Discussion (circle): 10 AM 11 AM 12 PM Name: Daniel McLaury

Math 180, Quiz 7 Retest: Tuesday, March 19, 2013

Take fifteen minutes to complete this quiz. Please show all your work, and write your name on the front *and* back of the paper before turning it in. Make sure to show all relevant work.

1. **(4 pts)** Find the absolute extrema of $f(x) = x\ln(x) + 2$ on the interval $[e^{-2}, 1]$.

$f'(x) = (x)\frac{1}{x} + (1)\ln(x) + 0 = \ln(x) + 1$

$\ln(x)+1 = 0 \Rightarrow \ln(x) = -1 \Rightarrow x = e^{-1}$

$f(e^{-2}) = e^{-2}(-2)+2 = 2 - \frac{2}{e^2}$ $f(e^{-1}) = 2 - \frac{1}{e}$ min $f(1) = 1(0)+2 = 2$ max

2. **(5 pts)** A 5 m-long log rolls down a snow-covered mountain, forming a cylinder of constant height but increasing diameter. It accumulates snow at a rate of 1 m^3/s. How quickly is the diameter increasing when the snow-covered log is 1/3 m across? (You probably want to work with radii first and then convert to diameters at the end.)

$D = 2r$ $V = \pi r^2 L$ $r = \frac{1}{6}m$ $\frac{dV}{dt} = 1 m^3/s$

$D' = 2r'$ $V' = 2\pi r L r'$

$\Rightarrow r' = \frac{V'}{2\pi r L} = \frac{1 m^3/s}{2\pi\left(\frac{1}{6}m\right)(5m)} = \frac{6}{10\pi}\ m/s \Rightarrow D' = \frac{6}{5\pi}\ m/s$

3. **(1 pt)** Suppose f and f^{-1} are differentiable functions, and that you are given the values

x	$f(x)$	$f'(x)$
0	3/2	1/2
1	2	1/2
3/2	19/8	1
2	3	3/2
5/2	31/8	2
3	5	5/2

What is $(f^{-1})'(3/2)$? (Show at least enough work that I can tell you didn't just make a lucky guess!)

Recall:

$f(f^{-1}(x)) = x$

$f'(f^{-1}(x))(f^{-1})'(x) = 1$

$(f^{-1})'(x) = \frac{1}{f'(f^{-1}(x))}$

$f^{-1}(3/2) = 0$

$f'(0) = 1/2$

$(f^{-1})'(3/2) = \frac{1}{1/2} = 2$