$$\vec{F} \quad = \quad -k\,\vec{x}$$

$$\vec{F} \quad = \quad m\vec{a} \quad = \quad m\frac{d^2\vec{x}}{dt^2}$$

$$m\frac{d^2\vec{x}}{dt^2} \quad = \quad -k\vec{x}$$

$$\frac{d^2\vec{x}}{dt^2} \quad = \quad -\left(\frac{k}{m}\right)\,\vec{x}$$

$$\frac{d^2\vec{x}}{dt^2} \quad = \quad -\omega^2\,\vec{x}$$

$$x(t) \quad = \quad A\cos\left(\sqrt{\frac{k}{m}}t\,+\,\phi\right)$$

$$\omega \quad = \quad \sqrt{\frac{k}{m}}$$

$$x(t) \quad = \quad A\cos\left(\omega t\,+\,\phi\right)$$