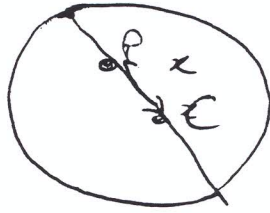


(a) notes [22 marks] 1989

(b)



$$I_P = \frac{1}{2} m r^2 + m x^2.$$

$$T = 2\pi \sqrt{\frac{I}{m g x}}$$

$$T = 2\pi \sqrt{\frac{\frac{1}{2} m r^2 + m x^2}{m g x}}$$
$$= 2\pi \sqrt{\frac{r^2 + 2x^2}{2g x}}$$

$$\frac{dT}{dx} = 0 \Rightarrow \frac{dT^2}{dx} = 0$$

$$\Rightarrow \frac{d}{dx} 4\pi^2 \left(\frac{r^2 + 2x^2}{2g x} \right) = 0$$

$$\Rightarrow 4\pi^2 \left[\frac{2gx \cdot (4x) - (r^2 + 2x^2) 2g}{(2gx)^2} \right] = 0$$

$$\Rightarrow 8gx^2 - 2gr^2 - 4gx^2 = 0$$

$$\Rightarrow 4x^2 - 2r^2 = 0$$

$$\Rightarrow x = \frac{r}{\sqrt{2}}.$$