CALCULUS - *for Computer Science and Engineering*

Midterm EXAM

Department of Computer Science and Engineering
National Sun Yat-sen University

November 18, 2009, 13:15~ 15:20

NAME: _____ Student ID Nr.: _____

Instructor: _____

General Instructions:

1. Do not open this exam until you are told to begin.
2. This exam has 6 pages including this cover. There are 5 questions.
3. Do not separate the pages of the exam. If any pages do become separated, write your name on them and point them out to your instructor when you turn in the exam.
4. Please read the instructions for each individual exercise carefully. One of the skills being tested on this exam is your ability to interpret questions, so instructors will not answer questions about exam problems during the exam.
5. Show an appropriate amount of work for each exercise so that the graders can see not only the answer but also how you obtained it. Include units in your answers where appropriate.
6. You may use your calculator.
7. If you use graphs or tables to obtain an answer, be certain to provide an explanation and sketch of the graph to show how you arrived at your solution.
8. Please turn off all cell phones and pagers and remove all headphones.

Problem	1	2	3	4	5	Total
Points	24	40	10	15	15	104
Score						

1. Circle True or False for each of the following problems. Circle 'True' only if the statement is always true. No explanation is necessary. *(3% for each)*

True	**False**	for $c > 1$, $y = -cf(x)$ compresses and reflects the graph of f across the y-axis.
True	**False**	A function $f(x)$ has a limit as x approaches c if and only if it has left-hand and right-hand limits there and these one-sided limits are equal.
True	**False**	If f has a derivative at $x = c$, then f is continuous at $x = c$.
True	**False**	$\frac{d}{dx}x^n = nx^{n-1}$, for all $n \in R$.
True	**False**	suppose $y = f(x)$ is continuous on a closed interval $[a,b]$ and differentiable on the interval's interior (a,b). Then there is at least one point c in (a,b) at which $\frac{f(b)-f(a)}{b-a} = f'(c)$
True	**False**	Suppose f'' is continuous on an open interval that contains $x = c$. If $f'(c)=0$ and $f''(c) > 0$, then f has a local maximum at $x = c$.
True	**False**	An inflection point exists at $x = c$ if and only if $f''(c)=0$.
True	**False**	L'Hôpital's Rule does not apply when either the numerator or denominator has a finite nonzero limit.

2. Please fill in the following blanks with your answers. *(4% for each)*

(a) $\lim_{x\to 0}\dfrac{\sin(\sin x)}{x} =$ _____

(b) $y = x^2\sin x + 2x\cos x - 2\sin x$, $\dfrac{dy}{dx} =$ _____

(c) $2x^3 - 3y^2 = 8$, $\dfrac{d^2y}{dx^2}$ (in terms of x and y) = _____

(d) $x + \tan(xy) = 0$, $y' =$ _____

(e) $\lim_{x\to 0}\dfrac{\sin 5x}{\sin 4x} =$ _____

(f) $\lim_{x\to 4}\dfrac{4x - x^2}{2 - \sqrt{x}} =$ _____

(g) The tangent to the curve $y = x + \dfrac{2}{x}$ at the point (1,3) can be expressed as $y = ax + b$, where a = _____ , b = _____

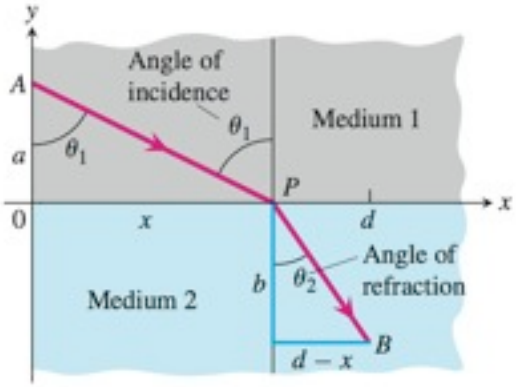
(h) The absolute minimum of $g(t) = 8t - t^4$ on [-2, 1] occurs at the point (p,q), where p = _____ and q = _____

(i) $\lim_{x\to\infty}\dfrac{x - 2x^2}{3x^2 + 5x} =$ _____

(j) $y = (1-x)(1+x^2)^{-1}$, $y' =$ _____

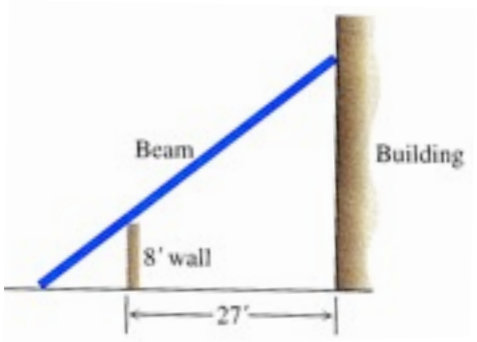
3. (10%) Fermat's Principle and Snell's Law

The speed of light depends on the medium through which it travels, and is generally slower in denser medium. Fermat's principle in optics states that light travels from one point to another along a path for which the time of travel is a minimum. Find the path that a ray of light will follow in going from a point A in a medium where the speed of light is c_1 to a point B in a second medium where its speed is c_2.



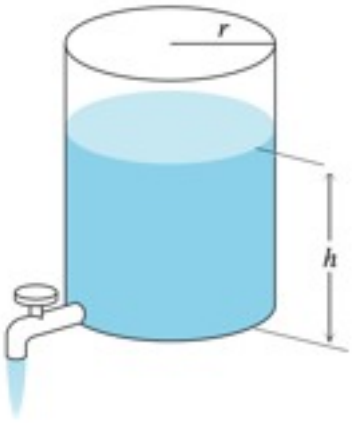
Answer: _____

4. (15%) The 8-ft wall shown here stands 27 ft from the building. Find the length of the shortest straight beam that will reach to the side of the building from ground outside the wall.



Answer: _____

5. (15%) How rapidly will the fluid level inside a vertical cylindrical tank drop if we pump the fluid out at the rate of 3000 L/min?
   Assuming that the tank's radius is ***r*** m.



Answer: _____

(End of this exam.)