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Building a Capital

Standards
Students understand the symbolic importance of capital cities. Students understand geometric transformation of figures.

Google Earth Tools

- Layers panel: Borders and Labels, Places
- Status bar: Eye alt
- Toolbar: Placemark, Polygon, Ruler

Overview

Students will use Google Earth to observe the layout of Washington, DC, calculate the sizes of various figures within the city, and create scale drawings of those figures.

Vocabulary

- rhombus

Materials

- *A Capital Idea* activity sheets (pages 184–186)

Procedure

1. Distribute copies of the *A Capital Idea* activity sheets (pages 184–186) to students and open Google Earth.

2. **Fly to** Washington, DC, **zoom** to an **Eye alt** of about 5 km (16,000 ft.), and navigate so that the National Mall is across the bottom of the **3D viewer** (see the screenshot on page 183). Ask students to describe some of the geometric shapes they see in the streets of the city.

3. Turn on the **Borders and Labels layer** and the **Places layer**. **Fly to** and **placemark** the White House, Scott Circle Park, and the Historical Society of Washington, DC. **Zoom** until all three **placemarks** are visible in the **3D viewer**. Use the **polygon tool** to make a triangle connecting these three points. Measure each side of the triangle in kilometers using the **ruler tool** and have students record the measurements on their activity sheets (question 1).

4. Use the **ruler tool** to determine the base and height of the triangle. Then, have students use the measurements to calculate the area of the triangle (question 2).

Building a Capital *(cont.)*

Procedure *(cont.)*

5. Tell students to use the side of the triangle connecting the White House and Scott Circle Park as an axis of symmetry and reflect the triangle along this axis. Have students determine which landmark will become the third point of the new triangle (question 3). **Zoom** in on this landmark and hover your cursor over the tree icon to find its name.

6. Draw the reflected triangle using the **polygon tool** in Google Earth. Ask students to use the information they have to estimate the area of the rhombus formed by joining the triangles (question 4). Save the polygon in a *Geometry* folder.

7. Have students identify the diagonals of the rhombus, using the chart on their activity sheets, and record the landmarks at the end of each diagonal (question 5). Measure the diagonals of the rhombus using the **ruler tool** and have students record the measurements to complete the chart. Then, ask students to calculate the area of the rhombus (question 6). Have students compare the calculated area of the rhombus to their estimate from question 4. Discuss their estimation techniques and accuracy.

8. Have students create a scale drawing of the rhombus on the grid on their activity sheets (question 7). The scale is one square = .25 kilometers.

9. Have students identify another shape formed by the streets of Washington, DC. Tell them to record the names of the landmarks at the corners of the shape and the measurements of the sides (question 8).

10. Have students write the name of the shape they discovered and calculate its area (question 9). Then, have students create a scale drawing of the new shape (question 10).

Extension Activity

Ask students which two important buildings are connected by Pennsylvania Avenue and the two branches of government these buildings house. Search for the building that houses the third branch of government and ask students, based on the original layout of Washington, DC, whether the Supreme Court was considered to be as important as the President and Congress.

Building a Capital *(cont.)*

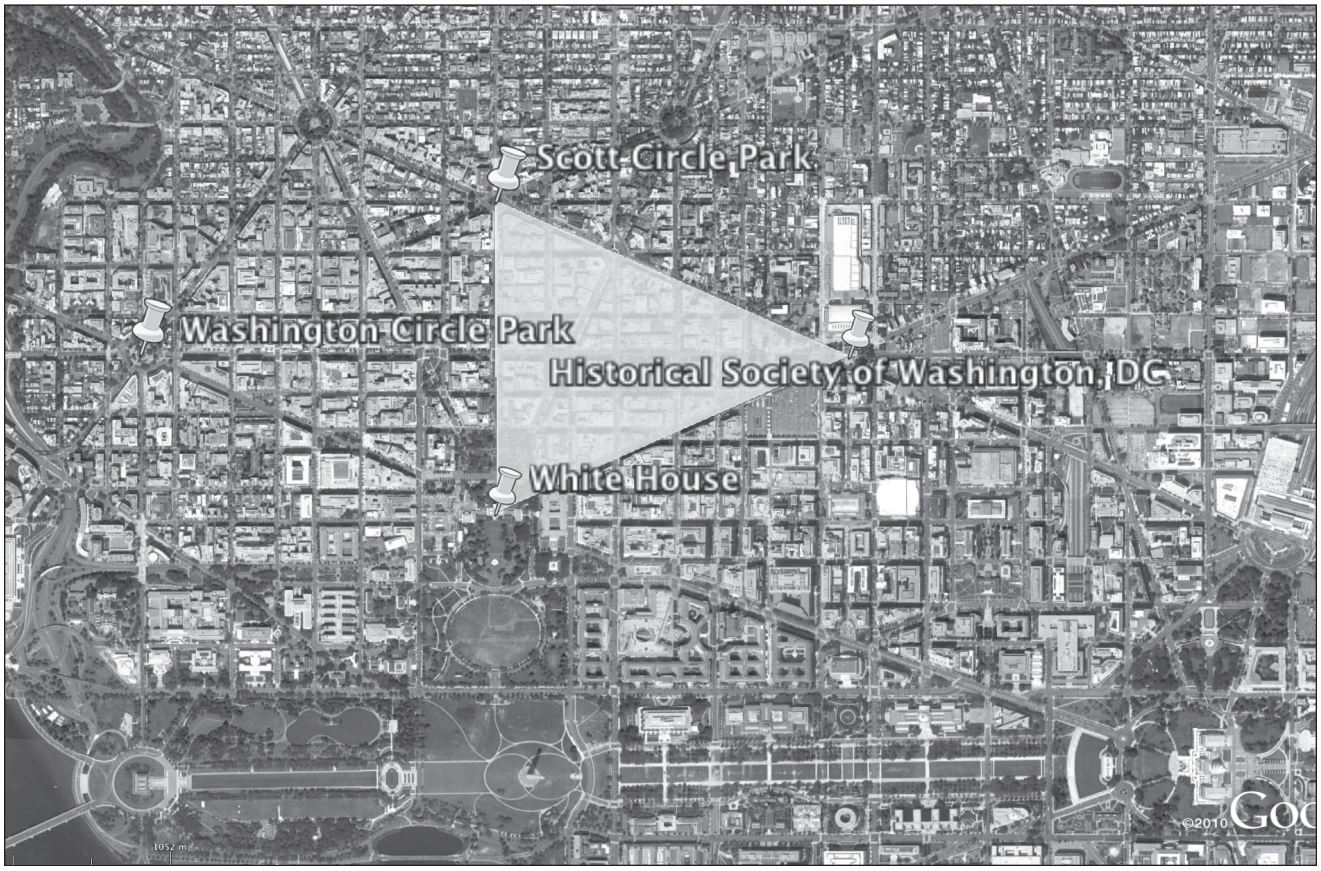
User Tip

If using an interactive whiteboard, have students use the pen tool to trace some of the shapes and patterns formed by the city streets.

Did You Know?

Pierre Charles L'Enfant was commissioned by George Washington to design Washington, DC. He was a fan of mathematics and used his math skills to make a very creative city with avenues radiating out from rectangles.

Screenshot



Washington, DC

Name_____ **Date** _____

A Capital Idea

1. Use the ruler tool to measure the distances between the Washington, DC landmarks listed below. Record the measurement for each distance in kilometers.

Landmarks	Distance Measurement
The White House to Scott Circle Park	
Scott Circle Park to The Historical Society of Washington, DC	
The Historical Society of Washington, DC to The White House	

2. Calculate the area of the triangle formed by connecting these landmarks.

Formula: area = $\frac{1}{2}bh$ (where b is base, and h is height)

b = _____

h = _____

Area = _____

3. When this triangle is reflected along the line of symmetry (White House to Scott Circle), what landmark becomes the third point of the new triangle?

_____

4. Estimate the area of the rhombus created by joining the two triangles.

Area = _____

A Capital Idea *(cont.)*

5 In the chart below, write the names of the landmarks that are each end of the diagonals of the rhombus. Record the lengths of the diagonals in kilometers.

Landmarks at Each End of Diagonal	Length of Diagonal

6 Calculate the area of the rhombus.

Formula: $\frac{d_1 d_2}{2}$ (where d is diagonal)

Area = _____

Was your estimate correct? _____

7 Make a scale drawing of the rhombus on the grid below. .25 km

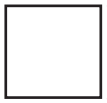
A Capital Idea *(cont.)*

8 Find a 3- or 4-sided shape formed by the streets of Washington, DC. Record the landmarks at the corners of this shape. Record the measurements of each side in kilometers.

Landmarks at Each End of Diagonal	Length of Side

9 Calculate the area of the shape.

Area = _____

10 Make a scale drawing of the shape you found.  .25 km

Answer Key *(cont.)*

7. Nonrenewable sources cannot be reproduced once used up. Renewable sources are reproducible and are less damaging to the environment.

Mathematics

Plots of Land (pages 179–180)

1. Survey–to determine the exact position and boundaries of an area of land using angular measurements and calculations.
2. Students' pros and cons will vary for each measurement system but could include:

   Parcels divided by 10: pro–easy math; con–hard to quarter
   Parcels divided by 4: pro–easy to quarter; con–hard math
   Organized squares: pro–easy to sell; con–hard to survey on terrain
   Organized by geography: pro–more river access; con–hard to survey
3. Organized squares/quilted pattern parcels divisible by 4.
4. Each section is one mile wide by one mile long.
5. There are 40 acres in a quarter-quarter section.
6.

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

7. Corrections at:

   46 58 40.13 N 97 29 36.04 W

   46 37 47 N 97 29 36 W

   46 16 57 N 97 29 23 W

   The corrections are 24 miles, 4 townships, or 24 sections apart from one another,

A Capital Idea (pages 184–186)

1.

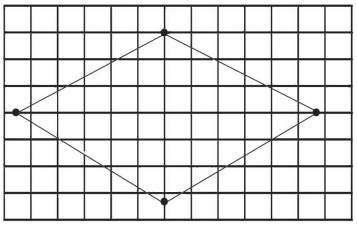
Landmark	Distance Measurement
White House to Scott Circle	1.06 km
Scott Circle to the Historical Society of Washington, DC	1.3 km
The Historical Society of Washington, DC to White House	1.3 km

2. b = 1.06 km

   h = 1.15 km

   Area = .6095 km^2
3. Washington Circle Park
4. Area = 2 x .6095 km^2 = 1.22 km^2
5.

Landmarks at Each End of Diagonal	Length of Diagonal
Scott Circle Park to the Historical Society of Washington, DC	1.06 km
The Historical Society of Washington, DC to Washington Circle Park	2.3 km

6. Area = 1.22 km^2
7. 
8. Students' responses will vary.
9. Students' responses will vary.
10. Students' responses will vary.