

Transformations



Chapter

11

Big Idea

Understanding the location and movement of shapes helps me describe the world around me.

Learning Goals

I can draw and describe the image after performing a combination of translations, rotations, and/or reflections on a 2-D shape, using technology.

I can draw and describe the image after performing a combination of translations, rotations, and/or reflections on a 2-D shape, without using technology.

I can identify and describe the transformations used to create a design.

I can use ordered pairs to identify points in the first quadrant of a Cartesian plane.

I can plot points in the first quadrant of a Cartesian plane.

I can perform and describe transformations of a 2-D shape in the first quadrant of a Cartesian plane.

Essential Question

How can I use the location and movement of shapes to describe the world around me?

Important Words

Cartesian plane
 coordinates
 image
 line of reflection
 origin
 point of rotation
 rotate
 reflect
 transform
 translate
 x -axis
 y -axis

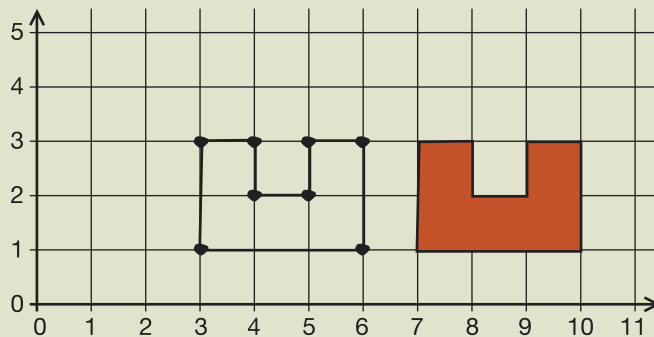


Students will plot points and use a Cartesian plane to draw and describe transformations of 2-D shapes.

Example:

A polygon has vertices at the points (3, 1), (3, 3), (4, 3), (4, 2), (5, 2), (5, 3), (6, 3), and (6, 1).

- Draw the shape on a Cartesian plane.
- Translate the shape right four spaces.
- Explain what you did.



I plotted all the points, and connected them. I knew the first point had to connect to the last point to make a closed shape. The shape is an irregular octagon.

I cut out a 2-D shape that matched the octagon, slid it right four spaces, and then traced it.

1. Plot and label the following ordered pairs on a **Cartesian plane**.

- (6, 4)
- the **origin**
- a point three units up from the **x-axis**
- (1, 0)
- (2, 9)
- a point five units to the right of the **y-axis**
- (0, 7)
- (8, 8)

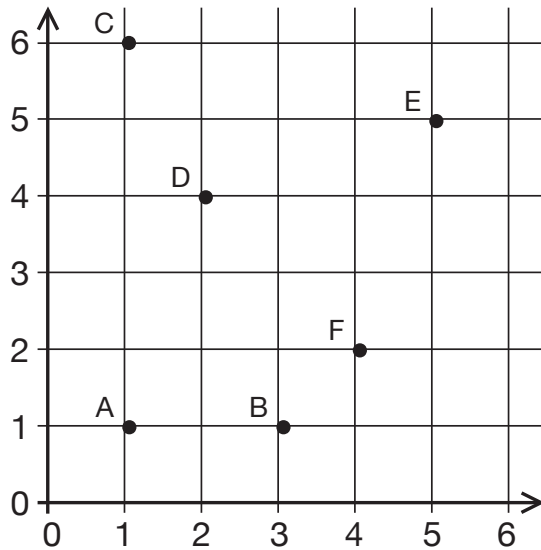
A **Cartesian plane** is a grid that can be used to show information.

The **origin** on a graph is at (0, 0), where the axes cross.

The **x-axis** is the horizontal line on a graph, usually labelled with numbers.

The **y-axis** is the vertical line on a graph, usually labelled with numbers.

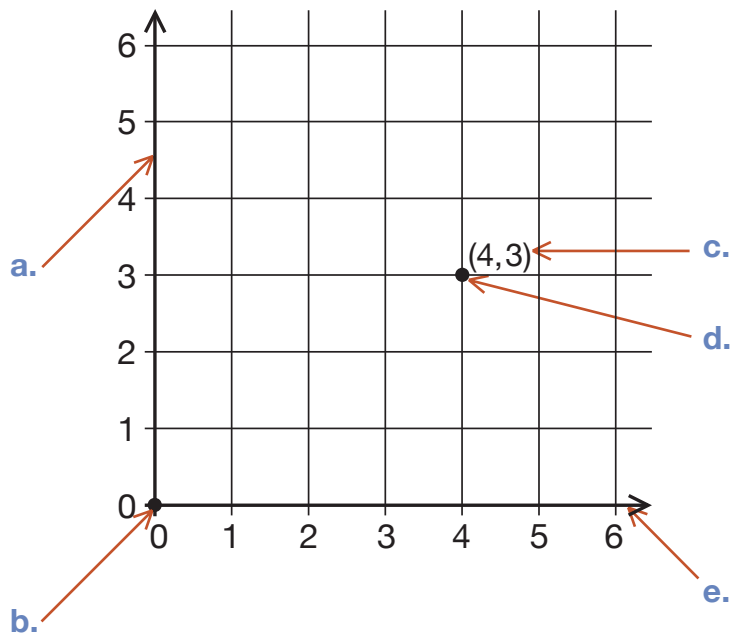
2. Use the Cartesian plane below to answer the questions that follow.



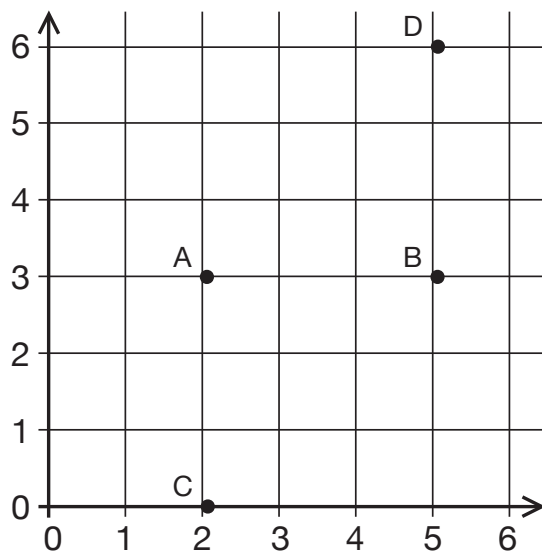
- a. Name the points using **coordinates**.
- b. How far apart are points A and B?
- c. How far apart are points A and C?
- d. Explain why you cannot tell exactly how far apart points A and D are.

The **coordinates** of a point are the two numbers (x, y) used to tell where a point is.

3. Name the parts of the Cartesian plane indicated by the arrows below.

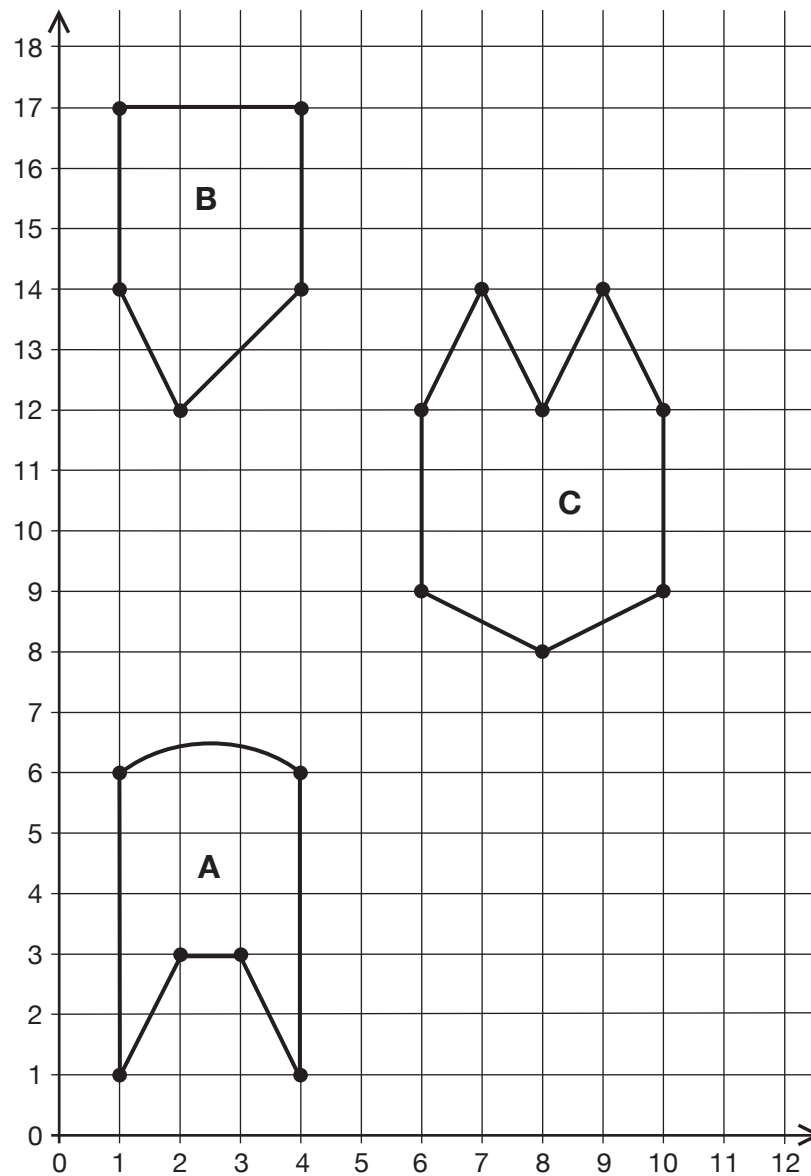


4. Ruby says points A and B, A and C, and A and D are all three units apart. Simran says that points A and B and points A and C are three units apart, but that points A and D are farther apart. Explain who you think is correct, and why.



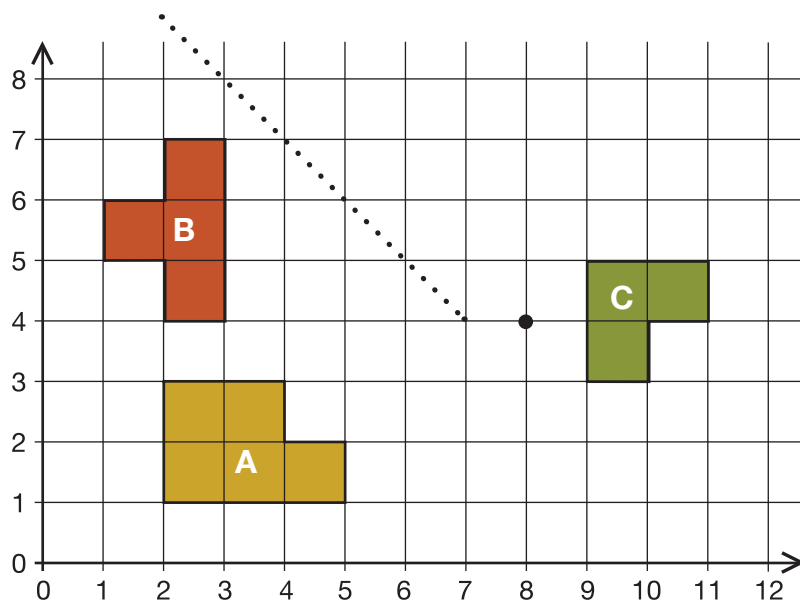
5. Use a Cartesian plane to plot each set of coordinates, then join the points and describe the shape created.
- $(7,2)$ $(8,3)$ $(8,5)$ $(10,5)$ $(10,3)$ $(11,2)$
 - $(2,4)$ $(2,6)$ $(6,6)$ $(6,4)$
 - $(2,7)$ $(5,10)$ $(8,7)$
6. List the points you could use to make each of the following shapes on a Cartesian plane.
- rectangle
 - triangle
 - right triangle
 - parallelogram

7. Three shapes are shown on the Cartesian plane below. Write the coordinates of the points in each shape.



8. Use coordinates to identify one acute, one right, one obtuse, and one reflex angle within any of the shapes in question 7.
9. Explain whether each of the shapes in question 7 is a polygon.

10. Copy each shape below onto a separate Cartesian plane and then perform each transformation.



To **transform** a shape, you slide, flip, or turn it.

To **translate** a shape, you slide it along a line.

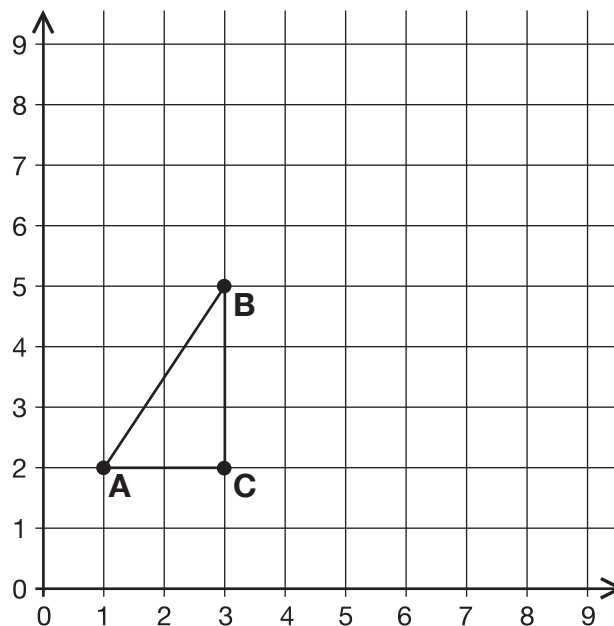
To **reflect** a shape, you flip it over a line.

To **rotate** a shape, you turn it around a point.

- a. **Translate** hexagon A right three spaces.
- b. **Reflect** octagon B over the diagonal line.
- c. **Rotate** hexagon C 180° clockwise around the point (8, 4).

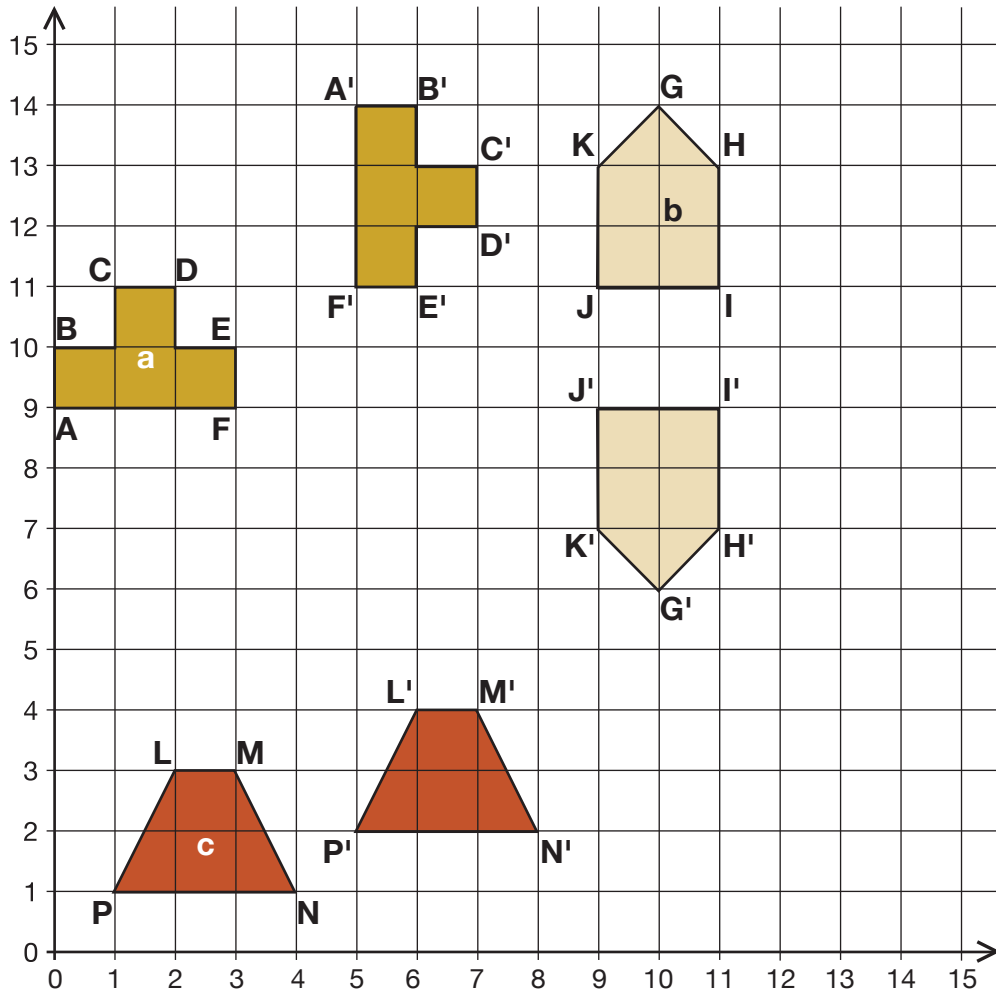
11. Examine the diagram below. The point (7, 6) is one of the vertices of shape ABC after it has been transformed.

- a. Describe how the original shape could be translated to have (7, 6) as one vertex. Identify the other vertices in the shape.
- b. Describe how the original shape could be reflected to have (7, 6) as one vertex. Identify the other vertices in the shape.
- c. Describe how the original shape could be rotated to have (7, 6) as one vertex. Identify the other vertices in the shape.



12. Study each pair of shapes below. Describe the single transformation used to create each **image**.

The **image** is the shape after a transformation.



13. How are reflect and flip similar? translate and slide? rotate and turn?

I can use ordered pairs to identify points in the first quadrant of a Cartesian plane.

I can plot points in the first quadrant of a Cartesian plane.

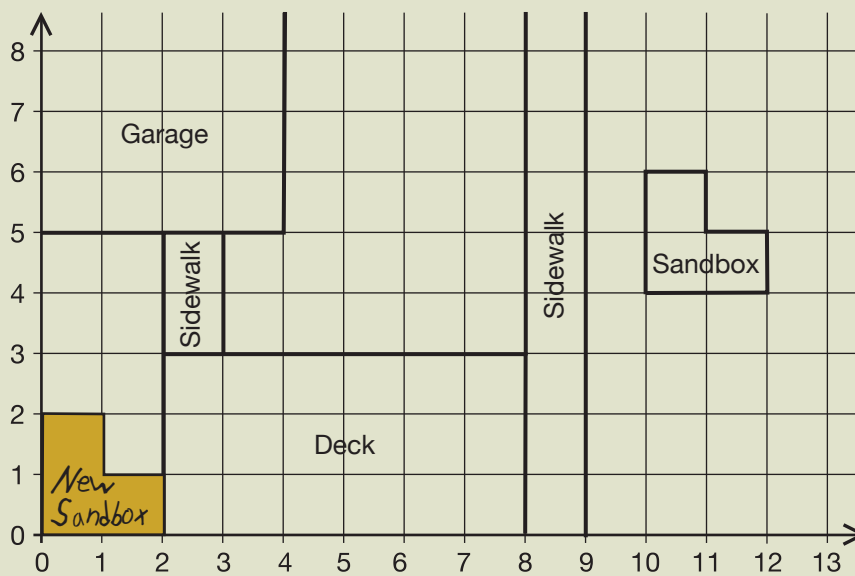
I can perform and describe transformations of a 2-D shape in the first quadrant of a Cartesian plane.



Draw shapes and perform single transformations on a Cartesian plane to model the location and movement of objects in real-life contexts, such as moving, designing, landscaping, and creating art.

Example:

Mrs. Imran had a new sandbox delivered for her children. Choose the best location in the yard for the sandbox. Explain how to move the sandbox from its current location to the new location. Describe the location using coordinates.



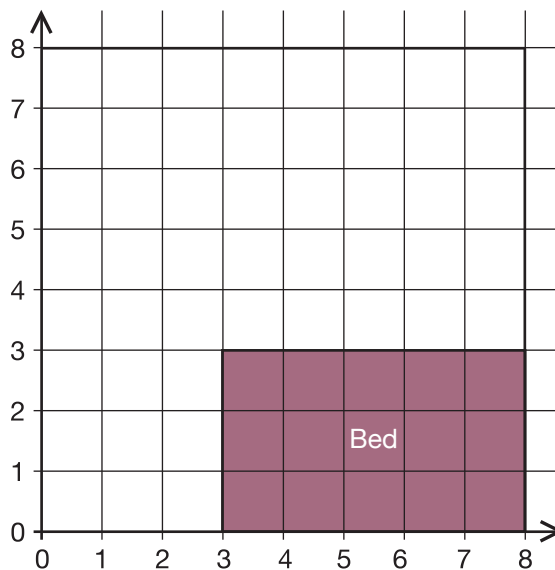
Rolph's strategy:

Because the sandbox is shaped like an L, I think it will fit best in a corner. I cut out the sandbox shape and put it over the original position. I translated the sandbox to the corner beside the deck by sliding it down four units and left 10 units. The coordinates of the sandbox are $(0,0)$, $(0,2)$, $(1,2)$, $(1,1)$, $(2,1)$, and $(2,0)$.

1. Mariam’s brother went into her room and moved her bed to a new location. Mariam didn’t like it, and wanted to move the bed back.

- a. What ordered pairs describe the current location of the bed?
- b. Her bed was originally located with one vertex at the origin. How could Mariam move the bed back into the corner?

Mariam’s Room



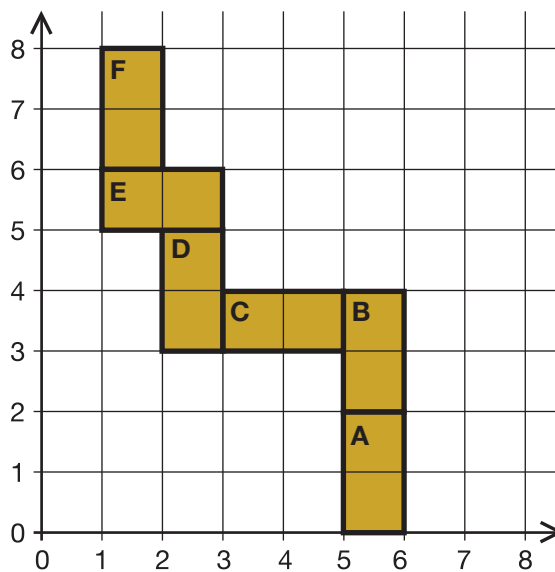
The **line of reflection** is the line over which a shape is flipped in a reflection.

2. Bryson drew triangle ABC with vertices at $A(1, 5)$, $B(0, 2)$, and $C(4, 0)$ and then reflected the triangle to $A'(5, 5)$, $B'(6, 2)$, and $C'(2, 0)$. Name two points on the **line of reflection** Bryson used.

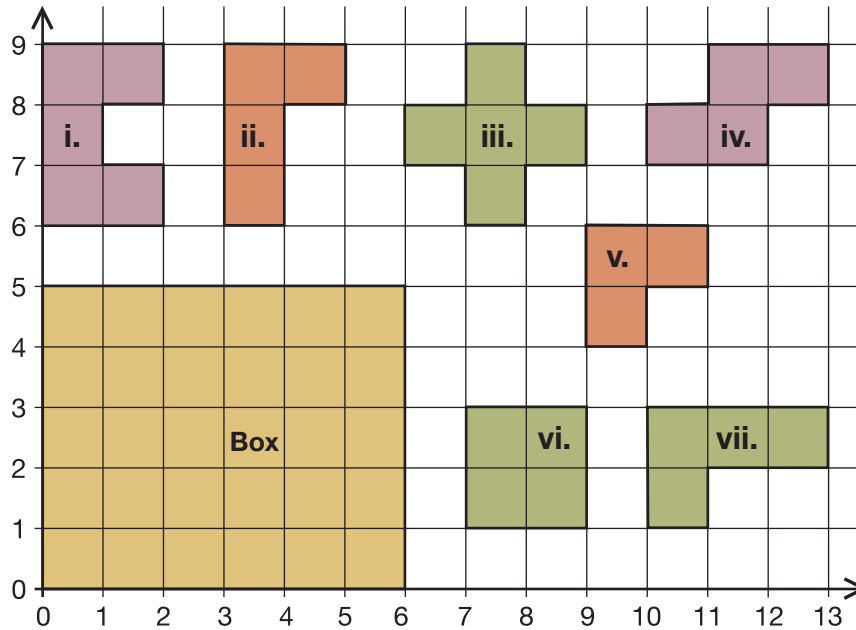
3. Krista is planning a new pathway through her backyard using large rectangular paving stones. Use the paving stones shown to illustrate:

- a. a translation.
- b. a reflection.
- c. a rotation.

Krista’s Yard



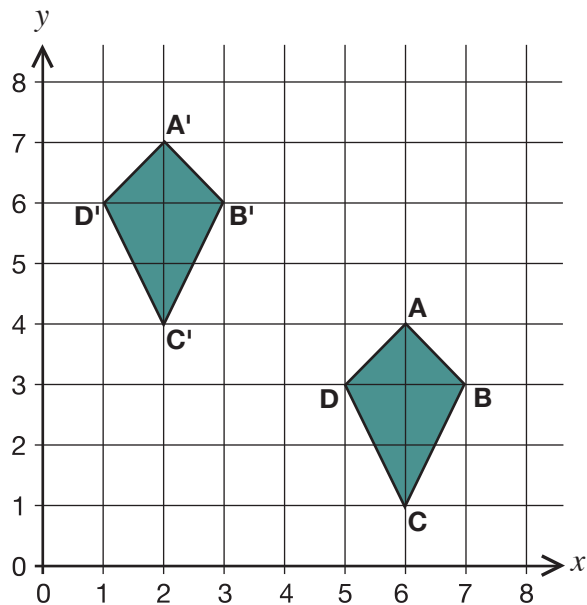
4. Marcus is packing a box, and wants to fit as many shapes in the box as he possibly can.



- Arrange as many of the shapes within the box as you can.
- Describe the transformations you used to move the shapes into the box.

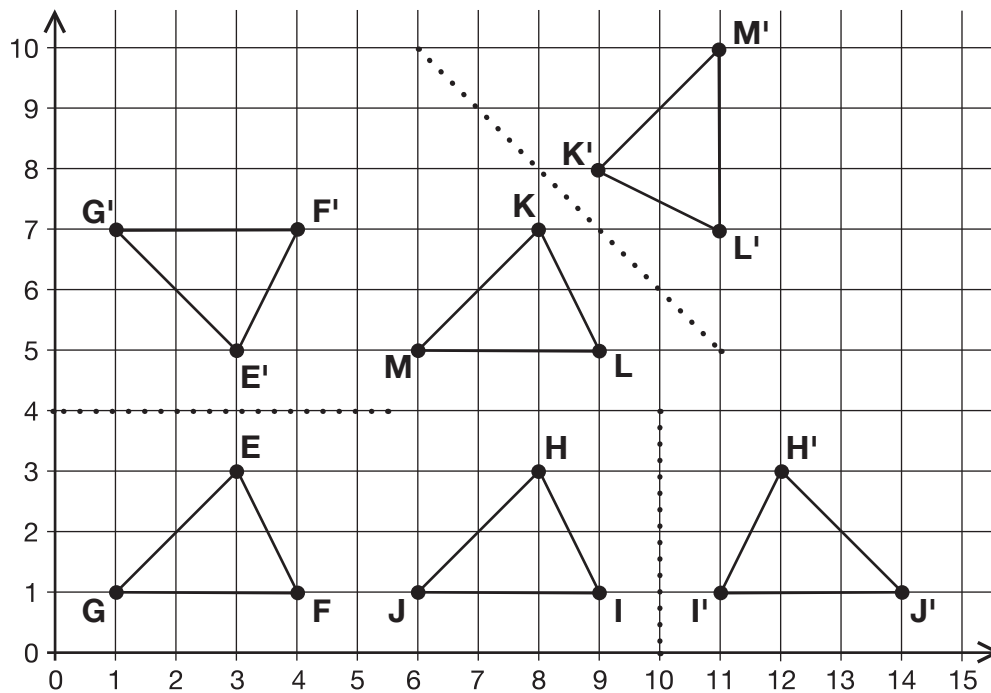
5. Brynn translated the shape shown.

- Describe the translation.
- Brynn noticed that the x -coordinates of the vertices in the image were four less than the x -coordinates of the vertices in the original shape. How does the translation explain the change in the x -coordinates?
- Describe any observations you can make about the changes in the y -coordinates of the vertices.

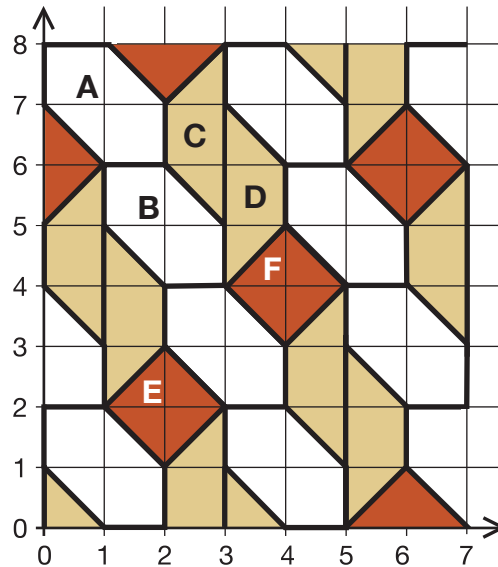


6. As an interior decorator, you have to plan the furniture layout for a living room.
 - a. Create shapes to represent furniture, such as couches, chairs, rugs, televisions, and cabinets.
 - b. Arrange the furniture on a Cartesian plane to create a floor plan.
 - c. Use ordered pairs to describe the location of each piece of furniture.

7. Claudia reflected the shapes below and concluded that a reflection makes the x -coordinates of the vertices change and the y -coordinates stay the same. Is Claudia correct? Use the transformations below to support your answer.



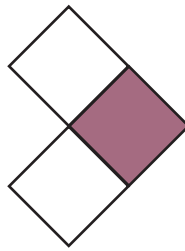
8. Mr. Mastel’s class is studying tessellations like the one shown below. They are trying to use transformations to describe the way the pieces in the tessellation are related.



- a. Describe the location of hexagon A using coordinates.
 - b. Describe a transformation that would move piece A to piece B in the tessellation.
 - c. Describe the location of trapezoid C using coordinates.
 - d. Describe a transformation that would move piece C to piece D in the tessellation.
 - e. Describe the location of square E using coordinates.
 - f. Describe a transformation that would move piece E to piece F in the tessellation.
9. Destiny drew a pentagon with vertices at (1, 2), (2, 3), (3, 2), (3, 0) and (1, 0), and then rotated the pentagon 90° .
- a. Draw the pentagon and explain whether it is regular or irregular.
 - b. After the rotation, the vertices of the pentagon were at (4, 3), (3, 4), (4, 5), (6, 5), and (6, 3). Draw the image after the rotation.
 - c. Name the **point of rotation** Destiny used.
 - d. Describe the direction of the rotation.

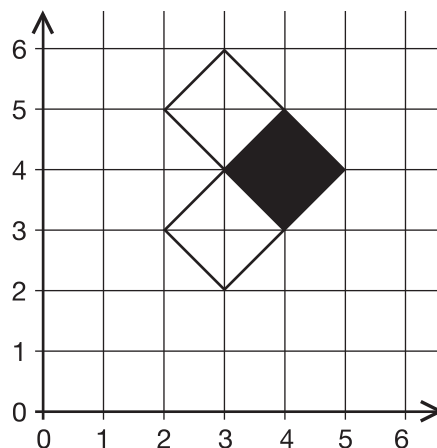
The **point of rotation** is the point around which a shape is turned in a rotation.

10. Dexter found the logo shown and thinks it was created using transformations.



DIAMOND

He copied the logo onto a Cartesian plane.



- Describe the transformations you see in this logo.
- Research other logos that seem to have been created using a transformation.



- Think of a time when you have had to move an object from one position to another. Explain what you had to do using the language of transformations.
- Explain what you find easy about performing transformations with a Cartesian plane.

I can use ordered pairs to identify points in the first quadrant of a Cartesian plane.

I can plot points in the first quadrant of a Cartesian plane.

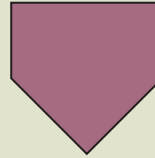
I can perform and describe transformations of a 2-D shape in the first quadrant of a Cartesian plane.



Draw, identify, and describe images after two or more transformations. Create a design using shapes and transformations.

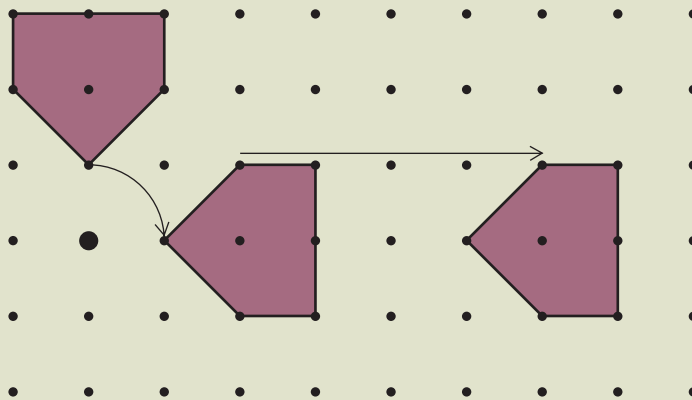
Example:

Draw the shape after it is rotated clockwise 90° and then translated four units right.



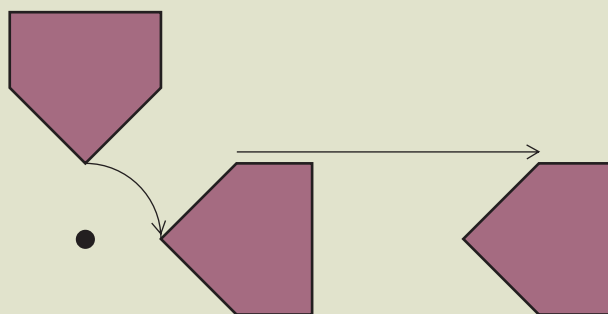
Jerard's strategy:

I cut out the shape and traced it on my dot paper. I then moved the shape and traced it after each transformation.

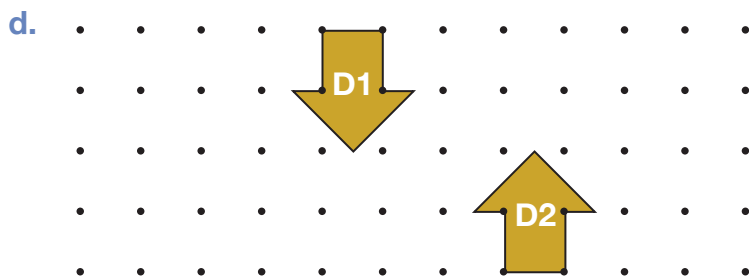
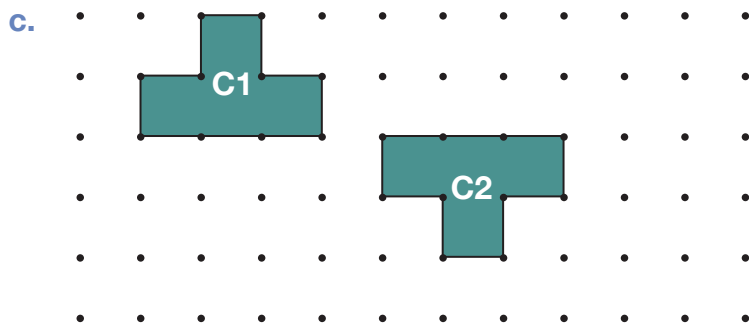
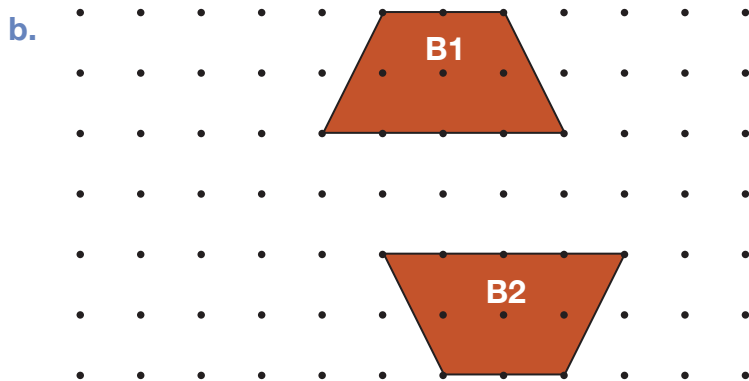
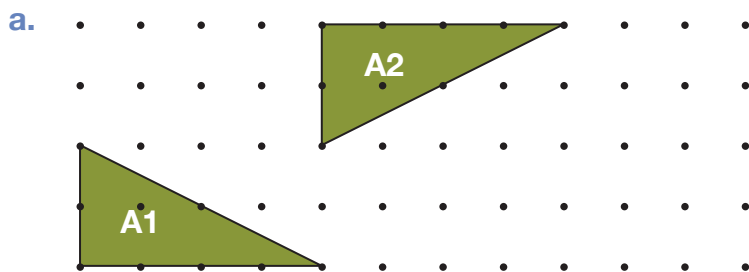


Zachary's strategy:

I created the same shape on my computer and then used the program to move it through the transformations.



1. Study each pair of shapes. Describe two successive transformations that could have been used to create the image.

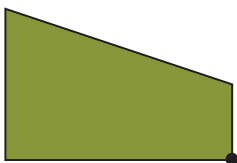


2. Explain whether any of the images in question 1 could have been created using:

- a. one transformation.
- b. a different set of two successive transformations.
- c. a set of three successive transformations.

3. Use grid paper or dot paper to draw each shape below, then perform the transformations described.

a.



Rotate 90° clockwise around the marked vertex and slide three units left.

b.



Flip down and rotate 180° counter-clockwise around the marked vertex.

c.



Reflect left and slide up four spaces.

d.



Slide down three spaces and flip up.

4. Draw each of the shapes described below on dot paper or grid paper, then transform them as indicated.

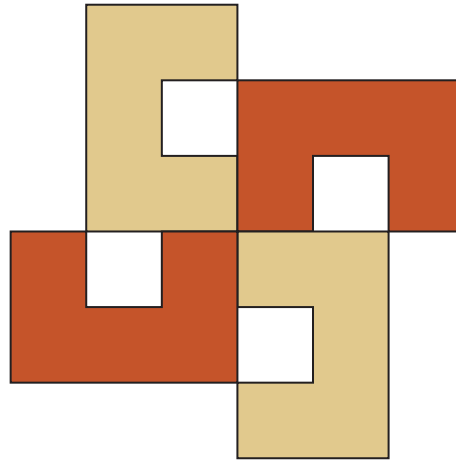
a. Draw a right scalene triangle. Reflect it to the right, translate it five units down, and rotate it 90° counter-clockwise around one vertex of the triangle.

b. Draw a regular quadrilateral. Slide it three units up, spin it 360° clockwise around one vertex of the quadrilateral, and flip it down.

c. Draw a trapezoid. Rotate it counter-clockwise 270° around one vertex of the trapezoid, slide it left four spaces, and reflect it to the left.

d. Draw an irregular pentagon. Flip it up, translate it down six spaces, and turn it 180° clockwise around one vertex of the pentagon.

5. Cole, Charlotte, Carter, and Chantelle designed the logo below for their curling team.



Cole said the second dark C was created by rotating the first dark C. Charlotte said that the first dark C was flipped and then slid to make the second dark C. Explain who you think is correct, and why.

6. Use a computer program to create and translate the following shapes. Describe the results.
- Draw an irregular hexagon. Reflect it to the right, translate it up, and rotate it 270° clockwise.
 - Draw an isosceles triangle. Flip it down, translate it diagonally down and to the right, and rotate it 90° clockwise.
 - Draw a parallelogram. Rotate it clockwise 270° , slide it up, and reflect it to the left.
7. Compare the images you created in question 6 with those created by a partner.



8. Are transformations on a Cartesian plane more or less exact than those not on a Cartesian plane? Explain.

I can draw and describe the image after performing a combination of translations, rotations, and/or reflections on a 2-D shape, using technology.

I can draw and describe the image after performing a combination of translations, rotations, and/or reflections on a 2-D shape, without using technology.

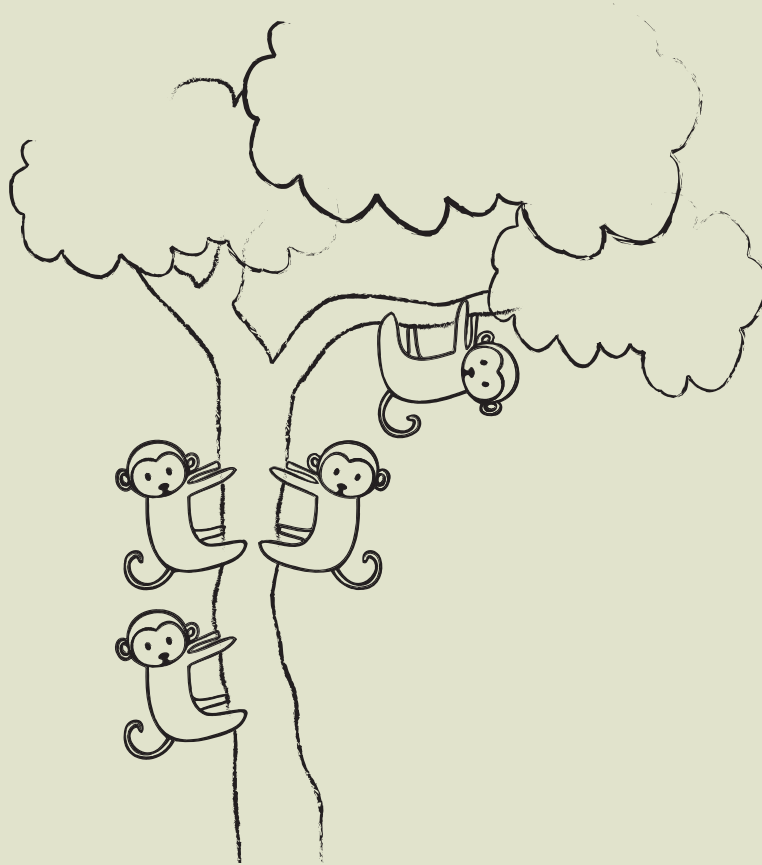
I can identify and describe the transformations used to create a design.



Draw, identify, and describe an image or design created using transformations in real-life situations, such as moving, designing, landscaping, and creating art.

Example:

Michaela visited the zoo and drew a picture of one of the monkeys in many different positions.



Use transformational language to describe the way the monkey moved.

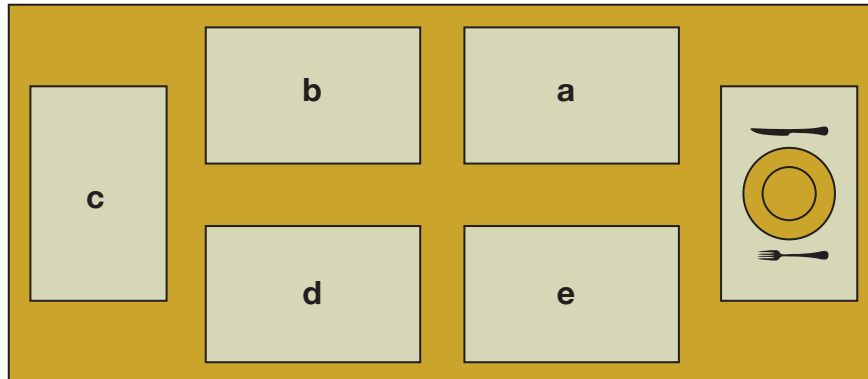
Jane's strategy:

The monkey started at the bottom of the tree on the left and then slid up the tree.

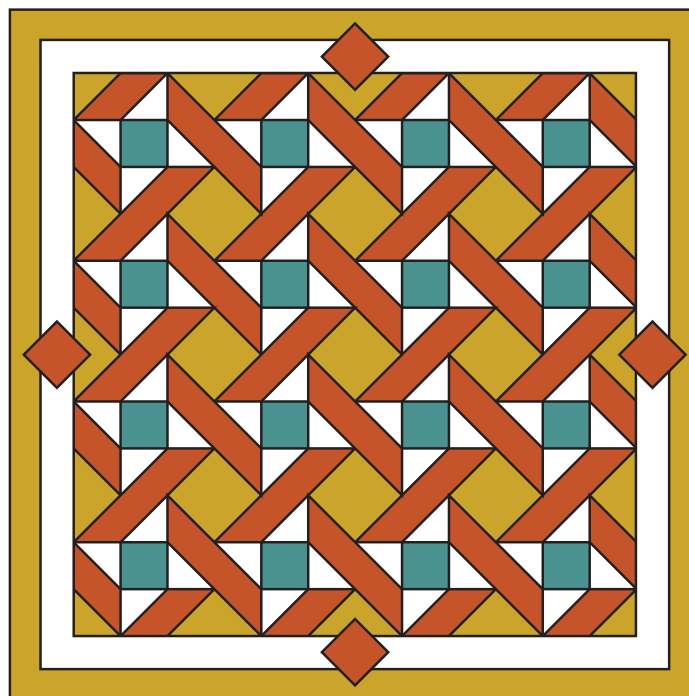
The monkey flipped from the left side of the tree to the right side of the tree.

The monkey turned up and out onto the branch by rotating 90° clockwise.

1. Marnie is having a dinner party. She is setting the table for six people. She has laid out the placemats as shown below, and arranged one place setting. What transformations could she use to describe how to move the place setting to each placemat, in order?



2. Kendle was watching a piece of paper float in the wind. He described the movement of the paper by writing down the first five transformations he saw. The paper reflected right, slid left, rotated clockwise 90° , slid down and diagonally to the right, and reflected left. Draw a path the piece of paper may have followed.
3. Julias's grandmother made him this quilt. Describe some of the transformations you see in the quilt design.

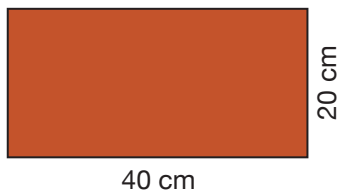


- 4. The twins Charlie and Carissa each have their own room. They want to have rooms that are the same, but opposite. They each have one bed, one dresser, one rug, one desk, and one chair.
 - a. Design both rooms so they are the same, but opposite.
 - b. What transformations did you use to make the rooms opposite but congruent?

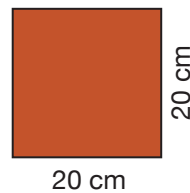
- 5. To make a presentation more powerful, you can make pictures and words come onto the screen from the sides and the corners.
 - a. Use presentation software to make a picture or word slide in, flip in, and rotate in.
 - b. Describe some other transformations you can make the picture or word undergo.

- 6. Alecia is planning to build a backyard patio with bricks. The bricks come in three different sizes as shown below.

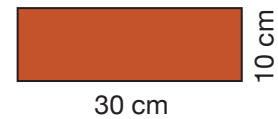
i.



ii.



iii.



- a. Use grid paper, dot paper, or a computer program, to create a design for Alecia's backyard patio.
- b. Describe the transformations you used.



- 7. Where else in real life do you see examples of transformations?
- 8. How does using a computer help you perform transformations?

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I can draw and describe the image after performing a combination of translations, rotations, and/or reflections on a 2-D shape, without using technology.

I can identify and describe the transformations used to create a design.