

MAT 265 – Calculus for Engineers-I	Student Name :
Instructor : XXXXXXXXX	Student ID :
Exam # 1 (Form A)	Class Time :
<p><u>Honor Statement</u></p> <p>By signing below I confirm that I have neither given nor received any unauthorized assistance on this exam. This includes any use of a graphing calculator beyond those uses specifically authorized by the School of Mathematical and Statistical Sciences and my instructor. Furthermore, I agree not to discuss this exam with anyone until the exam testing period is over. In addition, my calculator's memory and menus may be checked at any time and cleared by any testing center proctor or School of Mathematical and Statistical Sciences instructor.</p>	
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Signature	Date

Instructions:

1. The exam consists of two parts: multiple choice, worth 70%, and free response (show your work), worth 30%. Please read each problem carefully.
2. There are 14 multiple choice questions worth 5 points each. Please circle your answer choice on the exam AND fill in the answer grid on the last page.
3. Provide complete and well-organized answers in the free response section.
4. Answers in the free response section without supporting work will be given zero credit. Partial credit is granted only if work is shown.
5. No calculators with Qwerty keyboards or ones like the Casio FX-2, TI-89, TI-92, or TI-*n*spire that do symbolic algebra may be used.
6. Proctors reserve the right to check calculators.
7. Please request scratch paper from the testing center staff if you need.
8. The use of cell phones is prohibited. **TURN YOUR CELL PHONE OFF!** Do not allow your cell phone to ring while you are taking the exam. Do not use the calculator on your cell phone. If a proctor sees you using a cell phone, they will take your exam and you will be reported to the Dean of Students for cheating.

PART I – Multiple choice. Choose the response that best completes the statements or answers the question.

Please circle your answer choice on the exam and fill in the answer grid on the last page.

Show your work on the space provided.

- Find the domain of the function $f(x) = \frac{\sqrt{25 - x^2}}{x + 3}$
 - $(-\infty, -3) \cup (3, \infty)$
 - $[-5, -3) \cup (-3, 5]$
 - $(-5, -3) \cup (-3, 5)$
 - $(-\infty, -5) \cup [5, \infty)$
 - None of the others
- Check whether the following function is even, odd, or neither. $f(x) = 5 - 3|x|$.
 - $f(x)$ is even.
 - $f(x)$ is odd.
 - $f(x)$ is neither.
 - $f(x)$ is both.
 - None of the others.
- Given the functions $f(x) = 7x - x^2$ and $g(x) = 4 - 5x$, find and simplify; $(f \circ g)(x)$
 - $12 - 35x - 25x^2$
 - $12 - 35x + 25x^2$
 - $12 - 5x + 25x^2$
 - $12 + 5x - 25x^2$
 - None of the others

Use the function $g(x) = \begin{cases} x^2 + 2x + 11 & \text{if } x < -1 \\ -10 \cos(\pi x) & \text{if } -1 < x < 2 \\ 3x - 6 & \text{if } x \geq 2 \end{cases}$ to find the limits in questions 4 and 5.

- Consider $\lim_{x \rightarrow -1} g(x)$, which of the following is true? (DNE means does not exist)
 - $\lim_{x \rightarrow -1^-} g(x) = 10, \lim_{x \rightarrow -1^+} g(x) = 10, \lim_{x \rightarrow -1} g(x) = 10$
 - $\lim_{x \rightarrow -1^-} g(x) = 10, \lim_{x \rightarrow -1^+} g(x) = 10, \lim_{x \rightarrow -1} g(x) = 10$
 - $\lim_{x \rightarrow -1^-} g(x) = 10, \lim_{x \rightarrow -1^+} g(x) = 10, \lim_{x \rightarrow -1} g(x) = -1$
 - $\lim_{x \rightarrow -1^-} g(x) = 10, \lim_{x \rightarrow -1^+} g(x) = 10, \lim_{x \rightarrow -1} g(x) DNE$
 - None of the others
- Consider $\lim_{x \rightarrow 2} g(x)$, which of the following is true? (DNE means does not exist)
 - $\lim_{x \rightarrow 2^-} g(x) = -10, \lim_{x \rightarrow 2^+} g(x) = 0, \lim_{x \rightarrow 2} g(x) = 0$
 - $\lim_{x \rightarrow 2^-} g(x) = 10, \lim_{x \rightarrow 2^+} g(x) = 0, \lim_{x \rightarrow 2} g(x) = 10$
 - $\lim_{x \rightarrow 2^-} g(x) = -10, \lim_{x \rightarrow 2^+} g(x) = 0, \lim_{x \rightarrow 2} g(x) DNE$
 - $\lim_{x \rightarrow 2^-} g(x) = 0, \lim_{x \rightarrow 2^+} g(x) = 0, \lim_{x \rightarrow 2} g(x) = 0$
 - None of the others

- Algebraically** calculate the following limit; $\lim_{x \rightarrow -2} \frac{3x^2 + 2x - 8}{x + 2}$.
 - 0
 - 10
 - does not exist.
 - ∞
 - None of the others
- Algebraically** calculate the following limit $\lim_{x \rightarrow 4} \frac{\sqrt{2x+1} - 3}{x - 4}$
 - 1/3
 - 0
 - ∞
 - does not exist.
 - None of the others.

8. Explain **why** the following function is discontinuous at $x = 1$, $f(x) = \begin{cases} 3 - x^2 & \text{if } x \leq 1 \\ 4 + 5x & \text{if } x > 1 \end{cases}$

- A) f is not defined at $x = 1$ B) The graph of f has a hole at $x = 1$ C) $\lim_{x \rightarrow 1} f(x)$ DNE
 B) D) f is a piecewise function E) None of the others

9. Explain **why** the following function is discontinuous at $x = -3$, $f(x) = \begin{cases} 5 + 2x & \text{if } x \neq -3 \\ x + 5 & \text{if } x = -3 \end{cases}$

- A) f is not defined at $x = -3$ B) $\lim_{x \rightarrow -3} f(x)$ DNE C) f has jump discontinuity $x = -3$
 D) $\lim_{x \rightarrow -3} f(x) \neq f(-3)$ E) None of the others

10. For what value of the constant c is the function $f(x) = \begin{cases} cx - 6 & \text{if } x \leq 2 \\ 3x - 2c & \text{if } x > 2 \end{cases}$ continuous on $(-\infty, \infty)$

- A) $c = -3$ B) $c = 3$ C) $c = -2$ D) $c = 2$ E) None of the others

11. Calculate the following limit $\lim_{x \rightarrow -\infty} \frac{4x^2 - 5}{7 - 8x^2}$.

- A) $\frac{1}{2}$ B) $-\infty$ C) does not exist. D) ∞ E) None of the others

12. Calculate the following limit $\lim_{x \rightarrow \infty} \frac{\sqrt{9x^4 - 1}}{5x^2 + 3x - 1}$.

- A) does not exist B) 5 C) $\frac{9}{5}$ D) $\frac{3}{5}$ E) None of the others

13. Use your calculator to graph $f(x) = \sqrt[3]{x-4}$, then explain why f is not differentiable at $x = 4$

- A) At $x = 4$ the tangent line to the graph of f is vertical.
 B) At $x = 4$ the tangent line to the graph of f is horizontal.
 C) The function is not defined at $x = 4$.
 D) The function is not continuous at $x = 4$.
 E) None of the others

14. Let $h(x) = 5g(x) - 3x^2 + 2 \sin(x) - 7x$, and suppose $g'(0) = 2$, find $h'(0)$

- A) 0 B) 3 C) 1 D) 5 E) None of the others

PART II – Free response. Show all your work

1. **Algebraically** find an equation of the tangent line to the curve $f(x) = \sqrt{x}$ at the point with abscissa $x = 4$. **[10 pt]**

Since $f'(x) = \frac{1}{2\sqrt{x}}$ we have $f'(4) = \frac{1}{4}$, and therefore the slope of the tangent line is $m = \frac{1}{4}$. (6 points)

So $y - 2 = \frac{1}{4}(x - 4)$ or $y = \frac{1}{4}x + 1$ (4 points)

2. Let $f(x) = \frac{6}{2x-3}$. Use the **limit definition** of the derivative to find $f'(x)$. **[10 pt]**

Definition: $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ (2 points)

So $f'(x) = \lim_{h \rightarrow 0} \frac{\frac{6}{2(x+h)-3} - \frac{6}{2x-3}}{h}$ (2 points)

$= \lim_{h \rightarrow 0} \frac{6 \left[\frac{2x-3 - (2x+2h-3)}{(2(x+h)-3)(2x-3)} \right]}{h}$ (2 points)

$= \lim_{h \rightarrow 0} \frac{6 \left[\frac{-2h}{(2(x+h)-3)(2x-3)} \right]}{h}$ (1 point)

$= \lim_{h \rightarrow 0} \frac{-12}{(2(x+h)-3)(2x-3)}$ (1 point)

$= \frac{-12}{(2x-3)(2x-3)} = \frac{-12}{(2x-3)^2}$ (2 points)

3. A particle moves along a vertical line and its position at time t is given by $S(t) = 93 + 72t - 12t^2$, where S is in feet and t is in seconds. **[10 pt]**
- a. Find $\mathbf{v}(t)$ and $\mathbf{a}(t)$, the velocity and acceleration functions at any time t .

$$\mathbf{v}(t) = 72 - 24t; \quad \mathbf{a}(t) = -24 \quad (5 \text{ points})$$

- b. Use the velocity function from part (a) to determine the maximum height of the particle.

Maximum height occurs when $\mathbf{v} = 0$:

That is, $72 - 24t = 0 \Rightarrow t = 3 \text{ sec.}$ and $S(3) = 201 \text{ ft.}$ (5 points)

Answer to multiple choice part	
Question number	Answers; A, B, C, D, or E (Please use capital)
1	B
2	A
3	D
4	B
5	C
6	B
7	A
8	C
9	D
10	B
11	E
12	D
13	A
14	C

Total point	
Multiple choice points	
Show work points	
Test # 1 total points	