These are only a few sample problems to *help* you prepare for the exam. You should also be certain that you completely understand the assigned homework, in-class work, and your class notes.

1. You will certainly want to review all of the antidifferentiation problems from the homework and in-class work.

2. Let $I = \int_{\pi}^{2\pi} \sqrt{1 + \cos(x)^2}\, dx$.
   (a) Explain how I can be interpreted as giving the area of a certain region R. What is R?
   (b) Explain how I can be interpreted as the length of the portion of the graph of $y = f(x)$. What is $f(x)$?
   (c) Explain how I can be interpreted as giving the volume formed when a function $g(x)$ is rotated about the x-axis. What is $g(x)$?
   (d) Explain how I can be interpreted as giving the volume formed when a function $h(x)$ is rotated about the y-axis. What is $h(x)$?

3. Sketch the region bounded by the graphs $y = \sqrt{8x}$ and $y = x^2$. Find the volume of the solid formed when the region is rotated about
   (a) The x-axis
   (b) The y-axis
   (c) The horizontal line $y = 5$

4. Show that the improper integral $\int_1^{\infty} e^{-x} x\, dx$ converges and find its exact value.

5. Do the following integrals converge or diverge? You do not need to find the values of the convergent integrals.
   (a) $\int_2^{\infty} \frac{x}{x^2 - 2}\, dx$
   (b) $\int_0^{\infty} \frac{1}{x^4 + \sqrt[3]{x}}\, dx$

6. Let $I = \int_1^{\infty} \frac{1}{x^5 + 3x}\, dx$. Show that I converges, and explain how you could approximate I. How would you determine the maximum error of your approximation?

7. Determine if the following sequences converge or diverge.
   (a) $\left\{ \frac{\ln(k)}{\sqrt[3]{k+1}} \right\}_{k=1}^{\infty}$
   (b) $\{a_k\}_{k=1}^{\infty}$ where $a_k = \int_1^k \frac{1}{1 + x^2}\, dx$