Limits & Derivatives Practice Problems

Day 1 Topics

1. Evaluate the following limits

   (a) $\lim_{x \to 0} \frac{(3+x)^2 - 9}{x}$

   (b) $\lim_{x \to 4} 5x^2 - 2x + 3$

   (c) $\lim_{x \to -3} \frac{x^2 - 9}{2x^2 + 7x + 3}$

2. Find $f'(x)$

   (a) $f(x) = x^5 + e^x$

   (b) $f(x) = 7x^2 + \ln(x)$

   (c) $f(x) = 2x^{-4/5}$

3. Find $f'(x)$

   (a) $f(x) = \sqrt{x} \ln(x)$

   (b) $f(x) = \ln(x^2) + e^x \ln(x)$

4. $f'(x)$

   (a) $f(x) = \frac{e^x}{1+x}$

   (b) $f(x) = \frac{x^2 + x - 2}{x^3 + 6}$

5. Find $f'(x)$

   (a) $f(x) = \ln(x)^2$

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

6. Find $f''(x)$

   (a) $f(x) = xe^x$

   (b) $f(x) = (1+x)^6$

Day 2 Topics

7. Consider $f(x) = -x^3 + 2x^2 - x - 6$

   (a) Find over what intervals $f(x)$ is increasing and decreasing.

   (b) Find over what intervals $f(x)$ is concave and convex.

   (c) Find the minima and maxima of $f(x)$.

8. Consider $f(x) = x^3 - 3x^2 - 9x + 5$

   (a) Find over what intervals $f(x)$ is increasing and decreasing.

   (b) Find over what intervals $f(x)$ is concave and convex.

   (c) Find the minima and maxima of $f(x)$.

9. Find $\frac{\partial f(x,y)}{\partial x}$, $\frac{\partial f(x,y)}{\partial y}$, and $\frac{\partial^2 f(x,y)}{\partial x \partial y}$ for the following.

   (a) $f(x,y) = 3x^2 + 2y$

   (a) $f(x,y) = e^x + y^3$

   (b) $f(x,y) = x^{3/2}y^{1/2} + x^{1/2}$

   (c) $f(x,y) = \ln(x + y)$