

Math 371 Section 3.3 Exercise 11

Let  $x$  be the number of bolts of Type I

Let  $y$  be the number of bolts of Type II

<u>Machine 1:</u> $0.2x + 0.2y \leq 300$	<u>Machine 2:</u> $0.6x + 0.2y \leq 720$
<u>Machine 3:</u> $0.04x + 0.08y \leq 100$	<u>Constraints</u> (and, of course, $x \geq 0$ and $y \geq 0$ )

Let's find out where the lines cross before graphing the feasible region, and determine which of those points are corner points.

$$\begin{aligned} 0.2x + 0.2y = 300 &\implies -0.2x - 0.2y = -300 \\ 0.6x + 0.2y = 720 &\implies \underline{0.6x + 0.2y = 720} \\ &0.4x = 420 \\ &x = 1050 \end{aligned}$$
$$\begin{aligned} &\rightarrow 0.2(1050) + 0.2y = 300 \\ &210 + 0.2y = 300 \\ &0.2y = 90 \\ &y = 450 \end{aligned}$$

Does the point  $(1050, 450)$  satisfy  $0.04x + 0.08y \leq 100$ ?  
Yes, so it is a corner point of the feasible region.

$$\begin{aligned} 0.2x + 0.2y = 300 &\implies 0.2x + 0.2y = 300 \\ 0.04x + 0.08y = 100 &\implies \underline{-0.2x - 0.4y = -500} \\ &-0.2y = -200 \\ &y = 1000 \end{aligned}$$
$$\begin{aligned} &\rightarrow 0.2x + 0.2(1000) = 300 \\ &0.2x + 200 = 300 \\ &0.2x = 100 \\ &x = 500 \end{aligned}$$

Does  $(500, 1000)$  satisfy  $0.6x + 0.2y \leq 720$ ? Yes, so it is a corner point.

$$\begin{aligned} 0.6x + 0.2y = 720 &\implies 0.6x + 0.2y = 720 \\ 0.04x + 0.08y = 100 &\implies \underline{-0.6x - 1.2y = -1500} \\ &-y = -780 \\ &y = 780 \end{aligned}$$
$$\begin{aligned} &\rightarrow 0.6x + 0.2(780) = 720 \\ &0.6x + 156 = 720 \\ &0.6x = 564 \\ &x = 940 \end{aligned}$$

Does the point  $(780, 940)$  satisfy  $0.2x + 0.2y \leq 300$ ?

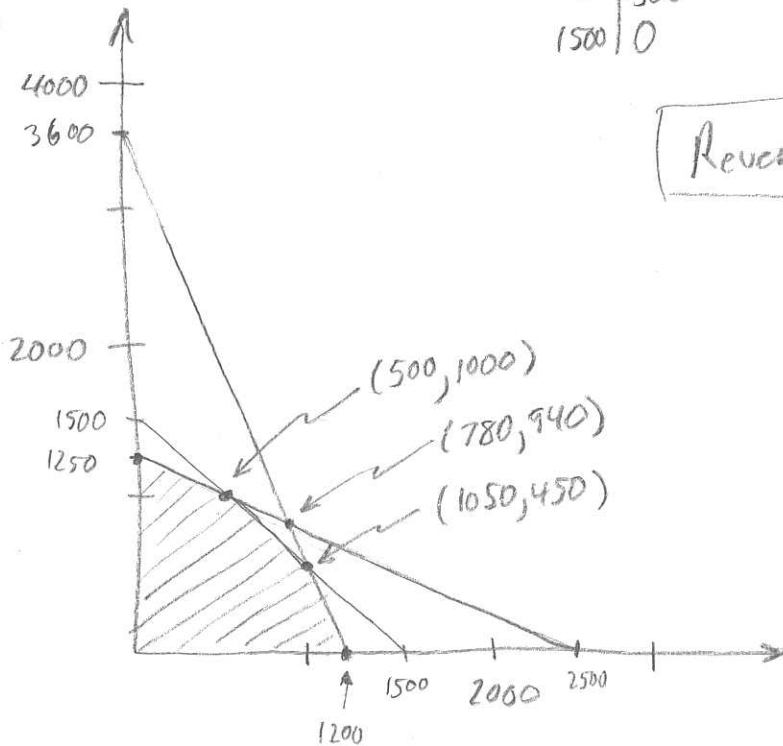
No, so it is not a corner point.

Now let's graph  $0.2x + 0.2y = 300$ ,  $0.6x + 0.2y = 720$ ,  $0.04x + 0.08y = 100$

x	y
0	1500
1500	0

x	y
0	3600
1200	0

x	y
0	1250
2500	0



$$\text{Revenue} = 0.15x + 0.2y$$

Point	Revenue
(0, 1250)	\$ 250
(500, 1000)	\$ 275
(1050, 450)	\$ 247.50
(1200, 0)	\$ 240

The maximum revenue is \$275 when they produce 500 bolts of Type I and 1000 bolts of Type II.