

**MATH 151, SPRING 2011
COMMON EXAM I - 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 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: _____

DO NOT WRITE BELOW!

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

1. Which of the following points is not on the curve parametrized by $x = \sqrt{t}$, $y = 1 - t$?

- (a) $(2, -3)$
- (b) $(0, 1)$
- (c) $(-1, 0)$
- (d) More than one of the points is not on the curve.
- (e) $(1, 0)$

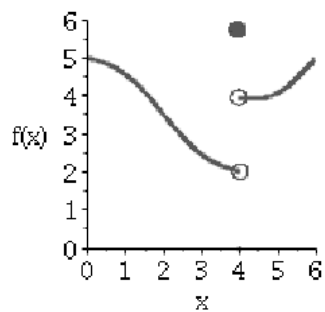
2. Which of the following is equivalent to $\frac{\cos x}{1 - \sin x}$?

- (a) $\sec x + \tan x$
- (b) $\cos x - \cot x$
- (c) $\cos x + \cot x$
- (d) $\sec x - \tan x$
- (e) $\frac{1}{1 + \tan x}$

3. Compute $\lim_{x \rightarrow \infty} \frac{\cos x}{x}$.

- (a) 0
- (b) Limit does not exist
- (c) $\frac{\pi}{2}$
- (d) 1
- (e) -1

4. The graph of a function f is shown below. What is $\lim_{x \rightarrow 4^-} f(x)$?



- (a) 4
- (b) 2
- (c) 3
- (d) 6
- (e) Limit does not exist

5. Which statement is true about the equation $x^3 - x^2 + x = 10$?

- (a) It has a solution on $[0, 1]$ by the Intermediate Value Theorem.
- (b) It has a solution on $[2, 3]$ by the Intermediate Value Theorem.
- (c) It does not have a solution.
- (d) It has a solution on $[2, 3]$ by the Squeeze Theorem.
- (e) It has a solution on $[0, 1]$ by the Squeeze Theorem.

6. Vector \mathbf{a} starts at the point $(3, -1)$ and ends at the point $(6, 3)$. Which of the following is a unit vector in the direction of \mathbf{a} ?

- (a) $\left\langle \frac{3}{\sqrt{13}}, \frac{2}{\sqrt{13}} \right\rangle$
- (b) $3\mathbf{i} + 4\mathbf{j}$
- (c) $\left\langle \frac{3}{5}, \frac{4}{5} \right\rangle$
- (d) $9\mathbf{i} + 2\mathbf{j}$
- (e) $\left\langle \frac{9}{\sqrt{85}}, \frac{2}{\sqrt{85}} \right\rangle$

7. Let $f(x) = \begin{cases} 6 - x & \text{if } x < 5 \\ 2 & \text{if } x = 5 \\ -8 + 2x & \text{if } x > 5 \end{cases}$. Which of the following statements is true?

- (a) None of the other statements is true.
- (b) f is continuous only from the left at $x = 5$.
- (c) f is not continuous at $x = 5$, but the $\lim_{x \rightarrow 5} f(x)$ exists.
- (d) f is continuous only from the right at $x = 5$.
- (e) f is continuous at $x = 5$.

8. Find the horizontal asymptote of $f(x) = \frac{3x - 8}{4x + 9}$.

- (a) $y = \frac{8}{3}$
- (b) $y = \frac{3}{4}$
- (c) $y = -\frac{9}{4}$
- (d) $y = -\frac{8}{9}$
- (e) $y = \frac{4}{3}$

9. A 30-lb block on wheels is at the top of a 20 foot long ramp which is inclined at an angle of 30° above the horizontal. Assuming no friction, find the work done by gravity if the block slides all the way down the ramp.

- (a) $300\sqrt{3}$ ft-lbs
- (b) 600 ft-lbs
- (c) $300\sqrt{2}$ ft-lbs
- (d) 5,880 ft-lbs
- (e) 300 ft-lbs

10. Given $f(3) = 4$ and the slope of the line which passes through the points $(3, f(3))$ and $(3 + h, f(3 + h))$ is $h^2 - 4h + 7$, what is the equation of the line tangent to f at $x = 3$?

- (a) $y = 4x - 8$
- (b) $y = 7x - 17$
- (c) $y = 2x - 2$
- (d) $y = 2x - 4$
- (e) Not enough information

11. Compute $\lim_{x \rightarrow 6} \frac{x^2 - 6x}{x - 6}$.

- (a) 1
- (b) Does not exist
- (c) 12
- (d) 0
- (e) 6

12. Which of the following functions is continuous, but not differentiable at $x = 0$?

- (a) $f(x) = x^2$
- (b) None of these
- (c) $f(x) = \frac{1}{x}$
- (d) $f(x) = \frac{|x|}{x}$
- (e) $f(x) = \sqrt[3]{x}$

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 points) Use the limit definition of the derivative to find $f'(1)$ given $f(x) = \sqrt{2 + 3x}$.

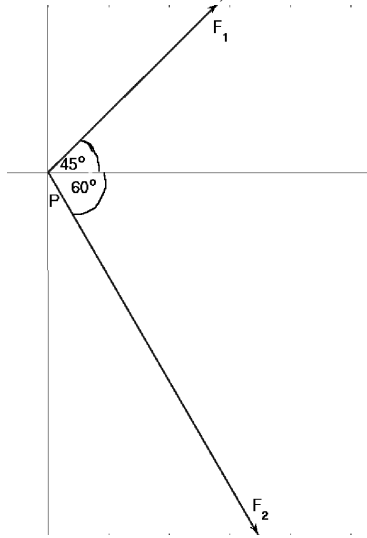
14. Let $\mathbf{m} = \langle 1, 1 \rangle$ and $\mathbf{n} = \langle 4, 2 \rangle$:

(a) (6 points) Find the orthogonal projection of \mathbf{m} onto \mathbf{n} , which is defined as $\text{orth}_{\mathbf{n}}\mathbf{m} = \mathbf{m} - \text{proj}_{\mathbf{n}}\mathbf{m}$.

(b) (6 points) Find the distance from the point $(1, 1)$ to the line parametrized by $\mathbf{r}(t) = \langle 4t, 2t \rangle$.

15. (10 points) Compute $\lim_{x \rightarrow 2} \frac{\frac{1}{x} - \frac{1}{2}}{x - 2}$.

16. (10 points) Two forces \mathbf{F}_1 and \mathbf{F}_2 with magnitudes 8 N and 14 N, respectively, act on an object at a point P as shown in the figure below. Find the magnitude of the resultant force. (NOTE: your final answer does not need to be simplified, but all trigonometric expressions which can be evaluated must be).



17. (10 points) Find parametric equations for the tangent line to the curve $\mathbf{r}(t) = (5t)\mathbf{i} + (8 - 3t^2)\mathbf{j}$ at the point where $t = 1$. Use the limit definition $\lim_{t \rightarrow a} \frac{1}{t - a}(\mathbf{r}(t) - \mathbf{r}(a))$.