INFORMATION: Calculators are allowed but no other materials are permitted. Always show your work: problems with little or no work shown may receive little or no credit.

1. Calculate the value of the definite integral

$$\int_0^5 \sqrt{3} \, dx$$

2. Calculate the value of the definite integral

$$\int_{-1}^1 xe^{-x^2} \, dx$$

3. Solve the initial value problem: $f'(x) = 3x^2 - 8x$ and $f(1) = 0$.

4. Solve the initial value problem: $f'(x) = \sqrt{x+1}$ and $f(8) = 10$.

5. Evaluate the indefinite integral: $\int \frac{x}{5x^2 - 1} dx$.

6. Approximate the area under the graph of $f(x) = x^3$ over the interval $[0, 2]$ using a Riemann sum with 4 sub-intervals and left end-points.

7. Use logarithmic differentiation to find the derivative of $f(x) = \dfrac{e^x}{x^3}$.

8. Use logarithmic differentiation to find the derivative of $f(x) = 5^x$.

9. Differentiate $f(x) = \ln\left(\dfrac{x+1}{x-1}\right).$

10. Differentiate $f(x) = xe^{\frac{1}{x}}.$

11. An account initially contains $5000 and earns 6% annual interest with quarterly compounding. After 10 years how much money is in the account if there are no additional deposits or withdrawals?

12. Carbon 14 decays according to the formula $Q(t) = Q_0 2^{-\frac{t}{5730}}$. How old is an artifact containing only 20% of its initial amount of carbon 14?