

Answers

$$1(b) \quad \omega = \frac{n\pi}{L} \sqrt{\frac{P}{m}}, \quad n = 1, 2, 3, \dots; \quad (d) \quad \omega^2 \approx \frac{P\pi^2}{4L(mL + M)}$$

$$2(a) \quad \tan \alpha L = \tanh \alpha L, \quad \omega^2 = \frac{Eh^2}{12\rho} \alpha^4;$$

(c) 20.35, 33.08 semitones

3(b) Displacement patterns (i) [25, 13, 7, 3]; (ii) [14, 12, 9, 5]

(c) (i) $\omega \approx 0.5117\sqrt{k/m}$; (ii) $\omega \approx 0.4534\sqrt{k/m}$

4 (a) $A = 1/3$; $B = 1/6$; $C = 2/3$

$$(d) \quad \omega = \sqrt{\frac{6k}{7m}} (3 \pm \sqrt{2})$$