

# MATH 1110 SPRING 2006 UNIFORM FINAL

Name: \_\_\_\_\_

Circle your section number:

<b>001</b>	<b>002</b>	<b>003</b>	<b>004</b>
<b>MacMillan</b>	<b>Olson</b>	<b>Shepherd</b>	<b>Olson</b>
<b>MW 11:30 - 12:45</b>	<b>MW 8:30 - 9:45</b>	<b>TR 1:00 - 2:15</b>	<b>TR 4:00 - 5:15</b>

**Instructions:** .Put your name on this page, the next page, and part III, which you will pick up after you have handed in parts I and II.

.Circle your section number above.

.Scratch paper will be provided. No notes will be allowed on this exam. No calculator will be allowed on parts I and II. When you pick up part III you can then use your graphing calculator.

.If you are unclear what a problem is asking, then talk to your instructor for clarification. You may not ask for hints, verification of formulas, or if you have done the problem correctly. This exam is over what YOU know to date.

.In part I, just record your answers. In part II and part III show your work as partial credit will be given.

.Be neat. If the grader cannot understand what you have recorded, you will not get credit.

**DO NOT WRITE BELOW THIS LINE**

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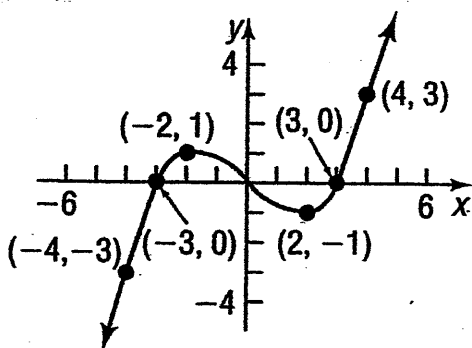
<b>Page 1 (19 pts)</b>	<b>Page 2. (15 pts)</b>	<b>Page 3. (20 pts)</b>	<b>Page 4. (26 pts)</b>
<b>Page 5 &amp; 6.( 29pts)</b>	<b>Page 7. (19 pts)</b>	<b>Page 8 &amp; 9.(22 pts)</b>	

**TOTAL: \_\_\_\_\_ (out of 150 points)**

Part I: Short answer questions. No work is required. Each answer is worth 1 point.

- The slope of the line  $x = 5$  is \_\_\_\_\_.
- The product of  $2 + 3i$  and the conjugate of  $5 + 2i$  is \_\_\_\_\_.
- What is the slope of the line perpendicular to  $2x - 3y = 6$ ? \_\_\_\_\_
- Write  $\{x \mid x \geq -2 \text{ and } x < 8\}$  in interval notation. \_\_\_\_\_
- Find the solution set of  $|3x + 4| = 2$ . \_\_\_\_\_

In answering questions 6 and 7 use the figure below.



6. The zeros of the function are \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.

7. The open intervals on which  $f$  is increasing or decreasing.

Increasing: \_\_\_\_\_ Decreasing: \_\_\_\_\_

8. Find the function that is finally graphed after the following transformations are applied to the graph of  $y = |x|$ .  
(1) shifted right 3 units (2) vertically stretched by a factor of 2 (3) Shift down 4 units

$f(x) =$  \_\_\_\_\_

9. Given the function:  $f(x) = -2x^3(x-5)^2(x+4)^5$

- What is the degree of the polynomial? \_\_\_\_\_
- What are the zeros of the function? \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

10. Write the exponential equation  $b^{2x} = 7$  in logarithmic form. \_\_\_\_\_

11. Find the exact value of the following logarithmic expressions.

- $\ln \frac{1}{e^5}$  \_\_\_\_\_
- $\log_3 81$  \_\_\_\_\_
- $\log 600 + \log 4 - \log 24$  \_\_\_\_\_

12. The logistic growth model  $P(t) = \frac{1600}{1 + 39e^{-0.439t}}$  represents the population (in grams) of a bacterium after  $t$  hours. Determine the initial population size. \_\_\_\_\_

13. The solution to the system of equations  $\begin{cases} 2x + 3y = 5 \\ -3x + 5y = 21 \end{cases}$  is (\_\_\_\_\_, \_\_\_\_\_).

14. Evaluate:  $-2 \begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix} + \begin{bmatrix} 5 & 2 \\ -3 & 6 \end{bmatrix} = \begin{bmatrix} & \\ & \end{bmatrix}$

15. The reduced row echelon form of a system of equations is given as:

$$\begin{bmatrix} 1 & 0 & 0 & -3 \\ 0 & 1 & 0 & 4 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Is there a unique solution to this system? \_\_\_\_\_

**Part II: Show all your work on the following problems. Use exact answers only.**

16.(3 pts.) Solve the equation  $2 + \sqrt{12 - 2x} = x$ . Be sure to check for extraneous solutions.

17. (6 pts.) Given the equation of a circle.  $x^2 + y^2 - 6x + 4y - 12 = 0$

a) Find the center and radius of the circle.

b) Find the equation of the line (in slope intercept form) that passes through the center and the point (-6, 1).

18. (10 pts.)  $f(x) = 2x^2 - 5x$

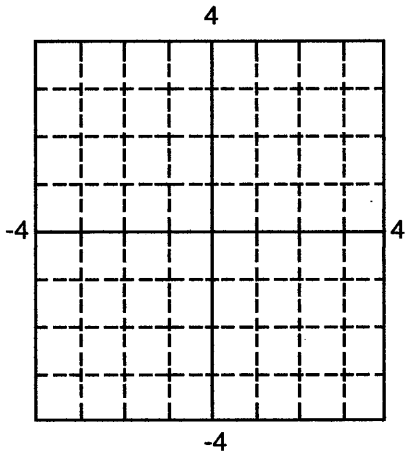
a)  $f(3) =$  \_\_\_\_\_

b) Find  $f(x+h) - f(x)$  and simplify.

c) If  $f(x) = -3$ , what are the values of  $x$ ?

d) Find the average rate of change of  $f$  from  $x = 1$  to  $x = 3$ .

19. (6 pts.) For the following function state the transformations and sketch the graph.  $f(x) = -2\sqrt{x+3} + 1$




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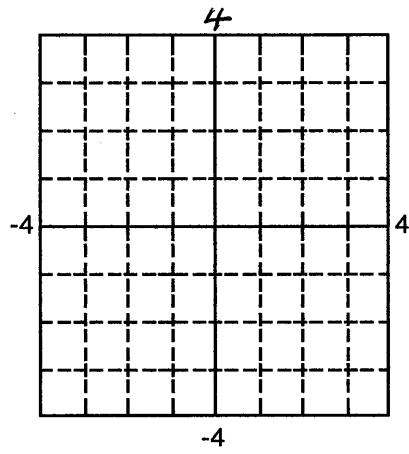


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20. (4 pts.) Graph the following piecewise defined function. 
$$h(x) = \begin{cases} 3 & \text{if } x < -2 \\ x^2 - 1 & \text{if } -2 \leq x \leq 0 \\ \frac{1}{x} & \text{if } x > 0 \end{cases}$$



21. (10 pts.) Find the following information about the given function.  $f(x) = 2x^2 - 4x + 1$

Write  $f(x)$  in the form  $f(x) = a(x - h)^2 + k$ : \_\_\_\_\_ Vertex: (\_\_\_\_\_, \_\_\_\_\_)

Line of Symmetry: \_\_\_\_\_

Opens up or down \_\_\_\_\_

Write all the intercepts as ordered pairs. \_\_\_\_\_  
Leave answers in reduced radical form.

22. (10 pts.) Given  $R(x) = \frac{x^2 - 3x - 4}{3x^2 - 6x}$ . If there is no answer, write **none**.

a) Write  $R(x)$  in factored form and reduce if possible.  $R(x) =$  \_\_\_\_\_

b) State the Domain: \_\_\_\_\_

c) Write the intercepts as ordered pairs.

x-intercepts: \_\_\_\_\_

d) Write equations of the asymptotes.

y-intercepts: \_\_\_\_\_

Vertical asymptotes: \_\_\_\_\_

Horizontal asymptotes: \_\_\_\_\_

23. (6 pts.) If  $f(x) = 3x - 2$  and  $g(x) = \frac{4x + 1}{2x - 3}$ , find the following.

a)  $f(g(1)) =$  \_\_\_\_\_

b)  $g(f(x)) =$  \_\_\_\_\_

24. (4 pts.) If  $f(x) = \frac{3x}{2x-1}$ , find  $f^{-1}(x)$ .

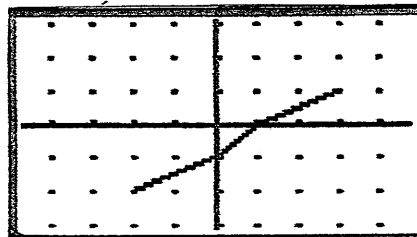
$f^{-1}(x) =$  \_\_\_\_\_

25. (8 pts.) The entire graph of the function  $f$  is shown.

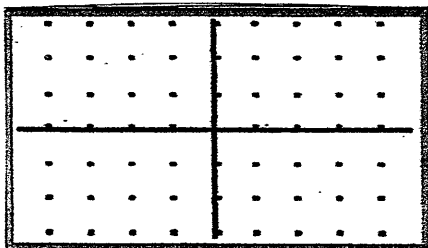
a) State the Domain and Range of  $f$ .

Domain: \_\_\_\_\_

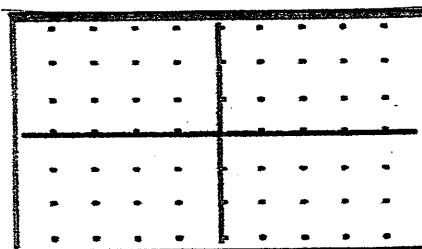
Range: \_\_\_\_\_



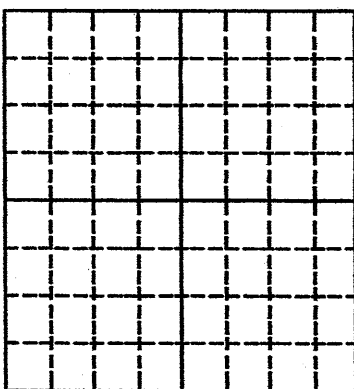
b) Sketch the graph of  $y = f^{-1}(x)$



c) Sketch the graph of  $y = f(x+2)+1$



26. (5 pts.) On the same grid graph  $y = 2^x$  and  $y = \log_2 x$



Are these 2 functions inverses? \_\_\_\_\_

27. (3 pts.) Solve the equation.  $3^{2x-7} = 27$

28. (3 pts) Solve the following log equation.  
 $\log_6(x+3) + \log_6(x+4) = 1$

29. (3pts.) Radium 226 decays according to the exponential model  $A(t) = A_0 e^{kt}$ , where  $t$  is time in years. There is initially 15 grams of radium 226, and half of it decays in 1612 years (the half-life). Find the value of  $k$ . Leave your answer in terms of logarithms.

30.(3 pts.) Multiply the following matrices.  $\begin{bmatrix} 4 & 1 \\ -6 & -2 \end{bmatrix} \cdot \begin{bmatrix} -2 & 3 & -5 \\ 1 & 0 & 4 \end{bmatrix}$

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**Part III: You may use a graphing calculator on this part of the exam. On some problems you will still be required to show your work.**

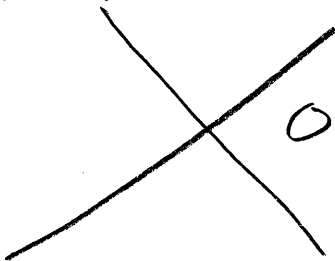
31. (4 pts.) Solve the inequality:  $\frac{x+5}{x^2-4} \geq 0$  You may do this problem graphically or algebraically by showing an appropriate sign chart. If you are doing the problem graphically sketch the graph.


Solutions: \_\_\_\_\_

32. (15 pts.) Given the function  $f(x) = 6x^4 - x^3 - 30x^2 + 21x - 10$  (Round all decimals to the nearest 0.01)

a) List all possible rational zeros of f.

b) Draw a complete graph of f.

~~~~ OMIT(a)


c) The rational zeros of f are \_\_\_\_\_.

d) Find all local maximum and minimum values of f. Max: \_\_\_\_\_ Min: \_\_\_\_\_

e) Increasing intervals:

f) Find the remaining complex zeros. (show your work)  
Leave your answers in reduced radical form.

\_\_\_\_\_

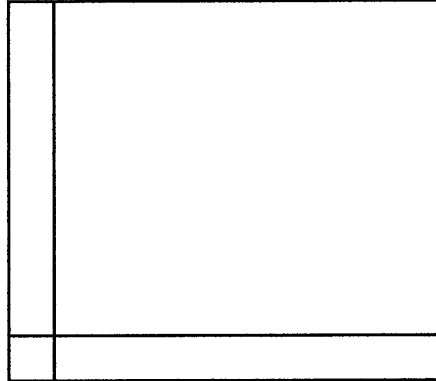
Decreasing intervals:

\_\_\_\_\_

33. ( 7 pts.) Jim has 1500 feet of available fencing to enclose a rectangular field. One side of the fence lies along a river, so only three sides require fencing.

a) Express the area  $A$  of the rectangle as a function of  $x$ , where  $x$  is one of the sides of the rectangle.

B) Graph  $A = A(x)$  with your graphing calculator. Indicate your window or label your graph.



c) From your graph, the maximum area is \_\_\_\_\_ sq. ft. and the

dimensions of the rectangle that maximize the area are: \_\_\_\_\_ ft. by \_\_\_\_\_ ft.

34. (2 pts. ) Using the Change of Base Theorem, calculate the following. Round your answer to 4 decimal places.

$$\log_9 111 = \underline{\hspace{2cm}}$$

35. (3 pts.) How long will it take an investment to triple in value if it earns 4.5% interest compounded continuously? Show your work. The continuous interest formula is  $A = Pe^{rt}$ .

36. (6 pts.) At a local fast food restaurant a customer was given the following information. The cost of 3 burgers, 2 orders of fries and 4 drinks is \$11.55. For 7 burgers, 5 orders of fries and no drinks the cost is \$19.40, and the cost of 12 burgers, 15 orders of fries and 7 drinks is \$46.60. Find the individual cost of one burger, one order of fries, and one drink. Define your variables, write a system of equations, write the augmented matrix for your system and write the matrix in reduced row echelon form. Finally, answer the question with a complete sentence

37. (4 pts.) A chemist has a 1000-gram sample of radioactive material. She records the amount of radioactive material remaining in the sample every day for a week and obtains the following data: Round decimals to 2 decimal places.

Day	Weight (in grams)
0	1000
1	897.1
2	802.5
3	719.8
4	651.1
5	583.4
6	521.7
7	468.3

a) Using a graphing utility, fit an exponential regression function to the data.

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b) When will the weight be less than 300 grams? \_\_\_\_\_