Polygons

POLYGONS

Series H

MATHLETICS

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Page 4 questions

Polygons

1 **a** 

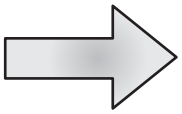
- [x] Polygon
- [ ] Not a polygon

b 

- [ ] Polygon
- [x] Not a polygon

c 

- [ ] Polygon
- [x] Not a polygon

d 

- [x] Polygon
- [ ] Not a polygon

e 

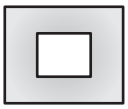
- [ ] Polygon
- [x] Not a polygon

f 

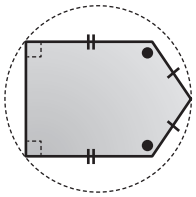
- [ ] Polygon
- [x] Not a polygon

g 

- [ ] Polygon
- [x] Not a polygon

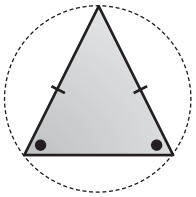
h 

- [ ] Polygon
- [x] Not a polygon

2 **a** 

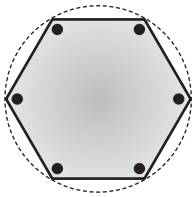
- [x] Convex
- [ ] Concave
- [ ] Equilateral
- [ ] Equiangular
- [ ] Cyclic
- [ ] Regular

Convex pentagon

b 

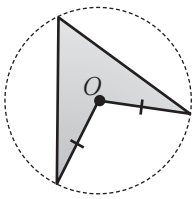
- [x] Convex
- [ ] Concave
- [ ] Equilateral
- [ ] Equiangular
- [x] Cyclic
- [ ] Regular

Convex, cyclic trigon (or triangle)

c 

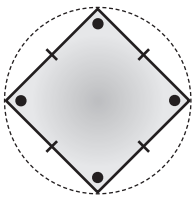
- [x] Convex
- [ ] Concave
- [ ] Equilateral
- [x] Equiangular
- [x] Cyclic
- [ ] Regular

Convex, cyclic, equiangular hexagon

d 

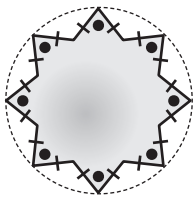
- [ ] Convex
- [x] Concave
- [ ] Equilateral
- [ ] Equiangular
- [ ] Cyclic
- [ ] Regular

Concave quadrilateral

e 

- [x] Convex
- [ ] Concave
- [x] Equilateral
- [x] Equiangular
- [x] Cyclic
- [x] Regular

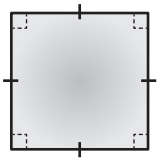
Convex, equilateral, equiangular, regular tetragon

f 

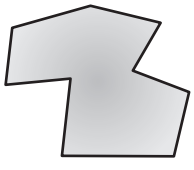
- [ ] Convex
- [x] Concave
- [x] Equilateral
- [ ] Equiangular
- [ ] Cyclic
- [ ] Regular

Concave, equilateral hexadecagon

3 **a** A regular tetragon.



b A concave nonagon.



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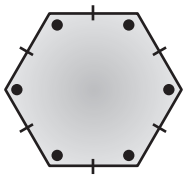
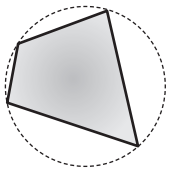
Polygons

4 a A convex, equilateral hexagon.

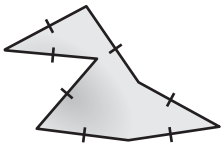


b A convex, cyclic tetragon which is not equilateral.



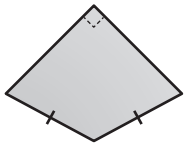
c An equiangular, pentagon which is not equilateral.

d A concave, equilateral heptagon with two reflex angles ($180° < \text{angle} < 360°$).



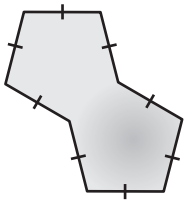
5 A cyclic quadrilateral cannot have any concave angles.

6 a



A tetragon with one pair of equal sides next to each other (adjacent).
The angle diagonally opposite the angle formed by the two equal sides is a right angle (or equal to $90°$).

b

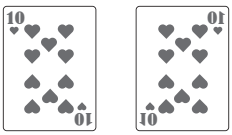


A peanut-shaped equilateral concave octagon with two internal reflex angles.

Page 7 questions

Transformations

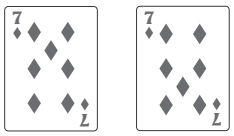
1 a



object image

☐ Reflection
☒ Translation
☒ Rotation

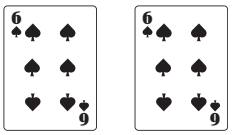
b



object image

☐ Reflection
☐ Translation
☒ Rotation

c



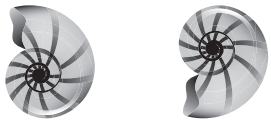
object image

☐ Reflection
☒ Translation
☐ Rotation

Page 7 questions

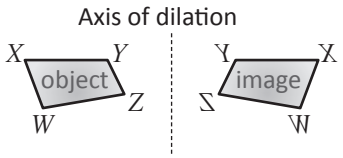
Transformations

2 **a**



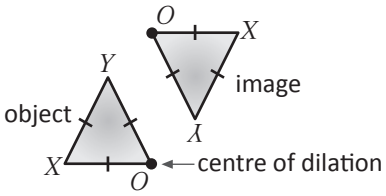
- [x] Reflection
- [ ] Translation
- [x] Rotation

b



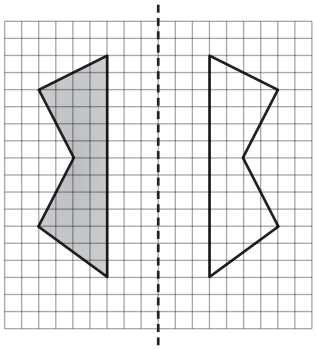
- [x] Reflection
- [x] Translation
- [ ] Rotation

c

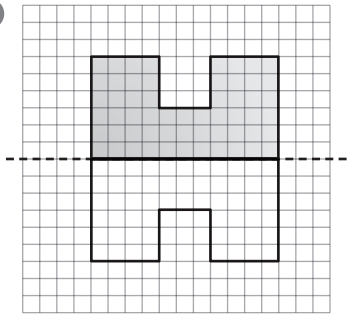


- [ ] Reflection
- [x] Translation
- [x] Rotation

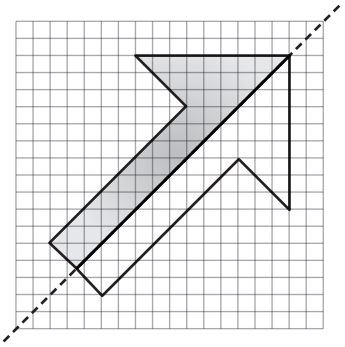
3 **a**



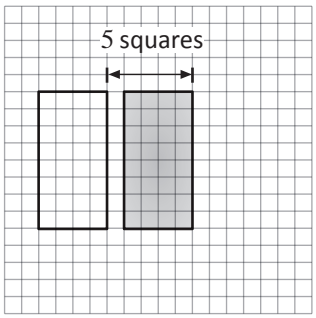
b



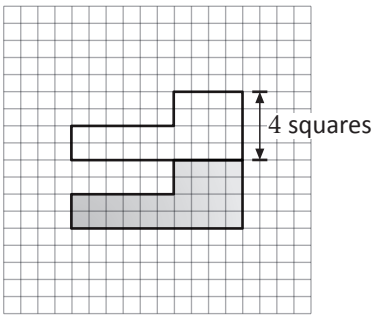
c



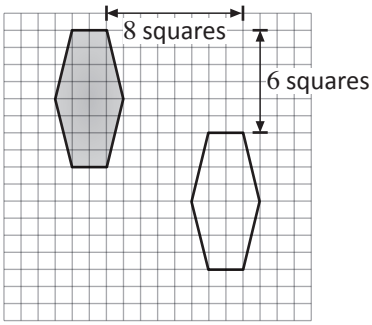
4 **a** Five squares horizontally to the left.



b Four squares vertically up.



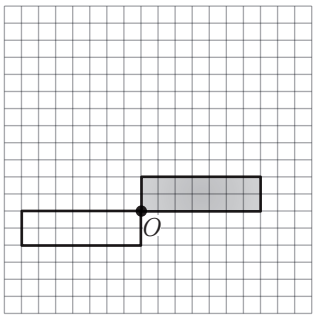
c Eight squares to the right, then six squares down.



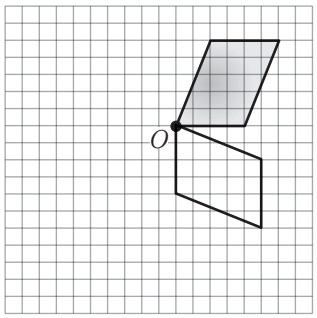
Page 8 questions

Transformations

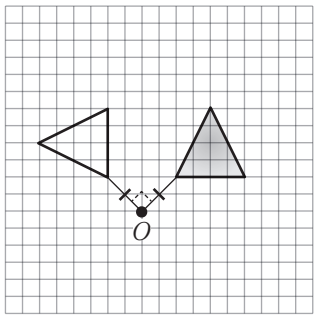
5 **a** One half turn (180° rotation).



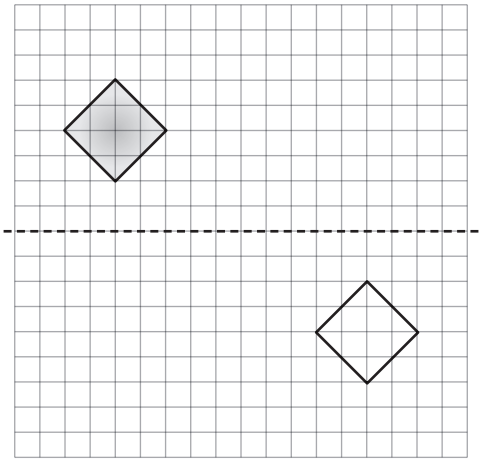
b Three quarter turn (270° rotation).



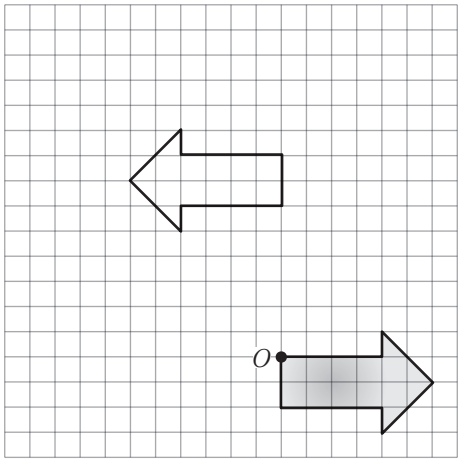
c One quarter turn (90° rotation).



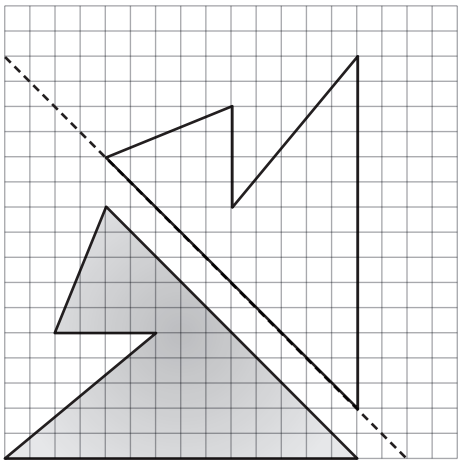
6 **a** Translate ten units to the right first then reflect down about the given axis of reflection.



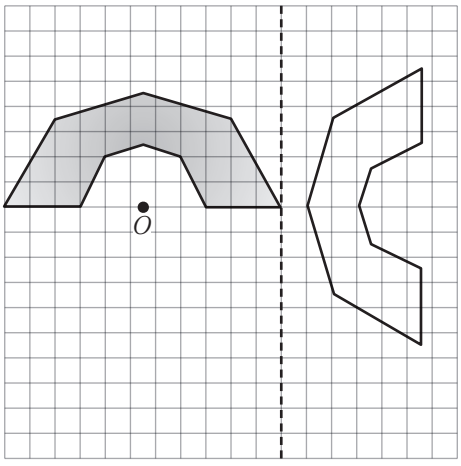
b Rotate 180° about the centre of rotation O, then translate six units up.



c Reflect about the given axis first, then tranlsate two units to the left.



d Three quarter turn (270° rotation) first, then reflect about the given axis of dilation.



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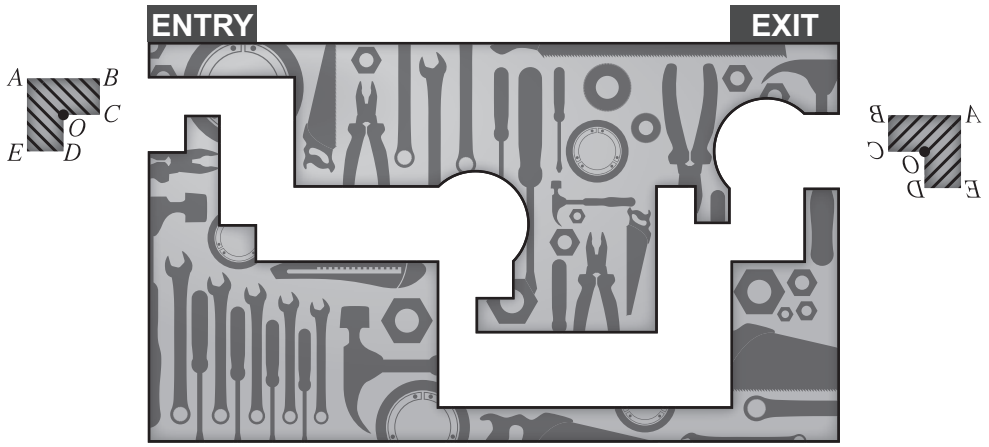
Transformations

7



(i) Translate shape horizontally to the right.

(ii) Reflect shape horizontally to the right using the edge BC as the axis of reflection.

(iii) Translate shape vertically down.

(iv) Translate shape horizontally to the right.

(v) Rotate shape one quarter turn ($90°$) about the vertex O.

(vi) Translate shape vertically down.

(vii) Reflect shape vertically down using the edge BC as the axis of reflection.

(viii) Translate shape horizontally to the right.

(ix) Translate shape vertically up.

(x) Reflect shape horizontally to the right using the edge DE as the axis of reflection.

(xi) Translate shape vertically up.

(xii) Rotate shape one quarter turn ($90°$) about the vertex O.

(xiii) Translate shape horizontally to the right.

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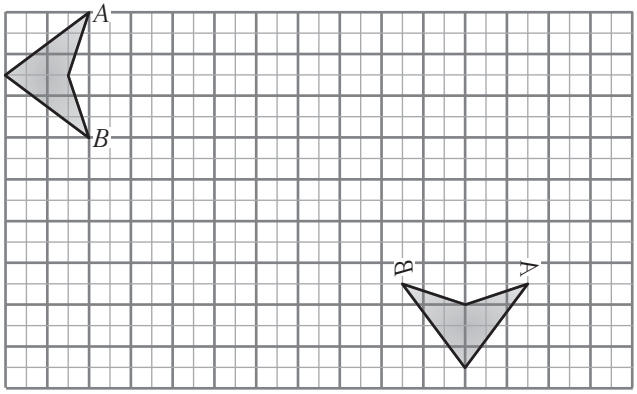
Transformations

8



There are many different correct ways of doing this, here are just four possible solutions.

a Method 1

- Translate shape horizontally 7.5 units to the right.
- Reflect the shape about the axis AB horizontally to the right.
- Rotate shape $\frac{3}{4}$ of a turn ($270°$) about the point B.
- Translate shape vertically down 2.5 units.

b Method 2

- Translate shape horizontally 7.5 units to the right.
- Rotate shape $\frac{1}{4}$ of a turn ($90°$) about the point B.
- Translate shape vertically down 2.5 units.
- Reflect the shape horizontally to the right about a vertical axis passing through B.

c Method 3

- Reflect the shape vertically down about a horizontal axis passing through B.
- Translate shape vertically down 2.5 units.
- Rotate shape $\frac{1}{4}$ of a turn ($90°$) about the point B.
- Translate shape horizontally 7.5 units to the right

d Method 4

- Rotate shape $\frac{1}{4}$ of a turn ($90°$) about the point A.
- Translate shape horizontally 4.5 units to the right.
- Reflect the shape horizontally to the right about a vertical axis passing through B.
- Translate shape vertically 5.5 units down.

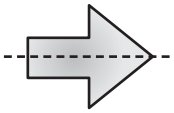
Page 12 questions

Reflection symmetry

1 **a**

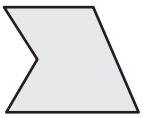
☒ Symmetric
☐ Asymmetric

b



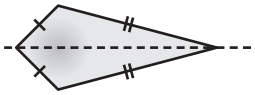
☒ Symmetric
☐ Asymmetric

c



☐ Symmetric
☒ Asymmetric

d

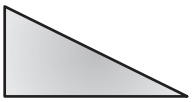


☒ Symmetric
☐ Asymmetric

e

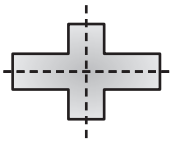
☒ Symmetric
☐ Asymmetric

f



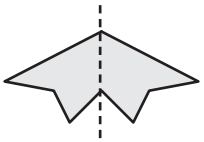
☐ Symmetric
☒ Asymmetric

g



☒ Symmetric
☐ Asymmetric

h

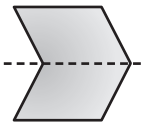


☒ Symmetric
☐ Asymmetric

i

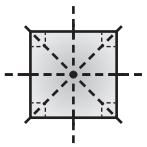
☒ Symmetric
☐ Asymmetric

j



☒ Symmetric
☐ Asymmetric

k

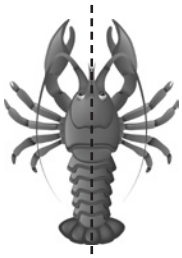


☒ Symmetric
☐ Asymmetric

l

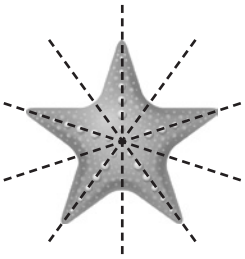
☒ Symmetric
☐ Asymmetric

2 **a**



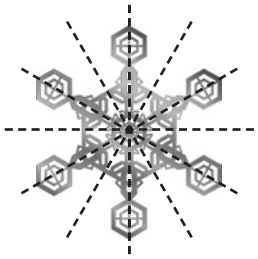
1

b



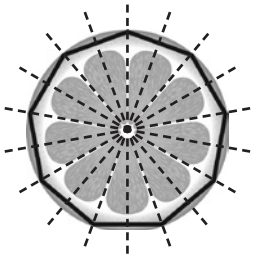
5

c



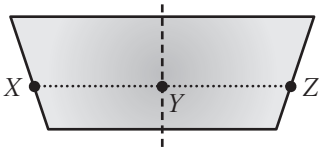
6

d



9

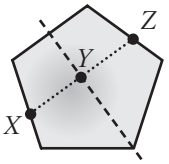
3 **a**



$YZ = 5$ cm

Distance from X to Y = 5 cm

b



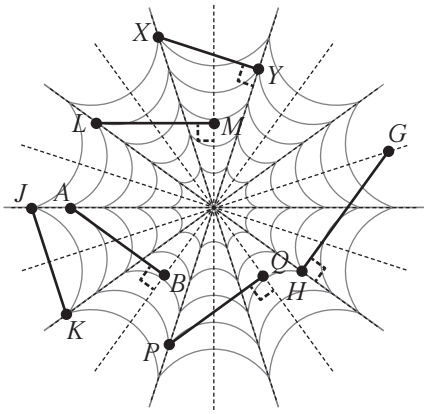
$XZ = 14$ cm

Distance from X to Y = 7 cm

Page 13 questions

Reflection symmetry

4 Answer these questions about the symmetric web below:



a How many axes of symmetry does the web have? 10

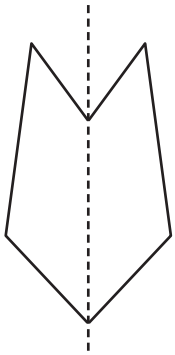
b What pair of points are equidistant to LM? P and Q

Psst: equidistant means the 'same distance'

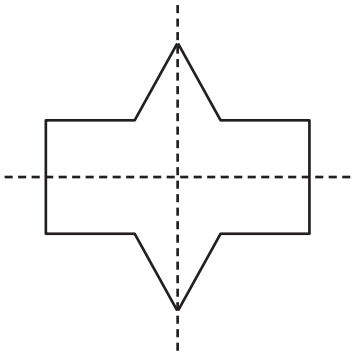
c Briefly explain below how you decided this was the correct answer.

Shapes with reflective symmetry have points equidistant on the other side of the axis. Points P and Q are just like LM, they start on an axis between the 3^{rd} and 4^{th} curved circle, move perpendicular to the axis and end on a point of the fifth circle three axes across.

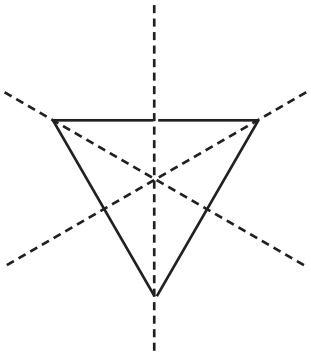
5 **a** Bilateral symmetry.



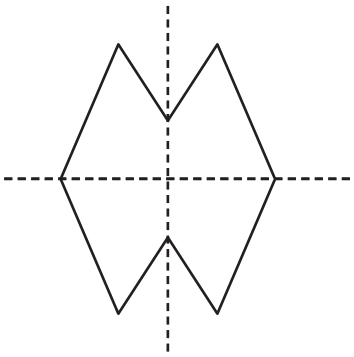
b Two fold symmetry.



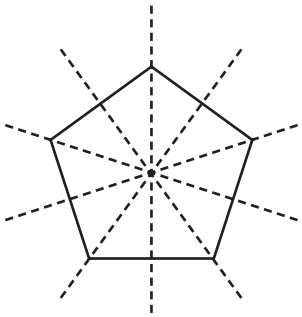
c Three axes of symmetry.



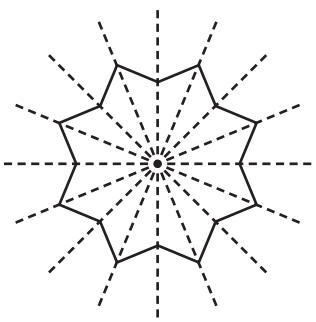
d Two axes of symmetry.



e Five-fold symmetry.
(show the other four axes)



f Eight-fold symmetry.
(show the other seven axes)



Page 15 questions

Rotational and point symmetry

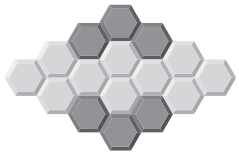
1 **a**

☒ Rotationally symmetric
☐ Rotationally asymmetric

b

☐ Rotationally symmetric
☒ Rotationally asymmetric

c



☒ Rotationally symmetric
☐ Rotationally asymmetric

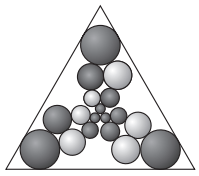
d

☒ Rotationally symmetric
☐ Rotationally asymmetric

e

☒ Rotationally symmetric
☐ Rotationally asymmetric

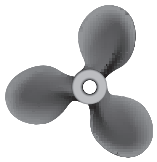
f



☐ Rotationally symmetric
☒ Rotationally asymmetric

2 **a**  2 **b**  4 **c**  2 **d**  4

3 **a** (i)



☐ Has point symmetry
☒ No point symmetry

(ii)

☒ Has point symmetry
☐ No point symmetry

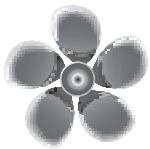
(iii)

☒ Has point symmetry
☐ No point symmetry

(iv)

☒ Has point symmetry
☐ No point symmetry

(v)



☐ Has point symmetry
☒ No point symmetry

(vi)

☐ Has point symmetry
☒ No point symmetry

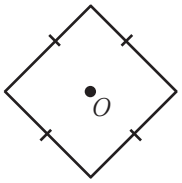
b If there is an even number of blades, the shape has point symmetry, if there is an odd number of blades, it doesn't.

c The number of blades on the even blade propellers is equal to the order of rotational symmetry.

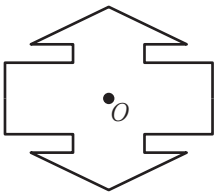
Page 16 questions

Rotational and point symmetry

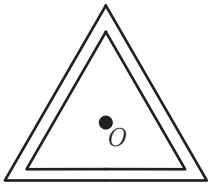
4 **a** Rotational symmetry of order 4 and also point symmetry.



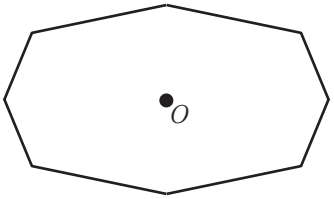
b Rotational symmetry of order 2 and also point symmetry.



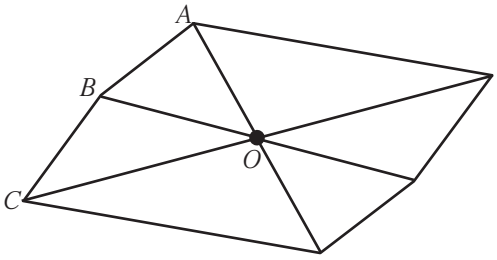
c Rotational symmetry of order 3 and no point symmetry.



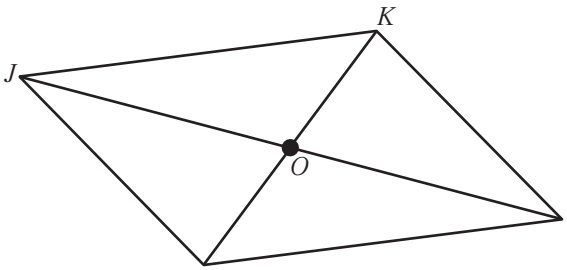
d Rotational symmetry of order 2 and also point symmetry.



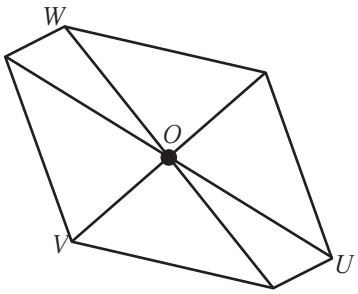
5 **a**



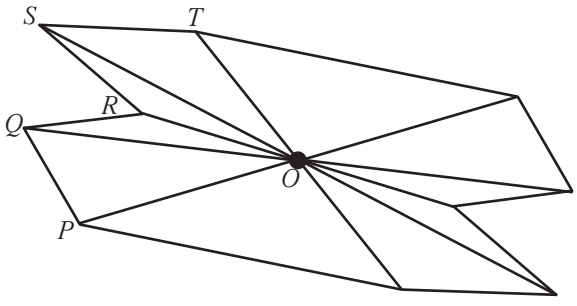
b



c



d



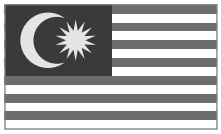
Page 17 questions

Combo time: Reflection, rotation and point symmetry

6 a 

Canada

- [x] Reflection symmetry with 1 folds
- [ ] Rotational symmetry of order .
- [ ] Point of symmetry.
- [ ] No symmetry

b 

Malaysia

- [ ] Reflection symmetry with folds
- [ ] Rotational symmetry of order .
- [ ] Point of symmetry.
- [x] No symmetry

c 

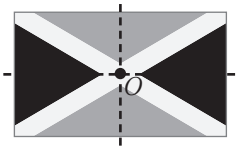
India

- [x] Reflection symmetry with 1 folds
- [ ] Rotational symmetry of order .
- [ ] Point of symmetry.
- [ ] No symmetry

d 

Australia

- [ ] Reflection symmetry with folds
- [ ] Rotational symmetry of order .
- [ ] Point of symmetry.
- [x] No symmetry

e 

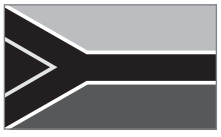
Jamaica

- [x] Reflection symmetry with 2 folds
- [x] Rotational symmetry of order 2.
- [x] Point of symmetry.
- [ ] No symmetry

f 

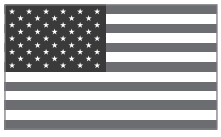
Pakistan

- [ ] Reflection symmetry with folds
- [ ] Rotational symmetry of order .
- [ ] Point of symmetry.
- [x] No symmetry

g 

South Africa

- [ ] Reflection symmetry with folds
- [ ] Rotational symmetry of order .
- [ ] Point of symmetry.
- [x] No symmetry

h 

United States of America

- [ ] Reflection symmetry with folds
- [ ] Rotational symmetry of order .
- [ ] Point of symmetry.
- [x] No symmetry

Page 17 questions

Combo time: Reflection, rotation and point symmetry

6 k

Vietnam

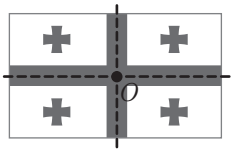
- [x] Reflection symmetry with 1 folds.
- [ ] Rotational symmetry of order .
- [ ] Point of symmetry.
- [ ] No symmetry

l

United Kingdom

- [ ] Reflection symmetry with folds.
- [x] Rotational symmetry of order 2.
- [ ] Point of symmetry.
- [ ] No symmetry

m



Georgia

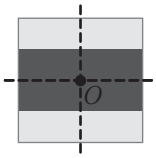
- [x] Reflection symmetry with 2 folds.
- [x] Rotational symmetry of order 2.
- [x] Point of symmetry.
- [ ] No symmetry

n

New Zealand

- [ ] Reflection symmetry with folds.
- [ ] Rotational symmetry of order .
- [ ] Point of symmetry.
- [x] No symmetry

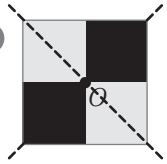
o



Letter 'D' signal flag

- [x] Reflection symmetry with 2 folds.
- [x] Rotational symmetry of order 2.
- [x] Point of symmetry.
- [ ] No symmetry

p



Letter 'L' signal flag

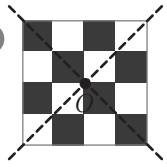
- [x] Reflection symmetry with 2 folds.
- [x] Rotational symmetry of order 2.
- [x] Point of symmetry.
- [ ] No symmetry

q

Letter 'Y' signal flag

- [ ] Reflection symmetry with folds.
- [ ] Rotational symmetry of order .
- [ ] Point of symmetry.
- [x] No symmetry

r



Letter 'N' signal flag

- [x] Reflection symmetry with 2 folds.
- [x] Rotational symmetry of order 2.
- [x] Point of symmetry.
- [ ] No symmetry

Page 20 questions

Special triangle properties

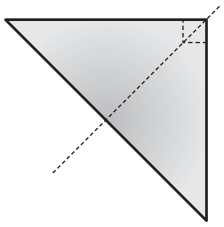
1 a Acute-angled scalene triangle.

b Right-angled isosceles triangle.

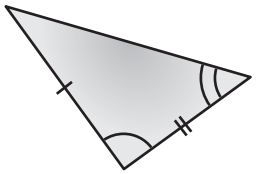
c Obtuse-angled isosceles triangle.

d Equilateral triangle.

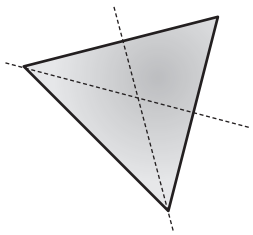
e Right-angled scalene triangle.

2 a 

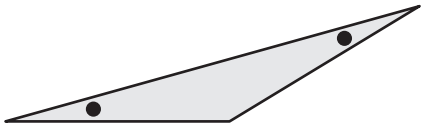
Right-angled isosceles triangle

b 

Scalene triangle

c 

Equilateral triangle

d 

Isosceles triangle

Page 23 questions

Special quadrilateral properties

1 a Rectangle

b Isosceles trapezium

c Rhombus

d Kite

e Square

f Kite

Page 23 questions

Special quadrilateral properties

2 **a**

- Squares have all sides equal, not just opposite sides.
- Squares have 2 more folds of reflective symmetry.

b

- Rectangles have all internal angles equal.
- Rectangles have reflective symmetry.

c

- Rhombus' have all sides equal, not just opposite sides.
- Diagonals of a rhombus are perpendicular.
- Diagonals of a rhombus bisect the angles.

d

- Opposite sides parallel in a rhombus.
- All sides equal in a rhombus.
- Both diagonals bisect the angles in a rhombus.
- Kite has only one pair of equal opposite angles.

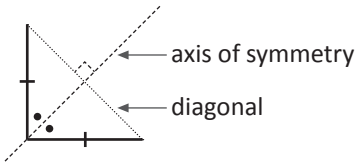
e

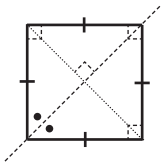
- Rhombus has all sides equal, not just opposite sides
- Diagonals of a rhombus are perpendicular.
- Squares have 4 folds of symmetry, rhombus only 2.

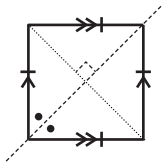
f

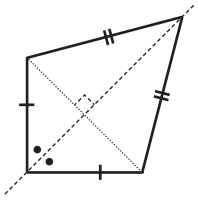
- Opposite sides parallel in a rhombus.
- Both diagonals bisect the angles in a rhombus
- Opposite angles equal in a rhombus, adjacent ones equal in isosceles trapezium.

3









a Square

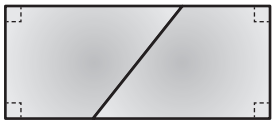
b Rhombus

c Kite

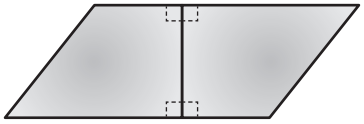
Page 24 questions

Combo time: Special quadrilateral and triangles

1

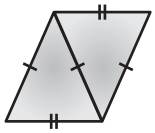


Rotate one shape a half-turn and translate until the non-perpendicular sides are common.
Or reflect one horizontally then transpose.



Rotate one shape a half-turn and translate until the perpendicular sides are common.
Or reflect one horizontally and then vertically, then translate.

2



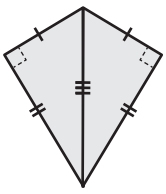
Parallelogram

Reflect one vertically up/down and then transpose until one pair of equal sides are shared.

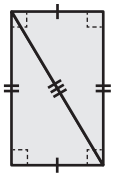
Rhombus

Reflect one vertically down and then transpose until the shorter sides are shared.

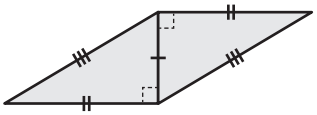
3



Kite



Rectangle

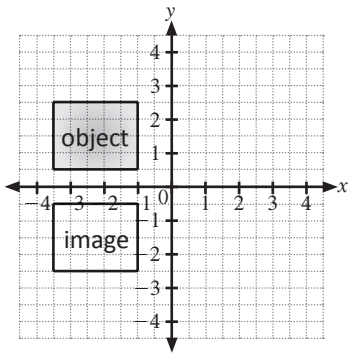


Parallelogram

Page 26 questions

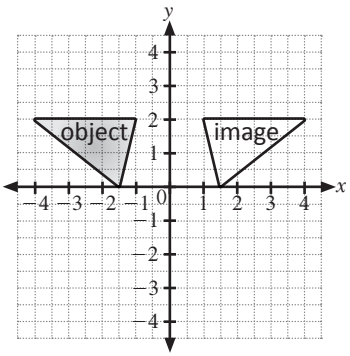
Transformation on the Cartesian number plane

1 a



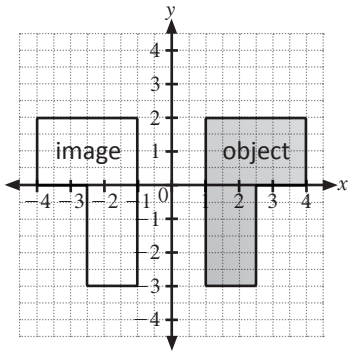
Reflected
- [x] Vertically
- [ ] Horizontally
- [ ] Diagonally

b



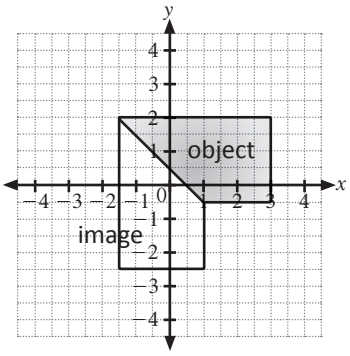
Reflected
- [ ] Vertically
- [x] Horizontally
- [ ] Diagonally

c



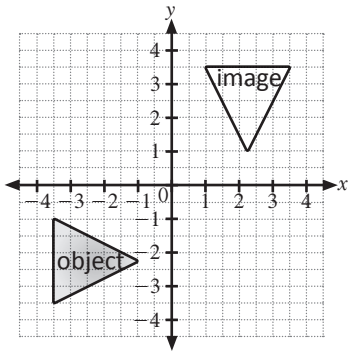
Reflected
- [ ] Vertically
- [x] Horizontally
- [ ] Diagonally

d



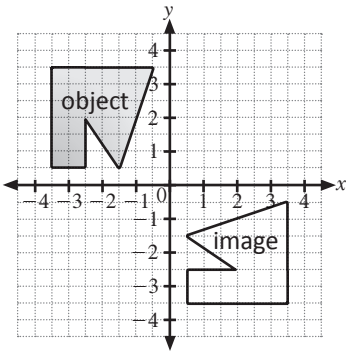
Reflected
- [ ] Vertically
- [ ] Horizontally
- [x] Diagonally

e



Reflected
- [ ] Vertically
- [ ] Horizontally
- [x] Diagonally

f

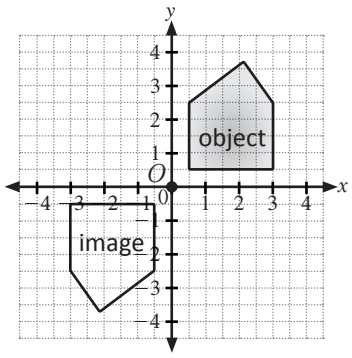


Reflected
- [ ] Vertically
- [ ] Horizontally
- [x] Diagonally

Page 27 questions

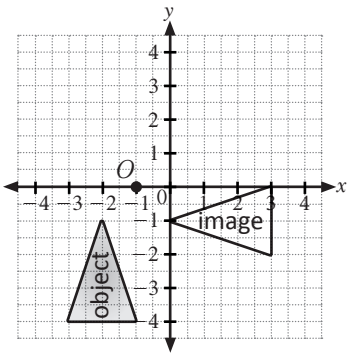
Transformation on the Cartesian number plane

2 **a**



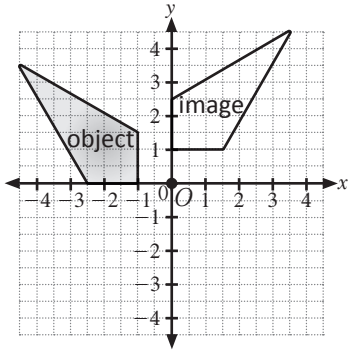
☐ 90° ☒ 180° ☐ 270° rotation

b



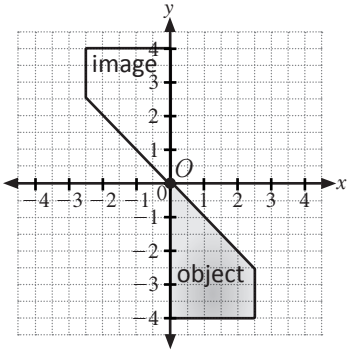
☒ 90° ☐ 180° ☐ 270° rotation

c



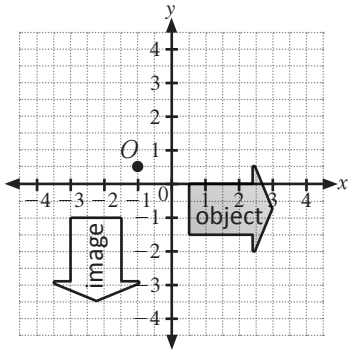
☐ 90° ☐ 180° ☒ 270° rotation

d



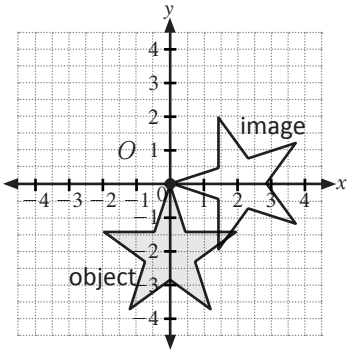
☐ 90° ☒ 180° ☐ 270° rotation

e



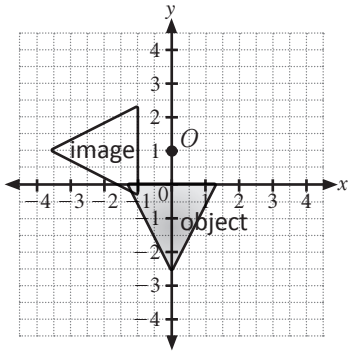
☐ 90° ☐ 180° ☒ 270° rotation

f



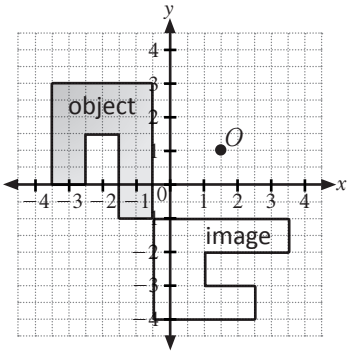
☒ 90° ☐ 180° ☐ 270° rotation

g



☐ 90° ☐ 180° ☒ 270° rotation

h



☒ 90° ☐ 180° ☐ 270° rotation

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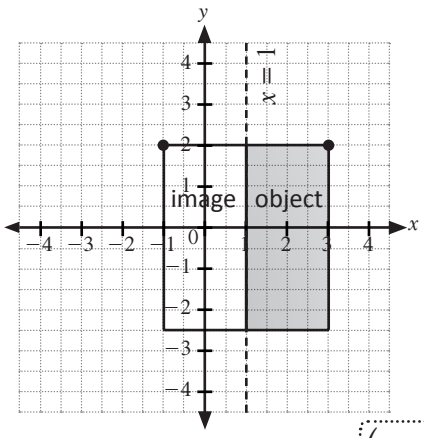
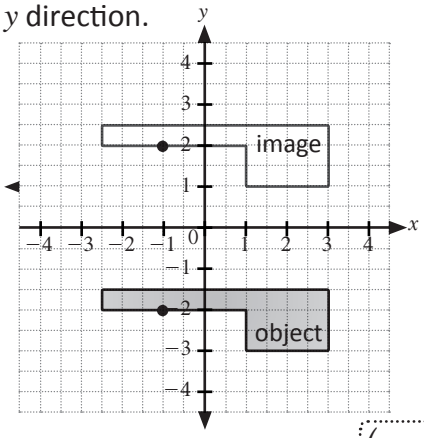
Transformations on the Cartesian number plane

3 **a** Reflect object about the line $x = 1$.



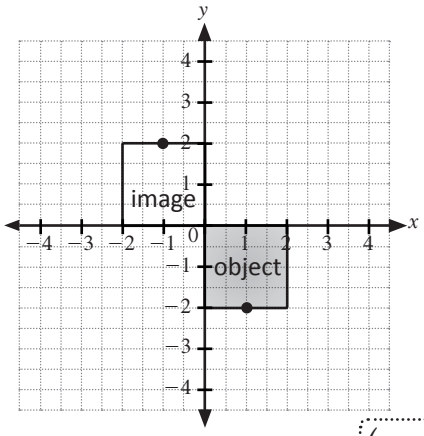
New coordinates for dot = $(-1, 2)$

b Translate the object four units in the positive y direction.



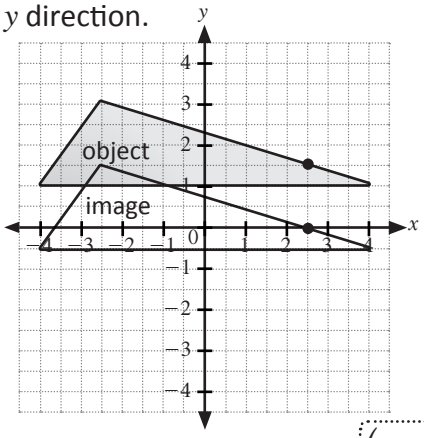
New coordinates for dot = $(-1, 2)$

c Rotate the object $180°$ about the $(0, 0)$.



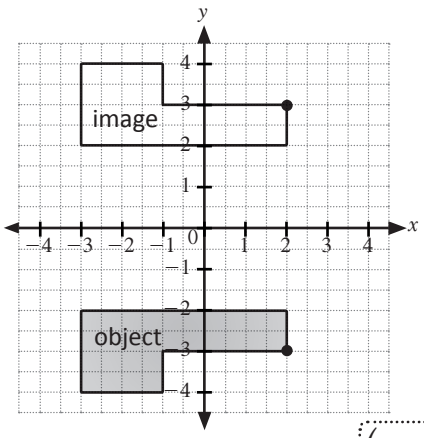
New coordinates for dot = $(-1, 2)$

d Translate the object four units in the negative y direction.



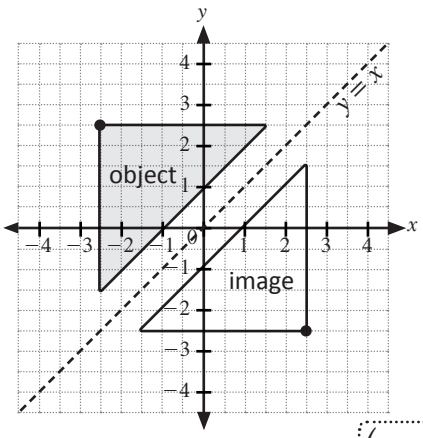
New coordinates for dot = $(2.5, 0)$

e Reflect object about the x-axis.



New coordinates for dot = $(2, 3)$

f reflect object about the given axis line, $y = x$.



New coordinates for dot = $(2.5, -2.5)$

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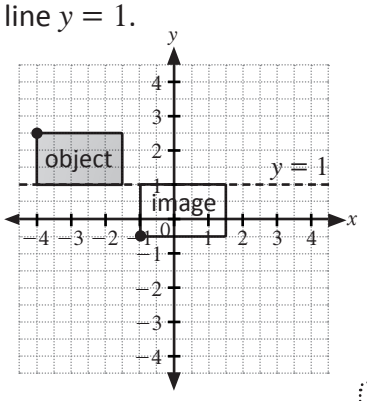
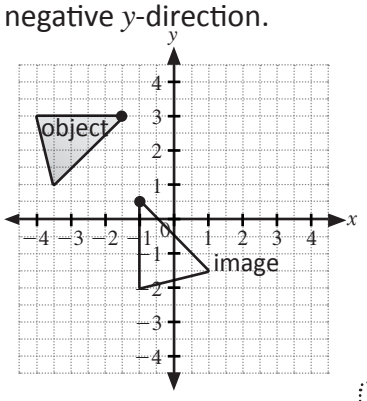
Transformations on the Cartesian number plane

4 **a** Translate object 3 units in the positive x-direction and then reflect about the line $y = 1$.



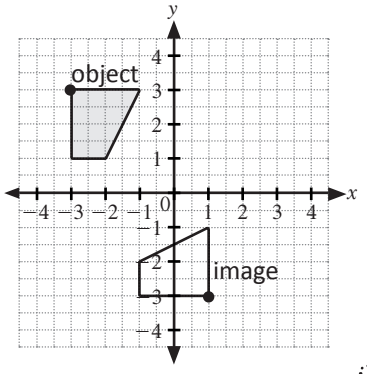
New coordinates for dot = $(-1, -1)$

b Rotate the object one quarter turn about the point $(-1, 3)$ then translate 2.5 units in the negative y-direction.



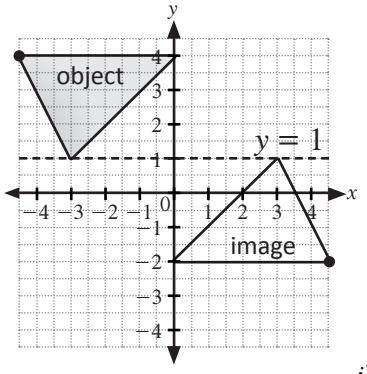
New coordinates for dot = $(-1, 0.5)$

c Rotate object $270°$ about the point $(-1, 1)$ and then reflect about the x-axis.



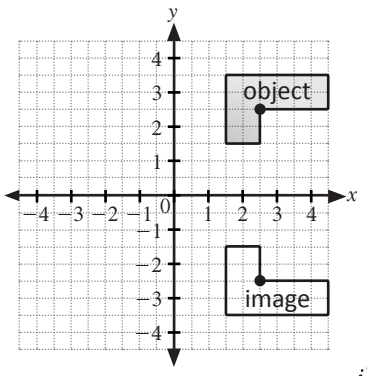
New coordinates for dot = $(1, -3)$

d Reflect the object about the y-axis, and then reflect about the line $y = 1$.



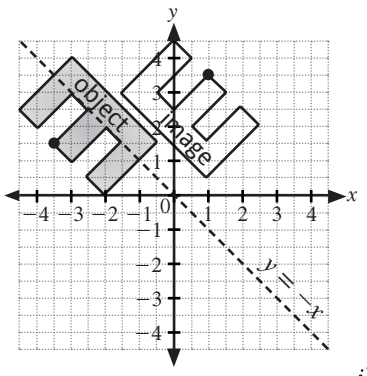
New coordinates for dot = $(4.5, -2)$

e Reflect object about the y-axis then rotate $180°$ about the origin $(0, 0)$.



New coordinates for dot = $(2.5, -2.5)$

f Translate the object 2.5 units in the negative y-direction and then reflect about the line $y = -x$.



New coordinates for dot = $(2, 3.5)$

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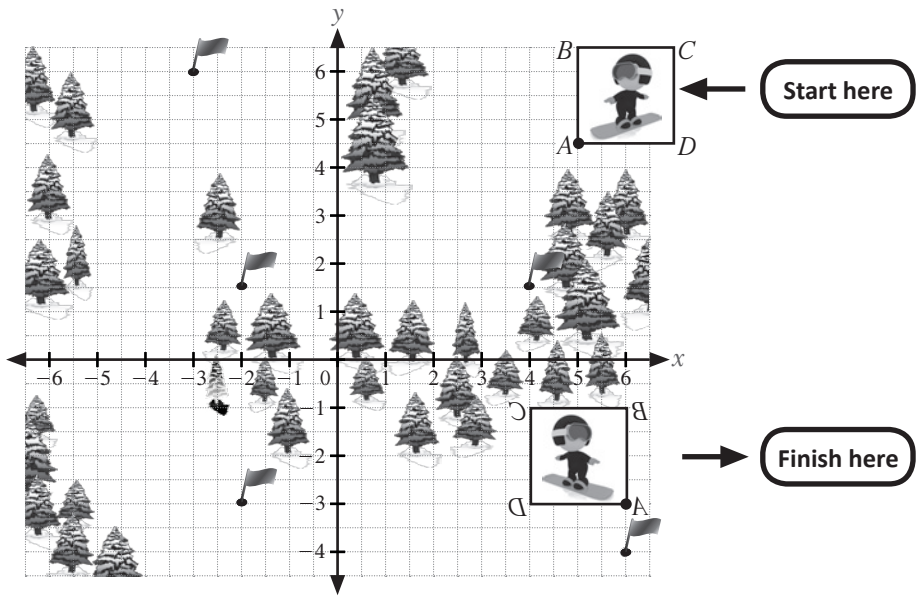
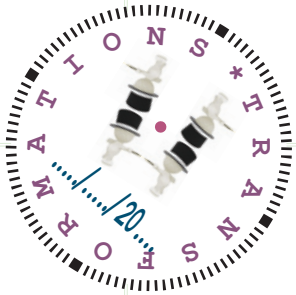
Transformations on the Cartesian number plane

5



- Reflect horizontally about the side AB. Coordinates of A: $(5, 4)$
- Translate horizontally in the negative x-direction 1 unit. Coordinates of A: $(4, 4)$
- Translate vertically in the negative y-direction 2.5 units. Coordinates of A: $(4, 1.5)$
- Translate horizontally in the negative x-direction 2 units. Coordinates of A: $(2, 1.5)$
- Reflect horizontally about the side CD. Coordinates of A: $(-2, 1.5)$
- Translate vertically in the positive y-direction 2.5 units. Coordinates of A: $(-2, 4)$
- Translate horizontally in the negative x-direction 3 units. Coordinates of A: $(-5, 4)$
- Rotate 180° about the centre of the player square. Coordinates of A: $(-3, 6)$
- Translate vertically in the negative y-direction 5 units. Coordinates of A: $(-3, 1)$
- Reflect vertically about the side BC. Coordinates of A: $(-3, -3)$
- Translate horizontally in the positive x-direction 1 unit. Coordinates of A: $(-2, -3)$
- Translate vertically in the negative y-direction 1 unit. Coordinates of A: $(-2, -4)$
- Translate horizontally in the positive x-direction 8 units. Coordinates of A: $(6, -4)$
- Translate vertically in the positive y-direction 1 unit. Coordinates of A: $(6, -3)$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SPECIAL TRIANGLE PROPERTIES
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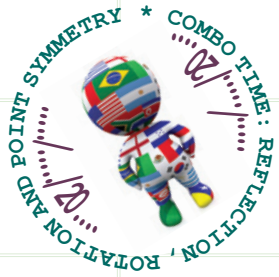
POLYGONS * POLYGONS * POLYGONS
/20


ROTATION AND POINT SYMMETRY * COMBO TIME : REFLECTION ,
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