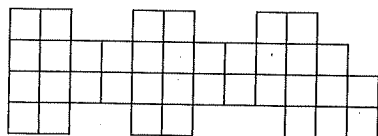


Assignment Guide for Problem 1.1

Applications: 1–24 | Connections: 37–54

Answers to Problem 1.1

A. 1. Possible answer:



2. Possible answers: The floor plan could be a 9-by-4 rectangle, or a 5-by-7 rectangle with an additional square somewhere. (See Figure 1.)

B. 1. Design A: area = 12 m^2 , perimeter = 26 m
 Design B: area = 18 m^2 , perimeter = 38 m
 Design C: area = 12 m^2 , perimeter = 18 m
 Design D: area = 16 m^2 , perimeter = 18 m

2. Designs A and C can be designed with the same number of floor tiles because they have the same area. They will have different numbers of rail sections because their perimeters are different. In Design A, the tiles are more spread out, while in Design C, the tiles are more compact and have fewer sides exposed.

3. Design A costs the most (\$1,010), and Design C costs the least (\$810).

4. Yes, you can make many rectangles with an area of 18 m^2 , including 1×18 , 2×9 , 3×6 , 6×3 , 9×2 , and 18×1 . The perimeters of these rectangles are:
 1×18 and 18×1 : perimeter = 38 m
 2×9 and 9×2 : perimeter = 22 m
 3×6 and 6×3 : perimeter = 18 m

C. 1. Design I: 36 m^2
 Design II: 40 m^2
 Design III: 55 m^2
 Strategies for finding area may vary. Any reasonable strategy, including counting the number of squares, is acceptable.

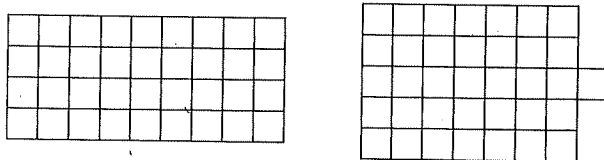
2. Design I: 24 m
 Design II: 26 m
 Design III: 32 m
 Strategies for finding area may vary. Strategies for finding perimeter may vary. Any reasonable strategy, including counting the units of the design's outline, is acceptable.

3. a. Possible answers:
 The perimeter is length plus width plus length plus width, or the perimeter is twice the sum of the length and width, or the perimeter is twice the length added to twice the width.
 $P = l + w + l + w$, or $P = (l + w) \times 2$, or $P = 2 \times l + 2 \times w$

b. Possible answers:
 The area is the length times the width.
 $A = l \times w$, or $A = w \times l$

c. $P = 2(6 + 15) = 2(21) = 42 \text{ cm}$ or
 $P = 2(6) + 2(15) = 12 + 30 = 42 \text{ cm}$
 $A = 6 \times 15 = 90 \text{ square centimeters}$

Figure 1





Assignment Guide for Problem 1.2

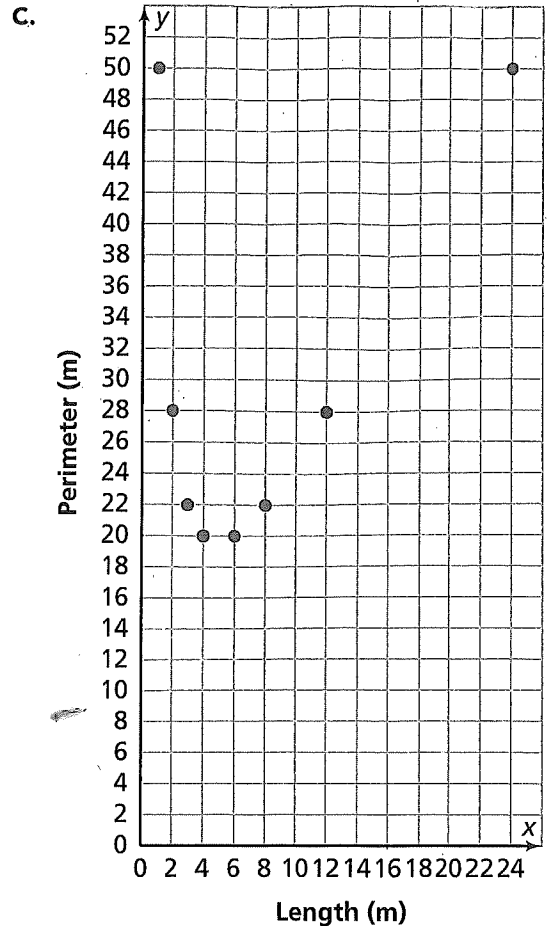
Applications: 25–30 | Connections: 55–57

Answers to Problem 1.2

A.

Length (m)	Width (m)	Perimeter (m)	Area (m ²)
1	24	50	24
2	12	28	24
3	8	22	24
4	6	20	24
6	4	20	24
8	3	22	24
12	2	28	24
24	1	50	24

- B.
1. Perimeter; possible explanation: Perimeter is the distance or length around the outside of a shape. The walls fit around the outside, so the number of panels depends on how long the distance around the outside is.
 2. The 1 m × 24 m (or 24 m × 1 m) shelter requires the most panels. The floor plan is long and skinny, with the least open space and the most wall sections.
 3. The 4 m × 6 m (or 6 m × 4 m) shelter requires the fewest panels. The floor plan is the most square-like of the possibilities. The floor plan would have the most open space and the fewest panels.



2. The graph is curved. Moving from left to right, the points get lower and lower, then begin to rise again. This is because if one side of the storm shelter is very short, the other must be very long, so the perimeter will be large. As the two dimensions become close to each other, the perimeter becomes smaller. Past a certain point, the perimeter becomes large again.
- D.
1. The 6 m × 6 m floor plan has the least perimeter (24 m) because it is the most square-like floor plan. The 36 m × 1 m floor plan has the greatest perimeter (74 m) because it is the skinniest floor plan.
 2. A long, skinny rectangle has the largest perimeter for a fixed area, while the rectangle that is most square-like has the smallest perimeter for a fixed area.

The more square-like a shape is, the more of the square units there are on the inside of the shape and less that touch the edge. When fewer units touch the edge, the perimeter is smaller. Prompt students to use the data in the table and the diagrams of the rectangles to support their reasoning when answering Question C.



Assignment Guide for Problem 1.3

Applications: 31–36 | Connections: 58–69
Extensions: 70–78

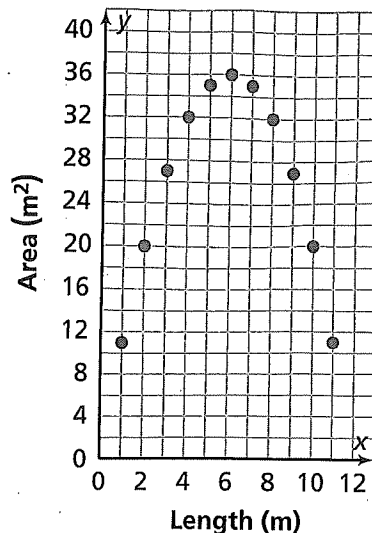
Answers to Problem 1.3

A. 1.

Length (m)	Width (m)	Perimeter (m)	Area (m ²)
1	11	24	11
2	10	24	20
3	9	24	27
4	8	24	32
5	7	24	35
6	6	24	36
7	5	24	35
8	4	24	32
9	3	24	27
10	2	24	20
11	1	24	11

- For rectangles with whole-number dimensions and a perimeter of 24 m, a 1 m × 11 m (or 11 m × 1 m) rectangle will have the least area and a 6 m × 6 m rectangle (a square) will have the greatest area.
- Possible answer: A 6 m × 6 m dog pen would be the best design to choose because it has the most area for a dog to roam around.

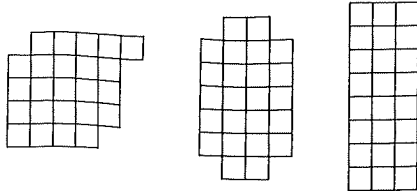
B. 1.



- The graph is curved. As you read it from left to right, the points rise to a certain place, then go down. In the table, as the length increases in the table, the width decreases. The area increases until we have a square. Here, the area is maximized and so increasing the length further begins to decrease the area.
- This graph is curved like the other one was, but the curve is different. The other graph was decreasing to a minimum, then increasing. This curve increases to a maximum, then decreases. This graph is symmetrical, the other was not. The two graphs show different relationships: the possible areas for a fixed perimeter and the possible perimeters for a fixed area.
- With 36 m of fencing, the rectangle with whole-number side lengths that has the least area will be 17 m × 1 m (or 1 m × 17 m). The greatest area is formed with a 9 m × 9 m rectangle (square).
- The longest and thinnest shape has the least area for a fixed perimeter. A square shape has the most area for a fixed perimeter.

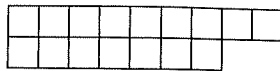
Applications

1. a. Possible answers:

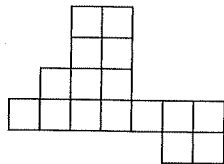


- b. The bumper-car ride has an area of 24 m^2 , which is the total number of square meters used to cover the floor plan of the bumper-car ride. The perimeter of 22 m is the total number of rail sections that are needed to surround the bumper-car ride.

2. Answers will vary. Maximum perimeter for whole-number dimensions is 34 units, minimum is 16 units. Possible answers:

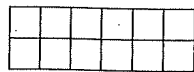


Perimeter: 22 units

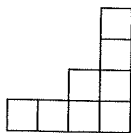


Perimeter: 26 units

3. Answers will vary. Maximum area for whole-number dimensions is 16 square units, minimum is 7 square units. Possible answers:

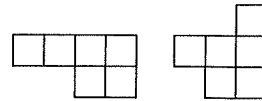


Area: 12 square units

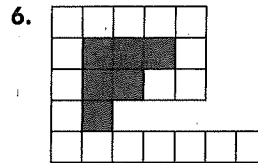


Area: 8 square units

4. Answers will vary. Possible answers:



5. Possible answers: The perimeters are not the same, because I counted the number of units around the edge of each figure and found that their perimeters were different.



Adding these six tiles reduced the perimeter of the figure. Only two of the new tiles have exposed edges, while together they cover ten previously exposed edges in the original figure.

7. $P = 4 \times 12 \text{ ft} = 48 \text{ ft}$, $A = 12 \text{ ft} \times 12 \text{ ft} = 144 \text{ ft}^2$
8. $P = 22 \times 12 \text{ ft} = 264 \text{ ft}$,
 $A = 144 \text{ ft}^2 \times 21 = 3,024 \text{ ft}^2$
9. $P = 30 \times 12 \text{ ft} = 360 \text{ ft}$,
 $A = 144 \text{ ft}^2 \times 26 = 3,744 \text{ ft}^2$
10. $P = 26 \times 12 \text{ ft} = 312 \text{ ft}$,
 $A = 144 \text{ ft}^2 \times 20 = 2,880 \text{ ft}^2$
11. $P = 16 \text{ units}$, $A = 7 \text{ units}^2$
12. $P = 16 \text{ units}$, $A = 16 \text{ units}^2$
13. $P \approx 11 \text{ units}$, $A \approx 5.5 \text{ units}^2$
14. $P = 40 \text{ in.}$, $A = 100 \text{ in.}^2$
15. $P = 40 \text{ m}$, $A = 75 \text{ m}^2$
16. $P = 2\ell + 2w$, $A = \ell \cdot w$

