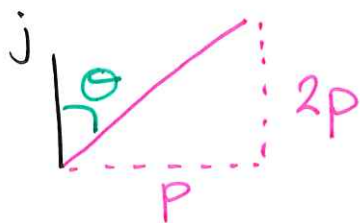


Q1.

a)



$$\theta = \tan^{-1} \left(\frac{p}{2p} \right) = \tan^{-1} \left(\frac{1}{2} \right)$$
$$= \underline{\underline{26.6^\circ}}$$

b)

$$R = \begin{pmatrix} 1 \\ -3 \end{pmatrix} + \begin{pmatrix} p \\ 2p \end{pmatrix} = \begin{pmatrix} 1+p \\ -3+2p \end{pmatrix}$$

$$i = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

parallel

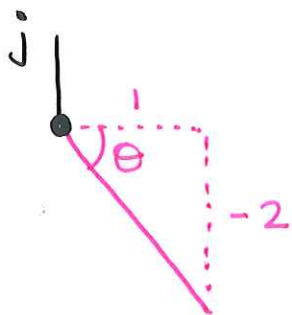
$$\frac{-3+2p}{1+p} = \frac{0}{1}$$

$$-3+2p = 0$$

$$p = \frac{3}{2}$$

Q2.

a)



$$\tan \theta = \frac{2}{1}$$

$$\theta = 63.4$$

Angle between R and j $90 + 63.4$
 $= \underline{\underline{153.4^\circ}}$

$$b) \quad R = \begin{pmatrix} 4 \\ -5 \end{pmatrix} + \begin{pmatrix} p \\ q \end{pmatrix} = \begin{pmatrix} 4+p \\ -5+q \end{pmatrix}$$

parallel to $\begin{pmatrix} 1 \\ -2 \end{pmatrix}$

$$\therefore \frac{-5+q}{4+p} = \frac{-2}{1}$$

$$-5+q = -8-2p$$

$$2p+q+3=0$$

$$c) \quad q=1$$

$$2p+1+3=0 \Rightarrow p=-2$$

$$R = \begin{pmatrix} 2 \\ -4 \end{pmatrix} \quad |R| = \sqrt{2^2 + (-4)^2} = \sqrt{20}$$

$$F = ma$$

$$\sqrt{20} = m \cdot 8\sqrt{5}$$

$$m = \underline{\underline{\frac{1}{4}}}$$

Q3.

$$a) \quad R = \begin{pmatrix} 4 \\ -2 \end{pmatrix} + \begin{pmatrix} 2 \\ q \end{pmatrix} = \begin{pmatrix} 6 \\ -2+q \end{pmatrix}$$

$$\frac{-2+q}{6} = \frac{1}{2}$$

$$-4 + 2q = 6$$

$$q = 5$$

$$b) \quad q = 5$$

$$R = \begin{pmatrix} 6 \\ 3 \end{pmatrix}$$

$$F = ma$$

$$6i + 3j = 1.5a$$

$$a = 4i + 2j$$

$$v = u + at$$

$$v = \begin{pmatrix} -2 \\ 4 \end{pmatrix} + \begin{pmatrix} 4 \\ 2 \end{pmatrix} (2)$$

$$v = \begin{pmatrix} 6 \\ 8 \end{pmatrix} = 6i + 8j$$

$$\text{Speed} = \sqrt{6^2 + 8^2} = \underline{\underline{10 \text{ ms}^{-1}}}$$

Q4.

a) $\vec{F}_1 = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$

$$\vec{F}_2 = \begin{pmatrix} x \\ x \end{pmatrix}$$

$$\vec{R} = \begin{pmatrix} -1 \\ 2 \end{pmatrix} + \begin{pmatrix} x \\ x \end{pmatrix} = \begin{pmatrix} -1+x \\ 2+x \end{pmatrix}$$

$$\frac{2+x}{-1+x} = \frac{3}{1}$$

$$2+x = -3+3x$$

$$5 = 2x$$

$$x = 2.5$$

$$\vec{F}_2 = \begin{pmatrix} 2.5 \\ 2.5 \end{pmatrix} = 2.5\vec{i} + 2.5\vec{j}$$

b) s

$$\vec{u} = 3\vec{i} - 22\vec{j}$$

v

$$\vec{a} = 3\vec{i} + 9\vec{j}$$

$$t = 3$$

$$\vec{v} = \vec{u} + \vec{a}t$$

$$\vec{v} = 3\vec{i} - 22\vec{j} + (3\vec{i} + 9\vec{j})(3)$$

$$\vec{v} = 12\vec{i} + 5\vec{j}$$

$$\text{Speed} = \sqrt{12^2 + 5^2} = \underline{\underline{13 \text{ ms}^{-1}}}$$