

Math 1070 Uniform Final Exam – May 10, 2008
Part 1 – No Calculators Allowed

Print your name: _____

Circle your section:

Jeff Larson	Elizabeth Untiedt	Shelley Speiss
001	002	003
MW 8:30 AM	TR 10:00 AM	MW 4:00

Instructions:

- **Put your name on this page and on the next page.**
- **NO CALCULATORS ARE ALLOWED** on this portion of the exam.
- There are two parts to this exam. Part 1 is worth 150 points and part 2 is worth 50 points.
- When you have finished part 1 of the exam, turn it in and start on part 2. You may NOT return to part 1 after you start part 2.
- Both parts of the exam are closed notes and closed book.
- Answer each question in the space provided. **Show your work when possible.** Partial credit is possible on most questions, but only if you show your work.
- You may not communicate with anyone other than the instructor during the exam. The instructor may help to clarify the meaning of a question but is not allowed to give you hints, verify formulas, or tell you if you have done the problem correctly.
- Be neat. If the grader cannot understand what you have written, you will not receive credit.

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Page 1 (16 pts) _____

Page 2 (10 pts) _____

Page 3 (15 pts) _____

Page 4 (9 pts) _____

Page 5 (20 pts) _____

Page 6 (14 pts) _____

Page 7 (14 pts) _____

Page 8 (19 pts) _____

Page 9 (18 pts) _____

Page 10 (15 pts) _____

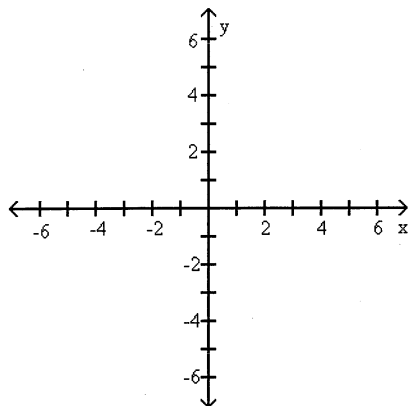
Part 1 Total (150 pts) _____

Name _____

Linear functions:

1. (2 Points) Solve the equation $E = m c^2$ for c .
2. (4 Points) Solve the equation $\frac{x}{2} - 4 = x + \frac{1}{2}$ for x .
3. (2 Points) What is the slope of the line passing through (3,5) and (0,-1)?
4. (4 Points) What is the equation of the line passing through (1,1) that is parallel to the line $y = \frac{2}{3}x - 4$?
5. (4 Points) Suppose that a 5 year-old watches television for 2 hours per day, and an 11 year old watches television for three hours per day. Find a linear function for television viewing by age, letting x be age.

6. (4 Points) Find the x -intercept and y -intercept of the graph of $4x - 5y = 20$. Graph the function and label the intercepts.



Exponential and Logarithmic Functions

7. (6 Points) For the equation $10^y + 4 = x$,
- Solve for y and write the equation in the form $y = f(x)$.
 - Is this equation a function? If so, give the domain of the function and the range of the function. (Hint: Look at the graph of $y = f(x)$.)
 - Find any zeros of the equation.

8. (6 Points) For the equation $\log_2(y + 3) = x$,

a. Solve for y and write the equation in the form $y = f(x)$.

b. Is this equation a function? If so, give the domain of the function and the range of the function.
(Hint: Look at the graph of $y = f(x)$)

c. Find any zeros of the equation.

9. (9 Points) Evaluate without using a calculator:

a. $\log_2 \frac{1}{2}$

b. $e^{\ln 0.72}$

c. $\log_5 125$

10. (6 Points) Write as a single logarithm. Simplify your answer.

a. $3 \log_3 x - \log_3 x^2 + 4 \log_3 y$

b. $\ln 30 - \ln 6$

11. (3 Points) Simplify, writing with positive exponents only: $\left(\frac{4yx^{-2}}{y^3}\right)^{-3}$

Quadratic and Other Nonlinear Functions:

12. (8 Points) For the quadratic function given, answer the questions below: $y = -3(x - 1)^2 + 12$

a) Does the graph open up or down? How do you know?

b) What are the coordinates of its vertex?

c) Is the vertex a maximum or a minimum?

d) Find the zeros of this function.

13. (8 Points) Given $f(x) = x^2 + 1$ and $g(x) = \frac{x-1}{4}$, find the following. Simplify your answer.

a) $(f \circ g)(-5)$

b) $(g \circ f)(4)$

14. (4 Points) Given $f(x) = 2x^3 - 3$, find $f^{-1}(x)$, the inverse of $f(x)$.

15. (6 Points) Consider the function $y = \frac{1}{x}$.

a) List the transformations, in order, needed to obtain $y = \frac{3}{x-5} + 2$ from the above function.

b) Suppose the graph of the function $y = \frac{1}{x}$ is compressed by a factor of $\frac{1}{2}$, shifted left by 3 units, and shifted down by 5 units. What is the equation of the new graph?

16. (8 Points) Solve the following equations for x .

a) $\sqrt{3x^2 + 9} - 2x = 0$

b) $(x - 6)^{3/2} - 8 = 0$

17. (6 Points) The profit in thousands of dollars for a product is given by $P(x) = -\frac{1}{2}x^2 + 5x - 8$, where x is the number of units produced. How many units should be produced to break even (a profit of zero)?

18. (8 Points) Solve the following inequalities.

a) $|3x + 7| > 4$

b) $x^2 - 5x \leq -4$

Higher Degree Polynomials

19. (8 Points) Consider the following polynomial $y = (x - 3)(x + 4)(x - 1)^2$

- a) List the y-intercept(s) if any.

- b) List the x-intercept(s) if any.

- c) What is the degree of this polynomial?

- d) What are the most zeros a polynomial of this degree can have?

- e) What are the fewest zeros a polynomial of this degree can have?

20. (4 Points) Solve the following equation for z : $z^3 + 5z^2 - 4z - 20 = 0$

21. (4 Points) Solve the following equation for t : $4t^4 - 8t^2 = 0$

22. (3 Points) What is the domain of $h(x) = 12x^{13} - 7x^{23} + \frac{2}{5}x^4 - 29$

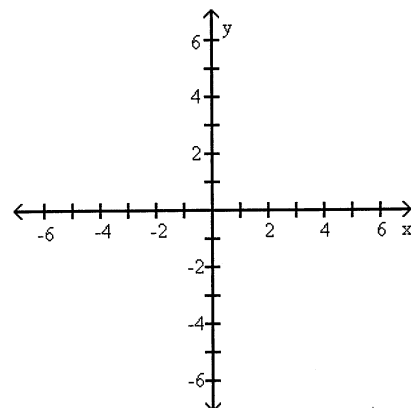
23. (8 Points) Given that $x=1$ is a solution to the equation $x^3 + 4x^2 - x - 4 = 0$, find the remaining zeros after using polynomial division or synthetic division.

Rational Functions:

24. (10 points) Consider the following rational function: $f(x) = \frac{3x+1}{x-1}$

- What are the equations of the vertical asymptote(s) if any?
- What are the equations of the horizontal asymptote(s) if any?
- What are the x-intercept(s), if any?
- What are the y-intercept(s), if any?

e) Sketch a graph of this rational function:



25. (3 Points) What is the domain of $g(x) = \frac{2}{(x-4)(x+1)x}$?

Sequences and Series

26. (2 Points) Find the first 4 terms in the sequence defined by $a_n = -n^2 - 2$

27. (2 Points) Evaluate and simplify the following sum

$$\sum_{k=1}^5 2^k$$

28. (2 Points) What are the next 3 terms in the following sequence 1, 2, 4, 7, 11, ...

29. (6 Points) A grandfather clock chimes once for each hour of the day. (4 times at 4:00, 8 chimes at 8:00 etc.).

a) Write the number of chimes that occur in a 12 hour period in sigma notation.

b) How many times does it chime during a 12 hour period?

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Part 2 – Calculators Allowed

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Page 4 (6 pts) _____

Total from part 2 (50 pts) _____

Total from part 1 (150 pts) _____

Total Score (200 pts) _____

Name _____

1. (5 Points) Find the intersection of the following lines. Write your answer as a fraction or as a decimal rounded to the nearest hundredth.

$$2x + 3y = -5$$

$$-4x + y = 2$$

2. (5 Points) The temperature-humidity index I is $I = t - 0.55(1 - h)(t - 58)$ where t is the air temperature in degrees Fahrenheit and h is the relative humidity expressed as a decimal. If the air temperature is 80 degrees Fahrenheit, find the humidity h (as a percent) that gives an index value of $I = 79$.

3. (10 Points) The population of Anytown, USA was 60,000 in 1989, and its future size is predicted to be $P = 60,000 e^{-0.04t}$ where t is the number of years after 1989.

a. Is this function increasing or decreasing?

b. What will the population be in 1995?

c. In what year will the population reach 15,000?

4. (9 Points) The table below gives the amount of money a particular high school put towards after school programs between the years 1980 and 2000.

Year	1980	1984	1988	1992	1996	2000
Amount (\$)	364.5	419	502.3	614.6	755.7	925.8

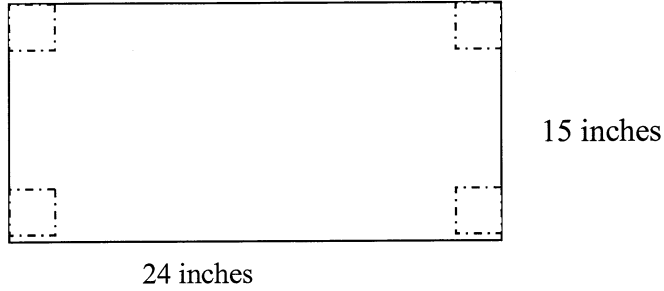
- a) Find a quadratic function to model the data, where x equals the number of years after 1980.
- b) Use the **unrounded** model to determine the amount of money spent in the year 1990.
- c) Use the **unrounded** model to approximate the year when the amount of spending reaches \$1179.

5. (9 Points) The table below gives the percentage of families that were single-parent families between the years 1960 and 1995.

Year	1960	1965	1970	1975	1980	1985	1990	1995
Percentage	8.1	11.7	15.1	18.4	21.6	24.7	27.7	30.9

- a) Find a power function to model the data, where x equals the number of years after 1950.
- b) Use the **unrounded** model to predict the percentage of single-parent families in 2000.
- c) Use the **unrounded** model to approximate the year when the percentage is 36

6. (6 Points) A piece of cardboard 24 inches long and 15 inches wide is to be made into a box by cutting squares as shown below, and folding up the sides. (Dashed lines show where a cut is to be made).



- What is the volume of the box if a 1" by 1" square is removed from each corner?
- What is the volume of the box if a 5" by 5" square is removed from each corner?
- What is the length, width, and height of the box if an x " by x " square is removed from each corner?
- What equation gives the volume of the previous box from part c?
- What value of x maximizes the volume of the box?

7. (6 Points) Suppose you are offered two identical jobs. Job A has a starting yearly salary of \$40,000 with yearly raises of \$2000. Job B has a starting yearly salary of \$36,000 with yearly raises of \$3200.

a. Which job will be paying more in 5 years? By how much?

b. Which job will be paying more in 10 years? By how much?

c. Which job will pay more over the first 7 years? By how much?