Math 142 Help Session Interview Questions

1. Solve the following for x: $\log_4(2x+4) + \log_4 x = 2$

2. Find the value(s) of x where $f(x)$, given below, is not continuous and explain why $f(x)$ is not continuous there by using the definition of continuity, not graphical explanations.

$$f(x) = \begin{cases} \frac{2x+2}{x-5} & , x \leq 7 \\ x+2 & , x > 7 \end{cases}$$

3. Find $\displaystyle\lim_{x\to\infty} \frac{e^{-2x} + e^{3x}}{3e^{3x} - e^{-2x}}$

4. Given the function, $f(x) = \dfrac{1}{x+1}$, find the derivative, $f'(x)$, using the limit definition of derivative.

5. Sketch a graph of a function that satisfies the following conditions:

   x-intercept at $x = 1$
   Horizontal Asymptote: $y = 0$
   Vertical Asymptote: $x = 0$
   $f'(2) = 0$, $f(2) = 1$, $f(3) = 8/9$
   $f'(x) > 0$ on $(0, 2)$
   $f'(x) < 0$ on $(-\infty, 0)$ and $(2, \infty)$
   $f''(x) > 0$ on $(3, \infty)$
   $f''(x) < 0$ on $(-\infty, 0)$ and $(0, 3)$

6. Find $\displaystyle\lim_{x\to 2} \frac{2x^2 - 5x + 2}{x^2 + x - 6}$

7. Given $f'(x) = a(x-1)^2(x+2)(x+5)$, $f(x)$ is defined everywhere and a is a constant function that is always negative, find

   (a) the intervals where $f(x)$ is increasing/decreasing.

   (b) the value(s) of x where any relative extremum of $f(x)$ occur and specify whether it is a maximum or minimum.

8. The demand equation of a particular product is given to be $p = e^{2x}$ where x is the number of items demanded and p is the price in dollars. Find the marginal revenue equation.

9. Find the area of the region between the curves $y = x^3 - 6x^2 + 9x$ and $y = x^2 - 3x$ on the interval [1,6]. Also, sketch the graph of the two curves and shade the described region.

10. If $\int_3^1 f(x)\,dx = 4$ and $\int_1^3 [2f(x) - 3g(x)]\,dx = 15$,then evaluate $\int_1^3 g(x)\,dx$.

11. Given $g(x) = 3\ln x$, find the average rate of change of $g(x)$ on the interval [1,e].

12. A poster is to have a total area of 200 in^2. The poster will contain a printed area plus 1 inch margins at the bottom and sides and a 2 inch margin at the top. What dimensions will give the largest printed area?

13. Fnd the derivative of the following functions:

    (a) $f(x) = 3x^2 + e^x - 5x^3 + \ln x$

    (b) $g(x) = \dfrac{3x^2 - 9}{10 - 5^x + e^3}$

    (c) $h(x) = (e^{(10x^3 - 9x)} - 10)(9x^6 - 2x^3 - \log_8(5x^3))$