Assignment 1: Integration Techniques

Calculus Course

Instructions

Answer the following questions on integration. Show all your work and justify each step using appropriate integration rules and methods.

Questions

Basic Integration

1. Evaluate the integral:
$$\int (3x^2 + 2x + 1)\,dx$$

2. Compute the definite integral:
$$\int_0^2 (4x^3 - 2x + 1)\,dx$$

Integration by Substitution

3. Evaluate the integral using substitution:
$$\int x\sqrt{1 + x^2}\,dx$$

4. Compute the integral:
$$\int \frac{e^{2x}}{1 + e^{2x}}\,dx$$

Integration by Parts

5. Use integration by parts to evaluate:
$$\int xe^x\,dx$$

6. Compute the integral using integration by parts:
$$\int \ln(x)\,dx$$

Trigonometric Integrals

7. Evaluate the integral:
$$\int \sin^3(x)\cos^2(x)\,dx$$

8. Compute the integral using a trigonometric identity:
$$\int \cos^2(x)\,dx$$

Trigonometric Substitution

9. Evaluate the integral using trigonometric substitution:
$$\int \frac{dx}{\sqrt{a^2 - x^2}}$$

10. Compute the integral using trigonometric substitution:
$$\int \frac{x^2}{\sqrt{x^2 + 4}}\,dx$$

Bonus Question

11. Solve the following challenging integral:
$$\int \frac{\sin(x)}{1 + \cos^2(x)}\,dx$$