Lesson 2: Finding Systems of Inequalities That Describe Triangular and Rectangular Regions
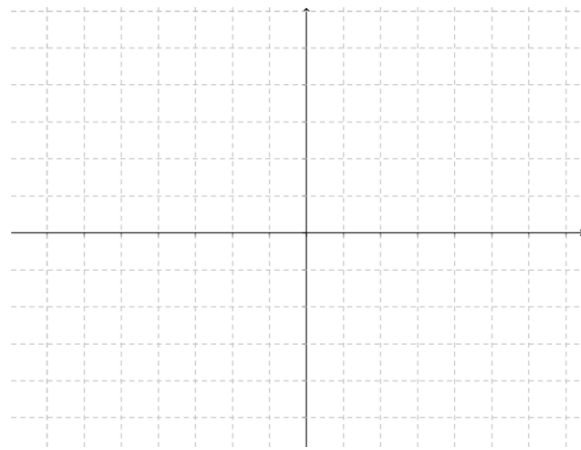
Classwork

Opening Exercise

Graph each system of inequalities.

a. $\begin{cases} y \geq 1 \\ x \leq 5 \end{cases}$

   i.   Is $(1,2)$ a solution? Explain.
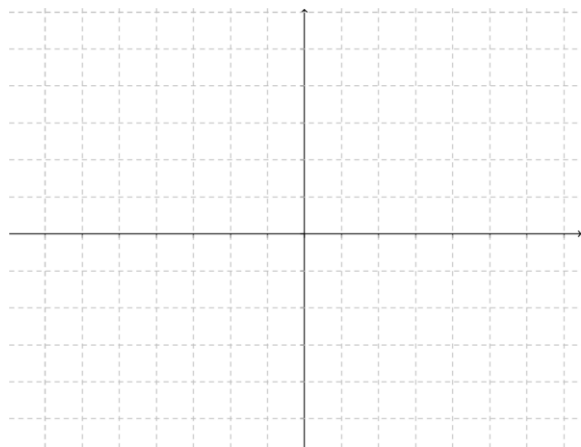
   ii.   Is $(1,1)$ a solution? Explain.

   iii.   The region is the intersection of how many half-planes? Explain how you know.

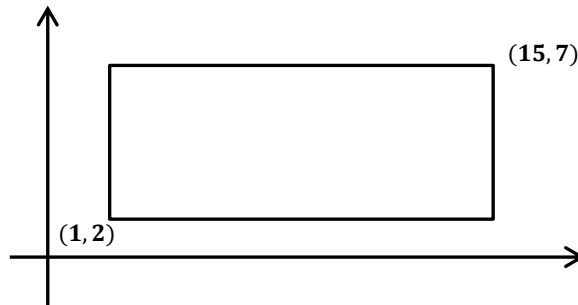b. $\begin{cases} y < 2x + 1 \\ y \geq -3x - 2 \end{cases}$

   i.   Is $(-2,4)$ in the solution set?

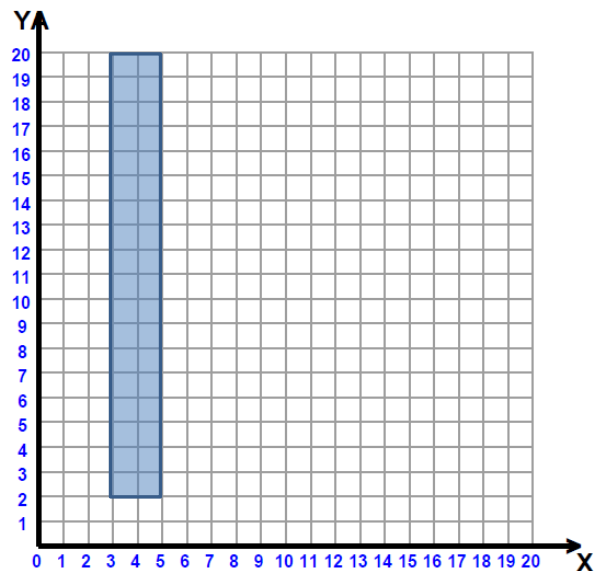   ii.   Is $(1,3)$ in the solution set?

iii. The region is the intersection of how many half-planes? Explain how you know.
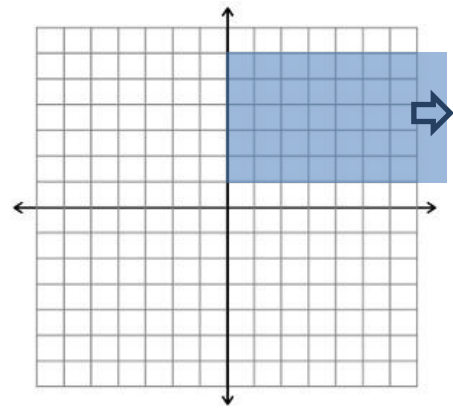
Example 1

Exercises 1–3

1. Given the region shown to the right:

   a. Name three points in the interior of the region.

   b. Name three points on the boundary.

   c. Describe the coordinates of the points in the region.

d.   Write the inequality describing the x-values.

e.   Write the inequality describing the y-values.

f.   Write this as a system of equations.

g.   Will the lines $x = 4$ and $y = 1$ pass through the region? Draw them.

2.   Given the region that continues unbound to the right as shown to the right:

a.   Name three points in the region.

b.   Describe in words the points in the region.

c.   Write the system of inequalities that describe the region.

d.   Name a horizontal line that passes through the region.

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              Rectangular Regions
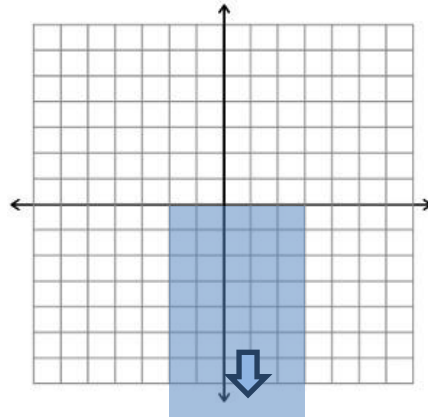
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3. Given the region that continues down without bound as shown to the right:

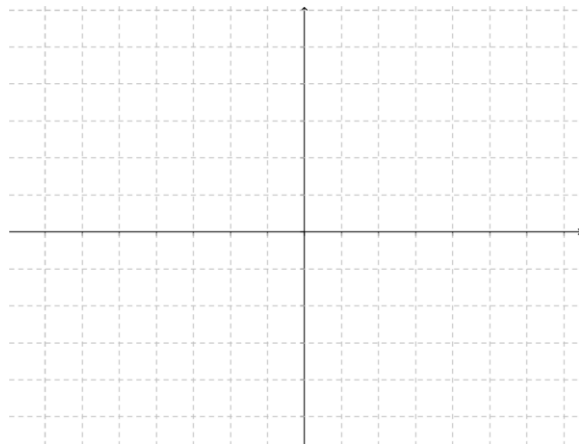   a. Describe the region in words.

   b. Write the system of inequalities that describe the region.

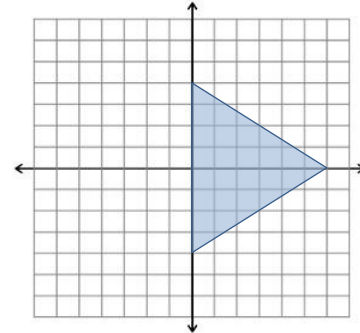   c. Name a vertical line that passes through the region.

Example 2

Draw the triangular region in the plane given by the triangle with vertices $(0,0)$, $(1,3)$, and $(2,1)$. Can we write a set of inequalities that describes this region?
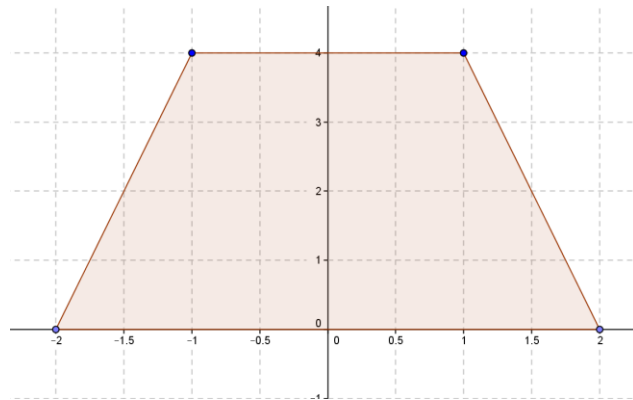
Exercises 4–5

4. Given the triangular region shown, describe this region with a system of inequalities.
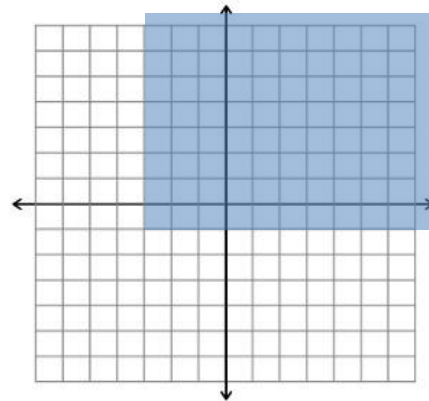

5. Given the trapezoid with vertices $(-2,0)$, $(-1,4)$, $(1,4)$, and $(2,0)$, describe this region with a system of inequalities.

Problem Set

1. Given the region shown:

    a. How many half-planes intersect to form this region?

    b. Name three points on the boundary of the region.
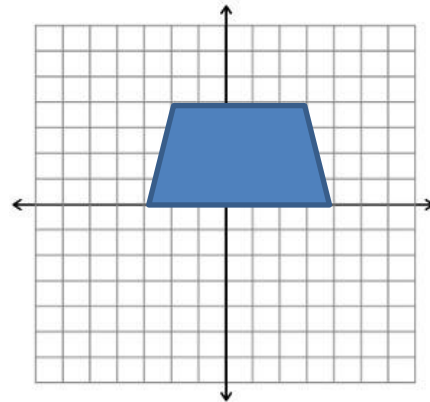
    c. Describe the region in words.

2. Region T is shown to the right.

    a. Write the coordinates of the vertices.

    b. Write an inequality that describes the region.

    c. What is the length of the diagonals?

    d. Give the coordinates of a point that is both in the region and on one of the diagonals.
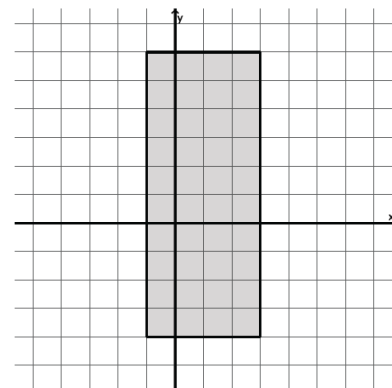
3. Jack wants to plant a garden in his backyard. His yard is 120 feet wide and 80 feet deep. He wants to plant a garden that is 20 feet by 30 feet.

    a. Set up a grid for the backyard, and place the garden on the grid. Explain why you placed your garden in its place on the grid.

    b. Write a system of inequalities to describe the garden.

    c. Write the equation of three lines that would go through the region that he could plant on, and explain your choices.

4. Given the trapezoidal region shown to the right:

    a. Write the system of inequalities describing the region.

    b. Translate the region to the right 3 units and down 2 units. Write the system of inequalities describing the translated region.

Challenge Problems:

5. Given the triangular region shown with vertices $A(-2,-1)$, $B(4,5)$, and $C(5,-1)$:

    a. Describe the systems of inequalities that describe the region enclosed by the triangle.

    b. Rotate the region $90°$ counterclockwise about Point A. How will this change the coordinates of the vertices?

    c. Write the system of inequalities that describe the region enclosed in the rotated triangle.
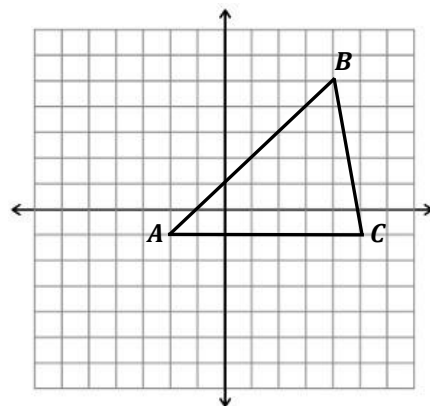
6. Write a system of inequalities for the region shown.