

Question number	Scheme	Marks
7 (a)	$\overrightarrow{BC} = \overrightarrow{BO} + \overrightarrow{OC}$ $\overrightarrow{BC} = -(15\mathbf{i} - 6\mathbf{j}) + 8\mathbf{i} + \mathbf{j} = -7\mathbf{i} + 7\mathbf{j}$	M1 A1 [2]
(b)	$ \overrightarrow{BC} = \sqrt{98} = (7\sqrt{2})$ Unit vector is $\frac{1}{\sqrt{98}}(-7\mathbf{i} + 7\mathbf{j})$ oe	B1 B1 [2]
(c)	$(\overrightarrow{OM} = 4\mathbf{i} - 3\mathbf{j}) \quad \overrightarrow{ON} = 5\mathbf{i} - 2\mathbf{j}$ $\Rightarrow \overrightarrow{MN} = -(4\mathbf{i} - 3\mathbf{j}) + 5\mathbf{i} - 2\mathbf{j} (= \mathbf{i} + \mathbf{j})$ $\Rightarrow \overrightarrow{MC} = -(4\mathbf{i} - 3\mathbf{j}) + 8\mathbf{i} + \mathbf{j} (= 4\mathbf{i} + 4\mathbf{j})$ <p>Conclusion: \overrightarrow{MN} and \overrightarrow{MC} are parallel oe (and have same point of origin (M)) hence they are collinear.</p> <p>ALT 1</p> $(\overrightarrow{OM} = 4\mathbf{i} - 3\mathbf{j}) \quad \overrightarrow{ON} = 5\mathbf{i} - 2\mathbf{j} \quad \text{or} \quad \overrightarrow{NB} = 10\mathbf{i} - 4\mathbf{j}$ $\Rightarrow \overrightarrow{MN} = -(4\mathbf{i} - 3\mathbf{j}) + 5\mathbf{i} - 2\mathbf{j} (= \mathbf{i} + \mathbf{j})$ $\Rightarrow \overrightarrow{NC} = 10\mathbf{i} - 4\mathbf{j} - 7\mathbf{i} + 7\mathbf{j} (= 3\mathbf{i} + 3\mathbf{j})$ or $\Rightarrow \overrightarrow{NC} = -(5\mathbf{i} - 2\mathbf{j}) + 8\mathbf{i} + \mathbf{j} (= 3\mathbf{i} + 3\mathbf{j})$ <p>Conclusion: \overrightarrow{MN} and \overrightarrow{NC} are parallel oe (and share the same point (N)) hence they are collinear.</p> <p>ALT 2</p> $(\overrightarrow{OM} = 4\mathbf{i} - 3\mathbf{j}) \quad \overrightarrow{ON} = 5\mathbf{i} - 2\mathbf{j} \quad \text{or} \quad \overrightarrow{NB} = 10\mathbf{i} - 4\mathbf{j}$ $\Rightarrow \overrightarrow{MC} = -(4\mathbf{i} - 3\mathbf{j}) + 8\mathbf{i} + \mathbf{j} (= 4\mathbf{i} + 4\mathbf{j})$ $\Rightarrow \overrightarrow{NC} = 10\mathbf{i} - 4\mathbf{j} - 7\mathbf{i} + 7\mathbf{j} (= 3\mathbf{i} + 3\mathbf{j})$ <p>Conclusion: \overrightarrow{MC} and \overrightarrow{NC} are parallel oe (and share the same point (C)) hence they are collinear.</p>	B1 M1 M1 A1 [4] {B1} {M1} {M1} {A1} [4] {B1} {M1} {M1} {A1} [4]
Total 8 marks		

(a)	
M1	$\overrightarrow{BC} = \overrightarrow{BO} + \overrightarrow{OC}$
A1	$\overrightarrow{BC} = -7\mathbf{i} + 7\mathbf{j}$
(b)	
B1	$\sqrt{98}$ oe
B1	$\frac{1}{\sqrt{98}}(-7\mathbf{i} + 7\mathbf{j})$ oe
(c)	
B1	$\overrightarrow{ON} = 5\mathbf{i} - 2\mathbf{j}$ (may be implied by \overrightarrow{MN})
M1	$\overrightarrow{MN} = -(4\mathbf{i} - 3\mathbf{j}) + 5\mathbf{i} - 2\mathbf{j} (= \mathbf{i} + \mathbf{j})$
M1	$\overrightarrow{MC} = -(4\mathbf{i} - 3\mathbf{j}) + 8\mathbf{i} + \mathbf{j} (= 4\mathbf{i} + 4\mathbf{j})$
A1	Correct conclusion from correct working e.g. $\overrightarrow{MC} = 4\overrightarrow{MN}$
ALT 1	
B1	$\overrightarrow{ON} = 5\mathbf{i} - 2\mathbf{j}$ or $\overrightarrow{NB} = 10\mathbf{i} - 4\mathbf{j}$ (may be implied by \overrightarrow{MN} or \overrightarrow{NC})
M1	$\overrightarrow{MN} = -(4\mathbf{i} - 3\mathbf{j}) + 5\mathbf{i} - 2\mathbf{j} (= \mathbf{i} + \mathbf{j})$
M1	$\overrightarrow{NC} = 10\mathbf{i} - 4\mathbf{j} - 7\mathbf{i} + 7\mathbf{j} (= 3\mathbf{i} + 3\mathbf{j})$ or $-(5\mathbf{i} - 2\mathbf{j}) + 8\mathbf{i} + \mathbf{j} (= 3\mathbf{i} + 3\mathbf{j})$
A1	Correct conclusion from correct working e.g. $\overrightarrow{NC} = 3\overrightarrow{MN}$
ALT 2	
B1	
M1	$\overrightarrow{NB} = 10\mathbf{i} - 4\mathbf{j}$ (may be implied by \overrightarrow{NC})
M1	$\overrightarrow{MC} = -(4\mathbf{i} - 3\mathbf{j}) + 8\mathbf{i} + \mathbf{j} (= 4\mathbf{i} + 4\mathbf{j})$
A1	$\overrightarrow{NC} = 10\mathbf{i} - 4\mathbf{j} - 7\mathbf{i} + 7\mathbf{j} (= 3\mathbf{i} + 3\mathbf{j})$
	Correct conclusion from correct working e.g. $\overrightarrow{NC} = \frac{3}{4}\overrightarrow{MC}$
For part c: Send any geometrical solutions to review	