

**MATH 151, FALL 2009  
COMMON EXAM III - VERSION B**

LAST NAME, First name (print): \_\_\_\_\_

INSTRUCTOR: \_\_\_\_\_

SECTION NUMBER: \_\_\_\_\_

UIN: \_\_\_\_\_

SEAT NUMBER: \_\_\_\_\_

**DIRECTIONS:**

1. The use of a calculator, laptop or computer is prohibited.
2. In Part 1 (Problems 1-12), mark the correct choice on your ScanTron using a No. 2 pencil. *For your own records, also record your choices on your exam!*
3. In Part 2 (Problems 12-17), present your solutions in the space provided. *Show all your work* neatly and concisely and *clearly indicate your final answer*. You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.
4. Be sure to *write your name, section number and version letter of the exam on the ScanTron form*.

THE AGGIE CODE OF HONOR

**“An Aggie does not lie, cheat or steal, or tolerate those who do.”**

Signature: \_\_\_\_\_

**DO NOT WRITE BELOW!**

Question	Points Awarded	Points
1-12		48
13		11
14		11
15		10
16		10
17		10
		100

PART I: Multiple Choice

1. (4 pts)  $\lim_{x \rightarrow 0} \frac{x - \arcsin(4x)}{x + \arctan x} =$

- (a) 0
- (b)  $\frac{1}{2}$
- (c)  $-\frac{1}{2}$
- (d)  $-\frac{3}{2}$
- (e)  $\infty$

2. (4 pts) Find all critical numbers for  $f(x) = x \ln x$ .

- (a)  $x = \frac{1}{e}$
- (b)  $x = 0$
- (c)  $x = e$
- (d)  $x = 0$  and  $x = e$
- (e)  $x = \frac{1}{e}$  and  $x = 0$ .

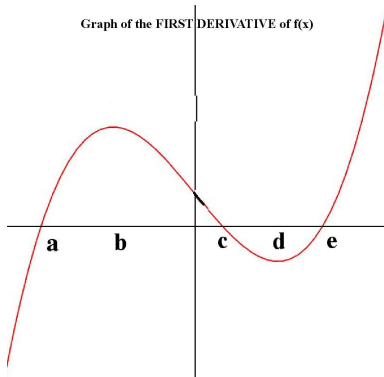
3. (4 pts) Find  $f(\pi)$  if  $f'(x) = 3 \cos x - 5 \sin x$  and  $f(0) = 4$ .

- (a)  $f(\pi) = -6$
- (b)  $f(\pi) = -5$
- (c)  $f(\pi) = -4$
- (d)  $f(\pi) = -3$
- (e)  $f(\pi) = -2$

4. (4 pts)  $\arctan\left(\tan\frac{4\pi}{3}\right) =$

- (a)  $\frac{4\pi}{3}$
- (b)  $\frac{2\pi}{3}$
- (c)  $\frac{\pi}{3}$
- (d)  $\frac{5\pi}{3}$
- (e)  $-\frac{\pi}{3}$

5. (4 pts) Given the graph of the derivative,  $f'(x)$ , of a function  $f(x)$  below, where is the graph of  $f(x)$  concave up?



- (a)  $(0, \infty)$
- (b)  $(-\infty, b) \cup (d, \infty)$
- (c)  $(a, c) \cup (e, \infty)$
- (d)  $(-\infty, 0)$
- (e)  $(b, d)$

6. (4 pts) Find  $\frac{dy}{dx}$  for  $y = x^{\sin x}$ .

- (a)  $\frac{dy}{dx} = \cos x(\ln x)x^{\sin x}$
- (b)  $\frac{dy}{dx} = \cos x \ln x + \frac{\sin x}{x}$
- (c)  $\frac{dy}{dx} = x^{\sin x} \left( -\cos x \ln x + \frac{\sin x}{x} \right)$
- (d)  $\frac{dy}{dx} = x^{\sin x} \left( \cos x \ln x + \frac{\sin x}{x} \right)$
- (e)  $\frac{dy}{dx} = (\sin x)x^{\sin x - 1}$

7. (4 pts) If  $\sum_{i=1}^4 a_i = 3$  and  $\sum_{i=1}^4 b_i = -2$ , find  $\sum_{i=1}^4 (a_i + 2b_i + 2)$

- (a)  $-3$
- (b)  $-1$
- (c)  $3$
- (d)  $1$
- (e)  $7$

8. (4 pts) Find the absolute maximum for  $f(x) = x^3 - 12x + 1$  on the interval  $[1, 3]$ .

- (a)  $-10$
- (b)  $17$
- (c)  $-8$
- (d)  $-15$
- (e)  $0$

9. (4 pts) If  $f(x) = \ln(\arctan x)$ , then  $f'(1) =$

- (a)  $\ln \frac{1}{2}$
- (b)  $\frac{4}{\pi}$
- (c)  $\frac{1}{8\pi}$
- (d)  $\ln \frac{4}{\pi}$
- (e)  $\frac{2}{\pi}$

10. (4 pts) Where is  $f(x) = xe^{3x}$  increasing?

- (a)  $(-\infty, \infty)$
- (b)  $(-\frac{1}{3}, \infty)$
- (c)  $(-\infty, -\frac{1}{3})$
- (d)  $(-3, \infty)$
- (e)  $(-\infty, -3)$

11. (4 pts) Find the  $x$  coordinate of the inflection point(s) for  $f(x) = x^4 - 6x^2$ .

- (a)  $x = 0$  and  $x = \pm\sqrt{3}$
- (b)  $x = 1$
- (c)  $x = \pm\sqrt{3}$
- (d)  $x = \pm 1$
- (e)  $x = -1$

12. (4 pts)  $\sin(\arctan x) =$

- (a)  $\frac{1}{\sqrt{1+x^2}}$
- (b)  $\frac{x}{\sqrt{1-x^2}}$
- (c)  $\frac{\sqrt{1-x^2}}{x}$
- (d)  $\frac{1}{1+x^2}$
- (e)  $\frac{x}{\sqrt{1+x^2}}$

## PART II WORK OUT

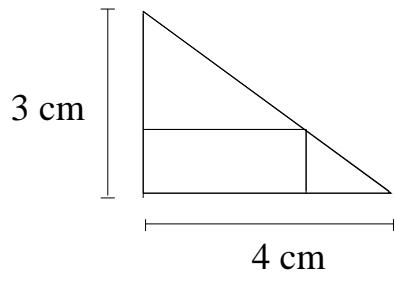
**Directions:** Present your solutions in the space provided. *Show all your work* neatly and concisely and *Box your final answer*. You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.

13. (11 pts) Solve for  $x$ :  $\log_4(x^2 - 16) - \log_4(1 - 2x) = 1$

14. (11 pts) Find  $\lim_{x \rightarrow \infty} (e^x + x)^{1/x}$ .

15. (10 pts) Newton's Law of Cooling states the rate of cooling of an object is proportional to the temperature difference between the object and the temperature of the object's surroundings. A pie is taken from an oven where its temperature has reached  $375^\circ\text{F}$  and is placed on a table in a room where the temperature is  $75^\circ\text{F}$ . If the temperature of the pie is  $200^\circ\text{F}$  after 30 minutes, find a formula for the temperature of the pie at time  $t$ , where  $t$  is measured in minutes.

16. (10 pts) Find the area of the largest rectangle that can be inscribed in a right triangle with legs of length 3 cm and 4 cm if two sides of the rectangle lie along the legs.



17. (10 pts) Approximate the area under the graph of  $f(x) = x^2 + 2$ , above the  $x$  axis, from  $x = -2$  to  $x = 6$  using 4 subintervals of equal width and left endpoints. Simplify your answer.