Sample: **Graph Theory** - Linear Programming Problems
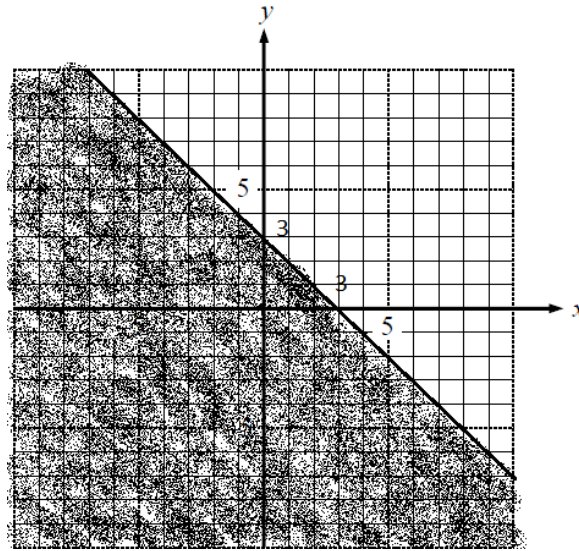
Q1

(a)

Write the inequality in standard form:

$$y \leq -x + 3$$

So, solution of the inequality is the area below the line

$$y = -x + 3$$

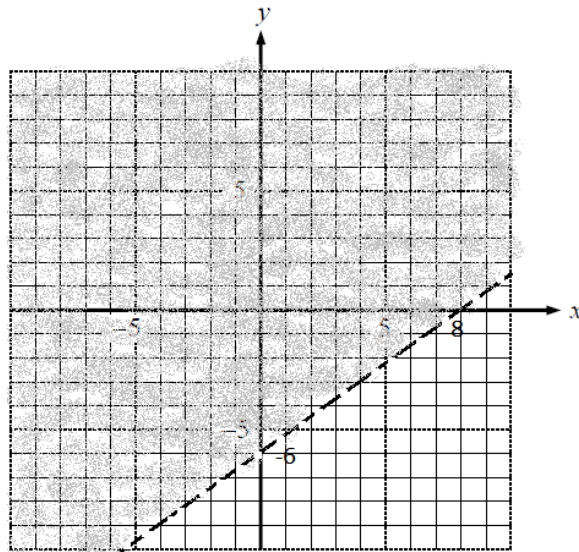(The sign is $\leq$, so the line is included into the region).

(b) Write the inequality in standard form:

$$y > \frac{3x}{4} - 6$$

So, solution of the inequality is the area above the line

$$y = -\frac{3x}{4} - 6$$

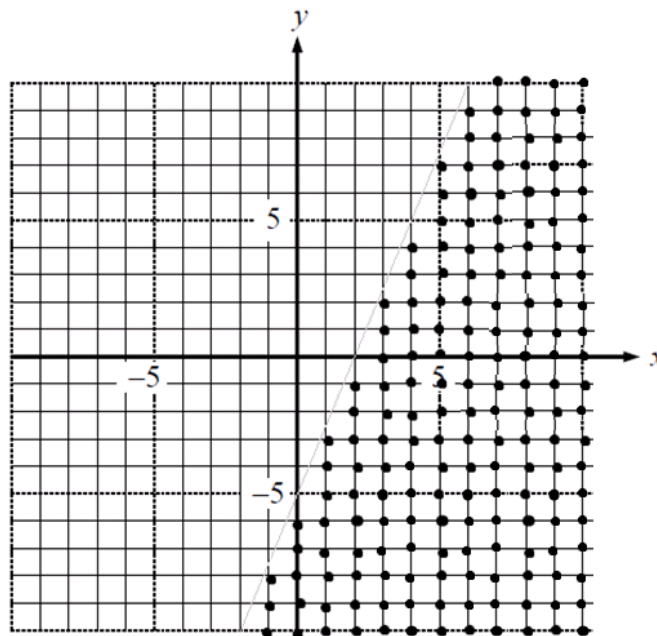(The sign is $>$, so the line is excluded from the region).

1

(c) Write the inequality in standard form:

$$y < \frac{5}{2}x - 5$$

So, solution of the inequality is formed by all the integer nodes of coordinate grid in the area below the line

$$y = -\frac{3x}{4} - 6$$

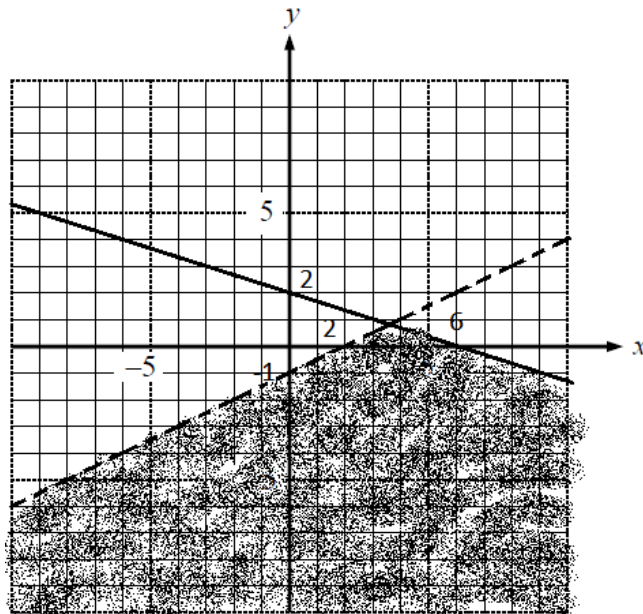(The sign is $<$, so the line is excluded from the region).

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Q2

(a) Write the inequalities in standard form:

$$\begin{cases} y \le -\dfrac{x}{3} + 2 \\ y < \dfrac{x}{2} - 1 \end{cases}$$

Solution of the system of inequalities is the region that is simultaneously:

- below the line $y = -\dfrac{x}{3} + 2$ (the line is included into the region)

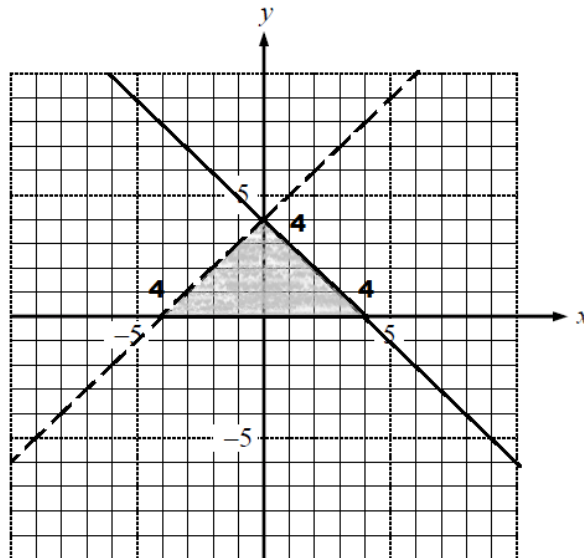- below the line $y = \dfrac{x}{2} - 1$ (the line is excluded from the region)

(b) Write the inequalities in standard form:

$$\begin{cases} y \le -x + 4 \\ y < x + 4 \\ y \ge 0 \end{cases}$$

Solution of the system of inequalities is the region that is simultaneously:
- below the line $y = -x + 4$ (the line is included into the region)
- below the line $y = x + 4$ (the line is excluded from the region)
- in the top half of the plane (above x-axis, the axis is included to the region)
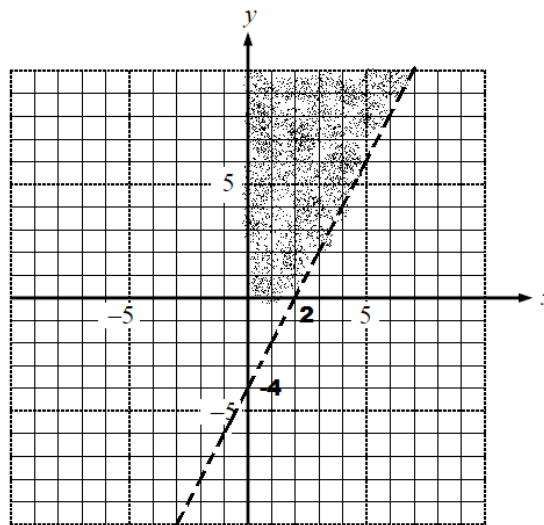
(c) Write the inequalities in standard form:

$$\begin{cases} y > 2x - 4 \\ x \geq 0 \\ y \geq 0 \end{cases}$$

Solution of the system of inequalities is the region that is simultaneously:
- above the line $y = 2x - 4$ (the line is excluded from the region)
- in the first quarter (axes are included to the region)

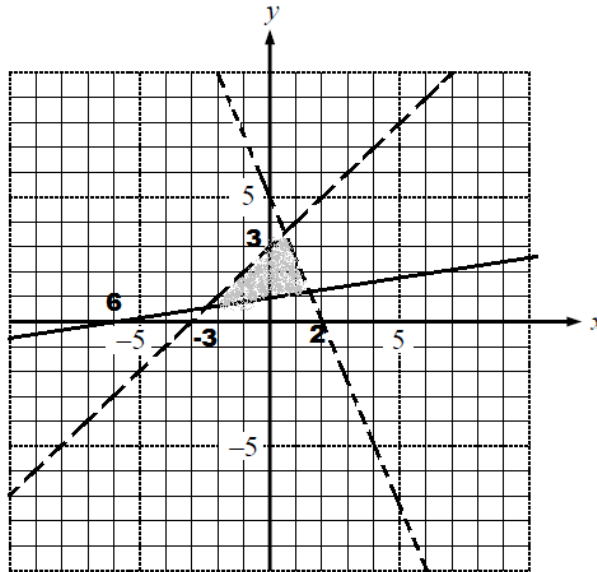(d) Write the inequalities in standard form:

$$\begin{cases} y \geq \dfrac{x}{6} + 1 \\ y < -\dfrac{5x}{2} + 5 \\ y < x + 3 \end{cases}$$

Solution of the system of inequalities is the region that is simultaneously:
- above the line $y = \dfrac{x}{6} + 1$ (the line is included into the region)
- below the line $y = -\dfrac{5x}{2} + 5$ (the line is excluded from the region)

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- below the line $y = x + 3$ (the line is excluded from the region)

(e) Write the inequalities in standard form:

$$\begin{cases} y < \dfrac{5x}{4} - 5 \\ y \le -\dfrac{x}{2} + 2 \\ x \le 0 \\ y \le 0 \end{cases}$$

Solution of the system of inequalities is the region that is simultaneously:

- below the line $y = \dfrac{5x}{4} - 5$ (the line is excluded from the region)

- below the line $y = -\dfrac{x}{2} + 2$ (the line is included to the region)

- in the third quarter (axes are included to the region)

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