Midterm 1 Preview
Calculus II, Spring 2013

Things to keep in mind:
• Practice doing these algebraically, without using your calculator.
• Practice variations on each problem.
• Memorize as many basic integral formulas as you can: this will make you faster and better at using them than if you had to look everything up in a sheet of notes.

• You should practice all the variations on volumes generated by rotation.
• You should practice some other integration by parts examples, including the “trick” ones for $\int e^{x} \sin(x) \, dx$, $\int \ln(x) \, dx$ and $\int \tan^{-1}(x) \, dx$, etc.

1. Find the following integral $\int \frac{x}{\sqrt{7+x^2}} \, dx$

2. Find the following integral $\int \frac{\cos(\pi/x)}{x^2} \, dx$

3. Find the area between the two curves $y = x^2$ and $y = \frac{2}{x^2 + 1}$.

4. Find the volume generated by rotating the region bounded by the following curves around the line $y = -1$:
   
   $y = \frac{1}{x}$, $y = 0$, $x = 1$, $x = 3$

5. Find the volume generated by rotating the region bounded by the following curves around the line $x = 5$
   
   $y = -x^3 + 3x^2$, $y = 0$, $x = 0$, $x = 3$

6. Find the volume generated by rotating the region between $x = y^3 + 4y^2$, and $x = 3y + 18$, between $y = -3$ and $y = 2$, around the line $x = 25$, as shown below:

![Graph of the region](image-url)
7. The velocity of blood that flows in a blood vessel is given by

\[ v(r) = \frac{1}{2}(0.0001 - r^2) \text{ m/s} \]

where \( 0 \leq r \leq 0.01 \) is the distance, in meters, from the center of the blood vessel.
Find the average velocity of blood in the blood vessel.

8. Find the following integral

\[ \int_{1}^{4} x^2 \ln(x) \, dx \]

9. Find the following integral

\[ \int_{1}^{4} x^2 e^x \, dx \]

10. Find the following integral

\[ \int \frac{8x^3 - 3x^2 + 2x + 1}{(x + 7)^{2/3}} \, dx \]

11. Find the following integral

\[ \int (7x^3 - 2x^2 + x - 5)e^{3x+1} \, dx \]