

**MATH 151, FALL 2008
COMMON EXAM III - VERSION A**

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 13-17), 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		10
14		10
15		8
16		12
17		12
Total		100

PART I: Multiple Choice

1. (4 pts) Find $\lim_{x \rightarrow 0} \frac{2^x - 5^x}{x}$

- (a) 0
- (b) ∞
- (c) 1
- (d) $\ln \frac{2}{5}$
- (e) $\ln(10)$

2. (4 pts) A population of bacteria triples every 5 minutes. If the population follows the exponential growth model, $y = y_0 e^{kt}$, find k .

- (a) $\frac{\ln 2}{5}$
- (b) 3
- (c) 5
- (d) $\frac{\ln 3}{5}$
- (e) Insufficient information

3. (4 pts) Find $f'(e)$ for $f(x) = \ln(x + \ln x)$.

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

4. (4 pts) If $f'(x) = 3 \cos x + 5 \sin x$ and $f(0) = 4$, find $f(\pi)$.

- (a) -6
- (b) 4
- (c) 14
- (d) 2
- (e) -7

5. (4 pts) Evaluate $\int_0^3 \sqrt{9-x^2} dx$ by interpreting the definite integral in terms of area.

- (a) $\frac{3\pi}{4}$
- (b) $\frac{9\pi}{2}$
- (c) $\frac{3\pi}{2}$
- (d) 3π
- (e) $\frac{9\pi}{4}$

6. (4 pts) $\int_1^4 \left(\sqrt{x} + \frac{1}{\sqrt{x}} \right)^2 dx =$

- (a) $\frac{42}{3}$
- (b) $\frac{13}{4}$
- (c) $\frac{27}{2} + \ln 4$
- (d) $\frac{15}{2} + \ln 4$
- (e) None of these.

7. (4 pts) $\lim_{x \rightarrow \infty} \arccos\left(\frac{1-x}{2x+3}\right) =$

- (a) $\frac{\pi}{3}$
- (b) $\frac{\pi}{6}$
- (c) $\frac{2\pi}{3}$
- (d) $\frac{5\pi}{6}$
- (e) $-\frac{\pi}{3}$

8. (4 pts) The critical numbers for $f(x) = \sqrt[3]{x^2 - 2x}$ are

- (a) $x = 1$ only
- (b) $x = 1, x = 0$ and $x = 2$ only
- (c) $x = 0$ and $x = 2$ only
- (d) $x = 0$ and $x = 1$ only
- (e) $x = 2$ only

9. (4 pts) Find the absolute extrema for $f(x) = x^3 - 12x + 1$ on $[-3, 0]$.

- (a) absolute maximum: 17; absolute minimum: -15
- (b) absolute maximum: 10; absolute minimum: 1
- (c) absolute maximum: 10; absolute minimum: -15
- (d) absolute maximum: 17; absolute minimum: 1
- (e) There is no absolute extrema.

10. (4 pts) $f(x) = x^2e^x$ has:

- (a) A local minimum $x = 0$ and no local maximum.
- (b) A local maximum at $x = 2$ and a local minimum at $x = 0$.
- (c) A local maximum at $x = -2$ and a local minimum at $x = 0$.
- (d) A local maximum at $x = -2$ and no local minimum.
- (e) A local maximum at $x = 2$ and no local minimum.

11. (4 pts) Use the midpoint rule with $n = 4$ to approximate $\int_1^2 \ln x \, dx$

- (a) $\ln \frac{9}{8} + \ln \frac{11}{8} + \ln \frac{13}{8} + \ln \frac{15}{8}$
- (b) $\frac{1}{2} \left(\ln \frac{5}{4} + \ln \frac{7}{4} + \ln \frac{9}{4} + \ln \frac{11}{4} \right)$
- (c) $\ln \frac{5}{4} + \ln \frac{7}{4} + \ln \frac{9}{4} + \ln \frac{11}{4}$
- (d) $\frac{1}{4} \left(\ln \frac{9}{8} + \ln \frac{11}{8} + \ln \frac{13}{8} + \ln \frac{15}{8} \right)$
- (e) $\frac{1}{2} \left(\ln \frac{9}{8} + \ln \frac{11}{8} + \ln \frac{13}{8} + \ln \frac{15}{8} \right)$

12. (4 pts) $\frac{d}{dx} \int_1^{\ln x} \frac{dt}{\sqrt{t^3 + t}} =$

- (a) $\frac{1}{\sqrt{(\ln x)^3 + \ln x}}$
- (b) $\frac{2\sqrt{(\ln x)^3 + \ln x}}{x}$
- (c) $\frac{1}{x\sqrt{(\ln x)^3 + \ln x}}$
- (d) $6x^2\sqrt{(\ln x)^3 + \ln x}$
- (e) $2\sqrt{(\ln x)^3 + \ln x}$

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. (10 pts) Find $\lim_{x \rightarrow \infty} \left(1 - \frac{2}{x}\right)^x$.

14. (a) (4 pts) $\sin\left(\arccos\left(\frac{4}{5}\right)\right) =$

(b) (6 pts) Find the derivative of $f(x) = \arctan(\arcsin x)$.

15. (8 pts) Suppose a particle is moving with acceleration $\mathbf{a}(t) = \langle 1, 2t \rangle$, initial velocity $\mathbf{v}(0) = \langle 1, -1 \rangle$ and initial position $\mathbf{s}(0) = \langle 0, 1 \rangle$. Find the position, $\mathbf{s}(t)$, at time t .

16. (12 pts) Suppose 36 square feet of material is available to make a box with a closed top. The length of the base is 3 times the width. What are the dimensions of the box that maximizes the volume? Justify ALL steps.

Exam continues on next page

17. If $f(x) = x^4 - 6x^2 + 4$:

(i) (5 pts) Find the intervals where f is increasing and decreasing.

(ii) (5 pts) Find the intervals where f is concave up and concave down.

(iii) (2 pts) Find the inflection points of f .

End of Exam