Linear Programming (Q 11, Paper 2)

Lesson No. 1: Graphing Linear Inequalities

2001

11 (a) Using graph paper, illustrate the set of points (that simultaneously satisfy the three inequalities:

$$y \geq 2$$
$$x + 2y \leq 8$$
$$5x + y \geq -5.$$

Solution

Drawing Linear Inequalities

Steps
1. Graph the equation of the line first by finding the x and y intercepts.
2. Take a test point like (0, 0) and substitute it into the inequality.
3. If you get a true result, shade in the side of the line containing (0, 0). If you get a false result, shade in the side **not** containing (0, 0).

Note: If the line passes through (0, 0) then choose another point like (1, 0).

Graph $x + 2y \leq 8$.

1. Draw $x + 2y = 8$. Intercepts: (0, 4), (8, 0)

2. Test with (0, 0): $(0) + 2(0) \leq 8 \Rightarrow 0 \leq 8.$ This is true.

3. Shade in the side of the line that contains (0, 0).

Graph $5x + y \geq -5$.

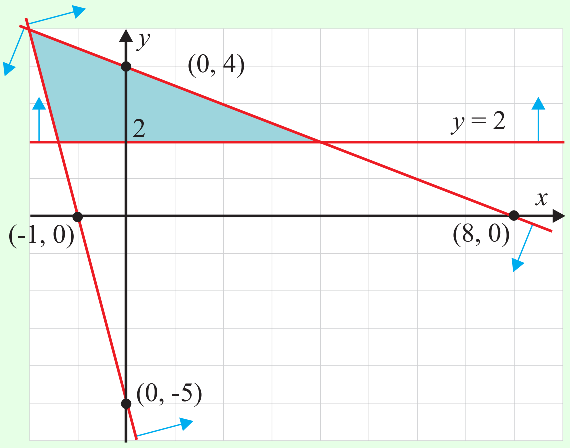
1. Draw $5x + y = -5.$ Intercepts: (0, –5), (–1, 0)

2. Test with (0, 0): $5(0) + (0) \geq -5 \Rightarrow 0 \geq -5.$ This is true.

3. Shade in the side of the line that contains (0, 0).

Graph $y \geq 2$.

Draw a horizontal line through y = 2 and shade above the line.



Draw the lines. The blue arrows indicate the side of the line for which the inequality is true. These regions all overlap in the region where the three lines intersect. Shade in this region. The points in this region simultaneously satisfy the three inequalities.

1998

11 (a) Write down the coordinates of two points on the line $2x + 3y = 18$.

On a diagram, illustrate the set of points (x, y) that satisfy simultaneously the three inequalities

$$2x+3y\le 18$$
$$x\ge 3$$
$$y\ge 2.$$

SOLUTION

DRAWING LINEAR INEQUALITIES

STEPS

1. Graph the equation of the line first by finding the x and y intercepts.
2. Take a test point like (0, 0) and substitute it into the inequality.
3. If you get a true result, shade in the side of the line containing (0, 0).
If you get a false result, shade in the side **not** containing (0, 0).

NOTE: If the line passes through (0, 0) then choose another point like (1, 0).

Graph $2x+3y\le 18$.

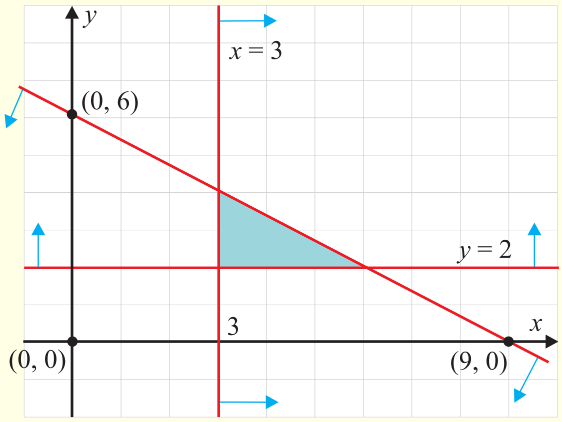
1. Draw $2x + 3y = 18$. Intercepts: (0, 6), (9, 0)

2. Test with (0, 0): $2(0)+3(0)\le 18 \Rightarrow 0\le 18.$ This is true.

3. Shade in the side of the line that contains (0, 0).

Graph $x\ge 3$.
Draw a vertical line through $x = 3$ and shade to the right of the line.

Graph $y\ge 2$.
Draw a horizontal line through $y = 2$ and shade above the line.



Draw the lines. The blue arrows indicate the side of the line for which the inequality is true. These regions all overlap in the region where the three lines intersect. Shade in this region. The points in this region simultaneously satisfy the three inequalities.

1997

11 (a) On one diagram, illustrate the set of points (x, y) that satisfy the three inequalities

$$x + y \le 7$$
$$2x + y \ge 8$$
$$y \ge 0.$$

SOLUTION

DRAWING LINEAR INEQUALITIES

STEPS
1. Graph the equation of the line first by finding the x and y intercepts.
2. Take a test point like (0, 0) and substitute it into the inequality.
3. If you get a true result, shade in the side of the line containing (0, 0). If you get a false result, shade in the side **not** containing (0, 0).

NOTE: If the line passes through (0, 0) then choose another point like (1, 0).

Graph $x + y \le 7$.

1. Draw $x + y = 7$. Intercepts: (0, 7), (7, 0)

2. Test with (0, 0): $(0)+(0) \le 7 \Rightarrow 0 \le 7$. This is true.

3. Shade in the side of the line that contains (0, 0).

Graph $2x + y \ge 8$.

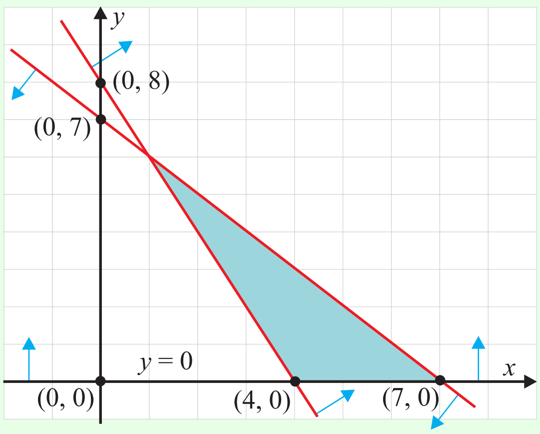
1. Draw $2x + y = 8$. Intercepts: (0, 8), (4, 0)

2. Test with (0, 0): $2(0)+(0) \ge 8 \Rightarrow 0 \ge 8$. This is false.

3. Shade in the opposite side to the line that contains (0, 0).

Graph $y \ge 0$.

Draw a horizontal line through $y = 0$ (the x-axis) and shade above the line.



Draw the lines. The blue arrows indicate the side of the line for which the inequality is true. These regions all overlap in the region where the three lines intersect. Shade in this region. The points in this region simultaneously satisfy the three inequalities.