VISIT MATH

Co-funded by the European Union

Symmetry

Topic	Geometry
Learning objectives	Drawing symmetry, recognising different types of symmetries
Age group	10-14 years
Estimated duration	1 hour
Activities	Recognising different types of symmetries
Related visits	Paris, Tournai, Tourcoing/Roubaix, Warsaw Old Town, Montauban

Previous knowledge required

Types of symmetries

Step by step : the sequence in the classroom

Step 1: Introducing the topic

Short presentation of the heritage elements in this sequence

Symmetry is a fascinating concept that transcends the boundaries of mathematics and permeates every facet of our world.

And where better to witness the captivating aspects of symmetry than in the realm of architecture?

From ancient civilizations monuments to modern skyscrapers, symmetry weaves its magic, transforming mere structures into captivating works of art.

Links between these elements and math topics

Architects and mathematicians have been using symmetry in architecture for centuries. Indeed, not only does symmetry please the eye, but it is also a mathematical principle that allow for sound buildings.

Beyond architecture, symmetry in everyday life objects, as the pedagogical sequence will show below.

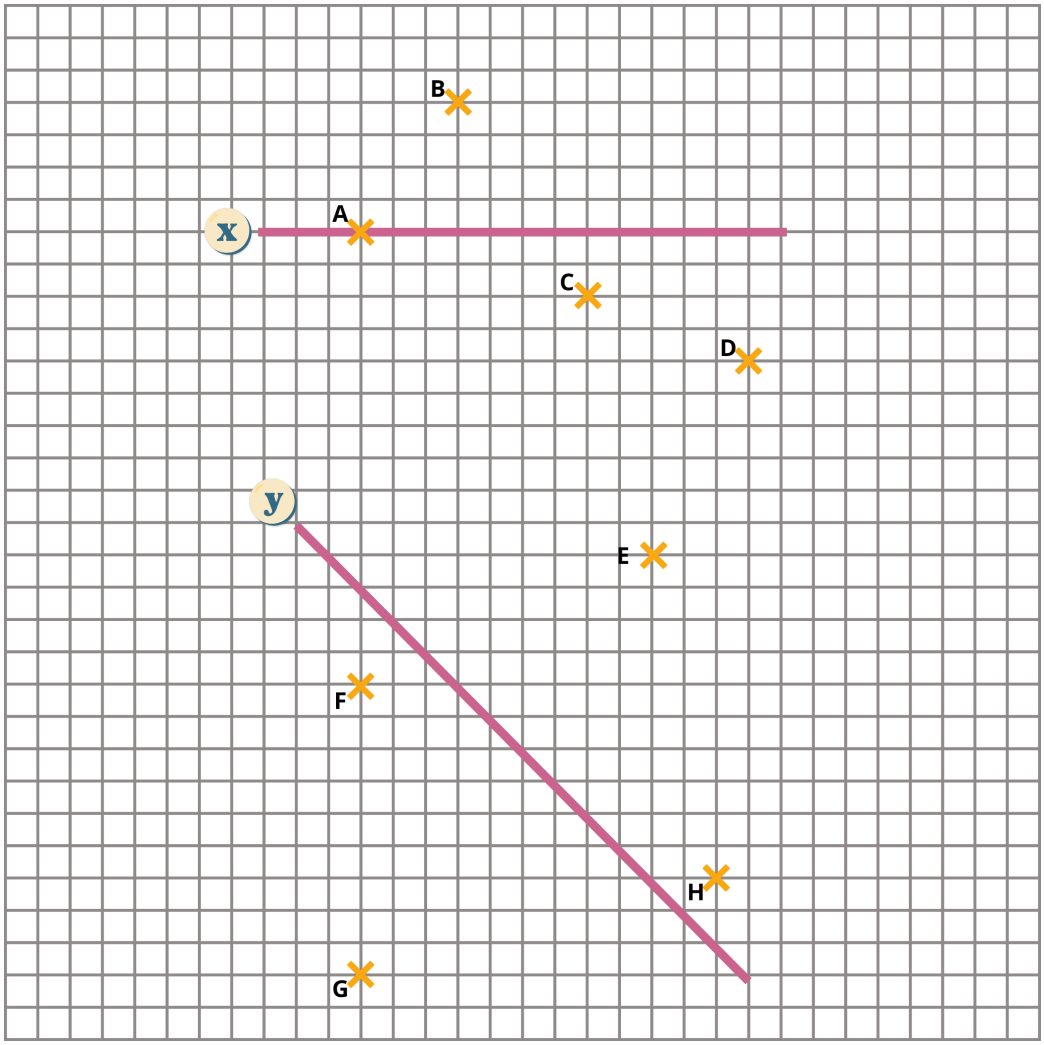
Step 2: Class activities

Draw the symmetries

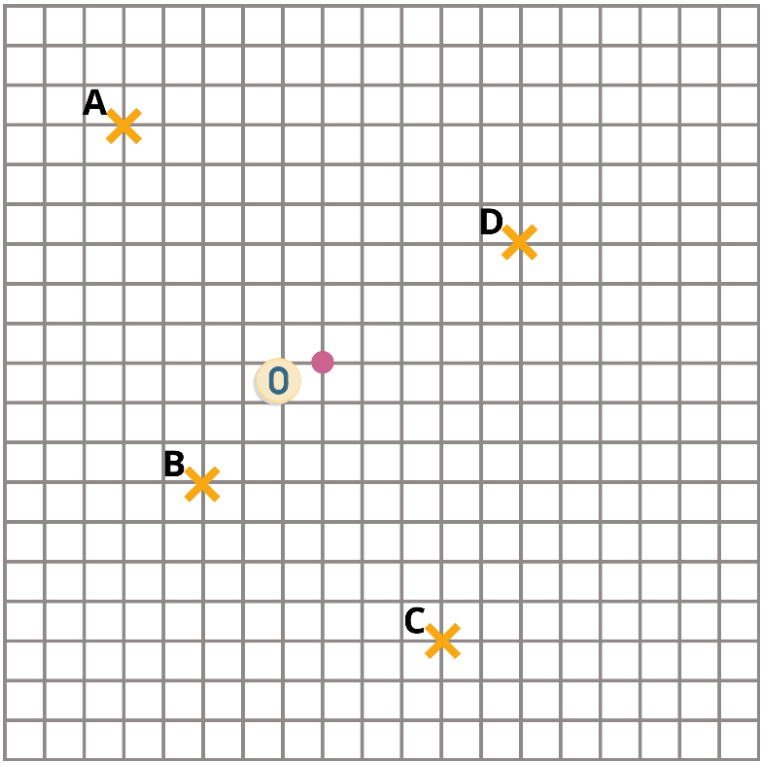
The three following exercises will train students to be able to draw axial and central symmetries. Indeed, the aim is for them to practice applying a symmetry through an axis and through a centre.

1. Draw the points A', B', C' and D', respective symmetries of A, B, C and D with respect to line *x*.

2. Draw the points E', F', G' and H', respective symmetries of E, F, G and H with respect to line *y*.



3. Draw the points A', B', C' and D', respective symmetries of A, B, C and D with respect to the centre O.

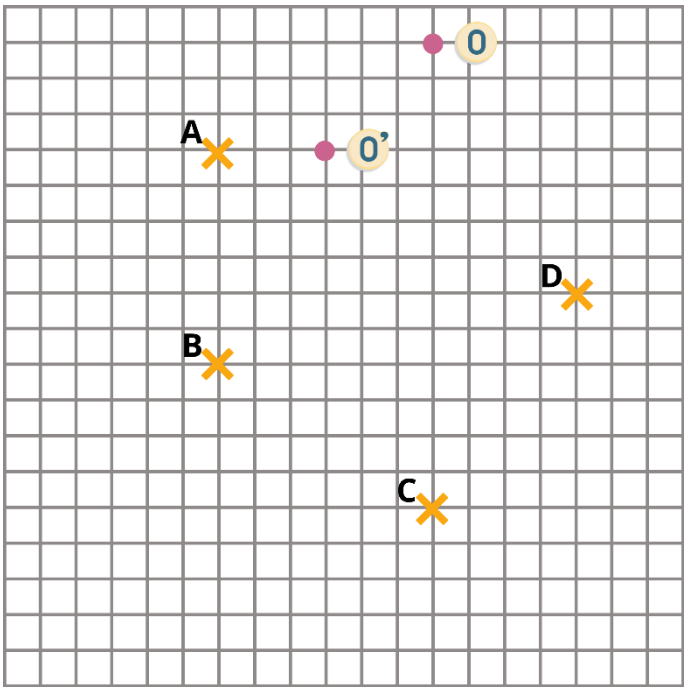


To go further

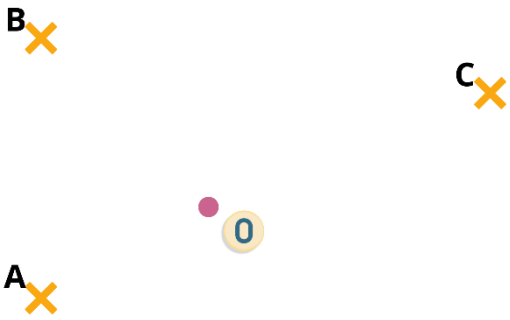
The following exercise goes further by applying a symmetry and afterwards a translation. Therefore, students should be familiar with the concept of "vector". By vector we mean "a quantity that has magnitude and direction and that is commonly represented by a directed line segment whose length represents the magnitude and whose orientation in space represents the direction" (Merriam-Webster).

4. Draw the points A', B', C' and D', respective symmetries of A, B, C and D with respect to the translation transforming O in O'.

First, students should apply the translation transforming O in O'. Then, by using the vector they traced, they can draw the symmetries of A, B, C and D.



To go even further



5. Draw the point A', symmetry of A.
Use the centre of rotation O with an angle of 40° in a clockwise direction.

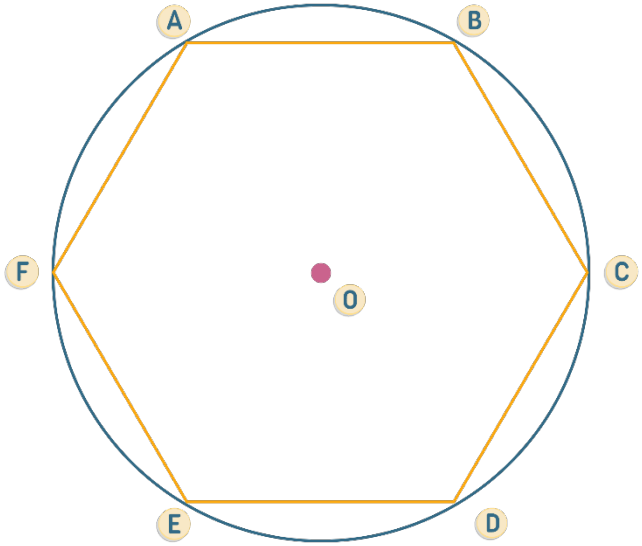
6. Draw the point B', symmetry of B.
Use the centre of rotation O with an angle of 100° in a clockwise direction.

7. Draw the point C', symmetry of C.
Use the centre of rotation O with an angle of 120° in a clockwise direction.

Before answering the following questions, here are two notions students should be familiar with:

- **Image of a point:** "A transformation where a point appears an equal distance on the other side of a given line - the line of reflection" (Math Open Reference – Reflection of a point).
- **Segment:** "A straight line which links two points without extending beyond them" (Math Open Reference – Line segment definition).

11. Look at the shape and answer the following questions.



a) The image of point F by the axial symmetry of axis BE is .....

b) The image of segment [AB] by central symmetry of centre O is .....

c) The image of point E by the translation applying point F on point O is .....

d) The axis of symmetry applying triangle AOF on triangle COD is .....

Step 3: Homework and development ideas

Whether in our homes, at school, in parks or even in the streets, symmetry surrounds us. What better way to study it than to apply it to our everyday objects then?

Draw symmetry centres, axis and vectors

Here are real life examples of symmetries.

8. Draw the centre of the central symmetry.

9. Draw the axis of the axial symmetry.

10. Draw the vector of the translation symmetry.

Types of Symmetries

Axial and central symmetries may appear as obvious when thinking about symmetry in general. Nevertheless, one may also take into account different types of symmetry, such as rotational, translational and glide reflection symmetry.

Here is how to differentiate them:

Axial Symmetry: Also known as line symmetry, it occurs when an object can be divided into two equal halves along a line. The two halves are mirror images of each other.

Central Symmetry: It occurs when an object looks the same when rotated by 180 degrees around a central point. The central point is called the centre of symmetry.

Rotational Symmetry: This type of symmetry occurs when an object can be rotated by a certain angle (less than 360 degrees) around a central point and still appear the same.

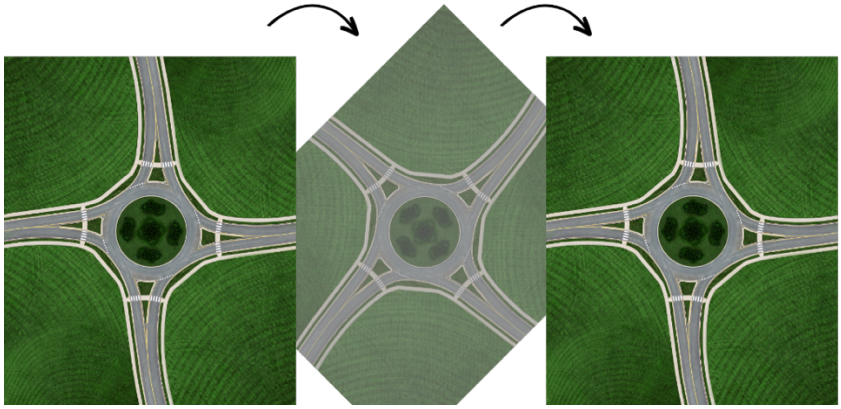
Translational Symmetry: It refers to the symmetry exhibited by an object when it can be translated or shifted along a specific distance without changing its overall appearance. This symmetry is often observed in repeating patterns, such as tiled floors or wallpapers.

Glide Reflection Symmetry: This symmetry combines a reflection and a translation. It occurs when an object can be reflected and then translated parallel to the reflection plane, resulting in the same object.

With this in mind, here are real life examples of those types of symmetries.

12. Identify the type of symmetry. Thick the correct answer.

- ☐ Axial symmetry
- ☐ Rotational symmetry
- ☐ Translational symmetry
- ☐ Glide reflection symmetry
- ☐ Central symmetry



- ☐ Axial symmetry
- ☐ Rotational symmetry
- ☐ Translational symmetry
- ☐ Glide reflection symmetry
- ☐ Central symmetry

- ☐ Axial symmetry
- ☐ Rotational symmetry
- ☐ Translational symmetry
- ☐ Glide reflection symmetry
- ☐ Central symmetry

- ☐ Axial symmetry
- ☐ Rotational symmetry
- ☐ Translational symmetry
- ☐ Glide reflection symmetry
- ☐ Central symmetry

- ☐ Axial symmetry
- ☐ Rotational symmetry
- ☐ Translational symmetry
- ☐ Glide reflection symmetry
- ☐ Central symmetry

References:

3e – Transformations: Symétries, translation et rotation. (2016). Retrieved 21 June 2023, from https://www.clg-hauts-de-plaine.ac-aix-marseille.fr/spip/sites/www.clg-hauts-de-plaine/spip/IMG/pdf/3eme_feuille_ex_symetrie_translation_rotation.pdf

CueMath. *Symmetry*. (n.d.). Retrieved 27 June 2023, from https://www.cuemath.com/geometry/symmetry/

Enseignement.be. (n.d.). *Les épreuves du CE1D de mathématiques*. Retrieved 21 June 2023, from http://www.enseignement.be/index.php?page=26835&navi=3451

Math Open Reference. (n.d.). *Line Segment Definition*. Retrieved 27 June 2023, from https://www.mathopenref.com/linesegment.html

Math Open Reference. (n.d.). *Reflection of a point*. Retrieved 27 June 2023, from https://www.mathopenref.com/reflectpoint.html

Merriam-Webster. (n.d.). *Vector definition & meaning*. Retrieved 27 June 2023, from https://www.merriam-webster.com/dictionary/vector.

VISIT MATH

Co-funded by the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Project code: 1-FR01-KA220-SCH-00027771

Learn more about Visit Math at: https://visitmath.eu

FERMAT SCIENCE
Une autre idée des maths

5th High School
Agrinio · Greece

ISTITUTO STATALE "E. MONTALE" PONTEDERA

LogoPsyCom

ZS 31

YuzuPulse