Investigation 1

ACE Assignment Choices

Differentiated Instruction
Solutions for All Learners

Problem 1.1

Core 1, 2
Other *Connections* 8–12

Problem 1.2

Core 14, 22
Other *Applications* 3, 4; *Connections* 13, 15–18; *Extensions* 21–26; unassigned choices from previous problems

Problem 1.3

Core 6, 7
Other *Applications* 5; *Connections* 19, 20; unassigned choices from previous problems

Adapted For suggestions about adapting Exercise 1 and other ACE exercises, see the CMP *Special Needs Handbook*.
Connecting to Prior Units 8–13, 19: *Covering and Surrounding;* 14–18, 20: *Bits and Pieces III*

Applications

1. a. 30 ft
b. 27 ft 6 in.

2. a. approx. 5 ft 7 in.
b. approx. 7 ft $2\frac{1}{2}$ in.

3. and 4. (NOTE: Labsheet 1ACE has left-handed and right-handed versions of these questions)
a. The new lengths are 2 (scale factor) times the original lengths.
b. The perimeter of the new figure is 2 (scale factor) times the original perimeter.
c. Angles remain the same.
d. Area of the new figure is 4 times the original area. It takes 4 copies of the original figure to cover its stretched image.

5. a. 50%; Students can use a side of a piece of paper to compare the side lengths of the floor plan.
b. The line segments in the reduced plan are half as long as the corresponding line segments in the original plan (or the line segments in the original plan are twice the lengths of the corresponding sides in the reduced plan).
c. Area of the whole house in the original plan is about 4 times the area of the reduced plan. The relationship between a room in the original plan and in the reduced plan is the same as the relationship between the whole plans.
d. 1 inch represents 2 ft

6. Answer is (C) since its height to width ratio is the same as in the original figure.

7. Angle measures do not change in each case. Side lengths and the perimeter are:
a. 2 times as long
b. 1.5 times as long
c. $\frac{1}{2}$ times as long
d. $\frac{3}{4}$ times as long

Connections

8. perimeter = 50 km; area = 131.25 km^2

9. perimeter = 42 m; area = 75 m^2

10. perimeter ≈ 55.29 m; area ≈ 243.28 m^2

11. perimeter = 43 mm area = 75 mm^2

12. perimeter = 67.8 cm area = 125 cm^2

ACE ANSWERS 1

13. (NOTE: Labsheet 1ACE has left-handed and right-handed versions of this exercise.)

a. Diameter of the image circle is 2 times as long as the diameter of the original circle.

b. Area of the image circle is 4 times as big as the area of the original circle.

c. Circumference of the image circle is 2 times as long as the circumference of the original circle.

14. **a.** 30 **b.** 96 **c.** 96

d. 105 **e.** 300 **f.** 300

15. B **16.** G **17.** C **18.** H

19. **a.** Circumference is about 25.13 cm.
Area is about 50.27 cm^2.

b. radius $=$ 6 cm
diameter $=$ 12 cm
circumference $\approx$ 37.7 cm
area $\approx$ 113.1 cm^2

c. radius $=$ 2 cm
diameter $=$ 4 cm
circumference $\approx$ 12.57 cm
area $\approx$ 12.57 cm^2

20. **a.** Both statements are accurate.

b. One can use similar statements in comparing sizes of shapes. For example, for question 19b, one could say: "Diameter of the image circle is 2 in. longer than the diameter of the original circle." or "Diameter of the image circle is 1.5 times as long as the diameter of the original circle."

c. The second method is more appropriate because each size will be enlarged or reduced by the same factor. However, the exact amount of increase or decrease of the lengths will be different.

Extensions

21. **a.** The width and height would be 2 times as large as the first picture.
width $=$ 6 ft
height $=$ 4 ft
area $=$ 24 square ft

b. The width and height would be 1.5 times as large as the first picture.
width $=$ 4.5 ft
height $=$ 3 ft
area $=$ 13.5 square ft

22. **a.** Diameter of B is 2 times as long as the diameter of A.

b. Area of B is 4 times as large as the area of A.

c. Circumference of B is 2 times as long as the circumference of A.

23. Note that there are two possible interpretations of this problem. Most students will use the knot closest to the anchor point to trace the original figure. This is the interpretation assumed in the answers that follow. Some students may use the knot closer to the pencil. This will give different results. See the discussion in the "Going Further" section of Problem 1.2 in this Teacher's Guide.

a. The shapes are similar to each other.

b. The lengths in the image figure are 3 times as long as the lengths in the original figure.

c. The areas in the image figure are 9 times as big as the areas in the original figure.

24. **a.** About 1.57 square in.

b. About 1.57 square in.

c. Path (1): along the outer circle. Path (2): along the outsides of the two smaller circles. Both paths are the same length (3.14 in. long each.) You can see this by the similarity of the large circle to the smaller one. The scale factor from the smaller to the larger circle is 2. So, the circumference of the large circle is twice as long as the circumference of the small one. Hence, walking along half of the circumference of the large circle is the same distance as walking along the full circumference of the small one, the same length as path (2).

25. **a.** The size of the image would still be the same as in the case when the anchor point is outside. However, in this case the image figure would enclose the original figure.

b. Sizes of sides and perimeters would be 2 times as long as the original figure. Angle measures would not change. Area would be 4 times as big as the area of the original figure.

c. Answers will vary.

26. **a.** The lengths are 1.5 times as long as the original figure. Angle measures do not change. The perimeter is 1.5 times as large as the original figure. Area would be $1.5 \times 1.5 = 2.25$ times as large as the original figure.

b. Answers will vary.

Possible Answers to Mathematical Reflections

1. The shape will remain the same except in size. The angle measures of corresponding angles will also remain the same.
2. Each length in the image will stretch or shrink by the same factor; hence the areas seem to change in some predictable pattern.
3. Two geometric shapes are similar if one can be obtained from the other by applying a stretch or a shrink, keeping the general shape of the figure unchanged, in which all the lengths are changed by the factor or multiplied by the same number (i.e., the same scaling factor), and all the corresponding angles are kept the same.

Note that if the scale factor or ratio is 1, then the two figures are still similar and in this case we say they are congruent, which tells us that a translation will also yield a similar figure. Students may not use ratio at this time. They may use "multiplied by the same factor."

Students will continue to develop deeper understandings as they move through the unit. At this stage we are looking for intuitive, informal answers that shape stays the same, but size may change.