

13.4a Area of composite figures

Objective

- Use the formula for the area of a rectangle to find the area of composite rectilinear figures.

Materials

- Cards or paper cut into various-sized rectangles with whole centimeter lengths
- Centimeter graph paper



Common Core State Standards

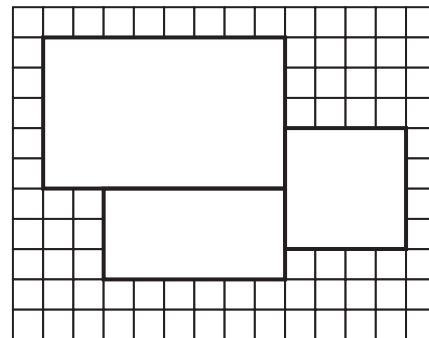
- 3.MD.7c
- 3.MD.7d
- 3.MD.8

Mathematical Practices

- MP1
- MP2
- MP4
- MP7

Area of composite figures

- Give students three different-sized rectangles and some centimeter graph papers. All students in a group should have the same-sized rectangles. The example on the right uses rectangles that are 8 cm × 5 cm, 3 cm × 6 cm, and 4 cm × 4 cm.
- Have students arrange them on centimeter graph paper such that adjacent rectangles touch at least 1 cm along the sides and that they line up with the centimeter squares. Get students to trace the outline or tape the cards to the graph paper.
- Have students find the area of the resulting figure. They should realize that they can find the total area simply by adding the area of each rectangle that made up the composite figure.
- You can also ask students to find the perimeter.
- Have students within a group compare their final shapes. Their shapes should all have the same area, but the perimeters of those shapes may vary.



Area: 74 square centimeters
Perimeter: 40 cm

Discussion

- Ask students to find the area using multiplication rather than counting squares. Students will need to divide each figure into two rectangles. There are two ways to divide each of them into two rectangles

Answers:

- A: Area = 22 square centimeters, Perimeter = 24 cm
- B: Area = 22 square centimeters, Perimeter = 20 cm
- C: Area = 22 square centimeters, Perimeter = 22 cm
- D: Area = 22 square centimeters, Perimeter = 24 cm

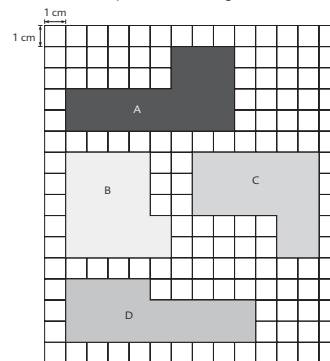
Yes, all the figures have the same area.

No, they do not have the same perimeter.

Textbook, pp. 160–163

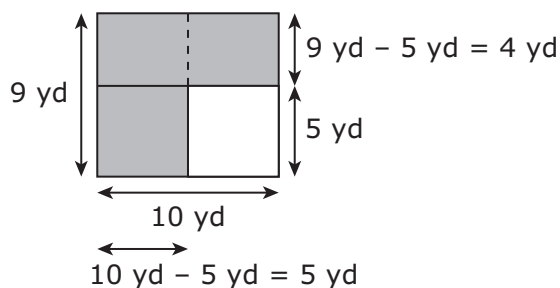
4 Composite Figures

Each of the following figures is made up of two rectangles. Find the area and perimeter of each figure.



Do the figures have the same area?
Do they have the same perimeter?

- Task 2: Have students use both methods to find the total area. They must first find some unlabeled lengths using subtraction. There is a third method as well: dividing the shape into two rectangles.

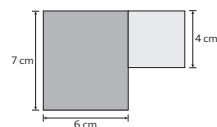


Answers:

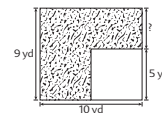
- Perimeter = $7\text{ cm} + 6\text{ cm} + 4\text{ cm} + 4\text{ cm} + 4\text{ cm} + 3\text{ cm} + 6\text{ cm}$
 $= 34\text{ cm}$
 $7\text{ cm} \times 6\text{ cm} = 42\text{ square centimeters}$
 $4\text{ cm} \times 4\text{ cm} = 16\text{ square centimeters}$
 Total area = $42\text{ square centimeters} + 16\text{ square centimeters}$
 $= 58\text{ square centimeters}$
- $5\text{ yd} \times 5\text{ yd} = 25\text{ square yards}$
 $10\text{ yd} \times 4\text{ yd} = 40\text{ square yards}$
 Area = $25\text{ sq yd} + 40\text{ sq yards}$
 $= 65\text{ square yards}$
 Or:
 $9\text{ yd} \times 10\text{ yd} = 90\text{ square yards}$
 $5\text{ yd} \times 5\text{ yd} = 25\text{ square yards}$
 Area = $90\text{ square yards} - 25\text{ square yards}$
 $= 65\text{ square yards}$
 The area of the carpet is 65 square yards.
 Perimeter = $10\text{ yd} + 4\text{ yd} + 5\text{ yd} + 5\text{ yd} + 5\text{ yd} + 9\text{ yd}$
 $= 38\text{ yd}$
 The perimeter of the carpet is 38 yards.

- Task 3: Have students find the areas of rectangles A and B separately and then find the area of rectangle C. Lead students to see that because both rectangles have one dimension that is the same, 4 units, they can be combined into a single larger rectangle.
- Lead students to see that:
They can add 5 groups of 4 and 2 groups of 4 to get 7 groups of 4.
 $(5 \times 4) + (2 \times 4) = 7 \times 4$
Hence, they can also find the area of rectangle C by adding the lengths of A and B first and then multiply by the width.

- The figure below is made up of a rectangle and a square. Find the perimeter and the area of the entire figure.



- A square was cut out of a rectangular piece of carpeting in order to carpet an L-shaped room. Find the area and perimeter of the piece of carpet.



The carpet is made up of a square and a rectangle. I found their areas and added them together.

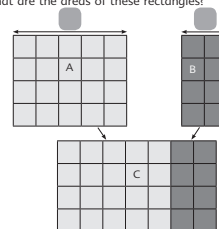
I found the area of the uncut carpet and then subtracted the area of the square part.



The area of the carpet is square yards.

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- What are the areas of these rectangles?



- Area of rectangle A = $4\text{ units} \times \text{ units}$
 $= \text{ square units}$
 Area of rectangle B = $4\text{ units} \times \text{ units}$
 $= \text{ square units}$
 Total area = Area of rectangle A + Area of rectangle B
 $= \text{ square units} + \text{ square units}$
 $= \text{ square units}$
 $5 + 2 = 7$
 $(4 \times 5) + (4 \times 2) = 4 \times 7$

- Length of rectangle C = $\text{ units} + \text{ units}$
 $= \text{ units}$
 Area of rectangle C = $4\text{ units} \times \text{ units}$
 $= \text{ square units}$



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Answers:

3. (a) 5
20
2
8
20; 8
28
(b) 5; 2
7
7
28

- Task 4: Discuss the two different methods. Because both pieces have one dimension that is the same, 9 in., they can be combined into a single larger rectangle.
- Lead students to see that:
 $(11 \times 9) + (8 \times 9) = 19 \times 9$
However, do note that students have not learned how to multiply a 2-digit number by a 2-digit number. Hence, they should not be adding the sides first before multiplying.

Answers:

4. (a) 99
72
99 square inches + 72 square inches
= 171 square inches
(b) 19
9 in. \times 19 in. = 171 square inches

4. Mark has 2 pieces of poster paper. Each has one side that is 9 in. long.
He puts them together to make a longer poster.
What is the area of his poster?

I found the area of each piece first.

(a) $9 \text{ in.} \times 11 \text{ in.} = \square$ square inches
 $9 \text{ in.} \times 8 \text{ in.} = \square$ square inches
 Total area = \square square inches + \square square inches
 = \square square inches

(b) $11 \text{ in.} + 8 \text{ in.} = \square$ in.
 Total area = $9 \text{ in.} \times \square \text{ in.} = \square$ square inches

I found the total length first.

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Assessment

Textbook, p. 164

Answers:

5. A: Area = 25 square centimeters,
Perimeter = 20 cm
 B: Area = 154 square inches,
Perimeter = 54 in.
 C: Area = 108 square centimeters,
Perimeter = 48 cm
 D: Area = 55 square feet,
Perimeter = 32 ft
 E: Area = 162 square meters,
Perimeter = 54 m
6. $(50 \text{ m} \times 5 \text{ m}) + (18 \text{ m} \times 5 \text{ m})$
 = 250 square meters + 90 square meters
 = 340 square meters
 He needs **340** square meters of carpet to cover the entire living room.

5. Each figure is made up of squares and rectangles.
Find the area and perimeter of each.

6. Mr. Cheng wants to lay carpet over his living room.
Find the area of carpet he needs to cover the entire living room.

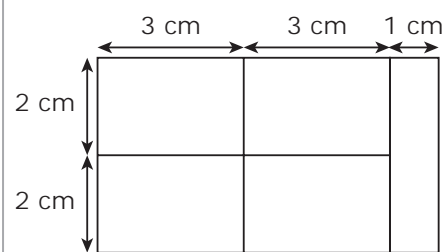
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- Draw the figure shown on the right and ask students to find the total number of rectangles in this figure and the area of each.

Answers:

There are 12 rectangles.

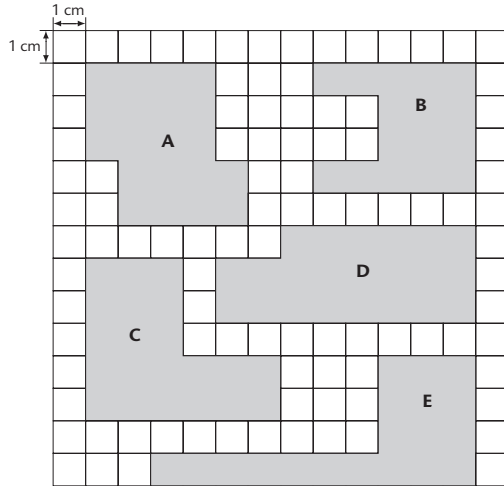
- 1 with area = $1 \text{ cm} \times 4 \text{ cm} = 4$ square centimeters
- 4 with area = $3 \text{ cm} \times 2 \text{ cm} = 6$ square centimeters
- 2 with area = $2 \text{ cm} \times 6 \text{ cm} = 12$ square centimeters
- 2 with area = $3 \text{ cm} \times 4 \text{ cm} = 12$ square centimeters
- 1 with area = $4 \text{ cm} \times 4 \text{ cm} = 16$ square centimeters
- 1 with area = $4 \text{ cm} \times 6 \text{ cm} = 24$ square centimeters
- 1 with area = $7 \text{ cm} \times 4 \text{ cm} = 28$ square centimeters



- Have students complete Workbook Exercise 7 on pages 178–180.

EXERCISE 7

1. Find the area and perimeter of each of the following figures.

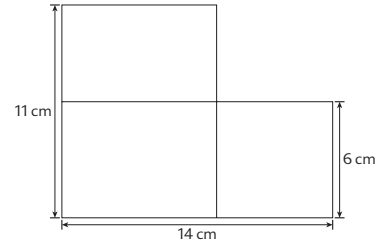


- A. Area = 20 square centimeters Perimeter = 20 cm
 B. Area = 16 square centimeters Perimeter = 22 cm
 C. Area = 21 square centimeters Perimeter = 22 cm
 D. Area = 22 square centimeters Perimeter = 22 cm
 E. Area = 19 square centimeters Perimeter = 28 cm

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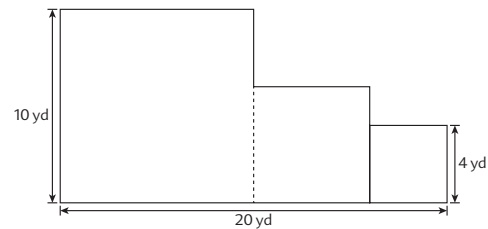
Unit 13: Area and Perimeter

2. The figure below is made up of two rectangles and a square. Find the area and the perimeter.



Area = 124 square centimeters Perimeter = 50 cm

3. The entrance and living room of a house need to be carpeted. The living room has an L shape consisting of two squares. The entrance is also shaped like a square. The carpet and padding cost \$8 per square yard. How much will it cost to carpet the two rooms? \$1,216



Unit 13: Area and Perimeter

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4. The length of a tablecloth is 4 m.
Its width is 2 m.
Find the area of the tablecloth.

$4 \text{ m} \times 2 \text{ m} = 8 \text{ square meters}$
The area of the tablecloth is 8 square meters.

5. Mrs. Wiley wants to cover a strip of a wall with square mosaic tiles. Each square mosaic tile has an area of 1 square inch. The strip of wall has a length of 90 in. and a width of 9 in. How many square mosaic tiles must she use to cover the strip of wall?

$90 \times 9 = 810$
She must use 810 square mosaic tiles.

6. The length of a square mirror is 8 ft.
Find the area of the mirror.

$8 \text{ ft} \times 8 \text{ ft} = 64 \text{ square feet}$
The area of the mirror is 64 square feet.

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Unit 13: Area and Perimeter