

APPM 1340 — Exam #3 — December 3, 2008

On the front of your bluebook print (1) your name, (2) your student ID number, and (3) a grading table. **Explain all of your answers.** A correct answer with no supporting work may receive no credit while an incorrect answer with some correct work may receive partial credit. The exam is out of 100 points but there are 110 available points so it is possible to earn up to 10 extra credit points. No electronic devices of any kind (e.g. cell phones, calculators, etc.) are permitted.

1. (30 points) For each of the following equations find  $\frac{dy}{dx}$  and the slope of line tangent to the curve at the given point.

(a)  $x^{3/2} + 2y^{3/2} = 17$ ,  $(1, 4)$

(b)  $y^4 = y^2 - x^2$ ,  $(\frac{\sqrt{3}}{4}, \frac{\sqrt{3}}{2})$

(c)  $x^2 \cos^2 y - \sin y = 0$ ,  $(0, \pi)$

2. (30 points)

(a) State the Mean Value Theorem and provide a sketch to illustrate both its hypotheses and conclusion.

(b) Find the value of  $c$  that satisfies the conclusion of the Mean Value Theorem for the function  $f(x) = \sqrt{2x-1}$  on the interval  $[1, 3]$ .

(c) Show that  $f(x) = x^3 + 2x$  has no local maximum or minimum values anywhere on  $(-\infty, \infty)$ .

3. (20 points) Use first and second derivatives to graph each of the following equations. Include the coordinates of any local extreme points or inflection points.

(a)  $y = x^{2/3}$

(b)  $y = x^4 + 2x^3$

4. (30 points) Malcolm is standing in a meadow when he suddenly spots a baby velociraptor to the south and its mother to the west. Malcolm stands frozen in place as the two raptors begin to run toward him. The baby raptor runs at a constant speed of 10 m/sec. At the moment the baby is 50 m from Malcolm, the distance between the raptors is 130 m and decreasing at a rate of 26 m/sec.

(a) At what speed is the mommy raptor moving then?

(b) At what rate is the angle  $\theta$  changing at this moment? (See diagram.) Express your answer in radians per second.

(c) If the raptors maintain their speeds, which will reach Malcolm first? Justify your answer.

