$$m\ddot{x} = -b\dot{x} - kx \Rightarrow \ddot{x} + \underbrace{\frac{b}{m}}_{2\gamma}\dot{x} + \underbrace{\frac{k}{m}}_{\omega^2}x = 0$$

using $x(t) = C\exp(-Dt)$ we get $v(t) = \frac{dx(t)}{dt} = -D\,C\exp(-Dt)$

$$a(t) = \frac{d^2x(t)}{dt^2} = D^2 C\exp(-Dt)$$

$$\Rightarrow D^2 \overbrace{C\exp(-Dt)}^{x(t)} - 2\gamma D C\exp(-Dt) + \omega^2 C\exp(-Dt) = 0$$

$$x(t)\left(D^2 - 2\gamma D + \omega^2\right) = 0 \Rightarrow D^2 - 2\gamma D + \omega^2 = 0$$

$$\Rightarrow D_{1,2} = -\gamma \pm \sqrt{\gamma^2 - \omega^2}$$

$$\Rightarrow x(t) = C_1\exp\left[\left(-\gamma + \sqrt{\gamma^2-\omega^2}\right)t\right] + C_2\exp\left[\left(-\gamma - \sqrt{\gamma^2-\omega^2}\right)t\right]$$

$$v(t) = \frac{dx(t)}{dt} = C_1\left(-\gamma + \underbrace{\sqrt{\gamma^2-\omega^2}}_{\alpha}\right)\exp\left[\left(-\gamma + \sqrt{\gamma^2-\omega^2}\right)t\right] + C_2\left(-\gamma - \sqrt{\gamma^2-\omega^2}\right)\exp\left[\left(-\gamma - \sqrt{\gamma^2-\omega^2}\right)t\right]$$

$$= C_1(-\gamma + \alpha)\exp\left[(-\gamma+\alpha)t\right] + C_2(-\gamma-\alpha)\exp\left[(-\gamma-\alpha)t\right]$$

$$x(0) = C_1 + C_2 \stackrel{!}{=} \overbrace{0{,}15312\,m}^{A} \Rightarrow C_2 = A - C_1$$

$$v(0) = C_1(-\gamma+\alpha) + C_2(-\gamma-\alpha) \stackrel{!}{=} 0$$

$$= C_1(-\gamma+\alpha) + A(-\gamma-\alpha) - C_1(-\gamma-\alpha)$$

$$= C_1(-\gamma+\alpha+\gamma+\alpha) + A(-\gamma-\alpha) = 2\alpha C_1 - A(\gamma+\alpha) \stackrel{!}{=} 0$$

$$\Rightarrow C_1 = \frac{A(\gamma+\alpha)}{2\alpha}$$

$$C_2 = A\left(1 - \frac{\gamma+\alpha}{2\alpha}\right)$$

Now compute $v(t) = \frac{A(\alpha^2-\gamma^2)}{2\alpha}\exp\left[(\alpha-\gamma)t\right] - A\left(1 - \frac{\gamma+\alpha}{2\alpha}\right)(\gamma+\alpha)\exp\left[-(\gamma+\alpha)t\right]$

and find max t. Then resubstitute and solve $v(m)$. Maybe