Graphing Linear Inequalities in Two Variables

Two-Variable Inequalities: Feasible Designs and Budgets

Name _____ **Date** _____ **Score** _____ / 6

QUICK REVIEW

A budget $x + y \le 6$ means $y \le 6 - x$. Use a solid boundary for $\le, \ge$ and a dashed boundary for $<, >$. Restrict physical quantities to $x, y \ge 0$. For whole-item counts, mark only integer points in the allowed region; continuous shading is a guide.

Worked example

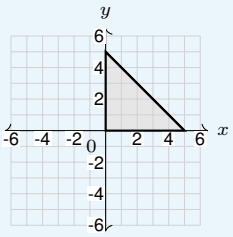
Two materials cost $\$1$ per meter each. Graph $x + y \le 5$ for lengths $x, y \ge 0$.

1. Rewrite: $y \le 5 - x$. Boundary endpoints are $(0, 5)$ and $(5, 0)$.

2. Equality is allowed, so join them with a solid line.

3. At $(0, 0)$, $0 \le 5$. Shade below the line, only where $x, y \ge 0$.

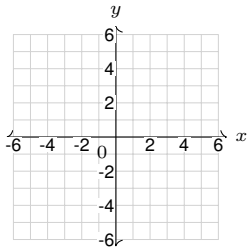
Answer: Solid boundary $(0, 5)$–$(5, 0)$; shade the first-quadrant triangle.



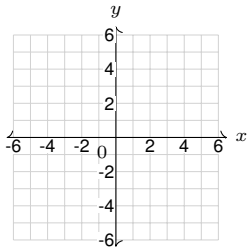
Practice Problems

Show your thinking.

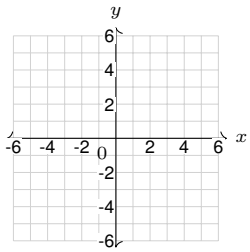
1. An activity uses $x \ge 0$ hours of reading and $y \ge 0$ of writing, with at most 6 hours total. Graph $x + y \le 6$. Draw the boundary and solution region. Test $(0, 0)$.



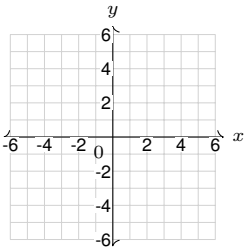
2. A garden design requires width y at least half its length x plus 1 meter. Graph $y \ge \frac{1}{2}x + 1$ for $x, y \ge 0$. Draw the boundary and solution region. Test $(0, 0)$.



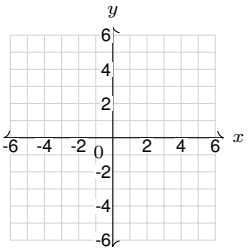
3. Small kits cost $\$2$, refills $\$1$, and budget is $\$6$. With whole counts x kits and y refills, graph $2x + y \le 6$ and mark feasible integer points. Draw the boundary and solution region. Test $(0, 0)$.



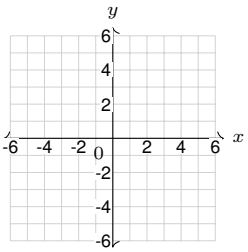
4. A design score is $y - x$. It must be strictly more than 1. Graph $y - x > 1$ for nonnegative real dimensions x, y. Draw the boundary and solution region. Test $(0, 0)$.



5. A storage plan requires at least 4 total meters of two materials, with lengths $x, y \ge 0$. Graph $x + y \ge 4$. Draw the boundary and solution region. Test $(0, 0)$.



6. A robot must stay on or below height $y = \frac{3}{2}x$ and in the first quadrant. Draw the allowed region $y \le \frac{3}{2}x$; decide whether $(2, 4)$ is allowed. Draw the boundary and solution region. Test $(0, 1)$.



Answer Key

1. Solid boundary through $(0,6),(2,4)$; shade below; $(0,0)$ included. Restrict shading to $x \geq 0, y \geq 0$.
2. Solid boundary through $(0,1),(2,2)$; shade above; $(0,0)$ excluded. Restrict shading to $x \geq 0, y \geq 0$.
3. Solid boundary through $(0,6),(2,2)$; shade below; $(0,0)$ included. Restrict shading to $x \geq 0, y \geq 0$. Mark only whole-coordinate solutions within that region. The shading is a continuous guide; the discrete purchase solutions are $(0, j),\ j \in \{0,1,2,3,4,5,6\}$; $(1, j),\ j \in \{0,1,2,3,4\}$; $(2, j),\ j \in \{0,1,2\}$; $(3, j),\ j \in \{0\}$ (16 points).
4. Dashed boundary through $(0,1),(2,3)$; shade above; $(0,0)$ excluded. Restrict shading to $x \geq 0, y \geq 0$.
5. Solid boundary through $(0,4),(2,2)$; shade above; $(0,0)$ excluded. Restrict shading to $x \geq 0, y \geq 0$.
6. Solid boundary through $(0,0),(2,3)$; shade below; $(0,1)$ excluded. Restrict shading to $x \geq 0, y \geq 0$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Solve the total-time limit for writing: $y \leq 6 - x$. Boundary points $(0,6)$ and $(2,4)$ use exactly 6 hours each.
2. Draw a solid line through $(0,6)$ and $(2,4)$. Equality is allowed, so boundary points belong to the solution set.
3. Test $(0,0)$: $0 \leq 6$ is true. Shade below the boundary, including this test point. Restrict shading to $x \geq 0, y \geq 0$.

Problem 2

1. Use the boundary $y = \frac{1}{2}x + 1$. At $x = 0$, $y = 1$; at $x = 2$, $y = (\frac{1}{2})(2) + (1) = 2$.
2. Draw a solid line through $(0,1)$ and $(2,2)$. Equality is allowed, so boundary points belong to the solution set.
3. Test $(0,0)$: $0 \geq 1$ is false. Shade above the boundary, excluding this test point. Restrict shading to $x \geq 0, y \geq 0$.

Problem 3

1. Rearrange $2x + y \leq 6$ to $y \leq -2x + 6$. The boundary contains $(0,6)$ and $(2,2)$ because $-2(2) + 6 = 2$.
2. Draw a solid line through $(0,6)$ and $(2,2)$. Equality is allowed, so boundary points belong to the solution set.
3. Test $(0,0)$: $0 \leq 6$ is true. Shade below the boundary, including this test point. Restrict shading to $x \geq 0, y \geq 0$. Mark only whole-coordinate solutions within that region.

Problem 4

1. Add x to both sides of $y - x > 1$ to get $y > x + 1$. Boundary points are $(0,1)$ and $(2,3)$; equality does not meet the requirement.
2. Draw a dashed line through $(0,1)$ and $(2,3)$. Equality is excluded, so boundary points do not belong to the solution set.
3. Test $(0,0)$: $0 > 1$ is false. Shade above the boundary, excluding this test point. Restrict shading to $x \geq 0, y \geq 0$.

Problem 5

1. Rearrange the minimum-total condition as $y \geq -x + 4$. Boundary points $(0,4)$ and $(2,2)$ each have total length 4 meters.
2. Draw a solid line through $(0,4)$ and $(2,2)$. Equality is allowed, so boundary points belong to the solution set.
3. Test $(0,0)$: $0 \geq 4$ is false. Shade above the boundary, excluding this test point. Restrict shading to $x \geq 0, y \geq 0$.

Problem 6

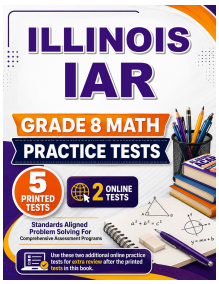
1. At $(2,4)$, the height limit is $\frac{3}{2}(2) = 3$, so $4 \leq 3$ is false: that point is not allowed. Boundary points include $(0,0)$ and $(2,3)$.
2. Draw a solid line through $(0,0)$ and $(2,3)$. Equality is allowed, so boundary points belong to the solution set.
3. Test $(0,1)$: $1 \leq 0$ is false. Shade below the boundary, excluding this test point. Restrict shading to $x \geq 0, y \geq 0$.

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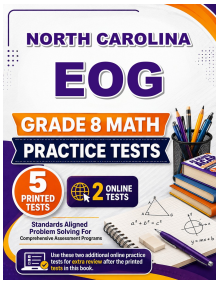
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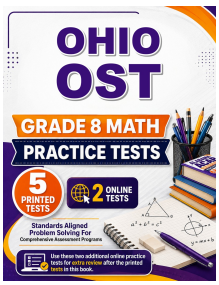
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