



# Topical Worksheets for Cambridge O LEVEL Mathematics D (4024)

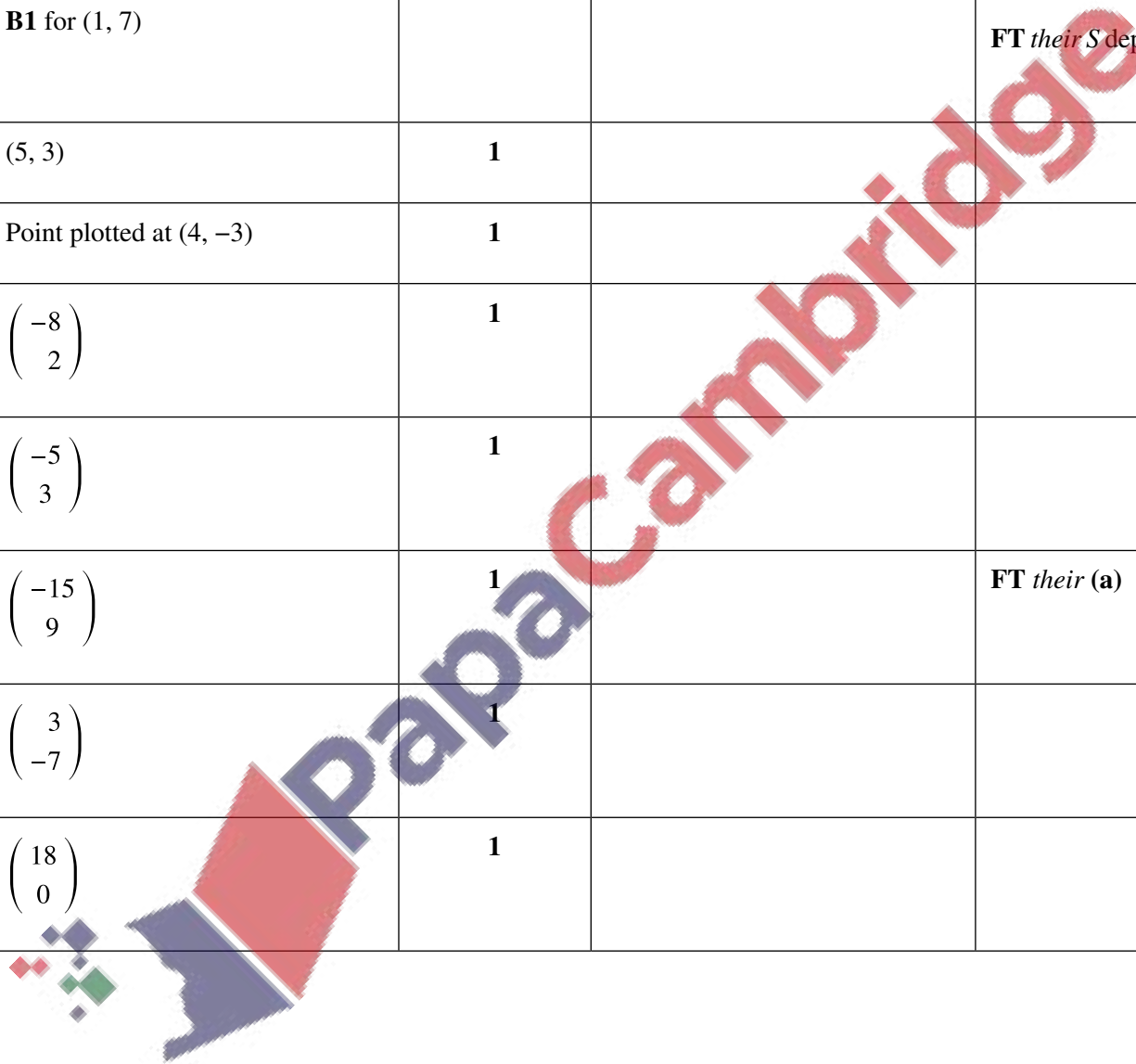
**Vectors**

**Mark Scheme**

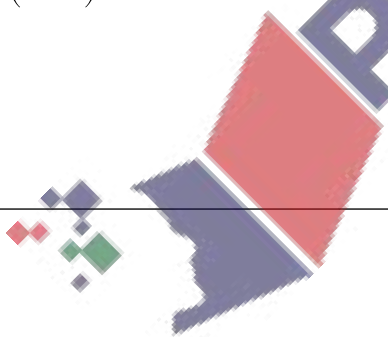
1<sup>st</sup> edition, for examination until 2025

Question	Answer	Marks	AO Element	Notes	Guidance
1(a)	$\begin{pmatrix} 2 \\ 4 \end{pmatrix}$ cao	1			
1(b)	4.47 or 4.472...	2		M1 for $(\text{their } 2)^2 + (\text{their } 4^2)$	
1(c)	(7, 10)	2		B1 for each	
1(d)	$y = 2x - 4$ oe	3		M1 for gradient = $\frac{6-2}{5-3}$ oe or answer $y = mx - 4$ M1 for substituting (3, 2) or (5, 6) into $y = \text{their } mx + c$ or into $y - k = \text{their } m(x - h)$ or into $\text{their } y = mx - 4$	
1(e)	(0, -4)	1		FT <i>their</i> (d)	
2(a)	(-2, 5)	1			
2(b)	$\begin{pmatrix} 4 \\ -3 \end{pmatrix}$	1			
2(c)	(5, 4) plotted	1			

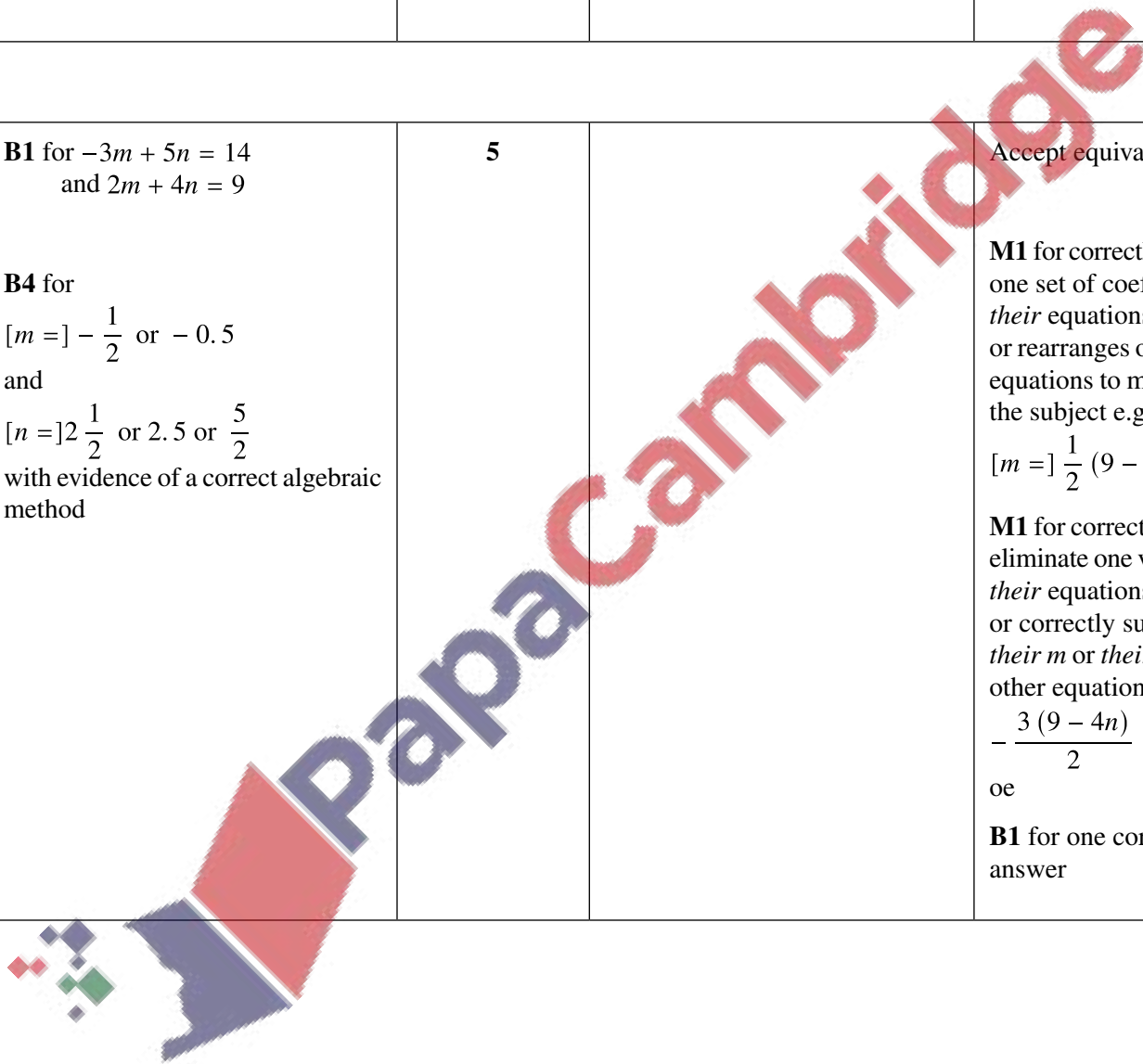
Question	Answer	Marks	AO Element	Notes	Guidance
2(d)	<b>B1</b> for parallelogram $PQRS$ correctly drawn <b>B1</b> for (1, 7)	<b>2</b>		<b>FT</b> their $R$ <b>FT</b> their $S$ dep on first <b>B1</b>	
3(a)	(5, 3)	<b>1</b>			
3(b)	Point plotted at (4, -3)	<b>1</b>			
3(c)	$\begin{pmatrix} -8 \\ 2 \end{pmatrix}$	<b>1</b>			
4(a)	$\begin{pmatrix} -5 \\ 3 \end{pmatrix}$	<b>1</b>			
4(b)	$\begin{pmatrix} -15 \\ 9 \end{pmatrix}$	<b>1</b>		<b>FT</b> their (a)	
5(a)	$\begin{pmatrix} 3 \\ -7 \end{pmatrix}$	<b>1</b>			
5(b)	$\begin{pmatrix} 18 \\ 0 \end{pmatrix}$	<b>1</b>			



Question	Answer	Marks	AO Element	Notes	Guidance
6	$\begin{pmatrix} 13 \\ 18 \end{pmatrix}$	2		<b>B1</b> for $\begin{pmatrix} 10 \\ 0 \end{pmatrix}$ or $\begin{pmatrix} 3 \\ 18 \end{pmatrix}$ or $\begin{pmatrix} 13 \\ m \end{pmatrix}$ or $\begin{pmatrix} n \\ 18 \end{pmatrix}$	
7(a)	$\begin{pmatrix} -15 \\ 12 \end{pmatrix}$	1			
7(b)	$\begin{pmatrix} 5 \\ 2 \end{pmatrix}$	1			
8(a)	$\begin{pmatrix} -1 \\ 4 \end{pmatrix}$	1			
8(b)	$\begin{pmatrix} -21 \\ 28 \end{pmatrix}$	1			
9(a)	$\begin{pmatrix} -19 \\ -2 \end{pmatrix}$	2		<b>B1</b> for answer $\begin{pmatrix} -19 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -2 \end{pmatrix}$ or for $\begin{pmatrix} -9 \\ 6 \end{pmatrix}$ or $\pm \begin{pmatrix} 10 \\ 8 \end{pmatrix}$ seen	



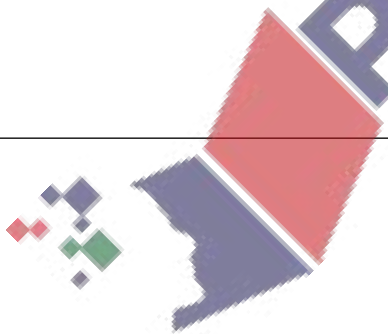
Question	Answer	Marks	AO Element	Notes	Guidance
9(b)	3.61 or 3.605 to 3.606	2		<b>M1</b> for $\sqrt{([-]3)^2 + 2^2}$ oe	
9(c)	<p><b>B1</b> for <math>-3m + 5n = 14</math> and <math>2m + 4n = 9</math></p> <p><b>B4</b> for  <math>[m =] -\frac{1}{2}</math> or <math>-0.5</math>                      and  <math>[n =] 2\frac{1}{2}</math> or <math>2.5</math> or <math>\frac{5}{2}</math>                      with evidence of a correct algebraic method</p>	5		<p>Accept equivalents</p> <p><b>M1</b> for correctly equating one set of coefficients of <i>their</i> equations or rearranges one of <i>their</i> equations to make <i>m</i> or <i>n</i> the subject e.g.  <math>[m =] \frac{1}{2} (9 - 4n)</math> oe</p> <p><b>M1</b> for correct method to eliminate one variable for <i>their</i> equations or correctly substitutes <i>their m</i> or <i>their n</i> into the other equation e.g.  <math>-\frac{3(9 - 4n)}{2} + 5n = 14</math>                      oe</p> <p><b>B1</b> for one correct answer</p>	



Question	Answer	Marks	AO Element	Notes	Guidance
10(a)	$\mathbf{c} + \frac{2}{3}\mathbf{a}$	2		<b>M1</b> for correct unsimplified form or correct route e.g. $\overrightarrow{OC} + \overrightarrow{CP}$	
10(b)(i)	$\frac{2}{5}\mathbf{a} + \frac{3}{5}\mathbf{c}$	2		<b>M1</b> for correct unsimplified form or correct route e.g. $\overrightarrow{OC} + \overrightarrow{CX}$	
10(b)(ii)	3 : 2 oe	2		<b>B1</b> for $\overrightarrow{OX} = \frac{3}{5}\overrightarrow{OP}$ oe or $\overrightarrow{XP} = \frac{2}{5}\mathbf{c} + \frac{4}{15}\mathbf{a}$	
11(a)(i)	$-\mathbf{a} + 2\mathbf{c}$	1			
11(a)(ii)	$\frac{3}{8}(-\mathbf{a} + 2\mathbf{c})$ or $-\frac{3}{8}\mathbf{a} + \frac{3}{4}\mathbf{c}$ oe	1		<b>FT</b> $\frac{3}{8}$ ( <i>their(a)(i)</i> ) in simplest form	
11(a)(iii)	$\frac{1}{2}(5\mathbf{a} - 2\mathbf{c})$ or $\frac{5}{2}\mathbf{a} - \mathbf{c}$ oe	1			
11(a)(iv)	$\frac{1}{8}(5\mathbf{a} - 2\mathbf{c})$ or $\frac{5}{8}\mathbf{a} - \frac{1}{4}\mathbf{c}$ oe	2		<b>M1</b> for a correct unsimplified route	
11(b)	4	1			

Question	Answer	Marks	AO Element	Notes	Guidance
12(a)	12.6 or 12.64 to 12.65	3		<p><b>M2</b> for <math>12^2 + (-4)^2</math></p> <p>OR</p> <p><b>B1</b> for <math>\begin{pmatrix} 12 \\ -4 \end{pmatrix}</math></p> <p><b>M1</b> for <math>(their\ 12)^2 + (their - 4)^2</math></p>	
12(b)	$\begin{pmatrix} -11 \\ 13 \end{pmatrix}$	2		<p><b>B1</b> for <math>\begin{pmatrix} -11 \\ k \end{pmatrix}</math> or</p> <p><math>\begin{pmatrix} k \\ 13 \end{pmatrix}</math> or for</p> <p><math>[\vec{BA} = ] \begin{pmatrix} -8 \\ 7 \end{pmatrix}</math></p>	
13(a)	$-\frac{1}{3}\mathbf{q} + \frac{1}{2}\mathbf{p}$ oe	2		<b>M1</b> for correct unsimplified answer or correct route	
13(b)	$\frac{1}{2}\mathbf{p} + \frac{1}{2}\mathbf{q}$ oe	2		<b>M1</b> for correct unsimplified answer or correct route	
14(a)	$\frac{1}{3}\mathbf{p} - \frac{1}{2}\mathbf{q}$ oe simplified	2		<b>M1</b> for a correct unsimplified answer or a correct route	

Question	Answer	Marks	AO Element	Notes	Guidance
14(b)	$\frac{5}{6}\mathbf{p} + \frac{3}{4}\mathbf{q}$ oe simplified	2		<b>M1</b> for a correct unsimplified answer or a correct route	
15(a)	$-\mathbf{s} + \mathbf{t}$	1			
15(b)	$-\frac{4}{5}\mathbf{s} - \frac{1}{5}\mathbf{t}$ oe simplified	3		<p><b>M2</b> for correct unsimplified e.g.</p> $-\mathbf{t} + \frac{4}{5}(-\mathbf{s} + \mathbf{t})$ <p>or <math>-\mathbf{s} - \frac{1}{5}(-\mathbf{s} + \mathbf{t})</math></p> <p>or <b>M1</b> for a correct route e.g. <math>\overrightarrow{CB} + \overrightarrow{BN}</math></p> <p>or <math>\left[ \overrightarrow{BN} = \right] \frac{4}{5}(-\mathbf{s} + \mathbf{t})</math></p> <p>or <math>\left[ \overrightarrow{DN} = \right] -\frac{1}{5}(-\mathbf{s} + \mathbf{t})</math></p>	
16(a)	$\frac{5}{3}\mathbf{p} - 2\mathbf{q}$ oe simplified	2		<p><b>M1</b> for correct unsimplified answer or <math>c\mathbf{p} - 2\mathbf{q}</math></p> <p>or <math>\frac{5}{3}\mathbf{p} + c\mathbf{q} \quad c \neq 0</math></p> <p>or for a correct route</p>	





Question	Answer	Marks	AO Element	Notes	Guidance
16(b)	$\frac{5}{6}$	2		<p><b>B2FT</b> for <math>\frac{\text{their } c}{2}</math> if <i>their</i>                      (a) is <math>cp - 2q</math> oe</p> <p><b>M1</b> for <math>\overrightarrow{MX} = \frac{5}{6} \mathbf{p} - \mathbf{q}</math>                      or <math>\overrightarrow{MX} = \frac{1}{2}</math> <i>their</i> (a)                      or <math>\overrightarrow{BX} = \frac{1}{2} \overrightarrow{AN}</math>                      or <math>\mathbf{q} + \frac{1}{2}</math> <i>their</i> (a)                      or <math>\mathbf{q} + \overrightarrow{MX} - k\mathbf{p} = 0</math>                      oe</p>	
17(a)	$6\mathbf{a} - 2\mathbf{b}$ or $2(3\mathbf{a} - \mathbf{b})$	2		<p><b>M1</b> for  <math>4\mathbf{a} + \mathbf{b} - (-2\mathbf{a} + 3\mathbf{b})</math> or                      better</p>	
17(b)	$5\mathbf{a} - \mathbf{b}$	2		<p><b>M1</b> for a correct route                      e.g. <math>\overrightarrow{OD} + \overrightarrow{DE}</math>,  <math>4\mathbf{a} + \mathbf{b} + \mathbf{a} - 2\mathbf{b}</math>, <math>\overrightarrow{OE}</math></p>	
18(a)	$\frac{1}{3} = (-\mathbf{a} + \mathbf{b})$ oe	2		<p><b>M1</b> for any correct route                      eg <math>AO + OB + \frac{2}{3} BA</math></p> <p>or <b>B1</b> for <math>\overrightarrow{AB} = -\mathbf{a} + \mathbf{b}</math>                      oe</p>	

Question	Answer	Marks	AO Element	Notes	Guidance
18(b)	$\frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{b}$ or simplified	2		<p><b>FT</b> their <math>(\mathbf{a}) + \mathbf{a}</math> simplified only if in terms of <math>\mathbf{a}</math> and <math>\mathbf{b}</math>.</p> <p><b>M1</b> for identifying <math>\vec{OC}</math> as position vector or correct route in any form or for correct unsimplified answer</p>	
19	$\mathbf{p} + \frac{3}{4}\mathbf{q}$	2		<p><b>M1</b> for a correct route or for <math>\vec{AE} = \frac{3}{4}\mathbf{q}</math></p>	
20	26	2		<p><b>M1</b> for <math>10^2 + (-24)^2</math> or better</p>	
21	$\mathbf{x} + 7\mathbf{y}$	2		<p><b>M1</b> for a correct route</p>	
					[Total: 83]

