

Name: _____

Student ID number: _____

Part I: Problem 1-5 選擇及填充-No Partial Credit

1. (5 pts) $\lim_{x \rightarrow -\infty} \frac{x^2 - x - 1}{2x^2 - 7} = ?$

- A) ∞
- C) $1/2$,

- B) $-\infty$,
- D) $-1/2$

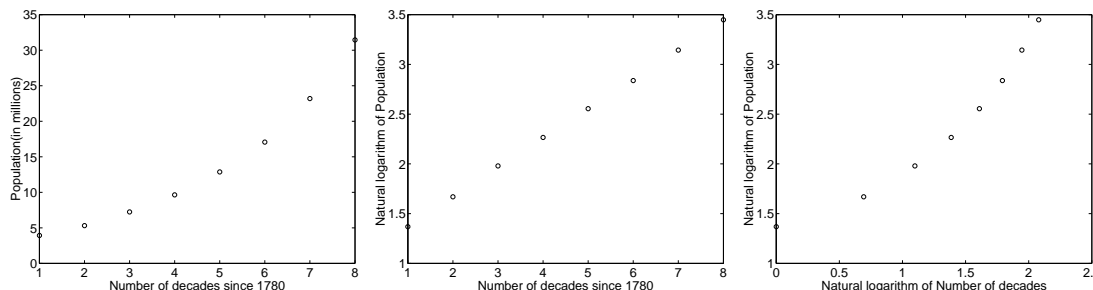
2. (5 pts) $\lim_{x \rightarrow \infty} \sqrt{x^2 + 1} = ?$

- A) ∞
- C) 1,

- B) $-\infty$,
- D) -1

3. (5 pts) The population of the United States from 1790 to 1860 was shown in the table below.

Year	1790	1800	1810	1820	1830	1840	1850	1860
Population	3,929,214	5,308,483	7,239,881	9,638,453	12,866,020	17,069,453	23,191,876	31,443,321



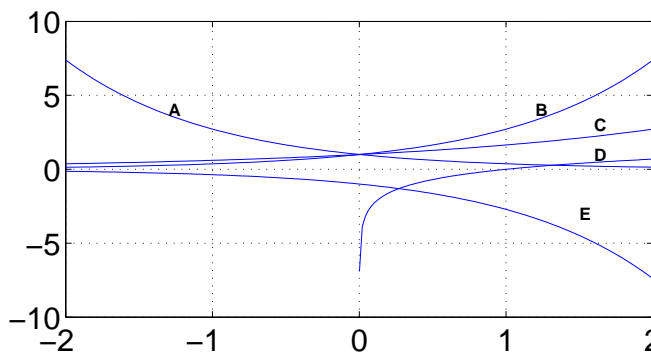
Determine if the population of the United States from 1790 to 1860 was increasing exponentially or as a polynomial.

A) exponentially ($y = ae^{bx}$).

B) as a polynomial ($y = bx^n$).

4. (10 pts) Match the curves in the figure to the functions?

- $e^x =$ _____,
- $e^{-x} =$ _____,
- $e^{x/2} =$ _____,
- $-e^x =$ _____,
- $\ln x =$ _____,



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5. (10 pts) Identify the limits from the graph of $f(x)$

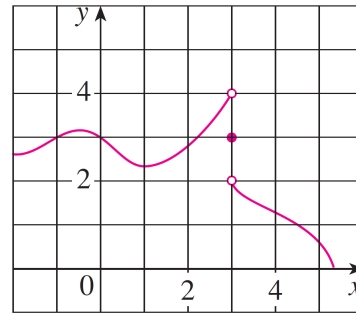
$$\lim_{x \rightarrow 0} f(x) = \underline{\hspace{2cm}},$$

$$\lim_{x \rightarrow 3^+} f(x) = \underline{\hspace{2cm}},$$

$$\lim_{x \rightarrow 3^-} f(x) = \underline{\hspace{2cm}},$$

$$\lim_{x \rightarrow 3} f(x) = \underline{\hspace{2cm}},$$

$$f(3) = \underline{\hspace{2cm}}.$$



Part II: Problem 6-13 計算及證明題

6. (10 pts) Find the domain of

(a) $f(x) = \frac{1}{1-e^x}$.

(b) $g(x) = \ln(2 + \ln(x))$.

7. (10 pts) Find the inverse function of

(a) $f(x) = \frac{4x - 1}{2x + 3}$.

(b) $g(x) = \ln(x + 3)$.

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8. (10 pts) Show that $f(x) = \cos x - x$ has a zero in $(0, 1)$ (use Intermediate Value Theorem)

9. (10 pts) Evaluate the limit, if it exists.

(a) $\lim_{x \rightarrow 7} \frac{\sqrt{x+2} - 3}{x - 7}$.

(b) $\lim_{t \rightarrow 1} \left(\frac{1}{t} - \frac{1}{t^2 + t} \right)$.

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10. (10 pts) Determine whether $f'(0)$ exists. (Hint: the definition of derivative and the Squeeze Theorem)

$$f(x) = \begin{cases} x^2 \sin \frac{1}{x}, & x \neq 0, \\ 0, & x = 0. \end{cases}$$

11. (10 pts) Let $f(x) = \begin{cases} x^2 + 1, & x \leq 1, \\ mx + b, & x > 1. \end{cases}$ Find the value of m and b that make f differentiable at $x = 1$.

12. (5 pts) Find the derivative of

$$y = \frac{x^2 - 2\sqrt{x}}{x}$$