Example with no damping

\[ \frac{1}{4} u'' + 64 u = 0 \]

General solution is

\[ u = A \sin 16 t + B \cos 16 t \]

Initial conditions \( u(0) = \frac{1}{2} \) \( u'(0) = 0 \)

amplitude = 

phase = 

period = 

circular frequency =
Change the initial conditions to

\[ u(0) = \frac{1}{2} \]
\[ u'(0) = \frac{1}{3} \]

amplitude = 

circular frequency = 

period = 

phase =
Damped Free Vibrations:
\[ m u'' + \xi u' + k u = 0 \]

Guess: \( u = e^{rt} \)

\[ r_1, r_2 = -\frac{\xi}{2m} \pm \sqrt{\frac{\xi^2 - 4km}{2m}} \]

Return to our example:
\[ \frac{1}{4} u'' + 2u' + 64u = 0 \]

Guess: \( u = e^{rt} \)

\[ r_1, r_2 = -\frac{8 \pm \sqrt{64 - 4 \times 64}}{2} \]
General Solution is

\[ u(t) = A e^{-4t} \sin \sqrt{1/5} \ t + B e^{-4t} \cos \sqrt{1/5} \ t \]

Add initial conditions

\[ u(0) = \frac{1}{2} \]

\[ u'(0) = 0 \]

\( R \)

\(-R \)

\( \delta \)

\( \omega_0 t \)

quasi frequency

quasi period