National 5 Mathematics

Vectors - Solutions

Marks are indicated in brackets after each question number

2014 Paper 1 Question 4, (2)

$$2\underline{u} - \underline{v} = 2 \begin{pmatrix} -2 \\ 3 \\ 5 \end{pmatrix} - \begin{pmatrix} 0 \\ -4 \\ 7 \end{pmatrix}$$

$$= \begin{pmatrix} -4 \\ 6 \\ 10 \end{pmatrix} - \begin{pmatrix} 0 \\ -4 \\ 7 \end{pmatrix}$$

$$= \begin{pmatrix} -4 \\ 10 \\ 3 \end{pmatrix}$$

2014 Paper 2 Question 2, (2)

$$B = (8, 4, 10)$$

$$C = (4, 0, 10)$$

2015 Paper 2 Question 4, (2)

$$|\underline{u}| = \sqrt{6^2 + (-13)^2 + 18^2}$$

$$= \sqrt{529}$$

$$= 23$$

2015 Paper 2 Question 5, (2)

$$\underline{p} = \begin{pmatrix} -5 \\ 3 \end{pmatrix}, \underline{q} = \begin{pmatrix} 4 \\ -5 \end{pmatrix}$$

$$\underline{p} + \underline{q} = \begin{pmatrix} -5 \\ 3 \end{pmatrix} + \begin{pmatrix} 4 \\ -5 \end{pmatrix} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$$

2016 Paper 1 Question 1, (2)

$$\frac{1}{2}\underline{p} + \underline{q} = \frac{1}{2}\begin{pmatrix} 4 \\ -6 \end{pmatrix} + \begin{pmatrix} -5 \\ -1 \end{pmatrix}$$

$$= \begin{pmatrix} 2 \\ -3 \end{pmatrix} + \begin{pmatrix} -5 \\ -1 \end{pmatrix}$$

$$= \begin{pmatrix} -3 \\ -4 \end{pmatrix}$$

2016 Paper 2 Question 3, (1)

$\overrightarrow{BD} = \underline{v} - \underline{u}$

2017 Paper 2 Question 8, (1) (2)

a) $\overrightarrow{PR} = -\underline{d} - \underline{c}$

b) $\overrightarrow{TV} = \overrightarrow{TP} + \frac{1}{2}\overrightarrow{PR}$

$\qquad = -\underline{d} + \frac{1}{2}(-\underline{d} - \underline{c})$

$\qquad = -\frac{3}{2}\underline{d} - \frac{1}{2}\underline{c}$

2018 Paper 1 Question 13, (2)

$B = (4, 8, 5)$

$C = (6, 8, 0)$

2018 Paper 2 Question 3, (2)

$|\underline{r}| = \sqrt{24^2 + (-12)^2 + 8^2}$

$\quad = \sqrt{784}$

$\quad = 28$

2018 Paper 2 Question 10, (2)

$\overrightarrow{BC} = \overrightarrow{BA} + \overrightarrow{AE} + \overrightarrow{ED} + \overrightarrow{DC}$

$\quad = -\underline{u} - \underline{w} + 2\underline{u} + \frac{1}{2}\underline{w}$

$\quad = \underline{u} - \frac{1}{2}\underline{w}$

2019 Paper 1 Question 10, (1) (2)

a) $\overrightarrow{PQ} = \overrightarrow{PR} + \overrightarrow{RQ}$

$\qquad = \begin{pmatrix} 6 \\ -4 \end{pmatrix} + \begin{pmatrix} -1 \\ 8 \end{pmatrix}$

$\qquad = \begin{pmatrix} 5 \\ 4 \end{pmatrix}$

b) $\overrightarrow{MQ} = \overrightarrow{MP} + \overrightarrow{PQ}$

$\qquad = \frac{1}{2}\overrightarrow{RP} + \overrightarrow{PQ}$

$\qquad = -\frac{1}{2}\overrightarrow{PR} + \overrightarrow{PQ}$

$\qquad = -\frac{1}{2}\begin{pmatrix} 6 \\ -4 \end{pmatrix} + \begin{pmatrix} 5 \\ 4 \end{pmatrix}$

$\qquad = \begin{pmatrix} -3 \\ 2 \end{pmatrix} + \begin{pmatrix} 5 \\ 4 \end{pmatrix}$

$\qquad = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$

2019 Paper 2 Question 2, (2)

$|\underline{p}| = \sqrt{6^2 + 27^2 + (-18)^2}$

$\qquad = \sqrt{1089}$

$\qquad = 33$

2024 Paper 1 Question 4, (2)

$3\boldsymbol{a} + \boldsymbol{b} = 3\begin{pmatrix} 3 \\ 4 \\ -1 \end{pmatrix} + \begin{pmatrix} 5 \\ 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 9 \\ 12 \\ -3 \end{pmatrix} + \begin{pmatrix} 5 \\ 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 14 \\ 15 \\ -1 \end{pmatrix}$
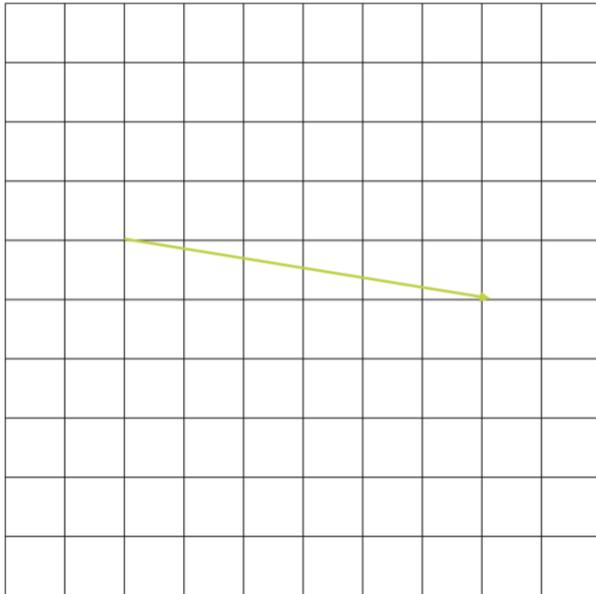
2024 Paper 2 Question 14, (1) (2)

a) $\overrightarrow{WX} = \overrightarrow{WZ} + \overrightarrow{ZX} = -\boldsymbol{a} + \boldsymbol{b}$

b) $\overrightarrow{WM} = \overrightarrow{WX} + \overrightarrow{XM} = -\boldsymbol{a} + \boldsymbol{b} - \frac{1}{2}\boldsymbol{a}$

$\qquad\qquad\qquad = -1\frac{1}{2}\boldsymbol{a} + \boldsymbol{b}$

$$p + q = \begin{pmatrix} 5 \\ 2 \end{pmatrix} + \begin{pmatrix} 1 \\ -3 \end{pmatrix} = \begin{pmatrix} 6 \\ -1 \end{pmatrix}$$

2025 Paper 2 Question 15, (2)

$\overrightarrow{GF} = \overrightarrow{GD} + \overrightarrow{DE} + \overrightarrow{EF}$

Notice that $\overrightarrow{DE} = \overrightarrow{DG} + \overrightarrow{GE} = r + s$

So, $\overrightarrow{GF} = \overrightarrow{GD} + \overrightarrow{DE} + \overrightarrow{EF}$

$\qquad = \overrightarrow{GD} + \overrightarrow{DE} + \frac{1}{3}\overrightarrow{DE}$

$\qquad = -r + r + s + \frac{1}{3}(r + s)$

$\qquad = s + \frac{1}{3}r + \frac{1}{3}s$

$\qquad = \frac{1}{3}r + \frac{4}{3}s$