For all questions, show your work. Use the back if you need more space.

1. Sketch the graph of \( f(x) = \frac{2}{3}x^2 - x^2 + x - 4 \); indicate local maxima/minima and inflection points. (Remember to check the intervals on which \( f \) is increasing/decreasing and concave up/concave down.)

\[
f'(x) = \frac{3}{3} x^2 - 2x + 1 = x^2 - 2x + 1 = (x-1)^2
\]
so \( f'(x) = 0 \Rightarrow (x-1)^2 = 0 \Rightarrow (x-1) = 0 \Rightarrow x = 1. \)

\[
f''(x) = 2x - 2 = 2(x-1)
\]
o no local max/min so \( f''(x) = 0 \Rightarrow 2(x-1) = 0 \Rightarrow (x-1) = 0 \Rightarrow x = 1. \)

\[
f(0) = -4 + \frac{11}{3} f(1) = \frac{1}{3} - 1 + 1 - 4 = -\frac{11}{3}
\]
\[
f(2) = \frac{8}{3} - 4 + 2 - 4 = -\frac{10}{3}
\]

2. Evaluate the following limits:
(a) \( \lim_{t \to 0} \frac{e^{3t} - 1}{t} \)

\[
\lim_{t \to 0} (e^{3t} - 1) = 1 - 1 = 0
\]
\[
\lim_{t \to 0} t = 0
\]
we have \( \frac{0}{0} \) so use L'H.

\[
\lim_{t \to 0} \frac{e^{3t} - 1}{t} = \lim_{t \to 0} \frac{3e^{3t}}{t'} = \lim_{t \to 0} \frac{3}{1} = 3.
\]

(b) \( \lim_{x \to 0} x^2 \ln x \)

\[
\lim_{x \to 0} x^2 = 0 \lim_{x \to 0} \ln x = -\infty
\]
we have \( 0 \cdot \infty \) so we write \( x^2 \) as \( \frac{1}{x^{-2}} \) to get \( \frac{0}{0} \)

\[
\lim_{x \to 0} x^2 \ln x = \lim_{x \to 0} \frac{\ln x}{x^{-2}}
\]
\[
(L'H) \lim_{x \to 0} \frac{\ln x}{x^{-2}} = \lim_{x \to 0} \frac{1/x}{-2x^3}
\]
\[
= -\frac{1}{2} \lim_{x \to 0} \frac{x^{-1}}{x^3} = -\frac{1}{2} \lim_{x \to 0} x^2 = 0
\]