Investigation 1

Coordinate Grids

In this investigation, you will review how to use a coordinate grid to locate points in the plane. You will then explore how to find distances between points and areas of figures on a coordinate grid.

In the first two problems of this investigation, the coordinate grid is in the form of a street map of a fictional city called Euclid. The streets in most cities do not form perfect coordinate grids as they do in Euclid. However, many cities have streets that are at least loosely based on a coordinate system. One well-known example is Washington, D.C.

Did You Know?

The Lincoln Memorial stands at the west end of the National Mall in Washington, D.C. Built between 1914 and 1922, the memorial houses a 99-foot-tall statue of the first Republican president, Abraham Lincoln. The memorial celebrates Lincoln's accomplishments in uniting the divided nation and his quest to end slavery.

People often make speeches at the Lincoln Memorial, using the setting to strengthen their message. Martin Luther King, Jr. gave his famous "I have a Dream" speech at the memorial during the March on Washington in 1963.

Go Online
PHSchool.com
For: Information about the Lincoln Memorial
Web Code: ape-9031

The map on the next page shows the central part of Washington, D.C. The city's street system was designed by Pierre L'Enfant in 1791.

L'Enfant's design is based on a coordinate system. Here are some key features of L'Enfant's system:

- The north-south and east-west streets form grid lines.
- The origin is at the Capitol.
- The vertical axis is formed by North and South Capitol Streets.
- The horizontal axis is the line stretching from the Lincoln Memorial, through the Mall, and down East Capitol Street.
- The axes divide the city into four quadrants known as Northeast (NE), Southeast (SE), Southwest (SW), and Northwest (NW).

Getting Ready for Problem 1.1

- Describe the locations of these landmarks:

  George Washington University

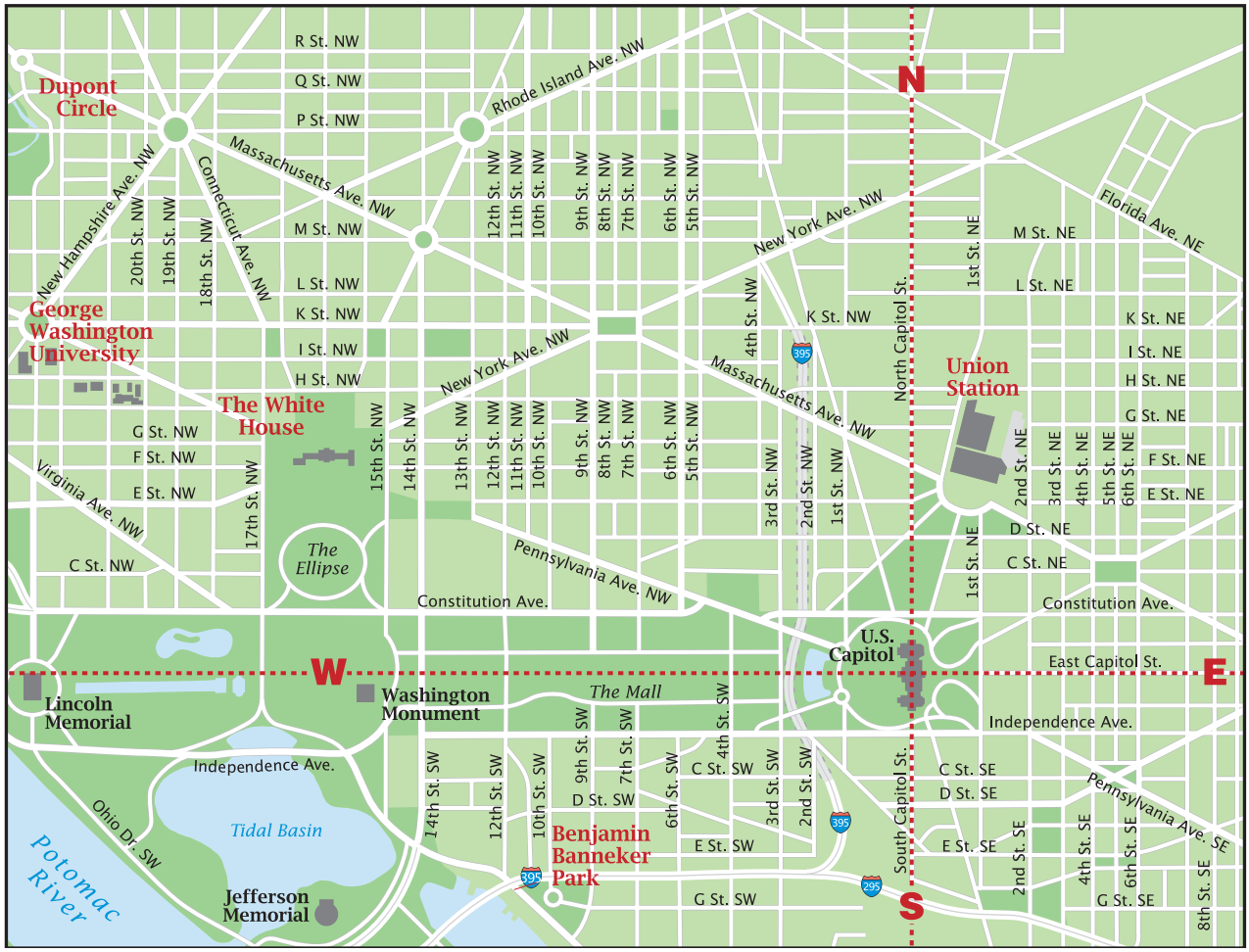
  Dupont Circle

  Benjamin Banneker Park

  The White House

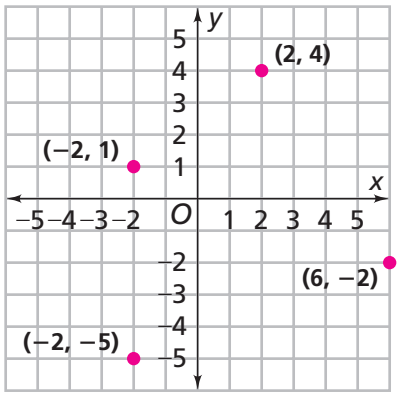
  Union Station

- How can you find the distance from Union Station to Dupont Circle?
- Find the intersection of G Street and 8th Street SE and the intersection of G Street and 8th Street NW. How are these locations related to the Capitol Building?



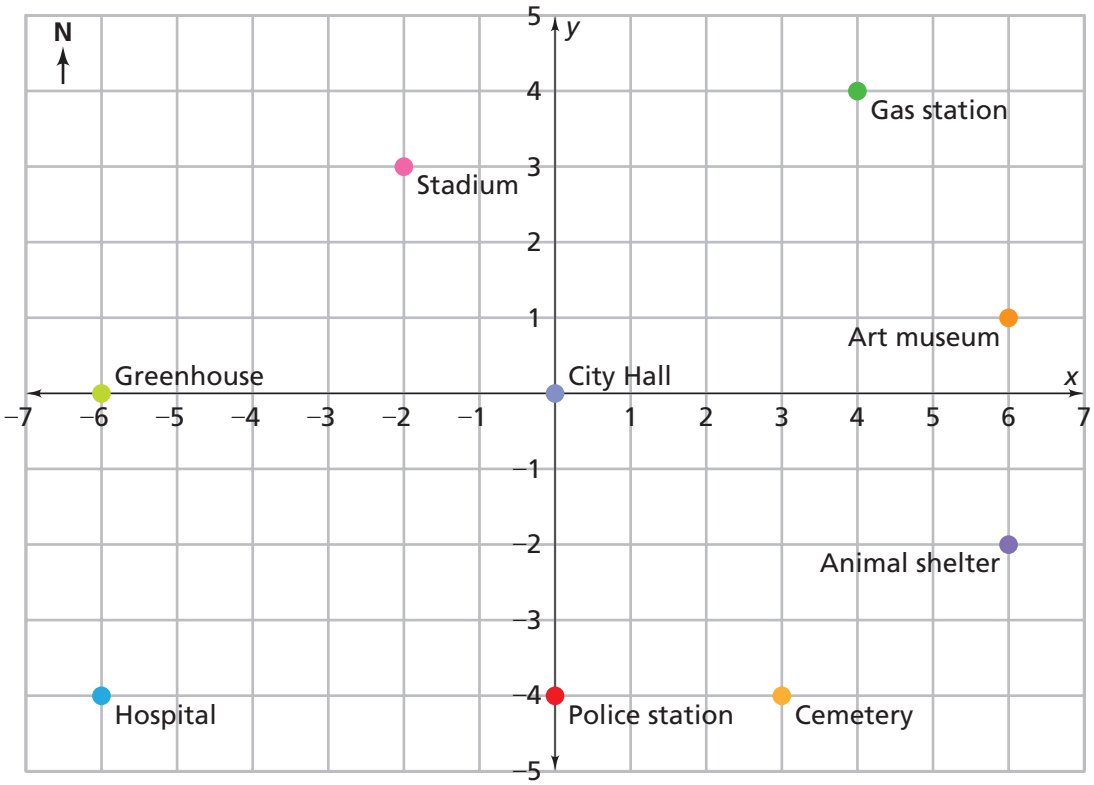
In mathematics, we use a coordinate system to describe the locations of points. Recall that horizontal and vertical number lines, called the x- and y-axes, divide the plane into four quadrants.

You describe the location of a point by giving its coordinates as an ordered pair of the form (x, y). On the coordinate grid at the right, four points are labeled with their coordinates.



1.1 Driving Around Euclid

The founders of the city of Euclid loved math. They named their city after a famous mathematician, and they designed the street system to look like a coordinate grid. The Euclideans describe the locations of buildings and other landmarks by giving coordinates. For example, the art museum is located at (6, 1).



Problem 1.1 Locating Points and Finding Distances

A. Give the coordinates of each landmark.

1. gas station

2. animal shelter

3. stadium

B. Euclid's chief of police is planning emergency routes. She needs to find the shortest driving route between the following pairs of locations:

Pair 1: the police station to City Hall

Pair 2: the hospital to City Hall

Pair 3: the hospital to the art museum

1. Give precise directions for an emergency car route for each pair.

2. For each pair, find the total distance in blocks a police car following your route would travel.

C. Suppose you know the coordinates of two landmarks in Euclid. How can you determine the shortest driving distance (in blocks) between them?

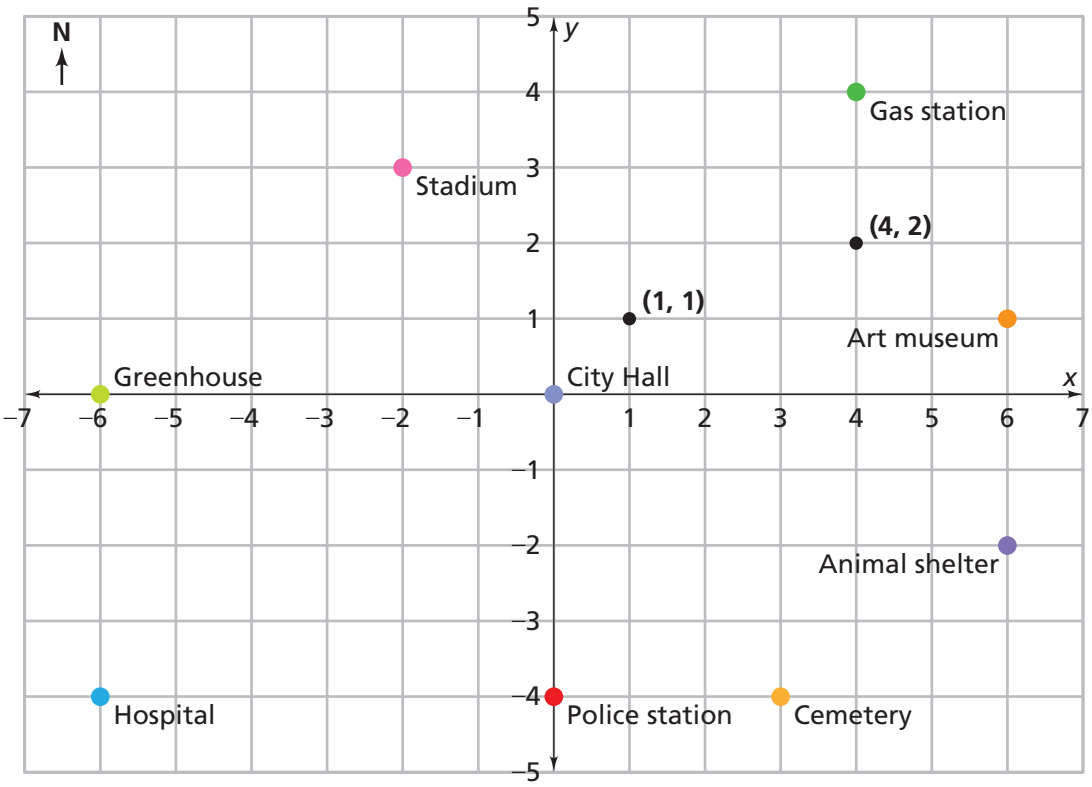
D. A helicopter can travel directly from one point to another. For each pair in Question B, find the total distance (in blocks) a helicopter would have to travel to get from the starting location to the ending location. You may find it helpful to use a centimeter ruler.

E. Will a direct helicopter route between two locations always be shorter than a car route? Explain your reasoning.

ACE Homework starts on page 12.

1.2 Planning Parks

The Euclid City Council is developing parks with geometric shapes. For some of the parks, the council gives the park designers constraints. For example, Descartes Park must have a border with vertices (1, 1) and (4, 2).



Problem 1.2 Shapes on a Coordinate Grid

Be prepared to explain your answers.

A. Suppose the park is to be a square. What could the coordinates of the other two vertices be? Give two answers.

B. Suppose the park is to be a nonsquare rectangle. What could the coordinates of the other two vertices be?

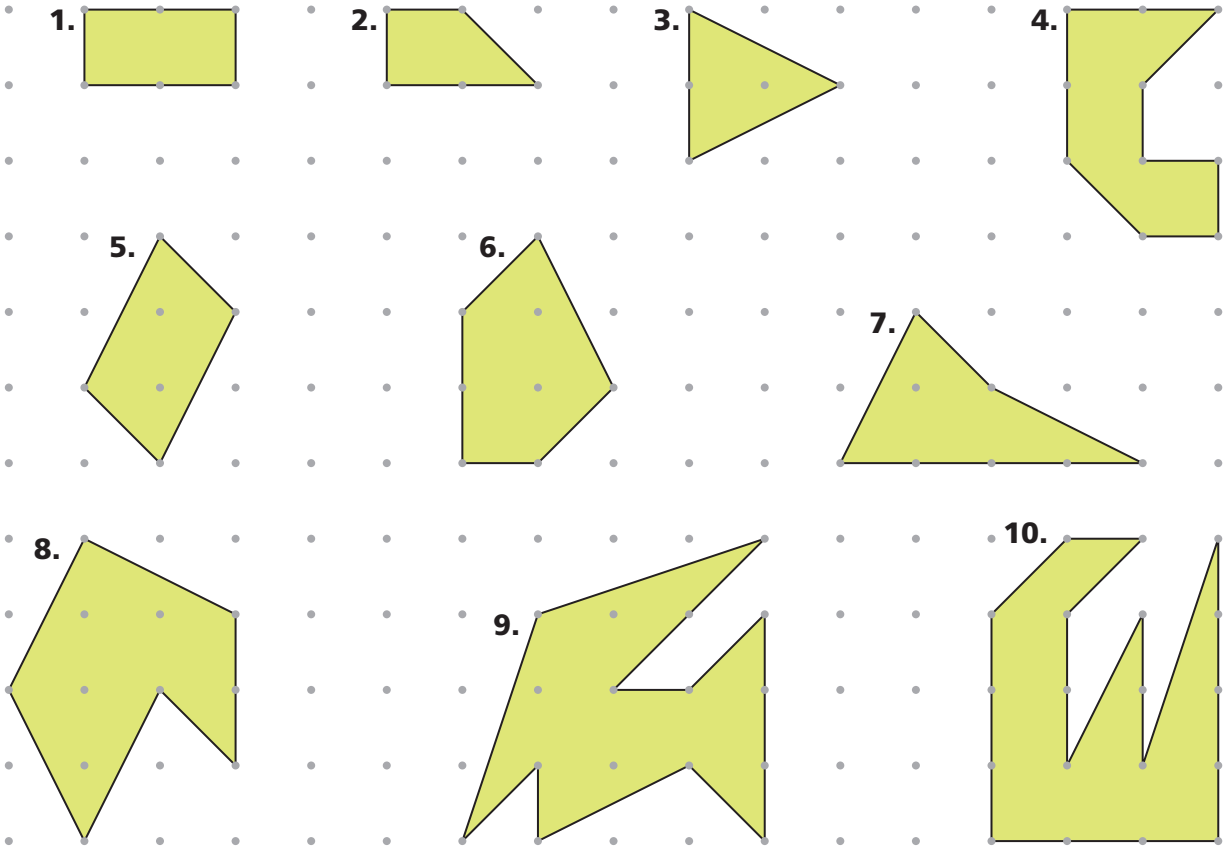
C. Suppose the park is to be a right triangle. What could the coordinates of the other vertex be?

D. Suppose the park is to be a parallelogram that is not a rectangle. What could the coordinates of the other two vertices be?

ACE **Homework starts on page 12.**

1.3 Finding Areas

Below are some park designs submitted to the Euclid City Council. To determine costs, the council needs to know the area of each park.



Problem 1.3 Finding Areas

Consider the horizontal or vertical distance between two adjacent dots to be 1 unit.

A. Find the area of each figure.

B. Find the area of one of the square parks you suggested in Problem 1.2.

C. Describe the strategies you used in Questions A and B.

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