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

4. Given the function, $f(x) = \frac{1}{x + 1}$, 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 $\lim_{x \to 2} \frac{2x^2 - 5x + 2}{x^2 + x - 6}$

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. Find the derivative of the following functions:

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

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

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