

Ch 9. Symmetry and Transformation

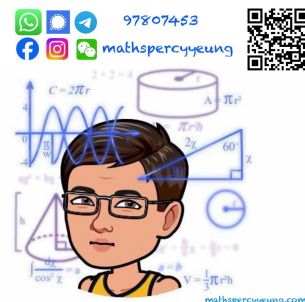
Set 1 Q

Determine whether each of the following figures has reflectional symmetry. If it does, draw the axis of symmetry.

(a)



(b)



Does each of the following figures have rotational symmetry? If it does, put a '×' to indicate the centre of rotation, and write down its order of rotational symmetry.

(a)

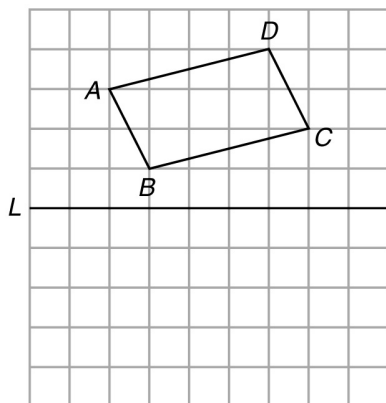


(b)



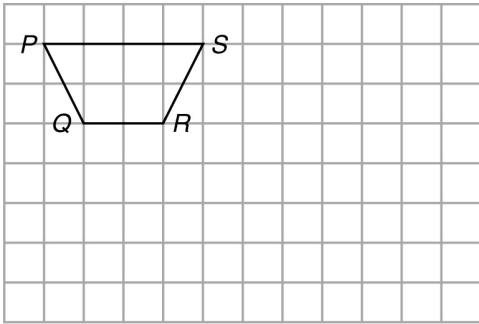
N

The figure shows a parallelogram $ABCD$ and a horizontal line L . If $ABCD$ is reflected about L , draw the image formed.

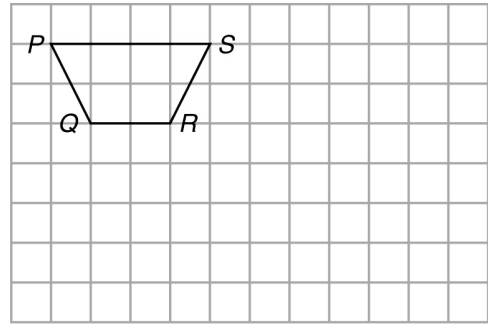


The figure shows a trapezium $PQRS$. According to the given scale factors, draw the images obtained after enlargement/reduction.

(a) Scale factor = 0.5



(b) Scale factor = 2



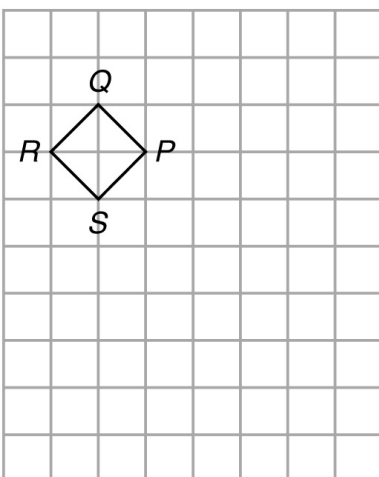
Consider the following letters.



- (a) Which of them have reflectional symmetry?
- (b) Which of them have rotational symmetry?
- (c) Which of them has exactly one axis of symmetry?
- (d) Which of them has 2 axes of symmetry and also 2-fold rotational symmetry?

Draw the image of square $PQRS$ as shown after the following transformations:

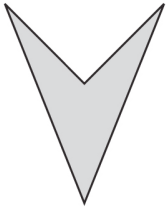
‘Translate the figure downwards by 3 units, then rotate through 90° anti-clockwise about P .’



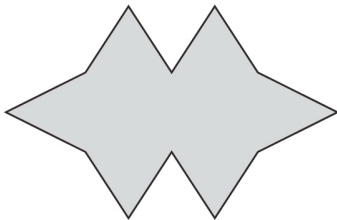
Ch 9. Symmetry and Transforamtion

Set 2 Q

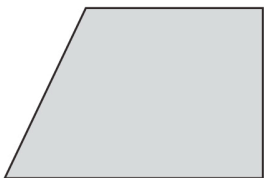
Draw the axis of symmetry for the following figure.



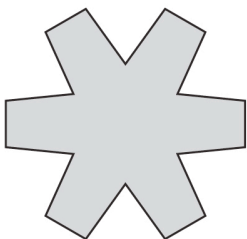
Draw the axis of symmetry for the following figure.



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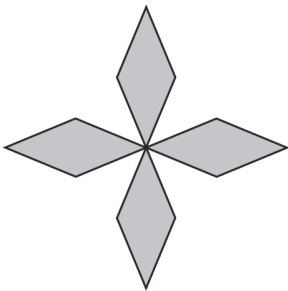
Draw the axis of symmetry for the following figure.



Write down the number of axes of symmetry of the following figure.



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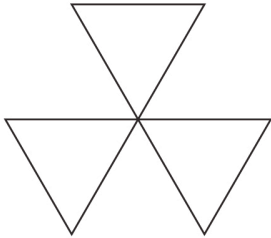


Ch 9. Symmetry and Transformation

Set 3 Q

Does each of the following figures have reflectional symmetry? If it does, draw all the axes of symmetry on the figure and write down the number of axes of symmetry.

(a)

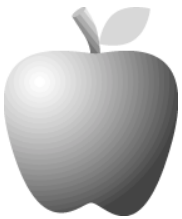


(b)

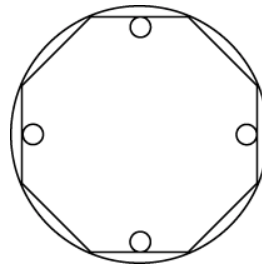


Does each of the following figures have reflectional symmetry? If it does, draw all the axes of symmetry on the figure and write down the number of axes of symmetry.

(a)



(b)

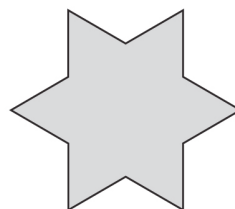


Does each of the following figures have reflectional symmetry? If it does, draw all the axes of symmetry on the figure and write down the number of axes of symmetry.

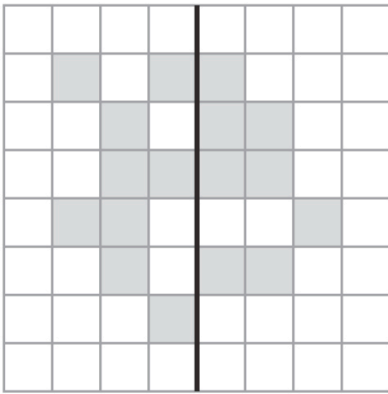
(a)



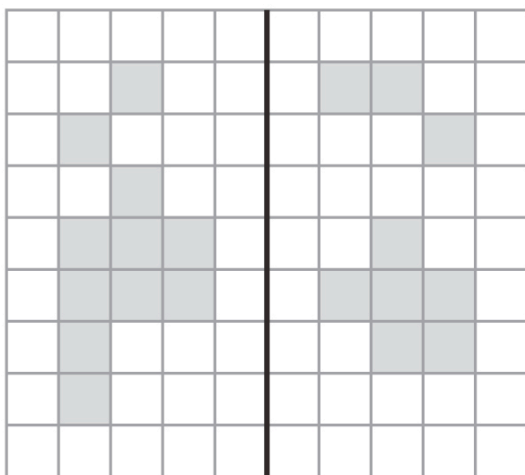
(b)



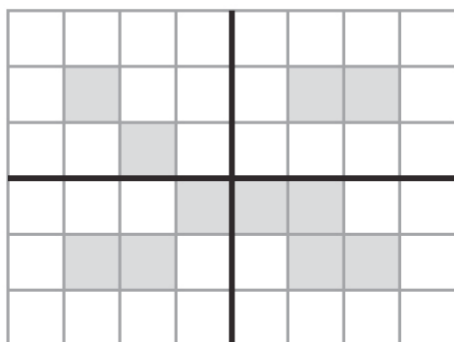
In the following figure, shade the least number of squares so that the bold black line becomes the axis of symmetry of the figure.



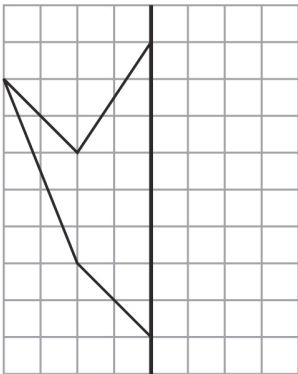
In the following figure, shade the least number of squares so that the bold black line becomes the axis of symmetry of the figure.



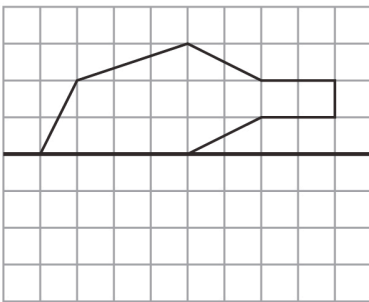
In the following figure, shade the least number of squares so that the bold black lines become the axes of symmetry of the figure.



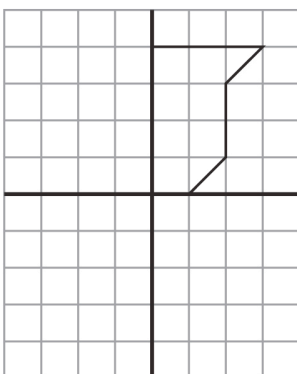
By taking the bold black line as the axis of symmetry, complete the following figure that has reflectional symmetry.



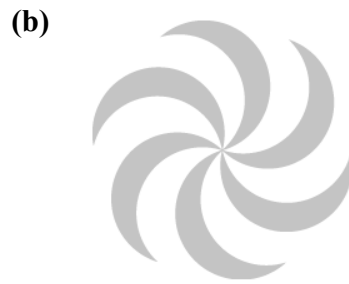
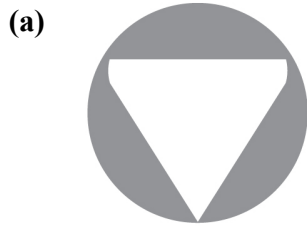
By taking the bold black line as the axis of symmetry, complete the following figure that has reflectional symmetry.



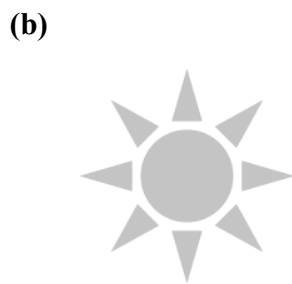
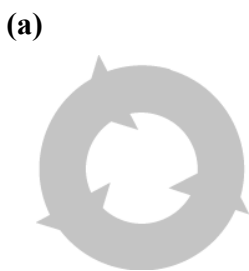
By taking the bold black lines as the axes of symmetry, complete the following figure that has reflectional symmetry.



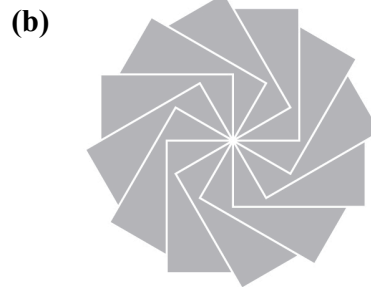
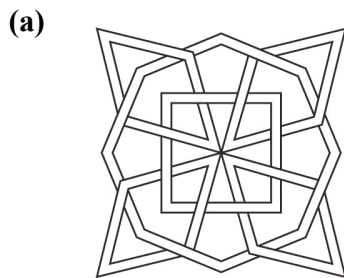
Does each of the following figures have rotational symmetry? If it does, put a 'x' to indicate the centre of rotation, and write down its order of rotational symmetry.



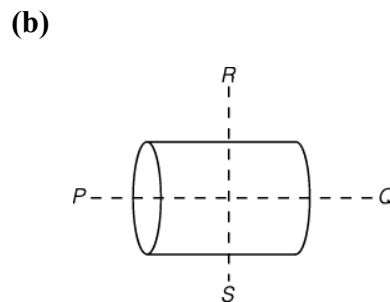
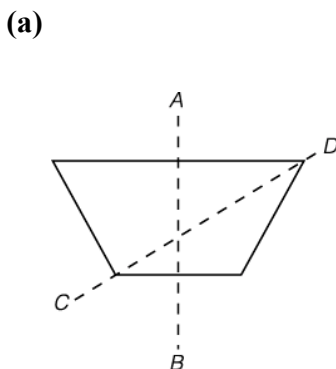
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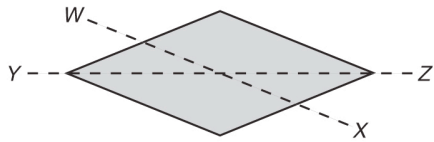


For each of the following figures, which straight line is not the axis of symmetry?

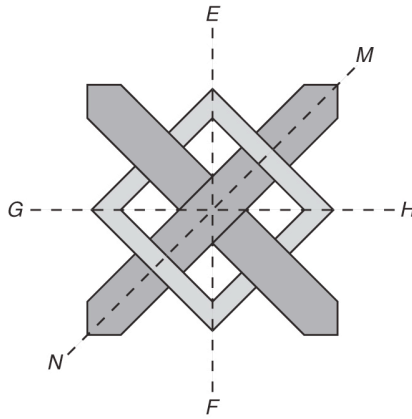


For each of the following figures, which straight line is not the axis of symmetry?

(a)

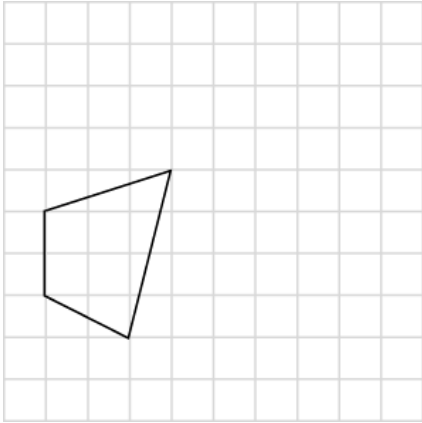


(b)



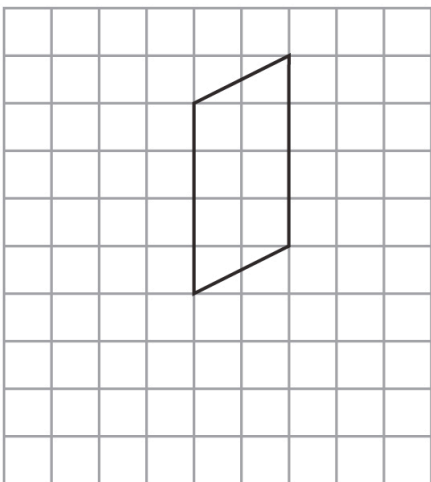
In the following figure, draw the image of the figure after translation.

Translate to the right by 5 units

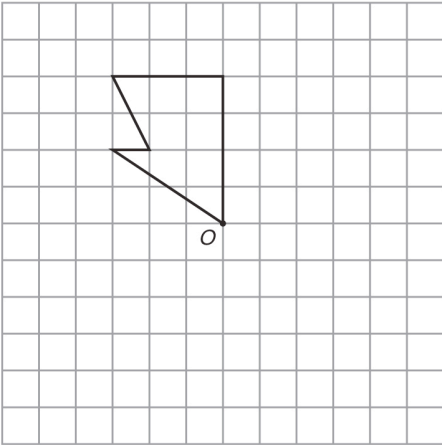


In the following figure, draw the image of the figure after translation.

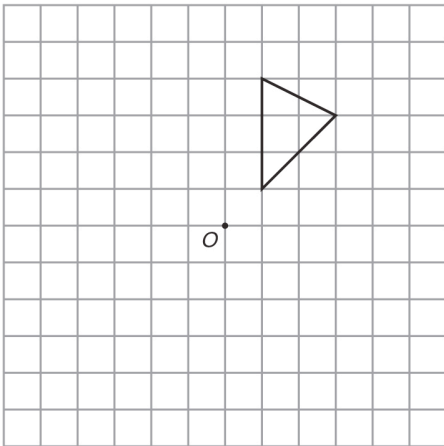
Translate downwards by 3 units



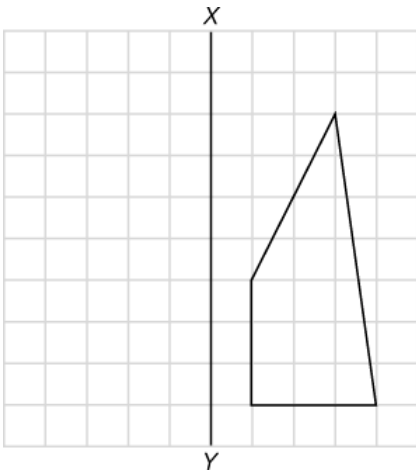
In the following figure, draw the image of the figure after rotation.
Rotate through 90° clockwise about O



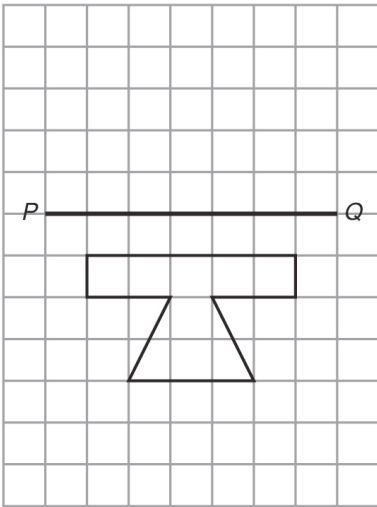
In the following figure, draw the image of the figure after rotation.
Rotate through 180° anti-clockwise about O



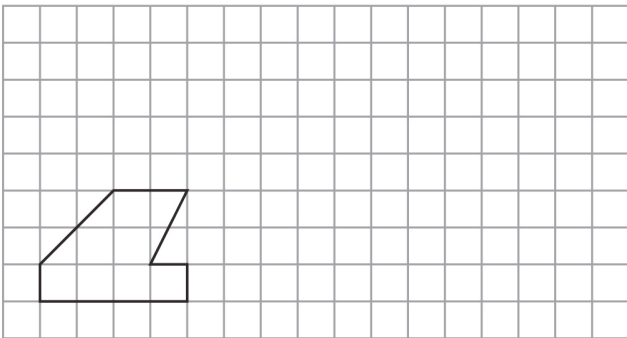
In the following figure, draw the image of the figure after reflection.
Reflect about XY



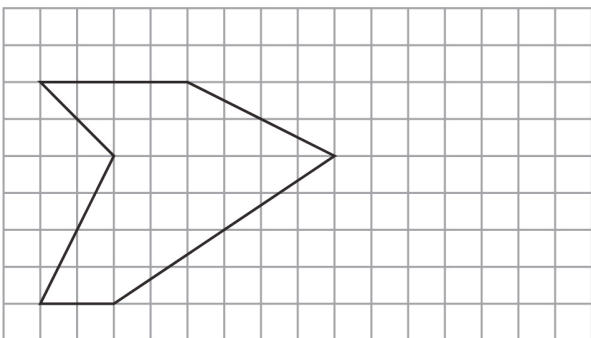
In the following figure, draw the image of the figure after reflection.
 Reflect about PQ



In the following figure, draw the image of the figure after enlargement.
 Enlarge the figure by a scale factor of 2




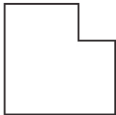


In the following figure, draw the image of the figure after reduction.
 Reduce the figure by a scale factor of 0.5



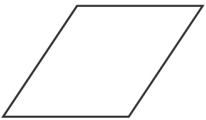
Consider the figure below.




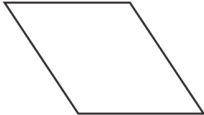


Which of the following images is formed by translating the above figure?

- A.  B.  C.  D. 

Consider the figure below.



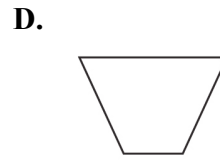
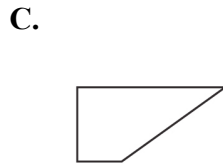
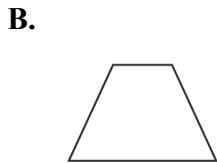
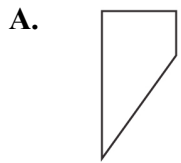
Which of the following images is formed by rotating the above figure?

- A.  B. 
- C.  D. 

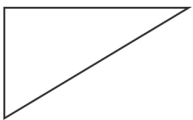
Consider the figure below.



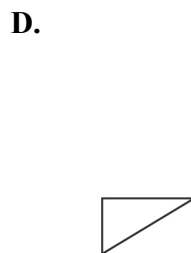
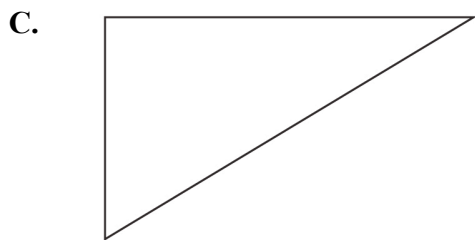
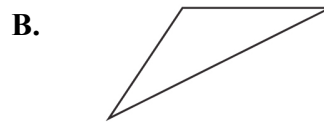
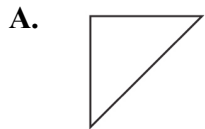
Which of the following images is formed by reflecting the above figure?



Consider the figure below.



Which of the following images is formed by enlarging the above figure?



Consider the following letters:

H O N E S T

- (a) Which of them have reflectional symmetry only?
- (b) Which of them have rotational symmetry only?
- (c) Which of them have both reflectional and rotational symmetries?

Consider the following Chinese characters:

回 父 因 中 米 合

- (a) Which of them have reflectional symmetry only?
- (b) Which of them have neither reflectional nor rotational symmetries?

State whether each of the following statements is true or false.

- (a) All regular polygons have both reflectional and rotational symmetries.
- (b) All figures with reflectional symmetry must also have rotational symmetry.

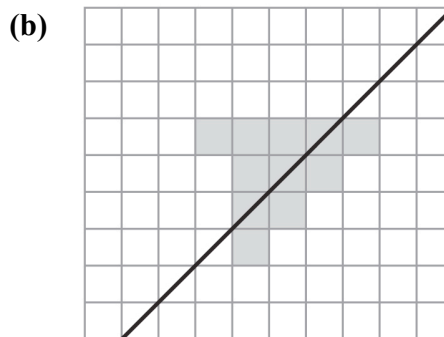
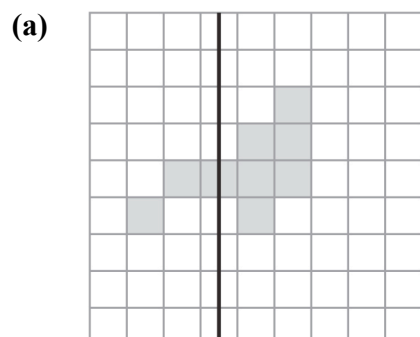
State whether each of the following statements is true or false.

- (a) When an object undergoes translation or rotation, its shape, size and orientation will not be changed.
- (b) When an object undergoes reflection or enlargement, its shape will not be changed.

Ch 9. Symmetry and Transformation

Set 4 Q

In the following figures, shade the least number of squares to construct figures with reflectional symmetry. Draw the axes of symmetry.

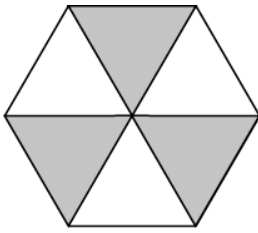


Draw TWO figures that have reflectional symmetry.

Draw TWO figures that have rotational symmetry.

List THREE Chinese characters that have 2-fold rotational symmetry.

- (a) How many axis of symmetry does a regular hexagon have? What is its order of rotational symmetry?
 (b) If we consider the colour of the following regular hexagon, what is its order of rotational symmetry?

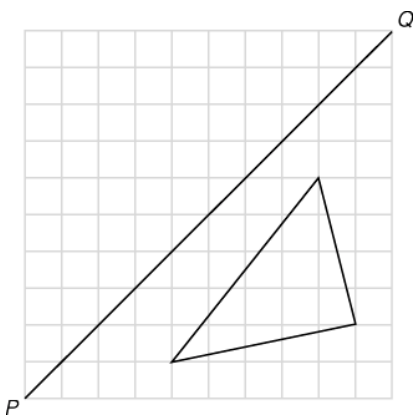


If a regular n -sided polygon has 9 axes of symmetry,

- (a) Find n ,
 (b) what is its order of rotational symmetry?

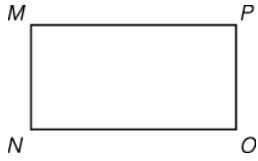
Draw a figure that has 4-fold rotational symmetry (excluding the square).

Reflect the following figure about PQ .

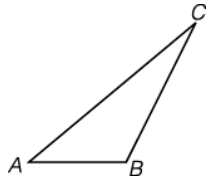


In each of the following, draw the image of the figure after rotation.

- (a) Rotate rectangle $MNOP$ through 60° clockwise about O .



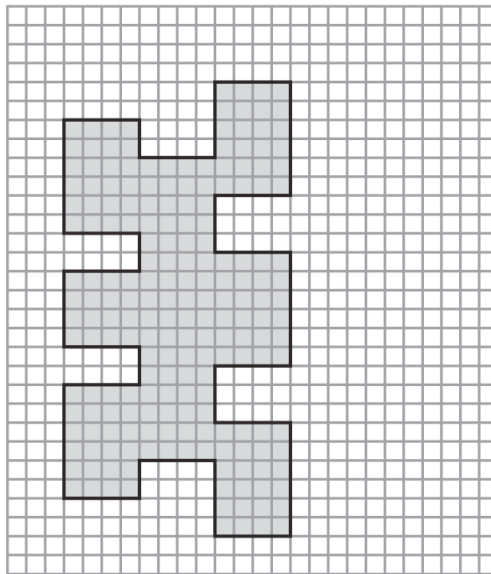
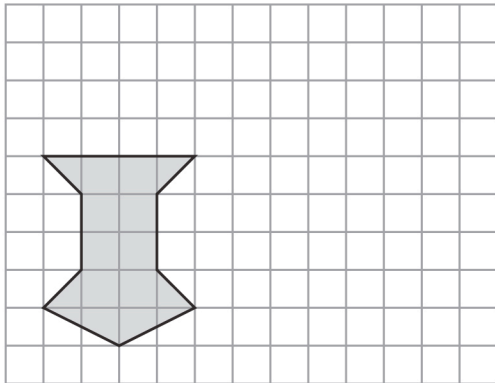
- (b) Rotate $\triangle ABC$ through 150° anti-clockwise about A .



In each of the following, draw the image after enlargement/reduction according to the given scale factor.

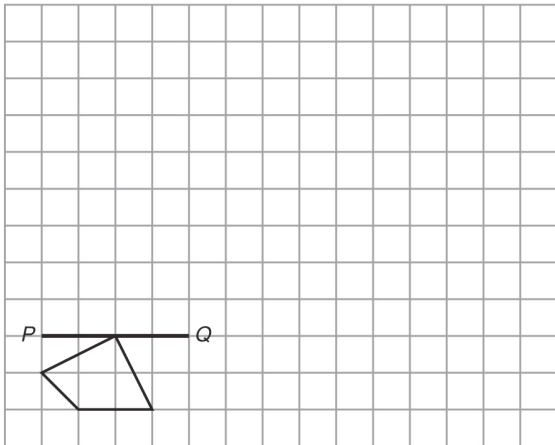
- (a) Scale factor = 1.5

- (b) Scale factor = 0.5



Draw the image of the figure after the following transformations:

‘Reflect about PQ . Then, translate upwards by 4 units. Finally, enlarge the figure by a scale factor of 3.’



Below is the symbol of Kowloon-Canton Railway Corporation.



- (a) Does the symbol have reflectional symmetry or rotational symmetry?
- (b) If the symbol is modified as shown, is the answer of (a) still true?



- (a) Among the letters H, I, J, K, L, M, N, which of them have 2-fold rotational symmetry?
- (b) If the letter N is rotated through 90° clockwise, which letter will be formed?

- (a) What does the number of axes of symmetry an equilateral triangle and a square have respectively?
- (b) An equilateral triangle and a square are combined to form the following figures. Does each of them have reflectional symmetry? Draw all the axes of symmetry in the figures and write down the number of axes of symmetry.



Fig. (A)

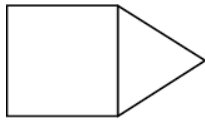


Fig. (B)

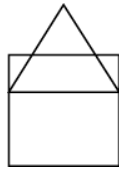


Fig. (C)

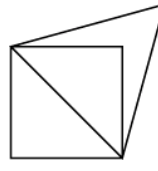


Fig. (D)

- (c) Two equilateral triangles and a square are combined to form the following figures. Does each of them have reflectional symmetry? Draw all the axes of symmetry in the figures and write down the number of axes of symmetry.

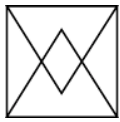


Fig. (E)

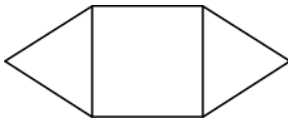


Fig. (F)

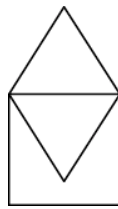


Fig. (G)

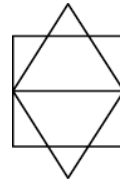


Fig. (H)

A man records the shape of the moon on any 3 days of a month (see the figure below). State which figure(s) has/have reflectional symmetry and write down the number of axes of symmetry.



Fig. (A)



Fig. (B)

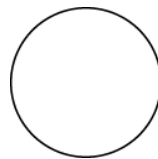
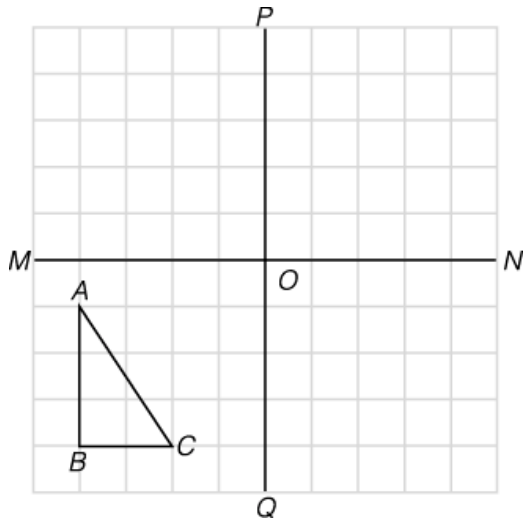


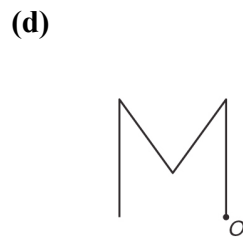
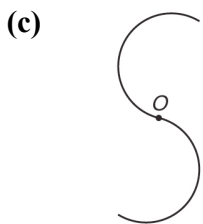
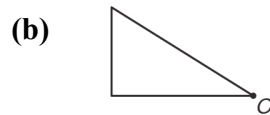
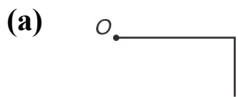
Fig. (C)

Refer to the figure on the right, answer the following questions.

- (a) Reflect $\triangle ABC$ about the line MN to form $\triangle DEF$, then reflect $\triangle DEF$ about the line PQ to form $\triangle JKL$. Draw $\triangle DEF$ and $\triangle JKL$ on the figure.
- (b) Reflect $\triangle ABC$ about the line PQ to form $\triangle GHI$, then reflect $\triangle GHI$ about the line MN to form $\triangle XYZ$. Draw $\triangle GHI$ and $\triangle XYZ$ on the figure.
- (c) Are the final images obtained in (a) and (b) the same?
- (d) To transform $\triangle ABC$ to $\triangle XYZ$, what is the angle of rotation about O ?



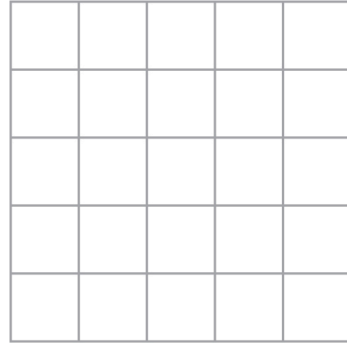
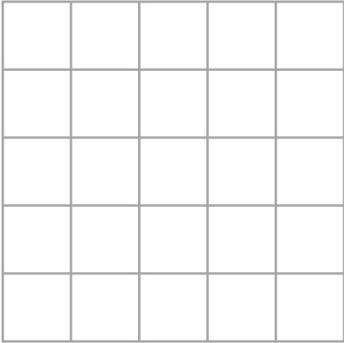
In each of the following figures, draw the three images of the figure when it is rotated three times consecutively through 90° clockwise about O .



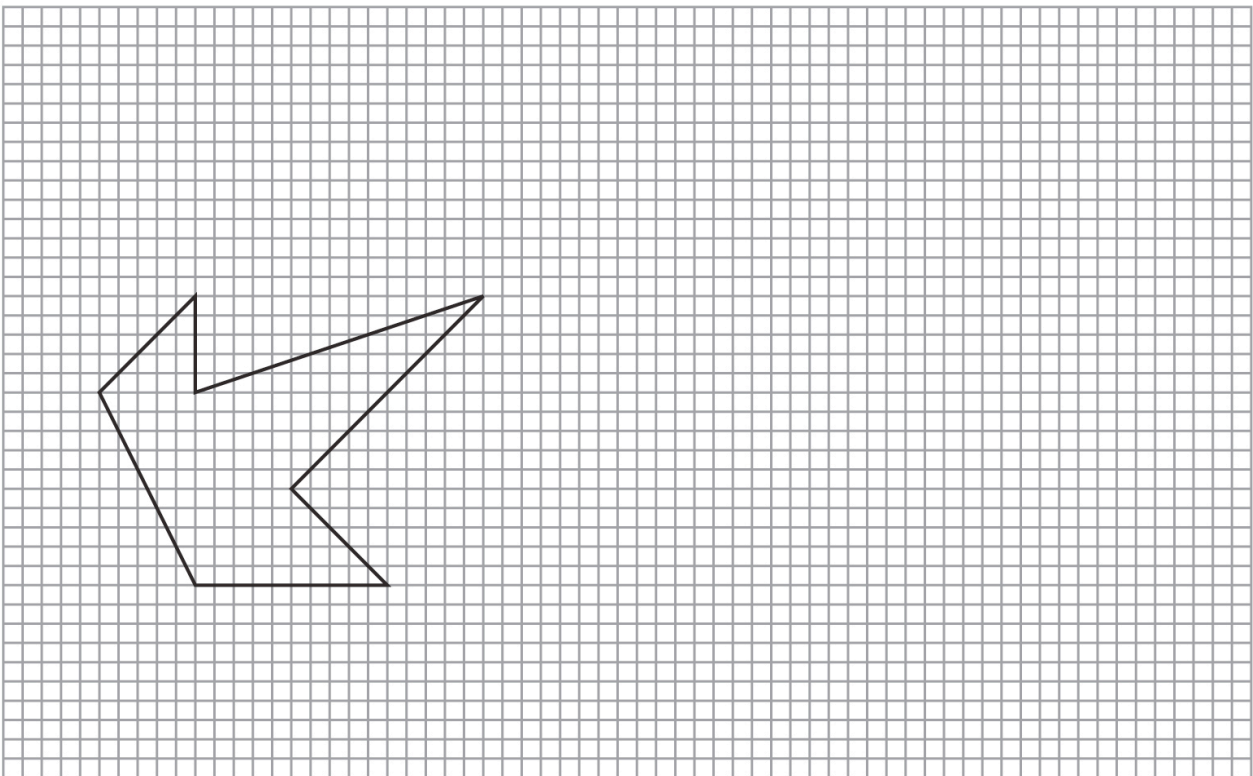
In each of the following, shade SIX squares on the grid paper to construct a figure with the property stated.

(a) A figure with TWO axes of symmetry.

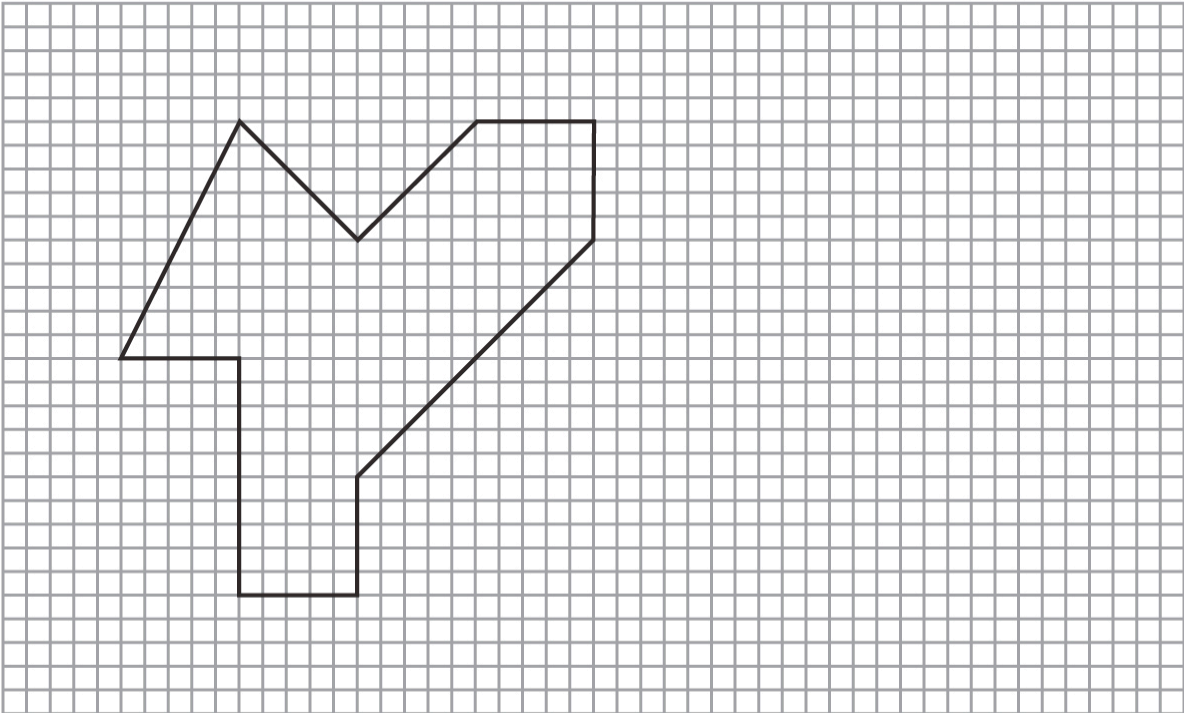
(b) A figure with 2-fold rotational symmetry.



Enlarge the following figure by a scale factor of 1.4.



Reduce the following figure by a scale factor of 0.6.

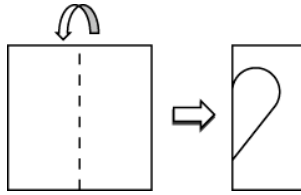


State the number of axes of symmetry of quadrilateral $ABCD$ in each of the following cases.

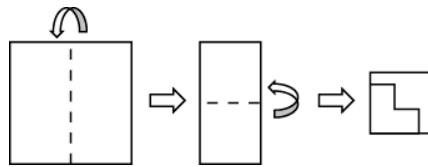
- (a) $AB \parallel DC, AD \parallel BC$
- (b) $AB = BC = CD = DA$
- (c) $AB \parallel DC, AD = BC, DC > AB$
- (d) $AB = BC = CD = DA, AB \perp BC$
- (e) $AB = DC, AD = BC, AB \perp BC$
- (f) $AB = AD, CB = CD$

Becky uses some square-shaped papers to do the following activities.

- (a) She folds the square-shaped paper once and cuts out a figure as shown on the right. Draw the figure obtained.

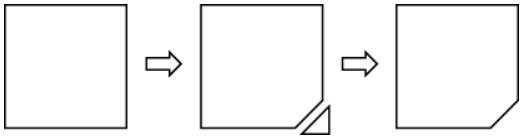


- (b) She folds another square-shaped paper twice and cuts out a figure as shown on the right. Draw the figure obtained.

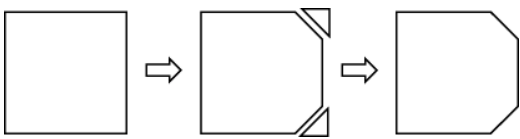


It is known that a square has reflectional symmetry and also 4-fold rotational symmetry.

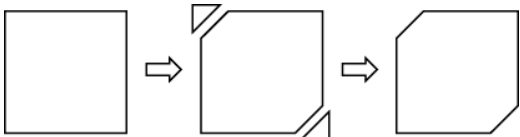
- (a) If an isosceles right-angled triangle is cut from the square as shown, does the figure still have reflectional or rotational symmetries?



- (b) If two identical right-angled isosceles triangles are cut from the square as shown, does the figure still have reflectional or rotational symmetries?

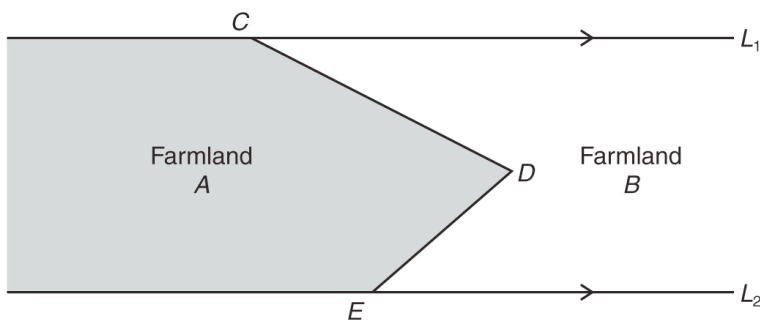
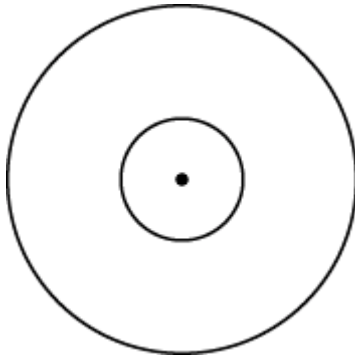


- (c) If two identical right-angled isosceles triangles are cut from the square as shown, does the figure still have reflectional or rotational symmetries?



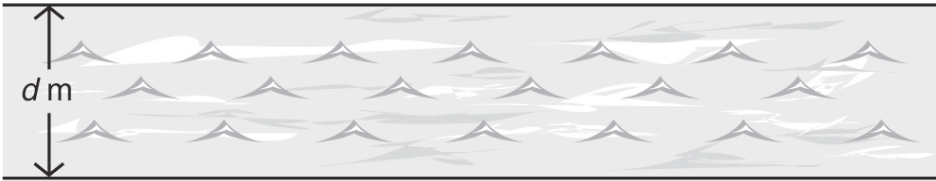
The figure shows two concentric circles.

- (a) Add two line segments of the same length on the figure, so that the figure has reflectional symmetry, but does not have rotational symmetry.
- (b) Add two line segments of the same length on the figure, so that the figure has rotational symmetry, but does not have reflectional symmetry.



L_1 and L_2 are two parallel lines. CDE is the borderline of two farmlands A and B . For the sake of convenience on management, both A and B agree to reconstruct a straight borderline so that the area of each farmland remains unchanged. Draw the new borderline on the figure.

A
x







x
B

Cities A and B are separated by a river. The river banks are two parallel lines and d m apart. A bridge and some roads are now built to connect the two cities. If the bridge should be built perpendicular to the banks and the total length of the roads must be a minimum, construct the network of bridge and roads on the above graph.

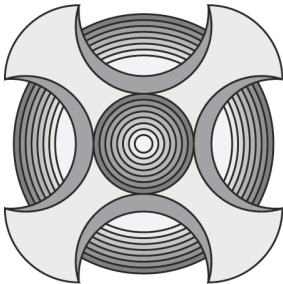
Ch 9. Symmetry and Transformation

Set 6 MC Q

Which of the following figures does not have reflectional symmetry?

- A. 
- B. 
- C. 
- D. 

How many axes of symmetry does the following figure have?

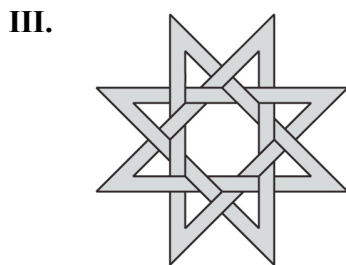
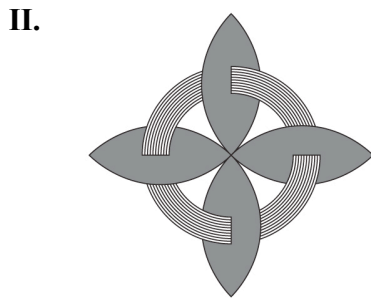


- A. 2
- B. 4
- C. 6
- D. 8

How many axes of symmetry does a circle have?

- A. 1
- B. 2
- C. 4
- D. Infinitely many

Which of the following figures have rotational symmetry?



- A. I only
- B. II only
- C. I and II only
- D. I, II and III

Which of the following letter does not have rotational symmetry?

- A. M
- B. H
- C. I
- D. X

What is the order of rotational symmetry of a rectangle?

- A. 1
- B. 2
- C. 3
- D. 4

Which of the following statement is wrong?

- A. An isosceles triangle has only one axis of symmetry.
- B. An equilateral triangle has three axes of symmetry.
- C. An acute-angled triangle may not have any axis of symmetry.
- D. All right-angled triangles do not have reflectional symmetry.

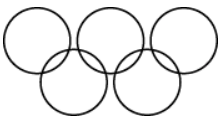
Which of the following statement is correct?

- A. 「W」 has 2 axes of symmetry.
- B. 「Z」 has reflectional symmetry.
- C. 「T」 has 2-fold rotational symmetry.
- D. 「N」 has 2-fold rotational symmetry.

If a figure has n axes of symmetry (n is an integer greater than 1), which of the following statement is wrong?

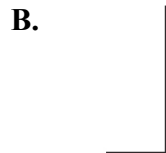
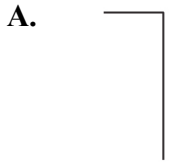
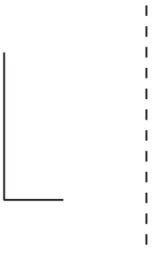
- A. The figure has rotational symmetry.
- B. The n axes of symmetry may intersect at two points.
- C. The centre of rotation of the figure is the intersecting point of all axes of symmetry.
- D. The figure has n -fold rotational symmetry.

Which of the following statement about the figure is correct?

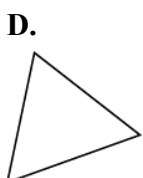
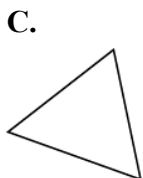
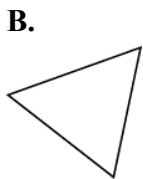
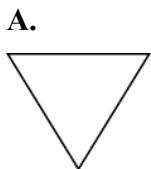
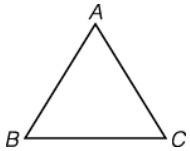


- A. It has 2-fold rotational symmetry.
- B. It has infinitely many fold rotational symmetry.
- C. It has reflectional symmetry.
- D. It has 2 axes of symmetry.

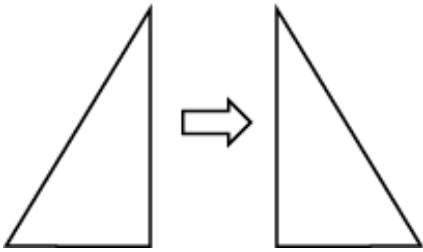
When the figure below is reflected about the dotted line, which of the following is the image obtained?



If an equilateral triangle ABC is rotated through 60° anti-clockwise about the centre of rotation C , which of the following figure will be obtained?



Which kind of transformation is involved in the figure below?



- A. Translation
- B. Rotation
- C. Reflection
- D. Enlargement

Which of the following kind(s) of transformation will not change the shape and the size of a figure?

- I. translation
 - II. reflection
 - III. rotation
 - IV. enlargement
-
- A. I and II only
 - B. II and III only
 - C. I, II and III only
 - D. I, II and IV only

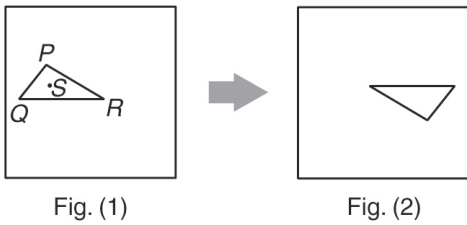
Which of the following kinds of transformation will not change the orientation of a figure?

- I. translation
 - II. rotation
 - III. reflection
 - IV. enlargement/reduction
-
- A. I and II only
 - B. I and IV only
 - C. II and III only
 - D. III and IV only

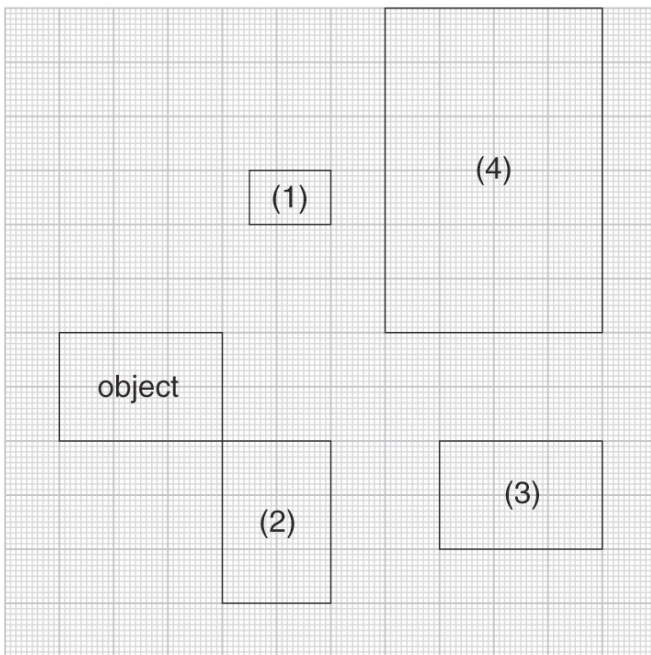
When the following letters are reflected about a horizontal line, which of them may repeat themselves?

- I. H
- II. M
- III. O
- IV. Z
- A. I and II only
- B. I and III only
- C. I and IV only
- D. I, III and IV only

The triangle in Fig. (1) is rotated through 180° clockwise to form the triangle in Fig. (2). The centre of rotation is

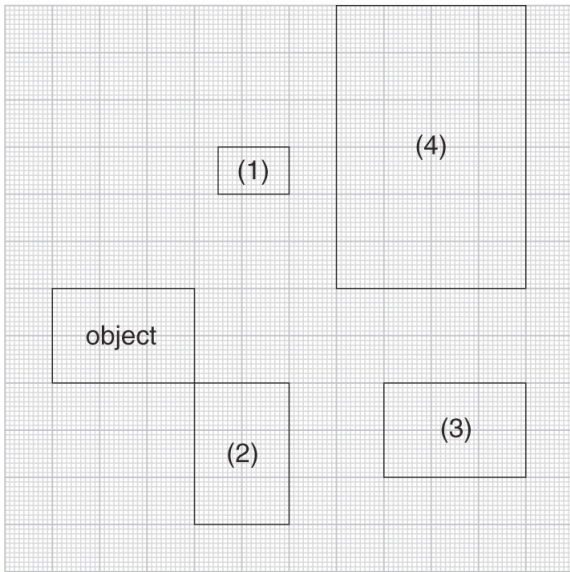


- A. P.
- B. Q.
- C. R.
- D. S.



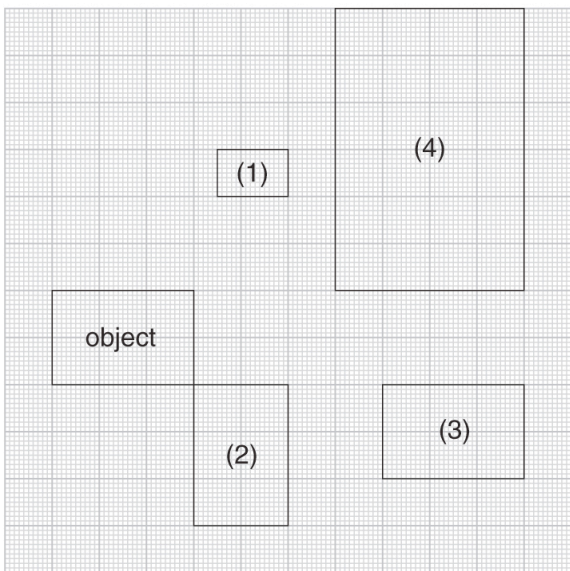
Refer to the above figure, which block may be the image obtained after the object undergoes reflection?

- A. Block (2) only
- B. Block (3) only
- C. Blocks (2) and (3) only
- D. None of the above



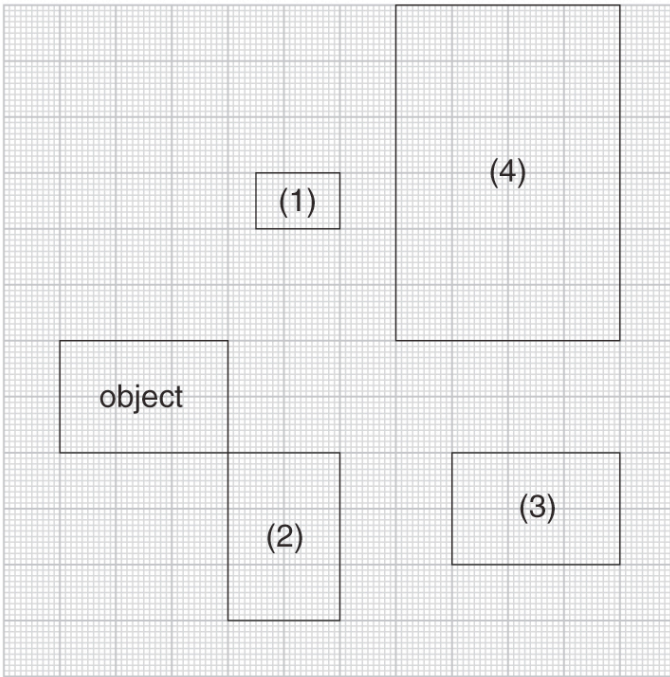
Refer to the above figure, which block may be the image obtained after the object undergoes rotation?

- A. Block (2) only
- B. Block (3) only
- C. Blocks (2) and (3) only
- D. None of the above



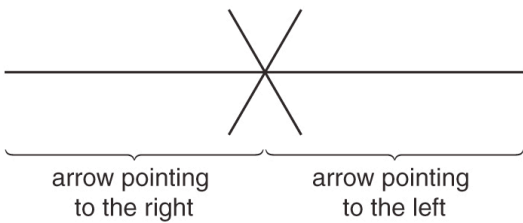
Refer to the above diagram, which block may be the image obtained after the object undergoes enlargement or reduction?

- A. Block (1) only
- B. Block (3) only
- C. Block (4) only
- D. Blocks (1) and (3) only



Refer to the above diagram, which block may be the image obtained after the object undergoes translation?

- A. Block (1) only
- B. Block (2) only
- C. Block (3) only
- D. Blocks (2) and (3) only



Refer to the above diagram, 'arrow pointing to the right' can be obtained when 'arrow pointing to the left' undergoes

- I. reflection.
 - II. rotation.
 - III. translation.
- A. I only
 - B. II only
 - C. I and II only
 - D. I, II and III

Given that the order of rotational symmetry of a figure is 3. When the figure is rotated about the centre of rotation through an angle of _____, it will repeat itself.

- I.** 60°
- II.** 120°
- III.** 240°
- A.** I only
- B.** II only
- C.** III only
- D.** II and III only

When enlarging a square of side 2 cm to a square of side 5 cm, what is the scale factor?

- A.** 40%
- B.** 200%
- C.** 250%
- D.** 500%