

Last Name:	First Name:	Student's ID:
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Instructions:

- You have 1 hour and 30 minutes to answer the following questions. Report your answers in the table provided below.
- No notes, books, or any other reference materials is allowed during the test.
- Electronic devices, including computers, tablets, and cell phones, are strictly prohibited. You are only permitted to use a non-scientific and non-graphing calculator.

Answers

1	2	3	4	5	6	7	8

Questions

1. For which $0 \leq x \leq 18$ does the function $\ell(x) = -\frac{1}{3}x^4 + 14x^3 - 108x^2$ decrease at the fastest rate?

- (a) $x = 11$
- (b) $x = 3$
- (c) $x = 18$
- (d) $x = 0$
- (e) None of the above

2. A certain chemical is introduced into a reaction chamber and, after t seconds, the concentration of the chemical is given by $C(t)$ grams per cubic centimeter (g/cm^3), where $C(t) = 0.2(5e^{-0.01t} + 1)$. Determine how long (in seconds) it takes for the chemical concentration to reach $0.45 \text{ g}/\text{cm}^3$.

- (a) $100 \ln(4)$
- (b) $1 \ln(45) - \frac{1}{5}$
- (c) $10 \ln(1)$
- (d) $50 \ln(5)$
- (e) It will never reach this concentration.

3. Compute the following definite integral:

$$\int_0^1 5 \left(x + \frac{3}{14} \right) e^{\frac{7x^2+3x}{4}} dx =$$

- (a) $\frac{2}{7}(e^2 - 1)$
- (b) $\frac{10}{7}(e^{\frac{5}{2}} - 1)$
- (c) $\frac{10}{7}e^{\frac{5}{2}}$
- (d) $\frac{20}{7}(e^{\frac{7}{4}} - 1)$
- (e) $\frac{20}{7}e^{\frac{7}{4}}$

4. The function $f(x) = 6x^2\sqrt{2x^2+5}$ is increasing for:

- (a) $x \leq -\sqrt{\frac{5}{3}}$ or $x \geq \sqrt{\frac{5}{3}}$
- (b) $-\sqrt{\frac{5}{3}} \leq x \leq \sqrt{\frac{5}{3}}$
- (c) every $x \in \mathbb{R}$
- (d) $x \leq 0$
- (e) $x \geq 0$

5. Compute the following limit

$$\lim_{x \rightarrow -\infty} \frac{9x^7 + 4x^6 - 8x + 18}{28x^6 - 6x^5 + 7} =$$

- (a) 0
- (b) $+\infty$
- (c) $-\frac{9}{28}$
- (d) $-\infty$
- (e) $\frac{9}{28}$

6. Determine the domain of the function

$$f(x) = \sqrt{\frac{12 - 2x}{2x^2 - 24x + 70}}$$

- (a) $(-\infty, 5] \cup [6, 7]$
- (b) $(5, 6] \cup (7, +\infty)$
- (c) $\mathbb{R} \setminus \{5, 7\}$
- (d) $[5, 6] \cup [7, +\infty)$
- (e) $(-\infty, 5) \cup [6, 7)$

7. Determine the antiderivatives of the function

$$f(x) = \frac{4x^{-\frac{4}{5}} + 5x + 3}{\sqrt[5]{x}}$$

- (a) $-4 \ln |x| - \frac{5}{9}x^{\frac{4}{5}} + x^{\frac{11}{5}} + C$
- (b) $4 \ln |x| + \frac{25}{9}x^{\frac{9}{5}} + \frac{15}{4}x^{\frac{4}{5}} + C$
- (c) $2 \ln |x| + \frac{5}{9}x^{\frac{11}{10}} - \frac{5}{2}\sqrt[5]{x} + C$
- (d) $-2 \ln |x| - \frac{25}{9}\sqrt[5]{x} + \frac{15}{4}x^{\frac{6}{5}} + C$
- (e) None of the above

8. Compute the following limit

$$\lim_{x \rightarrow -2} \left(\frac{3x + 6}{4 \ln(x^2 + 5x + 7)} \right) =$$

- (a) $\frac{9}{8}$
- (b) 0
- (c) It does not exist
- (d) $\frac{3}{4}$
- (e) $+\infty$