10.2 Solutions

Answer 1

$\boldsymbol{a} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$ $\boldsymbol{b} = \begin{pmatrix} -13 \\ -3 \end{pmatrix}$ $\boldsymbol{c} = \begin{pmatrix} -7.5 \\ 0 \end{pmatrix}$

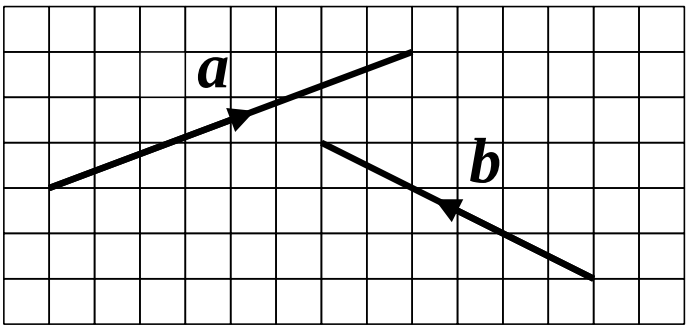
[3 marks]

Answer 2

$\boldsymbol{d} = 4\boldsymbol{i} - \boldsymbol{j}$ $\boldsymbol{e} = -12\boldsymbol{i} + 4\boldsymbol{j}$ $\boldsymbol{f} = -2\boldsymbol{j}$

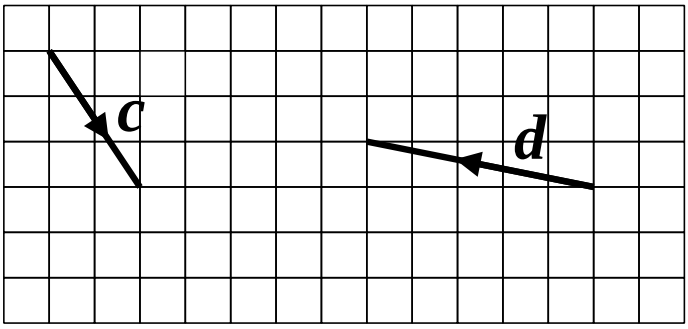
[3 marks]

Answer 3



[2 marks]

Answer 4



[2 marks]

Answer 5

(i) $|\boldsymbol{p}| = \sqrt{149}$ (12.2 but question requests the answer in surd form)

(ii) $180 - 55 = 125°$

[2, 2 marks]

Answer 6

$3\begin{pmatrix} 6 \\ 25 \end{pmatrix}$ $12\begin{pmatrix} 3 \\ 5 \end{pmatrix}$ $-4\begin{pmatrix} 6 \\ 25 \end{pmatrix}$ $20\begin{pmatrix} 1 \\ -4 \end{pmatrix}$ $-15\begin{pmatrix} 2 \\ 3 \end{pmatrix}$

The leftmost and the middle are parallel

[1 mark]

Answer 7

$\begin{pmatrix} 5 \\ 12 \end{pmatrix}$ $\begin{pmatrix} 12 \\ 5 \end{pmatrix}$ $\begin{pmatrix} 0 \\ -18 \end{pmatrix}$ $\begin{pmatrix} 36 \\ -15 \end{pmatrix}$ $\begin{pmatrix} -24 \\ -10 \end{pmatrix}$

$$5 \times 36 + 12 \times (-15) = 0$$

[1 mark]

Answer 8

$\begin{pmatrix} 4.69 \\ -5.59 \end{pmatrix}$

[3 marks]

Answer 9

(i) $\begin{pmatrix} 40 \\ -3 \end{pmatrix}$ **(ii)** $\begin{pmatrix} -16 \\ 28 \end{pmatrix}$

[2, 2 marks]

Answer 10

(a) **(i)** $\overrightarrow{AB} = -\boldsymbol{a} + \boldsymbol{b}$ **(ii)** $\overrightarrow{BD} = 2\boldsymbol{a} - 2\boldsymbol{b}$

(iii) $\overrightarrow{OD} = 2\boldsymbol{a} - \boldsymbol{b}$ **(iv)** $\overrightarrow{MA} = \frac{1}{2}\boldsymbol{b}$

[4 marks]

(b) **(i)**

$$\begin{pmatrix} p \\ q \end{pmatrix} = -\begin{pmatrix} 6 \\ 9 \end{pmatrix} + \begin{pmatrix} 0 \\ 13 \end{pmatrix}$$

$$p = -6 \quad \text{and} \quad q = 4$$

[2 marks]

(ii) Consider

$$\overrightarrow{OA} = \begin{pmatrix} 6 \\ 9 \end{pmatrix} \quad \text{and} \quad \overrightarrow{AB} = \begin{pmatrix} -6 \\ 4 \end{pmatrix}$$

And observe that

$$6 \times (-6) + 9 \times 4 = 0$$

$\therefore \angle OAB$ is a right angle $\square$

[2 marks]

Answer 11

(a) **(i)** $\overrightarrow{VC} = \boldsymbol{a} + \boldsymbol{b}$ **(ii)** $\overrightarrow{VO} = -\boldsymbol{a} + 2\boldsymbol{b}$

(iii) $\overrightarrow{VR} = -\boldsymbol{a} + \boldsymbol{b}$ **(iv)** $\overrightarrow{MT} = \frac{1}{2}\boldsymbol{a} + \frac{3}{2}\boldsymbol{b}$

[4 marks]

(b) $\left|\overrightarrow{MT}\right|^2 = 2.3^2 + 9.2^2 - 2 \times 2.3 \times 9.2 \times \cos 60°$

$= 8.29\,\text{cm}$

[2 marks]

Answer 12

(a) **(i)** $\overrightarrow{AD} = -\boldsymbol{a} + \frac{1}{2}\boldsymbol{c}$

(ii) $\overrightarrow{OE} = -2\boldsymbol{a} + \boldsymbol{c}$

[2 marks]

(b) $1 : 2$

[2 marks]

Answer 13

$CB : BX$

$2 : 3$

$4\boldsymbol{a} : 6\boldsymbol{a} \Rightarrow \overrightarrow{BX} = 6\boldsymbol{a} \Rightarrow \overrightarrow{AX} = 3\boldsymbol{c} + 6\boldsymbol{a} \Rightarrow \overrightarrow{CY} = 6\boldsymbol{c} + 12\boldsymbol{a}$

$\therefore \overrightarrow{OY} = 9\boldsymbol{c} + 12\boldsymbol{a}$

[3 marks]

Answer 14

(i) $\left|\boldsymbol{X}\right| = \sqrt{0.6^2 + 0.8^2}$

$= 1$

$\therefore X$ is a unit vector

[2 marks]

(ii) $\left|Y\right| = \sqrt{14^2 + 48^2}$

$= 50$

$\therefore$ Required unit vector is $\begin{pmatrix} 0.28 \\ 0.96 \end{pmatrix}$

[2 marks]

(iii) $\begin{pmatrix} \dfrac{p}{\sqrt{p^2 + q^2}} \\ \dfrac{q}{\sqrt{p^2 + q^2}} \end{pmatrix}$

[2 marks]