MATH 53 April 29, 2013

SECOND LONG EXAM Summer; AY 2012-2013

General Instructions: Use black or blue pen only. Show neat, complete and organized solutions to earn full points. Box all final answers. The use of any electronic devices is not allowed during the exam. Cheating is punishable by a grade of **5.00** for the course.

I. **DO NOT SIMPLIFY**. Find the derivative of

$$f(x) = \sec^2\left(\frac{1}{\sqrt[7]{x^2}} + x^5\right) + \frac{\tan x - 4\pi^2}{1 - 8x}.$$

II. Find the equation of the tangent line of $2xy^2 - 1 = y\sqrt{x}$ through the point $\left(1, -\frac{1}{2}\right)$.

III. The length and width of a rectangle are 7 inches and 4 inches respectively. Use differentials to **estimate** the new area when the length and width are changed to 7.01 inches and 3.98 inches, respectively.

IV. Use local linear approximation to estimate $\sin\left(\frac{\pi}{5.99}\right)$. Leave your answer in terms of π.

V. Aaron stands atop a building. Crazy as he is, he tosses his iPad upwards such that its height at any given time t is $h(t) = -16t^2 + 64t + 36$ feet from the ground.

1. Determine $v(t)$, the velocity of the iPad at any given time t.
2. Determine $a(t)$, the acceleration of the iPad at any given time t.
3. At what time does the iPad reach its maximum height?
4. What is the maximum height attained by the iPad?
5. With what speed does the iPad hit the ground?
6. At what time interval/s is the iPad slowing down?
7. How tall is the building?
8. With what initial velocity did Aaron throw his iPad?

VI. The equivalent resistance, R, of two resistors connected in parallel satisfy the equation

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

where R_1 and R_2 are the individual resistance of the two resistors. If R_1 and R_2 are increasing at rates 8Ω per second and 16Ω per second respectively, how fast is R increasing when $R_1 = 4\Omega$ and $R_2 = 12\Omega$?

END OF EXAM

TOTAL: 12 POINTS

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