Prince Sultan University
Department of Mathematical Sciences

MATH 113 – Final Examination
23 June 2009

Time allowed: 180 minutes
Maximum points: 100 points

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1. (15 points) Evaluate each integral.

   (a) $\int \frac{x^2}{x+1}\,dx$ (b) $\int \left[\phi + \frac{2}{\sin^2\phi}\right] d\phi$ (c) $\int \frac{y}{\sqrt{2y+1}}\,dy$

2. (6 points) Let $F(x) = \int_2^x \sqrt{3t^2+1}\,dt$. Find

   (a) $F(2)$ (b) $F'(2)$ (c) $F''(2)$

3. (6 points) Suppose that a particle is moving along an *s*-axis with velocity $v(t) = t^3 - 3t^2 + 2t$. Find the displacement and the distance traveled by the particle during the time interval $0 \le t \le 3$.

4. (9 points) Sketch the region enclosed by the curves $y = 2 + |x-1|$ and $y = -\frac{1}{5}x + 7$ and find its area.

5. (9 points) Find the volume of the solid that results when the region enclosed by the curves $x = \sqrt{y}$ and $x = \frac{y}{4}$ is revolved about the *x*-axis.

6. (12 points) Evaluate each limit.

   (a) $\lim_{x\to\infty} x \sin\frac{\pi}{x}$ (b) $\lim_{x\to\infty}\left(\sqrt{x^2+x} - x\right)$

7. (10 points) Evaluate each integral.

   (a) $\int \frac{\sin\theta}{\cos^2\theta + 1}\,d\theta$ (b) $\int_0^1 \frac{dx}{\sqrt{1-x^2}}$

8. (17 points) Evaluate each integral.

(a) $\int e^{\sqrt{x}}dx$ (b) $\int \frac{dx}{x^3+2x}$ (c) $\int \frac{3x^3}{\sqrt{1-x^2}}\,dx$

9. (8 points)

(a) Find the exact value of the integral $\int_1^5 \sqrt{e^x}\,dx$. Round your answer to the nearest six digits.

(b) Approximate the integral $\int_1^5 \sqrt{e^x}\,dx$ using Simpson's rule with $2n=8$ subintervals.

(c) Find the error in your approximation to six decimal places.

10. (8 points) Solve the initial-value problem:

$$y'\cosh x + y\sinh x = \cosh x,\quad y(\ln 2) = 7$$

Good Luck