Math 130 Day 31, Answers.

1. a) $f(x) = (x-2)e^x$. Critical numbers:

$$f'(x) = e^x + (x-2)e^x = [1+x-2]e^x = (x-1)e^x = 0. \;\; \text{CP} : x = 1.$$

		R Min	
	$----$	0	$++++$
f'			
	Decr	1	Incr

To do this which theorem did you use? First Derivative Test

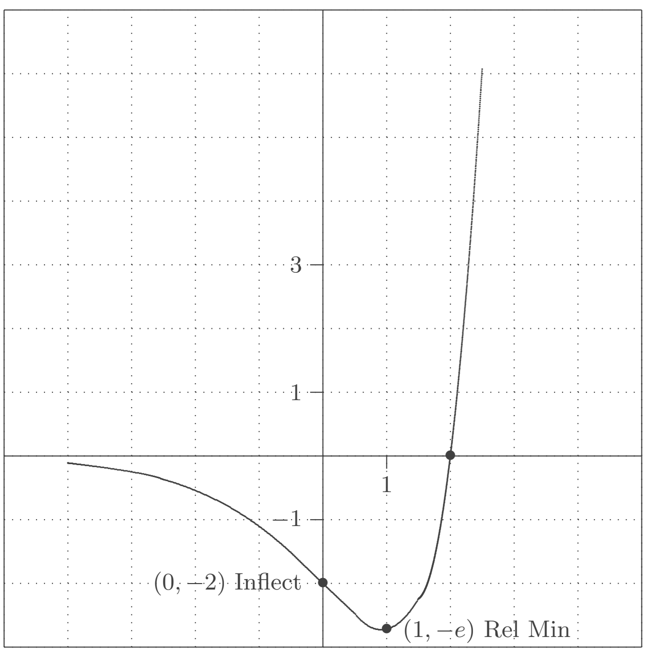
b)

$$f''(x) = e^x + (x-1)e^x = [1+x-1]e^x = x)e^x = 0. \;\; \text{CP} : x = 0.$$

		Inflect	
	$----$	0	$++++$
f''			
	Con Dn	0	Con Up

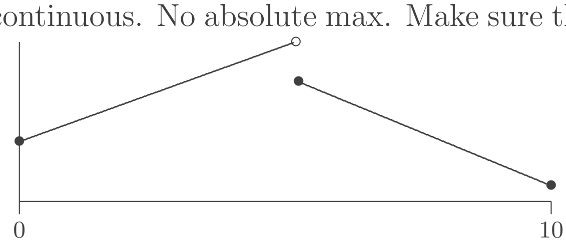
To do this which theorem did you use? Concavity Test

c)



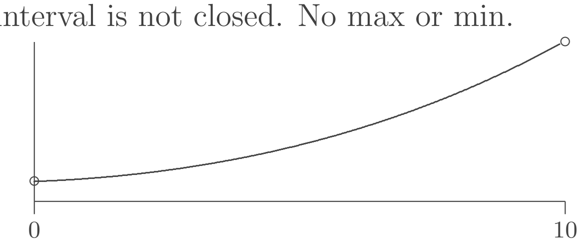
At the key points:
Relative Min: $f(1) = -e^1 = -e$
Inflect $f(0) = -2e^0 = -2$
x intercept: $(x-2)e^x = 0 \Rightarrow x = 2$

2. a) This is possible if f is not continuous. No absolute max. Make sure the function is defined at all points.



b) Impossible by the EVT a continuous function on a closed interval must have an absolute max and min.

c) This is possible since the interval is not closed. No max or min.



3. a) (Review) Determine the derivative of $f(x) = 8^{x^4-4x^3+1}$.

$$f'(x) = 8^{x^4-4x^3+1} \ln 8 (4x^3 - 12x^2).$$

b) (Review) Determine the derivative of $y = (x^4+1)^{\arctan(x^2)}$. What technique is appropriate?

$$\begin{aligned}
\ln y &= \ln(x^4+1)^{\arctan(x^2)} = \arctan(x^2)\ln(x^4+1) \\
\frac{1}{y}\frac{dy}{dx} &= \frac{2x\ln(x^4+1)}{1+x^4} + \frac{4x^3\arctan(x^2)}{1+x^4} \\
\frac{dy}{dx} &= y\left(\frac{2x\ln(x^4+1)}{1+x^4} + \frac{4x^3\arctan(x^2)}{1+x^4}\right) \\
\frac{dy}{dx} &= (x^4+1)^{\arctan(x^2)}\left(\frac{2x\ln(x^4+1) + 4x^3\arctan(x^2)}{1+x^4}\right)
\end{aligned}$$