解　　答

２０２５	科目名	物理情報：力学

[問 1]

① $m\ddot{x} + kx = 0$

$\rightarrow \ddot{x} + \omega^2 x = 0, \quad \omega = \sqrt{k/m}$

② $x(t) = C\sin(\omega t + \phi)$

③ $K = \frac{1}{2}m\dot{x}^2 = \frac{1}{2}m\omega^2 C^2 \cos^2(\omega t + \phi)$

$U = \frac{1}{2}kx^2 = \frac{1}{2}kC^2 \sin^2(\omega t + \phi)$

④ $K + U = \frac{1}{2}kC^2$

[問 2]

① $m\ddot{x} + 2m\gamma\dot{x} + m\omega^2 x = 0$

$\rightarrow \ddot{x} + 2\gamma\dot{x} + \omega^2 x = 0, \quad \omega = \sqrt{k/m}$

② $\ddot{x} + 2\gamma\dot{x} + \omega^2 x = 0$

$put \quad \underline{x \sim e^{pt}}$

$\Rightarrow p^2 + 2\gamma p + \omega^2 = 0$

判別式から　　$p = -\gamma \pm \sqrt{\gamma^2 - \omega^2}$

$if\ \gamma^2 < \omega^2, \quad (\omega' = \sqrt{\omega^2 - \gamma^2})$　　(減衰振動)

$p = -\gamma \pm i\omega'$

$\therefore \quad x \sim e^{(-\gamma \pm i\omega')t}$

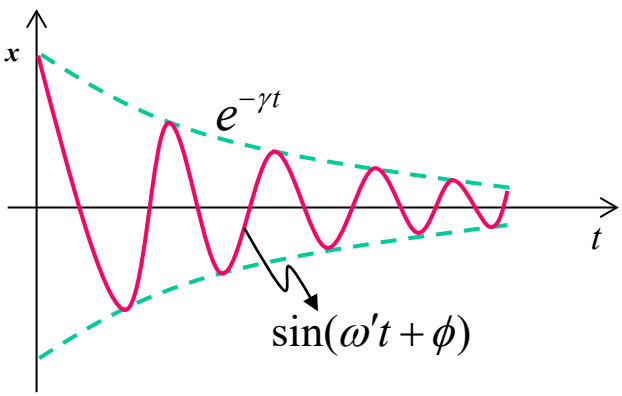
$= e^{-\gamma t}(Pe^{i\omega' t} + Qe^{-i\omega' t})$

$= e^{-\gamma t}[(P+Q)\cos\omega' t + i(P-Q)\sin\omega' t]$

$= e^{-\gamma t}(A\cos\omega' t + B\sin\omega' t)$

$\therefore \quad x = e^{-\gamma t}(A\cos\omega' t + B\sin\omega' t)$

$\rightarrow \quad x = Ce^{-\gamma t}\sin(\omega' t + \phi)$



[問 3]

① $m\ddot{x} + 2m\gamma\dot{x} + m\omega^2 x = mf_0 \cos\omega_e t$

$\rightarrow \ddot{x} + 2\gamma\dot{x} + \omega^2 x = f_0 \cos\omega_e t$

② $\dfrac{dA}{d\omega_e} = 0 \Rightarrow \omega_e = \sqrt{\omega^2 - 2\gamma^2}$