1. \( \lim_{x \to \infty} \frac{4 + 6x - 4x^3}{3 - 12x + 7x^3} = \)
   (a) \( \frac{4}{3} \)
   (b) \( -\frac{4}{7} \)
   (c) \( -\frac{1}{2} \)
   (d) 0
   (e) \( \infty \)

2. Which of the following is an equation of the line tangent to \( y = \ln x \) at \( x = 2 \)?
   (a) \( y = \frac{1}{2}x \)
   (b) \( y = \frac{1}{2}(x - 2) \)
   (c) \( y = \frac{1}{2}(x - 2) + \ln 2 \)
   (d) \( y = \frac{1}{x}(x - 2) + \frac{1}{2} \)
   (e) \( y = \frac{1}{x}(x - 2) + \ln 2 \)

3. If \( f(x) = x^4 - 10 \), then \( \lim_{h \to 0} \frac{f(x + h) - f(x)}{h} = \)
   (a) 1
   (b) \( \frac{f(h)}{h} \)
   (c) \( 4x^3 - 10 \)
   (d) \( \frac{4x^3h + 6x^2h^2 + 4x^3h + h^4 - 20}{h} \)
   (e) \( 4x^3 \)

4. Find the derivative of \( y = x^3(x^4 + 6) \)
   (a) \( 7x^5 + 18x^3 \)
   (b) \( 7x^5 \)
   (c) \( 7x^6 + 18x^2 \)
   (d) \( 7x^6 + 6x^3 \)
   (e) \( 7x^6 + 6x^3 + 6x^2 \)
5. If \( f(x) = 3^x \), then \( f'(x) = 
\begin{align*}
(a) & \quad 3^x \\
(b) & \quad 3(2^x) \\
(c) & \quad \frac{3^x}{\ln(3)} \\
(d) & \quad 3^x \ln(3) \\
(e) & \quad 3^x 
\end{align*} 
\)

6. You are told that a function has the following derivatives:  
\[ f'(x) = (x - 5)^2(x - 2) \text{ and } f''(x) = 3(x - 3)(x - 5) \]
Which of the following gives the largest interval on which \( f \) is decreasing?
\(\begin{align*}
(a) & \quad (-\infty, 2) \\
(b) & \quad (3, 5) \\
(c) & \quad (-\infty, 2) \cup (3, 5) \\
(d) & \quad (-\infty, 2) \cup (5, \infty) \\
(e) & \quad (2, 5)
\end{align*}\)

7. Using the function described in \#6, which of the following gives the largest interval on which \( f \) is concave up?
\(\begin{align*}
(a) & \quad (-\infty, 3) \cup (5, \infty) \\
(b) & \quad (4, \infty) \\
(c) & \quad (3, 5) \\
(d) & \quad (2, 3) \cup (5, \infty) \\
(e) & \quad (-\infty, \infty)
\end{align*}\)

8. An account with an initial deposit of $1000 at 6% annual interest compounded monthly will grow to \( A = 1000(1.005)^{12t} \), where \( A \) is in dollars and \( t \) is the number of years after starting the account. How fast is the account growing after 2 years? (include appropriate units)
9. Find the derivatives of the following functions (you do not have to simplify).

(a) \( f(x) = \frac{x^3 + 1}{x^2 - e^x} \)

(b) \( f(x) = 3x^2 \ln(x) \)

(c) \( g(x) = x^{-1/2} \cdot 4^x \)

10. Find the first and second derivatives of \( f(x) = e^{-x^2} \) (you do not have to simplify).
11. The demand for a 16 GB USB flash drive is given by \( p = \frac{100}{1 + x} \), where \( x \) is the number of thousand flash drives and \( p \) is the price in dollars. The cost (in thousands of dollars) for producing them is given by \( C(x) = 6 + \frac{1}{6}x \). Find the marginal profit when 3 thousand flash drives are produced. What does your answer tell you about producing more?

12. Find all relative maxima, relative minima, and inflection points of \( f(x) = x^7 - \frac{7}{6}x^6 + 1 \).

13. Find the equation of the line tangent to \( f(x) = (x^2 + x)^{100} \) at \( x = 1 \).
14. Given the graph below is the graph of the DERIVATIVE of $f(x)$, answer each of the following:

(a) List the intervals where $f$ is increasing.

(b) List the $x$-coordinates where $f$ has a local minimum

(c) List the intervals where $f$ is concave down

15. A rectangular field has a barn on one side (see figure below). If 240 feet of fencing are to enclose the field with none needed along the barn, find the dimensions of the field which maximize the area.
16. Use the four-step graphing method to analyze each of the following for \( f(x) = xe^{-x} \):

(a) Intercepts and Asymptotes
(b) Intervals of Increasing and Decreasing
(c) Intervals of Concave Up and Concave Down
(d) Graph