PART 1. Part 1 consists of 9 questions. Show your work and clearly mark your final answer in the space provided. (6 points each)

1. If \( F(x) = \int_{2}^{x} e^{t^2+1} \, dt \), find \( F'(x) \).

2. Evaluate the definite integral \( \int_{-3}^{3} \sqrt{9-x^2} \, dx \) by interpreting it in terms of area.

3. Evaluate \( \int_{1}^{2} x \ln x \, dx \)
4. Evaluate $\int \frac{x}{\sqrt{1-x^2}} \, dx$

5. Evaluate $\int_{1}^{e} \frac{1}{6x} \, dx$

6. Evaluate $\int \frac{1}{x^2 - 1} \, dx$
7. Evaluate \( \int e^{\sqrt{x}} dx \).

8. Write out the terms of the Riemann sum \( M_4 \) with \( n = 4 \) and using the midpoint rule in order to approximate \( \int_{1}^{3} \frac{1}{x} \, dx \). You do not need to actually compute and add the terms in the sum.

9. Find the average value of \( f(x) = \frac{x}{x-1} \) over the interval \([2, 4]\).
Part 2. Part 2 consists of 4 problems. Problems 1 through 3 are worth 10 points each. Problem 4 is worth 16 points. Show all your work for full credit! Displaying only the final answer (even if correct) without the relevant steps is not enough.

1. Evaluate \( \int x^2 \sin x \, dx \)

2. Evaluate \( \int \frac{x+1}{x^2(x^2+1)} \, dx \)
3. A particle moves along a line with velocity function \( v = t^2 - t, \ t \geq 0 \), where \( v \) is measured in meters per second.

a. Find the change in position, i.e. the displacement, over the time interval \([0, 3]\).

b. Find the distance traveled by the particle during the time interval \([0, 3]\).
4. Evaluate the following integrals.

a. \[
\int\frac{\cos^2 x - \sin x}{\cos x} \, dx
\]

b. \[
\int \sin^4 x \cos^3 x \, dx
\]

c. \[
\int \sec^4 x \tan x \, dx
\]