MA 15910 Review Problems for Exam 3, FALL 2015

For problems 1, 2, and 3: Find equation of any vertical or horizontal asymptotes. If there are none, write 'none'.

1) $y=\dfrac{-2x}{x^2-5x+6}$

2) $f(x)=\dfrac{3x^2-3x-6}{2x^2-6x-20}$

3) $g(x)=\dfrac{2x^3+3x}{5x-1}$

Find the derivative of each function.

4) $f(x)=6e^{x^2-2x}$

5) $g(x)=x^2e^{1-x}$

6) If the demand function (price function) for a product is modeled by $p=56e^{-0.000012x}$ where x is the number of units produced and the price in in dollars, How many units should be produced to achieve maximum revenue? What is that maximum revenue?

7) (a) Convert to exponential form: $\log_b(212)=3x$

(b) Convert to logarithmic form: $e^{2x-1}=15$

8) Write the logarithm below as a sum, difference, or multiple of logarithms. In other words, expand.

$$\log\left(\frac{1000x^3}{y^2\sqrt{z}}\right)$$

9) Write $4^{0.5}=2$ in logarithmic form.

10) Use your calculator to approximate $\ln 35.6$ and $e^{2.3}$.

11) Use your calculator and the change of base formula to approximate $\log_3 17$ to 4 decimal places.

Solve each equation. Round to 4 decimal places, if necessary.

12) $\log_6(x+1)=2$

13) $\log(x+5)+\log(x+2)=1$

14) $3^{x+2}=7^x$

15) Suppose $\log_b 2=x$ and $\log_b 5=y$. Use the properties of logarithms to find $\log_b 20$.

16) Evaluate $\log_4 64$ and $\log_3 \dfrac{1}{9}$ without a calculator.

17) Use the properties of logarithms to write the expression as a sum, difference, or product of simpler logarithms. Simplify where possible. (In other words, expand the logarithm.)

$$\log_4\left(\frac{16p}{\sqrt{q}}\right)$$

18) Find each limit, if it exists. (a) $\lim_{x\to\infty}\frac{3x^2-5}{2x-5x^2}$ (b) $\lim_{x\to-\infty}\frac{5x-3}{2x^2+7x-1}$

Find each derivative. (19-23)

19) $y=-14e^{2x}$

20) $f(x)=-2x^2e^{-3x}$

21) $y=\frac{\ln(2x+6)}{x+3},\ x>-3$

22) $y=(x^3+e^{2x})^3$

23) $f(x)=\frac{e^x(x^2+2)}{\ln x}$

24) Find the slope of the tangent line and the equation of the tangent line to the curve $y=xe^x$ at the point where $x=1$.

25) Find any open intervals where these functions are increasing.

(a) $f(x)=4x^3+8x^2-16x+11$ (b) $g(x)=\frac{15}{2x+7}$

Find the locations and values of all relative maxima and minima.

26) $f(x)=2x^3+3x^2-12x+5$

27) $g(x)=\frac{\ln x}{2x^2},\ x>0$

Find the second derivative of each function.

28) $f(x)=9x^3+\frac{2}{x}$

29) $g(x)=\frac{1-2x}{4x+3}$

30) Find $f''(2)$ and $f''(5)$ if $f(x)=2x^2-5x^3+\frac{1}{x^2}$

31) Find any intervals where the function $f(x)=-x^3-12x^2-45x+2$ is concave upward. Find any intervals where the function is concave downward.

32) Find any relative maximum or relative minimum point(s) and any point(s) of inflection for the graph of the function $f(x)=-x(x-3)^2$.

33) Suppose that the number of bacteria N (in millions) present in a certain culture at time t (in hours) is given by the function $N(t)=t^3-18t^2+96t+1000$. In how many hours (before 8 hours) will the population of bacteria be maximized? Find that maximum population.

34) The percent of concentration of a drug in the bloodstream x hours after the drug is administered is given by $K(x) = \dfrac{4x}{3x^2 + 27}$. Find the time at which the concentration is a maximum and what the maximum concentration is.

35) If a cannonball is shot directly upward with a velocity of 256 feet per second, its height above the ground after t seconds is given by $h(t) = 256t - 16t^2$.
(a) Find the velocity of the cannonball after t seconds. After 2 seconds.
(b) Find the acceleration after t seconds (feet per second^2).
(c) What is the maximum height reached by the cannonball?
(d) When will the cannonball hit the ground?

36) Make a hand-drawn sketch of the function $f(x) = 2x^3 - 3x^2 - 12x + 1$. Use the intervals of increasing or decreasing, intervals of concavity, intercepts (if possible), relative extema, point(s) of inflection, etc.