Lesson 6-9

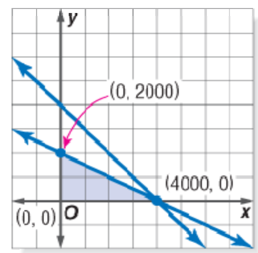
Example 1

MANUFACTURING High Tops Corporation makes two types of athletic shoes; running shoes and basketball shoes. The shoes are assembled by machine and then finished by hand. It takes 0.25 hour for the machine assembly and 0.5 hour by hand to make a running shoe. It takes 0.25 hour on the machine and 0.4 hour by hand to make the basketball shoe. At their manufacturing plant, the company can allocate no more than 800 machine hours and 400 hand hours per day. The profit is $20 on each type of running shoe and $10 on each basketball shoe. How many type of shoe should be made to maximize the profit?

Solution

If x represents the number of running shoes made and y represents the number of basketball shoes made then the profit objective function (P) is $P = 20x + 10y$.

We can write inequalities to represent each constraint.



Machine hours: $0.2x + 0.25y \leq 800$
Hand hours: $0.5x + 0.4y \leq 400$

To make sure the feasible region is completely within the first quadrant of the coordinate plane, we include the constraints $x \geq 0$ and $y \geq 0$. Graph the system of inequalities.

The vertices of the feasible region are at (0, 0), (4000, 0), and (0, 2000) Evaluate the objective function at each of the vertices of the feasible region.

Vertex	20*x* + 10*y*	Profits *P*, dollars
(0, 0)	20(0) + 10(0)	0
(4000, 0)	20(4000) + 10(0)	80,000 (maximum)
(0, 2000)	20(0) + 10(2000)	20,000

Under the given daily constraints, the maximum daily profit the show company should expect to make is $30,000. To do this, they would have to product and sell 4000 running shoes and 0 basketball shoes per day.

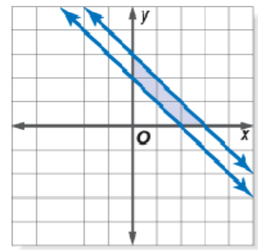
Example 2

GRAPHING Using a graphing utility, graph the solution set of the system of inequalities below to determine the maximum value of $P = 4x + 2y$.

$$x + y \geq 2 \qquad x \geq 0$$
$$y \leq -x + 3 \qquad y \geq 0$$

Solution

Graph each inequality by graphing the equation of each line. Then locate the vertices of the feasible region using the trace, zoom and intersect features to determine the coordinates. Make a table of the vertices and the value of P for each vertex.



inequality	$x + y \geq 2$	$y \leq -x + 3$	$x \geq 0$	$y \geq 0$
boundary equation	$x + y = 2$	$y = -x + 3$	$x = 0$	$y = 0$
shading	above	below	right of *y*-axis	above *x*-axis
line	solid	solid	solid	solid

Vertex	$4x + 2y$	*P*
(0, 2)	4(0) + 2(2)	4
(0, 3)	4(0) + 2(3)	6
(2, 0)	4(2) + 2(0)	8
(3, 0)	4(3) + 2(0)	12

The maximum value of P is 12 when $x = 3$ and $y = 0$.