

7.3

Reflections



GOAL

Explore the properties of reflections of 2-D shapes.

You will need

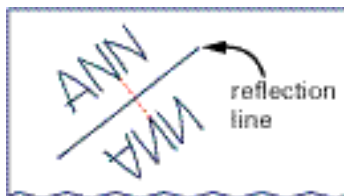
- centimetre grid paper
- a ruler
- a transparent mirror
- a protractor

Learn about the Math

Andrea is decorating the door of her room.

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

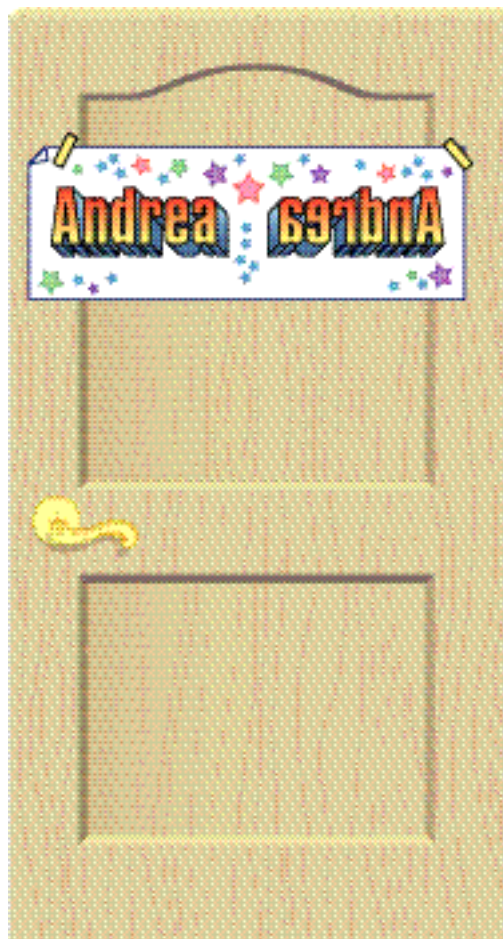
- On a piece of paper, print your name in capital letters on a slant.
- Draw a reflection line that is not horizontal or vertical.



- 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?

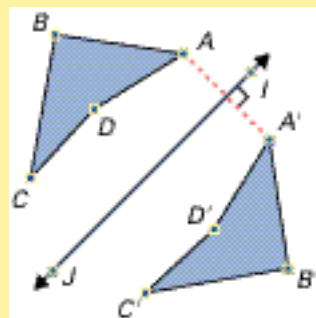


Work with the Math

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.

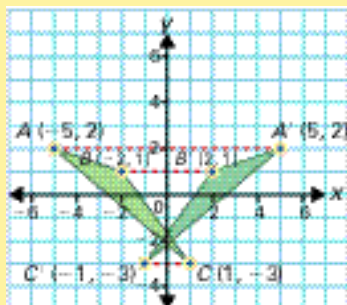
I joined A' , B' , C' , and D' to form the image. I noticed that the orientation of the image is opposite to the orientation of the pre-image.



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 $(2, 1)$.

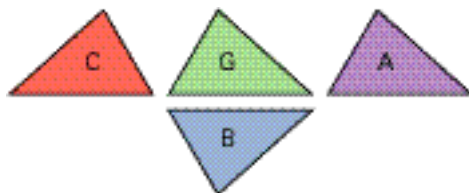
C is 1 unit to the right of the y -axis, so the image point C' is 1 unit to the left of the y -axis at $(-1, -3)$.

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

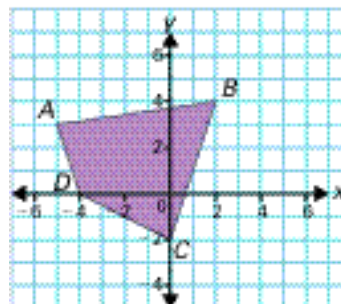


A Checking

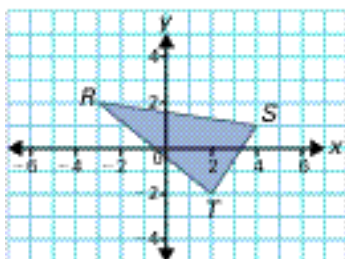
5. Which of figures A, B, and C is not a reflection of figure G? Explain.



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

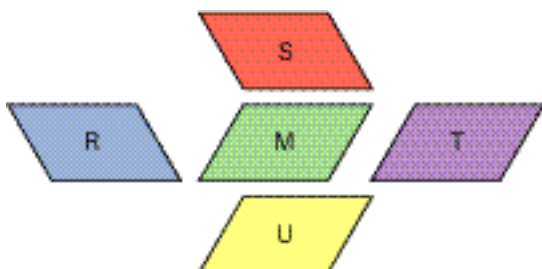


6. b) Reflect $\triangle RST$ in the x -axis. Determine the coordinates of the image triangle.

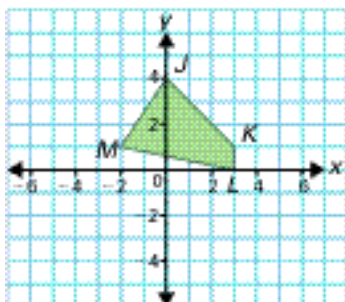


B Practising

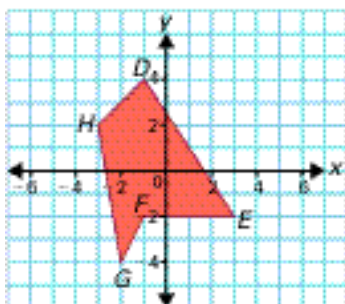
7. Which of figures R, S, T, and U are not reflections of figure M? Explain.



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

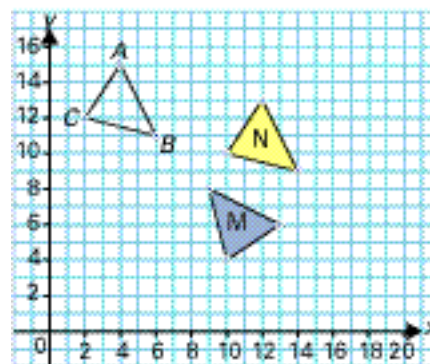


- b) Reflect pentagon $DEFGH$ in the y -axis. Determine the coordinates of the image.



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

a) image M b) image N



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.



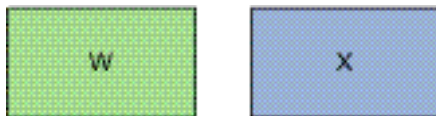
- a) Write the longest three words you can think of that are the same when they are reflected in a horizontal line.
- b) Must these words also be palindromes? Explain.

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 $\triangle ABC$.

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

13. Figure X is the image of figure W.

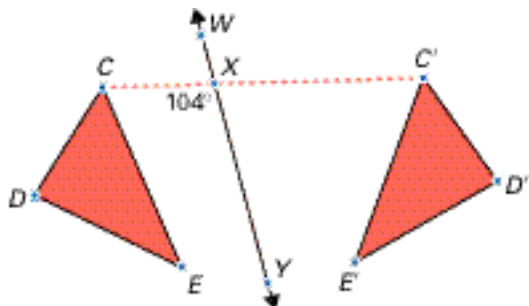
- Can you tell whether figure W was translated or reflected? Explain.



- 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?

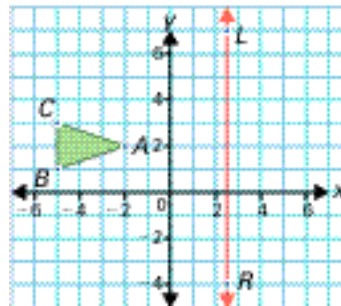
15. The reflected image of $\triangle CDE$ is $\triangle C'D'E'$. Is line segment WY the reflection line? Explain, giving at least two reasons for your answer.



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 $\triangle A'B'C'$.



- Reflect $\triangle A'B'C'$ in the line LR to produce the image $\triangle A''B''C''$.
- Determine the coordinates of $\triangle A''B''C''$.
- 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.
- 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 $T(3, 3)$.

- Reflect $\triangle ABC$ in the y -axis. Then reflect the resulting image in the line ST . Determine the coordinates of the final image triangle.
- Reflect $\triangle ABC$ in the line ST . Then reflect the resulting image in the y -axis. Determine the coordinates of the final image triangle.
- 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.