

**MATH 151, SPRING 2010
COMMON EXAM I - 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 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: _____

1. Compute $\lim_{x \rightarrow 2} \frac{x^2 + x - 6}{x^2 - 5x + 6}$.

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

(b) $\frac{1}{5}$

(c) -5

(d) 1

(e) 0

2. Given $f(x) = \begin{cases} 4 - \frac{3}{5}x & \text{if } x < 5 \\ 4 & \text{if } x = 5 \\ -1 + x & \text{if } x > 5 \end{cases}$, which of the following statements is true when $x = 5$?

(a) f is not continuous, but the limit exists.

(b) f is continuous only from the left.

(c) None of the other statements is true.

(d) f is continuous only from the right.

(e) f is continuous.

3. Given $-\frac{1}{3}x + 2 \leq f(x) \leq \frac{3}{x}$ for $0 < x \leq 6$, what is $\lim_{x \rightarrow 3} f(x)$?

(a) Not enough information to answer.

(b) 2

(c) $\frac{1}{2}$

(d) 1

(e) 0

4. The graph of $f(x) = \frac{x^2 - 4}{1 - 9x^2}$ has a horizontal asymptote at which of the following values?

- (a) $-\frac{1}{9}$
- (b) $\frac{1}{3}, -\frac{1}{3}$
- (c) $2, -2$
- (d) $-\frac{1}{4}$
- (e) $\frac{1}{2}, -\frac{1}{2}$

5. The graph of $f(x) = \frac{x^2 - 4}{1 - 9x^2}$ has a vertical asymptote at which of the following values?

- (a) $-\frac{1}{9}$
- (b) $\frac{1}{3}, -\frac{1}{3}$
- (c) $2, -2$
- (d) $-\frac{1}{4}$
- (e) $\frac{1}{2}, -\frac{1}{2}$

6. Which statement is true about the equation $x^5 + x^2 - 2x = 3$?

- (a) It has a solution on $[1, 2]$ by the Squeeze Theorem.
- (b) It has a solution on $[0, 1]$ by the Squeeze Theorem.
- (c) It has a solution on $[1, 2]$ by the Intermediate Value Theorem.
- (d) It has a solution on $[0, 1]$ by the Intermediate Value Theorem.
- (e) It does not have a solution.

7. Given the vectors $\mathbf{a} = -4\mathbf{i} + \mathbf{j}$ and $\mathbf{b} = 3\mathbf{i} + 5\mathbf{j}$, which of the following is a unit vector in the direction of $2\mathbf{a} + \mathbf{b}$?

(a) $\frac{-2}{\sqrt{148}}\mathbf{i} + \frac{12}{\sqrt{148}}\mathbf{j}$

(b) $\frac{-5}{\sqrt{74}}\mathbf{i} + \frac{7}{\sqrt{74}}\mathbf{j}$

(c) $\frac{2}{\sqrt{153}}\mathbf{i} + \frac{11}{\sqrt{153}}\mathbf{j}$

(d) $\frac{-5}{\sqrt{102}}\mathbf{i} + \frac{7}{\sqrt{102}}\mathbf{j}$

(e) $\frac{2}{\sqrt{125}}\mathbf{i} + \frac{11}{\sqrt{125}}\mathbf{j}$

8. Given triangle ABC with vertices $A(-2, 4)$, $B(1, 3)$, and $C(2, 5)$, find the cosine of angle A .

(a) $\frac{11}{\sqrt{170}}$

(b) $\frac{6}{\sqrt{85}}$

(c) $\frac{10}{\sqrt{200}}$

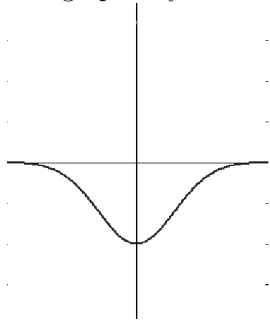
(d) $\frac{56}{\sqrt{580}}$

(e) $\frac{17}{\sqrt{290}}$

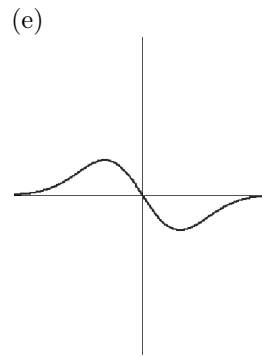
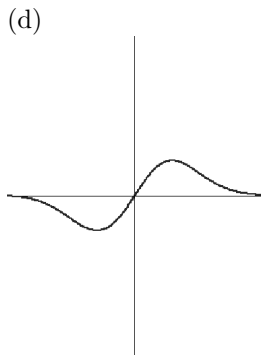
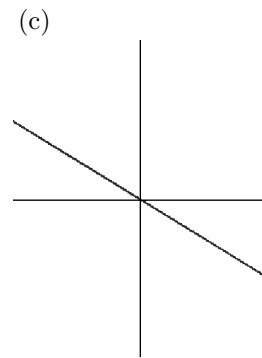
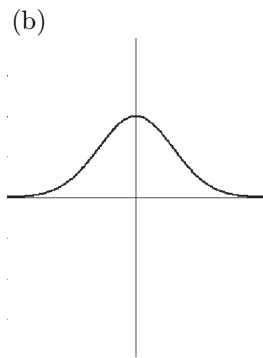
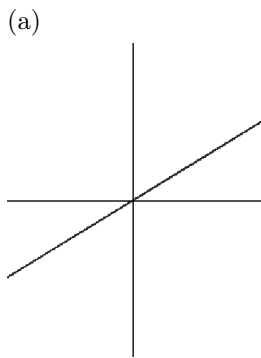
9. $\lim_{x \rightarrow -3^+} \frac{x}{x+3} =$

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

10. The graph of f is shown below.



Which of the following is the graph of f' ?



11. Which of the following give parametric equations of the line which passes through the points $(-1, 1)$ and $(2, 3)$?

(a) $\mathbf{r}(t) = \left\langle \frac{5}{3} + \frac{2}{3}t, t \right\rangle$

(b) $\mathbf{r}(t) = \langle -1 + t, 1 + 4t \rangle$

(c) $\mathbf{r}(t) = \langle -1 + 2t, 1 + 3t \rangle$

(d) $\mathbf{r}(t) = \langle -1 + 3t, 1 + 2t \rangle$

(e) $\mathbf{r}(t) = \langle 5 - 2t, 5 + 3t \rangle$

12. The graph of a function f passes through the point $(2, -4)$. The slope of the line through $(2, -4)$ and $(2 + h, f(2 + h))$ is $3 + 5h + h^2$. Find the equation of the line tangent to f at $x = 2$.

(a) $y = 5x - 14$

(b) $y = 3x - 10$

(c) $y = 17x - 38$

(d) $y = 2x + 5$

(e) $y = 9x - 22$

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 points) Use the limit definition of the derivative to find the derivative of $f(x) = \frac{2}{3+x}$.

14. Given the point $P(-1, 2)$ and the line $\ell : \mathbf{r}(t) = (1 + 4t)\mathbf{i} + (2 - 2t)\mathbf{j}$:

(a) (4 points) Does line ℓ pass through each of the following points? Write “Yes” or “No” in the blank (Do NOT abbreviate!).

$(1, 2)$. _____ $(4, -2)$. _____

$(-2, -1)$. _____ $(5, 0)$. _____

(b) (4 points) Let Q be one of the points above through which ℓ does pass. Find the vector \mathbf{b} which starts at Q and ends at P .

(c) (4 points) Find a vector \mathbf{a} which is orthogonal to ℓ .

(d) (5 points) Find the distance from P to ℓ .

15. (10 points) Compute $\lim_{x \rightarrow \infty} \frac{1}{\sqrt{x^2 - 3x + 2} - x}$.

16. (10 points) A woman walks due west on a ship at 4 mph. The ship is moving $N30^\circ W$ (30 degrees west of north) at 20 mph. Find the speed of the woman relative to the water. (NOTE: your final answer does not need to be simplified, but all trigonometric expressions which can be evaluated must be).

17. (10 points) Find the values of c and K which make $f(x) = \begin{cases} cx^2 + 4x & \text{if } x < 3 \\ K & \text{if } x = 3 \\ x^3 + cx + 1 & \text{if } x > 3 \end{cases}$ continuous at $x = 3$.

DO NOT WRITE BELOW!

| Question | Points Awarded | Points |
|--------------|----------------|--------|
| 1-12 | | 48 |
| 13 | | 10 |
| 14 | | 17 |
| 15 | | 10 |
| 16 | | 10 |
| 17 | | 10 |
| TOTAL | | 105 |