MA162: Finite mathematics

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University of Kentucky

October 3rd, 2012

SCHEDULE:

- HW 3.2, 3.3 are due Friday, Oct 5th, 2012
- HW 4.1 is due Friday, Oct 12th, 2012
- Exam 2 is Monday, Oct 15th, 5:00pm-7:00pm in BS107 and BS116.
- Exam grades on blackboard, PDFs on mathclass.

Today we will cover 3.3: solving the small problems with a pretty picture

3.3: Linear programming problems

- An LPP has three parts:
  - The variables (the business decision to be made)
  - The inequalities (the laws, constraints, rules, and regulations)
  - The objective (maximize profit, minimize cost)
- If there are only two variables, they are easy to solve!
- Both the maximum and minimum will occur on a corner.

3.3: Example 1 from Monday

- **Variables**:
  X = the number of water bottles to make each day
  Y = the number of OSARPs to make each day

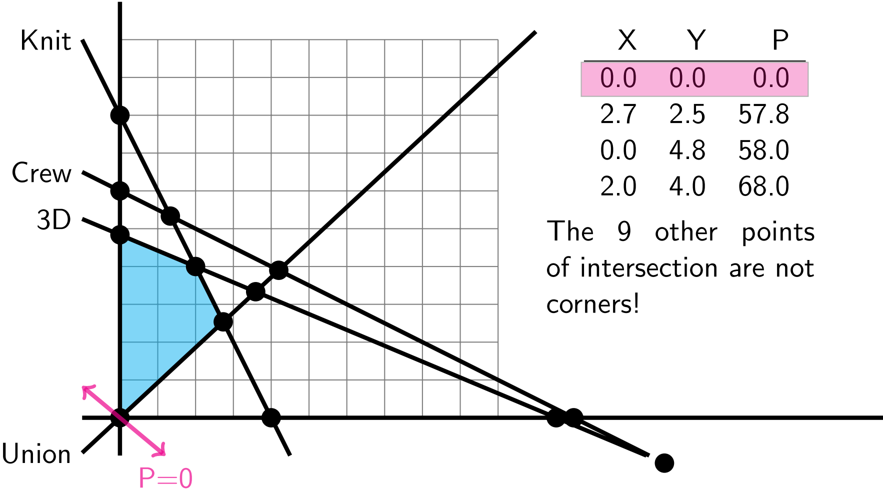
- **Constraints**:

$$\begin{aligned} 26X + 62Y &\leq 300 && \text{(3D printer time)} \\ 60X + 30Y &\leq 240 && \text{(KnitBot time)} \\ 20X + 40Y &\leq 240 && \text{(Human time)} \\ 26X - 28Y &\leq 0 && \text{(Union req.)} \end{aligned}$$

  and $X \geq 0,\ Y \geq 0$

- **Objective**:
  Maximize the profit $P = 10X + 12Y$

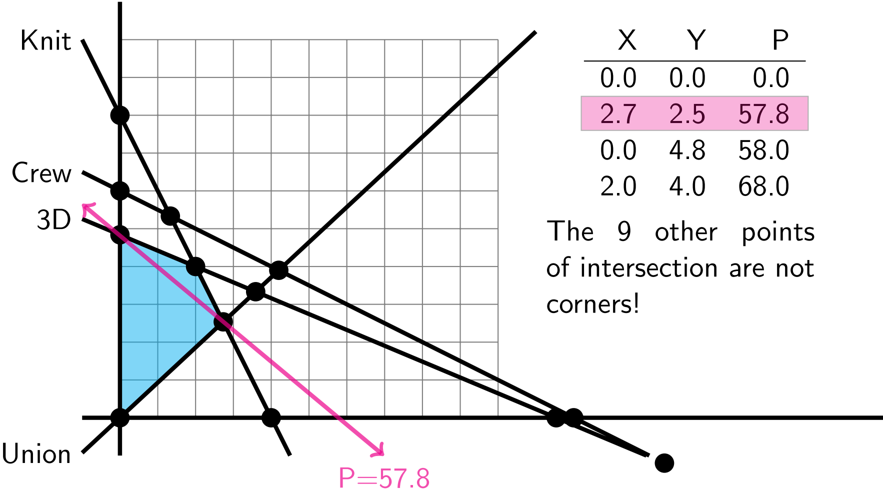
3.3: Graph the region like in 3.1



X	Y	P
0.0	0.0	0.0
2.7	2.5	57.8
0.0	4.8	58.0
2.0	4.0	68.0

The 9 other points of intersection are not corners!

3.3: Graph the region like in 3.1



X	Y	P
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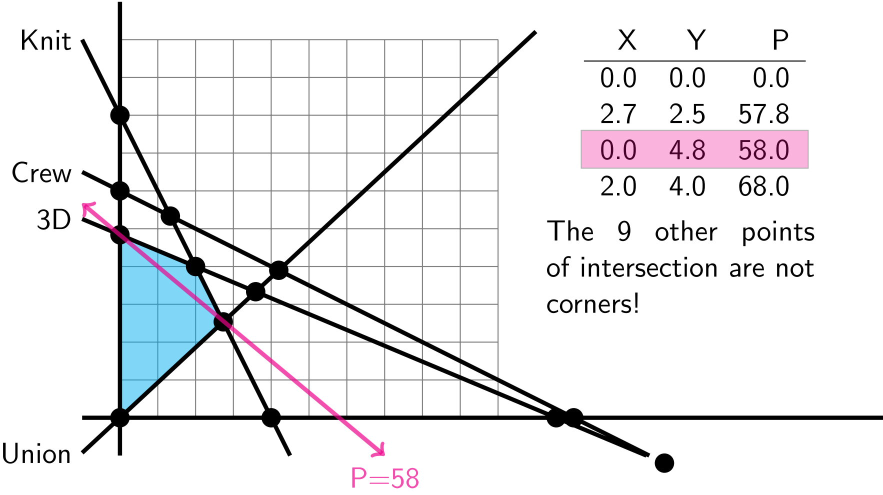

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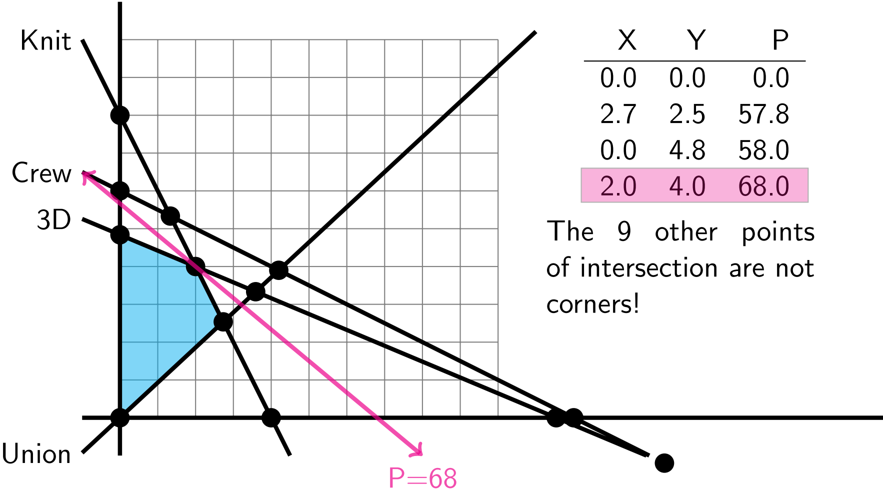

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The 9 other points of intersection are not corners!

3.2: Example 2 from Monday

- **Variables**:
  X = number of pills of brand A
  Y = number of pills of brand B

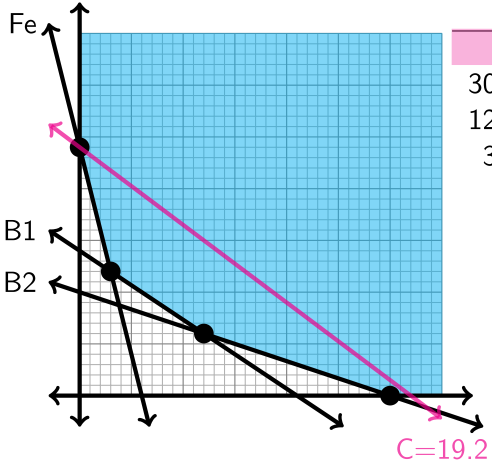
- **Constraints**:

$$
\begin{aligned}
40X + 10Y &\geq 2400 \qquad &\text{(Iron)}\\
10X + 15Y &\geq 2100 \qquad &\text{(B1)}\\
5X + 15Y &\geq 1500 \qquad &\text{(B2)}
\end{aligned}
$$

  and $X \geq 0,\ Y \geq 0$

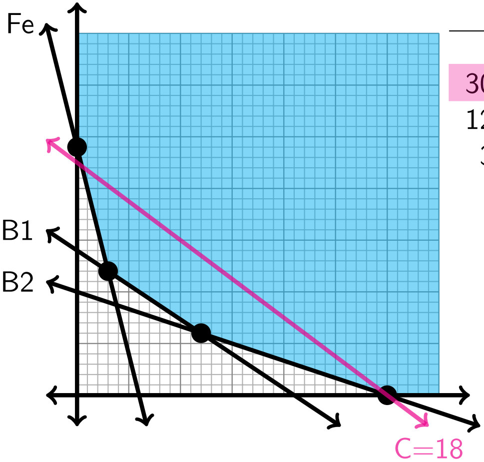
- **Objective**:
  Minimize cost $C = 0.06X + 0.08Y$

3.3: Example 2 graphed



X	Y	C
0	240	$19.20
300	0	$18.00
120	60	$12.00
30	120	$11.40

3.3: Example 2 graphed



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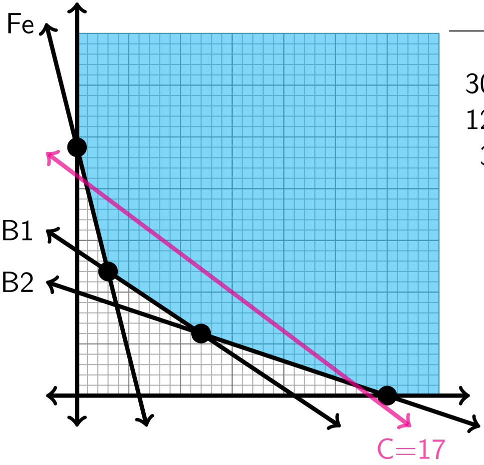

X	Y	C
0	240	$19.20
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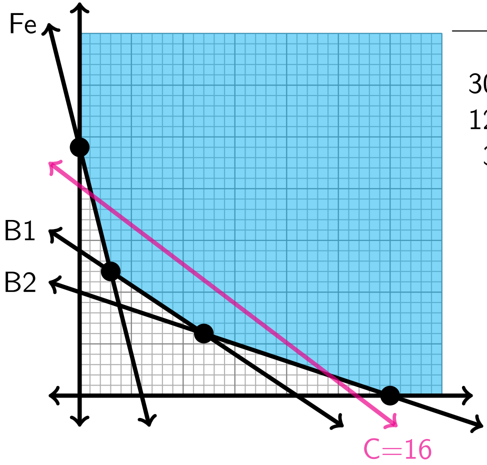

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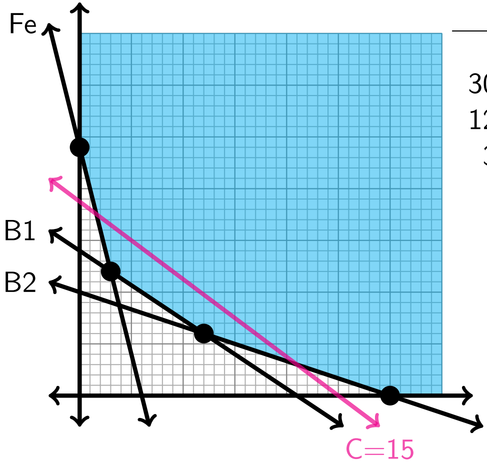

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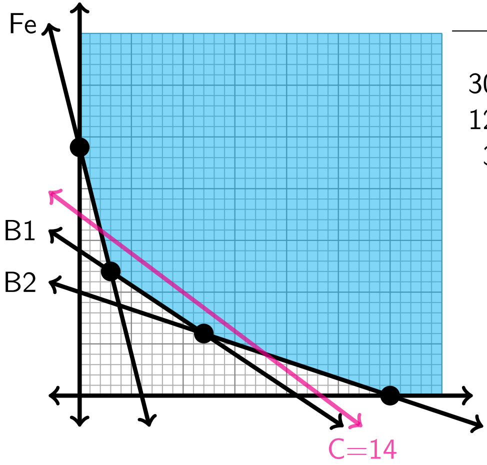

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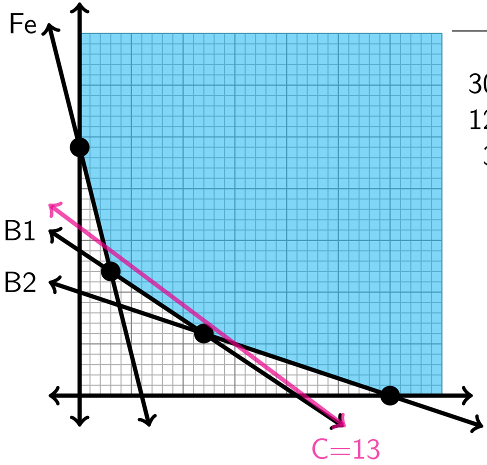

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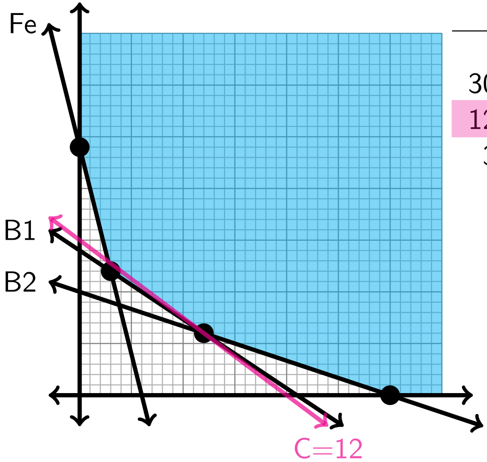

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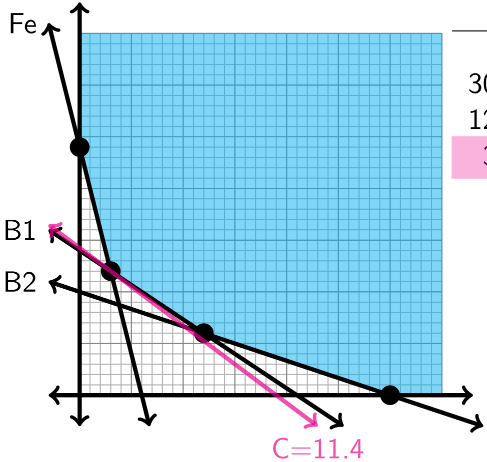


X	Y	C
0	240	$19.20
300	0	$18.00
120	60	$12.00
30	120	$11.40

Example 3 from Monday

- **Variables**:
  X = Number of engines from P1 to A1
  Y = Number of engines from P1 to A2
  $80 - X$ = Number of engines from P2 to A1 (the rest of A1's demand)
  $70 - Y$ = Number of engines from P2 to A2 (the rest of A2's demand)

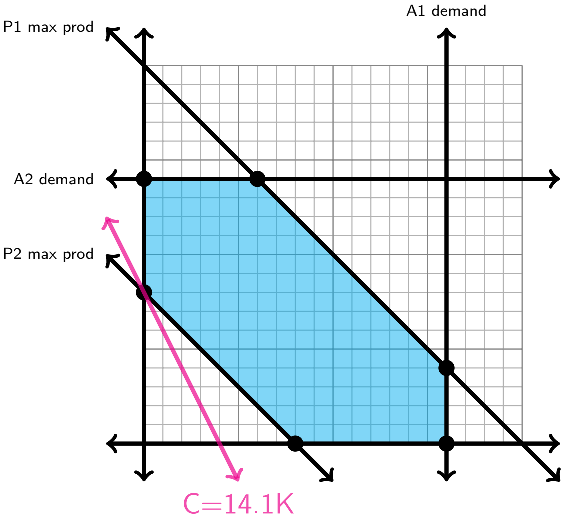
- **Constraints**:

$$\begin{array}{rcll} X + Y & \leq & 100 & \text{(P1 max production)} \\ X + Y & \geq & 40 & \text{(P2 max production)} \\ X & \leq & 80 & \text{(sanity, A1 max demand)} \\ Y & \leq & 70 & \text{(sanity, A2 max demand)} \end{array}$$

  and $X \geq 0$, $Y \geq 0$

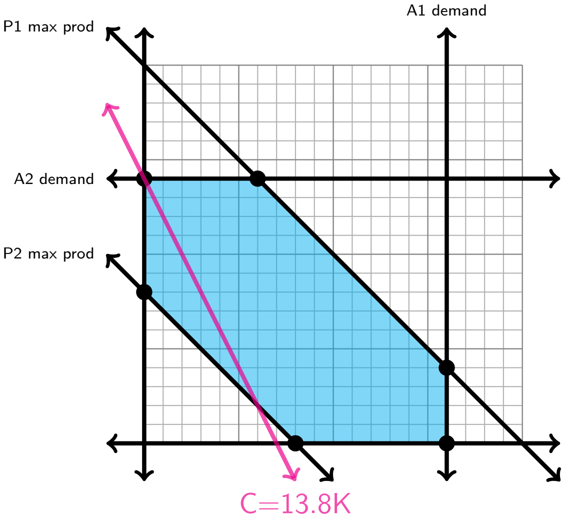
- **Objective**:
  minimize shipping cost $C = 14500 - 20X - 10Y$

Example 3 graphed



X	Y	C
0	40	$14.1K
0	70	$13.8K
40	0	$13.7K
30	70	$13.2K
80	0	$12.9K
80	20	$12.7K

Example 3 graphed



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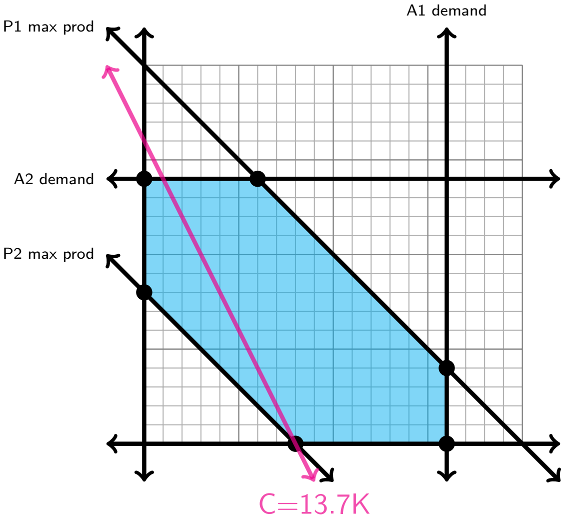

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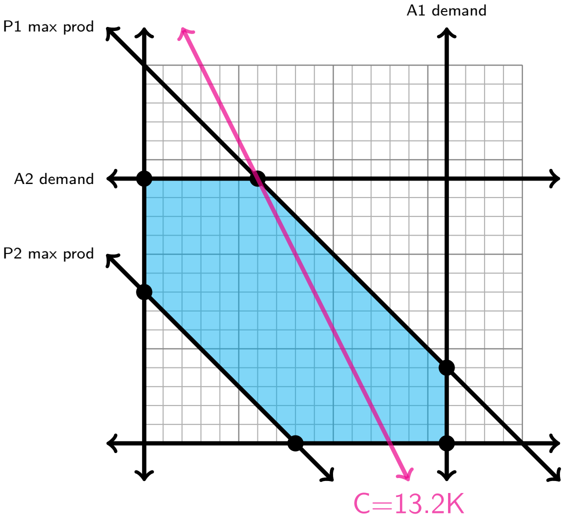

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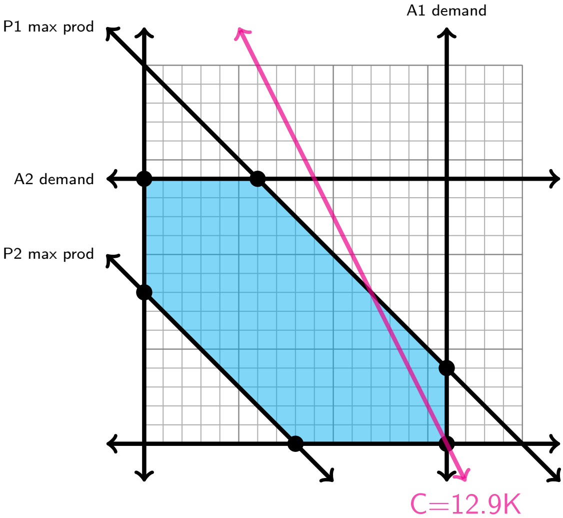

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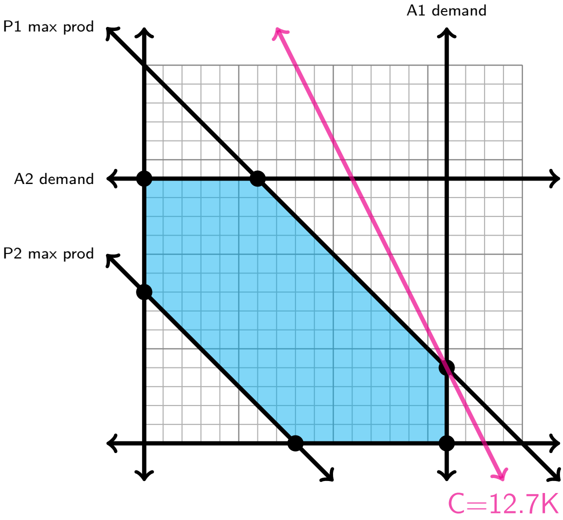

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