Johannes Byle

11.3

$$(K-\omega^2 M) = \begin{bmatrix} k_1+k_2-m_1\omega^2 & -k_2 \\ -k_2 & k_2+k_3-m_2\omega^2 \end{bmatrix}$$

$$\det(K-\omega^2 M) = (k_1+k_2-m_1\omega^2)(k_2+k_3-m_2\omega^2)-k_2^2$$

$$\omega_1 = \sqrt{\frac{k_1}{m_1}}, \omega_2 = \sqrt{\frac{k_3}{m_2}}$$

11.5(a)

$$(K-\omega^2 M) = \begin{bmatrix} 2k-m\omega^2 & -k \\ -k & k-m\omega^2 \end{bmatrix}$$

$$\det(K-\omega^2 M) = (2k-m\omega^2)(k-m\omega^2)-k^2$$

$$\omega = \pm\sqrt{\frac{3\pm\sqrt{5}}{2}}\sqrt{\frac{k}{m}}$$

(b)

$$v_1 = \begin{bmatrix} -\frac{1+\sqrt{5}}{2} \\ 1 \end{bmatrix}$$

$$v_2 = \begin{bmatrix} -\frac{1-\sqrt{5}}{2} \\ 1 \end{bmatrix}$$

Both carts oscillate

11.6(a)

$$(K-\omega^2 M) = \begin{bmatrix} 5k-m\omega^2 & -k \\ -k & 2k-m\omega^2 \end{bmatrix}$$

$$\det(K-\omega^2 M) = (5k-m\omega^2)(2k-m\omega^2)-k^2$$

$$\omega = \pm\frac{1}{2}\left(7\pm\sqrt{13}\right)\sqrt{\frac{k}{m}}$$

(b)

$$\begin{bmatrix} 5-(\pm\frac{1}{2}(7\pm\sqrt{13}))^2 & -1 \\ -1 & 2-(\pm\frac{1}{2}(7\pm\sqrt{13}))^2 \end{bmatrix}$$

$$v_1 = \begin{bmatrix} -\frac{3-\sqrt{13}}{2} \\ 1 \end{bmatrix}$$

$$v_2 = \begin{bmatrix} +\frac{3+\sqrt{13}}{2} \\ 1 \end{bmatrix}$$