1. (15%) Find the integral $\int (x^2 - 1)e^x dx$.

2. (15%) Evaluate the integral $\int_4^6 \frac{x^2}{\sqrt{x^2-9}} dx$.

3. (15%) Find the integral $\int \frac{e^x}{(e^{2x}+1)(e^x-1)} dx$.

4. (15%) Find the limit
$$\lim_{x \to 0^+} [\cos(\frac{\pi}{2} - x)]^x.$$

5. (10%) Evaluate $\int_0^\infty \frac{dx}{\sqrt{x}(x+1)}$.

6. (10%) Evaluate the definite integral $\int_0^{\pi/4} \sec^2 t\sqrt{\tan t}\, dt$.

7. (10%) Find the arc length of the graph of $y = \frac{x^3}{6} + \frac{1}{2x}$ on the interval $[\frac{1}{2}, 2]$.

8. Use the disk or the shell method to find the volume of the solid generated by revolving the region bounded by the graph of the equation about each given line.
$y = x^3$, $y = 0$, $x = 2$

   (a) (5%) the x-axis,
   (b) (5%) the line $x = 4$.