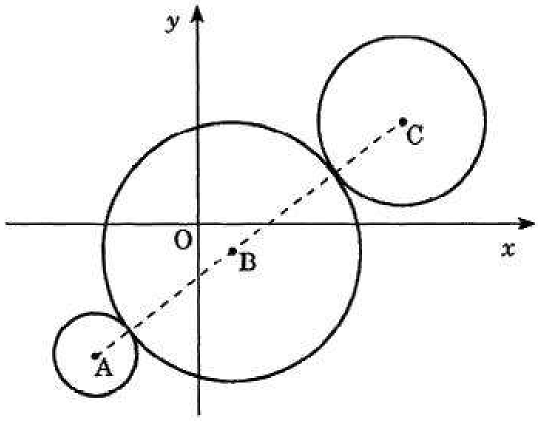
Vectors Supported Study

[SQA] 1. When newspapers were printed by lithograph, the newsprint had to run over three rollers, illustrated in the diagram by three circles. The centres A, B and C of the three circles are collinear.



The equations of the circumferences of the outer circles are

$(x+12)^2+(y+15)^2=25$ and $(x-24)^2+(y-12)^2=100$.

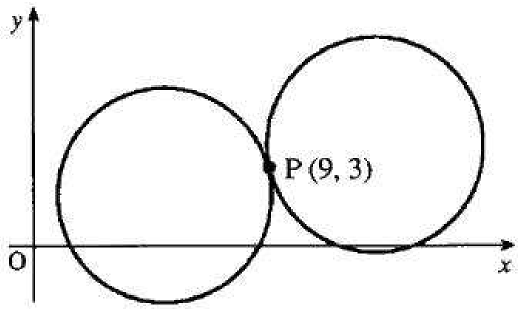
Find the equation of the central circle. **(8)**

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
	8	C	CN	G9, G10, G25		1995 P2 Q8

- •[1] $(-12,-15)$ and $(24,12)$
- •[2] radii are 5 and 10
- •[3] $AC=45$
- •[4] radius $=15$
- •[5] B divides AC in ratio 4:5
- •[6] $\vec{OB}=\frac{1}{9}\left[4\vec{OC}+5\vec{OA}\right]$ stated or implied
- •[7] $\vec{OB}=\frac{1}{9}\left[4\begin{pmatrix}24\\12\end{pmatrix}+5\begin{pmatrix}-12\\-15\end{pmatrix}\right]$
- •[8] $(x-4)^2+(y+3)^2=15^2$

[SQA] 2. Two identical circles touch at the point P (9, 3) as shown in the diagram. One of the circles has equation $x^2 + y^2 - 10x - 4y + 12 = 0$.

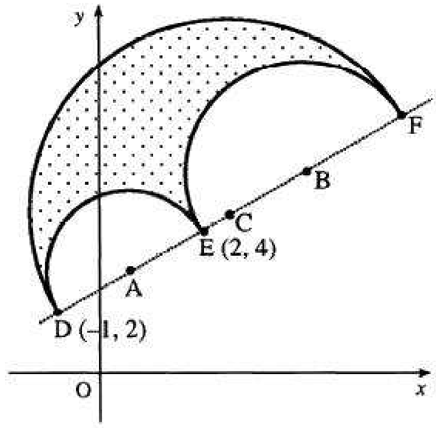
Find the equation of the other circle. 5



Part	Marks	Level	Calc.	Content	Answer	U3 OC1
	5	C	CN	G9, G25		1997 P1 Q12

- •[1] use P as midpoint of C_1C_2
- •[2] $C_1 = (5,2)$
- •[3] $C_2 = (13,4)$
- •[4] radius $= \sqrt{17}$
- •[5] $(x-13)^2 + (y-4)^2 = 17$

[SQA] 3. The shape shown in the diagram is composed of 3 semicircles with centres A, B and C which lie on a straight line.



DE is a diameter of one of the semicircles. The coordinates of D and E are (–1, 2) and (2, 4).

(*a*) Find the equation of the circle with centre A and diameter DE. **(3)**

The circle with centre B and diameter EF has equation $x^2 + y^2 - 16x - 16y + 76 = 0$.

(*b*) (i) Write down the coordinates of B.

(ii) Determine the coordinates of F and C. **(3)**

(*c*) In the diagram the perimeter of the shape is represented by the thick black line. Show that the perimeter is $5\pi\sqrt{13}$ units. **(3)**

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
(*a*)	3	C	CN	G10		1998 P2 Q6
(*b*)	3	C	CN	G9, G25		
(*c*)	3	A/B	CN	CGD		

(a) •[1] $A = \left(\frac{1}{2}, 3\right)$

•[2] $r^2 = \frac{9}{4} + 1$ ***or*** $d^2 = 13$

•[3] $\left(x - \frac{1}{2}\right)^2 + (y-3)^2 = \frac{13}{4}$

or $x^2 + y^2 - x - 6y + 6 = 0$

(b) •[4] $B\ (8,8)$

•[5] $F\ (14,12)$

•[6] $C\ \left(\frac{13}{2}, 7\right)$

(c) •[7] $\frac{1}{2}\pi DF + \frac{1}{2}\pi DE + \frac{1}{2}\pi EF$

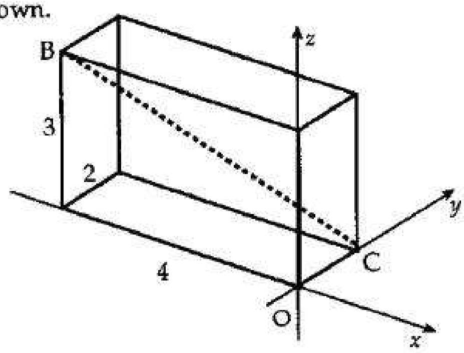
•[8] $\frac{1}{2}\pi DF = \frac{5}{2}\pi\sqrt{13}$ ***OR*** $\frac{1}{2}\pi EF = 2\pi\sqrt{13}$

•[9] $\frac{5}{2}\pi\sqrt{13} + \frac{1}{2}\pi\sqrt{13} + 2\pi\sqrt{13}$

[SQA] 4. A cuboid crystal is placed relative to the coordinate axes as shown.

(*a*) Write down $\overrightarrow{BC}$ in component form.

(*b*) Calculate $\left|\overrightarrow{BC}\right|$. 2



Part	Marks	Level	Calc.	Content	Answer	U3 OC1
(*a*)	1	C	CN	G16		1990 P1 Q5
(*b*)	1	C	CN	G16		

•[1] $\overrightarrow{BC} = \begin{pmatrix} 4 \\ 2 \\ -3 \end{pmatrix}$

•[2] $\sqrt{29}$

[SQA] 5. A is the point $(-3,2,4)$ and B is $(-1,3,2)$. Find

(*a*) the components of vector $\overrightarrow{AB}$; 1

(*b*) the length of AB. 2

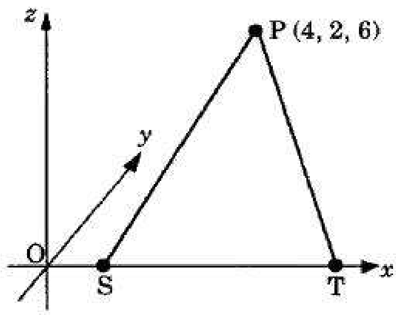
Part	Marks	Level	Calc.	Content	Answer	U3 OC1
(*a*)	1	C	CN	G16		1993 P1 Q1
(*b*)	2	C	CN	G16		

•[1] $\begin{pmatrix} 2 \\ 1 \\ -2 \end{pmatrix}$

•[2] $\sqrt{(-3+1)^2 + (2-3)^2 + (4-2)^2}$

•[3] 3

[SQA] 6. The diagram shows a point P with coordinates (4, 2, 6) and two points S and T which lie on the x-axis. If P is 7 units from S and 7 units from T, find the coordinates of S and T. 3



Part	Marks	Level	Calc.	Content	Answer	U3 OC1
	3	A/B	CN	G16		1994 P1 Q18

•1	$(x,0,0)$ or equiv.	*OR*	•1	$PQ=\sqrt{40}$	*OR*	•1	$d^2=7^2-6^2-2^2$
•2	$(x-4)^2+4+36=49$ or equiv.		•2	$d=3$		•2	$d=3$
•3	$x=1,\ 7$		•3	$(1,0,0),\ (7,0,0)$		•3	$(1,0,0),\ (7,0,0)$

[SQA] 7. Vectors p, q and r are defined by

$$p=i+j-k,\quad q=i+4k \quad\text{and}\quad r=4i-3j.$$

(*a*) Express $p-q+2r$ in component form. 2

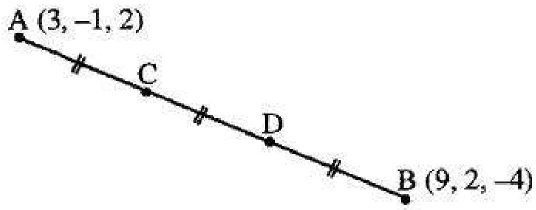
(*b*) Calculate $p.r$ 1

(*c*) Find $|r|$. 1

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
(*a*)	2	C	CN	G16		1998 P1 Q3
(*b*)	1	C	CN	G26		
(*c*)	1	C	CN	G16		

•1	$p=\begin{pmatrix}1\\1\\-1\end{pmatrix},\ q=\begin{pmatrix}1\\0\\4\end{pmatrix},\ r=\begin{pmatrix}4\\-3\\0\end{pmatrix}$ s/i by •2	•3	1
•2	$\begin{pmatrix}8\\-5\\-5\end{pmatrix}$	•4	5

[SQA] 8. The line AB is divided into 3 equal parts by the points C and D, as shown. A and B have coordinates (3, –1, 2) and (9, 2, –4).



(*a*) Find the components of $\overrightarrow{AB}$ and $\overrightarrow{AC}$. 2

(*b*) Find the coordinates of C and D. 2

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
(*a*)	2	C	CN	G16		1998 P1 Q5
(*b*)	2	C	CN	G16		

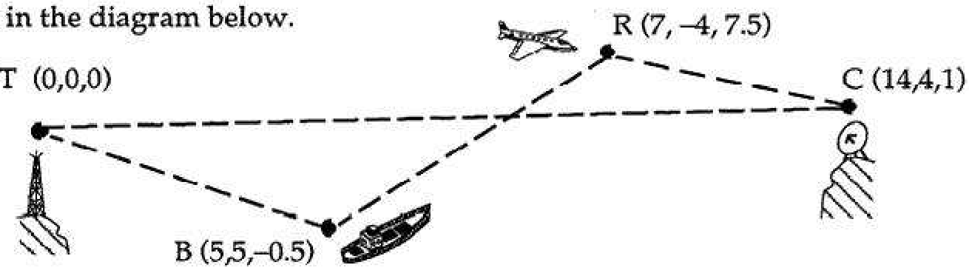
•[1] $\overrightarrow{AB} = \begin{pmatrix} 6 \\ 3 \\ -6 \end{pmatrix}$

•[2] $\overrightarrow{AC} = \begin{pmatrix} 2 \\ 1 \\ -2 \end{pmatrix}$

•[3] $C = (5,0,0)$

•[4] $D = (7,1,-2)$

[SQA] 9. Relative to a suitable set of co-ordinate axes with a scale of 1 unit to 2 kilometres, the positions of a transmitter mast, ship, aircraft and satellite dish are shown in the diagram below.



The top T of the transmitter mast is the origin, the bridge B on the ship is the point (5, 5, –0·5), the centre C of the dish on the top of a mountain is the point (14, 4, 1) and the reflector R on the aircraft is the point (7, –4, 7·5).

(*a*) Find the distance from the bridge of the ship to the reflector on the aircraft. **(3)**

(*b*) Three minutes earlier the aircraft was at the point M(–2, 4, 8·5). Find the speed of the aircraft in kilometres per hour. **(2)**

(*c*) Prove that the direction of the beam TC is perpendicular to the direction of the beam BR. **(3)**

(*d*) Calculate the size of angle TCR. **(5)**

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
(*a*)	3	C	CR	G16		1992 P2 Q2
(*b*)	2	C	CR	G16		
(*c*)	3	C	CR	G27		
(*d*)	5	C	CR	G28		

(*a*) •1 Strategy: use vectors or 3-D distance formula

•2 $\overrightarrow{BR} = \begin{pmatrix} 2 \\ 7 \\ 4 \end{pmatrix}$ *or* $BR^2 = 2^2 + 7^2 + 4^2$

•3 answer

(*b*) •4 $|\overrightarrow{MR}| = \sqrt{115.25}$ or equivalent

•5 answer

(*c*) •6 know to use a scalar product

•7 $\overrightarrow{TC}.\overrightarrow{BR} = 0$

•8 communication: 0 ⇔ perpendicularity

(*d*) •9 Strategy: know to use $\cos T\hat{C}R = \dfrac{\overrightarrow{TC}.\overrightarrow{RC}}{|TC||RC|}$ or equiv.

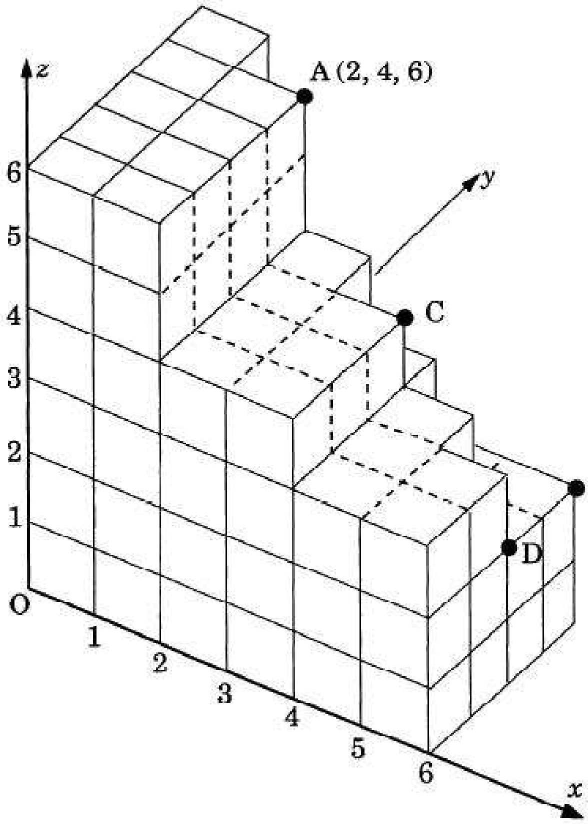
•10 $\overrightarrow{TC} = \begin{pmatrix} 12 \\ -4 \\ 1 \end{pmatrix}$ and $\overrightarrow{RC} = \begin{pmatrix} 5 \\ -6 \\ -2 \end{pmatrix}$

•11 $\sqrt{161}$ and $\sqrt{65}$

•12 $\overrightarrow{TC}.\overrightarrow{RC} = 82$

•13 36.7°

[SQA] 10. With coordinate axes as shown, the point A is (2,4,6).



(*a*) Write down the coordinates of B,C and D. **(3)**

(*b*) Show that C is the midpoint of AD. **(1)**

(*c*) By using the components of the vectors $\overrightarrow{OA}$ and $\overrightarrow{OB}$, calculate the size of angle AOB, where O is the origin. **(4)**

(*d*) Hence calculate the size of angle OAB. **(2)**

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
(*a*)	3	C	CR	G16		1994 P2 Q3
(*b*)	1	C	CR	G25		
(*c*)	4	C	CR	G28		
(*d*)	2	C	CR	CGD		

(*a*) •1 One of B,C or D

•2 Remaining two of B, C and D

•3 B (6,4,2), C (4,3,4), D (6,2,2)

(*b*) •4 $\left(\frac{2+6}{2}, \frac{4+2}{2}, \frac{6+2}{2}\right)$

(*c*) •5 $\cos A\hat{O}B = \frac{\overrightarrow{OA}.\overrightarrow{OB}}{|\overrightarrow{OA}||\overrightarrow{OB}|}$ *or* $\frac{OA^2 + OB^2 - AB^2}{2 \times OA \times OB}$ or equivalents

•6 $\overrightarrow{OA}.\overrightarrow{OB} = 40$ *or* $AB^2 = 32$

•7 $OA = \sqrt{56} = OB$

•8 44°

(*d*) •9 strategy: e.g. use isosceles Δ

•10 68°

[SQA] 11. The vectors $\boldsymbol{p}$, $\boldsymbol{q}$ and $\boldsymbol{r}$ are defined as follows:

$$\boldsymbol{p} = 3\boldsymbol{i} - 3\boldsymbol{j} + 2\boldsymbol{k},\ \boldsymbol{q} = 4\boldsymbol{i} - \boldsymbol{j} + \boldsymbol{k},\ \boldsymbol{r} = 4\boldsymbol{i} - 2\boldsymbol{j} + 3\boldsymbol{k}.$$

(*a*) Find $2\boldsymbol{p} - \boldsymbol{q} + \boldsymbol{r}$ in terms of $\boldsymbol{i}$, $\boldsymbol{j}$ and $\boldsymbol{k}$. **1**

(*b*) Find the value of $|2\boldsymbol{p} - \boldsymbol{q} + \boldsymbol{r}|$. **2**

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
(*a*)	1	C	CN	G18		1989 P1 Q3
(*b*)	2	C	CN	G16		

•1 $6\boldsymbol{i} - 7\boldsymbol{j} + 6\boldsymbol{k}$

•2 $\sqrt{6^2 + (-7)^2 + 6^2}$

•3 11

[SQA] 12. The vector $a\boldsymbol{i} + b\boldsymbol{j} + \boldsymbol{k}$ is perpendicular to both the vectors $\boldsymbol{i} - \boldsymbol{j} + \boldsymbol{k}$ and $-2\boldsymbol{i} + \boldsymbol{j} + \boldsymbol{k}$.

Find the values of a and b. **3**

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
	3	C	CN	G18	$a = 2, b = 3$	1990 P1 Q12

•1 $\begin{pmatrix} a \\ b \\ 1 \end{pmatrix} . \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix} = a - b + 1$ *or* $\begin{pmatrix} a \\ b \\ 1 \end{pmatrix} . \begin{pmatrix} -2 \\ 1 \\ 1 \end{pmatrix} = -2a + b + 1$

•2 $a - b + 1 = 0$ *or* $-2a + b + 1 = 0$

•3 $a = 2$ *and* $b = 3$

[SQA] 13. Calculate the length of the vector $2\boldsymbol{i} - 3\boldsymbol{j} + \sqrt{3}\boldsymbol{k}$. **2**

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
	2	C	CN	G18	4	1995 P1 Q1

•1 $\sqrt{2^2 + (-3)^2 + (\sqrt{3})^2}$ stated or implied by •2

•2 4

[SQA] 14. The position vectors of the points P and Q are $p = -i + 3j + 4k$ and $q = 7i - j + 5k$ respectively.

(a) Express $\overrightarrow{PQ}$ in component form. **2**

(b) Find the length of PQ. **1**

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
(a)	2	C	CN	G18, G16		1997 P1 Q4
(b)	1	C	CN	G16		

•[1] $q - p = 8i - 4j + k$

or $p = \begin{pmatrix} -1 \\ 3 \\ 4 \end{pmatrix}$, $q = \begin{pmatrix} 7 \\ -1 \\ 5 \end{pmatrix}$

•[2] $\overrightarrow{PQ} = \begin{pmatrix} 8 \\ -4 \\ 1 \end{pmatrix}$

•[3] 9

[SQA] 15. The vectors a, b and c are defined as follows:

$$a = 2i - k, \quad b = i + 2j + k, \quad c = -j + k.$$

(a) Evaluate $a.b + a.c$. **3**

(b) From your answer to part (a), make a deduction about the vector $b + c$. **2**

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
(a)	3	C	CN	G18, G26		1993 P1 Q12
(b)	2	A/B	CN	G27		

•[1] $a = \begin{pmatrix} 2 \\ 0 \\ -1 \end{pmatrix}, b = \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}, c = \begin{pmatrix} 0 \\ -1 \\ 1 \end{pmatrix}$

•[2] $a.b = 1$

•[3] $a.c = -1$

•[4] $a.b + a.c = a.(b + c)$

•[5] $a \perp b + c$

[SQA] 16. Show that the vectors $a = 2i + 3j - k$ and $b = 3i - j + 3k$ are perpendicular. **3**

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
	3	C	CN	G18, G27	$a.b = \cdots = 0$	1991 P1 Q3

•[1] strat: $a.b = \ldots\ldots\ldots$

•[2] $a.b = 0 \Rightarrow$ perpendicularity explicitly stated

•[3] $\begin{pmatrix} 2 \\ 3 \\ -1 \end{pmatrix} . \begin{pmatrix} 3 \\ -1 \\ 3 \end{pmatrix} = 6 - 3 - 3 = 0$

[SQA] 17. (a) Show that the points L(−5, 6, −5), M(7, −2, −1) and N(10, −4, 0) are collinear. **4**
(b) Find the ration in which M divides LN. **1**

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
(*a*)	4	C	CN	G23		1991 P1 Q7
(*b*)	1	C	CN	G25		

•1 $\overrightarrow{LM} = \begin{pmatrix} 12 \\ -8 \\ 4 \end{pmatrix}$ or equivalent combinations for (a)

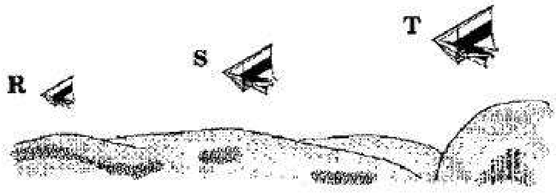
•2 $\overrightarrow{MN} = \begin{pmatrix} 3 \\ -2 \\ 1 \end{pmatrix}$

•3 $\overrightarrow{LM} = 4\overrightarrow{MN}$

•4 vectors are parallel and have common point so L, M, N are collinear

•5 4:1

[SQA] 18. Relative to the top of a hill, three gliders have positions given by R(−1, −8, −2), S(2, −5, 4) and T(3, −4, 6). Prove that R, S and T are collinear. **3**



Part	Marks	Level	Calc.	Content	Answer	U3 OC1
	3	C	CN	G23		1994 P1 Q4

•1 $\overrightarrow{ST} = \begin{pmatrix} 1 \\ 1 \\ 2 \end{pmatrix}$ or equivalent **and** $\overrightarrow{RS} = \begin{pmatrix} 3 \\ 3 \\ 6 \end{pmatrix}$ or equivalent

•2 $\overrightarrow{RS} = 3\overrightarrow{ST}$ or equiv.

•3 RS // ST **and** S is common.

[SQA] 19. Show that P(2, 2, 3), Q(4, 4, 1) and R(5, 5, 0) are collinear and find the ratio in which Q divides PR. **4**

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
	4	C	CN	G23, G25	$\overrightarrow{QR} = \frac{1}{2}\overrightarrow{PQ}$, $PQ : QR = 2 : 1$	1990 P1 Q4

•1 $\overrightarrow{PQ} = \begin{pmatrix} 2 \\ 2 \\ -2 \end{pmatrix}$

•2 $\overrightarrow{QR} = \begin{pmatrix} 1 \\ 1 \\ -1 \end{pmatrix} = \frac{1}{2}\overrightarrow{PQ}$

or equivalent

•3 vectors parallel and have pt in common so pts collinear

•4 $PQ:QR = 2:1$

[SQA] 20. ABCD is a quadrilateral with vertices $A(4,-1,3)$, $B(8,3,-1)$, $C(0,4,4)$ and $D(-4,0,8)$.

(*a*) Find the coordinates of M, the midpoint of AB. **1**

(*b*) Find the coordinates of the point T, which divides CM in the ratio $2:1$. **3**

(*c*) Show that B, T and D are collinear and find the ratio in which T divides BD. **4**

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
(*a*)	1	C	CN	G6, G25		1989 P2 Q2
(*b*)	3	C	CN	G25		
(*c*)	4	C	CN	G23, G25		

(*a*) •1 $(6,1,1)$

(*b*) •2 *e.g.* $\overrightarrow{CM}=\begin{pmatrix}6\\-3\\-3\end{pmatrix}$

•3 $\overrightarrow{CT}=\begin{pmatrix}4\\-2\\-2\end{pmatrix}$

•4 $T=(4,2,2)$

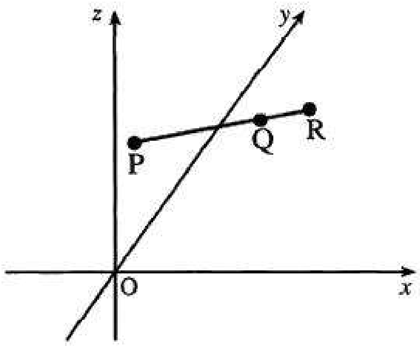
(*c*) •5 *e.g.* $\overrightarrow{BT}=\begin{pmatrix}-4\\-1\\3\end{pmatrix}$

•6 $\overrightarrow{TD}=\begin{pmatrix}-8\\-2\\6\end{pmatrix}=2\times\overrightarrow{BT}$

•7 TD is parallel to BT, T is common point so B, T, D collinear

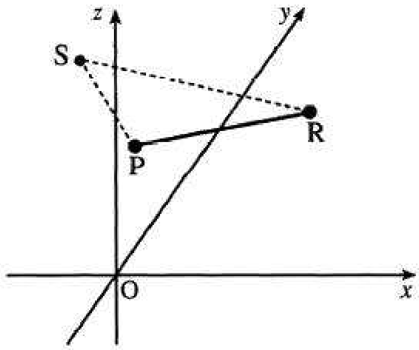
•8 $BT:TD=1:2$

[SQA] 21. Relative to the axes shown and with an appropriate scale, P(−1, 3, 2) and Q(5, 0, 5) represent points on a road. The road is then extended to the point R such that $\overrightarrow{PR} = \frac{4}{3}\overrightarrow{PQ}$.



(*a*) Find the coordinates of R. **(3)**

(*b*) Roads from P and R are built to meet at the point S (−2, 2, 5). Calculate the size of angle PSR. **(7)**



Part	Marks	Level	Calc.	Content	Answer	U3 OC1
(*a*)	3	C	CR	G25		1997 P2 Q2
(*b*)	7	C	CR	G28		

(a)

•1 $\overrightarrow{PQ} = \begin{pmatrix} 6 \\ -3 \\ 3 \end{pmatrix}$ •2 $\begin{pmatrix} 8 \\ -4 \\ 4 \end{pmatrix}$

•3 $R = (7, -1, 6)$

(b)

•4 $\overrightarrow{SP}.\overrightarrow{SR} = |SP||SR|\cos P\hat{S}R$

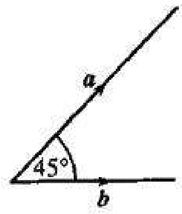
•5 $\overrightarrow{SP} = \begin{pmatrix} 1 \\ 1 \\ -3 \end{pmatrix}$ •6 $\overrightarrow{SR} = \begin{pmatrix} 9 \\ -3 \\ 1 \end{pmatrix}$

•7 $|SP| = \sqrt{11}$ •8 $|SR| = \sqrt{91}$

•9 $\overrightarrow{SP}.\overrightarrow{SR} = 3$

•10 $P\hat{S}R = 84 \cdot 6°$

[SQA] 22. The diagram shows two vectors a and b, with $|a| = 3$ and $|b| = 2\sqrt{2}$. These vectors are inclined at an angle of 45° to each other.



(*a*) Evaluate (i) $a.a$
(ii) $b.b$
(iii) $a.b$ **2**

(*b*) Another vector p is defined by $p = 2a + 3b$.
Evaluate $p.p$ and hence write down $|p|$. **4**

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
(*a*)	2	C	CN	G26		1999 P1 Q17
(*b*)	4	A/B	CN	G29, G30		

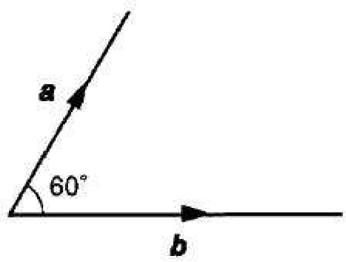
•[1] $a.a = 9$ and $b.b = 8$	•[3] $(2a+3b).(2a+3b)$
•[2] $a.b = 6$	•[4] $4a.a + 9b.b + 12a.b$
	•[5] 180
	•[6] $\sqrt{180}$

[SQA] 23. For what value of t are the vectors $u = \begin{pmatrix} t \\ -2 \\ 3 \end{pmatrix}$ and $v = \begin{pmatrix} 2 \\ 10 \\ t \end{pmatrix}$ perpendicular? **2**

Part	Marks	Level	Calc.	Content	Answer	U3 OC1
	2	C	CN	G27	$t = 4$	2000 P2 Q7

•[1] ss: know to use scalar product	•[1] $u.v = 2t - 20 + 3t$
•[2] ic: interpret scalar product	•[2] $u.v = 0 \Rightarrow t = 4$

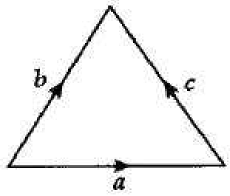
[SQA] 24. The diagram shows representatives of two vectors, a and b, inclined at an angle of 60°.
If $|a| = 2$ and $|b| = 3$, evaluate $a.(a + b)$ **3**



Part	Marks	Level	Calc.	Content	Answer	U3 OC1
	3	C	CN	G29, G26		1992 P1 Q18

•[1] $a.a + a.b$
•[2] $2 \times 3 \times \cos 60°$
•[3] 4

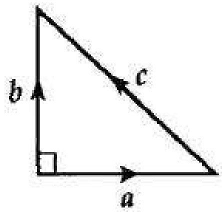
[SQA] 25. The sides of this equilateral triangle are 2 units long and represent the vectors $\boldsymbol{a}$, $\boldsymbol{b}$ and $\boldsymbol{c}$ as shown.
Evaluate $\boldsymbol{a}.(\boldsymbol{a}+\boldsymbol{b}+\boldsymbol{c})$. 5



Part	Marks	Level	Calc.	Content	Answer	U3 OC1
	1	C	NC	A6		1989 P1 Q9
	4	A/B	NC	G29, G26		

- •[1] $\boldsymbol{a}.\boldsymbol{a}+\boldsymbol{a}.\boldsymbol{b}+\boldsymbol{a}.\boldsymbol{c}$
- •[2] $\boldsymbol{a}.\boldsymbol{a}=|\boldsymbol{a}||\boldsymbol{a}|\cos 0$
- •[3] $\boldsymbol{a}.\boldsymbol{b}=|\boldsymbol{a}||\boldsymbol{b}|\cos 60$
- •[4] $\boldsymbol{a}.\boldsymbol{c}=|\boldsymbol{a}||\boldsymbol{c}|\cos 120$
- •[5] 4

[SQA] 26. The diagram shows a right-angled isosceles triangle whose sides are represented by the vectors $\boldsymbol{a}$, $\boldsymbol{b}$ and $\boldsymbol{c}$.
The two equal sides have length 2 units.
Find the value of $\boldsymbol{b}.(\boldsymbol{a}+\boldsymbol{b}+\boldsymbol{c})$ 5



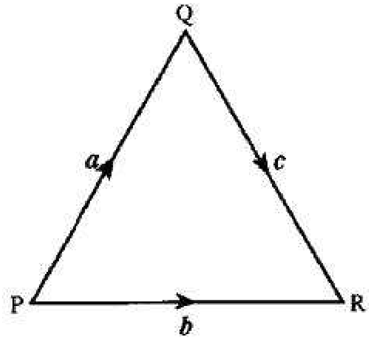
Part	Marks	Level	Calc.	Content	Answer	U3 OC1
	5	C	CN	G29, G27		1991 P1 Q17

- •[1] $\boldsymbol{b}.\boldsymbol{a}+\boldsymbol{b}.\boldsymbol{b}+\boldsymbol{b}.\boldsymbol{c}$
- •[2] $\boldsymbol{b}.\boldsymbol{a}=0$
- •[3] $\boldsymbol{b}.\boldsymbol{b}=4$
- •[4] $|\boldsymbol{c}|=2\sqrt{2}$
- •[5] $\boldsymbol{b}.\boldsymbol{c}=4$

[SQA] 27. PQR is an equilateral triangle of side 2 units.

$\overrightarrow{PQ} = \boldsymbol{a}$, $\overrightarrow{PR} = \boldsymbol{b}$ and $\overrightarrow{QR} = \boldsymbol{c}$.

Evaluate $\boldsymbol{a}.(\boldsymbol{b}+\boldsymbol{c})$ and hence identify two vectors which are perpendicular. **4**



Part	Marks	Level	Calc.	Content	Answer	U3 OC1
	1	C	CN	G26		1997 P1 Q13
	3	A/B	CN	G29, G27		

•[1]	$\boldsymbol{a}.\boldsymbol{b}+\boldsymbol{a}.\boldsymbol{c}$
•[2]	$\boldsymbol{a}.\boldsymbol{b} = 2\times2\times\frac{1}{2}$
•[3]	$\boldsymbol{a}.\boldsymbol{c} = 2\times2\times-\frac{1}{2}$
•[4]	0 and $\boldsymbol{a}$ is perpendicular to $(\boldsymbol{b}+\boldsymbol{c})$

[END OF QUESTIONS]