Drawing with Linear Perspective

OBJECTIVE Use linear equations to represent a drawing made with linear perspective.

Materials: graph paper, ruler

During the Renaissance, artists turned to mathematics to develop *perspective*, a method for realistically depicting a three-dimensional object on a two-dimensional surface. A drawing with linear perspective has all slanted lines converging toward a point or points on the horizon. These points are called *vanishing points*. The painting below and on the left has all slanted lines converging toward a single vanishing point at the far end of the road. The painting on the right has all slanted lines converging toward one of two vanishing points, one on either side of the building.
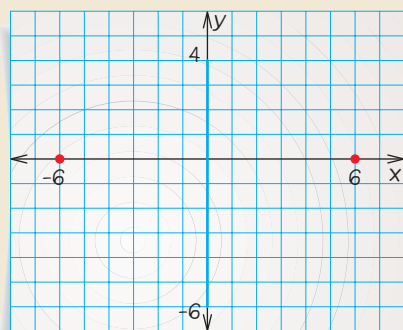
*The Avenue at Middelharnis*, painted in 1689 by Meindert Hobbema

*Corner of George and Hunter Streets, Sydney,* painted in 1849 by A. Torning

HOW TO DRAW AN OBJECT IN TWO-POINT PERSPECTIVE

1 Use the *x*-axis as the horizon. Select two points equidistant from the origin and on the *x*-axis as the vanishing points. Draw a vertical segment to represent the front edge of the object—in this case, the front edge of a building.
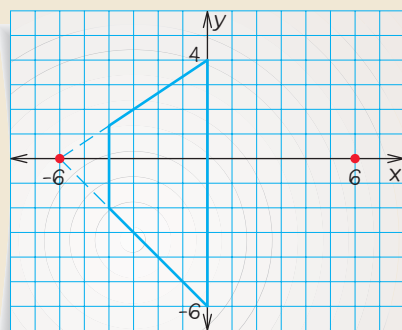
2 To draw the left wall of the building, draw segments from the endpoints of the front edge toward the vanishing point on the left. Connect the segments with a vertical line to represent the end of the wall.
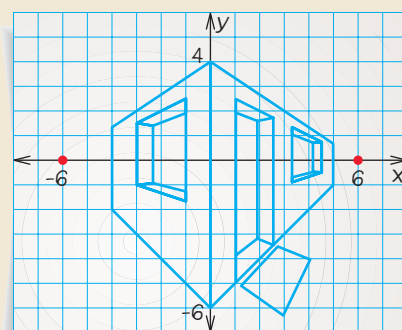
3 Continue drawing slanted lines that are to the left of the front edge toward the vanishing point on the left, and lines that are to the right of the front edge toward the vanishing point on the right.

INVESTIGATION

1. Choose an object that has many parallel edges, such as a building, courtyard, or computer. Use the method given on the previous page to draw the object in two-point perspective.

2. Experiment with using a lower or higher horizon line, as well as vanishing points that are farther apart or closer together, until your drawing has the look you want. How does the placement of the horizon line and the vanishing points affect the way your drawing looks?

3. Write an equation for each line in your drawing. Include the domain to indicate the length of the line. For example, the upper left edge of the building on the previous page is defined by $y = \frac{2}{3}x + 4$ for $-4 \leq x \leq 0$.
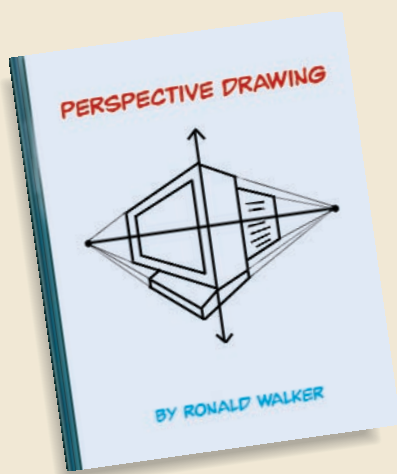
PRESENT YOUR RESULTS

Write a report to present your results.

- Include your drawing and any preliminary sketches you did.

- Include your answers to Exercises 1–3 above.

- Write a set of instructions for how to draw the object just as you have drawn it. Include the equations you wrote.

- Tell how this project has helped you mathematically.

Test your results.

- Trade drawing instructions with a partner (do not trade actual drawings). Follow the instructions to create your partner's drawing.

- Compare your drawing with the original.

EXTENSION

Another way to suggest a three-dimensional object on a two-dimensional surface is to add shadowing. Select a point for a light source and decide where the shadows cast by your object would fall. Write a system of linear inequalities to indicate each shaded region. Add these to your report.
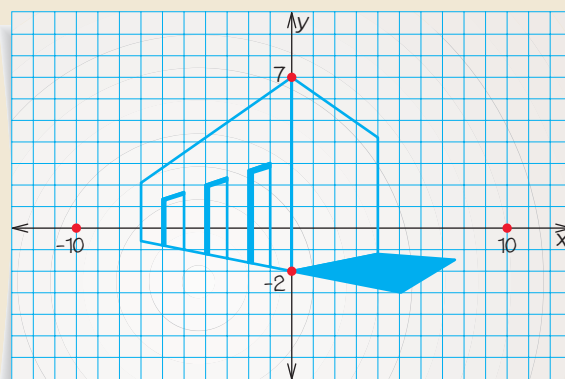
System of inequalities for the building's shadow:

$$y \leq \frac{1}{5}x - 2$$

$$y \geq -\frac{1}{5}x - 2$$

$$y \geq \frac{3}{5}x - 6$$

$$y \leq -\frac{3}{35}x - \frac{6}{7}$$