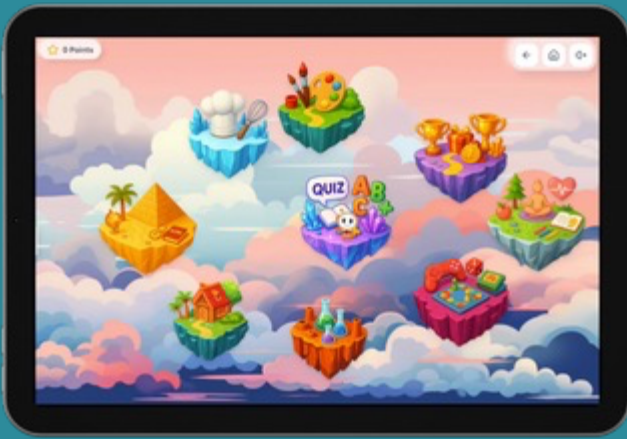


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Line and Rotational Symmetry - Year 5

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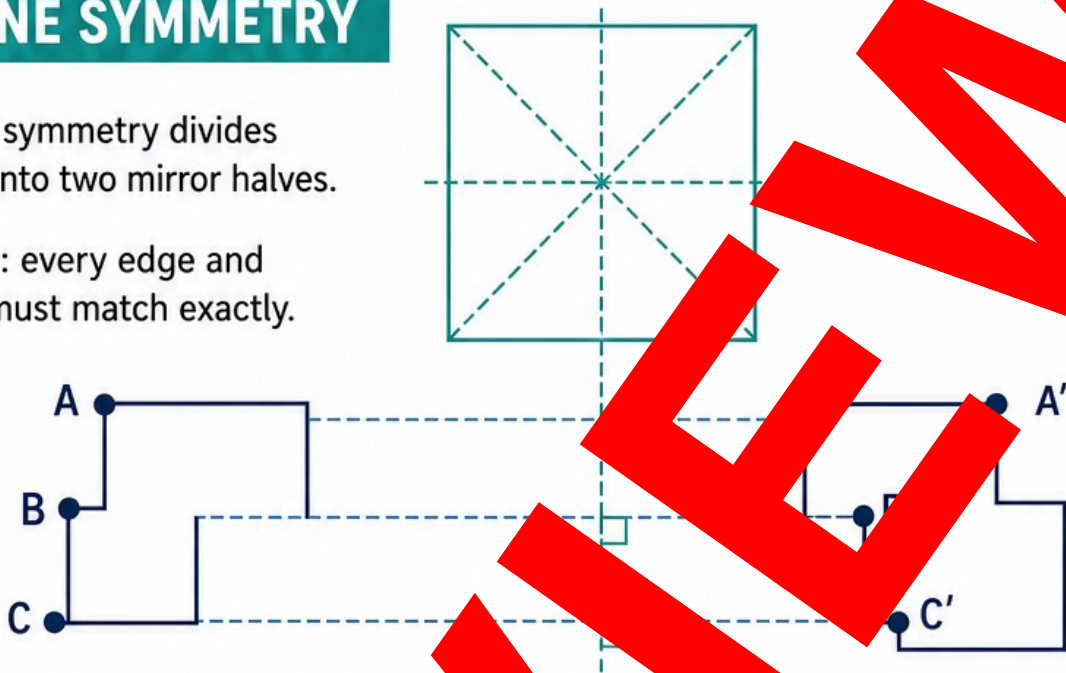


SYMMETRY AT A GLANCE

1 LINE SYMMETRY

A line of symmetry divides a shape into two mirror halves.

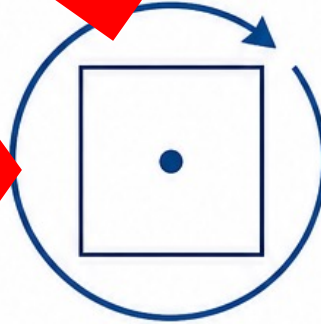
Fold test: every edge and feature must match exactly.



2 ROTATIONAL SYMMETRY

A shape has rotational symmetry when it matches itself before a full turn.

Order = number of matching positions in 360° , including the start.



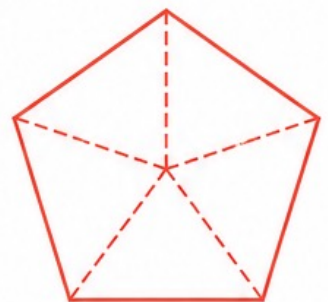
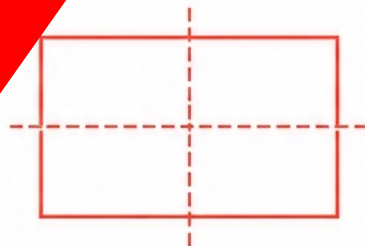
3 ORDER AND ANGLE

Smallest angle of rotation $= 360^\circ \div \text{order}$

square: order 4 $\rightarrow$

rectangle: order 2 $\rightarrow 180^\circ$

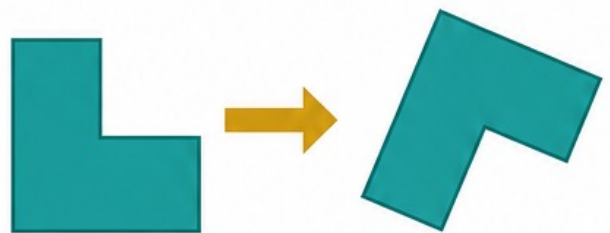
regular pentagon: order 5 $\rightarrow 72^\circ$



WHAT STAYS THE SAME?

Shape, size, side lengths and angles stay the same.

Position and orientation may change.



ORDER 1 = no non-trivial rotational symmetry

SIMMETRY SORT LAB

Place each card where it belongs. Be ready to prove your choice.

LINE ONLY

ROTATIONAL ONLY

to



BOTH



EITHER

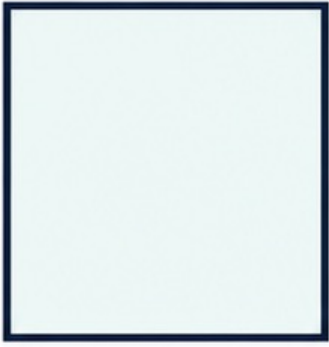


Use order 2 or greater when deciding whether a shape has rotational symmetry.



SYMMETRY SORT LAB — CARDS A

1



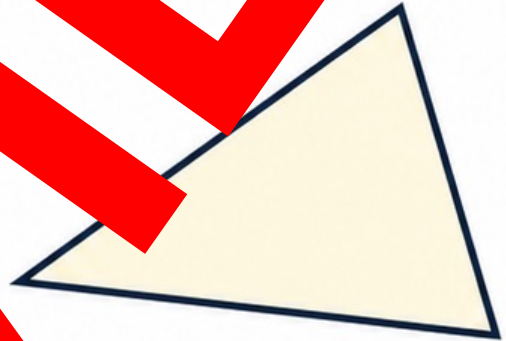
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3



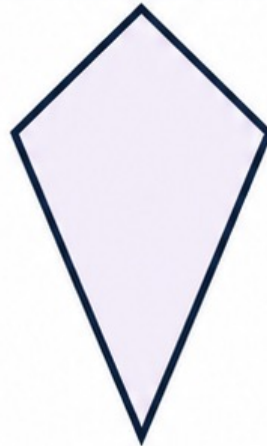
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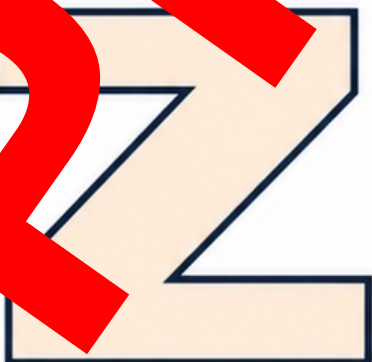
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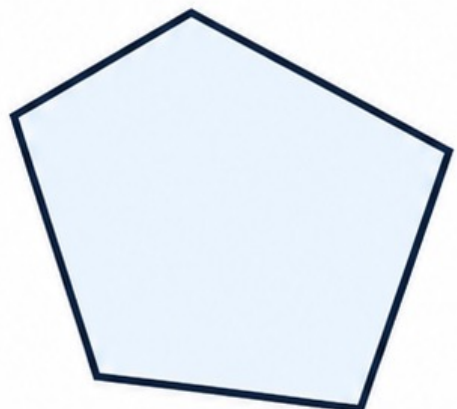
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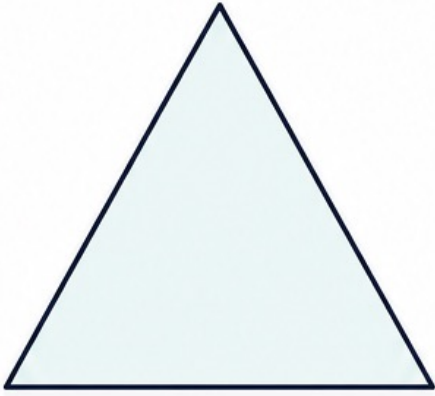


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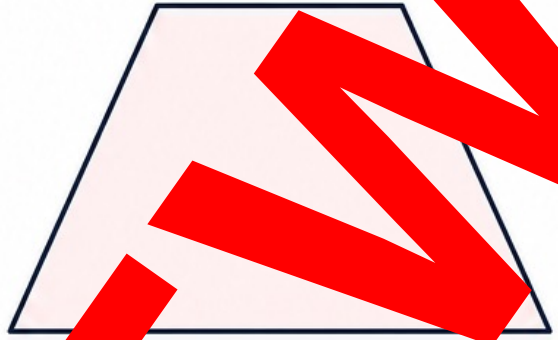


SYMMETRY SORT LAB – CARDS B

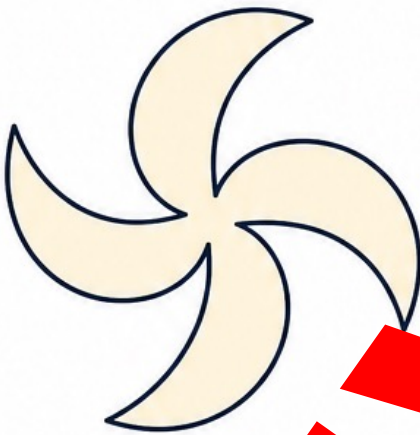
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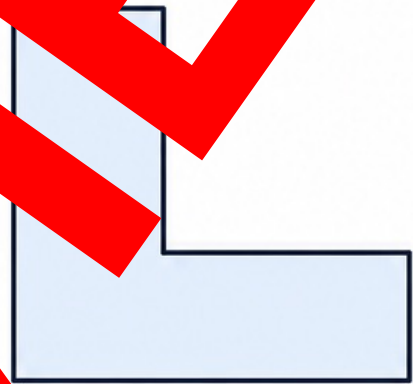
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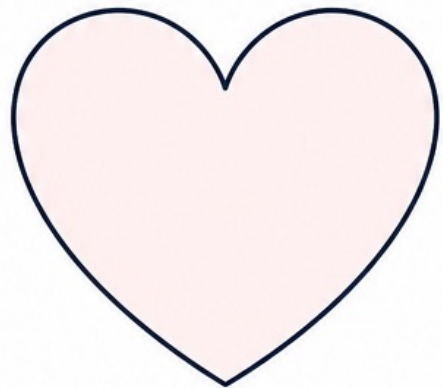
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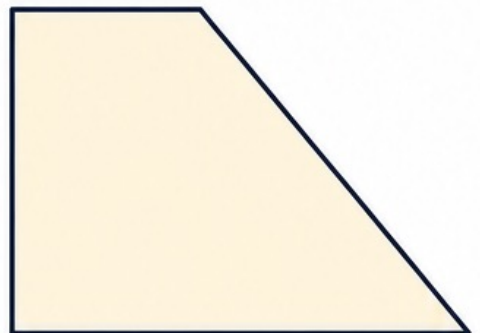
13



14



16



SYMMETRY SORT LAB – TEACHER KEY

LINE ONLY

- 2 isosceles triangle
- 6 kite
- 10 isosceles trapezium
- 14 heart



ROTATION ONLY

- 3 parallelogram (order 2)
- 7 L-shaped polygon (order 2)
- 11 four-armed pinwheel (order 4)
- 15 three-bladed pinwheel (order 3)



BOTH

- 1 square
- 5 rectangle
- 9 equilateral triangle
- 13 regular hexagon



NEITHER

- 4 scalene triangle
- 8 irregular pentagon
- 12 L-shaped polygon
- 16 right trapezium



Accept a classification only when the student can justify it with a fold or turn test.

TURN-AND-MATCH CHALLENGE



First player to FINISH wins.

TURN-AND-MATCH — SPINNER & CHALLENGE CARDS



1. Name a shape with exactly 1 line of symmetry.

2. Show all lines of symmetry on a square.

3. Which has more lines: a square or a rectangle?

4. Explain the fold test.

5. Give the order of symmetry of a rectangle.

6. Order 4: find the smallest angle.

7. Name a shape with order 2 and 1 line of symmetry.

8. Explain why order 1 is not a non-trivial symmetry.

9. Square: line only, rotational only, both or neither?

10. Parallelogram: line only, rotational only, both or neither?

11. Name two properties unchanged by a rotation.

12. Sketch a shape with both types of symmetry.

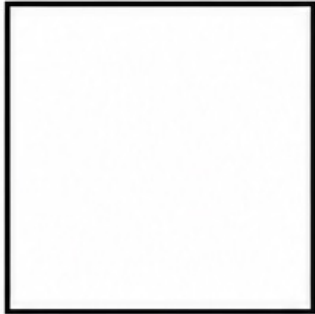
LINE SYMMETRY DETECTIVE — PAGE 1

Name: _____

Date: _____

Draw every line of symmetry. Then write the total.

1.



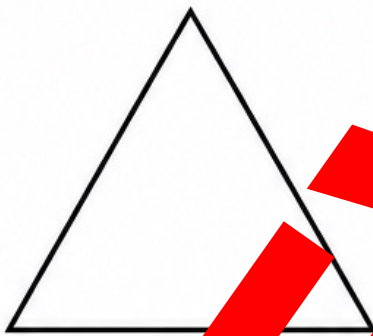
Total: _____

2.



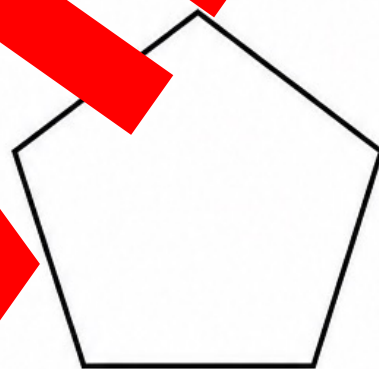
Total: _____

3.



Total: _____

4.



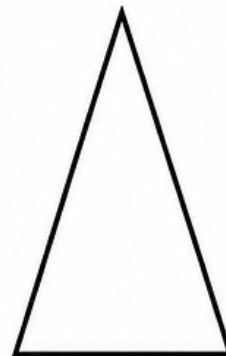
Total: _____

5.



Total: _____

6.



Total: _____

7. What pattern do you notice for regular polygons?

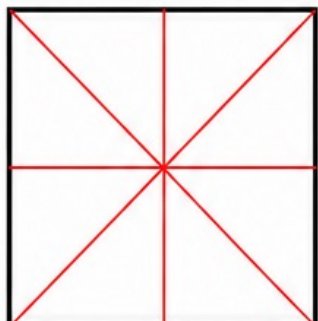
LINE SYMMETRY DETECTIVE — PAGE 1

Name: ANSWERS

Date: _____

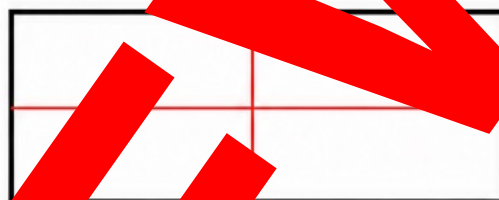
Draw every line of symmetry. Then write the total.

1.



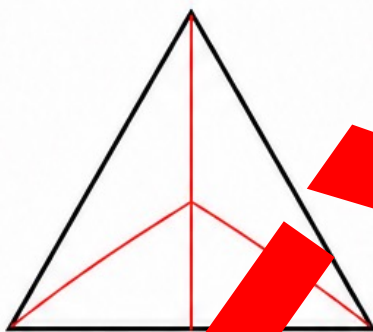
Total: 4

2.



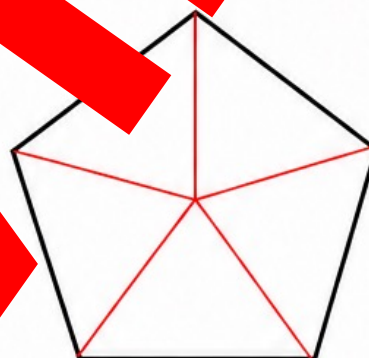
Total: 2

3.



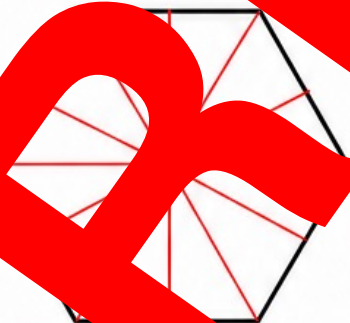
Total: 3

4.



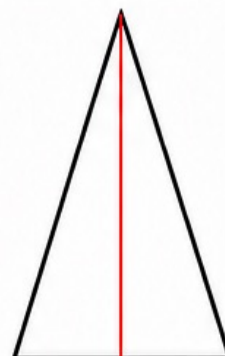
Total: 5

5.



Total: 6

6.



Total: 1

7. What pattern do you notice for regular polygons?

A regular polygon has the same number of lines of symmetry as sides.

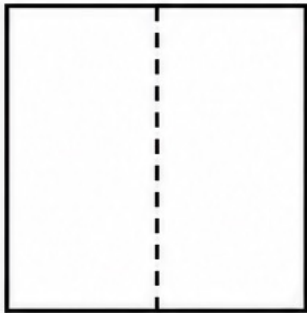
LINE SYMMETRY DETECTIVE — PAGE 2

Name: _____

Date: _____

Is the dashed line a line of symmetry? Tick YES or NO. If not, draw a correct one when one exists.

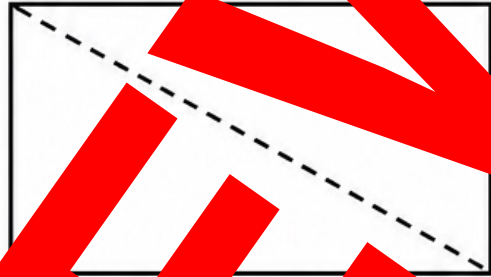
1.



YES ☐

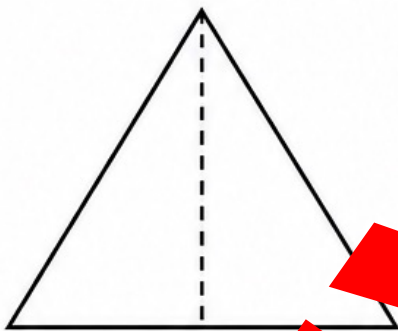
NO ☐

2.



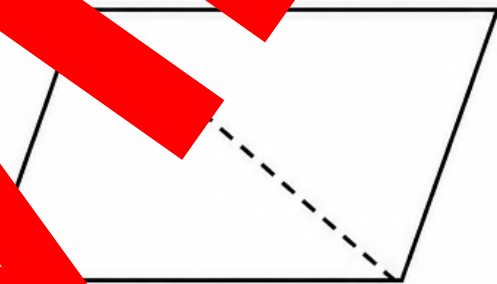
☐

3.



YES ☐

☐



YES ☐

NO ☐

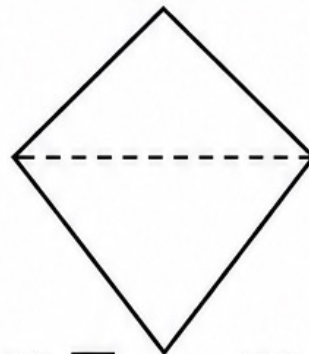
5.



☐

NO ☐

6.



YES ☐

NO ☐

or sketch a shape with exactly one line of symmetry.

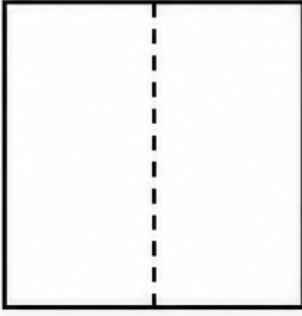
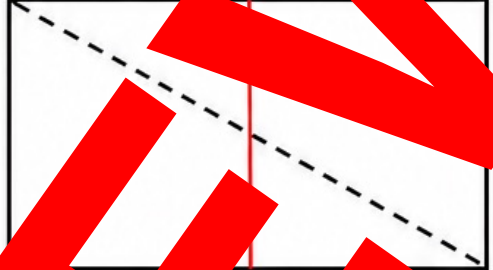
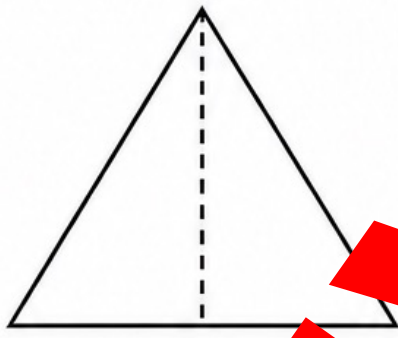
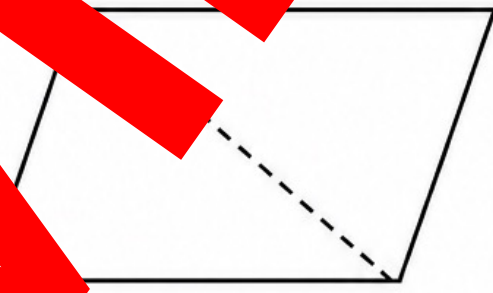
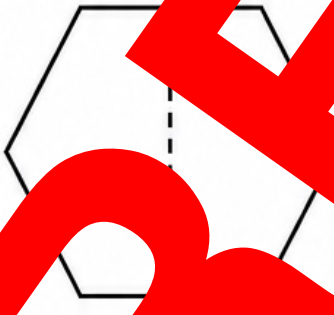
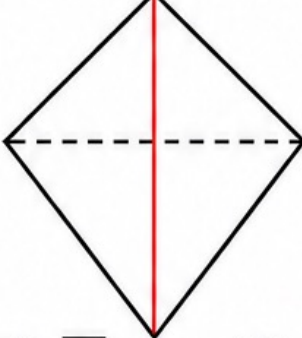
Explain how folding can test a proposed line of symmetry.

LINE SYMMETRY DETECTIVE — PAGE 2

Name: **ANSWERS**

Date: _____

Is the dashed line a line of symmetry? Tick YES or NO. If not, draw a correct one when one is possible.

1.  YES ☒ NO ☐	2.  YES ☐ NO ☒
3.  YES ☒ NO ☐	4.  YES ☐ NO ☒
5.  YES ☒ NO ☐	6.  YES ☐ NO ☒

For each shape, draw a line of symmetry or sketch one with exactly one line of symmetry.

Example: a non-equilateral isosceles triangle.

Explain how folding can test a proposed line of symmetry.

Place the shape on the line. Every edge and feature on one half must

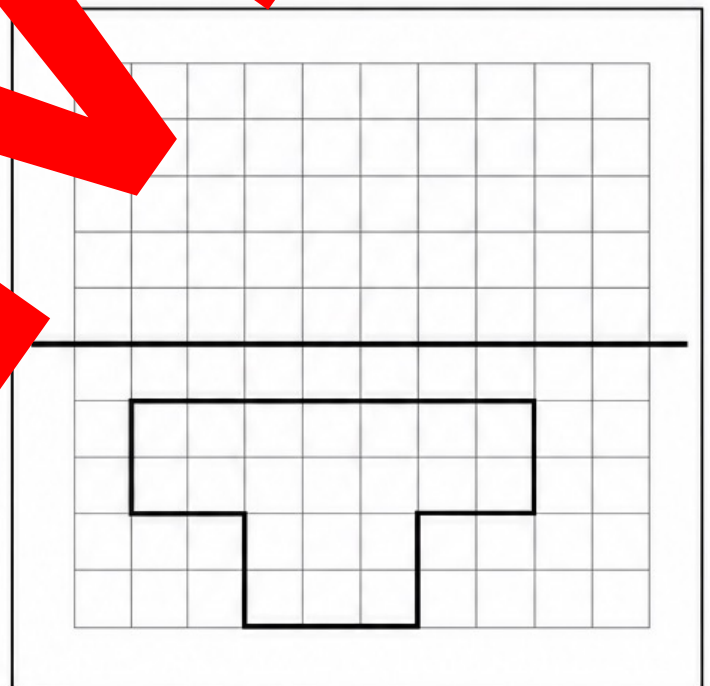
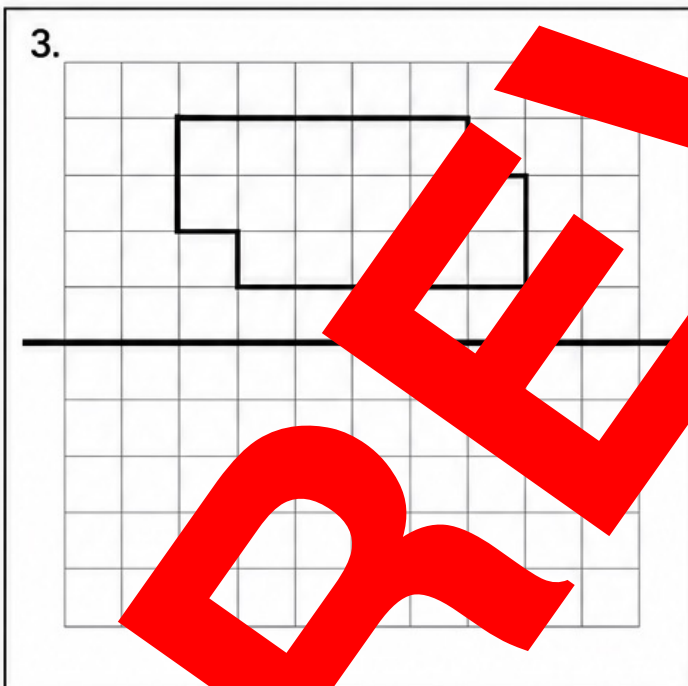
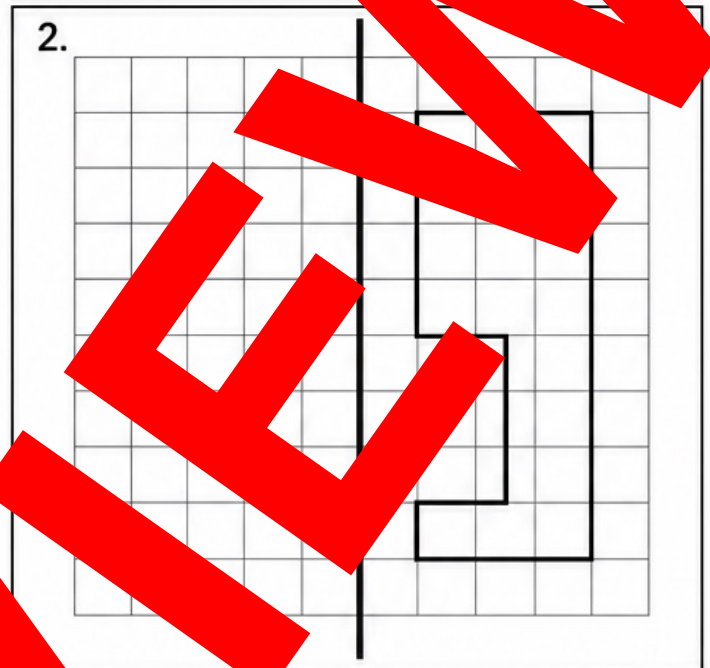
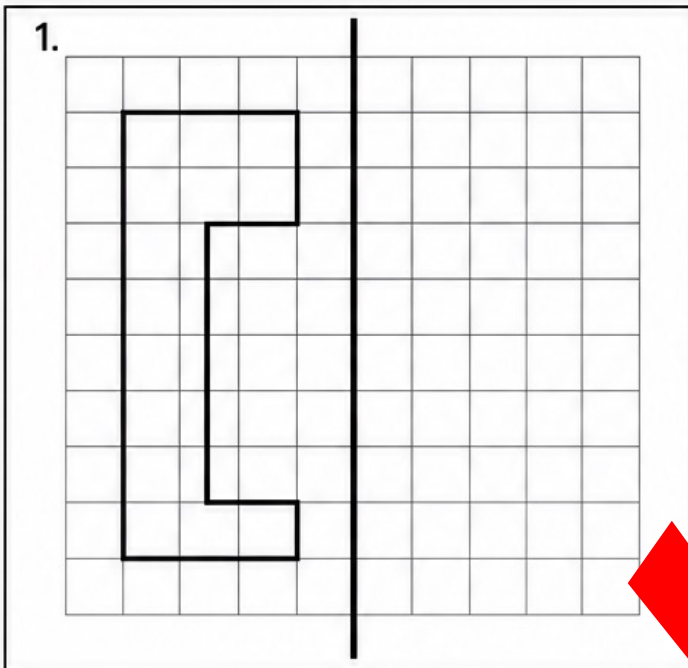
coincide exactly with the other half.

COMPLETE THE REFLECTION — PAGE 1

Name: _____

Date: _____

Reflect each shape across the bold mirror line. Use the grid to keep every part the same perpendicular distance from the line.



Does the shape change after a reflection?

6. What may change after a reflection?

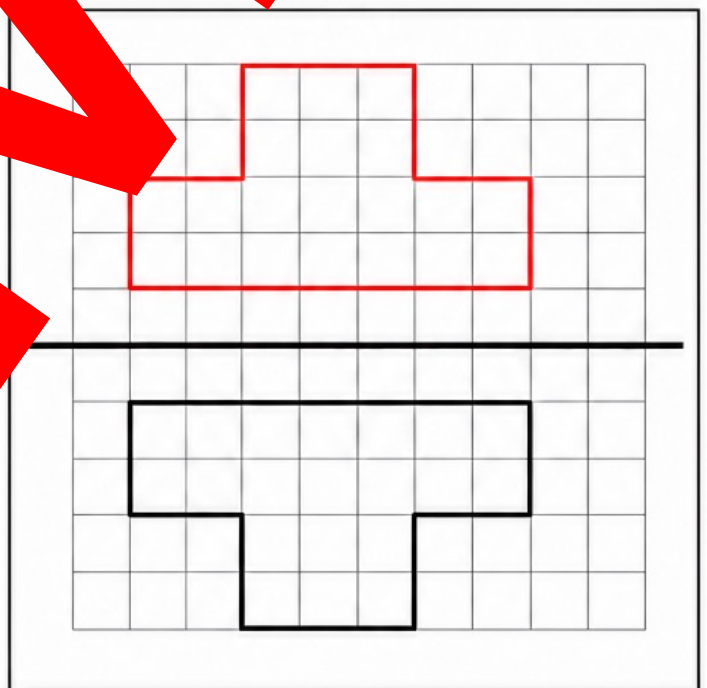
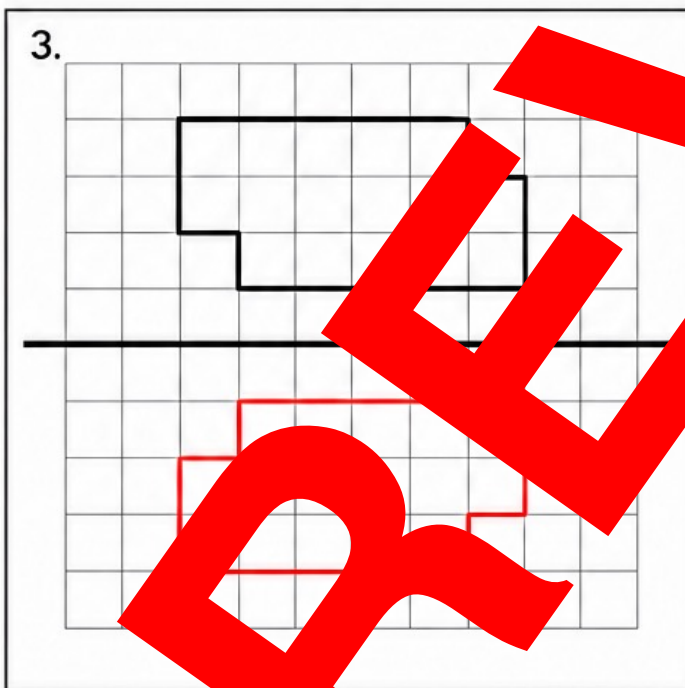
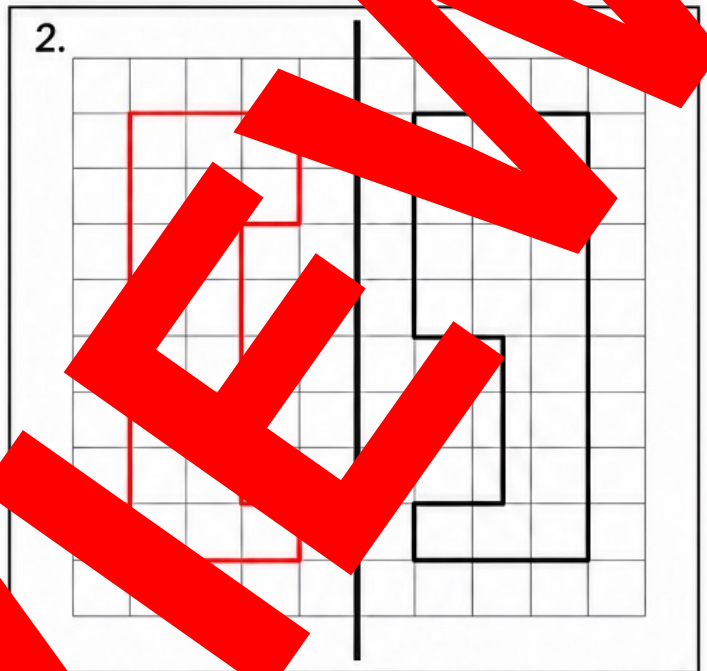
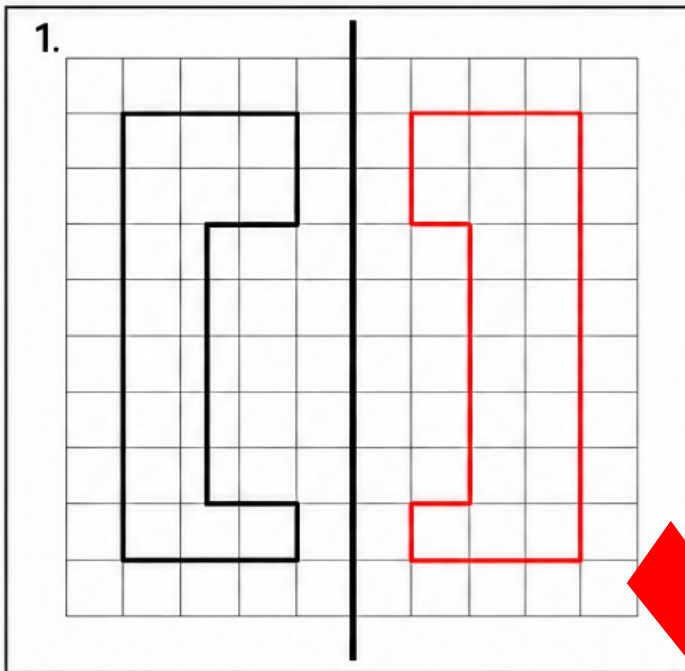
COMPLETE THE REFLECTION — PAGE 1

Name: _____

ANSWERS

Date: _____

Reflect each shape across the bold mirror line. Use the grid to keep every part the same perpendicular distance from the line.



What stays the same after a reflection?

Shape, size, side lengths and angles stay the same.

What may change after a reflection?

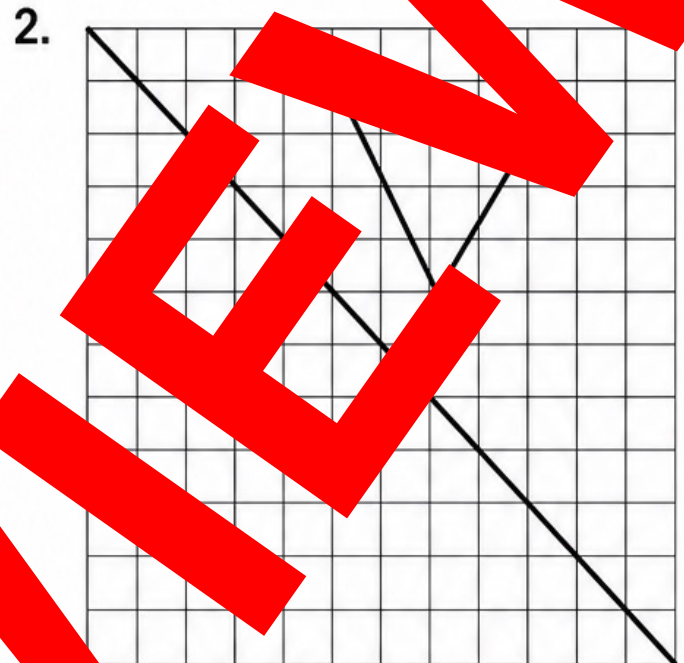
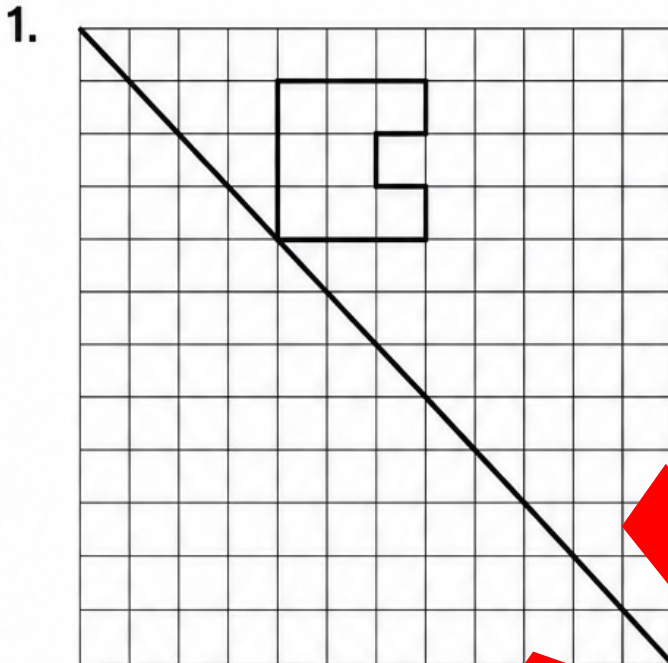
Position and orientation may change.

COMPLETE THE REFLECTION — PAGE 2

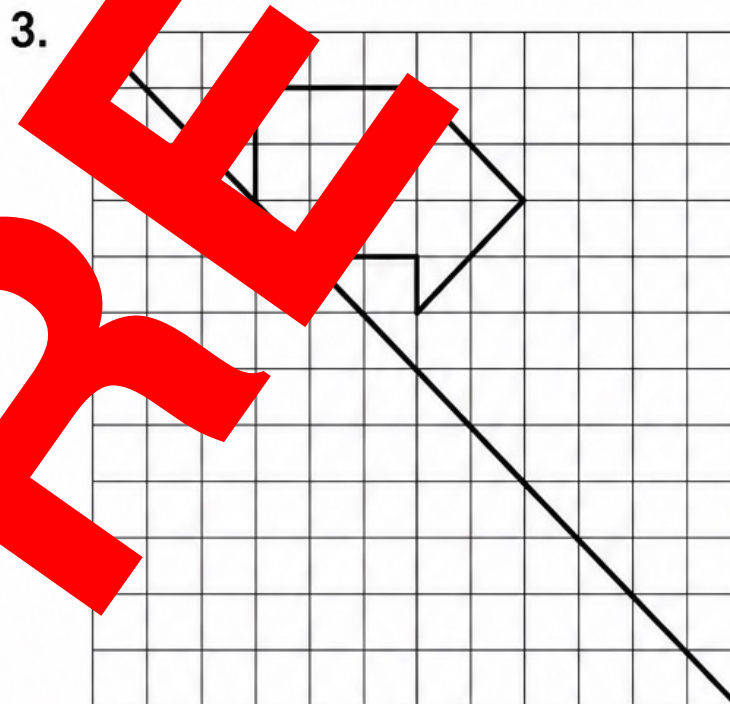
Name: _____

Date: _____

Complete each diagonal reflection. Plot the image point by point before the mirror line.



How did the orientation change? _____ the orientation change? _____



How did the orientation change? _____

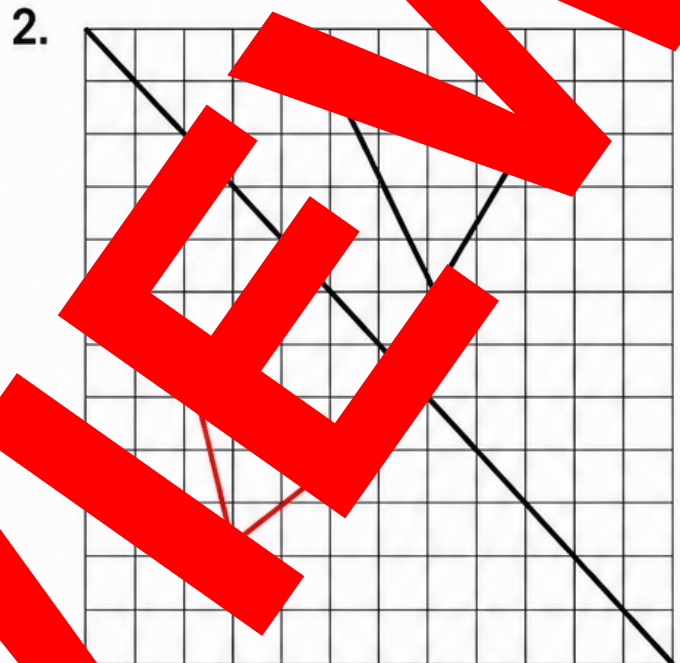
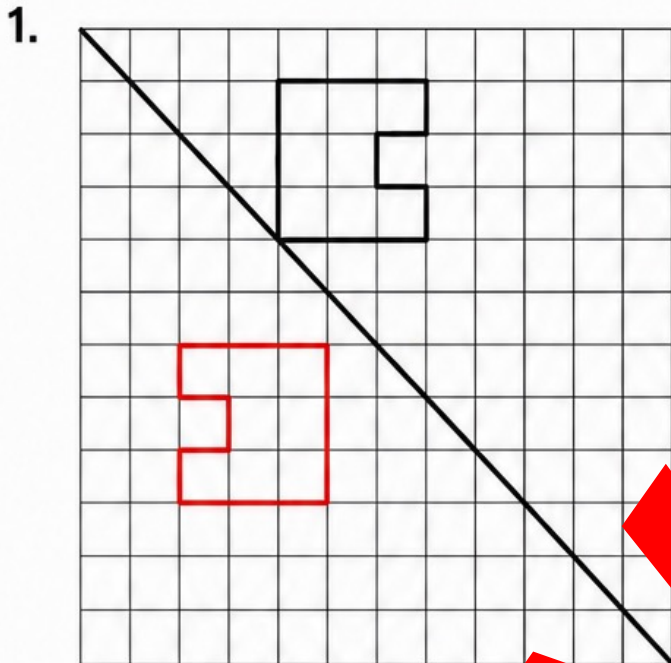
4. A point is 3 grid squares from a mirror line. How far from the line is its image? _____

COMPLETE THE REFLECTION – PAGE 2

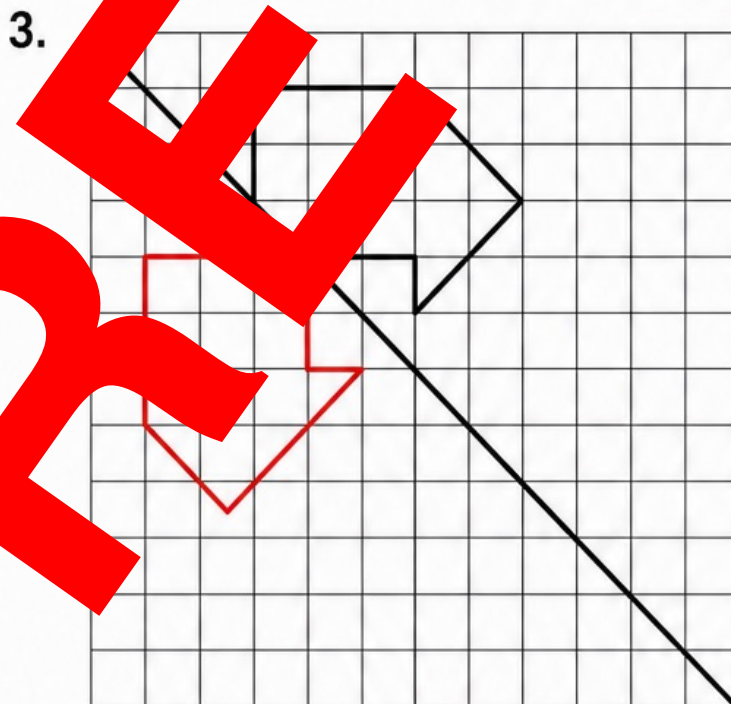
Name: **ANSWERS**

Date: _____

Complete each diagonal reflection. Plot the image point by point before the mirror line.



How did the orientation change? It is flipped across the diagonal mirror line.



How did the orientation change? It is flipped across the diagonal mirror line.

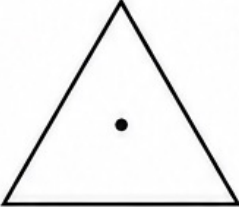
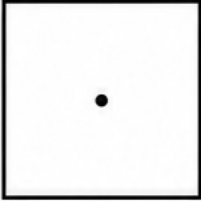
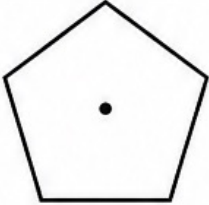
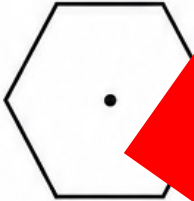
4. A point is 3 grid squares from a mirror line. How far from the line is its image? 3 grid squares

ROTATIONAL SYMMETRY — ORDER & ANGLE — PAGE 1

Name: _____

Date: _____

Smallest angle = $360^\circ \div \text{order}$
The starting position counts.

	SHAPE	ORDER	SMALLEST ANGLE
1.		_____	_____
2.		_____	_____
3.		_____	_____
4.		_____	_____
5.		_____	_____

6. What relationship do you notice between the number of sides and the order for these regular polygons?

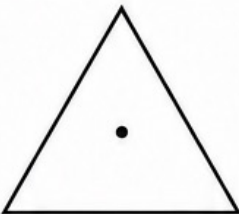
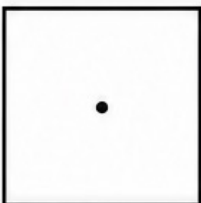
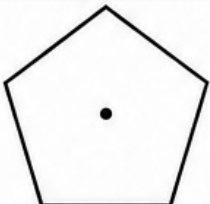
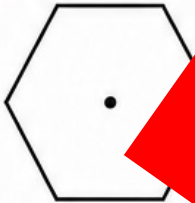
7. Explain why a square does not have order 8.

ROTATIONAL SYMMETRY — ORDER & ANGLE — PAGE 1

Name: **ANSWERS**

Date: _____

Smallest angle = $360^\circ \div \text{order}$
The starting position counts.

SHAPE	ORDER	SMALLEST ANGLE
1. 	<u>3</u>	<u>120°</u>
2. 	<u>4</u>	<u>90°</u>
3. 	<u>5</u>	<u>72°</u>
4. 	<u>6</u>	<u>60°</u>
5. 	<u>8</u>	<u>45°</u>

6. What relationship do you notice between the number of sides and the order for these regular polygons?

For a regular polygon, the rotational order equals the number of sides.

Explain why a square does not have order 8.

A 90° turn does not make a square coincide with its starting position; the first match is at 90° .

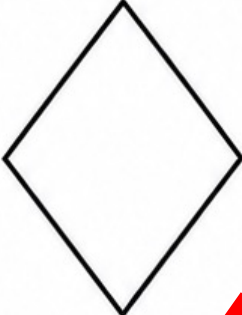
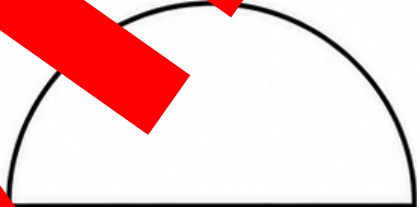
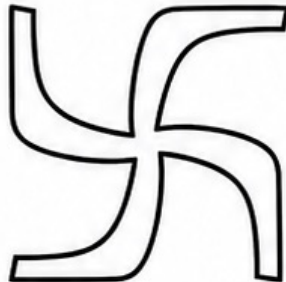
ROTATIONAL SYMMETRY — ORDER & ANGLE — PAGE 2

Name: _____

Date: _____

Decide the order. Then calculate the smallest angle.

Order 1 means no non-trivial match before 360° .

1.  ORDER: _____ SMALLEST ANGLE: _____	2.  ORDER: _____ SMALLEST ANGLE: _____
3.  ORDER: _____ SMALLEST ANGLE: _____	4.  ORDER: _____ SMALLEST ANGLE: _____
5.  ORDER: _____ SMALLEST ANGLE: _____	6.  ORDER: _____ SMALLEST ANGLE: _____

Which shapes above have no non-trivial rotational symmetry?

Which shapes both have order 2. Must they also have the same number of lines of symmetry? Explain.

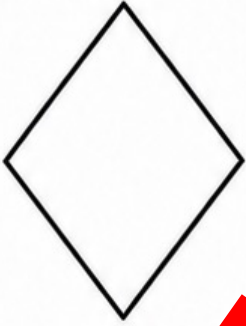
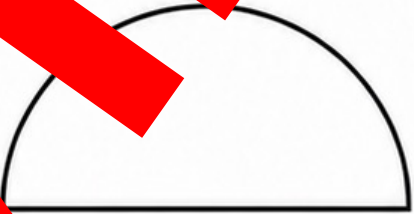
ROTATIONAL SYMMETRY — ORDER & ANGLE — PAGE 2

Name: _____ **ANSWERS**

Date: _____

Decide the order. Then calculate the smallest angle.

Order 1 means no non-trivial match before 360° .

1.  ORDER: <u>2</u> SMALLEST ANGLE: <u>180°</u>	2.  ORDER: _____ SMALLEST ANGLE: <u>180°</u>
3.  ORDER: <u>2</u> SMALLEST ANGLE: <u>180°</u>	4.  ORDER: <u>1</u> SMALLEST ANGLE: <u>360°</u>
5.  ORDER: _____ SMALLEST ANGLE: <u>360°</u>	6.  ORDER: <u>4</u> SMALLEST ANGLE: <u>90°</u>

Which shapes above have no non-trivial rotational symmetry?

The semicircle and scalene triangle.

Which shapes both have order 2. Must they also have the same number of lines of symmetry? Explain.

- No, a rectangle has 2 lines, while a general parallelogram _____

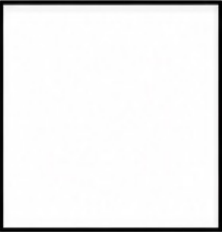
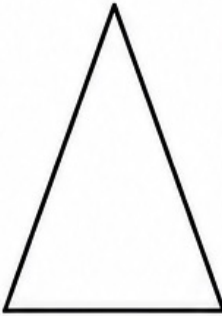
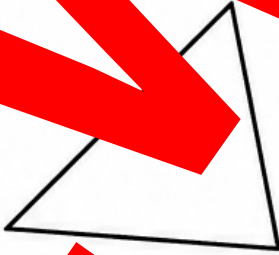
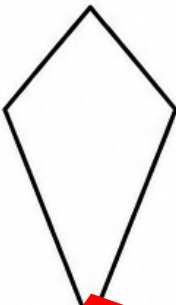
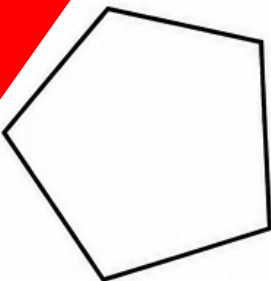
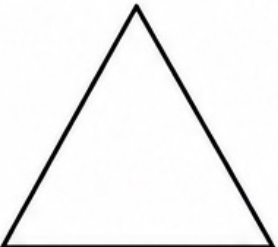
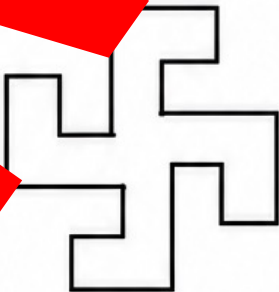
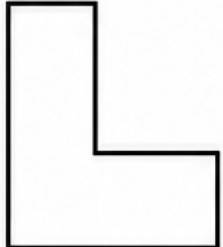
- has 0, both have order 2. _____

SYMMETRY CLASSIFICATION — PAGE 1

Name: _____

Date: _____

Classify each shape as LINE ONLY, ROTATIONAL ONLY, BOTH or NEITHER. Record its number in the table.

1. 	2. 	3. 	4. 
5. 	6. 	7. 	8. 
9. 	10. 	11. 	12. 

LINE ONLY	ROTATIONAL ONLY	BOTH	NEITHER
_____	_____	_____	_____
_____	_____	_____	_____

13. Choose one shape and justify its classification.

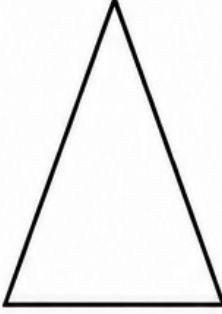
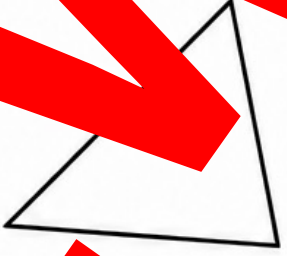
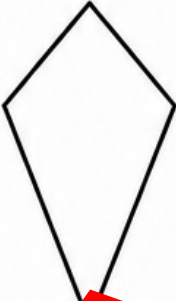
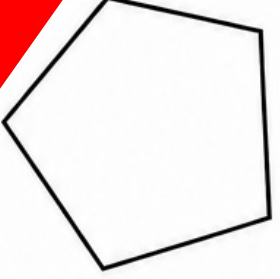
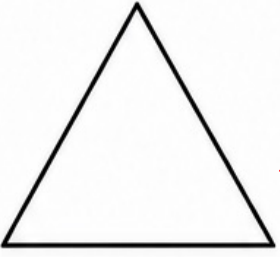
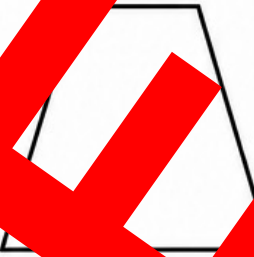
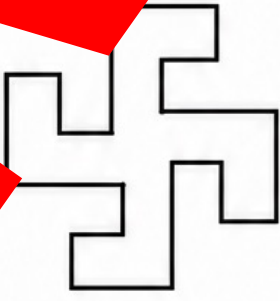
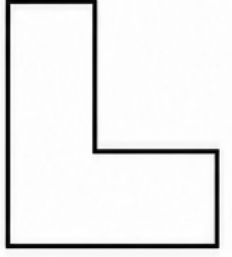
SYMMETRY CLASSIFICATION — PAGE 1

Name: _____

ANSWERS

Date: _____

Classify each shape as LINE ONLY, ROTATIONAL ONLY, BOTH or NEITHER. Record its number in the table.

1. 	2. 	3. 	4. 
5. 	6. 	7. 	8. 
9. 	10. 	11. 	12. 

LINE ONLY	ROTATIONAL ONLY	BOTH	NEITHER
<u>2, 6,</u>	<u>3, 7, 11</u>	<u>1, 5, 9</u>	<u>4, 8, 12</u>
_____	_____	_____	_____

13. Choose one shape and justify its classification.

Shape 3 has order 2 because it matches after 180° ,
 but no fold produces matching mirror halves.

SYMMETRY REASONING – PAGE 2

Name: _____

Date: _____

Write ALWAYS, SOMETIMES or NEVER. Give an example or explanation.

1. A shape with rotational symmetry also has line symmetry.

Decision: _____

2. A regular polygon has both line and rotational symmetry.

Decision: _____

3. A triangle has non-trivial rotational symmetry.

Decision: _____

4. A reflection changes a shape's size.

Decision: _____

5. Two shapes with order 2 have the same number of symmetry lines.

Decision: _____

6. A shape can have exactly one line of symmetry and order 2.

Decision: _____

TERMINOLOGY CHALLENGE

Consider this claim: "The degree of rotational symmetry of a square is 4."

SYMMETRY REASONING – PAGE 2

Name: ANSWERS

Date: _____

Write ALWAYS, SOMETIMES or NEVER. Give an example or explanation.

1. A shape with rotational symmetry also has line symmetry.

Decision: SOMETIMES

A square has both; a general parallelogram has rotational symmetry only.

2. A regular polygon has both line and rotational symmetry.

Decision: ALWAYS

A regular n-gon has n symmetry lines and rotational order n.

3. A triangle has non-trivial rotational symmetry.

Decision: SOMETIMES

An equilateral triangle has order 3; other triangles have order 1.

4. A reflection changes a shape's size.

Decision: NEVER

A reflection preserves size.

5. Two shapes with order 2 have the same number of symmetry lines.

Decision: SOMETIMES

A rectangle has 2 symmetry lines; a general parallelogram has 0. Both have order 2.

6. A shape with order 2 has exactly one line of symmetry and order 2.

Decision: NEVER

A half turn and one mirror line produce a second perpendicular mirror line.

TERMINOLOGY CHALLENGE

Consider the claim: "The degree of rotational symmetry of a square is 4."

The order is 4. Its smallest angle of rotational symmetry is 90°.

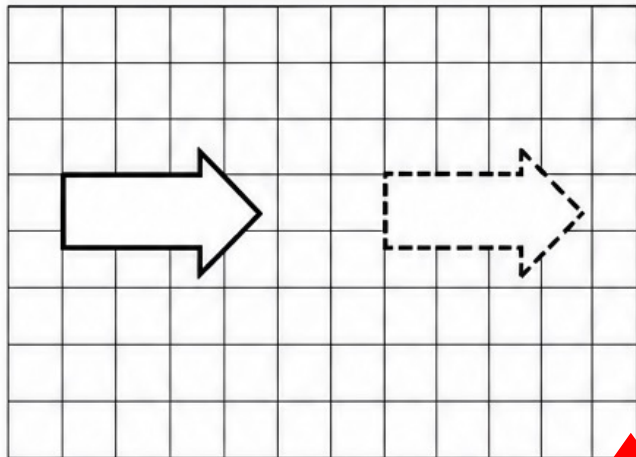
TRANSFORMATION DETECTIVE — PAGE 1

Name: _____

Date: _____

Identify each transformation. Then describe it precisely.

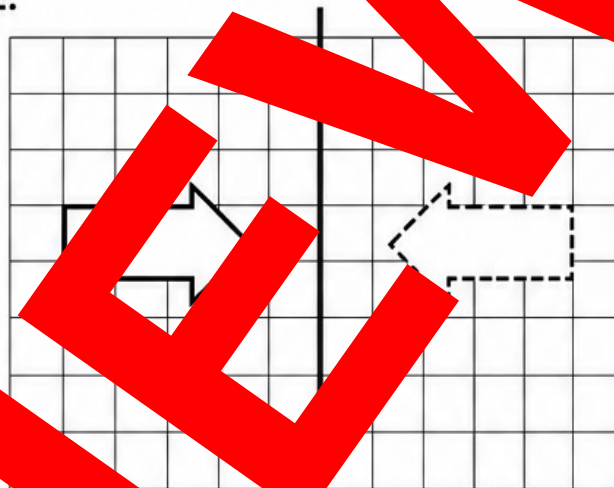
1.



TRANSLATION ☐ REFLECTION ☐ ROTATION ☐

Description: _____

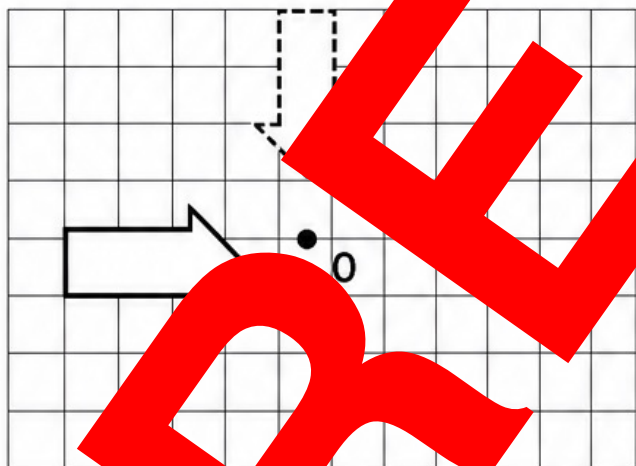
2.



TRANSLATION ☐ REFLECTION ☐ ROTATION ☐

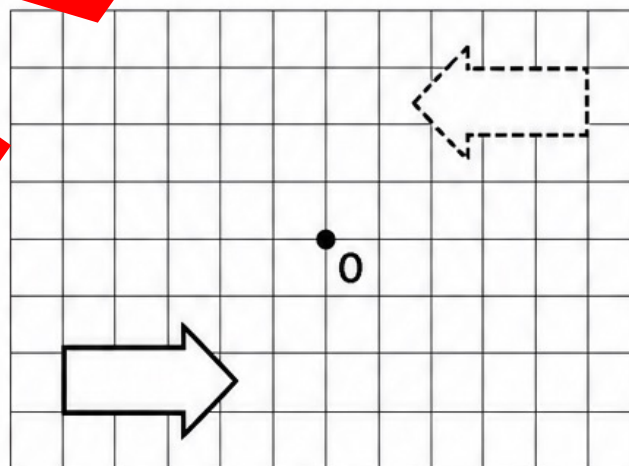
Description: _____

3.



TRANSLATION ☐ REFLECTION ☐ ROTATION ☐

Description: _____



TRANSLATION ☐ REFLECTION ☐ ROTATION ☐

Description: _____

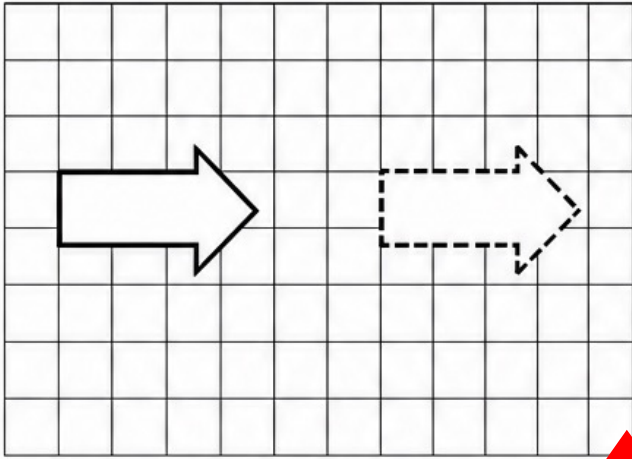
Two properties that stay the same in all four transformations.

TRANSFORMATION DETECTIVE — PAGE 1

Name: ANSWERS Date: _____

Identify each transformation. Then describe it precisely.

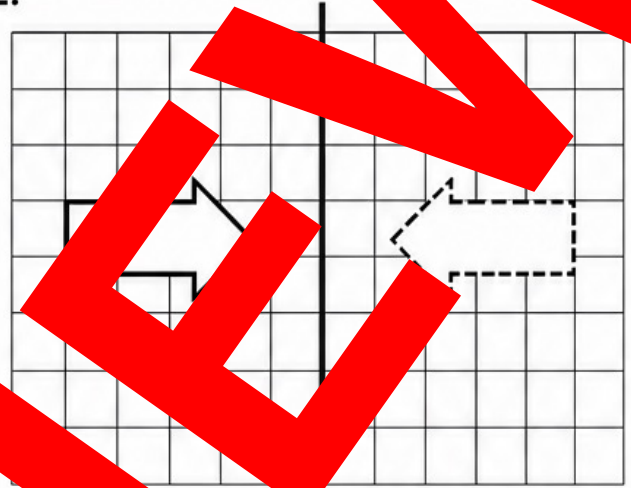
1.



TRANSLATION ☒ REFLECTION ☐ ROTATION ☐

Description: 6 squares right

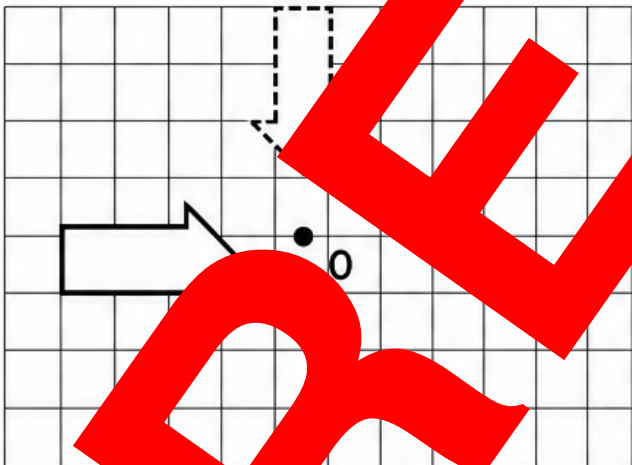
2.



TRANSLATION ☐ REFLECTION ☒ ROTATION ☐

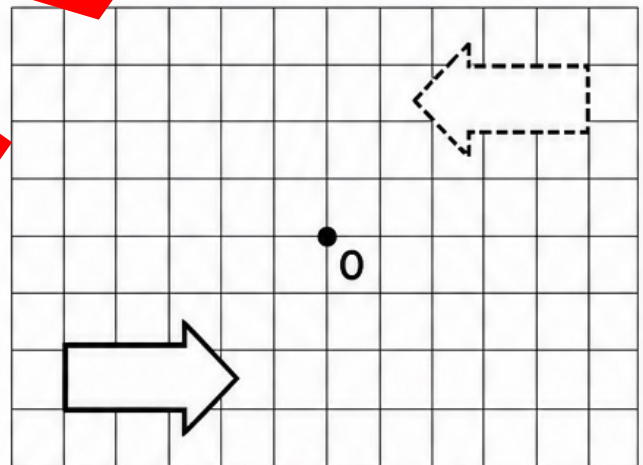
Description: across the vertical mirror line

3.



TRANSLATION ☐ REFLECTION ☐ ROTATION ☒

Description: 90° clockwise about O



TRANSLATION ☐ REFLECTION ☐ ROTATION ☒

Description: 180° about O

Two properties that stay the same in all four transformations.

Any shape, size, side lengths and angles.

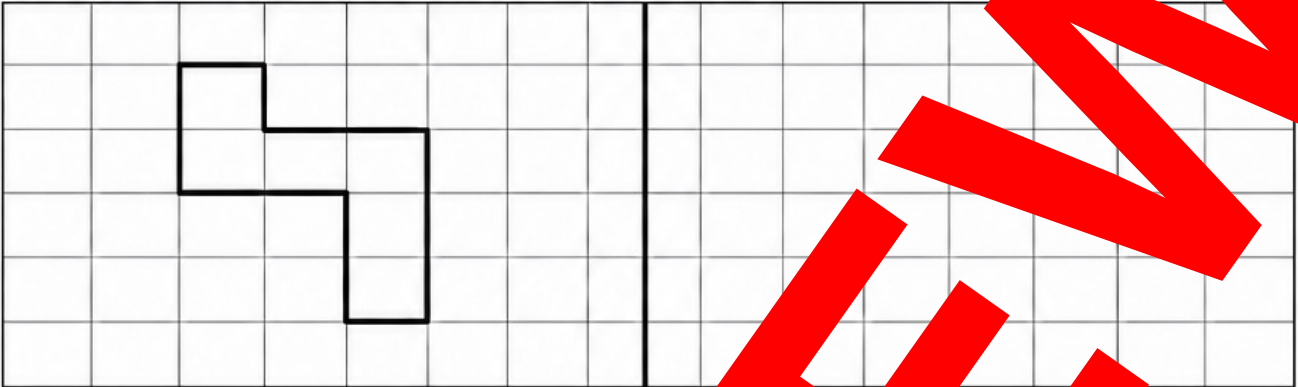
TRANSFORMATION DETECTIVE – PAGE 2

Name: _____

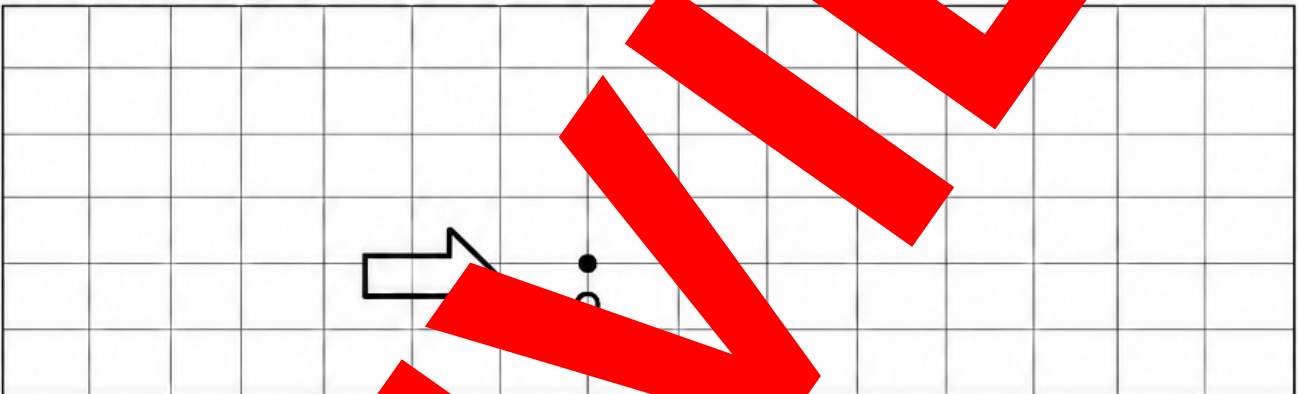
Date: _____

Draw each image accurately on the grid. Then explain your reasoning.

1. Reflect the polygon across the vertical mirror line.



2. Rotate the polygon 90° clockwise about point O.



3. Translate the polygon 3 squares right and 2 squares up.



4. Why do squares match itself after a 90° rotation?

5. Why does a non-square rectangle first match after 180°?

6. Why do scalene triangles need a full 360° turn to match?

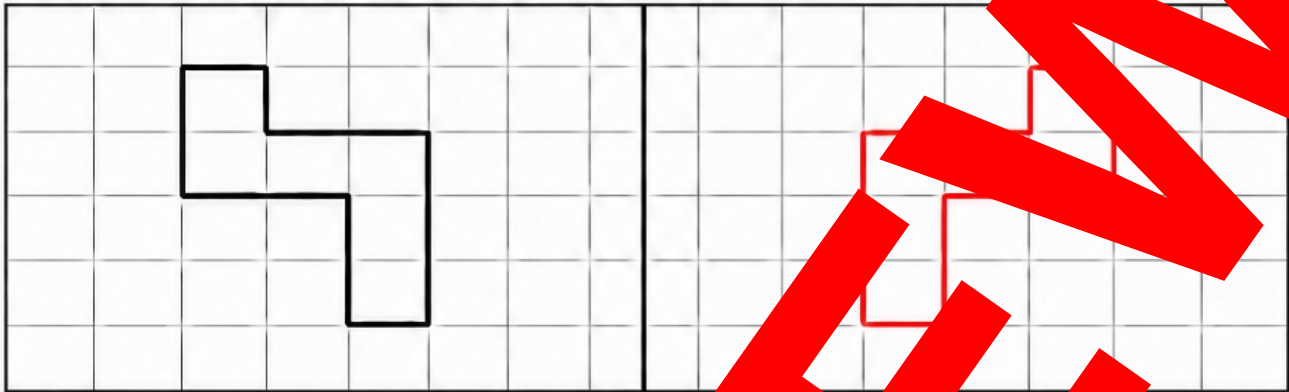
TRANSFORMATION DETECTIVE – PAGE 2

Name: ANSWERS

Date: _____

Draw each image accurately on the grid. Then explain your reasoning.

1. Reflect the polygon across the vertical mirror line.



2. Rotate the polygon 90° clockwise about point O.



3. Translate the polygon 3 squares right and 2 squares up.



4. Why do squares match itself after a 90° rotation?

Its four equal sides and angles occupy matching positions every quarter-turn.

5. Why does a non-square rectangle first match after 180°?

A quarter-turn swaps its unequal length and width, so it does not coincide until a half-turn.

6. Why does a scalene triangle need a full 360° turn to match?

Its unequal sides and angles cannot occupy matching positions before the starting position returns.

SYMMETRY DESIGN BRIEF

Name: _____

Date: _____

Design a square tile for a community garden path.

DESIGN CHECKLIST

☐ at least 2 lines of symmetry

☐ a clearly defined centre of rotation

☐ rotational order 4

☐ matching details in adjacent tiles



Number of symmetry lines: _____

Rotational order: _____

Smallest angle: _____

How can you prove your design works?

EXTENSION: Alter one feature so the design keeps rotational symmetry but has no line symmetry. Sketch the change on the back.

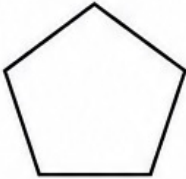
SYMMETRY DESIGN STUDIO — ASSESSMENT PAGE 1

Name: _____

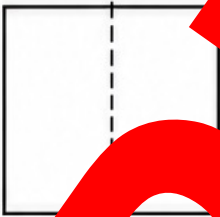
Date: _____

PART A — SYMMETRY FACTS

Complete the table.

SHAPE	DIAGRAM	LINES	ORDER
Square			
Regular pentagon			
Non-square rectangle			
General parallelogram			

PART B — APPLY AND EXPLAIN

5.  Is there a line of symmetry? Explain.

6.  Is there a line of symmetry? Explain.

7. A logo has rotational order 6. Calculate its smallest angle.

8. State properties that remain unchanged after a reflection or rotation.

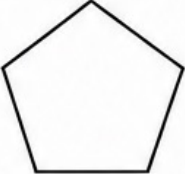
SYMMETRY DESIGN STUDIO — ASSESSMENT PAGE 1

Name: ANSWERS

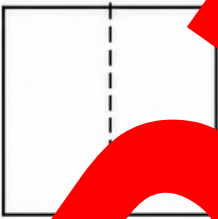
Date: _____

PART A — SYMMETRY FACTS

Complete the table.

SHAPE	DIAGRAM	LINES	ORDER	ANGLE
Square		4	4	90°
Regular pentagon		5	5	72°
Non-square rectangle		2	2	180°
General parallelogram		0	2	180°

PART B — APPLY AND EXPLAIN

5.  Is there a line of symmetry? Explain.
Yes. Reflection across the vertical line makes both halves coincide.
6.  Is there a line of symmetry? Explain.
No. The unequal length and width do not swap onto matching edges across a diagonal.
7. A logo has rotational order 6. Calculate its smallest angle.
 $360 \div 6 = 60^\circ$.
8. State properties that remain unchanged after a reflection or rotation.
Any two: shape, size, side lengths and angles.

SYMMETRY DESIGN STUDIO — ASSESSMENT PAGE 2

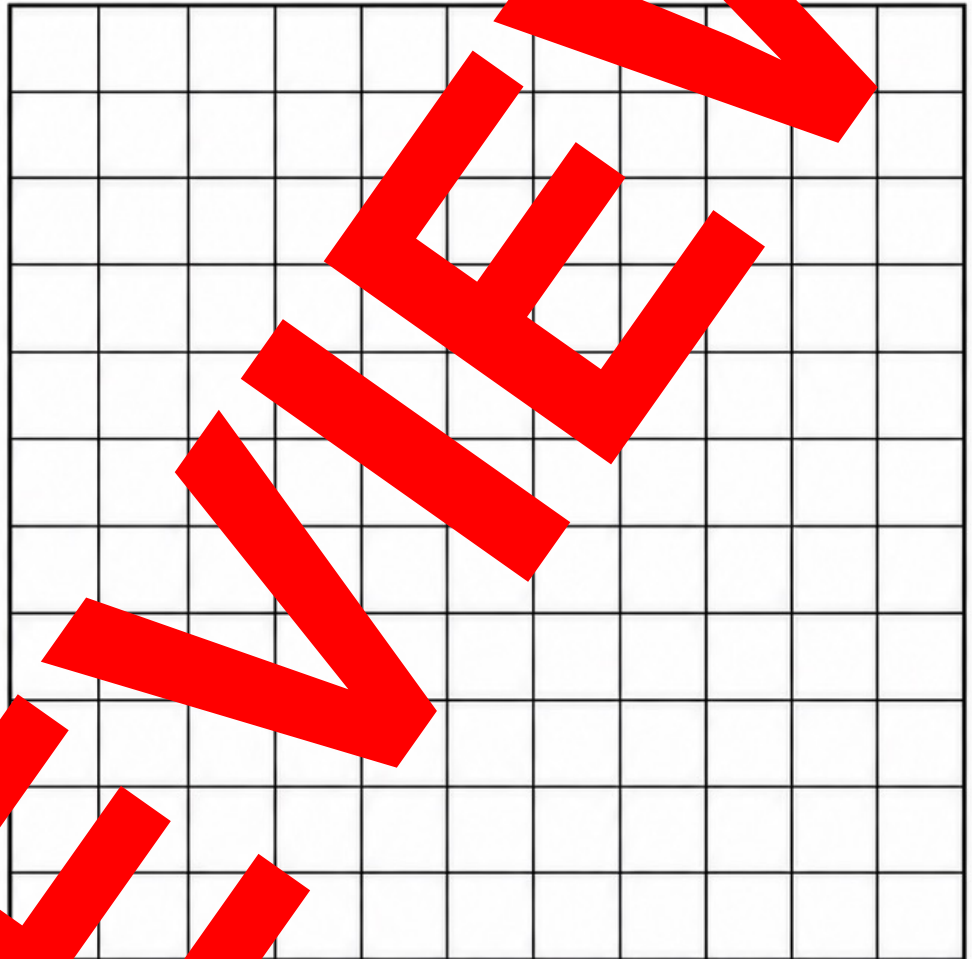
Name: _____

Date: _____

A community mosaic must look identical after every 90° turn.

YOUR DESIGN

- ☐ 1. Create a design on the 11 × 11 grid.
- ☐ 2. Show two perpendicular lines of symmetry.
- ☐ 3. Mark the centre of rotation O .
- ☐ 4. State the rotational order and smallest angle.
- ☐ 5. Describe what changes and what remains the same after a 90° turn.



Rotational order: _____

Smallest angle: _____

What changes and what remains the same after a 90° turn?

How do you prove that all four quarters match?

SYMMETRY DESIGN STUDIO — ASSESSMENT PAGE 2

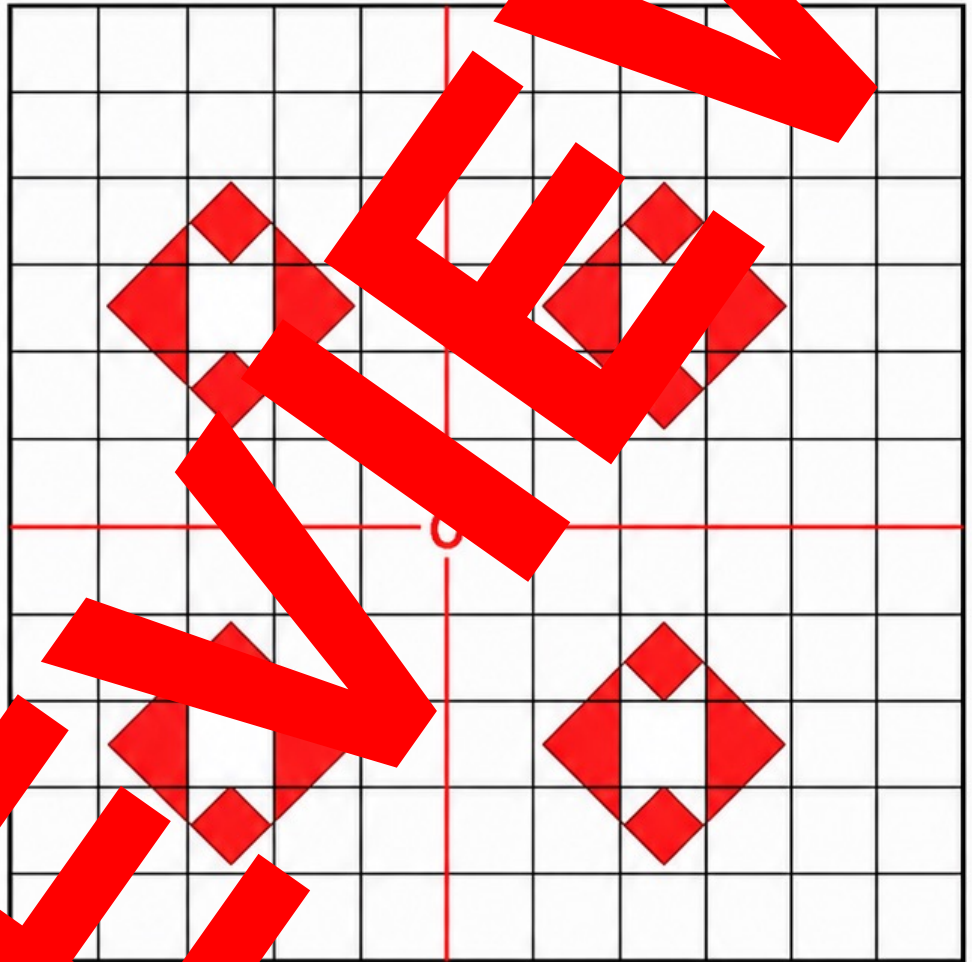
Name: ANSWERS

Date: _____

A community mosaic must look identical after every 90° turn.

YOUR DESIGN

- ☒ 1. Create a design on the 11×11 grid.
- ☒ 2. Show two perpendicular lines of symmetry.
- ☒ 3. Mark the centre of rotation O .
- ☒ 4. State the rotational order and smallest angle.
- ☒ 5. Describe what changes and what remains the same after a 90° turn.



Rotational order: 4

Smallest angle: 90°

What changes and what remains the same after a 90° turn?

Position and orientation may change. Shape, size, lengths and angles stay the same.

How do you prove that all four quarters match?

Reflection across either marked line and rotating 90° about O maps every square and motif onto an identical position.

LINE AND ROTATIONAL SYMMETRY RUBRIC

Student:

Date:

CRITERIA	BEGINNING	DEVELOPING	ACHIEVING	CONFIDENT	EXCEEDING
1. Identifies line symmetry	Needs support to identify line symmetry in familiar shapes.	Identifies some line symmetry in familiar shapes.	Accurately identifies and draws symmetry lines.	Explains why proposed lines do or do not work.	Generalises line symmetry across complex designs.
2. Determines rotational order and angle	Needs support to recognise and matching transformations.	Recognises order or angle in simple shapes.	Finds order and smallest angle accurately.	Uses $360^\circ \div$ order and justifies results.	Compares and reasons about unfamiliar designs.
3. Performs and describes transformations	Needs support to copy a transformation.	Performs a simple rotation or reflection.	Accurately performs and describes transformations.	Uses precise direction, angle, line or centre.	Combines transformations and predicts images.
4. Explains change and invariants	Names few relevant properties.	Recognises that shape or size stay the same.	Explains change in position or orientation and invariants.	Understands side lengths and angles as invariants.	Builds a clear general argument using invariants.
5. Designs and justifies a symmetrical pattern	Creates a partial pattern with support.	Creates a pattern with one stated symmetry.	Creates a valid pattern and states its symmetries.	Understands lines, angles and centre.	Adapts constraints while preserving chosen symmetry.

Overall achievement:

Teacher feedback:

Line and Rotational Symmetry



Line and Rotational Symmetry Quiz

