Part I. Show your work and put your answers in the box.
3 points each. No partial credit. Calculators not allowed.

\[ 1 \int (3x^2 + 1)^2 \, dx \]

\[ 2 \int x^2 e^x \, dx \]

\[ 3 \int \frac{x-1}{\sqrt{3x^2 - 6x + 9}} \, dx \]

\[ 4 \int \tan 2x \, dx \]

\[ 5 \int x \sin(x^2) \, dx \]

\[ 6 \int (\ln x)^2 \, dx \]

\[ 7 \int_{5}^{13} x\sqrt{x^2 - 25} \, dx \]

\[ 8 \int_{1}^{\infty} \frac{\ln x}{x} \, dx \]

\[ 9 \int_{5}^{\infty} \frac{1}{(2x - 3)^2} \, dx \]

\[ 10 \int_{-\infty}^{0} e^{4x} \, dx \]
Part II. 10 points each. Show your work. Put answers in boxes.

1. Compute the integral $\int_{0}^{\frac{1}{4}} x \sin \pi x \, dx$. Express your answer using $\pi$ and square roots. Calculator not allowed.

2. Use the fact that the area of a circle of radius $r$ is $\pi r^2$ to find the value of the following integral. Express your answer in terms of $\pi$. Calculator not allowed.

$$\int_{3}^{6} \sqrt{6x - x^2} \, dx$$

3. (a) Use the trapezoidal rule with $n = 3$ to approximate the integral $\int_{1}^{4} (2x - 3)^3 \, dx$.

(b) Find the exact value of the integral in part (a) by integration.

4. A rich uncle leaves you an inheritance which will generate a continuous stream of income at the rate of $5,000 per year for the rest of your life. Find the present value of this income stream over the next 50 years, assuming an interest rate of 6%. Express your answer to the nearest cent.

5. Find the total area bounded by the curve $y = x\sqrt{4 - x^2}$ and the $x$-axis.