Name: KEY Date: _____

SYSTEMS OF INEQUALITIES

We can have **systems of inequalities** as well as **systems of equations (equalities)**. The definition of solving a system still holds: we have to find all points that make all inequalities true.

Exercise #1: Consider the system of inequalities shown below. Determine if each of the following points is a solution or not to the system. Show work that justifies your answers.

(a) (3, 8) yes

$3+8>10$

$11>10$ ✓

$8 \geq 3(3)-5$

$8 \geq 9-5$

$8 \geq 4$ ✓

(b) (5, 9) no

$5+9>10$

$14>10$ ✓

$9 \geq 3(5)-5$

$9 \geq 15-5$

$9 \geq 10$ ×

(c) Graph the solution set to this system of inequalities.

$x+y>10$

$-x \quad -x$

$y > -x+10$

$m = \frac{-1}{1}$

$b = 10$

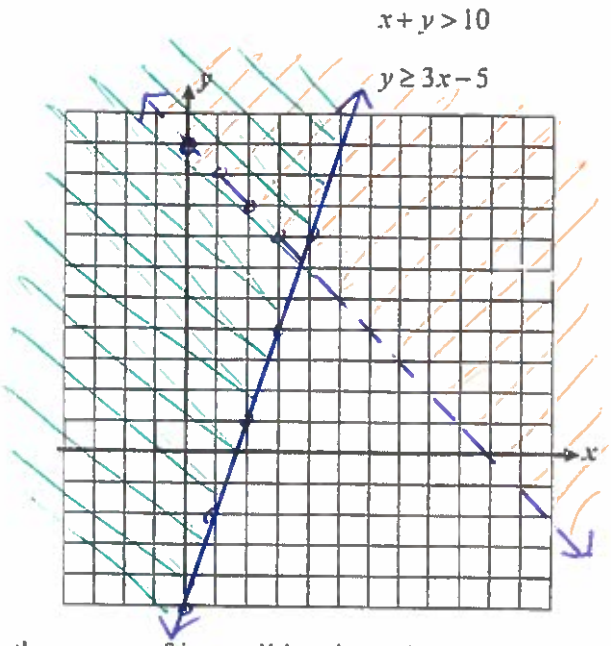
dashed line

$y \geq 3x-5$

$m = \frac{3}{1}$

$b = -5$

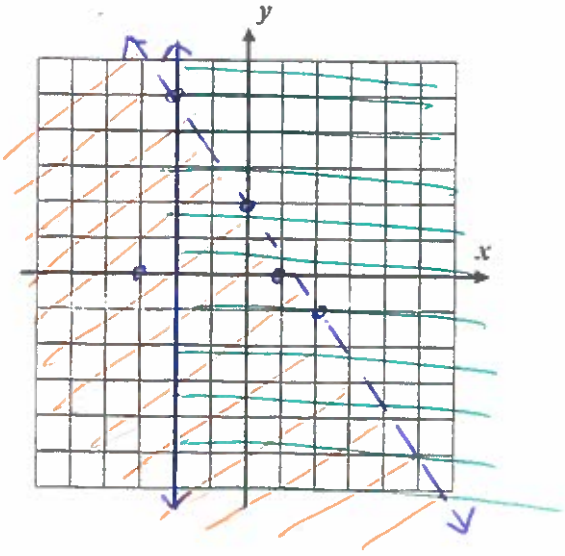
solid line



Exercise #2: On the grid shown below, graph the solution to the system of inequalities shown below. State a point that lies in the solution set and one that doesn't.

$y < -\frac{3}{2}x+2$ $m = -\frac{3}{2}$, $b = 2$ dashed

$x \geq -2$ solid



Point in Solution Set:

(1,0) yes

$0 < -\frac{3}{2}(1)+2$

$0 < -\frac{3}{2}+\frac{4}{2}$

$0 < \frac{1}{2}$ ✓

$1 \geq -2$ ✓

Point Not in Solution Set:

(-4,0) no

$0 < -\frac{3}{2}(-4)+2$

$0 < 6+2$

$0 < 8$ ✓

$-4 \geq -2$ ×

Exercise #3: Which of the following points is a solution to the system of inequalities shown below? Show the work that leads to your answer.

$y \le -4x + 2$

$y > \frac{x}{2} + 7$

(A) $(3, -6)$ $-6 \le -12 + 2$ $-6 \le -10$ ✗

(B) $(-2, 10)$ $10 \le 8 + 2$ $10 \le 10$ ✓ $10 > -1 + 7$ $10 > 6$ ✓

(C) $(0, 2)$ $2 \le 0 + 2$ $2 \le 2$ ✓ $2 > 7$ ✗

(D) $(4, 10)$ $10 \le -16 + 2$ $10 \le -14$ ✗

Very often, systems of inequalities will define portions of the xy-plane that can be visualized and manipulated.

Exercise #4: Consider the system of inequalities given below.

$y \ge -2$

$x < 4$

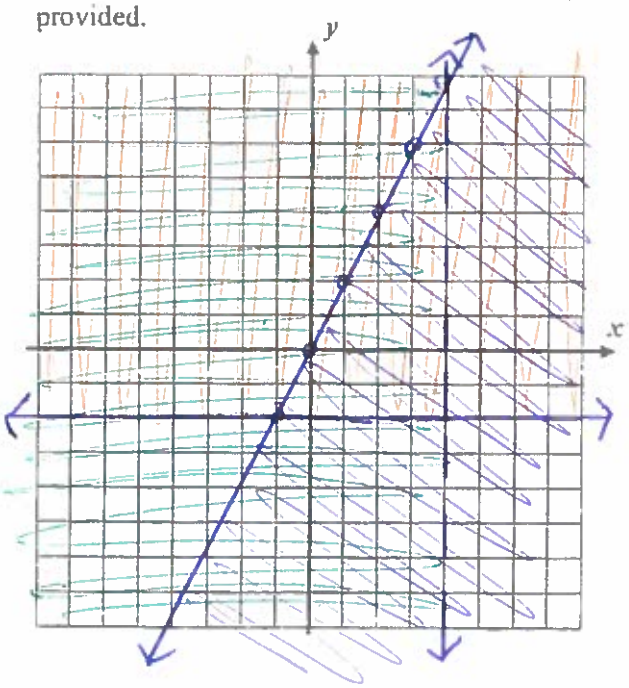
$y \le 2x$ $m = 2$ $b = 0$

(a) Determine which, if any, of these points is a solution to the system.

$(-1, 4)$ $4 \ge -2$ ✓ $-1 < 4$ ✓ $4 \le -2$ ✗

$(3, 1)$ $1 \ge -2$ ✓ $3 < 4$ ✓ $1 \le 6$ ✓

(b) Sketch the solution to the system on the grid provided.



(c) Find the area of the portion of the xy-plane that represents the solution.

$A = \frac{1}{2}bh$

$A = \frac{1}{2}(5)(10)$

$A = 25$

(d) Why does the dashed line of one of the borders not make a difference in terms of the area you found in part (c)?

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SOLVING SYSTEMS OF INEQUALITIES

FLUENCY

1. Which of the following points is a solution to the system of inequalities shown below?

$y > x+1$

$y \leq -2x+7$

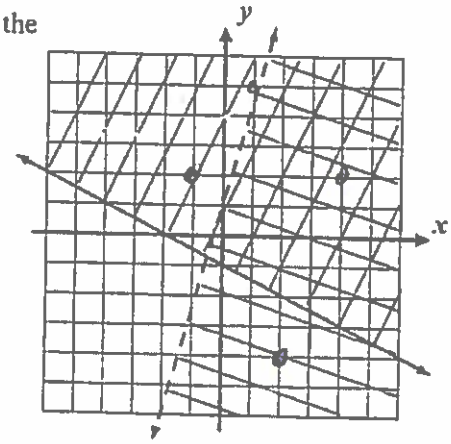
(1) $(3,5)$ $5>3+1$ $5>4$ ✓ $5 \leq 1$ ✗

(2) $(1,3)$ $3>2$ ✓ $3 \leq 5$ ✓

(3) $(1,-2)$ $-2>2x$ $-2 \leq 5$ ✓

(4) $(2,3)$ $3>3$ ✗ $3 \leq 3$ ✓

2. A system of inequalities is shown graphed below. Which of the following points lies in the solution set of this system?



(1) $(-1,2)$ ✗

(2) $(2,-4)$ ✗

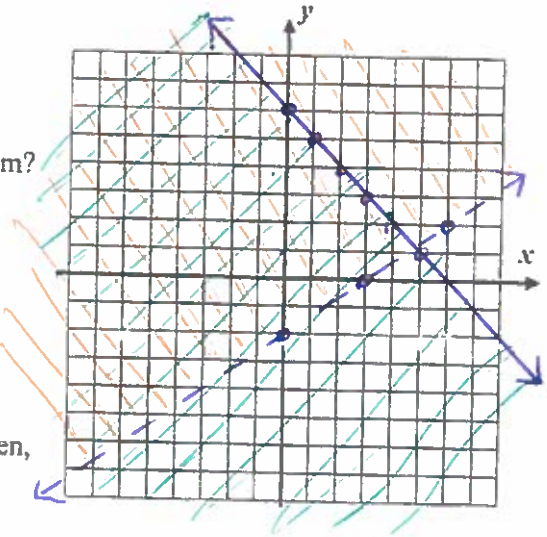
(3) $(1,5)$ ✗

(4) $(4,2)$ ✓

3. Consider the system of inequalities shown below.

$y > \frac{2}{3}x-2$ $m=\frac{2}{3}$, $b=-2$, dashed

$y \leq -x+6$ $m=\frac{-1}{1}$, $b=6$, solid



(a) Is the origin, $(0,0)$, part of the solution set of the system? Determine without first graphing.

$0>-2$ ✓ $0 \leq 6$ ✓ yes

(b) Graph the solution to the system of inequalities. Then, state one point that lies in the set and one that doesn't.

One Point That Lies in the Solution:

(0,0) (already shown)

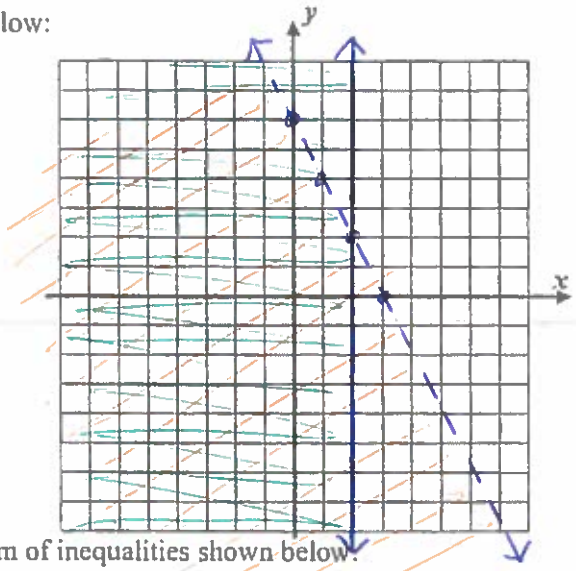
One Point that Does Not Lie in the Solution

(3, -2): $-2>2-2$ $-2>0$ ✗ $-2 \leq -3+6$ $-2 \leq 3$ ✓

4. Sketch the solution to the system of inequalities shown below:

$y + 2x < 6$ $y < -2x + 6$ $m = \frac{-2}{1}$ $b = 6$

$x \leq 2$



State a point that lies in the solution set:

$(-2, 0)$

$0 - 4 < 6$ $-2 \leq 2$ ✓

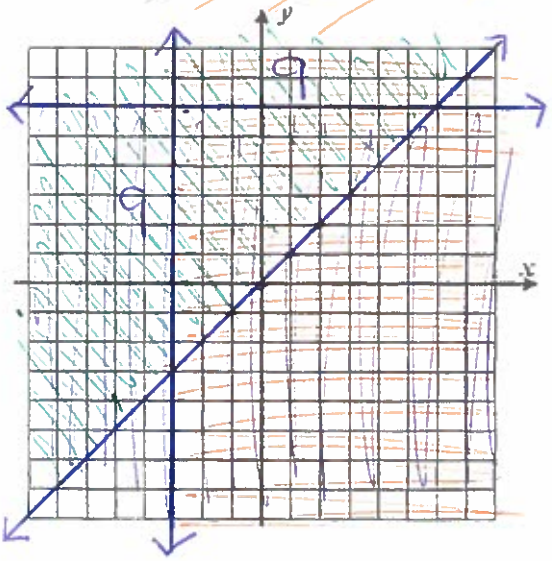
$-4 < 6$ ✓

5. Find the area of the triangular region defined by the system of inequalities shown below.

$y \geq x$ $m = \frac{1}{1}, b = 0$

$x \geq -3$

$y \leq 6$



$A = \frac{1}{2}bh$

$A = \frac{1}{2}(9)(9)$

$A = \frac{1}{2}(81)$

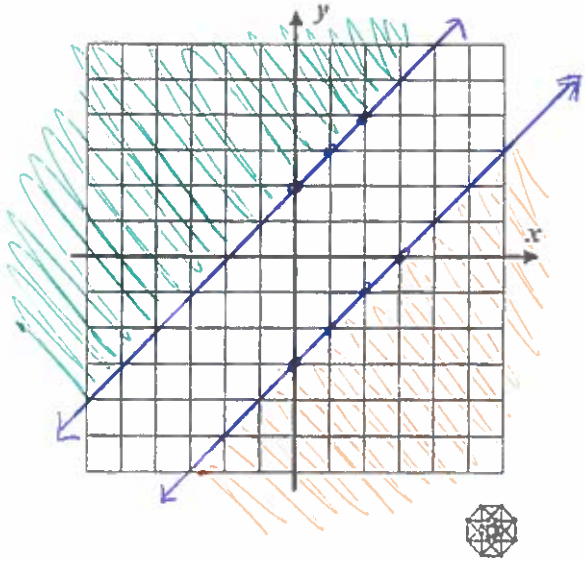
$A = 40.5$

Reasoning

6. Consider the system of inequalities shown below:

$y \geq x + 2$ $m = \frac{1}{1}, b = 2$

$y \leq x - 3$ $m = \frac{1}{1}, b = -3$



(a) Graph the system solution to the system on the grid.

(b) Why can you **not** state a point in the solution set?

the shading never overlaps