This is a sample exam in preparation for the second in-class exam, which will be given on Monday, March 1, 2010.

Do the following ten problems under the same conditions as the actual exam. Give yourself 50 minutes. While doing these problems, you may refer to a one-page (two-sided) handwritten set of notes, up to 8 1/2 by 11 inches. Seven of the problems below are from old final exams; those can be found by going to

⟨http://www.math.upenn.edu/ugrad/calc/m104/oldexams.html⟩.

1. Spring 2009 final, #1.

2. Spring 2009 final, #2.

3. Spring 2009 make-up final, #8.

4. Spring 2009 make-up final, #18.

5. Spring 2008 final, #9.

6. Spring 2008 final, #10.

7. Spring 2007 final, #11.

8. Using the table of integrals on the next page, evaluate $\int \frac{dx}{x\sqrt{9x^2-1}}$.

(a) $\sin^{-1}(3x) + C$ (b) $\sin^{-1}(x/3) + C$ (c) $\cos^{-1}(3x) + C$

(d) $\cos^{-1}(x/3) + C$ (e) $\sec^{-1}(3x) + C$ (f) $\sec^{-1}(x/3) + C$

9. The output of the Maple command

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int(sqrt(cos(x)^2 + 1),x=0..Pi);
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corresponds to:

(a) the area below the graph of $y = \cos^2 x + 1$, between $x = 0$ and $x = \pi$.

(b) the area between the graphs of $y = \cos^2 x + 1$ and $y = \sqrt{x}$, between $x = 0$ and $x = \pi$.

(c) the arclength of $y = \cos x$, between $x = 0$ and $x = \pi$.

(d) the arclength of $y = \sin x$, between $x = 0$ and $x = \pi$.

(e) the volume of revolution obtained by rotating the graph of $y = \cos x$, between $x = 0$ and $x = \pi$, about the $x$-axis.

(f) the volume of revolution obtained by rotating the graph of $y = \sin x$, between $x = 0$ and $x = \pi$, about the $y$-axis.

(continued)

10. Which of the following is a good approximation to $\int_0^2 e^{x^2}\,dx$?

(a) $\frac{1}{10}\left(e^{0^2} + 2e^{.2^2} + 2e^{.4^2} + \cdots + 2e^{1.8^2} + e^{2^2}\right)$

(b) $\frac{1}{20}\left(e^{0^2} + 2e^{.1^2} + 2e^{.2^2} + \cdots + 2e^{.9^2} + e^{1^2}\right)$

(c) $\frac{1}{10}\left(e^{0^2} + 4e^{.2^2} + 2e^{.4^2} + \cdots + 4e^{1.8^2} + e^{2^2}\right)$

(d) $\frac{1}{10}\left(e^{.1^2} + 2e^{.3^2} + 2e^{.5^2} + \cdots + 2e^{1.7^2} + e^{1.9^2}\right)$

(e) $\frac{1}{20}\left(e^{0^2} + e^{.1^2} + e^{.2^2} + \cdots + e^{1.9^2} + e^{2^2}\right)$

(f) $\frac{1}{20}\left(e^{0^2} - e^{.2^2} + e^{.4^2} - \cdots + e^{1.8^2} - e^{2^2}\right)$

*Short table of integrals*

$$\int \sqrt{u^2+c}\,du = \frac{u}{2}\sqrt{u^2+c} + \frac{c}{2}\ln\left|u+\sqrt{u^2+c}\,\right| \tag{1}$$

$$\int \sqrt{b^2-u^2}\,du = \frac{u}{2}\sqrt{b^2-u^2} + \frac{b^2}{2}\sin^{-1}\left(\frac{u}{b}\right) \tag{2}$$

$$\int \frac{du}{\sqrt{u^2+c}} = \ln\left|u+\sqrt{u^2+c}\,\right| \tag{3}$$

$$\int \frac{du}{\sqrt{b^2-u^2}} = \sin^{-1}\left(\frac{u}{b}\right) \tag{4}$$

$$\int \frac{\sqrt{b^2 \pm u^2}}{u}du = \sqrt{b^2\pm u^2} + b\ln\left|\frac{\sqrt{b^2\pm u^2}-b}{u}\right| \tag{5}$$

$$\int \frac{\sqrt{u^2-b^2}}{u}du = \sqrt{u^2-b^2} - b\cos^{-1}\left|\frac{b}{u}\right| \tag{6}$$

$$\int \frac{du}{u\sqrt{b^2\pm u^2}} = \frac{1}{b}\ln\left|\frac{\sqrt{b^2\pm u^2}-b}{u}\right| \tag{7}$$

$$\int \frac{du}{u\sqrt{u^2-b^2}} = \frac{1}{b}\sec^{-1}\left(\frac{u}{b}\right) \tag{8}$$