

Department of Mathematics and Statistics
Texas Tech University
Math 1451 Final Exam
Fall 2022

1. Evaluate the following limits.

(a) $\lim_{x \rightarrow 1} \frac{x^2 - 9}{x^2 + 2}$

(b) $\lim_{x \rightarrow \infty} \frac{x^3 + 8x^2 - 3x}{9x^3 - 7x^2}$

(c) $\lim_{x \rightarrow \infty} \frac{\ln(x)}{x^2}$

(d) $\lim_{x \rightarrow \infty} \left(1 + \frac{3}{x}\right)^{2x}$

2. Find the first derivative of each of the following functions.

(a) $y = \sqrt{3x} \sin(3x)$

(b) $f(x) = \left(\frac{x+4}{x-8}\right)^3$

(c) $f(x) = \ln(x^2 + 1)$

(d) $s(t) = \tan(5t - 2) + \sec(3t)$.

3. Write the equation of the tangent line at $(3, -2)$ of the implicit function $x^3 + y^3 = y + 21$

4. Consider the function $f(x) = x^3 + 3x^2 - 9x + 2$ and complete the following.

- (a) Find all critical values, (b) Identify the intervals where the $f(x)$ is increasing and decreasing., (c) Identify the point(s) of inflection, if they exist, and describe the concavity of $f(x)$., (d) Identify absolute and local maximums and minimums. If none exist, state none.

5. Evaluate the following antiderivatives.

(a) $\int \frac{t^4 - 5t^2 - 9}{t^5} dt$

(b) $\int 5x\sqrt{x} dx$

(c) $\int \frac{\ln(x)}{2x} dx$.

(d) $\int \cos^4(\theta) \sin(\theta) d\theta$

6. Evaluate the following integrals.

(a) $\int_{-2}^0 3e^x dx$

(b) $\int_0^1 \frac{2x}{1+x^2} dx$