

**INSTRUCTIONS:** Books, notes, and electronic devices are not permitted. Write (1) **your name**, (2) **1350/EXAM 2**, (3) **lecture number/instructor name** and (4) **FALL 2013** on the front of your blue-book. Also make a **grading table** with room for 5 problems and a total score. **Start each problem on a new page.** **Box** your answers. A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit. **SHOW ALL WORK**

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1. The following parts are not related:

(a) (12 pts) Find  $y'$  given:

$$(i) y = \frac{x}{\sqrt{1-x}} \quad (ii) y = \sec(x^2 - 1) - x \tan(x) \quad (iii) (x^2 + y^2)^2 = 2x^2 - 2y^2$$

(b) (8 pts) Let  $f(x)$  be a function such that  $f(2x+1) - xf(2x) = 0$  and  $f'(1) = f''(1) = 4$ . Find  $f''(2)$ .

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2. The following parts are not related:

(a) (10 pts) When a certain polyatomic gas undergoes adiabatic expansion, its pressure,  $P$ , and volume,  $V$ , satisfy the equation  $PV^{1.3} = k$ , where  $k$  is a constant. Find the relationship between the related rates  $dP/dt$  and  $dV/dt$ . (In other words find  $dP/dt$  in terms of  $dV/dt$ ,  $P$ , and  $V$ .)

(b) (10 pts) A particle is moving to the left along the line  $y = 3$ . When  $x = -4$ , the  $x$ -coordinate of the particle's position is decreasing at the rate of 0.5 cm/sec. At what rate is the distance of the particle from the origin changing at this moment?

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3. The following parts are not related:

(a) (10 pts) One leg of a right triangle is known to have length 4 cm. The other leg is measured to be 3 cm with a maximum error of +0.1 cm. Use differentials to estimate the maximum error in the calculation of the angle  $\theta$  between the measured leg and the hypotenuse.

(b) (10 pts) If possible, find all numbers  $c$  in the interval  $[0.5, 2]$  that satisfy the conclusion of the Mean Value Theorem for the function  $f(x) = \frac{x+1}{x}$ , justify your answer.

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**PROBLEMS #4 AND #5 ON THE OTHER SIDE**

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4. The following parts are **not related**:

(a) (10 pts) Find all local extrema of  $y = x\sqrt{1-x^4}$  on the interval  $(-1, 1)$ , justify your answer without graphing the function. (Just give the  $x$ -value of the extrema, if any.)

(b) (10 pts) In your blue book clearly sketch the graph of a function  $f(x)$  that satisfies the following properties (label any extrema, inflection points or asymptotes):

- $f'(x) > 0$  if  $|x| < 2$
- $f'(x) < 0$  if  $|x| > 2$
- $f'(-2) = 0$
- $\lim_{x \rightarrow 2} |f'(x)| = +\infty$
- $f''(x) > 0$  if  $x \neq 2$

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5. (20 pts, 4 ea.) Answer either **Always True** or **False**. Do NOT justify your answer. Do NOT abbreviate your answer.

- (a) Using a linearization of  $\sqrt{x}$  at  $a = 4$ , we can estimate  $\sqrt{3.6} \approx 1.06$ .
- (b) If  $f(x)$  is continuous on  $(a, b)$ , then  $f(x)$  attains an absolute maximum value  $f(c)$  and an absolute minimum value  $f(d)$  at some points  $c$  and  $d$  in  $(a, b)$ .
- (c) If  $m(x)$  is differentiable for all  $x$  then  $m'(x)$  is continuous.
- (d) If  $k(x) = \lim_{t \rightarrow x} \frac{\sec(t) - \sec(x)}{t - x}$ , then  $k(\pi/4) = \sqrt{2}$
- (e) If  $b(x)$  is differentiable and  $b(-1) = b(1)$ , then there is a number  $c$  such that  $|c| < 1$  and  $b'(c) = 0$ .
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THE LIST OF APPM 1350 LECTURE NUMBERS/INSTRUCTOR NAMES FOR THE FRONT OF YOUR BLUE BOOK:

Lecture #	Time	Location	Instructor
100	8-8:50	BESC 180	Sujeet BHAT
200	9-9:50	ECCR 200	Ryan CROKE
300	12-12:50	ECCR 200	Chris KETELSEN
400	1-1:50	ECCR 1B40	Murray COX
500	2-2:50	ECCR 265	Chris KETELSEN
600	1-1:50	ANDS N103	Sujeet BHAT
700	3-3:50	FLMG 154	Ryan CROKE

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