

### Answer on Question #56576 – Math – Other

A company is involved in the production of two items (X and Y). The resources need to produce X and Y are twofold, namely machine time for automatic processing and craftsman time for hand finishing. The table below gives the number of minutes required for each item:

	Machine time	Craftsman time
Item X	13	20
Item Y	19	29

The company has 40 hours of machine time available in the next working week but only 35 hours of craftsman time. Machine time is costed at £10 per hour worked and craftsman time is costed at £2 per hour worked. Both machine and craftsman idle times incur no costs. The revenue received for each item produced (all production is sold) is £20 for X and £30 for Y. The company has a specific contract to produce 10 items of X per week for a particular customer. Formulate the problem of deciding how much to produce per week as a linear program hence make the decision.

#### Solution

Let  $x$  be the number of items of X,  $y$  be the number of items of Y.

Then the LP is

maximise

$$20x + 30y - 10(\text{machine time worked}) - 2(\text{craftsman time worked})$$

subject to:

$$13x + 19y \leq 40(60) \text{ machine time}$$

$$20x + 29y \leq 35(60) \text{ craftsman time}$$

$$x \geq 10 \text{ contract}$$

$$x, y \geq 0$$

so that the objective function becomes

maximise

$$20x + 30y - \frac{10(13x + 19y)}{60} - \frac{2(20x + 29y)}{60}$$

i.e. maximise

$$17.1667x + 25.8667y$$

subject to:

$$13x + 19y \leq 2400$$

$$20x + 29y \leq 2100$$

$$x \geq 10$$

$$x, y \geq 0$$

It is plain from the diagram below that the maximum occurs at the intersection of  $x = 10$  and  $20x + 29y \leq 2100$ .

Solving simultaneously, rather than by reading values off the graph, we have that  $x = 10$  and  $y = 65.52$  with the value of the objective function being £1866.5.

