Quiz 9

September 30, 2016

Show all work and circle your final answer.

1. Compute $f''(e)$ if $f(x) = \ln(\ln x)$. Note: $\frac{d}{dx}(\ln x) = \frac{1}{x}$.

$f'(x) = \frac{1}{\ln x} \cdot \frac{d}{dx}(\ln x) = \frac{1}{\ln x} \cdot \frac{1}{x} = (x \ln x)^{-1}$ by chain rule

$f''(x) = -1 (x \ln x)^{-2} \frac{d}{dx}(x \ln x)$

$= -1 (x \ln x)^{-2} (\ln x + x \cdot \frac{1}{x})$

$= \frac{-(\ln x + 1)}{(x \ln x)^2}$

$f''(e) = \frac{-(\ln e + 1)}{(e \ln e)^2} = \boxed{\frac{-2}{e^2}}$

2. Let $f(x)$ and $g(x)$ be differentiable functions. Let $h(x) = (f[g(x)])^3$. Compute $h'(1)$ using the following table:

	1	2	3	4
$f(x)$	1	2	5	1
$f'(x)$	4	3	2	1
$g(x)$	3	-2	4	-5
$g'(x)$	-1	3	-2	3

$h'(x) = 3(f[g(x)])^2 \frac{d}{dx}(f[g(x)])$ by chain rule

$= 3(f[g(x)])^2 \cdot f'(g(x)) \cdot g'(x)$ by chain rule

$h'(1) = 3(f[g(1)])^2 \cdot f'(g(1)) \cdot g'(1)$

$= 3(f(3))^2 \cdot f'(3) \cdot (-1)$

$= 3(5)^2 \cdot 2 \cdot (-1) = \boxed{-150}$