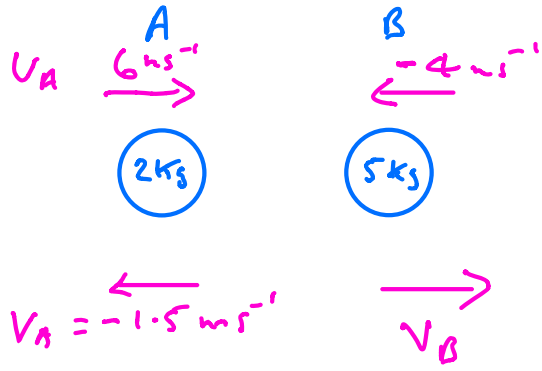
5)



PCLM

$$m_A u_A + m_B u_B = m_A v_A + m_B v_B$$

$$2 \times 6 - 5 \times 4 = 2 \times -1.5 + 5 v_B$$

$$12 - 20 = -3 + 5 v_B$$

$$-5 = 5 v_B$$

$$\underline{v_B = -1\ ms^{-1}}$$

So $1\ ms^{-1}$ in original direction

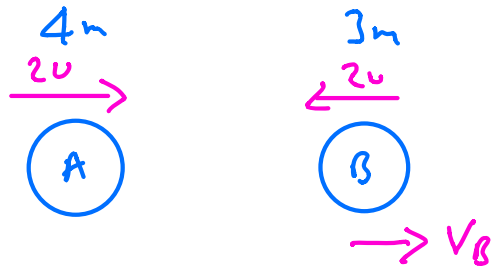
b) Impulse on B $= m_B v_B - m_B u_B$

$$= 5 \times -1 - 5 \times -4$$

$$= 15\ Ns$$

---

7)



a)

PCLM $\quad 4m \times 2u - 3m \times 2u = 4m \times 0 + 3m \times v_B$

$$8mu - 6mu = 0 + 3m v_B$$

$$2mu = 3m v_B$$

$$V_B = \frac{2u}{3}$$

in direction opposite to its original motion

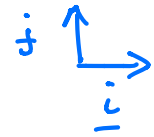
---

b) $$\text{Impulse} = m_B V_B - m_B U_B$$

$$= 3m \times \frac{2}{3}u - -3m \times 2u$$

$$= 8mu \text{ Ns}$$

Exercise 1C



1) 0.25 kg velocity $(12\underline{i} + 4\underline{j})$ ms^{-1}

receives impulse $(8\underline{i} - 7\underline{j})$ Ns. Find $\underline{V}$

$$\underline{I} = m\underline{V} - m\underline{U}$$

$$\begin{pmatrix} 8 \\ -7 \end{pmatrix} = 0.25\underline{V} - 0.25\begin{pmatrix} 12 \\ 4 \end{pmatrix}$$

$$\begin{pmatrix} 8 \\ -7 \end{pmatrix} + \begin{pmatrix} 3 \\ 1 \end{pmatrix} = 0.25\underline{V}$$

$$\begin{pmatrix} 11 \\ -6 \end{pmatrix} = \frac{1}{4}\underline{V}$$

$$\begin{pmatrix} 44 \\ -24 \end{pmatrix} = \underline{V}$$

$$\underline{V} = (44\underline{i} - 24\underline{j}) \text{ ms}^{-1}$$

---

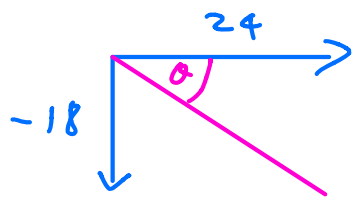
a) P 3 kg receives impulse of $\underline{Q}$ Ns

$$\underline{u} = \begin{pmatrix} 5 \\ 0 \end{pmatrix} \qquad \underline{v} = \begin{pmatrix} 13 \\ -6 \end{pmatrix}$$

$$\underline{I} = m\underline{v} - m\underline{u}$$

$$\underline{Q} = 3\begin{pmatrix} 13 \\ -6 \end{pmatrix} - 3\begin{pmatrix} 5 \\ 0 \end{pmatrix} = \begin{pmatrix} 24 \\ -18 \end{pmatrix}$$

$$|\underline{Q}| = \sqrt{24^2 + (-18)^2} = 30 \text{ Ns}$$



$$\theta = \tan^{-1}\frac{18}{24} = 36.9^\circ$$

---

12) 0.2 kg $\quad \underline{u} = \begin{pmatrix} -15 \\ 0 \end{pmatrix}$ ms^{-1}

$$\underline{I} = \begin{pmatrix} 2 \\ 6 \end{pmatrix} \text{ Ns}$$

$$\underline{I} = m\underline{v} - m\underline{u}$$

$$\begin{pmatrix} 2 \\ 6 \end{pmatrix} = 0.2\,\underline{v} - 0.2\begin{pmatrix} -15 \\ 0 \end{pmatrix}$$

$$\begin{pmatrix} 2 \\ 6 \end{pmatrix} = 0.2\,\underline{v} - \begin{pmatrix} -3 \\ 0 \end{pmatrix}$$

$$\begin{pmatrix}2\\6\end{pmatrix}+\begin{pmatrix}-3\\0\end{pmatrix} = 0.2\,\underline{v}$$

$$\begin{pmatrix}-1\\6\end{pmatrix} = 0.2\,\underline{v}$$

$$\underline{v} = \begin{pmatrix}-5\\30\end{pmatrix}\ ms^{-1}$$

$$\underline{v} = -5\underline{i} + 30\underline{j}\ ms^{-1}$$

---

13) $0.25\,kg$ $\quad \underline{v} = \begin{pmatrix}t^2-3\\4t\end{pmatrix}$

$$t=3,\quad \underline{u} = \begin{pmatrix}9-3\\4(3)\end{pmatrix} = \begin{pmatrix}6\\12\end{pmatrix}$$

$$\underline{I} = m\underline{v} - m\underline{u}$$

$$\begin{pmatrix}2\\2\end{pmatrix} = 0.25\,\underline{v} - 0.25\begin{pmatrix}6\\12\end{pmatrix}$$

$$\begin{pmatrix}2\\2\end{pmatrix}+\begin{pmatrix}1.5\\3\end{pmatrix} = 0.25\,\underline{v}$$

$$\begin{pmatrix}3.5\\5\end{pmatrix} = \frac{1}{4}\,\underline{v}$$

$$\underline{v} = \begin{pmatrix}14\\20\end{pmatrix}\ ms^{-1}$$

$$\underline{v} = 14\underline{i} + 20\underline{j}\ ms^{-1}$$

Classwork and Hwk

Exercise 1C

Q10, Q11, Q14, Q15, Q16