$$\ddot{x} - x\frac{fog}{a} = -fog$$

Sol H

$$x(t) = A\cosh\left(\sqrt{\frac{fog}{a}}\,t\right) + B\operatorname{senh}\left(\sqrt{\frac{fog}{a}}\,t\right)$$

Sol part

$$\boxed{x = a}$$

$$\rightarrow x(t) = A\cosh\left(\sqrt{\frac{fog}{a}}\,t\right) + B\operatorname{senh}\left(\sqrt{\frac{fog}{a}}\,t\right) + a$$

$$\dot{x}(t) = -A\operatorname{senh}\left(\sqrt{\frac{fog}{a}}\,t\right)\cdot\sqrt{\frac{fog}{a}} + B\cosh\left(\sqrt{\frac{fog}{a}}\,t\right)\cdot\sqrt{\frac{fog}{a}}$$

$$x(0) = x_0$$

$$\dot{x}(0) = 0$$

$$\rightarrow \boxed{B = 0}$$

$$\rightarrow x_0 = A + a \rightarrow \boxed{A = x_0 - a}$$

$$\dot{x}(t) = \omega r = (x_0 - a)\cosh\left(\sqrt{\frac{fog}{a}}\,t\right)$$

$$\frac{\omega r}{(x_0 - a)} = \cosh\left(\sqrt{\frac{fog}{a}}\,t\right)$$

$$\rightarrow \operatorname{Ar\,cosh}\left(\frac{\omega r}{(x_0 - a)}\right) = \sqrt{\frac{fog}{a}}\,t \rightarrow$$

$$\boxed{t = \frac{\operatorname{Ar\,cosh}\left(\dfrac{\omega r}{(x_0 - a)}\right)}{\sqrt{\dfrac{fog}{a}}}}$$