1. (10 points) The following graph depicts the function $f(x)$

(a) Where are the critical points of $f$?

(b) Is $f'(x)$ positive, negative or zero at $x = -1/2$?

(c) Is $f''(x)$ positive, negative or zero at $x = 1$?

(d) Where does $f(x)$ have point(s) of inflection?

(e) For what values of $x$ does $f(x)$ have absolute extrema on the interval $[-1, 0]$?
2. (10 points) Draw the graph of a function \( f(x) \) which satisfies:

(a) \( f'(x) = 0 \) for \( x = \pm 1 \)
(b) \( f''(-1) > 0 \)
(c) \( f''(1) < 0 \)
(d) \( \lim_{x \to \infty} f(x) = 0 \)
(e) \( f'(x) < 0 \) for \( x \) in \( (-\infty, -1) \)

3. (10 points) Use L'Hopital's Rule to compute the limit.

\[
\lim_{x \to 0^+} x \ln(x)
\]

4. (5 points) For which value of \( m \) is the following correct? If \( f(0) = 4 \) and \( f(2) = 7 \), and \( f \) is differentiable, then \( f \) has a tangent line of slope \( m \). \textit{Hint: use the Mean Value Theorem.}
5. (5 points) What is the relation between \( dA/dt \) and \( dB/dt \) when \( A = 2B^4 \)?

6. (10 points) Find the rate of change of the volume \( V \) of a cylinder of constant height \( h = 1/\pi \) cm and radius \( r = 5 \) cm, given that the radius is changing at a rate of 3 cm/s.

7. (5 points) If the sign combination of \( f' \) and \( f'' \) changes from \(- -\) to \(- +\) at \( x = c \) then:

(a) \( f(c) \) is a local max.

(b) \( f(c) \) is a local min.

(c) \( (c, f(c)) \) is an inflection point.
8. (10 points) Find the extreme values of \( y = x^2 - 2x + 1 \) on the interval \([-1, 2]\). (y-values)

9. (10 points) Find the critical points and the intervals on which the function \( f(x) = x^2 e^x \) is increasing or decreasing. Determine whether each critical point corresponds to a local min, max or neither.
10. (10 points) Find the points of inflection (x and y values) and the intervals of concavity of the function \( f(x) = x^4 + 2x^3 - 7x + 2 \).

11. (10 points) Use L'Hopital’s Rule to compute the limit.

\[
\lim_{x \to \infty} \frac{2x^3 - 5x}{e^{2x}}
\]

12. (5 points) Suppose that \( x = 5 \) is a critical point of \( f(x) \). If \( f''(5) < 0 \), then which of the following is true?

(a) \( f(5) \) is a local max.
(b) \( f(5) \) is a local min.
(c) \( (5, f(5)) \) is an inflection point.