**Calculus I: MAC2311** **Name:** ____________________
**Fall 2025**
**Exam 3 A** **Section:** ____________________
**11/5/2025**
**Time Limit: 100 Minutes** **UF-ID:** ____________________

**Scantron Instruction**: This exam uses a scantron. Follow the instructions listed on this page to fill out the scantron.

A. Sign your scantron **on the back** at the bottom in the white area.

B. Write **and code** in the spaces indicated:

1) Name (last name, first initial, middle initial)

2) UFID Number

3) 4-digit Section Number

C. Under *special codes*, code in the test numbers 3, 1:

1 2 • 4 5 6 7 8 9 0
• 2 3 4 5 6 7 8 9 0

D. At the top right of your scantron, fill in the *Test Form Code* as A .

• B C D E

E. This exam consists of 14 multiple choice questions and 4 free response questions. Make sure you check for errors in the number of questions your exam contains.

F. The time allowed is 100 minutes.

G. WHEN YOU ARE FINISHED:

1) Before turning in your test check for **transcribing errors**. Any mistakes you leave in are there to stay!

2) You must turn in your scantron and free response packet to your proctor. **Be prepared to show your proctor a valid GatorOne ID or other signed ID.**

It is your responsibility to ensure that your test has **18 questions**. If it does not, show it to your proctor immediately. You will not be permitted to make up any problems omitted from your test after the testing period ends. There are a total of 105 points available on this exam.

Part I Instructions: 14 multiple choice questions. Complete the scantron sheet provided with your information and fill in the appropriate spaces to answer your questions. Only the answer on the scantron sheet will be graded. Each problem is worth five (5) points for a total of 70 points on Part I.

1. How many of the following satisfy the conditions for Rolle's Theorem on the given interval?

$K(0) = -5$ $K(\pi) = 5$

(i) $k(x) = \sin^2(x) - 5\cos(2x)$ on $[0, \pi]$

(ii) $h(x) = \sqrt{x^4 + 4x^2 + 1}$ on $[-5, 5]$ $h(-5) = \sqrt{5^4}$

(iii) $g(x) = e^x - e^{-x}$ on $\cancel{[-2, 2]}$ $e^{-2} - e^{2}$

(iv) $f(x) = x^2 + 4x + 1$ on $[-3, -1]$

(A) 0 (B) 1 (C) 2

(D) 3 (E) 4

$9 - 12 + 1 = -2$

$1 - 4 + 1 = -2$

2. Using the linearization of $f(x) = \ln(x+2)^2$ at $a = -1$ to approximate $f(-1.1)$, we find $f(-1.1)$ is approximately:

(A) 0.2 (B) −0.2 (C) 0.01

(D) −0.05 (E) None of the above.

$\left(2\ln(x+2)\frac{1}{x+\cancel{2}}\right) - 0.1$

$f(x) = f(a) + f'(a)(x-a)$

$0$ $\frac{(-1.1+1)}{-0.1}$

$2 \ln 1$

$2\ln(x+2) \cdot \frac{1}{x+2}$

$1$

3. How many critical points does the function $f(x) = \dfrac{x+1}{x-3}$ have on the interval $[-1, 5]$?

(A) 0 (B) 1 (C) 2

(D) 3 (E) 4

$$f'(x) = \frac{(x-3)-(x+1)\cdot 1}{(x-3)^2} = \frac{-3}{(x-3)^2}$$

$f$

$-0.1$

4. For $f(x) = 2x\cos(\pi x)$ as $x$ goes from 2 to 1.9, $\Delta y$ is approximately equal to:

(A) $-0.4\pi$ (B) $-0.4$ (C) $0.4\pi$ (D) $-0.2$ (E) None of the above.

$f'(2)\,dx$

$f'(x) = 2\cos(\pi x) + 2x(-\sin(\pi x))\cdot\pi$

$2$

5. How many of the following is (are) true?

(i) $f(x) = \ln x$ has an absolute minimum.

(ii) $h(x) = \dfrac{e^x}{x+1}$ has an absolute maximum on $[0, 2]$.

(iii) $k(x) = x^4 - 4x$ has a local extrema on $[2, 6]$. $4x^3-4$ $x=1$

(iv) $l(x) = 2x - \cos x$ has local extrema on $[0, 2\pi]$.

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

$2+\sin(x)$

$$h'(x) = \frac{e^x(x+1) - e^x \cdot 1}{(x+1)^2} = \frac{e^x \cdot x}{(x+1)^2}$$

1

6. Let $y = f(x)$ be a continuous and differentiable function for all $x$. Define $L(x)$ to be the linearization of $f(x)$ at $x = a$. For values of $x$ **very close** to $a$, which of the following is **not** correct?

(A) $\Delta y \approx dy$.

(B) $f(x) \approx L(x)$.

(C) $L(x) = f(a)(x-a) + f'(a)$.

(D) $dy = f'(x)\,dx$.

7. Let $f(x) = x^3 - 6x^2 + 9x + 1$. At what $x$-value does $f$ have a **local minimum**?

$(A)$ $x = 1$ $(B)$ $x = 2$ $(C)$ $x = 3$

$(D)$ $x = -1$ $(E)$ None of these.

$3x^2 - 12x + 9$

$3(x-1)(x-3)$

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

$f''(x) = 6x - 12$

$f''(1) = -6 < 0$

$f''(3) > 0$

8. Given a function $f$ if the **derivative** is $f'(x) = (x-2)(x+1)^2$, then $f$ is

$(A)$ increasing on $(2, \infty)$ $(B)$ increasing on $(-\infty, -1) \cup (-1, 2)$

$(C)$ decreasing on $(2, \infty)$ $(D)$ decreasing on $(-1, 2) \cup (2, \infty)$

$-$ $-$ $+$

$-2$ $0$ $3$.

$-1$ $2$

9. For $f(x) = x^4 - 8x^2 + 3$, which of the following statements is true?

$(A)$ $x = 0$ is a local minimum.

$(B)$ $x = 2$ and $x = -2$ are both local minima.

$(C)$ $x = 2$ is the only local minimum.

$(D)$ $x = 2$ and $x = -2$ are both local maxima.

$f'(x) = 4x^3 - 16x = 4x(x^2-4)$

$= 4x(x-2)(x+2)$

$f''(x) = 12x^2 - 16$

$0$

$f''(0) = -16$ $f''(2) = 8$ $f''(-2) =$

10. Given a function $f$, if the **second derivative** is $f''(x) = 12x^2 - 24x$, then the function is **concave down** on

$(A)$ $(-\infty, 2)$

$(B)$ $(-\infty, 0)$

$(C)$ $(2, \infty)$

$(D)$ $(0, 2)$

$(E)$ $(-\infty, 0) \cup (2, \infty)$

$12x^2 - 24x < 0$

$12x(x-2) < 0$

11. Let $f(x) = \frac{1}{3}x^4 - 2x^2 + 1$. Determine where $f$ has a **point of inflection**.

$(A)$ $x = 0$ $(B)$ $x = 1$ only $(C)$ $x = -1$ and $x = 1$

$(D)$ $x = -1$ only $(E)$ None of these.

$$f'(x) = \frac{4}{3}x^3 - 4x$$

$$f''(x) = 4x^2 - 4 = 4(x-1)(x+1)$$

$-$

$-1$ $1$

12. Compute

$$\lim_{x\to 0} \frac{e^{3x} - 3x - 1}{x^2}.$$

$(A)$ 0 $(B)$ 3 $(C)$ $\frac{9}{2}$ $(D)$ $\frac{15}{2}$ $(E)$ Does not exist.

$$\lim_{x\to 0} \frac{3 \cdot e^{3x} - 3}{2x} = \lim_{x\to 0} \frac{9 \cdot e^{3x}}{2} = \frac{9}{2}$$

13. Compute

$$\lim_{x\to\infty} (e^x + x)^{\frac{1}{x}}.$$

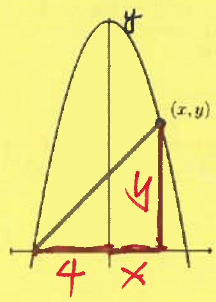
(A) 0 (B) 1 (C) $\frac{1}{e}$

(D) $e$ (E) $e^2$

$\ln(y) = \lim \frac{\ln(e^x + x)}{x}$ $\frac{\infty}{\infty}$ $\frac{e^x}{e^x+1}$

$\frac{\frac{1}{e^x+x}\cdot(e^x+1)}{1}$ $\frac{e^x+1}{e^x+x}$ $\frac{e^x}{e^x}$ $1$

14. Let $A$ be the area of the right triangle formed between the $x$-axis and the curve $y = 16 - x^2$. For which value of $x$ is $A$ maximized?




$16 - x^2 = 0$

$x = -4$

(A) $\frac{2}{3}$ (B) 1 (C) $\frac{4}{3}$ (D) $\frac{5}{3}$ (E) 2

$-3x^2 - 8x + 16 = 0$

$3x^2 + 8x - 16 = 0$

$S = \frac{(x+4)y}{2}$

1 4

3 -4

$S = \frac{(x+4)(16-x^2)}{2}$

$(x+4)(3x-4) = 0$

$\cancel{x = -4}$ $x = \frac{4}{3}$ $= \frac{16x + 64 - x^3 - 4x^2}{2} = -\frac{1}{2}x^3 - 2x^2 + 8x + 32$

$S' = -\frac{3}{2}x^2 - 4x + 8 = 0$