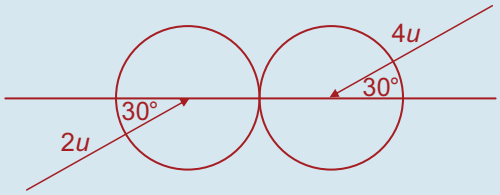
(ii) Rotate diagram as shown:



Before	(Mass)	After
$u\sqrt{3}\vec{i} + u\vec{j}$	$2m$	$p\vec{i} + u\vec{j}$
$-2u\sqrt{3}\vec{i} - 2u\vec{j}$	m	$q\vec{i} - 2u\vec{j}$

Momentum in the $\vec{i}$–direction is conserved

$\Rightarrow 2m(u\sqrt{3}) + m(-2u\sqrt{3}) = 2m(p) + m(q)$

… divide by m

$\Rightarrow 2p + q = 0$ **Equation 1**

N.E.L.

$$\frac{p - q}{u\sqrt{3} + 2u\sqrt{3}} = -\frac{1}{\sqrt{3}}$$

$\Rightarrow p - q = -3u$ **Equation 2**

Adding equations **1** and **2** we get

$3p = -3u$

$\Rightarrow p = -u$

Speed of 1st sphere after impact

$= \sqrt{p^2 + u^2}$

$= \sqrt{(-u)^2 + u^2}$

$= \sqrt{2u^2}$

$= u\sqrt{2}$

$q = -2p$ … from **Equation 1**

$\Rightarrow q = 2u$

Speed of 2nd sphere after impact

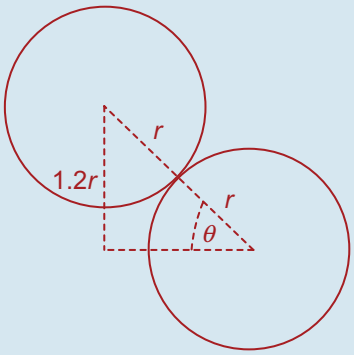
$= \sqrt{q^2 + (-2u)^2}$

$= \sqrt{(2u)^2 + (-2u)^2}$

$= \sqrt{8u^2}$

$= 2u\sqrt{2}$

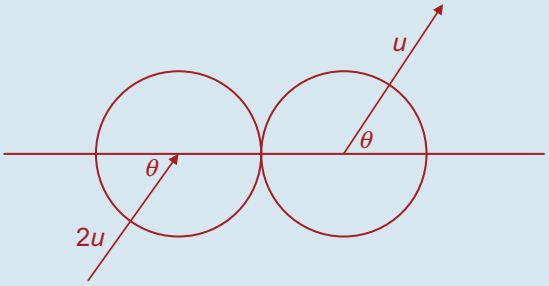
Q. 8. (i) Point of collision:



$\sin\theta = \frac{1.2r}{2r} = \frac{3}{5}$

$\Rightarrow \cos\theta = \frac{4}{5}$

Rotate diagram as shown in the diagram below:



Before	(Mass)	After
$\frac{8u}{5}\vec{i} + \frac{6u}{5}\vec{j}$	m	$p\vec{i} + \frac{6u}{5}\vec{j}$
$\frac{4u}{5}\vec{i} + \frac{3u}{5}\vec{j}$	m	$q\vec{i} + \frac{3u}{5}\vec{j}$

Momentum in the $\vec{i}$–direction is conserved

$\Rightarrow m\left(\frac{8u}{5}\right) + m\left(\frac{4u}{5}\right) = m(p) + m(q)$

… multiply by $\frac{5}{m}$

$\Rightarrow 5p + 5q = 12u$ **Equation 1**

N.E.L.

$$\frac{p - q}{\frac{8u}{5} - \frac{4u}{5}} = -\frac{1}{2}$$

$$\Rightarrow \frac{5p - 5q}{4u} = -\frac{1}{2}$$

$\Rightarrow 5p - 5q = -2u$ **Equation 2**

Adding equations **1** and **2** we get

$10p = 10u$

$\Rightarrow p = u$