1. [10 points] Solve for $x$: $\left(\frac{1}{2}\right)^{1-x} = 4$

2. [10 points] Solve for $x$: $\log_3(2x - 1) = 4$

3. [10 points] Write as a single logarithm: $\frac{1}{5} \log_3(x^2 + 3) - 2 \log_3(x - 1)$

4. [10 points] Approximately how long (in years) will it take to double an investment at 7% compounded continuously?
5. [10 points] \( \lim_{x \to \infty} \frac{2x^3 + x^2 - 6}{5x^3 - x + 3} = \)

6. [10 points] \( \lim_{x \to -2} \frac{x^2 + x - 2}{x^2 + 5x + 6} = \)

7. [10 points (5 points each)] Consider the function \( f(x) = \frac{1}{x} \). (The student must get part (i) correct to receive credit on part (ii))

(i). Find the average rate of change of the function \( f \) from \(-2\) to \(x\).

(ii). Find the limit of the average rate of change of the function \( f \) from \(-2\) to \(x\) as \(x\) approaches \(-2\).

8. [10 points] \( \lim_{x \to 5} \frac{2 - x}{5 - x} = \)
9. [10 points (1 point each)] Let \( f(x) = \begin{cases} 
  x + 1 & \text{if } x < 0 \\
  x^2 - 2x & \text{if } 0 \leq x < 3 \\
  x & \text{if } 3 \leq x 
\end{cases} \)

(Write DNE if the limit or value does not exist.)

(a). \( \lim_{x \to 0^-} f(x) = \)

(b). \( \lim_{x \to 0^+} f(x) = \)

(c). \( \lim_{x \to 0} f(x) = \)

(d). \( f(0) = \)

(e). \( \lim_{x \to 3^-} f(x) = \)

(f). \( \lim_{x \to 3^+} f(x) = \)

(g). \( \lim_{x \to 3} f(x) = \)

(h). \( f(3) = \)

(i). Is \( f \) continuous at 0?

(j). Is \( f \) continuous at 3?
10. [10 points] Use the definition of the derivative as \( \lim_{h \to 0} \frac{f(x + h) - f(x)}{h} \) to find \( f'(x) \), where \( f(x) = x^2 - 3x \). (Do not use the “easy rules” for taking derivatives in this problem.)
11. [10 points] The cost per day, \( C(x) \), of producing \( x \) pairs of eyeglasses is

\[
C(x) = 0.2x^2 + 3x + 1000
\]

(a). Find the marginal cost.

(b). Find the cost when \( x = 100 \).

(c). Find the marginal cost when \( x = 100 \).
12. [10 points] Find the equation of the tangent line to the graph of \( f \) at the point \((1, 4)\), where \( f(x) = x^4 + 3x^2 - x + 1 \).