

**MATH 151, FALL 2005
COMMON EXAM I - VERSION A**

NAME (print): _____

INSTRUCTOR: _____

SECTION NUMBER: _____

UIN: _____

DIRECTIONS:

1. The use of a calculator, laptop or computer is prohibited.
2. In Part 1 (Problems 1-13), mark the correct choice on your ScanTron form No. 815-E using a No. 2 pencil. *For your own records, also record your choices on your exam!* ScanTrons will be collected from all examinees after 90 minutes and will not be returned.
3. In Part 2 (Problems 14-18), 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
1-13		52
14		14
15		9
16		6
17		15
18		6
		102

PART I

1. (4 pts) Find a vector that is perpendicular to $\mathbf{a} = \langle 1, 2 \rangle$.

- (a) $\langle -2, 1 \rangle$
- (b) $\langle -1, 2 \rangle$
- (c) $\langle 1, 1 \rangle$
- (d) $\langle -1, 1 \rangle$
- (e) $\langle 2, 1 \rangle$

2. (4 pts) If $f(x) = x^2 + x$, then $f(f(x)) =$

- (a) $x^4 + 2x^3 + x^2 + x$
- (b) $x^4 + 2x^3 + 2x^2 + x$
- (c) $x^4 + x^3 + x^2 + x$
- (d) $2x^4 + 2x^3 + 2x^2 + x + 1$
- (e) $x^4 + 4x^3 + 2x^2 + 2x$

3. (4 pts) If θ is the angle between the vectors $\mathbf{F} = \langle 1, 2 \rangle$ and $\mathbf{D} = \langle -3, 4 \rangle$, then $\cos(\theta) =$

(a) $\frac{1}{\sqrt{5}}$

(b) $\frac{1}{4}$

(c) $\frac{2}{\sqrt{3}}$

(d) $\frac{1}{\sqrt{2}}$

(e) 1

4. (4 pts) A line is given by the parametric equations $x = 2 + 3t$, $y = 4 + 12t$. Find the slope of this line.

(a) $-\frac{1}{4}$

(b) $\frac{1}{4}$

(c) -4

(d) 4

(e) 36

5. (4 pts) Consider the function $g(x) = x^3 - 6x + 5$. Which of these intervals must contain the solution of $g(x) = 12$?

- (a) $[-2, 1]$
- (b) $[-1, 0]$
- (c) $[0, 1]$
- (d) $[1, 2]$
- (e) $[2, 3]$

6. (4 pts) $\lim_{x \rightarrow 2} \frac{3x^2 - 12}{x - 2} =$

- (a) 0
- (b) 1
- (c) 8
- (d) 12
- (e) ∞

7. (4 pts) Find the equation of the tangent line to the curve $y = x^3 - x$ at the point $(2, 6)$.

(a) $y = 3x^2 - 1$

(b) $y = -5x + 16$

(c) $y = 5x - 4$

(d) $y = -11x + 28$

(e) $y = 11x - 16$

8. (4 pts) If $f(x) = x^4 - x^3 + 2x + 1$, then $f'(x) =$

(a) $\frac{x^5}{5} - \frac{x^4}{4} + x^2 + x$

(b) $x^4 - 3x^2 + 2$

(c) $4x^3 - x^3 + 2$

(d) $4x^3 - 3x^2 + 2$

(e) $x^5 - x^4 + 2x^2 + x$

9. (4 pts) Find the domain of the vector function $\mathbf{F}(t) = \left\langle \frac{1}{\sqrt{2t-10}}, 2t-10 \right\rangle$.

- (a) $\{t \mid t > -5\}$
- (b) $\{t \mid t \geq 5\}$
- (c) $\{t \mid t > 5\}$
- (d) $\{t \mid t \geq 6\}$
- (e) $\{t \mid t > 6\}$

10. (4 pts) $\lim_{h \rightarrow 0} \frac{\sqrt{4+h} - 2}{h} =$

- (a) 1
- (b) $\frac{1}{4}$
- (c) 0
- (d) -1
- (e) ∞

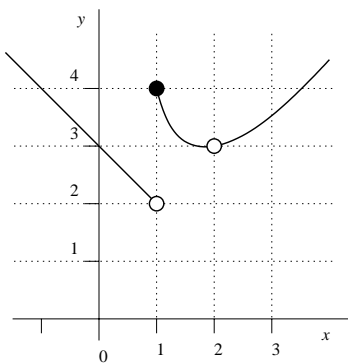
11. (4 pts) The vertical asymptotes of $f(x) = \frac{x-1}{x^2-4x+3}$ are located at

- (a) $x = 1$ and $x = 3$.
- (b) $x = 1$ and $x = -3$.
- (c) only $x = 1$.
- (d) only $x = 3$.
- (e) only $x = -3$.

12. (4 pts) Find the horizontal asymptotes of $f(x) = \frac{x-5}{\sqrt{9x^2+2}}$.

- (a) $y = \frac{1}{3}$ and $y = 0$.
- (b) $y = -\frac{1}{3}$ and $y = \frac{1}{3}$.
- (c) only $y = 0$.
- (d) only $y = \frac{1}{3}$.
- (e) only $y = -\frac{1}{3}$.

13. (4 pts) Here is the graph of a function $f(x)$.



Which of the following is *false*?

- (a) $f(x)$ is discontinuous on the interval $(1, 3)$.
- (b) $f(x)$ is continuous from the right at $x = 1$.
- (c) $\lim_{x \rightarrow 2} f(x)$ does not exist.
- (d) $\lim_{x \rightarrow 1^-} f(x) = 2$.
- (e) $f(1) = 4$.

PART II

14. Find $f'(x)$ for the following functions. Don't simplify!

(a) (7 pts) $f(x) = (x^2 + x + 7)(x^3 + 2x^2 + 3x + 1)$

(b) (7 pts) $f(x) = \frac{x^2 - 1}{x^2 + 4x}$

15. (a) (3 pts) Write the definition of $f'(x)$ as a limit.

(b) (6 pts) Use *only* the definition to find $f'(x)$ for $f(x) = \frac{1}{3x+2}$. (No credit will be given for using any other method, correct answer notwithstanding.)

16. (6 pts) Let $\mathbf{a} = \langle 1, 3 \rangle$ and $\mathbf{b} = \langle 1, 1 \rangle$. Find $\text{proj}_{\mathbf{a}}\mathbf{b}$, the *vector* projection of \mathbf{b} onto \mathbf{a} .

17. The displacement (in meters) of a particle moving along a horizontal line is given by $s(t) = t^2 - 8t + 18$, where t is measured in seconds.

(a) (3 pts) Find the average velocity on the time interval $[3, 4]$.

(b) (3 pts) Find the instantaneous velocity when $t = 3$.

(c) (3 pts) When is the particle at rest?

PROBLEM CONTINUES ON NEXT PAGE

(d) (3 pts) Find all values of t for which the particle is moving to the right.

(e) (3 pts) Find the total distance traveled by the particle on the time interval $[0, 5]$.

18. (6pts) Find the value of a for which the function

$$f(x) = \begin{cases} -2x + a, & \text{if } x < 2 \\ ax^2, & \text{if } x \geq 2 \end{cases}$$

is continuous. Explain your reasoning carefully and concisely.