

MATH 1500 D01/D02 Fall 2015

Assignment 3

Total Marks: 60

Due Date: Oct 24, 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. Differentiate the following functions. DO NOT SIMPLIFY.

(a) (3 points) $y = 4^{\sin^2 x}$

(b) (4 points) $y = \cos\left(\sqrt{\tan(\pi^2 x)}\right)$

(c) (4 points) $y = (\sqrt{e^x} + e^{-x})^{3/2}$

(d) (3 points) $f(t) = \ln|\sec(\pi^2 t - t^4)|$

(e) (4 points) $y = \log_3(\csc(5x) + \ln(x^2 + 1))$

2. Evaluate the following limits

(a) (4 points) $\lim_{x \rightarrow 0} \frac{3 \sin(7x)}{x - 3x^5}$

(b) (4 points) $\lim_{\theta \rightarrow 0} \frac{3\pi \sin \theta}{\theta - 2 \sin \theta}$

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

$$\frac{d}{dx} k \cot x = -k \csc^2 x.$$

4. (7 points) Use implicit differentiation to find the equation of the tangent line to the curve

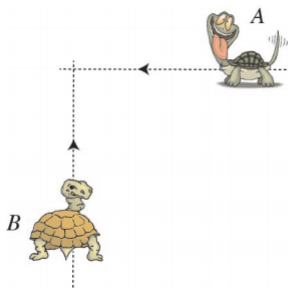
$$2xy - e^y + \sin(y) + e^x = 1$$

at the point $(\ln 2, 0)$.

5. (7 points) Use logarithmic differentiation to find the derivative of

$$y = \frac{e^{5x^2} (2x - 7)^{3/4}}{x^2}$$

6. (7 points) Turtle A is walking west, along a straight road, at 20 m/h and turtle B is walking north, along a straight road, at 30 m/h . Both are headed for the intersection of the their paths. At what rate are the turtles approaching each other when turtle A is 4 metres and turtle B is 3 metres from the intersection of the two roads.



7. (8 points) A particle moves along the curve $y = 2 \sin(\pi x)$. As the particle passes through the point $\left(\frac{1}{6}, 1\right)$, its x -coordinate increases at a rate of $\sqrt{37}$ cm/s. How fast is the distance from the particle to the origin changing at this instant?