

~~1998~~ 1997 no. 8 b(ii)

Periodic Time =

$$= 2\pi \sqrt{\frac{I}{mgh}}$$

$$= 2\pi \sqrt{\frac{I}{25mgh}}$$

$$= 2\pi \sqrt{\frac{2m(a^2 + 12x^2)}{24mgx + mga}} = 2\pi \sqrt{\frac{2(a^2 + 12x^2)}{24gx + ga}}$$

$$T^2 = 4\pi^2 \left(\frac{2(a^2 + 12x^2)}{g(24x + a)} \right) = \frac{8\pi^2}{g} \left[\frac{a^2 + 12x^2}{24x + a} \right]$$

$$\frac{d(T^2)}{dx} = \frac{(24x + a)(0 + 24x) - (a^2 + 12x^2)(24)}{(24x + a)^2} = 0$$

$$\Rightarrow 576x^2 + 24ax - 24a^2 - 288x^2 = 0$$

$$\Rightarrow 288x^2 + 24ax - 24a^2 = 0$$

$$\Rightarrow 12x^2 + ax - a^2 = 0$$

$$\Rightarrow (4x - a)(3x + a) = 0$$

$$\Rightarrow x = \frac{1}{4}a \quad \text{or} \quad x = -\frac{1}{3}a$$

$$\text{Ans: } x = \frac{1}{4}a$$