, -1)\)
   b. \((2, 4)\)
   c. \((-3, 2)\)
   d. \((1, 3)\)
   e. \((-4, 1)\)

2. Combine into a single fraction and simplify: \( \frac{2x}{x^2 - 3x} - \frac{3}{x^2 - 9} \). The numerator of the resulting fraction is which of the following:
   a. \(2x + 3\)
   b. \(3x - 2\)
   c. \(2x^2 + 3x\)
   d. \(2x^2 + 3x - 1\)
   e. \(2x^2 + 6x - 3\)
3. Solve: \(-6 = x^2 - 5x\) Then, add the solutions to get one of the following:
   a. \(-2\)
   b. \(-3\)
   c. 2
   d. 5
   e. 6

4. Simplify and write with positive exponents only: \(\frac{2x^{3/2} \left(8x^{-1/2}\right)^{1/3}}{4x^{-1/2}}\) The exponent of the \(x\) is which of the following?
   a. \(2/3\)
   b. \(5/6\)
   c. \(3/2\)
   d. \(11/6\)
   e. \(1/3\)
5. Solve $4^x - 8 \cdot 2^x = -15$ and round your answers to two decimal places. Now, add the solutions to get one of the following.
   a. 0.98
   b. 1.15
   c. 2.32
   d. 2.58
   e. 3.90

6. Find the domain of $f(x) = \frac{-2\sqrt{2x + 8}}{x^2 + 5x - 14}$
   a. $\{x | x \leq 4, x \neq 2\}$
   b. $\{x | x \geq 4, x \neq 2, x \neq -7\}$
   c. $\{x | x \neq 4, x \neq 8\}$
   d. $\{x | x \neq 0\}$
   e. $\{x | x \geq -4, x \neq 2\}$
7. Solve \( \frac{x-4}{x+2} \leq 2 \).
   a. \( x \leq -2 \) or \( x \geq 4 \)
   b. \( x \leq -8 \) or \( x > -2 \)
   c. \( x \leq -6 \) or \( x \geq 2 \)
   d. \( x \leq -4 \) or \( x \geq 2 \)
   e. \( x \leq -8 \) or \( x > 0 \)

8. The function \( f(x) = \frac{3x}{x+5} \) is one-to-one. Find the inverse, \( f^{-1}(x) \).
   a. \( f^{-1}(x) = \frac{-5x}{x-3} \)
   b. \( f^{-1}(x) = \frac{x-3}{5x} \)
   c. \( f^{-1}(x) = \frac{-1}{3x} \)
   d. \( f^{-1}(x) = \frac{x+5}{3x} \)
   e. \( f^{-1}(x) = \frac{-5x}{x+3} \)
9. Solve: \(8^{2x-3} = \frac{1}{16^{x+2}}\):
   a. 2
   b. 5
   c. \(\frac{1}{2}\)
   d. \(\frac{17}{2}\)
   e. \(\frac{1}{10}\)

10. Solve: \(2 \cdot \log_3 (x + 4) = 2 + \log_3 (9)\):
    a. \(-1\)
    b. 0
    c. 2
    d. 5
    e. 6
11. How much should you invest in order to have a total of $1,000 (principal and interest) in your account at the end of 18 months if the investment is compounded quarterly for 18 months at a 4% annual rate of interest? Round your answer to the nearest dollar.
   a. 882
   b. 898
   c. 912
   d. 935
   e. 942

12. The expression \( \log_3 2x - \log_9 x \) can be written as which of the following:
   a. \( \log_3 2\sqrt{x} \)
   b. \( \log_\sqrt{9} 2 \)
   c. \( \log_3 x \)
   d. \( \log_2 2x^2 \)
   e. \( \log_9 x \)
13. Write in simplest form: $5x \cdot \sqrt[3]{54xy} + \sqrt[3]{16x^4y}$
   
   a. $10x \cdot \sqrt[3]{2xy}$  
   b. $17x \cdot \sqrt[3]{2xy}$  
   c. $7x \cdot \sqrt[3]{xy}$  
   d. $xy \cdot \sqrt[3]{x^5y^2}$  
   e. $9x \cdot \sqrt[3]{xy}$
For the free response part of the exam, work each problem in the space provided and write your answer in the space provided. The value of each part of each problem is shown in brackets.

14. [10] Graph the function \( f(x) = \begin{cases} 
-x^2 & \text{if } x < 2 \\
3 & \text{if } 2 \leq x \leq 5 \\
x - 3 & \text{if } x > 5
\end{cases} \)
15. [10] Use transformations to graph \( f(x) = -(x - 3)^2 + 6 \). Show each step and be as precise as possible (i.e., being sloppy will cost you so you might want to plot a few points exactly).

**Step 1**

**Step 2**

**Step 3**

**Step 4**
16. The figure below shows a rectangle inscribed in an isosceles right triangle whose hypotenuse lies along the x-axis and is 8 units long.

![Diagram of a rectangle inscribed in an isosceles right triangle]

a. [8] Express the area $A$ of the rectangle in terms of $x$.  
   Ans: 

b. [2] What value of $x$ produces the largest area for the rectangle?  
   Ans: 

17. Consider the graph of \( R(x) = \frac{x^2 + 2x - 15}{x + 2} \).

• [2] What are the \( x \)-intercepts, if any: Ans: ____________

• [2] What are the \( y \)-intercepts, if any: Ans: ____________

• [2] On the grid below, show the vertical asymptotes, if any.
• [2] On the grid below, show the horizontal or oblique asymptote, if any.
• [2] Does the graph cross any asymptotes? If so, where? Ans: ____________
• [10] Sketch the graph.
18. Given \( f(x) = \frac{2}{x+1} \) and \( g(x) = (x-3)^2 \)

a. [4] Find the composition, \((f \circ g)(x)\) and simplify.  
   Ans: 

b. [2] What is the domain of \((f \circ g)(x)\)?  
   Ans: 

c. [4] Find \((f \circ g)(2)\).  
   Ans: 