

7.3 Reflections

GOAL

Explore the properties of reflections of 2-D shapes.

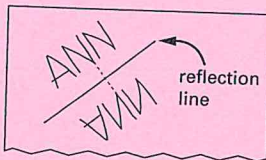
- You will need**
- centimetre grid paper
 - a ruler
 - a transparent mirror
 - a protractor

Learn about the Math

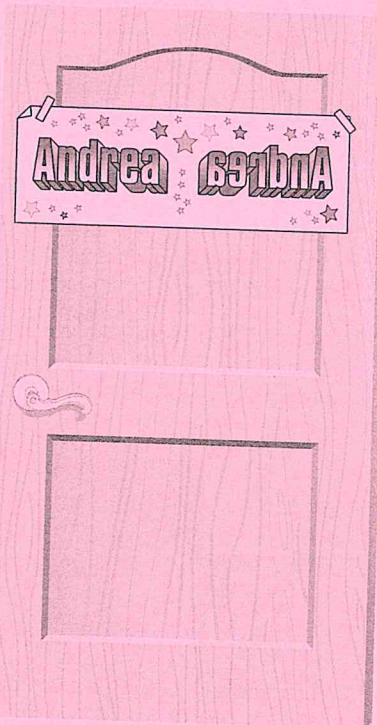
Andrea is decorating the door of her room.

? How can you draw the reflection of your name without a mirror?

- On a piece of paper, print your name in capital letters on a slant.
- Draw a reflection line that is not horizontal or vertical.



- Use a transparent mirror to trace the image of your name.
- Connect three different points on your name with their image points.
- Use a ruler and a protractor to draw a more accurate reflection image of your name.



Reflecting

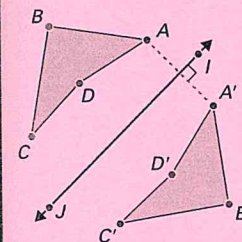
- How does the size and shape of a reflected image compare with the size and shape of the pre-image?
- What do you notice about the distances on each side of the reflection line?
- What do you notice about the angle between the reflection line and the line segments you drew?
- Why does using a ruler and protractor allow you to draw a more accurate reflection image?

Work with the Math

Example 1: Constructing a reflected image

Reflect quadrilateral $ABCD$ in reflection line IJ .

James's Solution



I drew a line segment from point A , perpendicular to IJ , and continued my line segment beyond IJ . I measured the distance from A to IJ along my line segment. I measured the same distance on the other side of IJ , and labelled the point A' .

I used this method to find the other three image vertices.

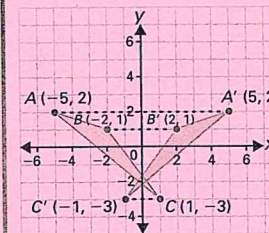
I joined A' , B' , C' , and D' to form the image. I noticed that the orientation of the image is opposite to the orientation of the pre-image.



Example 2: Drawing a reflected image using coordinates

Reflect $\triangle ABC$ in the y -axis.

Simon's Solution



A is 5 units to the left of the y -axis, so the image point A' is 5 units to the right of the y -axis at $(5, 2)$.

B is 2 units to the left of the y -axis, so the image point B' is 2 units to the right of the y -axis at $(2, 1)$.

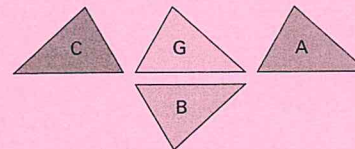
C is 1 unit to the right of the y -axis, so the image point C' is 1 unit to the left of the y -axis at $(-1, -3)$.

I joined the image points to form the image $\triangle A'B'C'$.

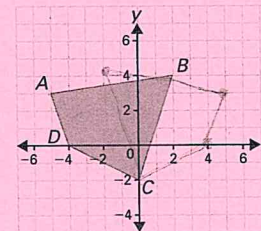


A Checking

- Which of figures A, B, and C is not a reflection of figure G? Explain.

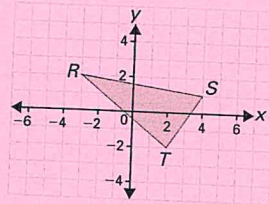


- Reflect quadrilateral $ABCD$ in the y -axis. Determine the coordinates of the image quadrilateral.



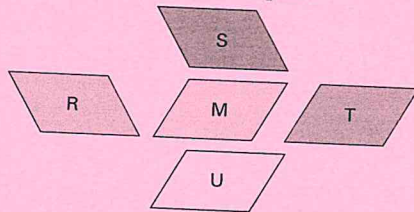
Per 1 + 5

6. b) Reflect $\triangle RST$ in the x -axis. Determine the coordinates of the image triangle.

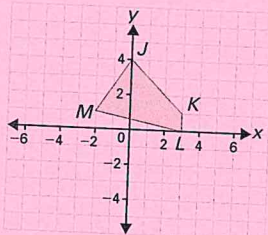


B Practising

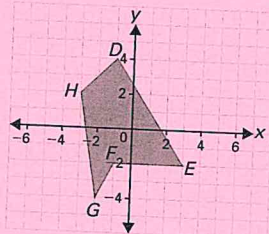
7. Which of figures R, S, T, and U are not reflections of figure M? Explain.



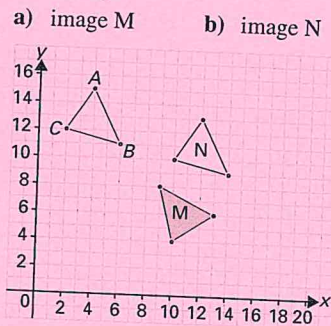
8. a) Reflect quadrilateral $JKLM$ in the x -axis. Determine the coordinates of the image.



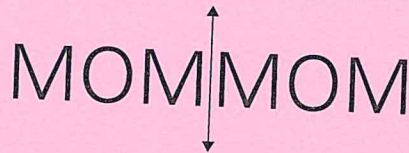
- b) Reflect pentagon $DEFGH$ in the y -axis. Determine the coordinates of the image.



9. Triangles M and N are images of $\triangle ABC$. Describe the transformation(s) that created each image.



10. The word MOM is a **palindrome**. This means that it is the same word when it is read backward. As well, MOM is the same word when it is reflected in a vertical line.



- a) Write the longest three words you can think of that are the same when they are reflected in a vertical line.
b) Must these words also be palindromes? Explain.

11. The word BOB is also a palindrome. As well, it is the same word when it is reflected in a horizontal line.



- a) Write the longest three words you can think of that are the same when they are reflected in a horizontal line.
b) Must these words also be palindromes? Explain.

12. The vertices of $\triangle ABC$ have coordinates $A(-3, 0)$, $B(1, 3)$, and $C(2, -1)$. Determine the coordinates of the image of $\triangle ABC$.

- a) after a reflection in the y -axis
b) after a reflection in the x -axis

13. Figure X is the image of figure W.

- a) Can you tell whether figure W was translated or reflected? Explain.



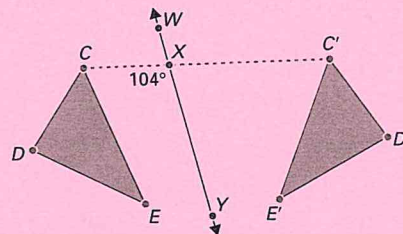
- b) Sketch the shapes in part (a). Label the vertices so that figure X is a reflection of figure W.

14. a) Use centimetre grid paper to draw a trapezoid. Label the trapezoid $WXYZ$.

- b) Draw a reflection line so that W' (the image point of vertex W) is 6 cm from W . Draw the reflected image of $WXYZ$, and label it $W'X'Y'Z'$.

- c) What is the distance from W to the reflection line?

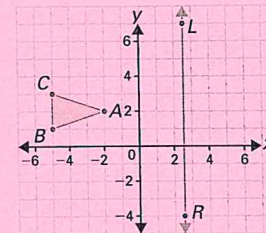
15. The reflected image of $\triangle CDE$ is $\triangle C'D'E'$. Is line segment WY the reflection line? Explain, giving at least two reasons for your answer.



16. Determine the greatest four-digit number that is a lesser number when you reflect it in a vertical line.

C Extending

17. a) Reflect $\triangle ABC$ in the y -axis to produce the image $\triangle A'B'C'$.



- b) Reflect $\triangle A'B'C'$ in the line LR to produce the image $\triangle A''B''C''$.
c) Determine the coordinates of $\triangle A''B''C''$.
d) Is there a single transformation that moves $\triangle ABC$ to the image $\triangle A''B''C''$? If so, describe the transformation. If not, explain why not.
e) Will the result in part (d) be true for reflections in every pair of parallel lines? Write a hypothesis, and explore it using a number of examples.

18. The vertices of $\triangle ABC$ have the coordinates $A(-2, 0)$, $B(0, 0)$, and $C(0, 3)$. Draw a line through the points $S(-3, 3)$ and $T(3, 3)$.

- a) Reflect $\triangle ABC$ in the y -axis. Then reflect the resulting image in the line ST . Determine the coordinates of the final image triangle.
b) Reflect $\triangle ABC$ in the line ST . Then reflect the resulting image in the y -axis. Determine the coordinates of the final image triangle.
c) Compare your results in parts (a) and (b). If you apply two reflections, one after the other, does the order in which you apply them matter? Write a hypothesis, and explore it using several examples.