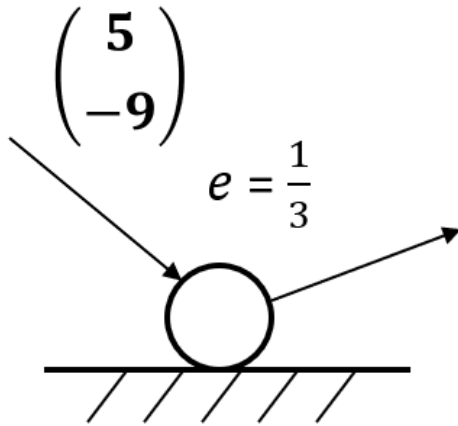


5.1) Oblique impact with a fixed surface

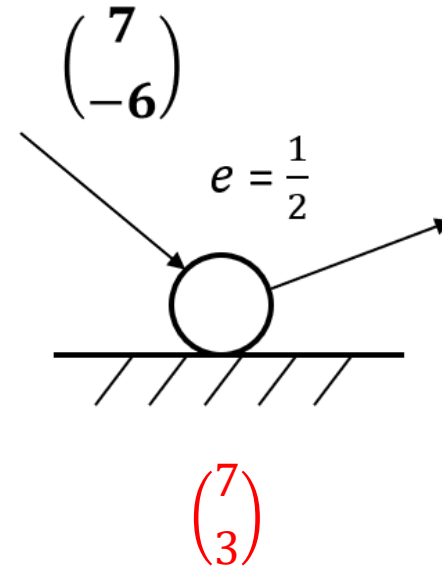
Worked example

A smooth sphere hits a smooth horizontal plane. Find the velocity after the collision.



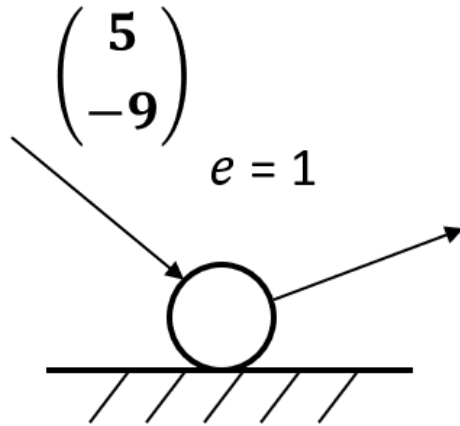
Your turn

A smooth sphere hits a smooth horizontal plane. Find the velocity after the collision.



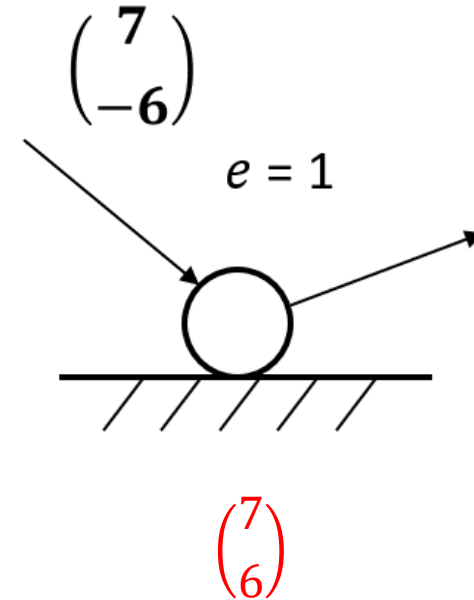
Worked example

A smooth sphere hits a smooth horizontal plane. Find the velocity after the collision.



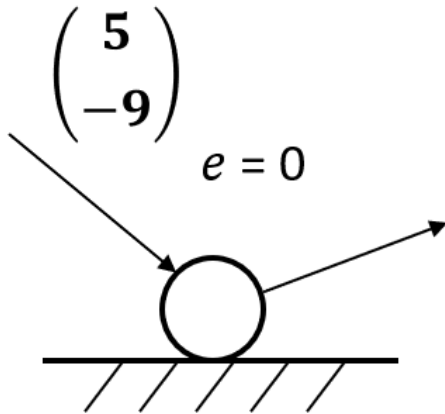
Your turn

A smooth sphere hits a smooth horizontal plane. Find the velocity after the collision.



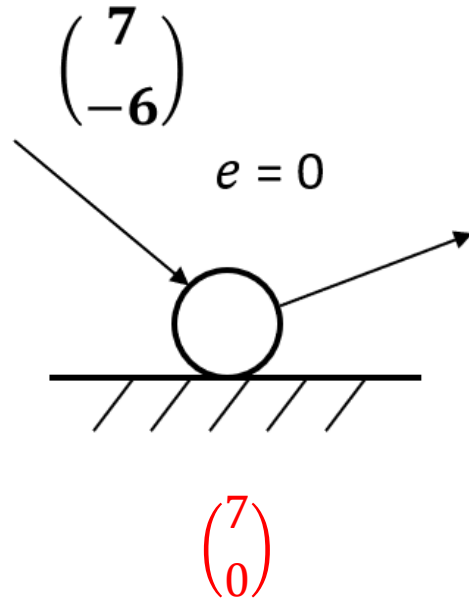
Worked example

A smooth sphere hits a smooth horizontal plane. Find the velocity after the collision.



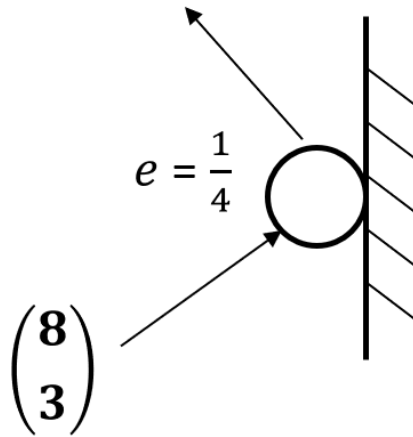
Your turn

A smooth sphere hits a smooth horizontal plane. Find the velocity after the collision.



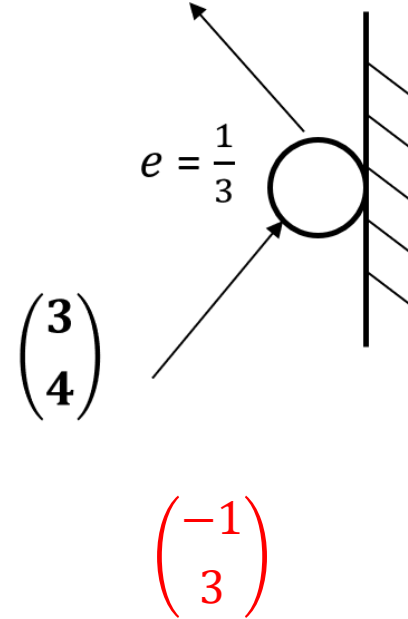
Worked example

A smooth sphere hits a smooth vertical plane. Find the velocity after the collision.



Your turn

A smooth sphere hits a smooth horizontal plane. Find the velocity after the collision.



Worked example

A smooth sphere S is moving on a smooth horizontal plane with speed u when it collides with a smooth fixed vertical wall.

At the instant of collision the direction of motion of S makes an angle of 30° with the wall. The coefficient of restitution between S and the wall is $\frac{1}{2}$. Find:

- a) The speed of S immediately after the collision
- b) The angle of deflection of S

Your turn

A smooth sphere S is moving on a smooth horizontal plane with speed u when it collides with a smooth fixed vertical wall.

At the instant of collision the direction of motion of S makes an angle of 60° with the wall. The coefficient of restitution between S and the wall is $\frac{1}{4}$. Find:

- a) The speed of S immediately after the collision
- b) The angle of deflection of S

a) $\frac{\sqrt{19}}{8} u$

b) 83.4° (3 sf)

Worked example

A small smooth ball is falling vertically. The ball strikes a smooth plane which is inclined at an angle α to the horizontal, where $\tan \alpha = \frac{1}{3}$. Immediately before striking the plane the ball has speed 10 ms^{-1} . The coefficient of restitution between the ball and the plane is $\frac{1}{3}$.

Find the speed of the ball immediately after impact.

Your turn

A small smooth ball is falling vertically. The ball strikes a smooth plane which is inclined at an angle α to the horizontal, where $\tan \alpha = \frac{1}{2}$. Immediately before striking the plane the ball has speed 5 ms^{-1} . The coefficient of restitution between the ball and the plane is $\frac{1}{2}$.

Find the speed of the ball immediately after impact.

3.16 ms^{-1} (3 sf)

Worked example

A small smooth ball of mass 4 kg is moving in the xy -plane and collides with a smooth fixed vertical wall which contains the y -axis. The velocity of the ball just before impact is $(-12\mathbf{i} - 8\mathbf{j}) \text{ ms}^{-1}$. The coefficient of restitution between the sphere and the wall is $\frac{1}{2}$. Find:

- The velocity of the ball immediately after the impact.
- The kinetic energy lost as a result of the impact.
- The angle of deflection of the ball

Your turn

A small smooth ball of mass 2 kg is moving in the xy -plane and collides with a smooth fixed vertical wall which contains the y -axis. The velocity of the ball just before impact is $(-6\mathbf{i} - 4\mathbf{j}) \text{ ms}^{-1}$. The coefficient of restitution between the sphere and the wall is $\frac{1}{3}$. Find:

- The velocity of the ball immediately after the impact.
- The kinetic energy lost as a result of the impact.
- The angle of deflection of the ball

a) $(2\mathbf{i} - 4\mathbf{j}) \text{ ms}^{-1}$

b) 32 J

c) 82.9° (3 sf)

Worked example

A smooth sphere S , of mass m , is moving with velocity $7\mathbf{i} + 2\mathbf{j}$ when it collides with a smooth fixed vertical wall. After the collision the velocity of the sphere, S , is $3\mathbf{i} - 3\mathbf{j}$

- The impulse exerted by the wall on the ball.
- Use the scalar product to find the coefficient of restitution between the sphere and the wall.

Your turn

A smooth sphere S , of mass m , is moving with velocity $2\mathbf{i} + 7\mathbf{j}$ when it collides with a smooth fixed vertical wall. After the collision the velocity of the sphere, S , is $\mathbf{i} - 3\mathbf{j}$

- The impulse exerted by the wall on the ball.
- Use the scalar product to find the coefficient of restitution between the sphere and the wall.

a) $m(-\mathbf{i} - 10\mathbf{j})$

b) $\frac{29}{72}$