1) Find the following derivatives. Simplify completely unless you are told not to. Do not use logarithmic differentiation unless you are told to. (59 points total)

a) $D_\theta \left[ \ln \left( \cos (5\theta) \right) \right]$ (5 points)

b) $D_x \left[ \log_2 (x^5 + 8) \right]$ (6 points)

c) $D_x \left[ \frac{\ln(6x^2 - x)}{5e^{9x} + 3} \right]$ (8 points)

You do not have to algebraically simplify, though perform all arithmetic.
d) $D_x\left(\left[\ln(2x+1)\right]^9\right)$  

(5 points)

\[
\begin{align*}
\text{e) } D_x & \left[ \frac{x^5 \sec(x)}{(4x + \pi)^9} \right] \\
& \text{ (17 points)}
\end{align*}
\]

You must use logarithmic differentiation and apply appropriate laws of logarithms whenever they apply, as in class. You do not have to write your final answer as a single fraction.
f) \( D_x \left[ 2^{\ln(x)} \right] \)  
   (6 points)

   Answer only is fine, though logarithmic differentiation may help.


g) \( D_x \left( x^{2x} \right) \)  
   (12 points)

   You must use logarithmic differentiation.  
   You do not have to write your final answer as a single fraction.
2) Evaluate the following integrals. Simplify completely. (46 points total)

a) \[ \int_1^2 \left( x^2 \right) \left( 3x^3 + 1 \right) \, dx \] (11 points)
   Give an exact answer; do not approximate.

b) \[ \int \frac{9x}{x^2 - 4} \, dx \] (8 points)
c) \[\int \frac{1}{x[\ln(x)]^4} \, dx\] (7 points)

d) \[\int \frac{\sec(\sqrt{\theta})}{\sqrt{\theta}} \, d\theta\] (10 points)

e) \[\int \csc(x) \, dx\] (4 points)

Answer only is fine.

f) \[\int \cot(7x) \, dx\] (6 points)

Answer only is fine.