

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

- You have 2 hours 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. Consider the function $f(x) = \frac{x^2-x+2}{x-1}$. Which of the following assertions is correct?

- (a) f has an oblique asymptote $y = x - 1$ as x goes to $-\infty$
- (b) f has a horizontal asymptote $y = -1$ as x goes to $+\infty$
- (c) f has an oblique asymptote $y = x$ as x goes to $+\infty$
- (d) f has a vertical asymptote $x = -1$
- (e) f has a horizontal asymptote $y = 1$ as x goes to $-\infty$

2. Determine where $h(x) := x^2\sqrt[3]{x^2-4}$ is decreasing:

- (a) $(-\infty, -\sqrt{3}] \cup [0, \sqrt{3}]$
- (b) $(-\infty, 0] \cup [\sqrt{3}, +\infty)$
- (c) $[-\sqrt{3}, 0] \cup [\sqrt{3}, +\infty)$
- (d) Never
- (e) $[-\sqrt{3}, \sqrt{3}]$

3. A community grows in such a way that t years from now, its population is $P(t)$ thousand, where

$$P(t) = 50 + 100 \ln(t + 2).$$

How many years T does it take for the population to double its initial value $P(0)$?

- (a) $T = 4\sqrt{e} - 2$
- (b) $T = 2\sqrt{e} - 4$
- (c) It will never double its initial value
- (d) $T = 2\sqrt{e} + 2$
- (e) $T = 4\sqrt{e} - 4$

4. Compute the following limit:

$$\lim_{x \rightarrow -\infty} \frac{x^7 - 5x^5 + 3x^2 - 10}{1 + \sqrt[3]{x} - x^2}$$

- (a) It does not exist
- (b) -1
- (c) $-\infty$
- (d) 0
- (e) $+\infty$

5. Determine the maximum value of the function $g(x) = x^4 - 4x^2$ in the interval $\frac{1}{2} \leq x \leq \frac{3}{2}$:

- (a) $-\frac{63}{16}$
- (b) $-\frac{15}{16}$
- (c) $\frac{63}{16}$
- (d) -4
- (e) 0

6. Compute the following limit:

$$\lim_{x \rightarrow 1} \frac{e^{(1-x^2)} - 1}{x - 1}$$

- (a) $-\infty$
- (b) 0
- (c) 1
- (d) 2
- (e) -2

7. Where is the function $\ell(x) = 17x^3 - 6x^3 \ln x$ increasing at the fastest rate in $(0, +\infty)$?

- (a) $x = 2$
- (b) $x = e^2$
- (c) $x = e^{-2}$
- (d) In the limit as x goes to $+\infty$
- (e) $x = e$

8. The domain of the function $f(x) := \ln \left(\frac{x^2 + x - 2}{e^x + 1} \right)$ is

- (a) $(-\infty, -2) \cup (1, +\infty)$
- (b) $[-2, 1]$
- (c) $(-2, 1)$
- (d) $\mathbb{R}$
- (e) $(-\infty, -2] \cup [1, +\infty)$