Please answer the following questions. Your answers will be evaluated on their correctness, completeness, and use of mathematical concepts we have covered. Please show all work and write out your work neatly. Answers without supporting work will receive no credit. The point values of the problems are listed in parentheses.

1. (10 points) Find the exact area of the region bounded by the graphs of $y = x^2$, $y = 0$, and $x = 2$.

2. (10 points) Find the volume of the solid of revolution generated by revolving the region bounded between $y = x^2$ and $y = 2x$ about the $x$-axis.
3. (10 points) Write out the first five nonzero terms of the Maclaurin series for \( g(x) = e^x - x^2 \).

4. (10 points) The region bounded by \( x = 4 - y^2 \) and \( x = y^2 - 4 \) is revolved around the line where \( y = 5 \). Using the method of shells, set up the definite integral for finding the volume of the solid of revolution. You do not need to evaluate the definite integral.
5. (10 points) Find the arc length of the portion of the graph of \( y = \frac{1}{2} + \sin 2x \) over the interval where \( 1 \leq x \leq 2\pi \). You may estimate the integral on your calculator. Your answer must be accurate to at least four decimal places.

6. (10 points) A Taylor polynomial of degree 4 with \( c = 1 \) is used to approximate \( f(x) = \cos(\pi x) \). What is the maximum theoretical error of the approximation on the interval \([0.9, 1.1]\)?
7. (10 points) The graph of $y = \cos 2x$ over the interval $[0, \pi]$ is revolved around the $x$-axis. Set up the definite integral for finding the surface area of the resulting solid of revolution. You do not need to evaluate the definite integral.

8. (10 points) A force of 55 pounds stretches a spring 10 inches. Find the work done stretching the spring 6 inches beyond its natural length.
9. (10 points) Compute the mass and center of mass of an object lying along the $x$-axis with $0 \leq x \leq 2$ if the linear density of the object is given by $\rho(x) = x^2 - x + 6$. 
10. (10 points) The end of a watering trough used to hold water for animals is in the shape of an equilateral triangle with sides of length two feet. If the trough is completely filled with water of density 62.4 pounds per cubic foot, find the hydrostatic force on the end of the trough.