7000 **(b)** A smooth sphere A collides with an identical smooth sphere B which is at rest. The velocity of A before impact makes an angle α with the line of centres at impact, where $0° \le \alpha < 90°$.

The coefficient of restitution between the spheres is $\frac{1}{2}$.

Show that the angle θ through which the path of A is deflected is given by

$$\tan\theta = \frac{3\tan\alpha}{1+4\tan^2\alpha}.$$

PCM $\quad m(u\cos\alpha) + m(0) = mv_1 + mv_2$ — 5

NEL $\quad v_1 - v_2 = -\frac{1}{2}(u\cos\alpha - 0)$ — 5

$$\Rightarrow \quad v_1 = \frac{u\cos\alpha}{4}$$ — 5

$$\tan\beta = \frac{u\sin\alpha}{\frac{1}{4}u\cos\alpha} = 4\tan\alpha$$ — 5

$$\tan\theta = \tan(\beta-\alpha) = \frac{\tan\beta - \tan\alpha}{1+\tan\beta\tan\alpha}$$ — 5

$$= \frac{4\tan\alpha - \tan\alpha}{1+4\tan\alpha\tan\alpha}$$

$$= \frac{3\tan\alpha}{1+4\tan^2\alpha}$$ — 5

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