

Invariant Points

Please write clearly in block capitals

Forename:

Surname:

Materials

For this paper you must have:

- mathematical instruments



You **can** use a calculator.

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer all questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

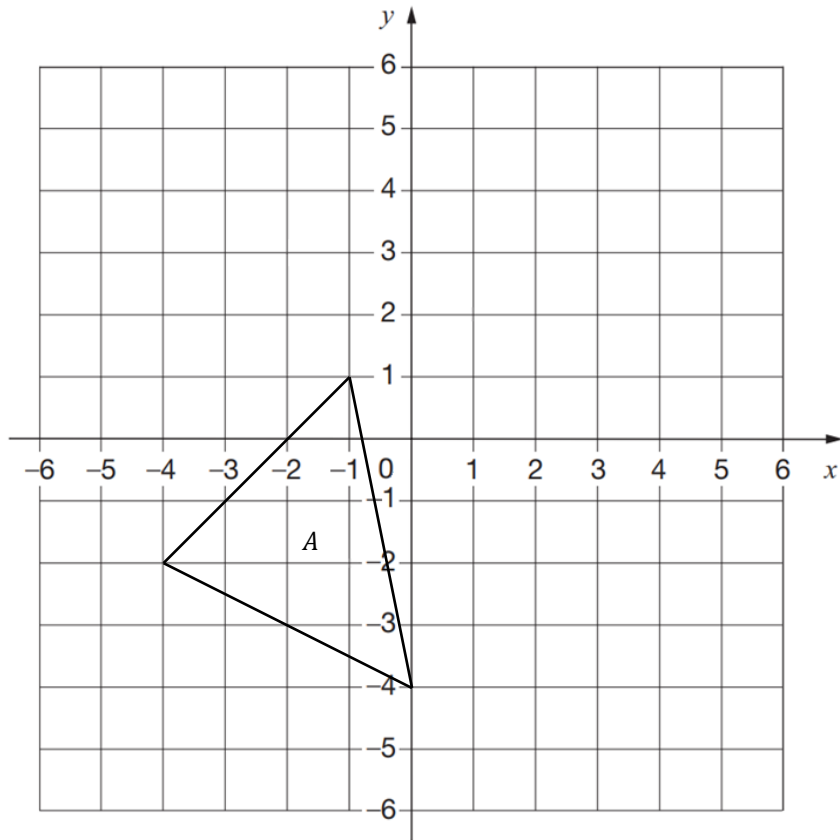
Information

- The marks for questions are shown in brackets.
- You may ask for graph paper, tracing paper and more answer paper. These must be tagged securely to this answer book.

Advice

- In all calculations, show clearly how you work out your answer.

- 1 A triangle is shown on the grid below.



- 1(a) On the grid above, indicate where the line $y = 1$ is, with a dashed line.

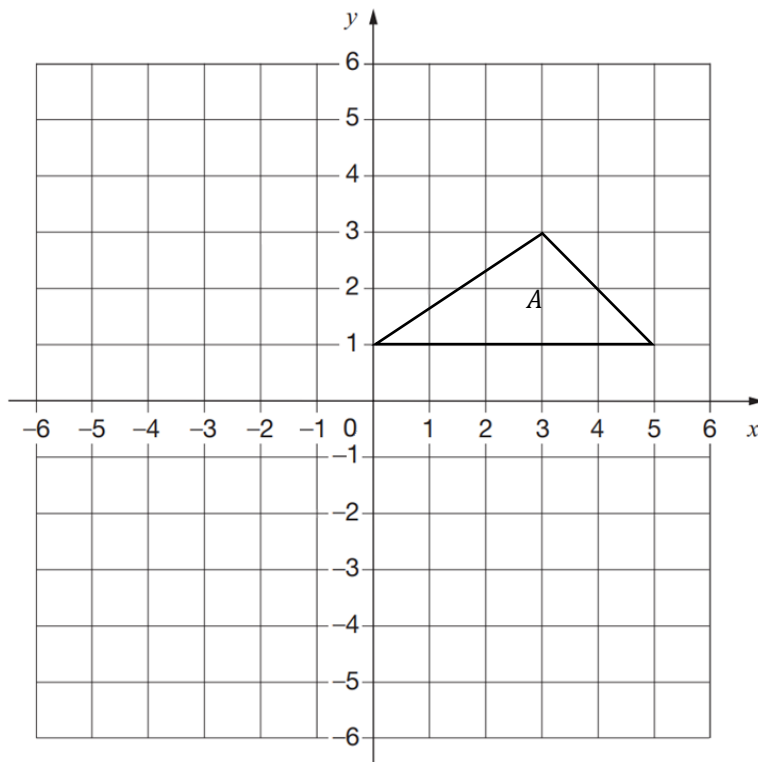
[1 mark]

- 1(b) Reflect shape A in the line $y = 1$, label the new shape B .
Write the coordinates for the invariant points for the reflected shape.

[2 marks]

Answer _____

- 2 A triangle is shown on the grid below.



- 2(a) Rotate shape *A* 90° clockwise around the point $(0,1)$, label the new shape *B*.

Write down the coordinates for any invariant points from the rotation.

[3 marks]

Answer _____

- 2(b) Now translate shape *B* by the vector $\begin{pmatrix} 1 \\ 5 \end{pmatrix}$ and label the new shape *C*.

Below, state any invariant points between shape *A* and shape *C*.

[2 marks]

Answer _____

Turn over for next question

- 3(a)** A triangle is rotated about one of its vertices more than 0° and less than 360° .
Circle the number of invariant points.

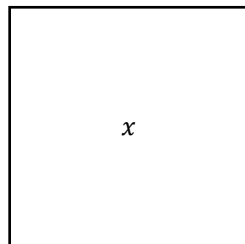
[1 mark]

1

2

3

0



- 3(b)** The square above has centre x .
The square is rotated 360° about centre x .
Circle the number of invariant vertices.

[1 mark]

0

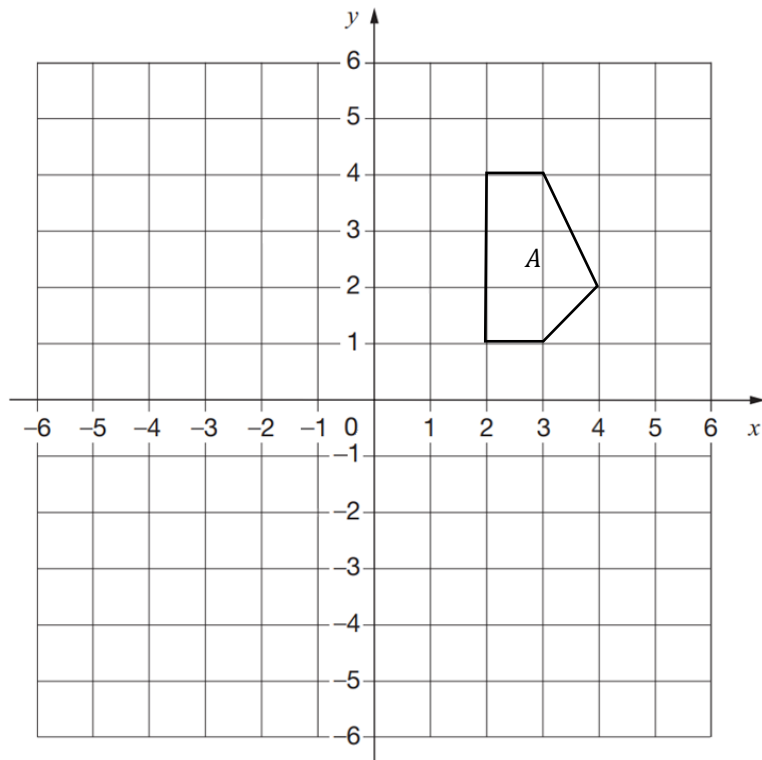
1

2

4

Turn over for next question

- 4 Shape A is shown on the grid below.



- 4(a) Reflect shape A in the line $x = 1$.
Label the new shape B .

[2 marks]

Answer _____

- 4(b) Describe a translation of shape B that would result in an invariant point at $(4, 2)$ when compared to shape A .

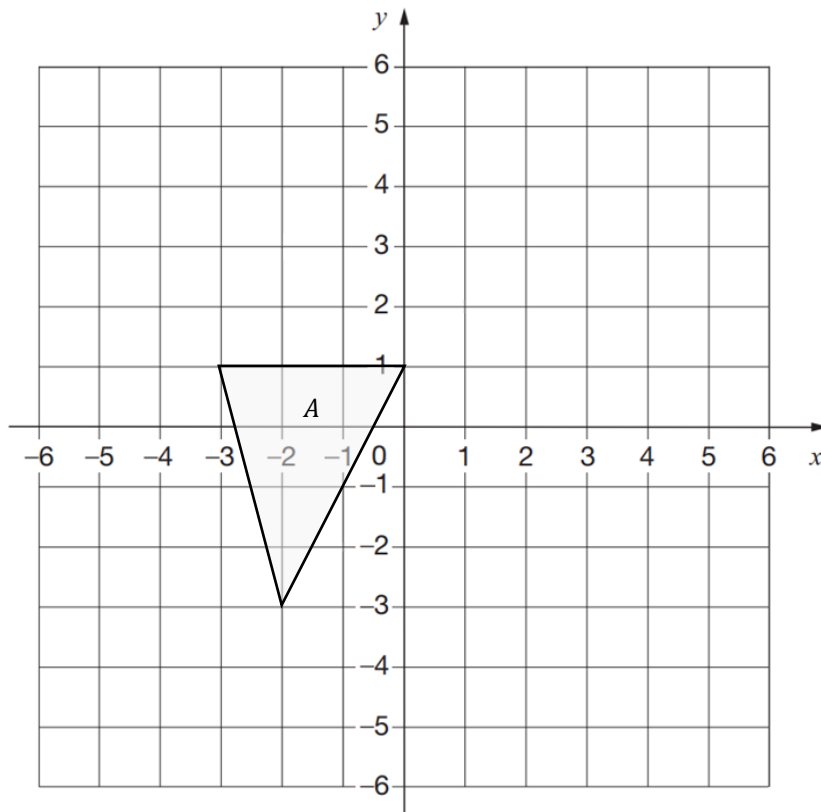
[1 mark]

Answer _____

Turn over for next question

Turn over ►

- 5 Shape A is shown on the grid below.



- 5(a) Enlarge shape A by scale factor 2 about point $(-2, -3)$.
Label the new shape B .

[2 marks]

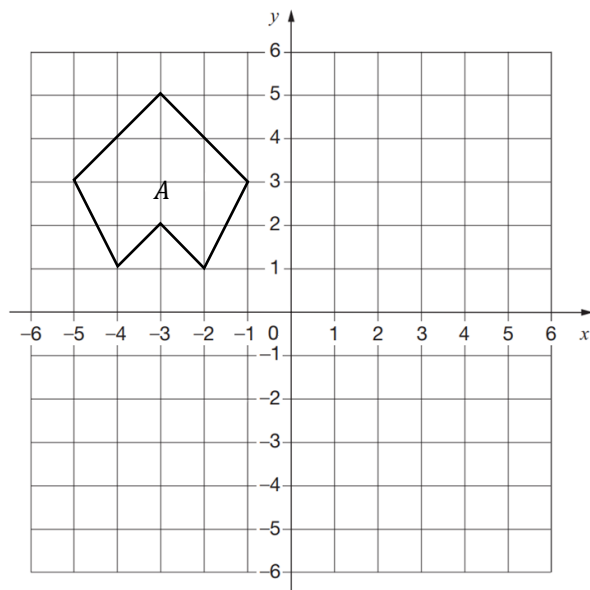
- 5(b) State the number of invariant points.

[1 mark]

Answer _____

Turn over for next question

- 6 Shape A is shown on the grid below.



- 6(a) Give the coordinates of all the invariant points if shape A is reflected in the line $x = -1$

[1 mark]

Answer _____

- 6(b) Give the coordinates of all the invariant points if shape A is reflected in the line $y = 3$

[2 marks]

Answer _____

- 6(c) Give the coordinates of all the invariant points if shape A is reflected in the line $y = -x + 2$

[2 marks]

Answer _____

End of Questions