CALCULUS - *for Computer Science and Engineering*
Midterm Exam

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

November 16, 2011, 13:20 ∼ 15:20

NAME: _____ Student ID No.: _____

Instructor: _____

General instructions:

1. Do not open this exam until you are told to begin.

2. This exam has 7 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 problem 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 problem 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. Do NOT use pencils but black or blue ball pens for your answers.

8. 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.

9. Please turn off all cell phones and pagers and remove all headphones.

Problem	1	2	3	4	5	Total
Points	40	20	10	15	15	100
Score						

1. (40%) Find the limits in the following problems. (4% for each)

(1) $\displaystyle\lim_{x\to-3}\frac{2-\sqrt{x^2-5}}{x+3}=$ _____ .

(2) $\displaystyle\lim_{x\to0}(2\sin x-1)=$ _____ .

(3) $\displaystyle\lim_{x\to0}\frac{x\csc 2x}{\cos 5x}=$ _____ .

(4) $\displaystyle\lim_{x\to\infty}\frac{2x+3}{5x+7}=$ _____ .

(5) $\displaystyle\lim_{x\to9}\frac{\sin(\sqrt{x}-3)}{x-9}=$ _____ .

(6) $\displaystyle\lim_{x \to 0} \frac{x - \sin x}{x^3} =$ _____ .

(7) $\displaystyle\lim_{x \to \infty} \left(\frac{x^2 + 1}{x + 2}\right)^{1/x} =$ _____ .

(8) $\displaystyle\lim_{t \to 0} \frac{t(1 - \cos t)}{t - \sin t} =$ _____ .

(9) $\displaystyle\lim_{x \to \infty} \frac{2^x - 3^x}{3^x + 4^x} =$ _____ .

(10) $\displaystyle\lim_{x \to \infty} \frac{\log_2 x}{\log_3(x + 3)} =$ _____ .

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2. (20%) Find the derivatives of the following problems. (5% for each)

(1) $y = \dfrac{x^2 + 3e^x}{2e^x - x}$, $\dfrac{dy}{dx} =$ _____ .

(2) $y = \dfrac{1}{21}(3x - 2)^7 + \left(4 - \dfrac{1}{2x^2}\right)^{-1}$, $\dfrac{dy}{dx} =$ _____ .

(3) $\ln xy = e^{x+y}$, $\dfrac{dy}{dx} =$ _____ .

(4) $y = x^{\sin x}$, $\dfrac{dy}{dx} =$ _____ .

3. (10%) If u and v are differentiable at x, and if $v(x) \neq 0$, then prove that:

$$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}.$$

4. (15%) This figure shows a rope running through a pulley at P and bearing a weight W at one end. The other end is held 5 ft above the ground in the hand M of a worker. Suppose the pulley is 25 ft above ground, the rope is 45 ft long, and the worker is walking rapidly away from the vertical line PW at the rate of 6 ft/sec. How fast is the weight being raised when the worker's hand is 21 ft away from PW?
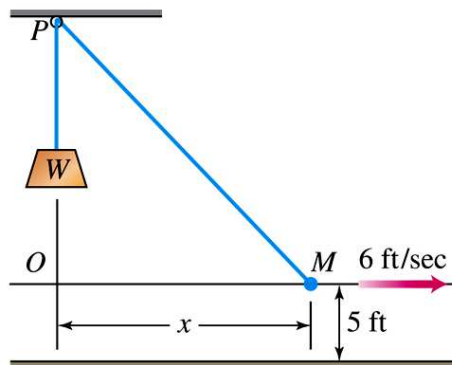
5. (15%) The 8-ft wall shown here stands $27\,ft$ from the building. Find the length of the shortest straight beam that will reach to the side of the building from the ground outside the wall.