Question

Find the damping parameter and the natural frequency of the system governed by the equation:

$$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 4x = 0$$

Answer

$$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 4x = 0$$

Auxiliary equation:
General form is $m^2 2G\omega m + \omega^2 = 0$
In this case it is $m^2 + 2m + 4 = 0$
Comparing the two equations gives $\omega = 2$ so $2G\omega = 2 \Rightarrow 4G = 2 \rightarrow G = \frac{1}{2}$