Assignment No.2

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Download all python codes from

https://github.com/Vallidevibolla/Assignment−2/blob/main/main.tex

and latex-tikz codes from

https://github.com/Vallidevibolla/Assignment−2/blob/main/main.tex

Question taken from

https://github.com/gadepall/ncert/blob/main/linalg/vectors/gvv_ncert_vectors.pdf− Q.no.2.18

1 Question No.2.18

Consider the collision depicted in Fig. 2.18 to be between two billiard balls with equal masses m1=m2. The first ball is called the cue while the second ball is called the target. The billiard player wants to 'sink' the target ball in a corner pocket, which is at angle ø = 37°. Assume that the collision is elastic and that friction and rotational motion are not important. Obtain θ.

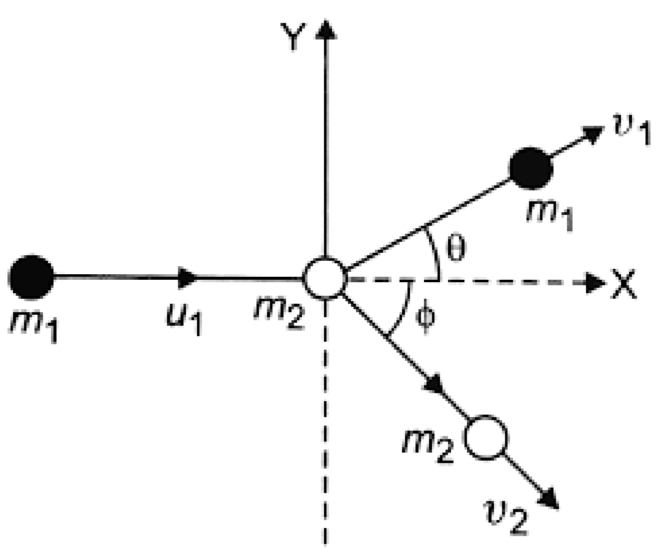

Fig. 1.1: Fig. 2.18

2 Solution

Given, two billiard balls with equal masses m1=m2

∴ m1=m2=m

The first ball is called the **cue** while the second ball is called the **target**.

Figure shows that the cue is moving with initial velocity u1 towards target

∴ The initial velocity of cue = u1

The initial velocity of target (Static) u2=0

The cue moving with velocity collide the target thereby both balls get collide and travel in two directions with some velocity.

∴ The final velocity of cue =v1

The final velocity of target = v2

3 Formula

Momentum of the ball is given as P=mv

$$\boxed{m1u1 + m2u2 = m1v1 + m2v2} \tag{3.0.1}$$

$$since(u2 = 0), also(m1 = m2 = m) \tag{3.0.2}$$

$$\boxed{u1 = v1 + v2} \tag{3.0.3}$$

The energy of two balls after collision is given by Kinetic energy. **K.E** $=\frac{1}{2}$m v^2

$\frac{1}{2}$mu1^2 =1$\frac{}{2}$mv1^2+1$\frac{}{2}$mv2^2

$$\boxed{u1^2 = v1^2 + v2^2} \tag{3.0.4}$$

$$\implies (v1 + v2)^2 = v1^2 + v2^2 \tag{3.0.5}$$

$$\implies v1^2 + v2^2 + 2v1v2 = v1^2 + v2^2 \tag{3.0.6}$$

$$\implies 2v1v2 = 0 \tag{3.0.7}$$

$$\implies v_1.v_2 = 0 \tag{3.0.8}$$

since $\cos 90° = 0$

$\implies v_1.v_2(\cos\Phi) = \cos 90°$

$Given, \Phi = 37° \implies \cos(\theta + 37°) = \cos 90°$

$\implies \theta + 37° = 90°$

$\boxed{\theta = 53°}$

∴ The angle of target was found to be $\theta = 53°$