

1. 4024/11/M/J/18 Q21

21(a)	$\begin{pmatrix} 13 \\ 9 \end{pmatrix}$	1	
21(b)	$n = -2$	2	<b>M1</b> for $\begin{pmatrix} 3 \\ 4 \end{pmatrix} + n \begin{pmatrix} -4 \\ 3 \end{pmatrix} = \begin{pmatrix} 11 \\ -2 \end{pmatrix}$ or $3 + (-4n) = 11$ or $4 + 3n = -2$

2. 4024/12/M/J/18 Q23

23(a)	$\begin{pmatrix} -2 & -1 \\ -4 & -2 \end{pmatrix}$	2	<b>B1</b> for two or three correct elements or <b>M1</b> for $\begin{pmatrix} 6 & -3 \\ 0 & -2 \end{pmatrix} - 2 \begin{pmatrix} 4 & -1 \\ 2 & 0 \end{pmatrix}$ oe or <b>SC1</b> for answer $\begin{pmatrix} 2 & 1 \\ 4 & 2 \end{pmatrix}$
23(b)	$\frac{1}{2} \begin{pmatrix} 0 & 1 \\ -2 & 4 \end{pmatrix}$ or $\begin{pmatrix} 0 & \frac{1}{2} \\ -1 & 2 \end{pmatrix}$ oe	3	<b>B2</b> for $k \begin{pmatrix} 0 & 1 \\ -2 & 4 \end{pmatrix}$ oe with $k \neq \frac{1}{2}$ or for $\frac{1}{2} \begin{pmatrix} \cdot & \cdot \\ \cdot & \cdot \end{pmatrix}$ oe or for 3 or 4 correct elements in $\begin{pmatrix} 0 & \frac{1}{2} \\ -1 & 2 \end{pmatrix}$ seen or <b>M1</b> for $\mathbf{Y} = \mathbf{A}^{-1}$ ; or for $\mathbf{Y} = \mathbf{A}^{-1} \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ or for determinant of $\mathbf{A} = 2$ or <b>B1</b> for $\begin{pmatrix} 4 & -1 \\ 2 & 0 \end{pmatrix} \begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 4a - c & 4b - d \\ 2a & 2b \end{pmatrix}$

3. 4024/22/M/J/18 Q8b

8(b)(i)	4c	1	
8(b)(ii)	9a - 6c or 3(3a - 2c)	2	<b>B1</b> for answer 9a + kc or ka - 6c ( $k \neq 0$ )
8(c)(i)	3 : 2	2	<b>B1</b> for 3k : 2k, where k is an integer
8(c)(ii)	9 : 4	1	<b>FT</b> their 3 <sup>2</sup> : their 2 <sup>2</sup>
8(c)(iii)	4 : 5	1	

4. 4024/11/O/N/18 Q20

20(a)	$\begin{pmatrix} 0 & -5 \\ -6 & 4 \end{pmatrix}$	2	<b>B1</b> for two or three correct elements.
20(b)	$\frac{1}{2}\begin{pmatrix} 1 & 1 \\ 0 & 2 \end{pmatrix}$ oe; or $\begin{pmatrix} \frac{1}{2} & \frac{1}{2} \\ 0 & 1 \end{pmatrix}$ oe	2	<b>B1</b> for $k\begin{pmatrix} 1 & 1 \\ 0 & 2 \end{pmatrix}$ oe with $k \neq \frac{1}{2}$ ; or for $\frac{1}{2}\begin{pmatrix} \cdot & \cdot \\ \cdot & \cdot \end{pmatrix}$ oe

5. 4024/12/O/N/18 Q23

23(a)	$\begin{pmatrix} 5 \\ -9 \end{pmatrix}$	2	<b>B1</b> for one correct element
23(b)	$(-3 \ -3 \ 7)$	2	<b>M1</b> for any $1 \times 3$ matrix If 0 scored, <b>SC1</b> for $\begin{pmatrix} -3 \\ -3 \\ 7 \end{pmatrix}$

6. 4024/21/O/N/18 Q7

7(a)	$\begin{pmatrix} 2 \\ 4 \end{pmatrix}$	1	
7(b)	6.71 or 6.708...	2	<b>M1</b> for $6^2 + (-3)^2$ oe
7(c)	(0, 5)	2	<b>FT</b> <i>their (a)</i> (( <i>their</i> 2 - 2), ( <i>their</i> 4 + 1)) <b>B1</b> for one value in coordinates correct or for $[\overline{CB} = ]\begin{pmatrix} 2 \\ -1 \end{pmatrix}$ soi

7. 4024/11/M/J/19 Q15

15	$\frac{1}{3}\begin{pmatrix} 5 & -7 \\ -1 & 2 \end{pmatrix}$ oe isw	2	<b>B1</b> for $\begin{pmatrix} 5 & -7 \\ -1 & 2 \end{pmatrix}$ soi or $[ T =] 3$
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8. 4024/12/M/J/19 Q25

25(a)	$\begin{pmatrix} 4 & 8 \\ -2 & -7 \end{pmatrix}$	2	<b>B1</b> for two or three correct elements
25(b)(i)	-2	1	
25(b)(ii)	$-\frac{1}{4}\begin{pmatrix} -2 & 1 \\ -2 & 3 \end{pmatrix}$ oe isw  or $\begin{pmatrix} \frac{1}{2} & -\frac{1}{4} \\ \frac{1}{2} & -\frac{3}{4} \end{pmatrix}$ oe isw	1	<b>FT</b> $-\frac{1}{4}\begin{pmatrix} \text{their } k & 1 \\ -2 & 3 \end{pmatrix}$

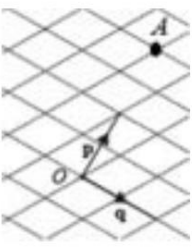
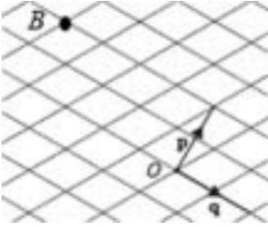
9. 4024/21/M/J/19 Q9

9(a)(i)(a)	$\frac{3}{2}(\mathbf{p} + 2\mathbf{q})$ oe simplified expression	1	
9(a)(i)(b)	$\frac{5}{2}\mathbf{p}$ or $2\frac{1}{2}\mathbf{p}$ or $2.5\mathbf{p}$	2	<b>M1</b> for a correct vector route
9(a)(ii)	Trapezium	<b>B1</b>	
	$\overline{PQ}$ is a multiple of $\overline{SR}$ or PQ is parallel to SR since $\overline{PQ}=4\mathbf{p}$ and $\overline{SR}=2.5\mathbf{p}$ oe	<b>B1</b>	
9(a)(iii)	8 : 5	2	<b>FT</b> their $\overline{SR}$ of form $k\mathbf{p}$ <b>B1</b> for 4 : 2.5 oe
9(b)(i)	$\begin{pmatrix} 2 \\ -3 \end{pmatrix}$ final answer	1	
9(b)(ii)	6.32 or 6.324 to 6.325	2	<b>M1</b> for $6^2 + (-2)^2$
9(b)(iii)	$\begin{pmatrix} 6 \\ 1 \end{pmatrix}$ final answer	2	<b>B1</b> for $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$

10. 4024/11/O/N/19 Q25

25(a)(i)	$4\mathbf{a}$	1	
25(a)(ii)	$2\mathbf{b} - 4\mathbf{a}$	1	<b>FT</b> $2\mathbf{b} - \text{their } (\mathbf{a})(\mathbf{i})$ in terms of $\mathbf{a}$ and/or $\mathbf{b}$ only
25(b)(i)	$\frac{3}{2}\mathbf{b}$	2	<b>M1</b> for a correct vector route or for $3\mathbf{a} + \frac{3}{4}$ <i>their</i> <b>(a)(ii)</b> or for $\frac{3}{4} \times 2\mathbf{b}$ If 0 scored <b>SC1</b> for $-\frac{3}{2}\mathbf{b}$ as final answer
25(b)(ii)	3 : 2 oe	1	
25(b)(iii)	Trapezium	1	Dep. on a correct part <b>(b)(i)</b> , or <i>their</i> part <b>(b)(i)</b> being a multiple of $\mathbf{b}$

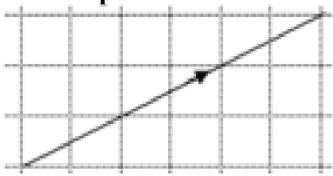
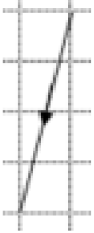
11. 4024/12/O/N/19 Q21

21(a)	$A$ positioned correctly 	1	
21(b)	$B$ positioned correctly 	1	
21(c)	$2\mathbf{q} - \mathbf{p}$ oe	2	<b>B1</b> for $2\mathbf{q}$ oe or for $-\mathbf{p}$ oe If 0 scored, <b>SC1</b> for answer $\mathbf{p} - 2\mathbf{q}$

12. 4024/11/M/J/20 Q25

25	$3\mathbf{a} + 6\mathbf{b}$	2	<b>M1</b> for $3\mathbf{a} + k\mathbf{b}$ or $k\mathbf{a} + 6\mathbf{b}$ ( $k \neq 0$ )
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13. 4024/12/M/J/20 Q19

19(a)	Vector $3\mathbf{p}$ drawn 	1	
19(b)	Vector $\mathbf{q} - \mathbf{p}$ drawn 	1	If 0 scored in (a) and (b), award <b>SC1</b> for two correct lines with no/incorrect arrows

14. 4024/21/O/N/20 Q9

9(a)(i)	$\begin{pmatrix} -8 \\ 4 \end{pmatrix}$	1	
9(a)(ii)	8.94[4...] nfw	2	<b>M1</b> for $(their - 8)^2 + (their 4)^2$ oe
9(a)(iii)	$\begin{pmatrix} 1 \\ 4 \end{pmatrix}$	2	<b>B1</b> for one component correct or for (1, 4) seen or <b>B1FT</b> for $\begin{pmatrix} -4 \\ 2 \end{pmatrix}$
9(b)(i)(a)	$2\mathbf{p}$	1	
9(b)(i)(b)	$\mathbf{p} + \mathbf{q}$	1	
9(b)(ii)	$\frac{3}{2}\mathbf{p} + \mathbf{q}$ oe simplified vector final answer	2	<b>B1</b> for $\overline{FX} = \frac{3}{2}\mathbf{p}$ soi or $\overline{BX} = -\frac{1}{2}\mathbf{p}$ soi or <b>M1</b> for a correct vector route along the lines of the diagram
9(b)(iii)	$\frac{1}{2}\mathbf{p} + \frac{4}{3}\mathbf{q}$ oe simplified vector final answer	3	<b>B2</b> for answer $k\mathbf{p} + \frac{4}{3}\mathbf{q}$ or $\frac{1}{2}\mathbf{p} + k\mathbf{q}$ or correct unsimplified vector or for $\overline{FY} = 2\mathbf{p} + \frac{4}{3}\mathbf{q}$ oe or <b>M1</b> for $\overline{FY} = k\overline{OX}$ soi or for correct route for $\overline{XY}$

15. 4024/22/O/N/20 Q8

8(a)(i)	11.7 or 11.66...	2	<b>M1</b> for $10^2 + (-6)^2$ oe
8(a)(ii)	(23, -14)	2	<b>B1</b> for one coordinate correct or for $\begin{pmatrix} 30 \\ -18 \end{pmatrix}$ seen After 0 scored, <b>SC1</b> for (-14, 23)
8(b)(i)	$4\mathbf{p} + \mathbf{q}$	1	
8(b)(ii)	$3\mathbf{p} + \frac{3}{5}\mathbf{q}$ oe simplified vector final answer	2	<b>B1</b> for $\overline{BX} = \frac{3}{5}\mathbf{q}$ or $\overline{XB} = -\frac{3}{5}\mathbf{q}$ or <b>M1</b> for a correct route along the lines of the diagram
8(b)(iii)	$4\mathbf{p} - \frac{2}{5}\mathbf{q}$ oe simplified vector final answer	2	<b>B1</b> for $\overline{CX} = -\frac{2}{5}\mathbf{q}$ or $\overline{XC} = \frac{2}{5}\mathbf{q}$ or <b>M1</b> for a correct route along the lines of the diagram

16. 4024/21/M/J/21 Q10

10(a)(i)	5.83 or 5.830 to 5.831	2	<b>M1</b> for $(-3)^2 + 5^2$ oe
10(a)(ii)(a)	(4, -3)	1	
10(a)(ii)(b)	(-2, 7)	2	<b>B1FT</b> for answer ( <i>their</i> $4 - 6, k$ ) or answer ( $k, \textit{their} (-3) + 10$ )
10(b)(i)	$\mathbf{q} - \mathbf{p}$	1	
10(b)(ii)	$\frac{1}{2}\mathbf{p} + \frac{1}{2}\mathbf{q}$ oe simplified vectors	2	<b>M1</b> for a correct vector route along the lines of the diagram or for correct unsimplified expression
10(b)(iii)	$\frac{1}{6}\mathbf{q} - \frac{1}{2}\mathbf{p}$ oe simplified vectors	2	<b>M1</b> for correct vector route along the lines of the diagram but can include <i>OS</i> or for correct unsimplified expression

17. 4024/22/M/J/21 Q12

12(a)(i)	$\begin{pmatrix} 1 \\ -8 \end{pmatrix}$	2	<b>B1</b> for answer $\begin{pmatrix} 1 \\ p \end{pmatrix}$ or $\begin{pmatrix} p \\ -8 \end{pmatrix}$  After 0 scored, <b>SC1</b> for answer $\begin{pmatrix} -1 \\ 8 \end{pmatrix}$
12(a)(ii)	$(-1, -2)$	1	
12(a)(iii)	10 and -4	3	<b>B2</b> for answer 10 or -4 nfw or $n-3 = \pm 7$ oe or $n^2 - 6n - 40 [=0]$ or <b>M1</b> for $\sqrt{74} = \sqrt{(-3-2)^2 + (n-3)^2}$ oe
12(b)	2 : 3 nfw	3	<b>B2</b> for $\overline{PL} = \frac{2}{5}\mathbf{q}$ oe or $\overline{RL} = -\frac{3}{5}\mathbf{q}$ oe or <b>M1</b> for correct vector route for $\overline{KL}$ along the lines of the diagram or $\overline{PL} = \frac{1}{2}\mathbf{q} - \frac{1}{10}\mathbf{q}$ oe or $\overline{RL} = -\frac{1}{2}\mathbf{q} - \frac{1}{10}\mathbf{q}$ oe

18. 4024/11/O/N/21 Q15

15(a)	$(-2, 5)$	2	<b>B1</b> for each value or for $\begin{pmatrix} -2 \\ 5 \end{pmatrix}$ seen
15(b)	13	2	<b>M1</b> for $(-5)^2 + 12^2$ oe

19. 4024/22/O/N/21 Q7

7(a)(i)	$(-1, 4.5)$	1	
7(a)(ii)	$(-1, 13)$	1	
7(a)(iii)	7.21[1...]	2	<b>M1</b> for $(-4)^2 + 6^2$ oe
7(b)(i)	$\mathbf{b} - \mathbf{a}$	1	
7(b)(ii)	$\frac{1}{4}\mathbf{a} + \frac{1}{4}\mathbf{b}$ or $\frac{1}{4}(\mathbf{a} + \mathbf{b})$	3	<b>M1</b> for correct vector route along the lines of the diagram  <b>B1</b> for $\overline{BC} = \frac{\mathbf{a}}{2}$ soi or for $\overline{NB} = \frac{1}{4}\text{their}(\mathbf{b} - \mathbf{a})$ soi or $\overline{NA} = \frac{3}{4}\text{their}(\mathbf{a} - \mathbf{b})$ soi

20. 4024/11/M/J/22 Q16

16(a)	$\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ drawn correctly with arrow	1	
16(b)	$\begin{pmatrix} -6 \\ 4 \end{pmatrix}$ drawn correctly with arrow	1	If 0 scored in (a) and (b), <b>SC1</b> for two correct vectors with missing or incorrect arrows
16(c)	$\begin{pmatrix} 5 \\ 1 \end{pmatrix}$ drawn correctly with arrow	2	<b>B1</b> for $\begin{pmatrix} 5 \\ 1 \end{pmatrix}$ soi

21. 4024/12/M/J/22 Q25

25(a)	$\frac{5}{2}\mathbf{c}$ oe final answer	1	
25(b)	$4\mathbf{a} + \frac{3}{2}\mathbf{c}$ or $\frac{8\mathbf{a} + 3\mathbf{c}}{2}$ final answer	2	<b>B1</b> for final answer $4\mathbf{a} + k\mathbf{c}$ oe or $k\mathbf{a} + 1.5\mathbf{c}$ oe, $k \neq 0$ or $\overline{AP} = 3\mathbf{a}$ soi or <b>M1</b> for a correct route along the lines of the diagram using the given vertex letters
25(c)	1 : 10 oe	1	

22. 4024/21/O/N/22 Q6

6(a)(i)	$\begin{pmatrix} 5 \\ -5 \end{pmatrix}$	1	
6(a)(ii)	$(\textit{their}5)^2 + (\textit{their}-5)^2$ oe or $(9-4)^2 + (2-7)^2$ oe	<b>M1</b>	Correct use of Pythagoras using <i>their</i> $\overline{AB}$ or $\overline{OB} - \overline{OA}$
	7.07[1...]	<b>A1</b>	
6(a)(iii)	[C = ] (5, 3) [D = ] (0, 8)	2	<b>B1</b> for each
6(b)	[r = ] -3 [t = ] 5 [u = ] 2	4	<b>B1</b> for $u = 2$  <b>M2</b> for two correct equations involving $r$ and/ or $t$  or <b>M1</b> for one correct equation involving $r$ and/ or $t$  OR  <b>B1</b> for $r = -3$  <b>M2</b> for two correct equations involving $u$ and/ or $t$  or <b>M1</b> for one correct equation involving $u$ and/ or $t$  After 0 scored, <b>SC1</b> for $\frac{u-4}{t-r} = -\frac{1}{4}$



23. 4024/11/M/J/22 Q25

25(a)(i)	$12\mathbf{a} + 6\mathbf{b}$ or $6(2\mathbf{a} + \mathbf{b})$ final answer	1	
25(a)(ii)	$7\mathbf{a} + 4\mathbf{b}$ final answer	2	<b>M1</b> for $\overrightarrow{AD} = \overrightarrow{AC} + \overrightarrow{CD}$ or their $\overrightarrow{AC} - \overrightarrow{DC}$ or their $\overrightarrow{AC} - (5\mathbf{a} + 2\mathbf{b})$
25(b)	$\overrightarrow{EB} = \overrightarrow{EA} + \overrightarrow{AB}$  or $\frac{1}{2}$ their $\overrightarrow{DA} + 6\mathbf{a} + 3\mathbf{b}$ or $-\frac{1}{2}$ their $\overrightarrow{AD} + 6\mathbf{a} + 3\mathbf{b}$ or $-\frac{1}{2}(7\mathbf{a} + 4\mathbf{b}) + 6\mathbf{a} + 3\mathbf{b}$	<b>M1</b>	Or equivalent vector route stated e.g. $\overrightarrow{EB} = \overrightarrow{ED} + \overrightarrow{DC} + \overrightarrow{CB}$
	$[\overrightarrow{EB} =] 2.5\mathbf{a} + \mathbf{b}$ or equivalent 2-term expression	<b>A1</b>	
	$\overrightarrow{EB}$ is parallel to $\overrightarrow{DC}$ because $\overrightarrow{EB} = k\overrightarrow{DC}$ oe	<b>A1</b>	