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 should, of course, be quite proficient at finding antiderivatives using integration-by-parts and u-substitution.

2. Consider the graph of $f(x) = \dfrac{1}{x}$ for $x \geq 1$.
   (a) Find the area below the graph and above the x-axis.
   (b) Find the volume of the solid formed when the graph is rotated about the x-axis.
   (c) Does anything seem strange about these answers?

3. Find the seventh order Taylor polynomial for $f(x) = \sin(x)$ at $x_0 = \frac{\pi}{2}$. How close will $P_7(x)$ approximate $\sin(2)$?

4. Using only a four function calculator $(+, -, \times, /)$ and that $\pi \approx 3.141$, approximate $\cos(7)$ accurate within 0.01.

5. Find the exact value of $\displaystyle\int_1^\infty e^{-x} x \, dx$.

6. Do the following integrals converge or diverge? You do not need to find the values of the convergent integrals.
   (a) $\displaystyle\int_2^\infty \frac{x}{x^2 - 2} \, dx$
   (b) $\displaystyle\int_0^\infty \frac{1}{x^4 + \sqrt[3]{x}} \, dx$
   (c) $\displaystyle\int_1^\infty \frac{x^2 + 1}{x^2} \, dx$

7. Let $I = \displaystyle\int_1^\infty \frac{1}{x^5 + 3x} \, dx$
   (a) Show that I converges.
   (b) Find a definite integral that will approximate I within 0.002 of its true value.
   (c) Explain *in detail* how to approximate I within 0.004 of the true value.

8. Is more work done to raise a 60-lb bucket from a 60-ft well or a 50-lb bucket from a 70-ft well? Assume that the rope weight 0.25 lb/ft.

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