

Lesson 11: Perimeters and Areas of Polygonal Regions Defined by Systems of Inequalities

Classwork

Opening Exercise

Graph the following:

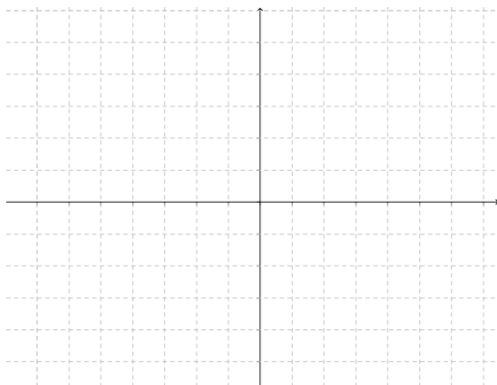
a. $y \leq 7$



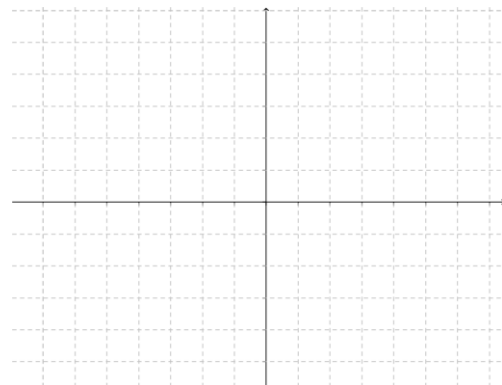
b. $x > -3$



c. $y < \frac{1}{2}x - 4$

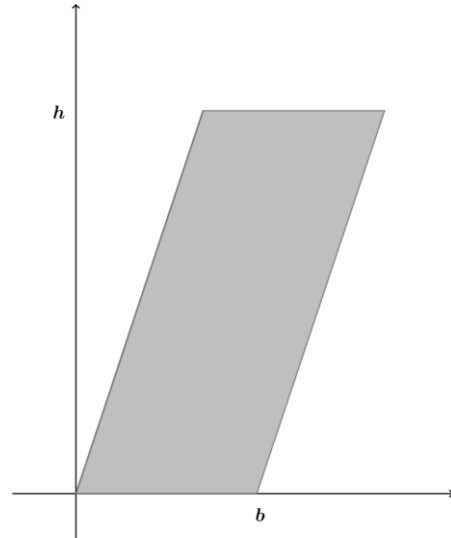


d. $y \geq -\frac{2}{3}x + 5$

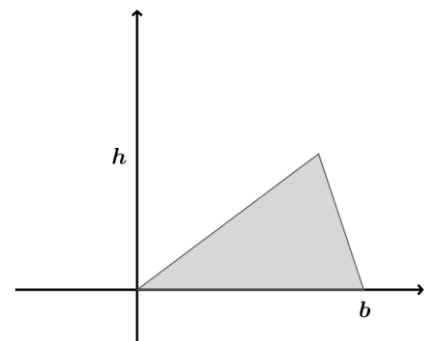


Example 1

A parallelogram with base of length b and height h can be situated in the coordinate plane, as shown. Verify that the shoelace formula gives the area of the parallelogram as bh .

**Example 2**

A triangle with base b and height h can be situated in the coordinate plane, as shown. According to Green's theorem, what is the area of the triangle?

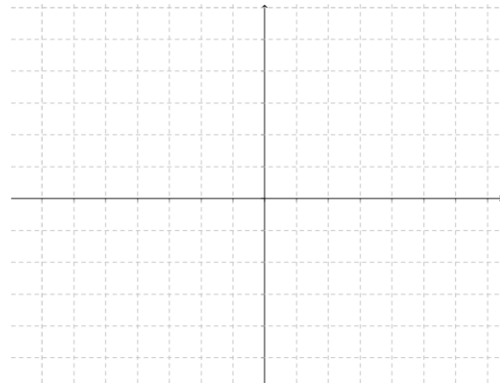


Exercises

1. A quadrilateral region is defined by the system of inequalities below:

$$y \leq x + 6 \qquad y \leq -2x + 12 \qquad y \geq 2x - 4 \qquad y \geq -x + 2$$

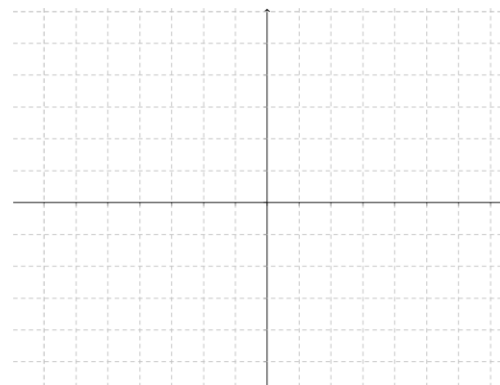
- a. Sketch the region.
- b. Determine the vertices of the quadrilateral.
- c. Find the perimeter of the quadrilateral region.
- d. Find the area of the quadrilateral region.



2. A quadrilateral region is defined by the system of inequalities below:

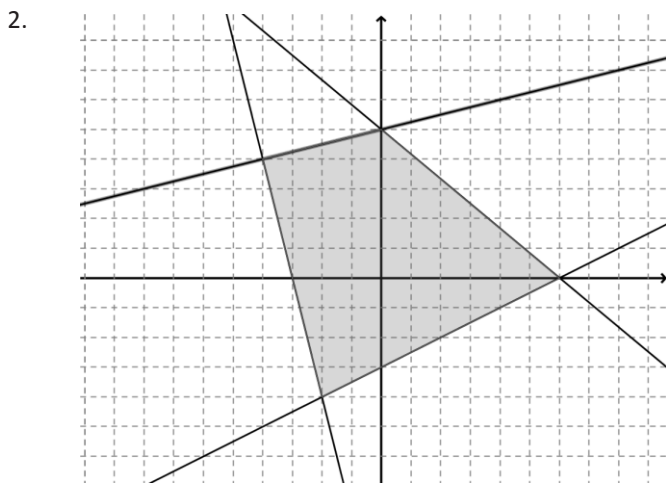
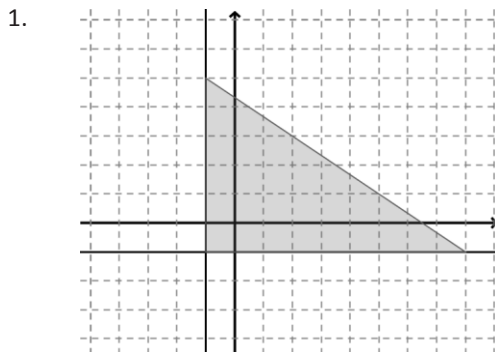
$$y \leq x + 5 \qquad y \geq x - 4 \qquad y \leq 4 \qquad y \geq -\frac{5}{4}x - 4$$

- a. Sketch the region.
- b. Determine the vertices of the quadrilateral.
- c. Which quadrilateral is defined by these inequalities? How can you prove your conclusion?
- d. Find the perimeter of the quadrilateral region.
- e. Find the area of the quadrilateral region.



Problem Set

For Problems 1–2 below, identify the system of inequalities that defines the region shown.



For Problems 3–5 below, a triangular or quadrilateral region is defined by the system of inequalities listed.

- Sketch the region.
- Determine the coordinates of the vertices.
- Find the perimeter of the region rounded to the nearest hundredth if necessary.
- Find the area of the region rounded to the nearest tenth if necessary.

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|-----------------------|-------------------|--------------------|----------------|
| 3. $8x - 9y \geq -22$ | $x + y \leq 10$ | $5x - 12y \leq -1$ | |
| 4. $x + 3y \geq 0$ | $4x - 3y \geq 0$ | $2x + y \leq 10$ | |
| 5. $2x - 5y \geq -14$ | $3x + 2y \leq 17$ | $2x - y \leq 9$ | $x + y \geq 0$ |