1. Evaluate the limit \( \lim_{x \to 2} \frac{\cos(\pi x/2) + 1}{e^{4x} - e^{8}} \).

\[
\frac{H}{X} \lim_{x \to 2} \frac{-\pi}{4} \sin \frac{\pi}{8} = 0
\]

2. Consider \( f(x) = [6x + x^2]^{1/2} \). Find all the end points of the domain of definition. Find all interior critical points. Test all these points to see where \( f(x) \) has a local maximum value and where \( f(x) \) has a local minimum value.

End points \( x = 0, x = -6 \). Interior points \( x < -6 \) and \( x > 0 \)

\( f'(x) = \frac{1}{2} [6x + x^2]^{-1/2} (6 + 2x) \). \( f'(x) \) is not defined for \( x = -3 \)

\( f'(-6) = -\infty \) local minimum at \( x = -6 \) by the left end point theorem,
\( f'(0) = +\infty \) local minimum at \( x = 0 \) by the right end point theorem.

3. Let \( f(x) = \begin{cases} x^2 + 4x - 6 & x < 3 \\ -x^2 + 8x & x \geq 3 \end{cases} \) Find all the values of \( x \) such that \( f'(x) > 0, f'(x) < 0 \).

\( f'(x) = \begin{cases} 2x + 4 & x < 3 \\ -2x + 8 & x \geq 3 \end{cases} \)

\( f'(3) = 0 \) \( f'(-2) = 0 \) \( f'(4) = 0 \)

b) Find all the values of \( x \) such that \( f''(x) > 0, f''(x) < 0 \).

\( f''(x) = \begin{cases} 2 & x < 3 \\ -2 & x \geq 3 \end{cases} \)

\( f''(3) = 0 \) \( f''(-2) = 0 \)

(c) Test the critical points of \( f(x) \) using the first derivative test.

\[
\begin{array}{cccc}
\text{f'(x)<0} & f'(x)>0 & f'(x)>0 & f'(x)<0 \\
-2 & 3 & 4 & x
\end{array}
\]

Local min at \( x = -2 \)

Neither at \( x = 3 \)

Local max at \( x = 4 \)

f' (x) 

d) Sketch a graph of \( f(x) \).