

1. A student writes

$$\text{By L'Hôpital's Rule, } \lim_{x \rightarrow -2} \frac{x-2}{x^2-2} = \lim_{x \rightarrow -2} \frac{1}{2x} = -\frac{1}{4}$$

Are the reasoning and the answer correct? Why? What is the correct answer?

2. Compute the following limits

a)  $\lim_{x \rightarrow 0} \frac{e^{2x} - 1}{\sin(3x)}$

b)  $\lim_{x \rightarrow +\infty} (x - \ln(1 + 2e^x))$

b)  $\lim_{x \rightarrow +\infty} x^{1/x}$

3. Which function grows faster as  $x \rightarrow +\infty$ ?. List in increasing order. You may use technology here, but justify your answer:  $e^{x^2}$ ,  $x^2$ ,  $\sqrt{x^4 + 1}$ ,  $\sqrt{x}$ ,  $1/x$ ,  $7$ ,  $e^x$ ,  $\ln(x)$ ,  $x^x$ ,  $x \ln(x)$ ,  $xe^x$ .

4. The vibrations of a vibrating spring subject to strong friction can sometimes be modelled by  $x(t) = te^{-t}$ ,  $t \geq 0$ .  
a) Find any vertical or horizontal asymptotes. (Hint: you will need to use l'Hopital here).

b) Find intervals of increase, decrease.

c) Find intervals of concavity.

d) Sketch graph based on a,b, c, and the fact that  $x(0) = 0$ .