

Houston Community College
Finite Mathematics
Joyce Hallaway
Exam 2

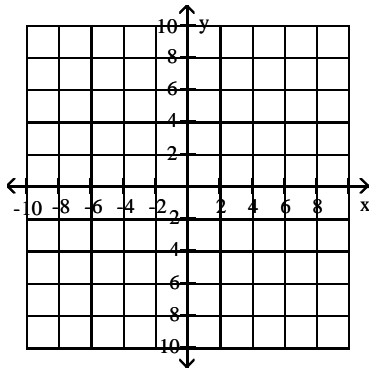
1. You must show your work on straight-edged paper, written neatly, legibly, and IN ORDER. No credit is given for no work.
2. All students must do his/her own work. However, you may consult with each other and compare answers. You may NOT do the work for each other.
3. You may use your textbooks, notes, and calculator. No other outside assistance or resources are allowed.
4. Sign the honor code to your exam: "On my Honor, I have neither given nor received any unauthorized aid on this exam."

Signed: _____

Thank you, and GOOD LUCK!!

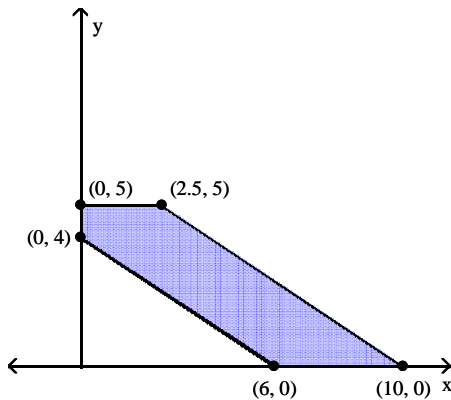
Graph the feasible region for the system of inequalities.

- 1) $2y + x \geq -2$
 $y + 3x \leq 9$
 $y \leq 0$
 $x \geq 0$



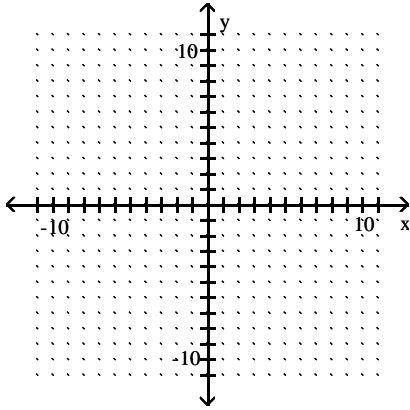
Use the indicated region of feasible solutions to find the maximum and minimum values of the given objective function.

- 2) $z = 6x + 9y$.



Use graphical methods to solve the linear programming problem.

3) Minimize $z = 4x + 5y$
 subject to:
 $2x - 4y \leq 10$
 $2x + y \geq 15$
 $x \geq 0$
 $y \geq 0$



State the linear programming problem in mathematical terms, identifying the objective function and the constraints.

4) A breed of cattle needs at least 10 protein and 8 fat units per day. Feed type I provides 6 protein and 3 fat units at \$5/bag. Feed type II provides 4 protein and 5 fat units at \$2/bag. Which mixture fills the needs at minimum cost?

A) Minimize $5x + 2y$
 Subject to: $6x + 4y \geq 8$
 $3x + 5y \geq 10$
 $x, y \geq 0$.

B) Minimize $5x + 2y$
 Subject to: $6x + 4y \leq 8$
 $3x + 5y \leq 10$
 $x, y \leq 0$.

C) Minimize $5x + 2y$
 Subject to: $6x + 4y \geq 10$
 $3x + 5y \geq 8$
 $x, y \geq 0$.

D) Minimize $2x + 5y$
 Subject to: $6x + 3y \geq 10$
 $4x + 5y \geq 8$
 $x, y \geq 0$.

Solve the problem.

5) The Acme Class Ring Company designs and sells two types of rings: the VIP and the SST. They can produce up to 24 rings each day using up to 60 total man-hours of labor. It takes 3 man-hours to make one VIP ring and 2 man-hours to make one SST ring. How many of each type of ring should be made daily to maximize the company's profit, if the profit on a VIP ring is \$40 and on an SST ring is \$30?

- A) 12 VIP and 12 SST B) 14 VIP and 10 SST C) 10 VIP and 14 SST D) 14 VIP and 14 SST

Use slack variables to convert the constraints into linear equations.

6) Maximize $z = 1.1x_1 + 2.6x_2$
 Subject to: $1.9x_1 + 1.5x_2 \leq 33$
 $1.6x_1 + 1.3x_2 \leq 19$
 with: $x_1 \geq 0, x_2 \geq 0$

A) $1.9x_1 + 1.5x_2 = s_1 + 33$
 $1.6x_1 + 1.3x_2 = s_2 + 19$

B) $1.9x_1 + 1.5x_2 + s_1 \leq 33$
 $1.6x_1 + 1.3x_2 + s_2 \leq 19$

C) $1.9x_1 + 1.5x_2 + s_1 = 33$
 $1.6x_1 + 1.3x_2 + s_1 = 19$

D) $1.9x_1 + 1.5x_2 + s_1 = 33$
 $1.6x_1 + 1.3x_2 + s_2 = 19$

Write the solutions that can be read from the simplex tableau.

7)
$$\begin{array}{cccccc|c} x_1 & x_2 & s_1 & s_2 & s_3 & z & \\ \hline 1 & 0 & 1 & 3 & 0 & 0 & 6 \\ 3 & 0 & 0 & 1 & 1 & 0 & 18 \\ 3 & 1 & 0 & 2 & 0 & 0 & 26 \\ \hline 2 & 0 & 0 & 3 & 0 & 1 & 17 \end{array}$$

A) $s_1 = 6, s_3 = 18, x_2 = 26, z = 17; x_1, s_2 = 0$

B) $x_1 = 6, s_3 = 18, x_2 = 26, z = 17; s_1, s_2 = 0$

C) $s_1 = 6, s_2 = 18, x_2 = 26, z = 17; x_1, s_3 = 0$

D) $x_1 = 6, s_2 = 18, x_2 = 26, z = 17; s_1, s_3 = 0$

Pivot once about the circled element in the simplex tableau, and read the solution from the result.

8)
$$\begin{array}{cccccc|c} x_1 & x_2 & x_3 & s_1 & s_2 & s_3 & z & \\ \hline \textcircled{1} & 4 & 2 & 1 & 0 & 0 & 0 & 50 \\ 2 & 6 & 3 & 0 & 1 & 0 & 0 & 100 \\ 3 & 2 & 1 & 0 & 0 & 1 & 0 & 150 \\ \hline -2 & 4 & -1 & 0 & 0 & 0 & 1 & 0 \end{array}$$

A bakery makes sweet rolls and donuts. A batch of sweet rolls requires 3 lb of flour, 1 dozen eggs, and 2 lb of sugar. A batch of donuts requires 5 lb of flour, 3 dozen eggs, and 2 lb of sugar. Set up an initial simplex tableau to maximize

9) The bakery has 660 lb of flour, 440 dozen eggs, 700 lb of sugar. The profit on a batch of sweet rolls is \$74.00 and on a batch of donuts is \$117.00.

$$\left[\begin{array}{cccccc|c} & & & & & & & \\ \hline & & & & & & & \\ \hline & & & & & & & \end{array} \right]$$

The initial tableau of a linear programming problem is given. Use the simplex method to solve the problem.

10)
$$\begin{array}{cccccc|c} x_1 & x_2 & x_3 & s_1 & s_2 & z & \\ \hline 4 & 2 & 2 & 1 & 0 & 0 & 30 \\ 3 & 1 & 1 & 0 & 1 & 0 & 25 \\ \hline -2 & -3 & -1 & 0 & 0 & 1 & 0 \end{array}$$

Use the simplex method to solve the linear programming problem.

11) Maximize $z = 5x_1 + 3x_2$
subject to: $2x_1 + 4x_2 \leq 13$
 $x_1 + 2x_2 \leq 6$
with $x_1 \geq 0, x_2 \geq 0$

Find the transpose of the matrix.

12)

$$\begin{bmatrix} 9 & 0 & 8 & 2 \\ 1 & 7 & 8 & 6 \end{bmatrix}$$

A)

$$\begin{bmatrix} 1 & 9 \\ 7 & 0 \\ 8 & 8 \\ 6 & 2 \end{bmatrix}$$

B)

$$\begin{bmatrix} 9 & 1 \\ 0 & 7 \\ 8 & 8 \\ 2 & 6 \end{bmatrix}$$

C)

$$\begin{bmatrix} 1 & 7 & 8 & 6 \\ 9 & 0 & 8 & 2 \end{bmatrix}$$

D)

$$\begin{bmatrix} 3 & 0 \\ 0 & 1 \\ 2 & 6 \\ 8 & 8 \end{bmatrix}$$

State the dual problem. Use $y_1, y_2,$ and y_3 as the variables. Given: $y_1 \geq 0, y_2 \geq 0,$ and $y_3 \geq 0.$

13) Maximize $z = x_1 + 2x_2 + 3x_3$
subject to: $6x_1 + 3x_2 + x_3 \leq 38$
 $4x_1 + 7x_2 + 3x_3 \leq 45$
 $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$

A) Minimize $w = 45y_1 + 38y_2$

subject to: $4y_1 + 6y_2 \leq 1$
 $7y_1 + 3y_2 \leq 2$
 $3y_1 + y_2 \leq 3$

B) Minimize $w = 38y_1 + 45y_2$

subject to: $6y_1 + 4y_2 \leq 1$
 $3y_1 + 7y_2 \leq 2$
 $y_1 + 3y_2 \leq 3$

C) Minimize $w = 38y_1 + 45y_2$

subject to: $6y_1 + 4y_2 \geq 1$
 $3y_1 + 7y_2 \geq 2$
 $y_1 + 3y_2 \geq 3$

D) Minimize $w = 45y_1 + 38y_2$

subject to: $4y_1 + 6y_2 \geq 1$
 $7y_1 + 3y_2 \geq 2$
 $3y_1 + y_2 \geq 3$

Use the simplex method to solve the linear programming problem.

14) Minimize $w = 4y_1 + 4y_2$
subject to: $5y_1 + 10y_2 \geq 100$
 $10y_1 + 20y_2 \geq 150$
 $y_1 \geq 0, y_2 \geq 0$