$$mx``=-kx`$$

$$x`=v_x(t)=v_x(0)*e^{-\frac{k}{m}t}$$

$$x=\frac{m*v_x(0)}{k}*\left(1-e^{-\frac{k}{m}t}\right)$$

$$my``=-mg-ky`=-k\left(y`+\frac{mg}{k}\right)$$

$$\left(y`+\frac{mg}{k}\right)`=-\frac{k}{m}\left(y`+\frac{mg}{k}\right)$$

$$y`+\frac{mg}{k}=v_y(t)+\frac{mg}{k}=\left(v_y(0)+\frac{mg}{k}\right)*e^{-\frac{k}{m}t}$$

$$v_y(t)=\left(v_y(0)+\frac{mg}{k}\right)*e^{-\frac{k}{m}t}-\frac{mg}{k}$$

$$v_y(\tau)=0\Rightarrow\left(v_y(0)+\frac{mg}{k}\right)*e^{-\frac{k}{m}\tau}-\frac{mg}{k}=0$$

$$e^{-\frac{k}{m}\tau}=\frac{\frac{mg}{k}}{v_y(0)+\frac{mg}{k}}$$

$$y(t)=\frac{m}{k}\left(v_y(0)+\frac{mg}{k}\right)*\left(1-e^{-\frac{k}{m}t}\right)-\frac{mg}{k}*t$$

$$y(\tau)=\frac{m}{k}\left(v_y(0)+\frac{mg}{k}\right)*\left(1-\frac{\frac{mg}{k}}{v_y(0)+\frac{mg}{k}}\right)-\frac{mg}{k}*\tau=\frac{m}{k}v_y(0)-\frac{mg}{k}*\tau=\frac{m}{k}\left(v_y(0)-g*\tau\right)=H$$

$$\tau=\frac{v_y(0)-\frac{k*H}{m}}{g}$$

$$\tau=\tau(k)$$

$$\tau(0)=\frac{v_y(0)-\frac{0*H}{m}}{g}=\frac{v_y(0)}{g}$$

$$\tau(0)-\tau(k)=\frac{k*H}{m*g}$$ – *это* ответ