MAC 2311 PM April 20, 2009
Final Exam and Key Prof. S. Hudson

1) (20 pts) Compute and simplify;

$\int e^{2x}\ dx =$

$\int \sec(x)(\sec(x) + \tan(x))\ dx =$

$\int \frac{1}{1+16t^2}\ dt =$

$\int \frac{t}{1+16t^2}\ dt =$

2) (10 pts) Suppose a particle has velocity $v(t) = 3t + 2$ at time t. Suppose it begins at position $s(0) = 5$. Find its position after 3 seconds.

3) (15 pts) Compute y';

a) $y = (2x)^x$

b) $y = \log_3(2x)$

c) $y = \sin^{-1}(x + 1)$

4) (10 pts) Find the slope of the tangent line to the curve, $x = \sec(t)$, $y = \tan(t)$ at the point where $t = \pi/3$. For maximum credit, use the chain rule as done in class.

5) (10 pts) Assume oil spilled from a ruptured tanker spreads in a circular pattern whose radius increases at a constant rate of 2ft/s. How fast is the area of the spill increasing when the radius of the spill is 60ft ?

6) (10 pts) CHOOSE ONE (you may continue on the back or on extra paper);

A) State and prove Rolle's Theorem.

B) State and prove the Product Rule.

7) (10 pts) Answer TRUE or FALSE:

$f(x) = \ln|x|$ is an increasing function.

A continuous function defined on $(-\infty, +\infty)$ must have a minimum value.

A rational function is continuous except where the denominator is zero.

If f is differentiable on the open interval (a, b) then it is continuous on the closed interval $[a, b]$.

The function $\cot(x)$ is continuous on the interval $(-\pi/4, \pi/4)$.

8) [5pts] Compute $\lim_{x\to+\infty}(1 + 2/x)^{2x} =$ (and show all work, as always)

9) [10pts] Suppose a particle has position $s(t) = t^3/3 - 2t^2 + 5$ [so, $v(t) = t^2 - 4t$ and $a(t) = 2t - 4$] for $t \geq 0$. When is the particle speeding up? slowing down? Explain briefly.

Remarks and Answers: The average was about 65 / 100, based on 7 grades above 40. The scores were slightly below 50% on problem 9, and only about 57% on the TF, but none of the problems were disasters. You can use the scale on the syllabus for this exam. I have not set a scale for the semester yet.

1a) $e^{2x}/2 + C$

1b) $\tan(x) + \sec(x) + C$

1c) $\tan^{-1}(4x)/4 + C$

1d) $\ln(1 + 16t^2)/32 + C$

2) $27/2 + 6 + 5$

3a) $(2x)x[\ln(2x) + 1]$

3b) $1/(x\ln(3))$

3c) $[1 - (x + 1)^2]^{-1/2}$

4) $\csc(\pi/3) = 2/\sqrt{3}$

5) 240π

6) see text

7) FFTFF

8) e^4

9) It speeds up when $t \in (0, 2)$ or $t \in (4, +\infty)$.