Math 124 C - Spring 2010
Mid-Term Exam Number Two
May 18, 2010

Name: _____ Student ID no. : _____

Signature: _____ Section: _____

1	10	
2	10	
3	15	
4	10	
5	10	
6	20	
Total	75	

- Complete all questions.
- You may use a scientific calculator during this examination; graphing calculators and other electronic devices are not allowed and should be turned off for the duration of the exam.
- If you use trial-and-error, a guess-and-check method, or numerical approximation when an exact method is available, you will not receive full credit.
- You may use one double-sided, hand-written, 8.5 by 11 inch page of notes.
- Show all work for full credit.
- You have 80 minutes to complete the exam.

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1. Let $f(x) = \cos(x)$.

   (a) Find the linearization of $f(x)$ at $a = \frac{\pi}{4}$.

   (b) Use the linearization to give an approximation of $\cos(43^\circ)$.

2. Give the equation of the tangent line to the curve

$$x^3 + y + xy^3 = 65$$

at the point $(2, 3)$.

3. For each of the following, determine $\dfrac{dy}{dx}$. Please do not simplify your results.

(a) $y = x^{\cos x}$

(b) $y = x \tan^{-1}\left(\dfrac{1}{x}\right)$

(c) $x^y = y^x$

4. The volume V of a cylinder with radius r and height h is given by

$$V = \pi r^2 h.$$

A cylinder is growing so that its radius is increasing at the rate of 2 cm per minute and its height is shrinking at the rate of 3 cm per minute.

How fast is the volume of the cylinder changing at the instant that its height is 80 cm and its radius is 50 cm?

5. A man walks away from a street light mounted at the end of a 10 meter high pole. The man walks at the rate of 1 meter/sec. Due to radiation exposure, the man's height is increasing at the rate of 0.01 meter/sec. At the instant the man is 12 meters from the pole, the man is 2 meters tall.

   How fast is the length of the man's shadow changing at that instant?

6. An object is moving in the plane with location at time t seconds given by the parametric equations

$$x(t) = 3\cos(2t),\ y(t) = 5\sin(2t).$$

(a) The object is moving around an ellipse with equation $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ with $a > 0$ and $b > 0$. Give the values of a and b.

(b) What is the horizontal velocity of the object at time $t = 1$?

(c) What is the vertical velocity of the object at time $t = 2$?

(d) Give a time t when the horizontal and vertical velocities of the object are equal.