Sample Questions for MATH 1270 for Final Exam, Spring 2010
April 23, 2011

1. Find the derivative of the function.
$$y = \frac{9}{x^6} - \frac{5}{x}$$

2. Find $f'(-2)$ if $f(x) = \dfrac{x^4}{3} - 10x$.

3. Use the product rule to find the derivative of
$$f(y) = (y^{-1} + y^{-2})(9y^{-3} - 10y^{-4})$$

4. Use the quotient rule to find the derivative of
$$f(y) = \frac{x^2 - 5x + 1}{x^2 + 4}$$

5. Find the derivative of
$$f(x) = \sqrt{4x^2 + 7}$$

6. Find the derivative of
$$f(x) = (3x + 2)^4(4x - 1)^{-3}$$

7. Find the derivative of
$$f(x) = (4x^2 - 7x + 8)e^{-3x}$$

8. Find the derivative of
$$f(x) = -4^{10x^2 - 1}$$

9. Find the derivative of
$$f(x) = 3 \cdot 9^{\sqrt{x-5}}$$

10. Find the derivative of
$$f(x) = \ln(4x^3 + 5x)^{9/5}$$

11. Find the derivative of
$$f(x) = \ln(xe^{\sqrt{x}} + 5)$$

12. Find the absolute maximum and minimum value of the function over the indicated interval, and indicate the x-values at which they occur.
$$f(x) = 2x^3 - x^2 - 4x + 12, \quad [-1, 0]$$

13. Find the absolute maximum and minimum value of the function over the indicated interval.

$$f(x) = \frac{x}{x^2+4}, \qquad [-3,3]$$

14. Johnny is designing a rectangular poster to contain 12 square inches of printing with a 6 in. margin at the top and bottom and a 2 in. margin at each side. What overall dimensions will minimize the amount of paper used?

15. A disease has hit a city. The percentage of the population infected t days after the disease arrives is approximated by $p(t) = 10te^{-t/7}$ for $0 \le t \le 35$. After how many days is the percentage of infected people a maximum? What is the maximum percent of population infected?

16. A publishing company sells 200,000 copies of certain books each year. It costs the company \$1 to store each book for a year. Each time it must print additional copies, it costs the company \$1,000 to set up the presses. How many books should the company produce during each printing in order to minimize its total storage and setup costs?

17. Find $\frac{dy}{dx}$ by implicit differentiation.

$$2x + \ln y = x^4 y^3$$

18. Find the equation of the tangent line at the given value of x on the curve.

$$y^3 + xy^2 - 5 = x + 3y^2, \qquad x = 3$$

19. A rock is thrown into a still pond. The circular ripples move outward from the point of impact of the rock so that the radius of the circle formed by the ripple increases at the rate of 4 feet per minute. Find the rate at which the area is changing at the instant the radius is 10 feet.

20. Assume x and y are functions of t. Evaluate $\frac{dy}{dt}$ for $4xe^y = 12 - \ln 729 + 6\ln x$, with the conditions $\frac{dx}{dt} = 9$, $x = 3$, $y = 0$.

21. Solve the system of equations by setting up an augmented matrix and using the Gauss-Jordan Method.

$$\begin{aligned} x + 2y - z &= 2 \\ 2x + z &= 5 \\ y - 3z &= -7 \end{aligned}$$

22. Solve the system of equations in Question # 21 by finding and using the inverse of the coefficient matrix.

23. Perform the operation and write the final matrix.

$$\begin{bmatrix} -4 & -2 & 1 \\ 7 & 0 & 0 \\ -1 & -1 & 3 \end{bmatrix} + \begin{bmatrix} -5 & 1 & -2 \\ -9 & -1 & 0 \\ 4 & 0 & 3 \end{bmatrix}$$

24. Perform the operation and write the final matrix.

$$\begin{bmatrix} -8 & -1 \\ 2 & 0 \\ 1 & -1 \end{bmatrix} \times \begin{bmatrix} 5 & 0 & -3 \\ -4 & 2 & -1 \end{bmatrix}$$

25. Let $A = \begin{bmatrix} 4 & -1 & 9 \\ -2 & 1 & -3 \\ 0 & 1 & 2 \end{bmatrix}$ and let $B = \begin{bmatrix} 1 & 2 & -1 \\ -6 & 0 & 0 \\ 0 & 2 & -3 \end{bmatrix}$. Find $3A - 2B$.

26. Find M^{-1}.

$$M = \begin{bmatrix} 1 & -2 & 0 \\ -2 & 1 & 1 \\ 0 & 2 & -1 \end{bmatrix}$$

27. Find the inverse, if it exists, of the matrix.

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

28. Find the production matrix for the following input-output and demand matrices using the open model. $A = \begin{bmatrix} 4 & 1 & 3 \\ 2 & 4 & 0 \\ 0 & 1 & 2 \end{bmatrix}$ $D = \begin{bmatrix} 4 \\ 6 \\ 5 \end{bmatrix}$

29. Graph the linear inequality

$$2x - 3y \geq 4$$

30. Graph the system of linear inequalities

$$3x + 5y < 15, \qquad 5x - 5y < 25$$

31. Maximize $P = 7x + 7y$ subject to

$$\begin{aligned} 2x + y &\leq 20 \\ x + 2y &\leq 16 \\ x, y &\geq 0 \end{aligned}$$

32. A banquet hall offers two types of tables for rent. 6-person rectangular tables at a cost of \$24 each and 10-person round tables at a cost of \$55 each. Kelly would like to rent the hall for a wedding banquet and needs tables for 240 people. The room can have a maximum of 35 tables and the hall only has 15 rectangular tables available. How many of each type of table should be rented to minimize cost and what is the minimum cost?