

HOMework ASSIGNMENT #3

due in class on Friday, September 27

Student No: _____ Name (Print): _____

Note: All homework assignments are due in class one week after being assigned. They must be on standard $8\frac{1}{2} \times 11$ size paper and they must be stapled. Assignments which are not stapled will not be accepted. I will not bring a stapler to class. Please enter your student number and name (as it appears on the registrar's list) in the spaces above. SURNAME FIRST IN CAPITALS, and given name second. Please put your answers in the boxes (if provided) and submit these pages for your assignment.

1. Each of the following questions can be done with little computation. Enter your answers in the boxes and show any work in the spaces provided. Suppose $f(x)$, $g(x)$ are functions satisfying $f(a) = \alpha$, $g(a) = \beta$, $f'(a) = \gamma$ and $g'(a) = \delta$ for some $a, \alpha, \beta, \gamma, \delta$.

(a) Compute the derivative of $f(x) + g(x)$ at $x = a$.

(b) Compute the derivative of $f(x)g(x)$ at $x = a$.

(c) Compute the derivative of $f(x)/g(x)$ at $x = a$.

(d) Compute the derivative of $x^2f(x) - x^3g(x)$ at $x = a$.

2. Each of the following questions can be done with little computation. Enter your answers in the boxes and show any work in the spaces provided. Suppose $f(x)$, $g(x)$ are functions satisfying $f(2) = 4$, $g(2) = 4$, $f'(2) = -1$ and $g'(2) = 1$.

(a) Compute the derivative of $f(xg(x) - 6)$ at $x = 2$.

(b) Compute the derivative of $f(x)/\sqrt{g(x)}$ at $x = 2$.

3. Each edge of an equilateral triangle is increasing at the rate of 4 cm/sec . At what rate is the area of the triangle changing when each edge is 20 cm ?

4. The area of a circle is decreasing at the rate of $3\pi \text{ cm}^2/\text{sec}$. At what rate is the radius of the circle changing when its area is 100 cm^2 ?

5. Find the derivatives of the following functions. DO NOT SIMPLIFY YOUR ANSWERS.

(a) $y = x/\sqrt{x^2 + 1}$

(b) $y = (\sin^4(x) + \cos^4(x))^2$

(c) $y = (x - 1/x)^4$

(d) $f(x) = \sqrt{x + \sqrt{x}}$

(e) $g(x) = \sqrt{\frac{x-1}{x+1}}$

(f) $f(t) = \left(\frac{1}{t} + \frac{1}{t^2} + \frac{1}{t^3}\right)^{-1}$

6. Let $f(x)$ be the function defined by $f(x) = \begin{cases} x^2 \sin(1/x) & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$

(a) Compute $f'(x)$ for $x \neq 0$.

(b) Prove that $f'(0) = 0$.

(c) Prove that $f'(x)$ is not continuous at $x = 0$.