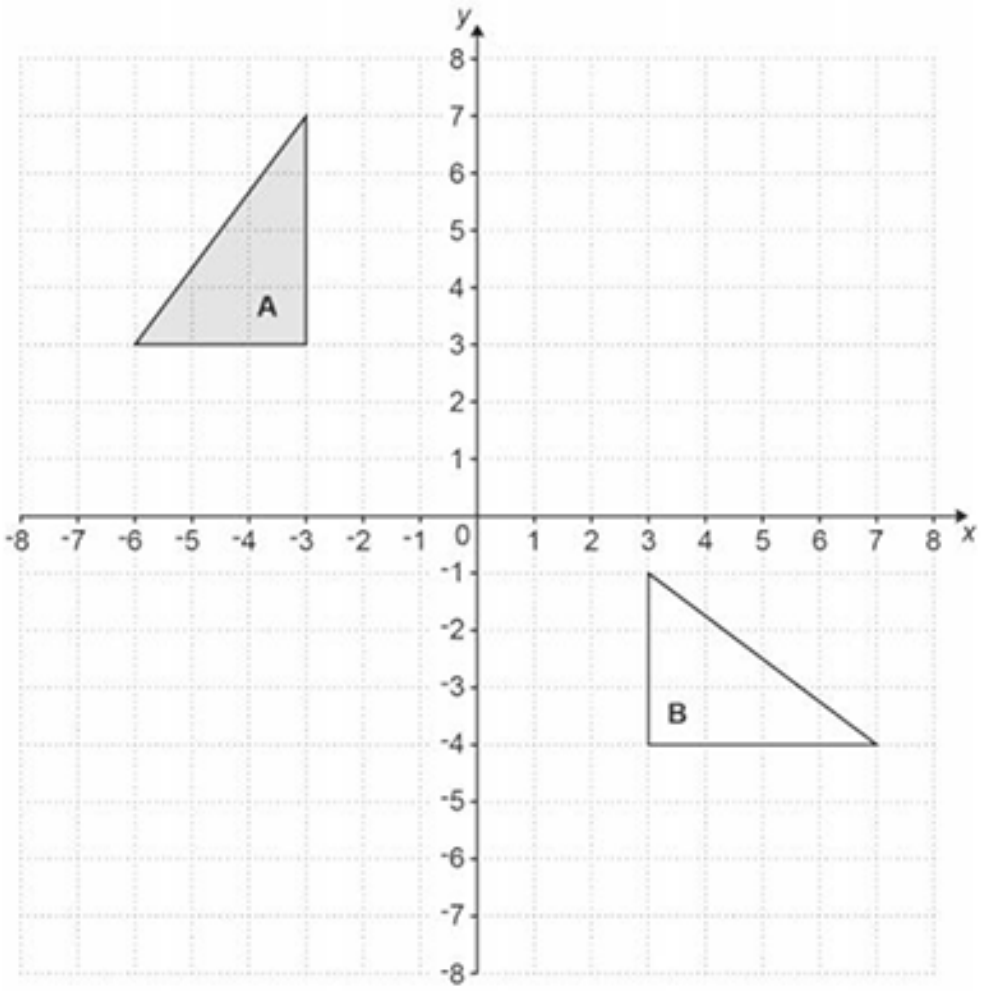
1. Triangle **A** and triangle **B** are shown on the coordinate grid.



Triangle **A** is mapped onto triangle **B** using a combination of two transformations:

- a transformation T, followed by
- a translation of $\begin{pmatrix} 4 \\ -9 \end{pmatrix}$

Describe fully transformation T.

---

[4]

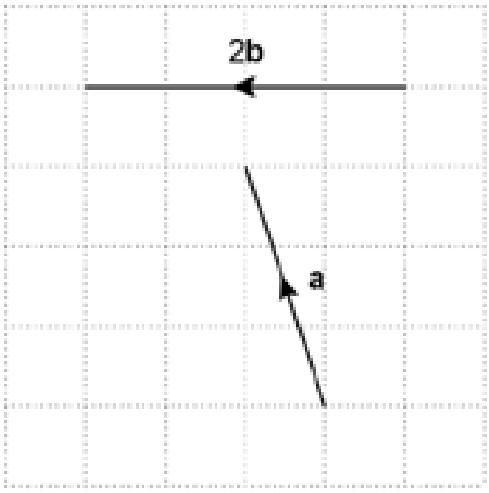
2. Two ornaments, A and B, are mathematically similar.
The table shows information about the two ornaments.

	Ornament A	**Ornament B**
Height (m)	*h*	14
Surface area (m^2)	216	*A*
Volume (m^3)	80	3430

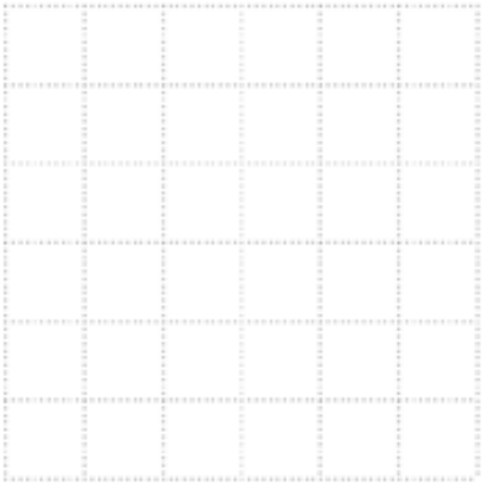
Find the value of *h* and the value of *A*.
You must show your working.

h = ...
A = ... **[6]**

3. Vector **a** and vector **2b** are drawn on this grid.



On the grid below, draw the vector **a** – **b**.



[3]

4. Two cylinders, A and B, are mathematically similar.

The ratio of the volume of cylinder A to the volume of cylinder B is 27 : 64.
The height of cylinder A is 15 cm.

Work out the height of cylinder B.

..... cm **[3]**

5(a).

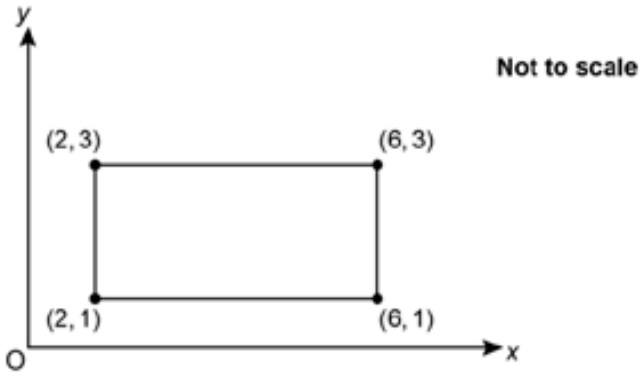
Describe fully the **single** transformation that is equivalent to:

- a rotation of 60° clockwise about the origin, followed by
- a rotation of 80° anticlockwise about the origin.

---

[2]

(b). The diagram shows the coordinates of the vertices of a rectangle.

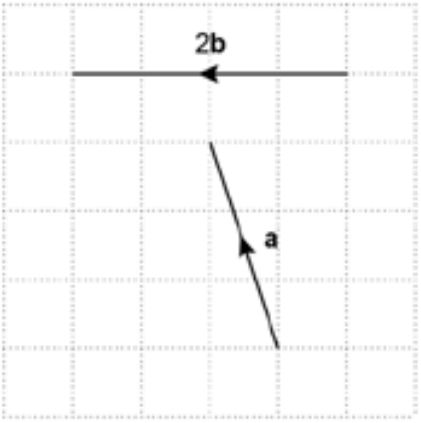


The rectangle is reflected in the line $x = 6$.

Write down the coordinates of the vertices of the rectangle that are invariant.

..... **[1]**

6. Vector **a** and vector **2b** are drawn on this grid.



Write vector **a** as a column vector.

( )

[2]

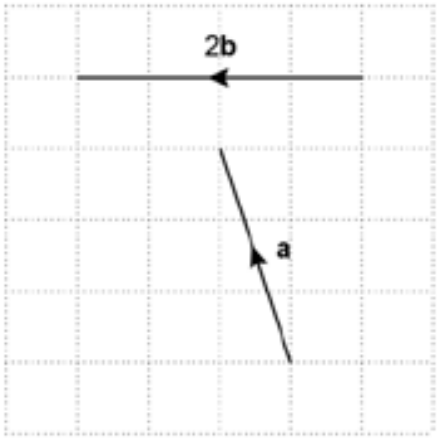
7. Two ornaments, A and B, are mathematically similar.
The table shows information about the two ornaments.

	Ornament A	**Ornament B**
Height (m)	*h*	12
Surface area (m^2)	216	*A*
Volume (m^3)	240	3750

Find the value of *h* and the value of *A*.
You must show your working.

h = ...
A = ... **[6]**

8. Vector **a** and vector **2b** are drawn on this grid.

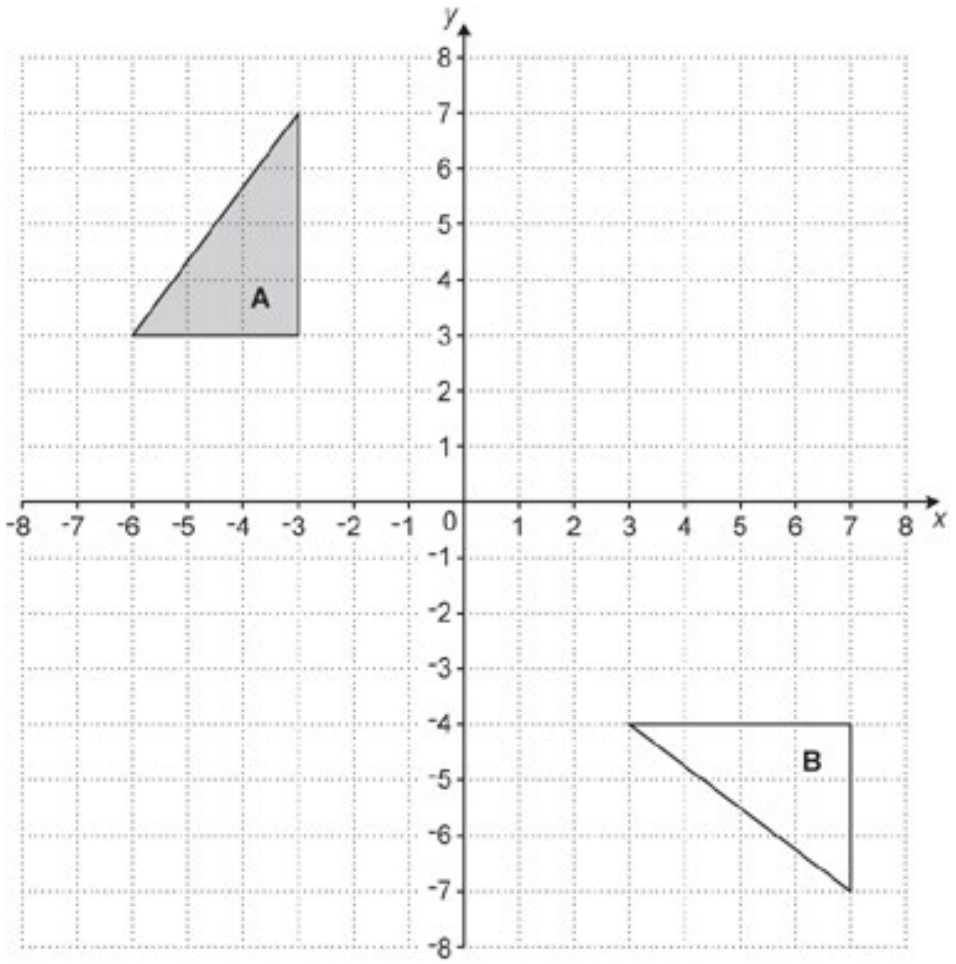


Write a column vector that is different in direction but has the same length as vector **a**.

( )

[2]

9. Triangle **A** and triangle **B** are shown on the coordinate grid.



Triangle **A** is mapped onto triangle **B** using a combination of two transformations:

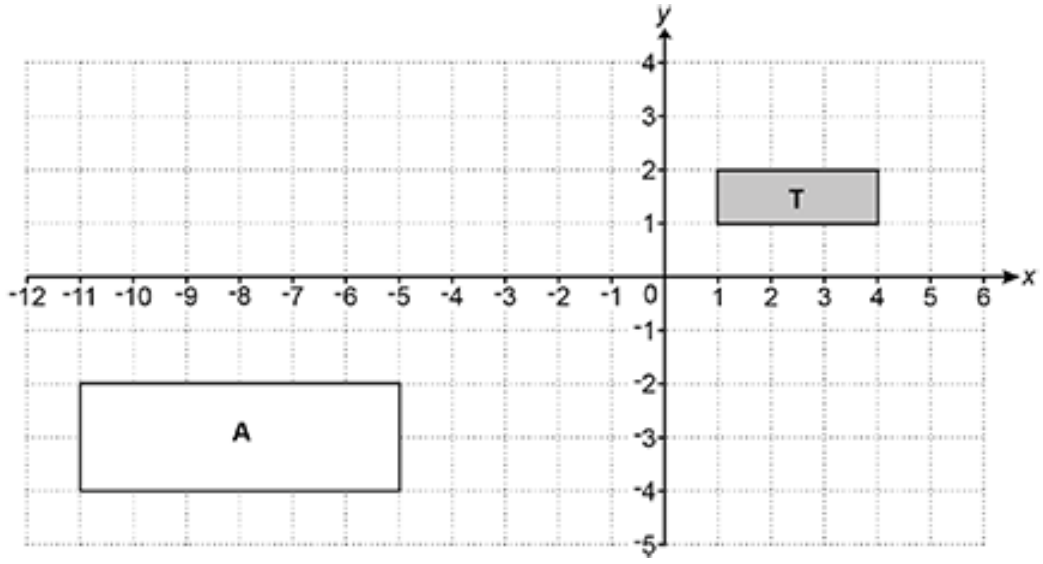
- a transformation T, followed by
- a translation of $\begin{pmatrix} 8 \\ -5 \end{pmatrix}$.

Describe fully transformation T.

---

[4]

10(a). Rectangle **T** and rectangle **A** are drawn on the coordinate grid.



Describe fully the **single** transformation that maps rectangle **T** onto rectangle **A**.

---

[3]

(b). Describe fully the **single** transformation that is equivalent to:

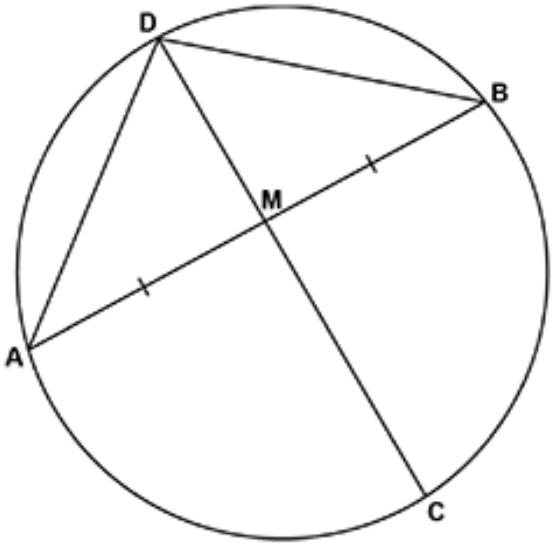
- a rotation of 90° anticlockwise about centre (0,0), followed by
- a reflection in the *x*-axis.

You may use the grid above to help you.

---

[3]

11. A, B, C and D are points on the circumference of a circle.
CD is a diameter of the circle.
M is a point on AB such that AM = MB.



Not to scale

Complete these sentences to show that triangle DMA is congruent to triangle DMB.

Side AM = side MB because it is given to you.

Angle AMD = angle _____ because _____

_____

_____

Side MD is _____

Triangle DMA is congruent to triangle DMB because

_____ **[3]**

12(a). Work out.

$$\begin{pmatrix} 6 \\ 4 \end{pmatrix} - 3\begin{pmatrix} 1 \\ -2 \end{pmatrix}$$

( )

[1]

(b). $\begin{pmatrix} 4 \\ -2 \end{pmatrix} + \begin{pmatrix} -3 \\ 5 \end{pmatrix}$

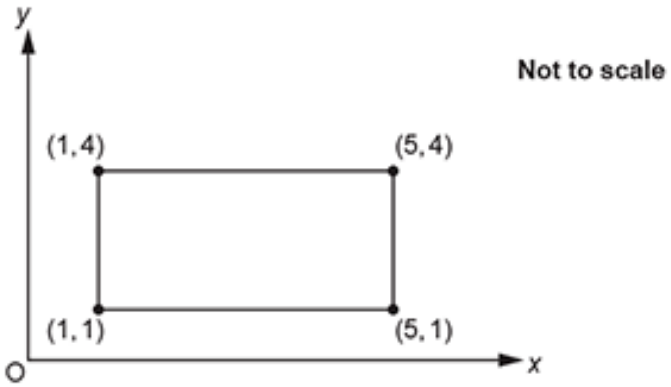
( ) **[1]**

13(a). Describe fully the **single** transformation that is equivalent to:

- a rotation of 20° anticlockwise about the origin, followed by
- a rotation of 70° clockwise about the origin.

---**[2]**

(b). The diagram shows the coordinates of the vertices of a rectangle.

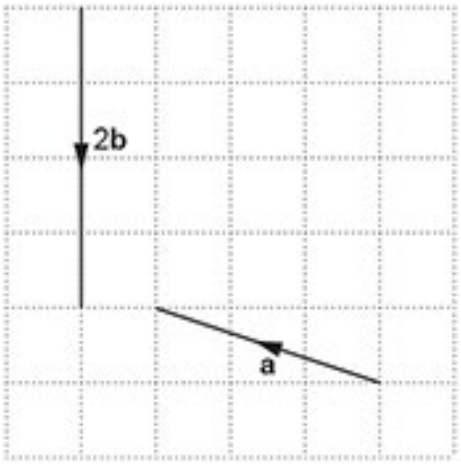


The rectangle is reflected in the line $y = 4$.

Write down the coordinates of the vertices of the rectangle that are invariant.

..... **[1]**

14(a). Vector **a** and vector 2**b** are drawn on this grid.



Write vector **a** as a column vector.

( )

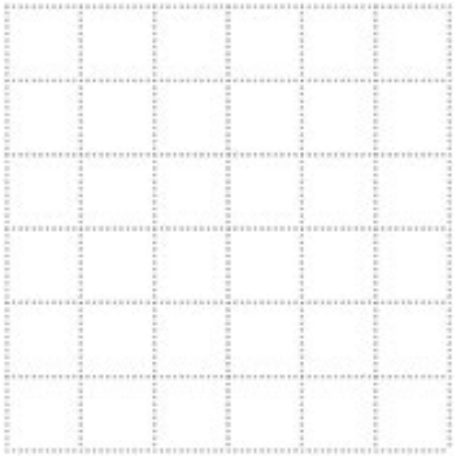
[2]

(b). Write a column vector that is different in direction but has the same length as vector **a**.

( )

[1]

(c). On the grid below, draw the vector **a** − **b**.



[3]

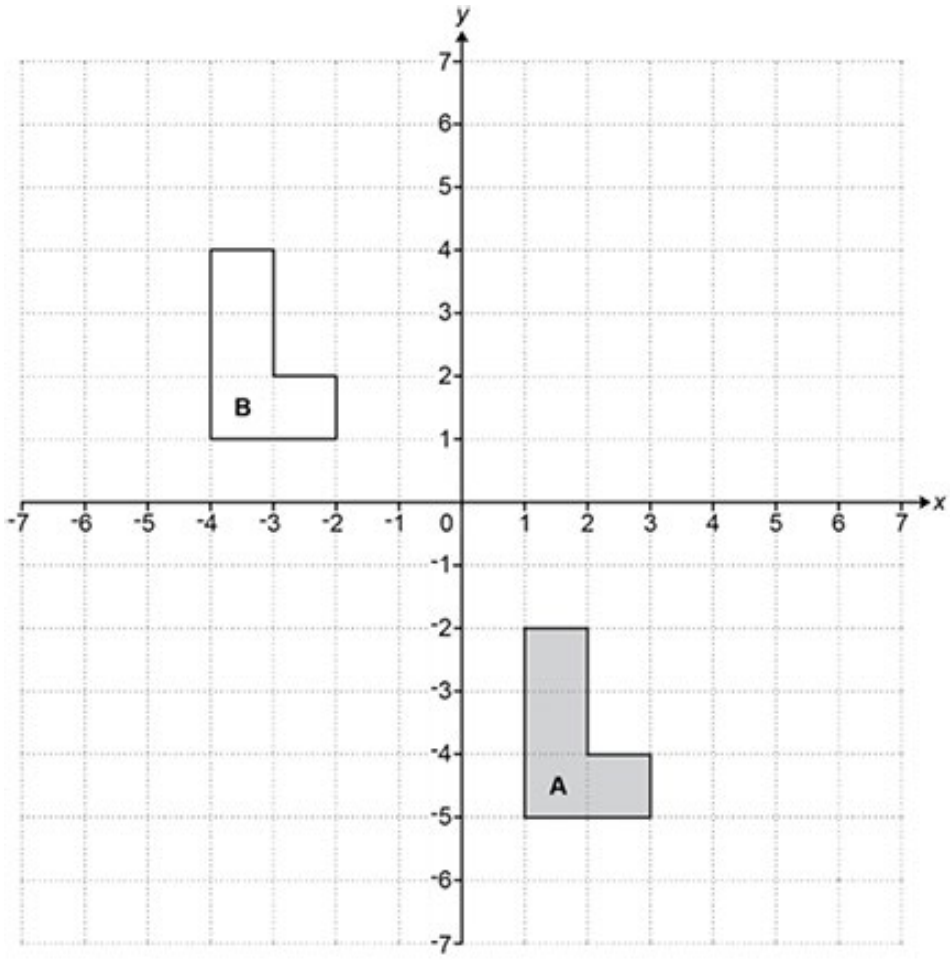
15. Two prisms, A and B, are mathematically similar.

The ratio of the volume of prism A to the volume of prism B is 8 : 27.
The height of prism A is 6 cm.

Work out the height of prism B.

..... cm **[3]**

16(a). Shape **A** and shape **B** are drawn on the coordinate grid.



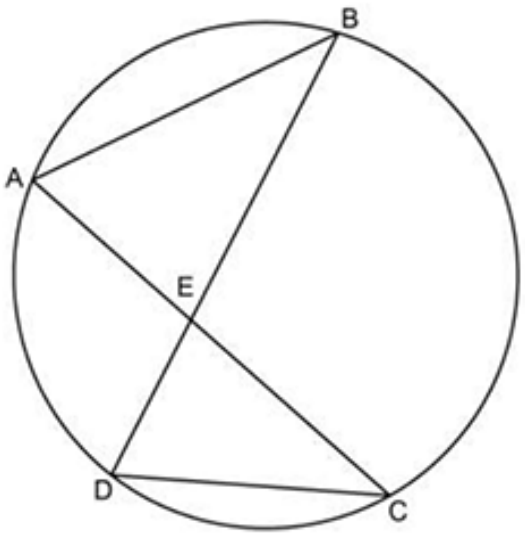
Describe fully the single transformation that maps shape **A** onto shape **B**.

[2]

(b). Reflect shape **A** in the line $y = -1$.

[2]

17. Points A, B, C and D lie on the circumference of a circle.
Line AC intersects line BD at point E.



Not to scale

Prove that triangle AEB is similar to triangle DEC.

[3]

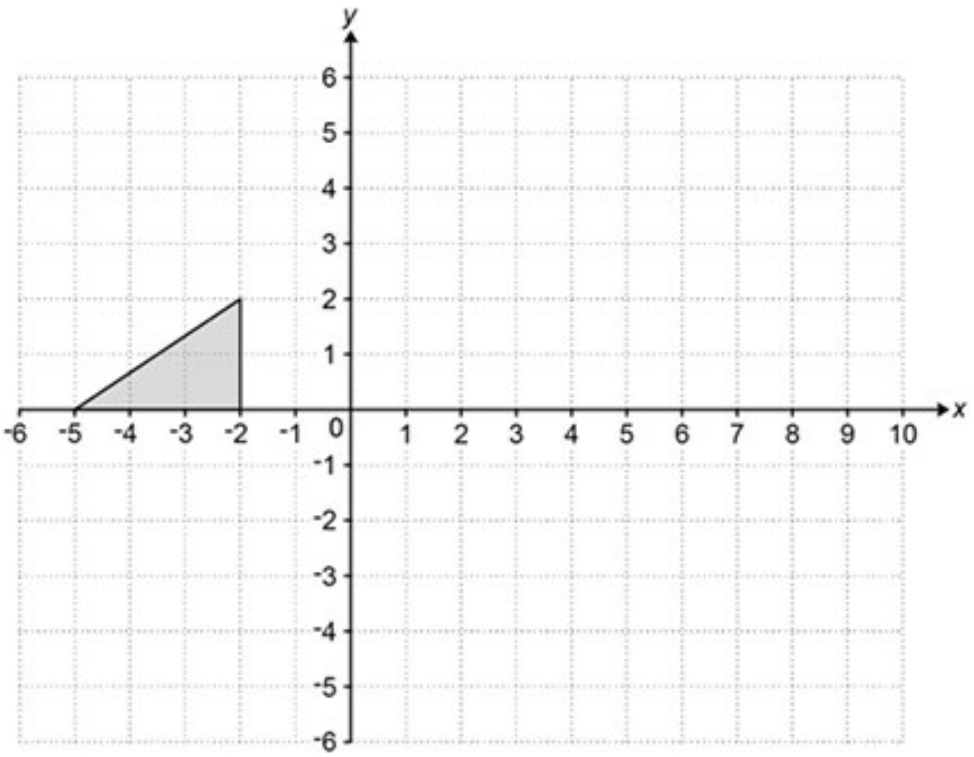
18. Two bottles are mathematically similar.

The small bottle holds 0.5 litres and has a height of 30 cm.
The large bottle holds 1.5 litres.

Calculate the height of the large bottle.

…….……..…… cm **[4]**

19. You may use this coordinate grid to help you answer the following question.

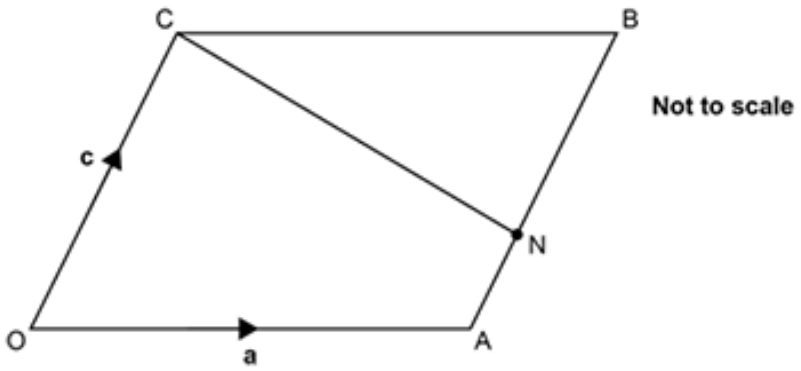


Describe fully the **single** transformation that is equivalent to:

- a rotation of 180° with centre (0, ⁻1), followed by
- a translation of $\begin{pmatrix} 0 \\ 6 \end{pmatrix}$.

---**[3]**

20(a). OABC is a parallelogram.



$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.

The point N lies on line AB such that AN : NB = 2 : 3.

Line CN is extended to reach point P, such that $\overrightarrow{CP} = \frac{5}{3}\overrightarrow{CN}$.

Show, using vectors, that OAP is a straight line.

[4]

(b). Find the following vectors in terms of **a** and **c**.
Give your answers in their simplest form.

i. $\overrightarrow{OB}$

$\overrightarrow{OB}$ = ... **[1]**

ii. $\overrightarrow{ON}$

$\overrightarrow{ON}$ = ... **[1]**

21. Two pyramids, A and B, are mathematically similar.

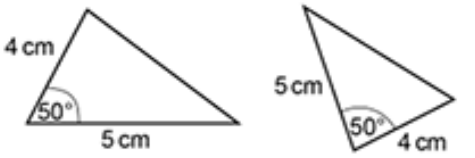
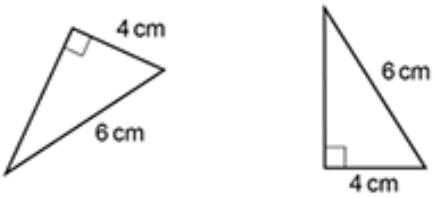
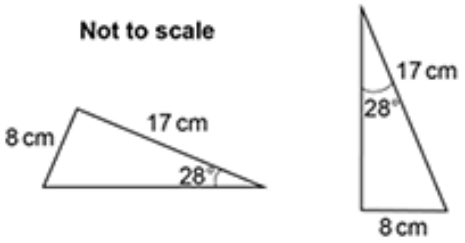
Pyramid A has surface area 12 cm^2 and volume 8 cm^3.
Pyramid B has surface area 48 cm^2.

Work out the volume of pyramid B.
You must show your working.

..... cm^3 **[4]**

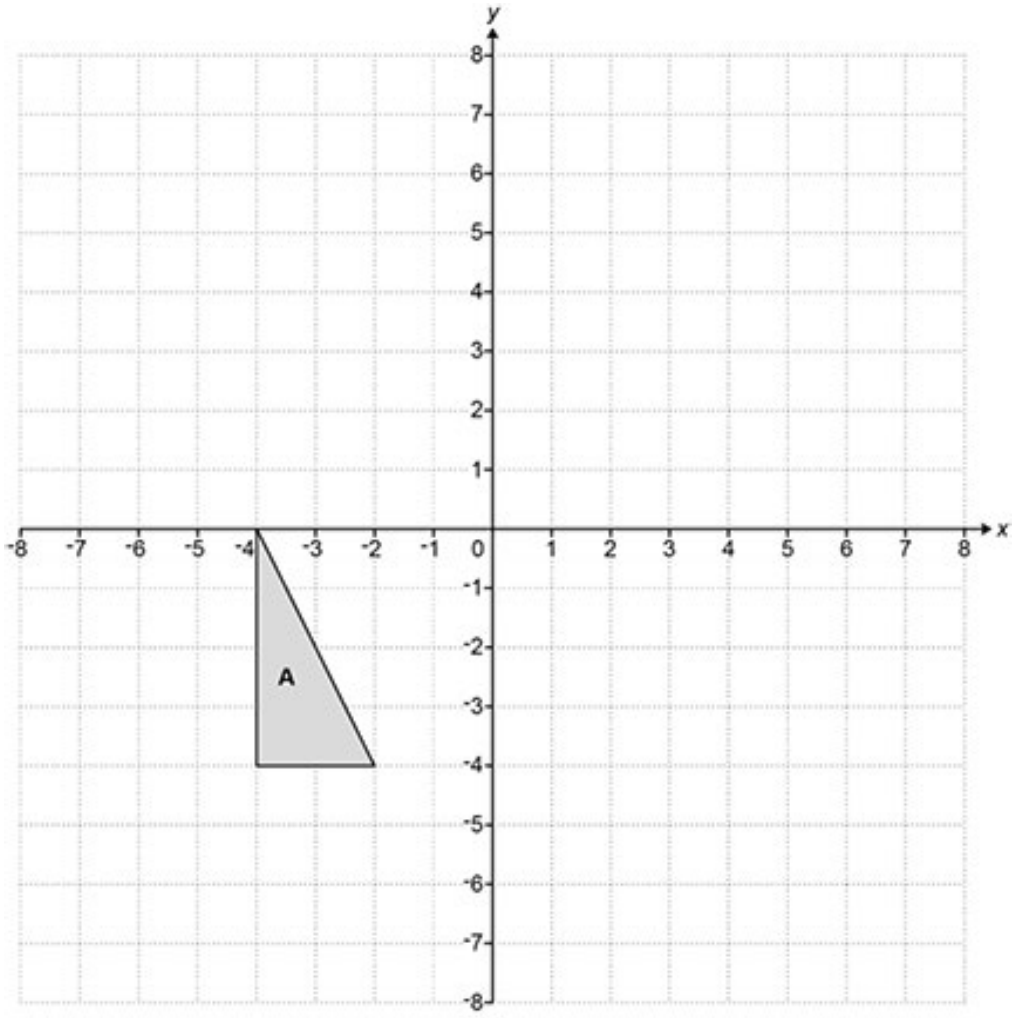
22. In each row of the table there are two triangles.

State whether the two triangles are congruent or not.
If they are congruent state a reason from SSS, SAS, ASA or RHS.

Triangles	Congruent (yes/no)	Reason (SSS, SAS, ASA, RHS)
Not to scale 		
Not to scale 		
Not to scale 		

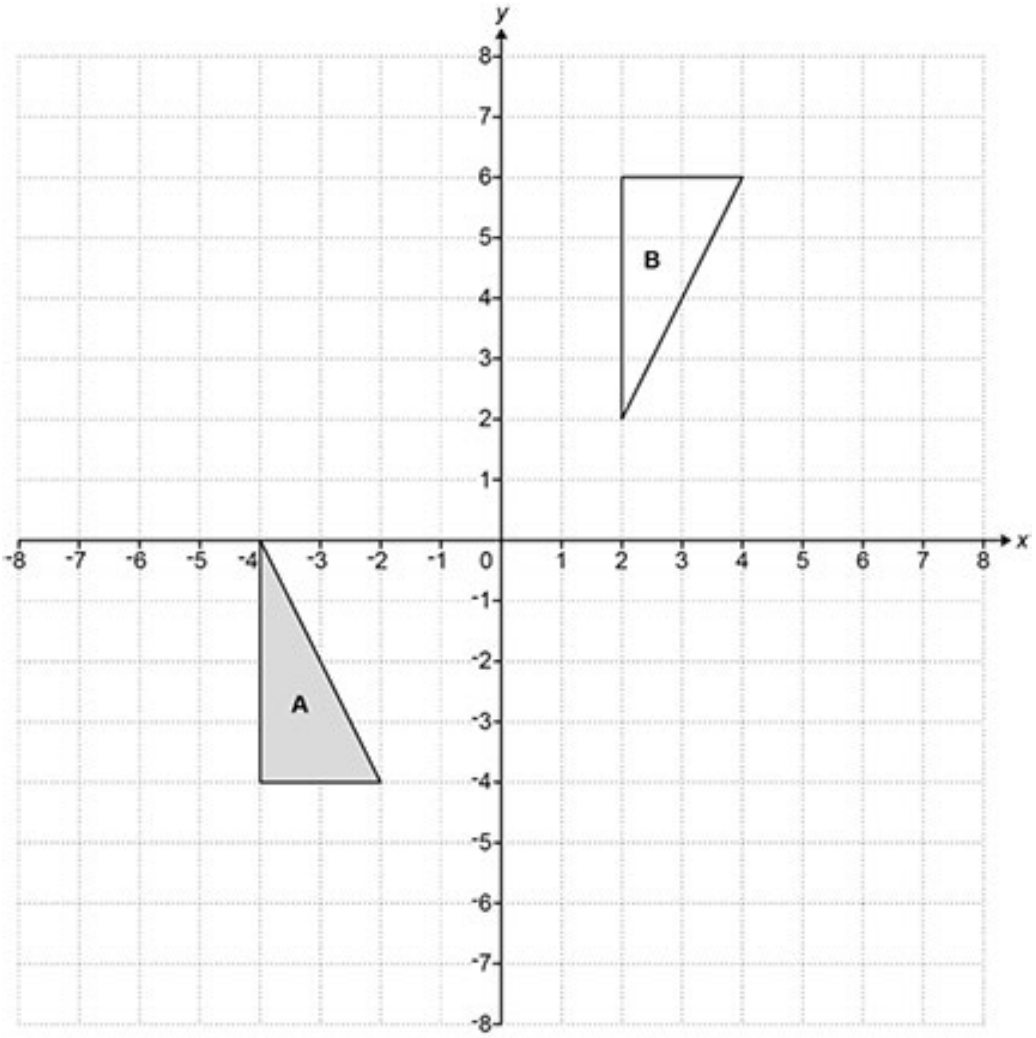
[3]

23(a). Enlarge triangle **A** with scale factor 2.5 and centre of enlargement ($^{-}8$, $^{-}4$).



[3]

(b). Triangle **A** and triangle **B** are shown on the coordinate grid below.



Triangle **A** is mapped onto triangle **B** using a combination of two transformations:

- a transformation T, followed by
- a reflection in the *y*-axis.

Describe fully transformation T.

---

[4]

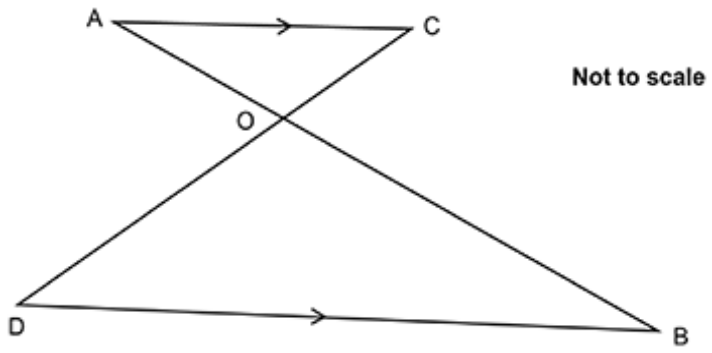
24. Two solid ornaments are mathematically similar.
The larger ornament is three times as tall as the smaller ornament.

The smaller ornament has a volume of 20 cm^3.

Work out the volume of the larger ornament.

…….…….…….. cm^3 **[2]**

25. The diagram shows two triangles ACO and BDO.



AC is parallel to DB.
The lines AB and CD meet at O.

Complete these statements to show that triangles ACO and BDO are similar.

Angle OAC = angle OBD because they are alternate angles.

Angle OCA = angle _____ because _____

Angle AOC = angle _____ because _____

Triangles ACO and BDO are similar because _____

_____ **[3]**

26(a). Work out.

$$\begin{pmatrix} 3 \\ -1 \end{pmatrix} + \begin{pmatrix} -2 \\ 4 \end{pmatrix}$$

( )

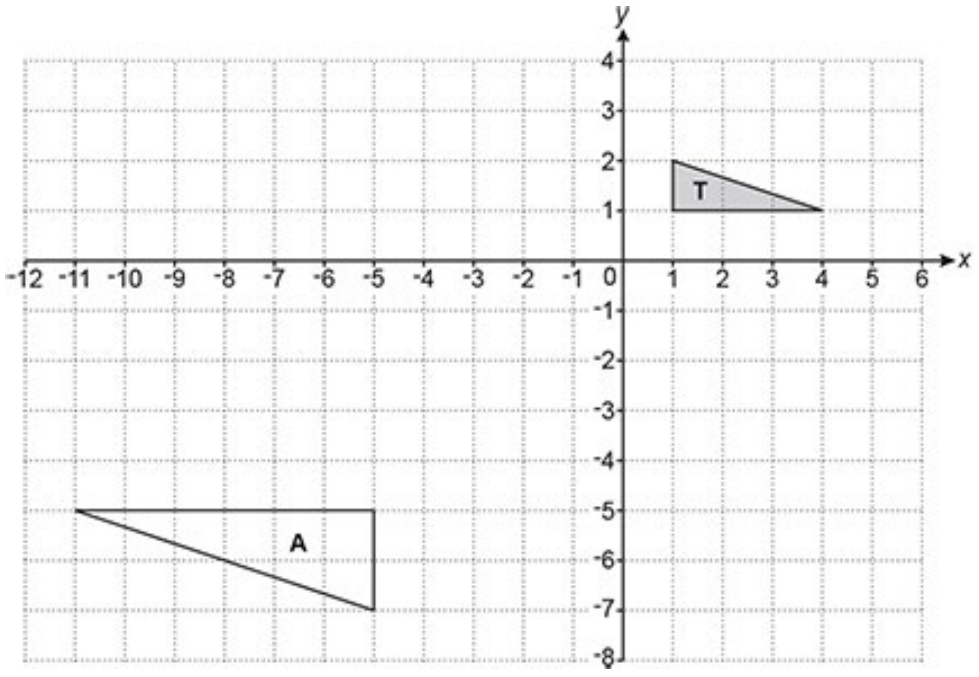
[1]

(b). $\begin{pmatrix} 5 \\ 3 \end{pmatrix} - 2\begin{pmatrix} 1 \\ -4 \end{pmatrix}$

( )

[2]

27(a). Triangle **T** and triangle **A** are drawn on the coordinate grid.



Describe fully the **single** transformation that maps triangle **T** onto triangle **A**.

_____

_____**[3]**

(b). Describe fully the **single** transformation that is equivalent to:

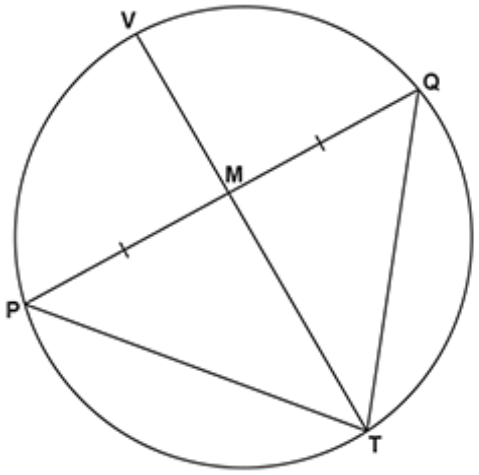
- a rotation of 90° clockwise about centre (0,0), followed by
- a reflection in the *y*-axis.

You may use the grid above to help you.

_____

_____**[3]**

28. P, Q, T and V are points on the circumference of a circle.
TV is a diameter of the circle.
M is a point on PQ such that PM = MQ.



Not to scale

Complete these sentences to show that triangle TMP is congruent to triangle TMQ.

Side PM = side MQ because it is given to you.

Angle PMT = angle _____ because _____

_____

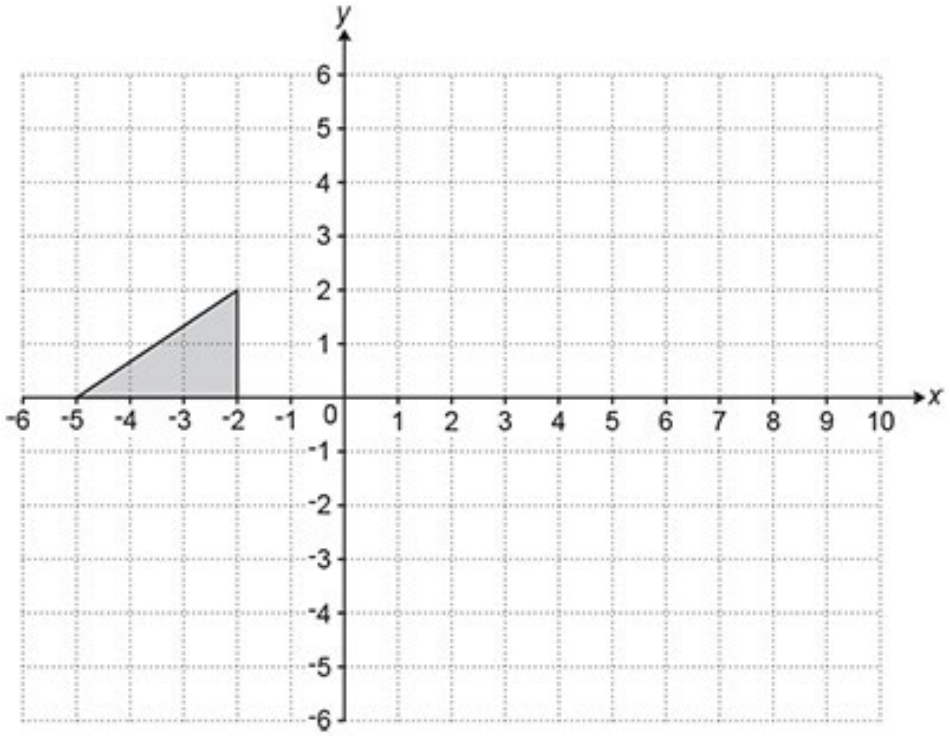
_____

Side MT is _____

Triangle TMP is congruent to triangle TMQ because

_____**[3]**

29. You may use this coordinate grid to help you answer the following question.



Describe fully the **single** transformation that is equivalent to:

- a rotation of 180° with centre (0, 1), followed by
- a translation of $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$

---

[3]

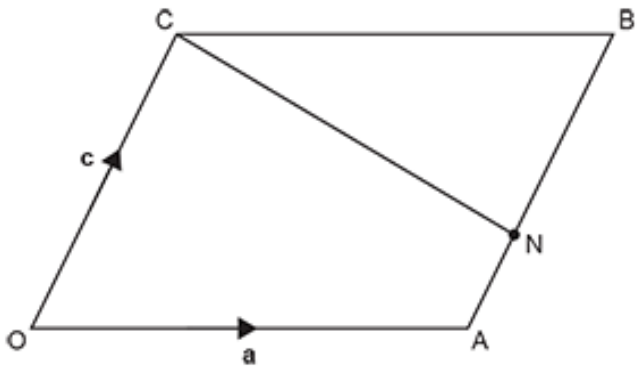
30. Two bottles are mathematically similar.

The small bottle holds 0.5 litres and has a height of 35 cm.
The large bottle holds 2 litres.

Calculate the height of the large bottle.

..... cm **[4]**

31(a). OABC is a parallelogram.



Not to scale

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$
The point N lies on line AB such that AN : NB = 3 : 5.

Find the following vectors in terms of **a** and **c**.
Give your answers in their simplest form.

i. $\overrightarrow{OB}$

$\overrightarrow{OB}$ = ... **[1]**

ii. $\overrightarrow{ON}$

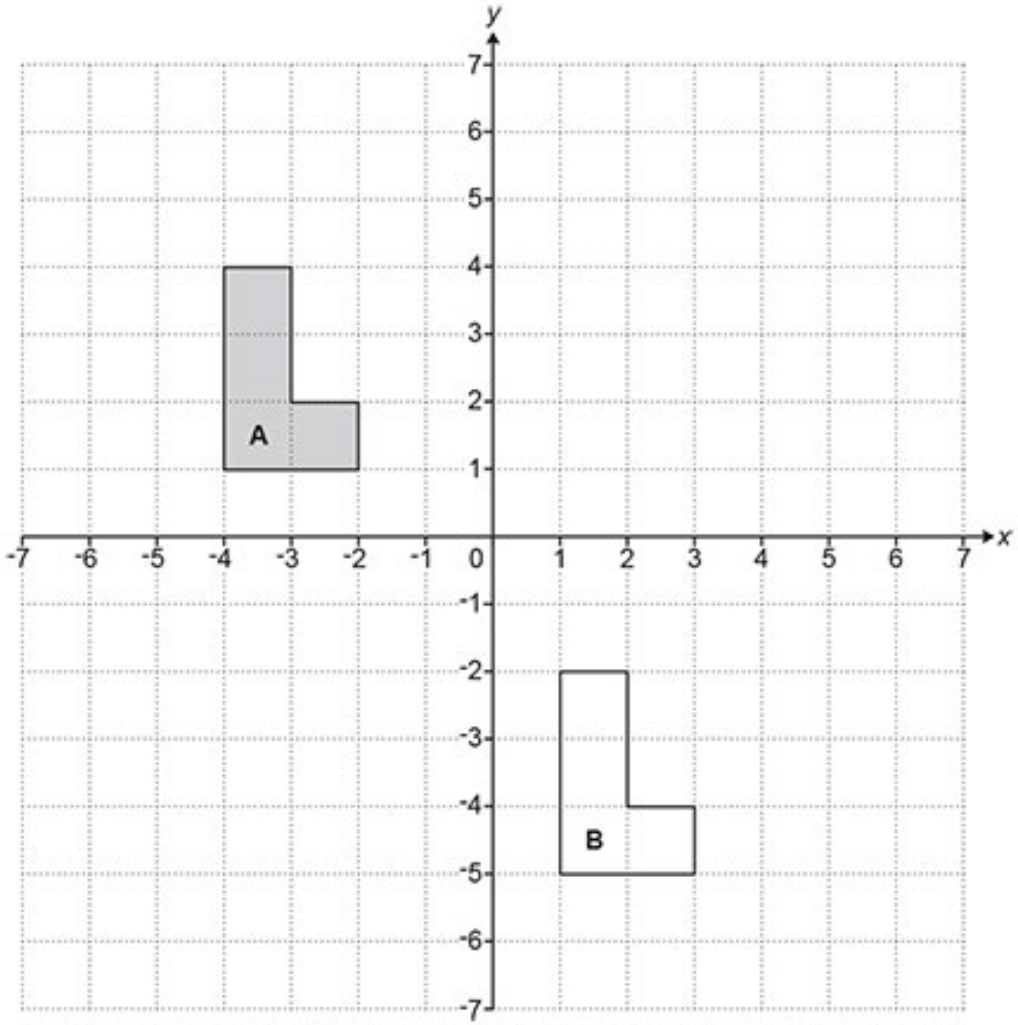
$\overrightarrow{ON}$ = ... **[2]**

(b). Line CN is extended to reach point P, such that $\overrightarrow{CP} = \frac{8}{5}\overrightarrow{CN}$.

Show, using vectors, that OAP is a straight line.

[4]

32(a). Shape **A** and shape **B** are drawn on the coordinate grid.



Describe fully the single transformation that maps shape **A** onto shape **B**.

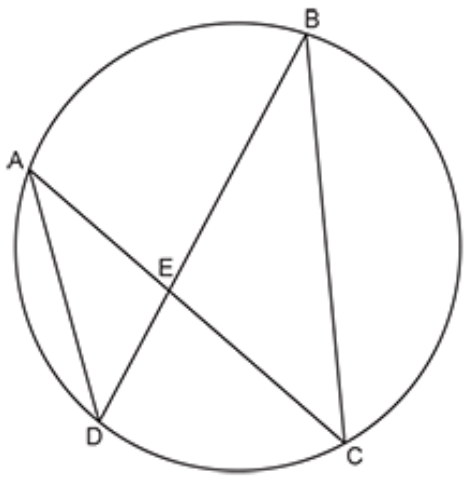
---

[2]

(b). Reflect shape **A** in the line $x = -1$.

[2]

33. Points A, B, C and D lie on the circumference of a circle.
Line AC intersects line BD at point E.



Not to scale

Prove that triangle AED is similar to triangle BEC.

[3]

34. Two pyramids, A and B, are mathematically similar.

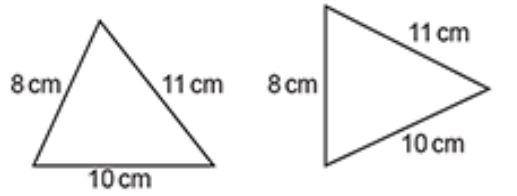
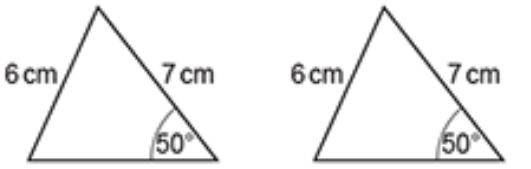
Pyramid A has surface area 12 cm^2 and volume 8 cm^3.
Pyramid B has surface area 75 cm^2.

Work out the volume of pyramid B.
You must show your working.

..... cm^3 **[4]**

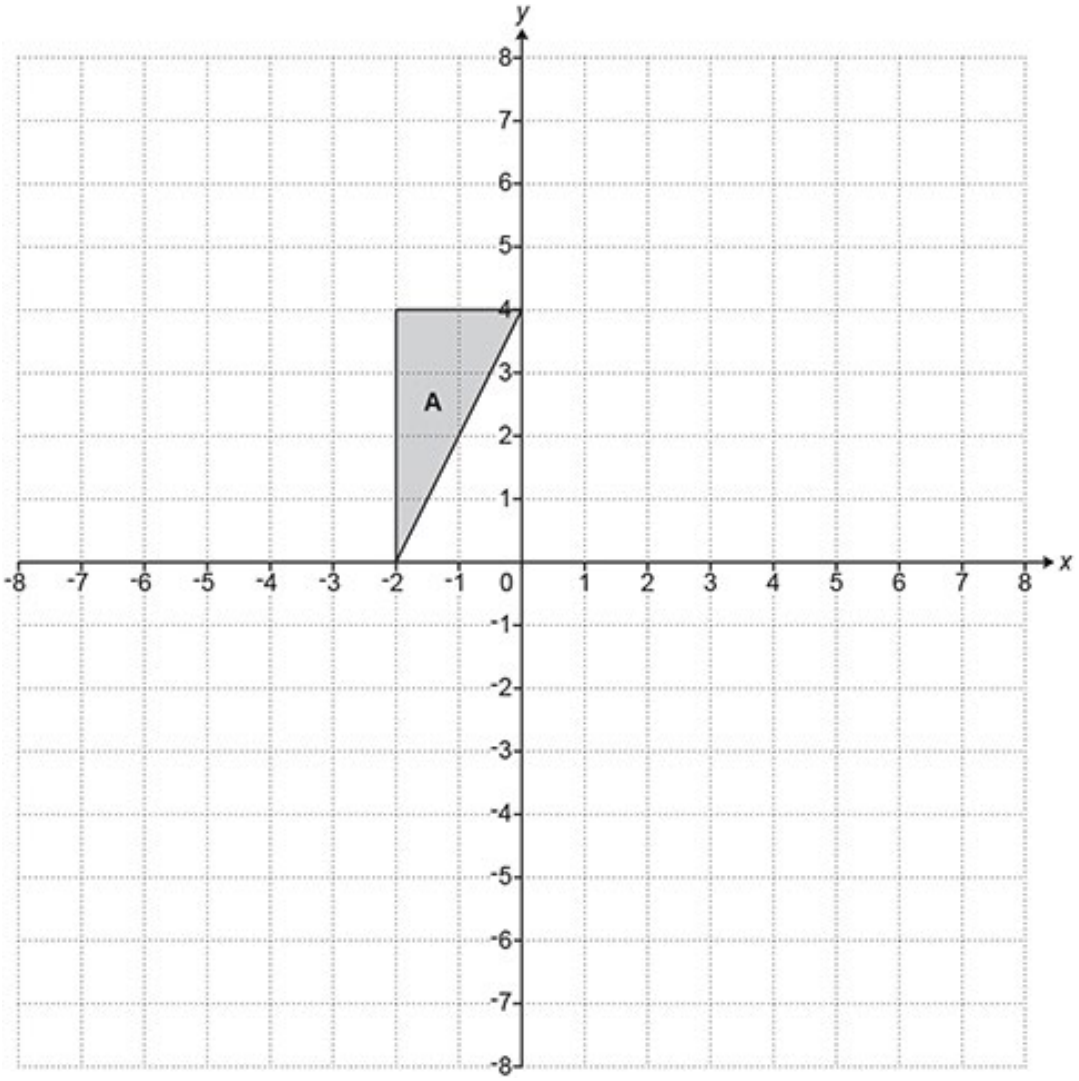
35. In each row of the table there are two triangles.

State whether the two triangles are congruent or not.
If they are congruent state a reason from SSS, SAS, ASA or RHS.

Triangles	Congruent (yes/no)	Reason (SSS/SAS/ASA/RHS)
Not to scale 		
Not to scale 		
Not to scale 		

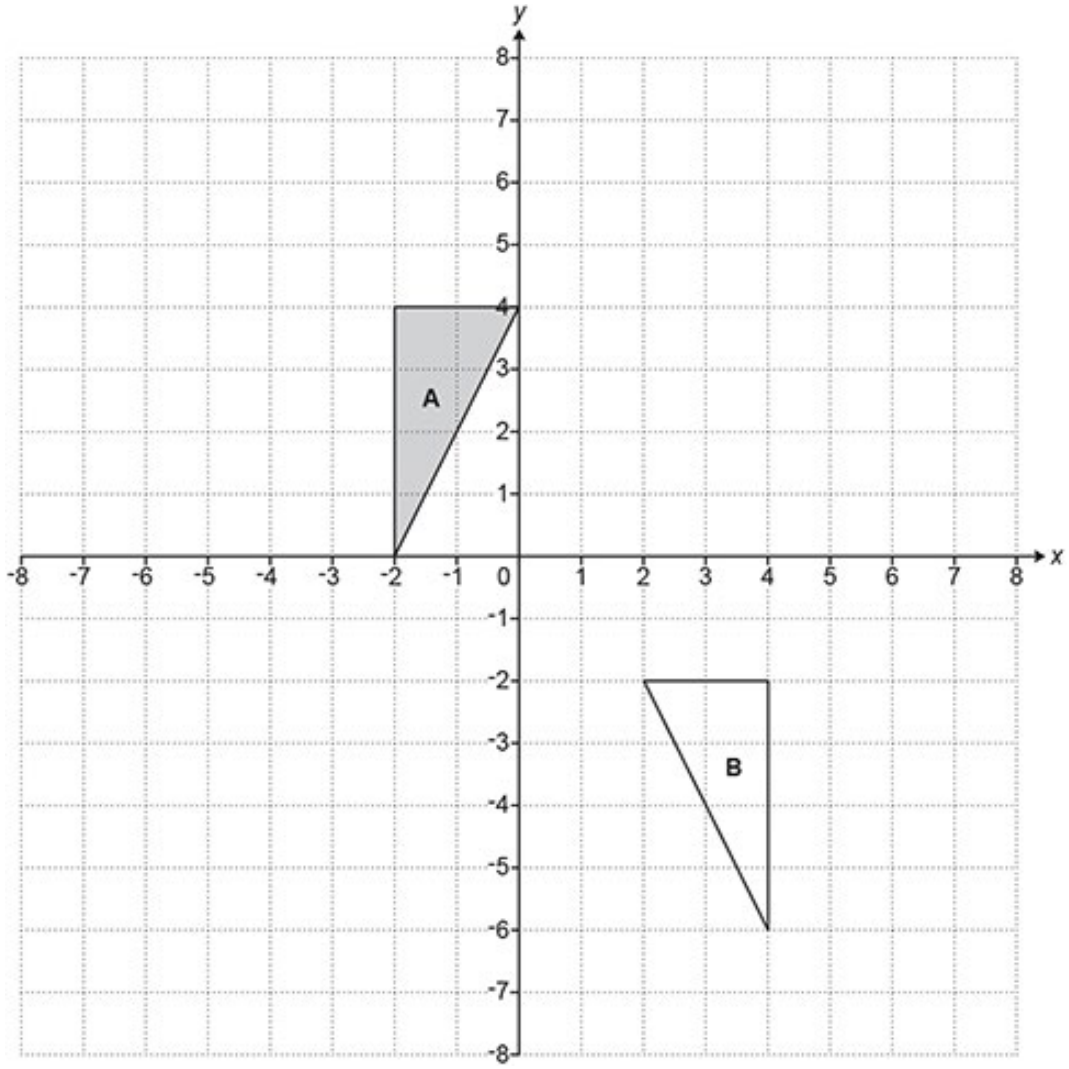
[3]

36(a). Enlarge triangle **A** with scale factor 1.5 and centre of enlargement (–8, 0).



[3]

(b). Triangle **A** and triangle **B** are shown on the coordinate grid below.



Triangle **A** is mapped onto triangle **B** using a combination of two transformations:

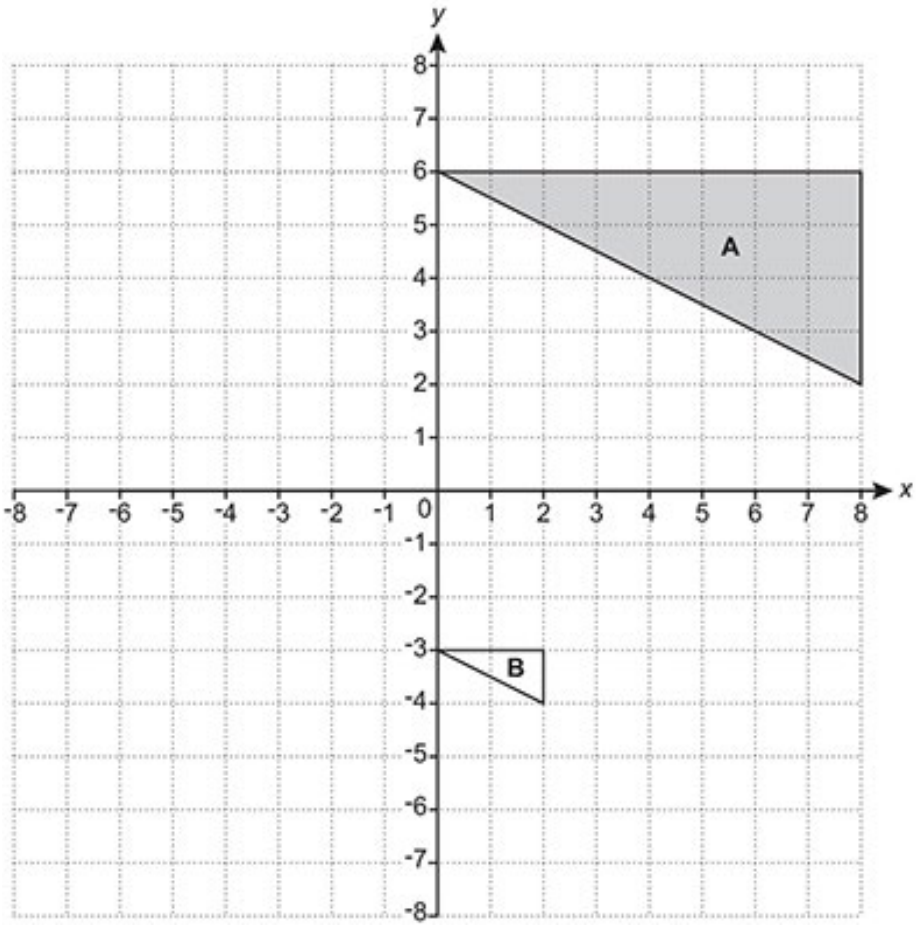
- a transformation T, followed by
- a reflection in the *x*-axis.

Describe fully transformation T.

---

[4]

37(a). Triangle A and triangle B are drawn on the coordinate grid.



Reflect triangle **A** in the line $x = 0$. **[2]**

(b).

Describe fully the **single** transformation that maps triangle **A** onto triangle **B**. **[3]**

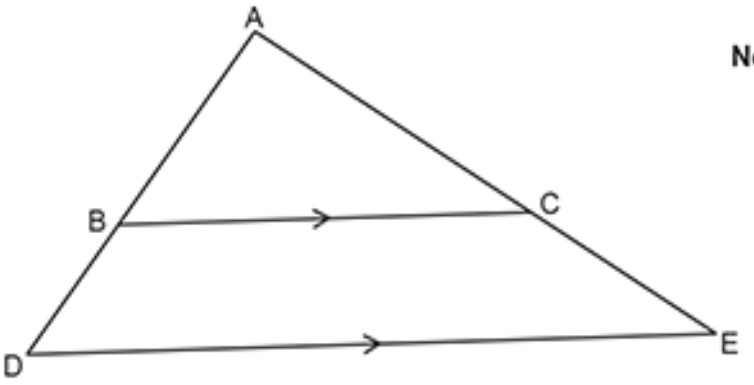
38. Two solid ornaments are mathematically similar.
The larger ornament is twice as tall as the smaller ornament.

The smaller ornament has a volume of 50 cm^3.

Work out the volume of the larger ornament.

..... cm^3 **[2]**

39. The diagram shows triangles ABC and ADE.



Not to scale

B lies on AD and C lies on AE.
BC is parallel to DE.

Complete these statements to show that triangles ABC and ADE are similar.

Angle ABC = angle ADE because they are corresponding angles.

Angle ACB = angle _____ because _____

Angle BAC is _____

Triangles ABC and ADE are similar because _____

_____

[3]

END OF QUESTION PAPER