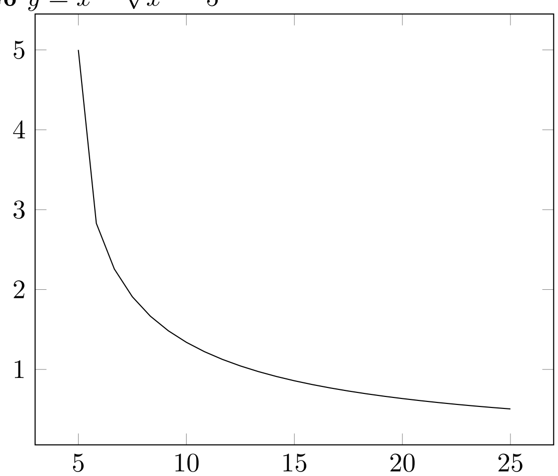
HW Feb 18, Johannes Byle

5.20 $y = x - \sqrt{x^2 - 5^2}$



5.26 From (5.36) we know $\omega_1 = \sqrt{\omega_0^2 - \beta^2}$

$$\beta = \sqrt{\omega_0^2 - \omega_1^2} = \sqrt{.002001}$$

$$t = \frac{2\pi}{\omega}$$

$$e^{-\beta t} \approx e^{-\frac{20\pi}{\omega_0}\beta} \approx 0.06$$

The amplitude will have diminished far more significantly.

5.30 (a)

$$x(t) = C_1 e^{-(\beta - \sqrt{\beta^2-\omega_0^2})t} + C_2 e^{-(\beta + \sqrt{\beta^2-\omega_0^2})t}$$

$$y(t) = -(\beta - \sqrt{\beta^2 - \omega_0^2})C_1 e^{-(\beta - \sqrt{\beta^2-\omega_0^2})t} - (\beta + \sqrt{\beta^2 - \omega_0^2})C_2 e^{-(\beta + \sqrt{\beta^2-\omega_0^2})t}$$

$$x_0 = C_1 + C_2$$

$$y_0 = -(\beta - \sqrt{\beta^2 - \omega_0^2})C_1 - (\beta + \sqrt{\beta^2 - \omega_0^2})C_2$$

$$\begin{bmatrix} C_1 \\ C_2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ -(\beta - \sqrt{\beta^2 - \omega_0^2}) & -(\beta + \sqrt{\beta^2 - \omega_0^2}) \end{bmatrix}^{-1} \begin{bmatrix} x_0 \\ v_0 \end{bmatrix}$$

$$C_1 = \frac{-(\beta + \sqrt{\beta^2 - \omega_0^2})x_0 - v_0}{-(\beta + \sqrt{\beta^2 - \omega_0^2}) + (\beta - \sqrt{\beta^2 - \omega_0^2})} = \frac{(\beta + \sqrt{\beta^2 - \omega_0^2})x_0 + v_0}{2\sqrt{\beta^2 - \omega_0^2}}$$

$$C_2 = \frac{-(\beta - \sqrt{\beta^2 - \omega_0^2})x_0 - v_0}{-(\beta + \sqrt{\beta^2 - \omega_0^2}) + (\beta - \sqrt{\beta^2 - \omega_0^2})} = \frac{-(\beta - \sqrt{\beta^2 - \omega_0^2})x_0 - v_0}{2\sqrt{\beta^2 - \omega_0^2}}$$