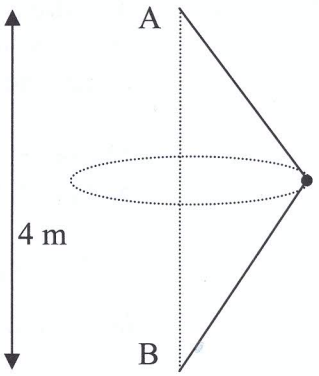
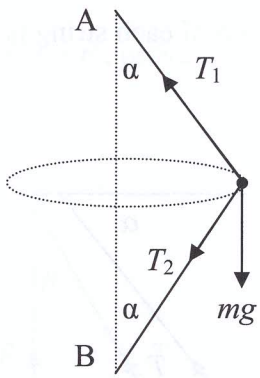
2011

6 **(b)** A and B are two fixed pegs.
A is 4 m vertically above B.
A mass m kg, connected to A and B by two light inextensible strings of equal length, ℓ, is describing a horizontal circle with uniform angular velocity ω.

Find the value of ω if the ratio of the tensions in the two strings is 11: 9.





$$T_1 \sin\alpha + T_2 \sin\alpha = m(\ell \sin\alpha)\omega^2$$
$$T_1 + T_2 = m\ell\omega^2 \qquad 5$$

$$\tfrac{11}{9}T_2 + T_2 = m\ell\omega^2$$
$$T_2 = \tfrac{9}{20}m\ell\omega^2 \qquad 5$$

$$T_1 \cos\alpha - T_2 \cos\alpha = mg$$
$$T_1 - T_2 = \frac{mg}{\cos\alpha} = \tfrac{1}{2}mg\ell \qquad 5$$

$$\tfrac{11}{9}T_2 - T_2 = \tfrac{1}{2}mg\ell$$
$$T_2 = \tfrac{9}{4}mg\ell \qquad 5$$

$$\tfrac{9}{20}m\ell\omega^2 = \tfrac{9}{4}mg\ell$$
$$\omega^2 = 49$$
$$\omega = 7 \text{ rad s}^{-1} \qquad 5$$

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