One last word problem

The rate of change of air pressure (in kPa) with respect to height (in m) is approximately proportional to the pressure. If the pressure is 100 kPa when $h = 0$ and $p = 80$ kPa when $h = 2000m$, find the expression relating pressure and height.
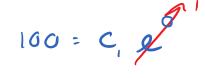
$$\frac{dP}{dh} = kP$$

now solve it!

$$\frac{dP}{P} = k\,dh$$

$$\ln P = kh + c$$

$$P = e^{kh+c} = e^{kh} e^{c}$$

$$P = C_1 e^{kh}$$

when $h = 0$, $P = 100$

$$100 = C_1 e^{0}$$

$$P = 100 e^{kh}$$

when $h = 2000$, $P = 80$

$$80 = 100 e^{k2000}$$

$$\frac{8}{10} = e^{2000k}$$

$$\ln 0.8 = 2000k$$

$$k = \frac{\ln 0.8}{2000}$$

$$P = 100 \, e^{\frac{\ln 0.8}{2000} h}$$