

**Instructions:** Listen to your TA's instructions. There are substantially more problems on this worksheet than we expect to be done in discussion, and your TA might not have you do problems in order. The worksheets are intentionally longer than will be covered in discussion in order to give students additional practice problems they may use to study. Do not worry if you do not finish the worksheet :).

1. Compute the derivatives of the following functions.

(a)  $f(x) = \ln(3x^2 - 5x)$

(b)  $g(u) = \frac{u + \ln(5u)}{\sin(u)}$ .

(c)  $f(s) = \ln\left(\sqrt{\frac{2s+1}{4s}}\right)$ .

(d)  $h(u) = e^{4u} \ln(ue^u)$

(e)  $y = x \log_4(\sin(x))$

(f)  $y = \log_2(x \log_5 x)$

2. Find the equation of the tangent line to the curve  $y = \ln(x^2)$  at the point  $(e, 2)$ .

3. Sketch the graph of  $f(x) = x + e^x$  using the Curve Sketching techniques you learned in Chapter 3.

4. Find  $y'$  if  $2e^y + \ln(xy) = 2x^2y + 4$ .

5. Find a formula for the  $n$ -th derivative of  $g(s) = e^{4s}$ .

6. Compute the following integrals.

(a)  $\int_0^{\frac{e-1}{2}} \frac{5}{1+2x} dx$

(b)  $\int \frac{\sin(\ln x)}{x} dx$

(c)  $\int_1^e \frac{(\ln t)^4}{t} dt$

(d)  $\int_0^{\ln(1+\pi)} e^x \cos(1 - e^x) dx$

(e)  $\int \frac{\log_{10} x}{x} dx$

7. Solve the inequality  $1 < e^{4x-2} < 2$ , for  $x$ .

8. Solve the following equations:

(a)  $e^{4x-6} = 8$ .

(b)  $e - e^{-4x} = 4$ .

(c)  $\ln(x) + \ln(x-1) = 1$ .

9. Differentiate the following functions:

(a)  $G(x) = 4^{C/x}$ , where  $C$  is a constant

(b)  $y = x^x$

(c)  $y = (\sin x)^{\ln x}$

(d)  $y = (3x^2 + 5)^{\frac{1}{x}}$

10. Find  $y'$  if  $x^y = y^x$ .

11. A computer is programmed to inscribe a series of rectangles in the first quadrant under the curve of  $y = e^{-x}$ . What is the area of the largest rectangle that can be inscribed?

12. Let  $a \neq -1$  be a constant. Calculate  $\int \frac{x}{a} + \frac{a}{x} + x^a + a^x + ax \, dx$ .

13. Sketch the graph of  $f(x) = \ln(1 + x^2)$  using the Curve Sketching techniques you learned in Chapter 3.