Math 180: Calculus I **Fall 2014**

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We may use the following derivative rules now:

$$\frac{d}{dx}b^x = b^x \ln(b) \quad \frac{d}{dx}\ln x = \frac{1}{x} \quad \frac{d}{dx}\ln|u(x)| = \frac{u'(x)}{u(x)} \quad \frac{d}{dx}\log_b x = \frac{1}{x\ln b}$$

And the technique of logarithmic differentiation: take a log of both sides of the equation, then take the derivative using implicit differentaition to solve for $f'(x)$.

1. Find the following derivatives
   (a) $\frac{d}{dx}(x^2 \ln x)$
   (b) $\frac{d}{dx}x^3 3^x$
   (c) $\frac{d}{dx}(\ln|\sin x|)$
   (d) $\frac{d}{dx}\ln(10^x)$
   (e) $\frac{d}{dx}(\ln(\ln x))$

2. Find the derivatives
   (a) $s(t) = \cos(2^t)$
   (b) $f(x) = \ln\left[(x^3+1)^\pi\right]$

3. Evaluate the derivative of $h(x) = x^{\sqrt{x}}$ at $x = 4$.

4. Find the horizontal tangent line equation for $y = x^{\ln x}$

5. Use logarithmic differentiation to find the derivative of
$$f(x) = \frac{x^8 \cos^3 x}{\sqrt{x-1}}$$

6. Find the derivative y' of
$$y = (x^2+1)^x$$
using two methods:
(1) Use the fact that
$$b^x = e^{x\ln b}$$
(2) Use logarithmic differentiation.