

Chapter 11: VECTORS (Answers)

①

$$\text{Current Position} = \text{Start Position} + \text{velocity} \times \text{time}$$

$$-4i - 7j = \text{Start Position} + (-3i + 2j) 6$$

$$-4i - 7j = \text{Start Position} + -18i + 12j$$

$$\text{Start Position} = 14i - 19j$$

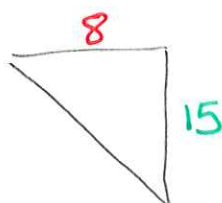
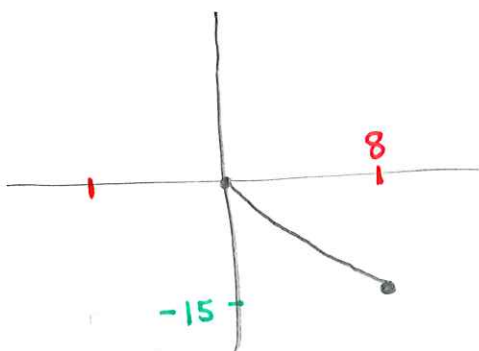
$$\text{Current Position} = 14i - 19j + (-3i + 2j)t$$

$$t = 2$$

$$\text{Current Position} = 14i - 19j + (-3i + 2j)2$$

$$= 14i - 19j - 6i + 4j$$

$$= 8i - 15j$$



$$\sqrt{8^2 + 15^2} = \underline{\underline{17m}}$$

②

$$v = u + at$$

$$-6i + j = u + (2i - 5j)3$$

$$-6i + j = u + 6i - 15j$$

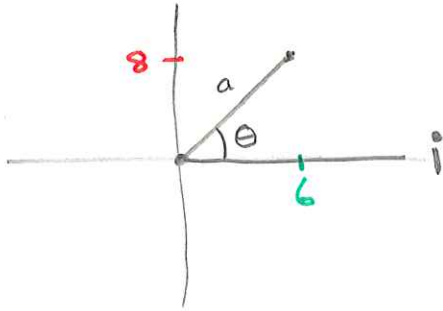
$$u = -12i + 16j$$

$$u = \sqrt{(-12)^2 + (16)^2} = \underline{\underline{20 \text{ ms}^{-1}}}$$

③

$$a = 6i + 8j$$

a)



$$\tan \theta = \frac{8}{6}$$

$$\theta = \underline{\underline{53^\circ}}$$

b)

$$F = ma$$

$$F = 0.4(6i + 8j)$$

$$= 2.4i + 3.2j$$

$$\text{magnitude } \sqrt{2.4^2 + 3.2^2} = \sqrt{16} = \underline{\underline{4}}$$

c)

$$t = 0 \quad v = 9i - 10j$$

$$v = u + at$$

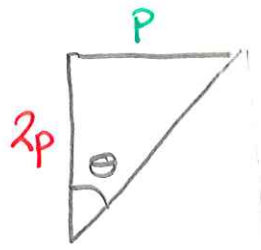
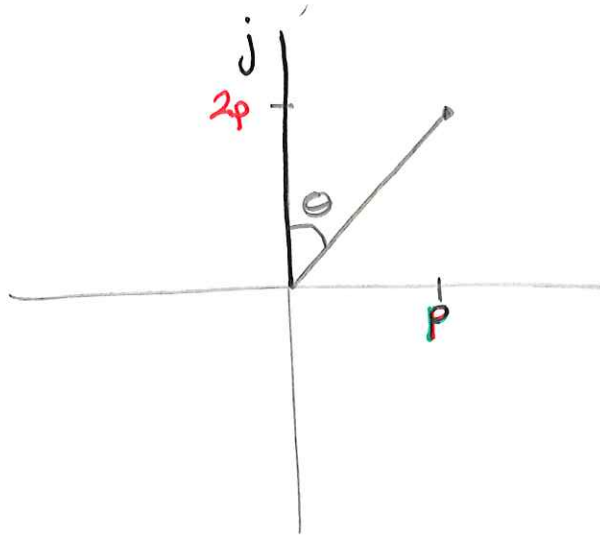
$$v = 9i - 10j + (6i + 8j)5$$

$$= 9i - 10j + 30i + 40j$$

$$= 39i + 30j$$

④

a)



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

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

$$\theta = \underline{\underline{26.6^\circ}}$$

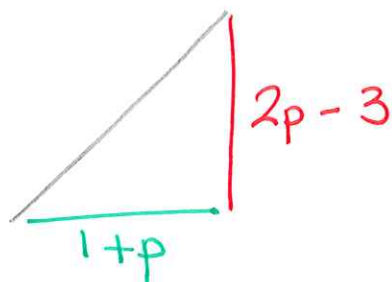
b)

$$F_1 + F_2 = R$$

$$i - 3j + pi + 2pj = 0$$

$$i + pi + 2pj - 3j = 0$$

$$(1+p)i + (2p-3)j = 0$$



parallel to i

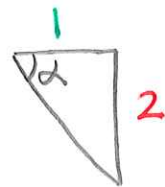
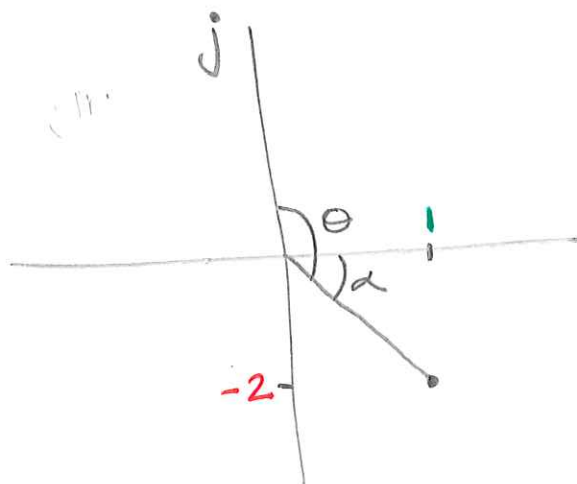
$$i \text{ gradient} = 0 \quad \text{---} i$$

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

$$2p-3 = 0 \quad \therefore p = \frac{3}{2}$$

⑤

a) parallel = same gradient



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

$$\alpha = 63.4^\circ$$

$$\begin{aligned}\theta &= 63.4 + 90 \\ &= \underline{\underline{153.4^\circ}}\end{aligned}$$

$$b) R = 4i - 5j + pi + 2j$$

$$R = (4+p)i + (2-5)j$$

$$\text{gradient of } R = \frac{2-5}{4+p}$$

$$\text{gradient of } (i-2j) = -\frac{2}{1}$$

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

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

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

⑤

$$c) \quad 2p + q + 3 = 0$$

$$2p + 1 + 3 = 0$$

$$2p + 4 = 0$$

$$p = -\frac{4}{2}$$

$$p = -2$$

$$q = 1$$

$$R = (4+p)i + (q-5)j$$

$$R = 2i - 4j$$

$$\text{magnitude} \quad \sqrt{2^2 + (-4)^2} = \sqrt{20}$$

$$F = ma$$

$$a = 8\sqrt{5}$$

$$F = \sqrt{20} = \sqrt{4 \cdot 5} = 2\sqrt{5}$$

$$2\sqrt{5} = m \cdot 8\sqrt{5}$$

$$2/8 = m$$

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

⑥

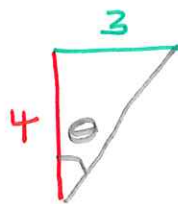
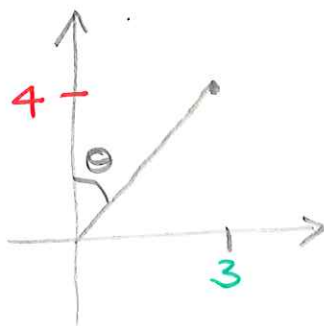
a) when $t = 0$ $s = 9i - 6j$
and when $t = 4$ $s = 21i + 10j$

hence in 4 secs s travels $12i + 16j$
 $\begin{matrix} \nearrow & \nearrow \\ 21-9 & -6-10 \end{matrix}$

$$\therefore \text{speed} = \frac{12i + 16j}{4} = 3i + 4j$$

$$\text{magnitude} = \sqrt{3^2 + 4^2} = \underline{\underline{5 \text{ ms}^{-1}}}$$

b)



$$\tan \theta = \frac{3}{4}$$

$$\theta = \underline{\underline{36.9^\circ}}$$

c)

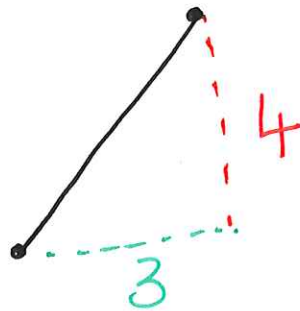
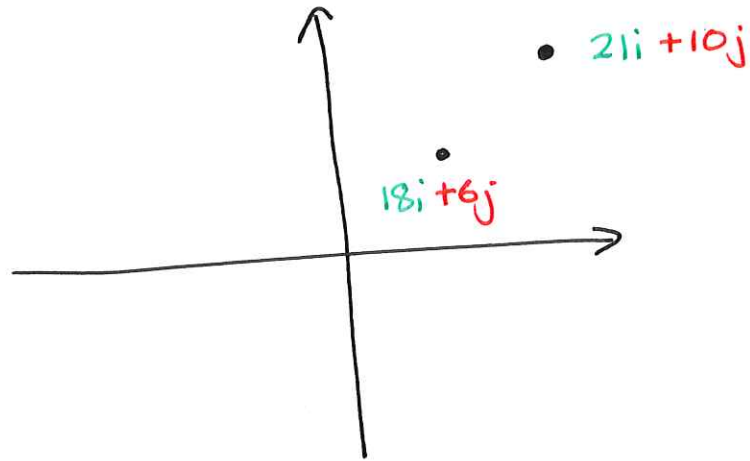
$$\text{Final position} = \text{Start position} + vt$$

$$= 9i - 6j + (3i + 4j)t$$

$$= 9i - 6j + 3ti + 4tj$$

$$= (9 + 3t)i + (4t - 6)j$$

⑥
d)



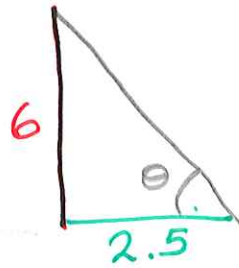
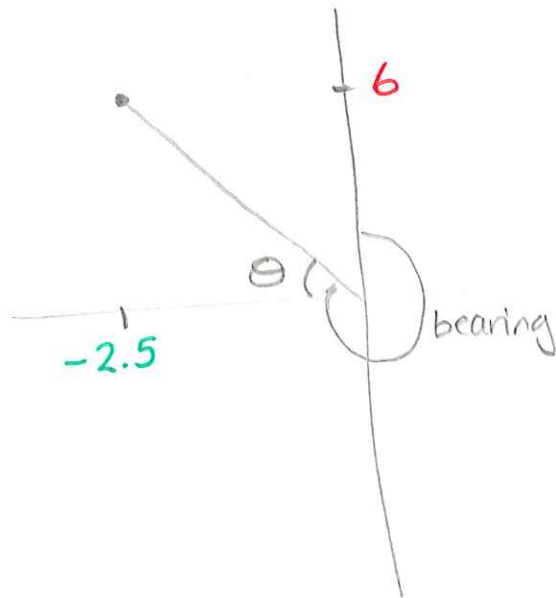
$$\text{Distance} = \sqrt{3^2 + 4^2} = \underline{\underline{5 \text{ km}}}$$

⑦

a) velocity = $-2.5i + 6j$

speed = $\sqrt{(-2.5)^2 + 6^2} = 6.5 \text{ ms}^{-1}$

b)



$$\tan \theta = \frac{6}{2.5}$$

$$\theta = 67.4^\circ$$

$$\begin{aligned} \text{Bearing} &= 67.4 + 270 \\ &= \underline{\underline{337.4^\circ}} \end{aligned}$$

c) Final position = start position + $v t$

$$= 16i + 5j + (-2.5i + 6j)3$$

$$= 16i + 5j - 7.5i + 18j$$

$$= 8.5i + 23j$$