The Radar Detector Company

A manufacturer of radar detectors produces LaserStop & SpeedBuster. LaserStop makes a profit of $3 and SpeedBuster makes a profit of $2. LaserStop uses 4 units of Component A and 2 units of Component B. SpeedBuster uses 2 units of Component A and 3 units of Component B. There is a limit of 20 units of component A and 18 of component B. How many of each radar detector should be produced to maximize profit?

Let's Read this Example Again

- A manufacturing company makes **two products LaserStop and SpeedBuster**
- **Resources A and B** are used in producing the two detectors
- **One LaserStop** requires **4 units of A and 2 units of B**
- **One SpeedBuster** requires **2 units of A and 3 units of B**
- **20 units of A** and **18 units of B** are available
- The company makes a **profit of $3 on one LaserStop** and a profit of **$2 on one SpeedBuster**
- Find the product mix (i.e. number of LaserStops and SpeedBusters produced) that gives ***maximum profit***

Representation of the Data for Example Problem

Resource	Resource Required per batch		Resource Available
	Product		
	LaserStop	SpeedBuster	
A	4	2	20
B	2	3	18
Profit per Item	$3	$2	

Now, Formulate as an LP Problem

Unknowns / Decision Variables:

x_1 = number of LaserStops to be produced

x_2 = number of SpeedBusters to be produced

Objective Function:

Z = total profit from producing products (in $'s)

And don't forget your constraints:

These are the elements of the problem which keep up from maximizing profits to infinity, or minimizing costs to zero – the realities of life

LP Problem in Mathematical Language

Maximize $Z = 3x_1 + 2x_2$

Subject to resource availability restrictions

$$4x_1 + 2x_2 \le 20$$

$$2x_1 + 3x_2 \le 18$$

and

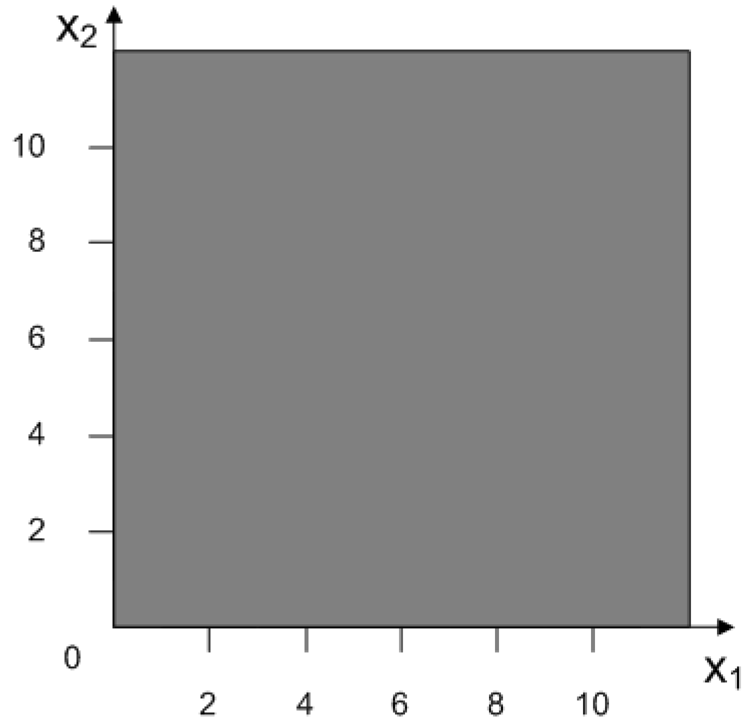
$$x_1 \ge 0, x_2 \ge 0$$

Resource	Resource Required		Resource Available
	Product		
	LaserStop	SpeedBuster	
A	4	2	20
B	2	3	18
Profit per detector	\$3	\$2	

Graphical Solution

- A graphical procedure can be used since the problem has only two unknowns
- Steps:
  - Construct a graph with x_1 and x_2 as the axes
  - Identify the values of (x_1, x_2) or the region permitted by the restrictions
  - Pick out the point that maximizes the value of Z

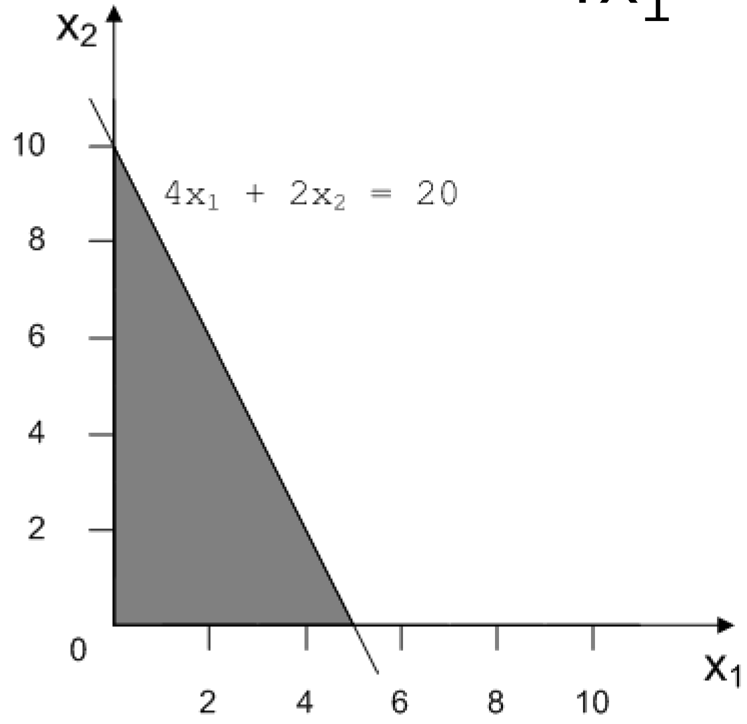
Graphical Solution



Graphical Solution

Constraint #1

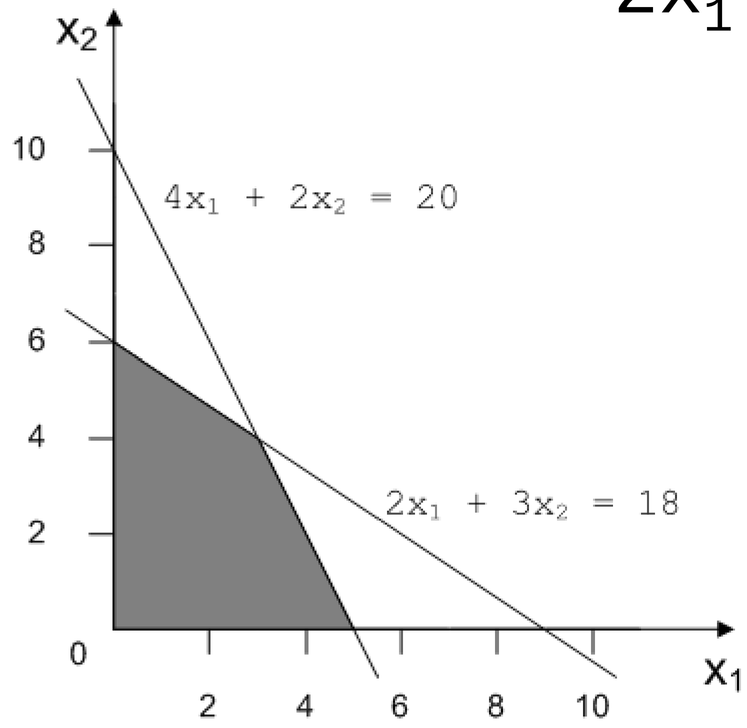
$$4x_1 + 2x_2 \leq 20$$



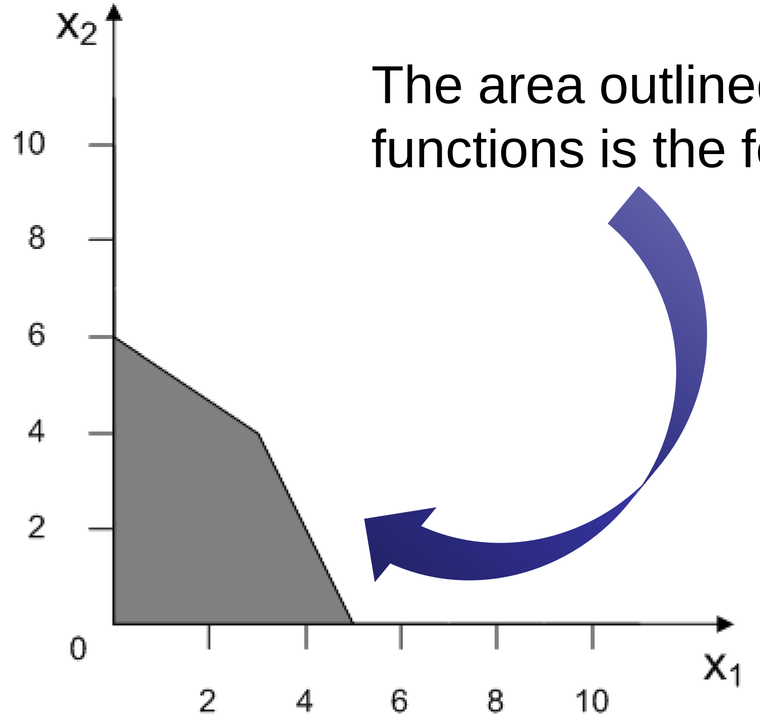
Graphical Solution

Constraint #2

$$2x_1 + 3x_2 \leq 18$$



Graphical Solution



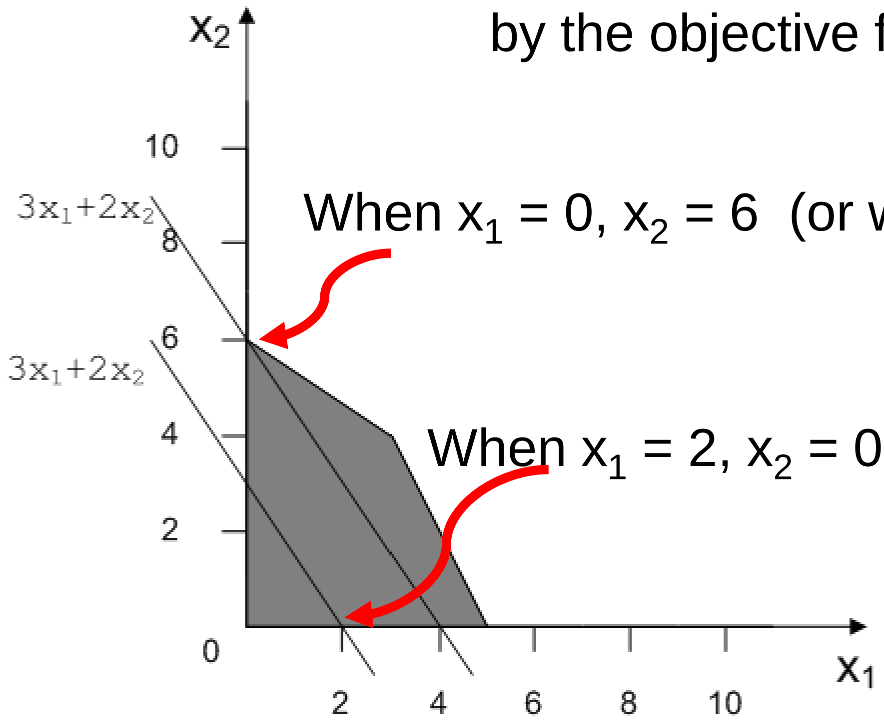
The area outlined by the constraint functions is the feasible region

Graphical Solution

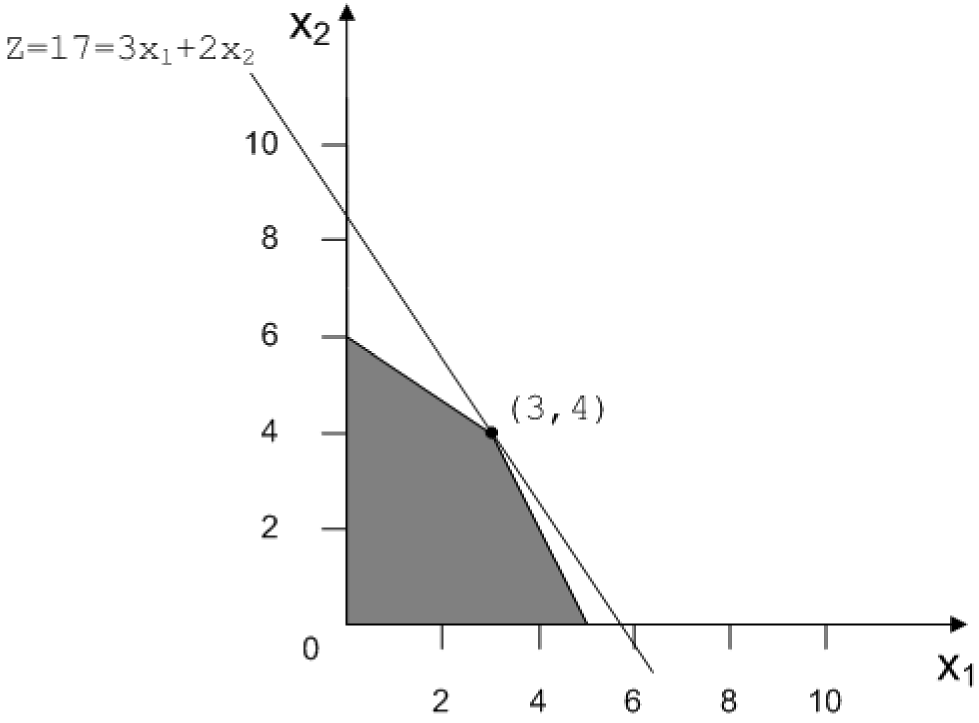
On top of that area, outlined by the constraint functions, we superimpose the objective function – remember, our goal is represented by the objective function

When $x_1 = 0$, $x_2 = 6$ (or when $x_1 = 4$, $x_2 = 0$), $Z = 12$

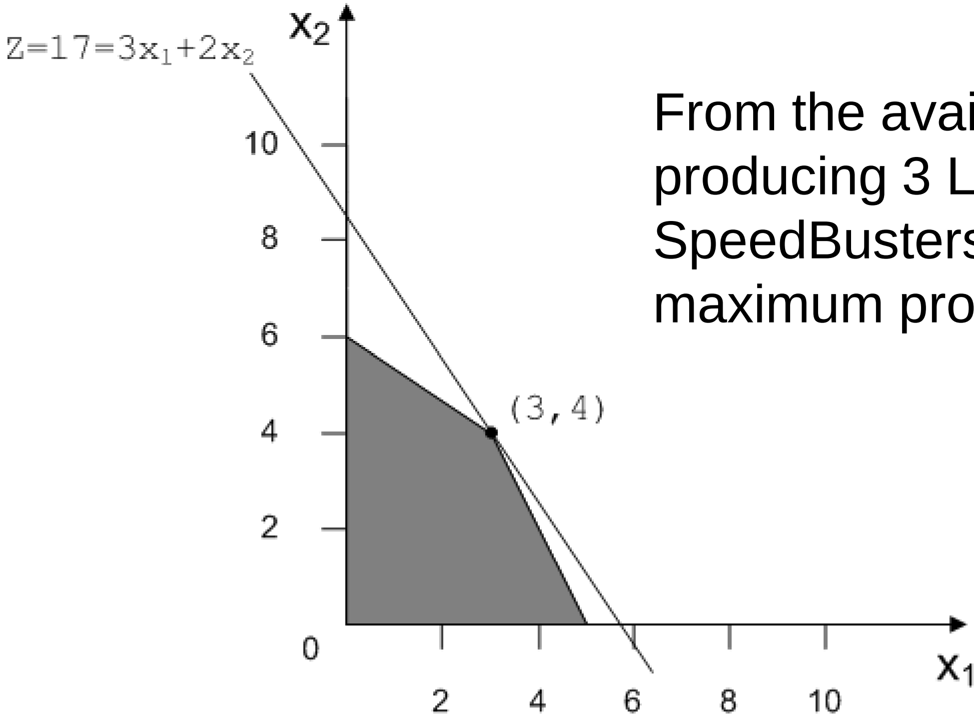
When $x_1 = 2$, $x_2 = 0$ (or when $x_1 = 4$, $x_2 = 0$), $Z = 6$



Graphical Solution



Graphical Solution



From the available resources, producing 3 LaserStops and 4 SpeedBusters will produce the maximum profit of $17