
Concept/s in Focus:
- A transformation that leaves a shape unchanged, but its orientation or location changed is called a rigid transformation.
- An object that remains unchanged after a transformation has symmetry
- Reflection symmetry occurs when shapes are reflected across a line of symmetry. The reflected shape is a mirror image of the original shape and will be the same distance from the reflection line.
- 2D shapes with reflection symmetry have a line of symmetry or reflection line

Introduction / Teacher Background Information:
Objects that have symmetry are appealing to the eye and create a sense of balance and proportion. Symmetry occurs frequently in nature and the built environment. There are three basic types of symmetry where the orientation or location of a shape or object is transformed but the shape or object remains unchanged. The most commonly recognised example of symmetry is line or reflection symmetry where a shape or design is reflected across a line in a way that both sides are the same but appear as mirror images. This lesson investigates line symmetry in an informal way and has students identify line symmetry in the environment around them and in images available online. The concept of symmetry as the same measure from the line of reflection is explored in more detail in further LTD lessons. In this lesson students will create images that are the same on both sides of a line that is provided rather than identifying the actual line of symmetry. Activities will connect with art activities to create symmetrical pictures and designs.

Australian Curriculum links: ACMMG066

Resources:
Whole Class Activity:
- Access to the internet and a method to project images
- A metre ruler or similar length straight edge for showing lines of symmetry on projected images.
- Access to a digital camera / iPad

Hands-On Activity:
- 1 copy of the Line Symmetry in the Environment Activity per student.
- A roll of Tracing paper e.g. kitchen baking paper
- Dark, soft pencils e.g. 3B or similar (HB will work but not as easily) per student.

Independent Activity:
- 1 copy of the Line Symmetry in the Environment Worksheet per student
- Colouring pens/pencils
Whole Class Activity:

- **Preparation:** Search the internet for examples of images that have line symmetry e.g. searching for ‘Symmetry in Photography’, ‘Symmetry in the Environment’, ‘Symmetry in Real Life’, ‘Symmetry in Aboriginal Art’ and choosing images will have many examples. Images can be selected and placed in a PowerPoint presentation for ease of access if desired.

- Gather the class in an area where images from the internet can be projected – ideally projected onto a whiteboard so a line of symmetry can be drawn on images projected but if not a metre ruler or similar straight edge implement can be used.
- Choose an image and project it where the students can see it.

? What do you notice about this picture?

- Accept descriptions and comments from a number of students about the image.
- Listen for mention of the image being the same on both sides.

? What do you mean ‘on both sides’… both sides of what?

- Listen for mention of the line of symmetry (but don’t expect the students to use the word symmetry necessarily)
- If the image is projected onto a surface where a line can be drawn draw the line of symmetry guided by the students who identified it.
- If the image can’t be drawn on, show the line of symmetry using an object with a straight edge e.g. a metre ruler.
- Continue to show other images and for each image have the class describe the image and invite a student to draw or show the line that divides the two sides of the image that are the same. Describe the line as the ‘line of symmetry’ or ‘line of sameness’ if an informal description might help the students understand the term.
- Choose some images where the line of symmetry is vertical and some where it is horizontal. If diagonal examples can be found, show these as well e.g. look at images of Aboriginal art. Choose images that are examples from nature as well as images from the built environment e.g. buildings that have line symmetry.

? What do you notice about the line of symmetry in this picture? (It goes the other way / is vertical / horizontal)

- Once it the students have a grasp of symmetry and the line of symmetry, take them outside into the playground / area around the school on a ‘Symmetry Hunt’. Take a digital camera or ipad to take photos of examples of symmetry around the school that can be printed and used in the classroom as a display or to find and draw the lines of symmetry on. Look for examples in the buildings and in plants and perhaps animals e.g. ants that might be around.
- If the school has a number of digital cameras / ipads the students can be in charge of finding and photographing examples themselves.
- Bring the class back inside and project some clear examples of symmetry and identify the line of symmetry on the pictures by drawing them or showing them with a straight edge.
- Some images are likely to have more than one line of symmetry. Follow this line of discussion if the students notice it. If it is not noticed that is fine for this introductory lesson.

- As an extra / extension activity, students could be set on a Symmetry Hunt at home as a homework task. Students can find examples of line symmetry at home and take photos that can either be printed and brought in to share or emailed to class for examination and discussion.
Hands On Activity:

- This section of the lesson involves an activity that could be done by the whole class or in small groups as one or two rotation activities.

- Provide each student with a copy of the Line Symmetry in the Environment Activity page and provide them with a piece of tracing paper about the size of an A4 piece of paper cut into quarters and a dark soft pencil.

- This page provides half an image for 4 different pictures – 3 that have a vertical line of symmetry and 1 that has a horizontal line.

**What do you notice about all the pictures on this page?** (There is only half of each picture)

*What do you think you might be going to do in this activity?*

- Listen for mention of drawing the other half of the picture.

*Do you think drawing the other side will be easy or hard? How could the other piece of paper I gave you help? What do you notice about this other piece of paper? Put it on top of one of the pictures on your page. What do you notice?*

- Assist the students to see that they can see the image through the tracing paper.

*Your job is to trace the side of the picture you can see on the page.*

- Demonstrate how to use the tracing paper to trace main parts of the image including some of the design on the inside, not just the outline. Be sure to trace the centre line as well so the traced image can be aligned for drawing the other side.

*How will I use this tracing of the picture to help me draw the other side?*

- Listen for mention of flipping the traced image over.

- Show the students that by flipping the traced image over and aligning the central line of symmetry the image starts to look complete.

- Set the students to work with the tracing paper to trace one of the images on their page.

- They may need to work with a partner to help hold the tracing paper and complete the tracing.

- Move around the room assisting the students to manage the tracing activity.

- When students have traced the image, demonstrate how to flip it over and align it with the line of symmetry.

- By using the dark, soft pencils the graphite used should transfer to the worksheet page by having the students draw over the traced lines from the back of the paper and pressing quite hard.

- Assist students who need help to make the tracing work or to keep the image and the tracing aligned.

- When the students have an idea of how to transfer the image to the tracing paper and back onto the original page in reverse to complete the process they can be left to experiment with completing the four images on the page. It doesn't matter how accurate or how well formed the resulting pictures are. The concepts about symmetry and flipping shapes over a line will be well practised.

- When the opposite side of an image has been traced and transfferred, student can work to complete the drawing and colour the new side so the image is a symmetrical picture.

- Students could work on all 4 images or they could work on one and the others can be kept for follow up activities, revision or rotation activities.
Independent Activity:

- Provide each student with a copy of the Line Symmetry in the Environment Worksheet.
- This worksheet uses grids to guide the students to create symmetrical designs which will be easier than the activity in the previous section of the lesson where the images were drawings.
- Students will need access to colouring pens/pencils for this activity.
- If the worksheet can be printed in colour the students can copy the colours as well as the positioning of each square to complete the symmetrical design. If the page is copied in black and white the tones of colours in the original should copy as different shades of grey. The students can choose their own colours to use to make both sides of the design symmetrical.

¿What do you notice about the design at the top of your page?

- Listen for recognition of the line and there being only half the image.

¿Your task is to make the other side of this design the same so the whole picture has symmetry. Use colour to show how the design is symmetrical?

- Set the students to work and move around the room watching how they manage to work out which colour and which squares to colour in particular positions. Look for students who use counting to ensure a square is coloured in a matching position. This is an important concept with symmetry (that it actually means same measure). This is not a focus in this lesson but will be in another lesson later in the Transformations sequence.
- Assist students who are not sure of what the task is asking them to do. Help them get started and then let them work it for themselves.
- Ask questions to identify student understandings e.g.

¿How are you going to work out which squares on this side you will colour in and which ones you won’t?

- When student complete the top activity on the page they can create a symmetrical design of their own choice on the grid below.
- Observe how they arrange the squares to complete a symmetrical design.
- When the designs are complete, students can share their creations and they can be displayed around the classroom.

Understandings to look for:

- Students who understand that a line of symmetry divides an image or object into two sections that are mirror images of each other.
- Students who can identify a line of symmetry in an image.
- Students who can complete an image that has a line of symmetry by paying attention to placement of parts of the image on both sides of the line.