

Total Marks: 60

Due Date: **June 19, 2015.**

**SHOW ALL WORK** to get full marks. Word problems should have sentence answers with units. This assignment covers sections 3.3, 3.4, 3.5, 3.6, 3.9 .

1. (17 points) Differentiate the following functions. DO NOT SIMPLIFY.

(a)  $y = 3^{2^{5 \cot x}}$

(b)  $y = \cos \left( \sqrt{\sin \pi x + \tan x} \right)$

(c)  $y = (x + e^{-x} \sqrt{x})^{3/2}$

(d)  $f(t) = \ln |\cos(\pi^{2e} - t^2)|$

(e)  $y = \log_4 (\sec 5x + \ln x^2)$

2. (6 points) Evaluate the following limits

(a)  $\lim_{x \rightarrow 0} \frac{2 \sin 3x}{3x^3 - 4x}$

(b)  $\lim_{t \rightarrow 3} \frac{\sin(t - 3)}{t^2 - 2t - 3}$

3. (5 points) Let  $b$  be a real number. Use quotient rule to prove that

$$\frac{d}{dx} b \csc x = -b \csc x \cot x.$$

4. (3 points) Let  $h(x) = \log_b(4x^2 - x - 1)$ . For what value of  $b$  is  $h'(2) = -3$ ?

5. (7 points) Use implicit differentiation to find the equation of the tangent line to the curve

$$x^3 y - 3y^2 + x + \cos(y) = \pi$$

at the point  $(0, \frac{\pi}{4})$ .

6. (8 points) Use logarithmic differentiation to find the derivative of

$$y = \frac{\sqrt{x-1} e^x (x-7)^{2/7}}{x}$$

7. (7 points) A boat is pulled into a dock by a rope attached to the bow of the boat and passing through a pulley on the dock that is 1 m higher than the bow of the boat. If the rope is pulled in at a rate of 1 m/s, how fast is the boat approaching the dock when it is 8 m from the deck?

8. (7 points) A particle moves along the curve  $y = 2 \sin\left(\frac{\pi x}{2}\right)$ . As the particle passes through the point  $\left(\frac{1}{3}, 1\right)$ , its  $x$ -coordinate increases at a rate of  $\sqrt{10}$  cm/s. How fast is the distance from the particle to the origin changing at this instant?