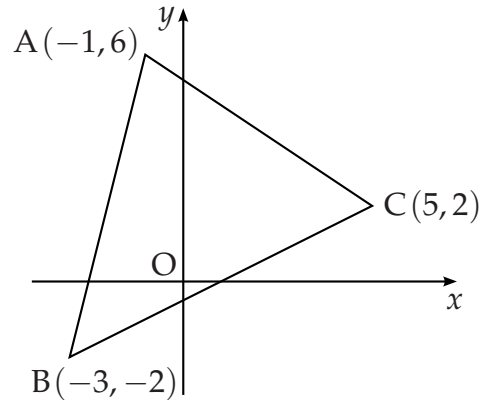


# Geometry Calculator C Grade

- [SQA] 1. Triangle ABC has vertices A(-1,6), B(-3,-2) and C(5,2).

Find

- (a) the equation of the line  $p$ , the median from C of triangle ABC.
- (b) the equation of the line  $q$ , the perpendicular bisector of BC.
- (c) the coordinates of the point of intersection of the lines  $p$  and  $q$ .



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4  
1

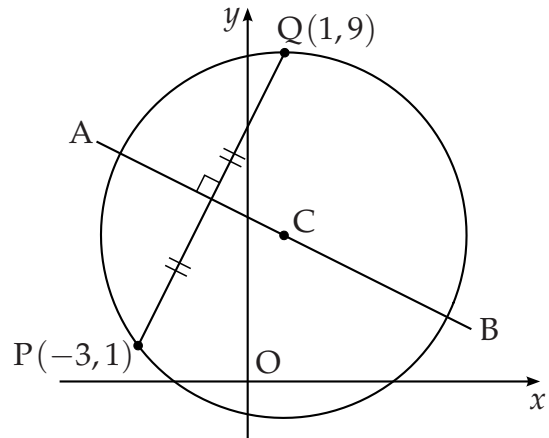
- [SQA] 2. (a) Find the equation of AB, the perpendicular bisector of the line joining the points P(-3,1) and Q(1,9).

- (b) C is the centre of a circle passing through P and Q. Given that QC is parallel to the  $y$ -axis, determine the equation of the circle.

- (c) The tangents at P and Q intersect at T.

Write down

- (i) the equation of the tangent at Q
- (ii) the coordinates of T.



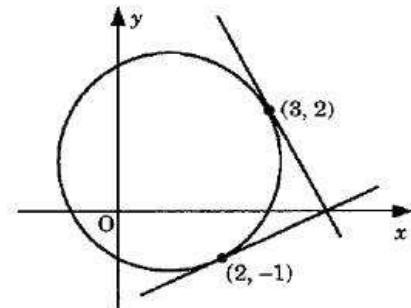
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- [SQA] 3. The circle shown in the diagram has equation

$$(x-1)^2 + (y-1)^2 = 5.$$

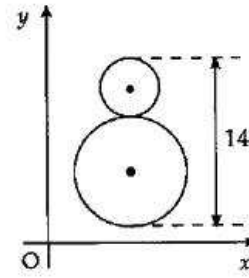
Tangents are drawn at the points (3, 2) and (2, -1).

Write down the coordinates of the centre of the circle and hence show that the tangents are perpendicular to each other.



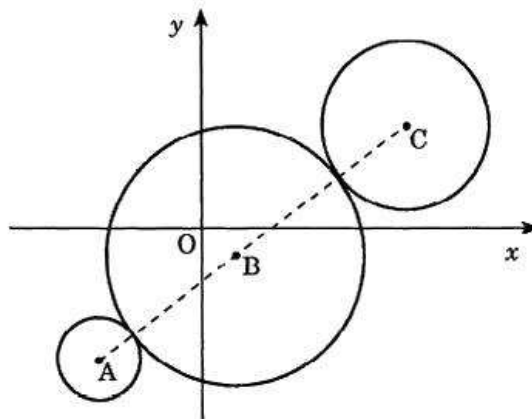
4

- [SQA] 4. A bakery firm makes gingerbread men each 14cm high with a circular "head" and "body".  
The equation of the "body" is  $x^2 + y^2 - 10x - 12y + 45 = 0$  and the line of centres is parallel to the  $y$ -axis. Find the equation of the "head".



5

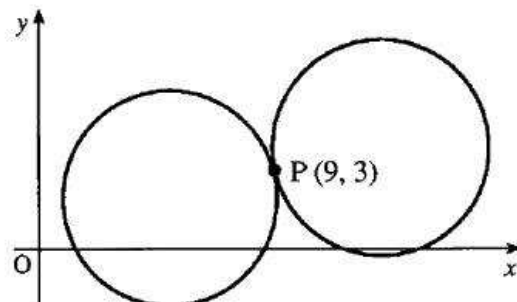
- [SQA] 5. When newspapers were printed by lithograph, the newsprint had to run over three rollers, illustrated in the diagram by three circles. The centres A, B and C of the three circles are collinear.



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.

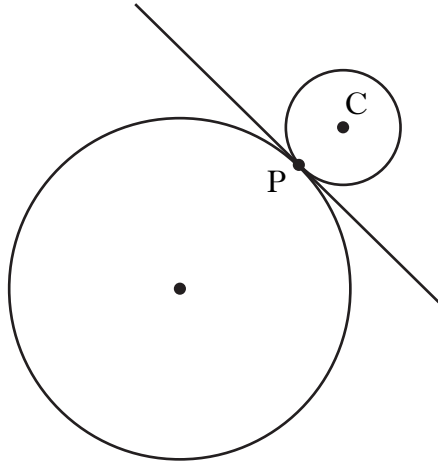
(8)

- [SQA] 6. 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

7. (a) (i) Show that the line with equation  $y = 3 - x$  is a tangent to the circle with equation  $x^2 + y^2 + 14x + 4y - 19 = 0$ .
- (ii) Find the coordinates of the points of contact, P. 5
- (b) Relative to a suitable set of coordinate axes, the diagram below shows the circle from (a) and a second smaller circle with centre C.



The line  $y = 3 - x$  is a common tangent at the point P.

The radius of the larger circle is three times the radius of the smaller circle.

Find the equation of the smaller circle. 6

- [SQA] 8. VABCD is a pyramid with rectangular base ABCD.

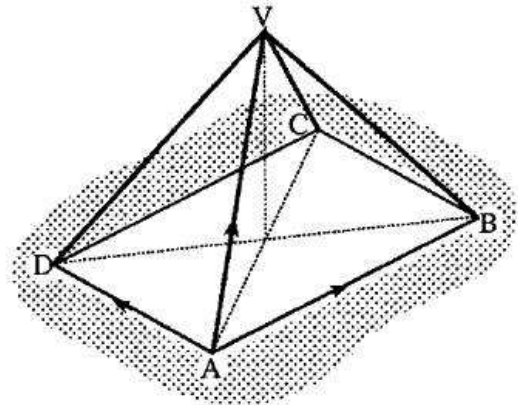
The vectors  $\vec{AB}$ ,  $\vec{AD}$  and  $\vec{AV}$  are given by

$$\vec{AB} = 8\mathbf{i} + 2\mathbf{j} + 2\mathbf{k}$$

$$\vec{AD} = -2\mathbf{i} + 10\mathbf{j} - 2\mathbf{k} \quad \text{and}$$

$$\vec{AV} = \mathbf{i} + 7\mathbf{j} + 7\mathbf{k}.$$

Express  $\vec{CV}$  in component form. 3



- [SQA] 9. The vector  $a\mathbf{i} + b\mathbf{j} + \mathbf{k}$  is perpendicular to both the vectors  $\mathbf{i} - \mathbf{j} + \mathbf{k}$  and  $-2\mathbf{i} + \mathbf{j} + \mathbf{k}$ .

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

- [SQA] 10. Calculate the length of the vector  $2\mathbf{i} - 3\mathbf{j} + \sqrt{3}\mathbf{k}$ . 2

[SQA] 11. Show that the vectors  $a = 2i + 3j - k$  and  $b = 3i - j + 3k$  are perpendicular. 3

[SQA] 12. The position vectors of the points P and Q are  $p = -i + 3j + 4k$  and  $q = 7i - j + 5k$  respectively.

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

(b) Find the length of PQ. 1

[SQA] 13. The vectors  $a$ ,  $b$  and  $c$  are defined as follows:

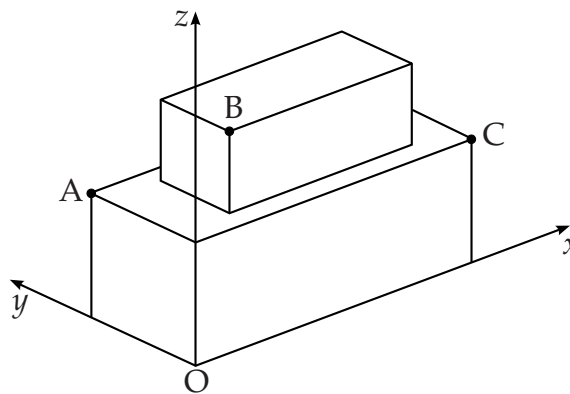
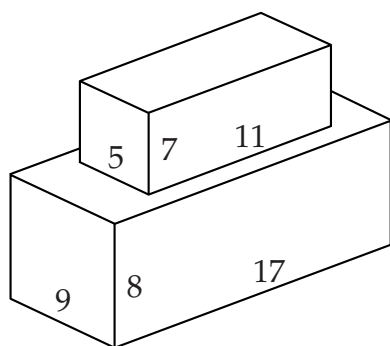
$$a = 2i - k, \quad b = i + 2j + k, \quad c = -j + k.$$

(a) Evaluate  $a \cdot b + a \cdot c$ . 3

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

[SQA] 14. A cuboid measuring 11 cm by 5 cm by 7 cm is placed centrally on top of another cuboid measuring 17 cm by 9 cm by 8 cm.

Coordinates axes are taken as shown.



(a) The point A has coordinates  $(0, 9, 8)$  and C has coordinates  $(17, 0, 8)$ .

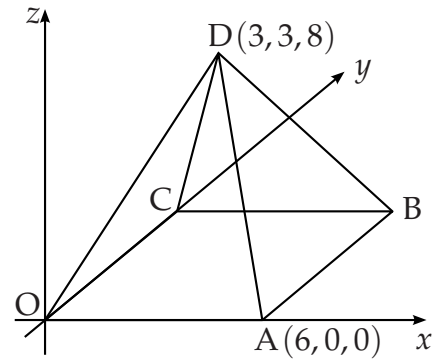
Write down the coordinates of B. 1

(b) Calculate the size of angle ABC. 6

[SQA] 15. The diagram shows a square-based pyramid of height 8 units.

Square OABC has a side length of 6 units.  
The coordinates of A and D are  $(6, 0, 0)$  and  $(3, 3, 8)$ .

C lies on the  $y$ -axis.



(a) Write down the coordinates of B.

1

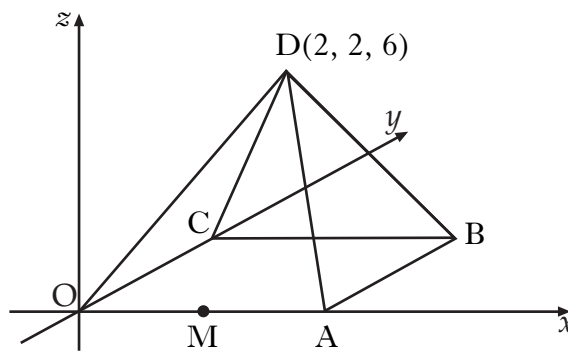
(b) Determine the components of  $\vec{DA}$  and  $\vec{DB}$ .

2

(c) Calculate the size of angle ADB.

4

16. D,OABC is a square based pyramid as shown in the diagram below.



O is the origin, D is the point  $(2, 2, 6)$  and  $OA = 4$  units.

M is the mid-point of OA.

(a) State the coordinates of B.

1

(b) Express  $\vec{DB}$  and  $\vec{DM}$  in component form.

3

(c) Find the size of angle BDM.

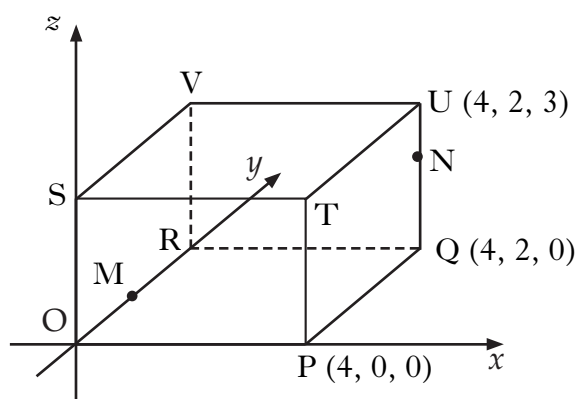
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17. The diagram shows a cuboid  $OPQR,STUV$  relative to the coordinate axes.

P is the point  $(4,0,0)$ , Q is  $(4,2,0)$  and U is  $(4,2,3)$ .

M is the midpoint of OR.

N is the point on UQ such that  $UN = \frac{1}{3}UQ$ .



- (a) State the coordinates of M and N. 2
- (b) Express the vectors  $\overrightarrow{VM}$  and  $\overrightarrow{VN}$  in component form. 2
- (c) Calculate the size of angle MVN. 5

[END OF QUESTIONS]