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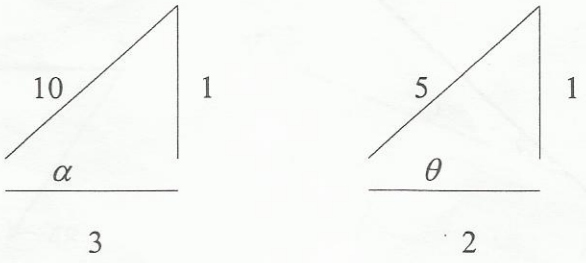
3 (b) If $\tan\theta = 0.5$ then

(i) find the magnitude of the velocity with which the particle strikes the inclined plane at q.

(ii) determine the total energy at p and show that it is equal to the total energy at q.



(i) $$t = \frac{8}{\sqrt{5}\cos\theta} = \frac{8}{\sqrt{5}.\frac{2}{\sqrt{5}}} = 4$$

$$\vec{v} = (4g\sqrt{2}.\frac{3}{\sqrt{10}} - g.\frac{1}{\sqrt{5}}.4)\vec{i} + (4g\sqrt{2}.\frac{1}{\sqrt{10}} - g\frac{2}{\sqrt{5}}.4)\vec{j}$$

$$= \frac{8g}{\sqrt{5}}\,\vec{i} \; - \; \frac{4g}{\sqrt{5}}\,\vec{j}$$

$$|\vec{v}| = \sqrt{\left(\frac{8g}{\sqrt{5}}\right)^2 + \left(\frac{-4g}{\sqrt{5}}\right)^2} = \frac{\sqrt{80}\,g}{\sqrt{5}} \quad \text{or} \quad 4g$$

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(ii) K.E. at p $= \frac{1}{2}$ (m) $(4g\sqrt{2})^2$ or $16\,m\,g^2$

K.E. at q $= \frac{1}{2}$ (m) $(4g)^2$ or $8\,m\,g^2$

P.E. at q = m g $mg(r\,\vec{i}\,\sin\theta)$

$$= m\,g\left\{\frac{48g}{\sqrt{5}} - \frac{8g}{\sqrt{5}}\right\}\frac{1}{\sqrt{5}}$$

$$= 8\,m\,g^2$$

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Total energy at p = Total energy at q