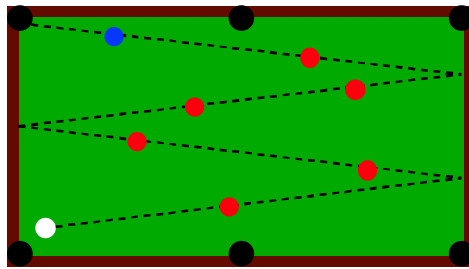


Newton's Snooker Challenge

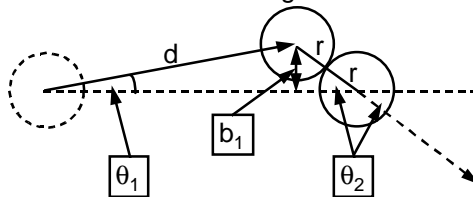
- ◆ The challenge is to pot the blue ball!



- ◆ Can ignore reflections at cushions, i.e. consider problem on big table.

Newton's Snooker Challenge cont.

- ◆ Look at effect of error (impact parameter b) made in striking first red on error in striking blue.



$$\sin \theta_1 = \frac{b_1}{d}$$

$$\sin \theta_2 = \frac{b_2}{d} = \frac{b_1}{2r} \Rightarrow b_2 = b_1 \frac{d}{2r}$$

$$\sin \theta_3 = \frac{b_3}{d} = \frac{b_2}{2r} \Rightarrow b_3 = b_2 \frac{d}{2r} = b_1 \left(\frac{d}{2r} \right)^2$$

$$b_n = b_1 \left(\frac{d}{2r} \right)^{n-1}$$

Newton's Snooker Challenge cont.

- ◆ What is effect of gravitational attraction of referee? (Assume mass of referee 100 kg, of ball 100g.)

- ◆ Force

$$F = \frac{GMm}{l^2}$$
$$\approx \frac{6 \cdot 67 \times 10^{-11} \times 100 \times 0.1}{1^2} \approx 10^{-9} \text{ N}$$

- ◆ Resulting first impact parameter if travel time of cue ball ~ 1 sec.

$$b_1 = \frac{1}{2} \frac{F}{m} t^2 \approx 10^{-8} \text{ m}$$

Newton's Snooker Challenge cont.

- ◆ Resulting seventh impact parameter, assuming $d \sim 1 \text{ m}$, $r \sim 1 \text{ cm}$:

$$b_7 = b_1 \left(\frac{d}{2r} \right)^{n-1}$$
$$= 10^{-10} * \left(\frac{1}{0.02} \right)^6$$
$$\approx 10^{-8} \times 10^{10} = 100 \text{ m.}$$

- ◆ That is, at some point (where?) in the chain, one of the balls misses its target completely.