Name: Mandy _____ **PID:** _____

TA: _____ **Sec. No:** _____ **Sec. Time:** _____

Math 10A.
Midterm Exam 2
November 16, 2010

Turn off and put away your cell phone.
You may use one page of notes, but no books or other assistance during this exam.
You may leave answers in symbolic form, for example $\sqrt{42}$ *or* $\ln(6)$.
Read each question carefully, and answer each question completely.
Show all of your work; no credit will be given for unsupported answers.
Write your solutions clearly and legibly; no credit will be given for illegible solutions.

If any question is not clear, ask for clarification.

#	Points	Score
1	9	
2	8	
3	9	
4	9	
Σ	35	

1. (9 points) Find the derivative of the given function. Please remember to show your work.

(a) $f(x) = e^x \cos(x)$

$e^x \cos x - e^x \sin x$

(b) $g(x) = (1 + \tan(x))^{1/3}$

$\frac{1}{3}(1+\tan x)^{-2/3} \cdot (\sec^2 x)$

$= \frac{1}{3} \frac{\sec^2 x}{(1+\tan x)^{2/3}}$

(c) $h(x) = 3^{-x^4}$

$(3^{-x^4} \ln 3)(-4x^3)$

$= -4x^3 \cdot 3^{-x^4} \ln 3$

2. (8 points) Let $s(t) = \dfrac{t}{t+3}$.

(a) Use the limit definition of the derivative to find $s'(2)$. Please remember to show your work.

$$s'(2) = \lim_{h\to 0} \frac{s(2+h)-s(2)}{h}$$

$$= \lim_{h\to 0} \frac{\frac{2+h}{2+h+3} - \frac{2}{2+3}}{h}$$

$$= \lim_{h\to 0} \frac{1}{h}\left(\frac{2+h}{5+h} - \frac{2}{5}\right)$$

$$= \lim_{h\to 0} \frac{1}{h}\left(\frac{10+5h-(10+2h)}{5(5+h)}\right).$$

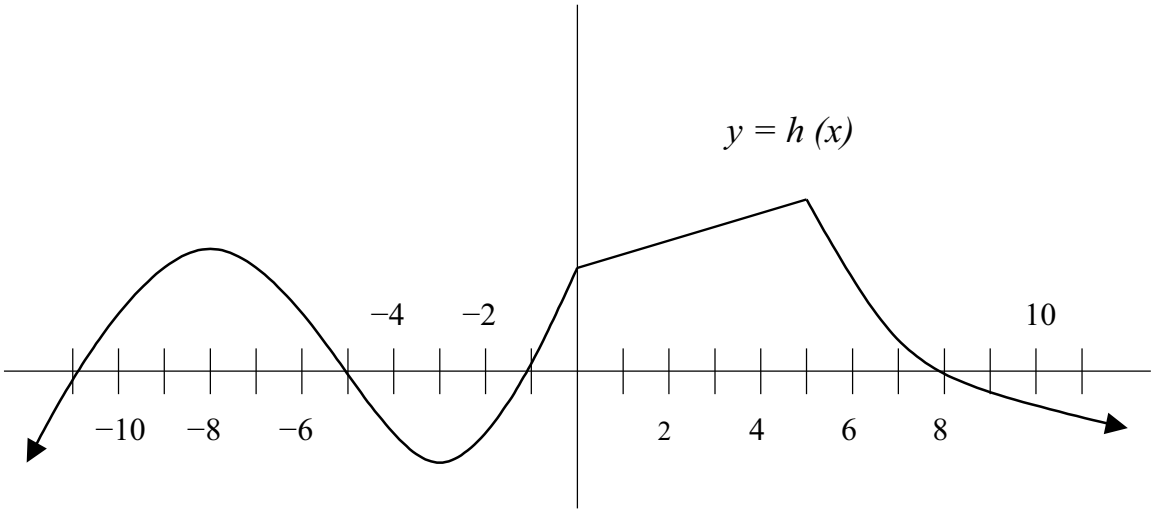
$$= \lim_{h\to 0} \frac{1}{h}\frac{3h}{5(5+h)} = \lim_{h\to 0} \frac{3}{5(5+h)} = \frac{3}{5\cdot 5} = \frac{3}{25}$$

(b) Use the quotient rule to find $s'(2)$. Please remember to show your work.

$$s'(t) = \frac{1\cdot(t+3) - t}{(t+3)^2} = \frac{3}{(t+3)^2}$$

$$s'(2) = \frac{3}{5^2} = \frac{3}{25}$$

3. (9 points) Use the graph of h below to answer the following questions.



(a) On which interval(s) is $h(x) > 0$?

$-11 < x < -5$, $-1 < x < 8$

(b) List all values of x (if any) at which $h'(x)$ does not exist.

$x = 0$, $x = 5$

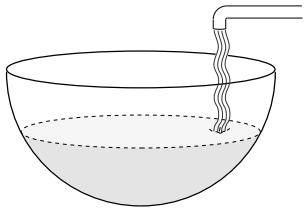
(c) On which interval(s) is $h'(x) < 0$?

$-8 < x < -3$, $5 < x$

(d) On which interval(s) is $h''(x) > 0$?

$-5 < x < -1$

4. (9 pts) Water is flowing into a large hemispherical tank at a constant rate in cubic inches per minute. Let $V(t)$ be the volume of the water in the tank (in cubic inches) at time t (in minutes), and let $H(t)$ be the height of the water (in inches) at time t (in minutes).



(a) Give a physical interpretation of $H'(t)$. That is, what does $H'(t)$ represent in this situation?

H'(t) is instantaneous rate of change of height (in inches) of water at time t (in mins)

(b) At the moment depicted in the figure, is $H'(t)$ positive, negative or zero? Please explain your answer.

H'(t) is positive
Since as more water is poured in, the height is longer.
(i.e. increasing height)

(c) At the moment depicted in the figure, is $V'(t)$ positive, negative or zero? Please explain your answer.

V'(t) is positive
Since water is flowing in by constant rate, so the volumn is increasing.