(3) **L'HOPITAL'S RULE**

(a) Use this rule to find the following limit, if it exists. If the limit does not exist, then state this. **SHOW EVERY STEP.** **[10 POINTS]**

$$\lim_{x\to 0}\left(\frac{2\sin(x)-2x^2-2x}{e^x-\cos x-x}\right) \begin{matrix}\to 0\\ \to 0\end{matrix}$$

$$\lim_{x\to 0}\left(\frac{2\cos x-4x-2}{e^x+\sin x-1}\right) \begin{matrix}\to 0\\ \to 0\end{matrix}$$

$$\lim_{x\to 0}\left(\frac{-2\sin x-4}{e^x+\cos x}\right)$$

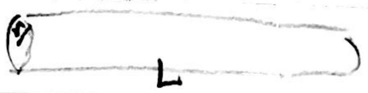
$$\frac{-4}{2}=-2$$

(b) Use this rule to show that $\sqrt[3]{x}$ dominates $\ln(x)$. **SHOW EVERY STEP.** **[10 POINTS]**

$$\lim_{x\to\infty}\frac{\ln(x)}{x^{1/3}}=\lim_{x\to\infty}\frac{x^{-1}\cdot x'}{\frac{1}{3}x^{-2/3}\cdot x'}=\lim_{x\to\infty}\frac{3}{x^{1/3}}=\infty$$

$\therefore$ $\sqrt[3]{x}$ dominates $\ln(x)$

(4) **A potter forms a piece of clay into a cylinder. As he rolls it, the length, L, of the cylinder increases and the radius, r, decreases. If the length of the cylinder is increasing at 0.1 cm per second, find the rate at which the radius is changing when the radius is 1 cm and the length is 5 cm.** hich is filling the balloon at a rate of 4 cubic radius of the balloon is increasing at the instance WORK AND GIVE EXACT ANSWER]. **[20 POINTS]**



$\frac{dL}{dt}=0.1$ $\quad \frac{dr}{dt}=?$ $\quad r=1$ $\quad L=5$

$$V=\pi r^2 L$$

$$\frac{dV}{dt}=\pi\left(2r\cdot\frac{dr}{dt}L+r^2\cdot\frac{dL}{dt}\right)$$

$$0=\pi\left(2\cdot 1\cdot\frac{dr}{dt}\cdot 5+1^2\cdot(0.1)\right)$$

$$0=10\frac{dr}{dt}+0.1$$

$$\frac{-0.1}{10}=\frac{dr}{dt}$$

$$\boxed{-0.01=\frac{dr}{dt}}$$