Widgets and Gadgets (Unpainted)

A widget takes 4 hours to assemble
A gadget takes 8 hours to assemble

If W = # widgets produced and G =# gadgets produced,
the number of hours of assembly time required is 4W + 8G

A maximum of 720 assembly hours are available per eight hour day since your factory can only accommodate 90 workers in the assembly area.

$4W + 8G \leq 720$

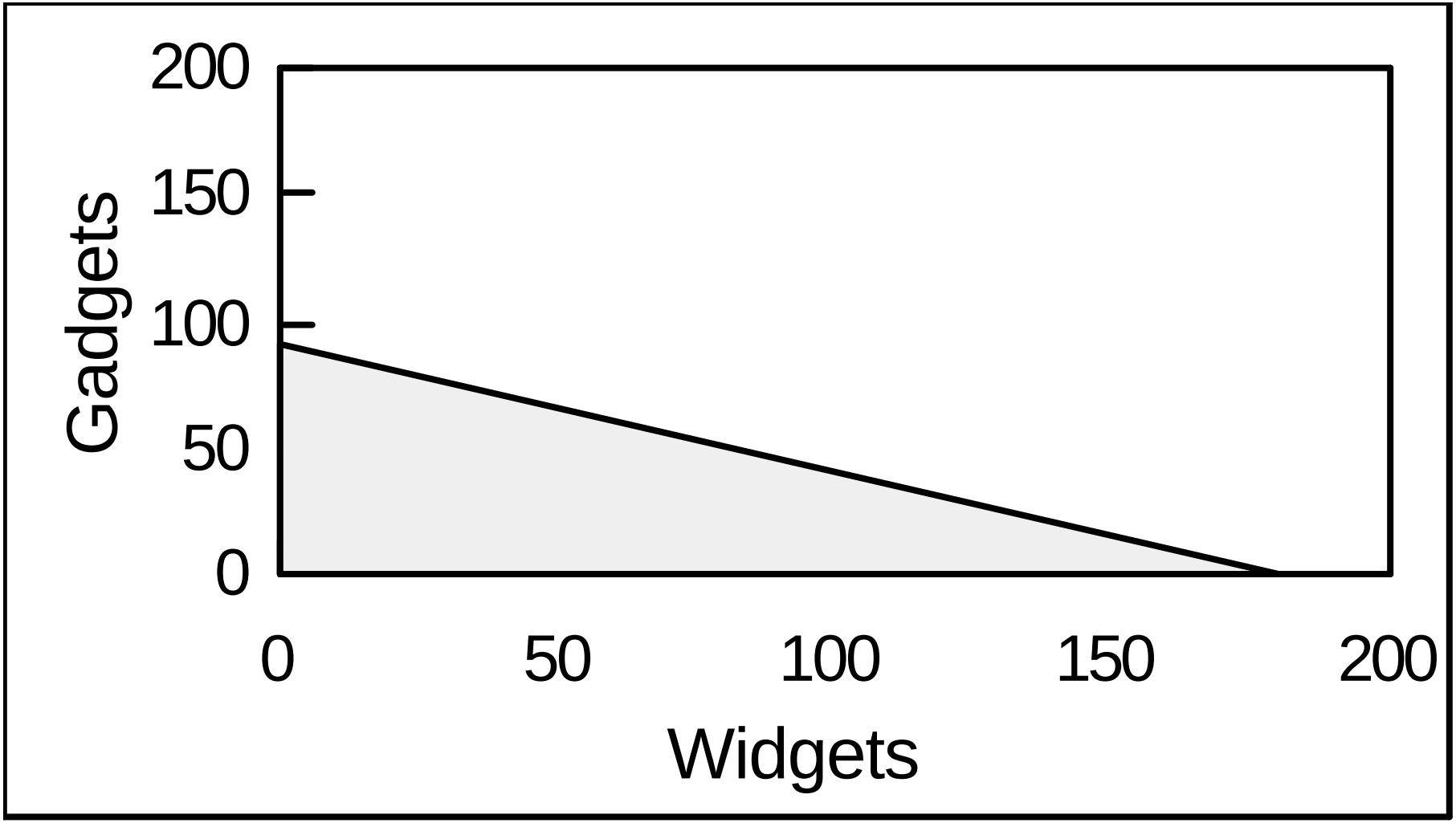
Each widget earns $50 contribution to profit and overhead. The contribution of gadgets varies from month to month; some months it is as low as $20 per gadget while other months it is as high as $110.

All widgets and gadgets are sold immediately at the going rate; none are kept in inventory.

QUESTION:
how many widgets and gadgets should you produce per day?

ANSWER: if the contribution per gadget is more than $100, produce 90 gadgets and no widgets. If the contribution per gadget is less than $100, produce 180 widgets and no gadgets.

(This problem is so simple that there's really no need for anything a powerful as linear programming, but it illustrates the barest essentials of an LP problem.)


200
150
100
50
0
Gadgets
0
50
100
150
200
Widgets

Widgets and Gadgets (Painted)

You have acquired the facilities to paint your widgets and gadgets. (There is no longer any market for unpainted ones).
Your assembly constraints are as before: $4W + 8G \leq 720$ since each widget takes 4 hours to assemble, each gadget takes 8 hours to assemble, and the assembly department can accommodate up to 90 workers yielding 720 assembly hours per day.
Each widget takes 2 hours to paint, and each gadget takes 1 hour to paint. The paint department can accommodate up to 15 painters, yielding 120 painting hours per day. Thus, $2W + 1G \leq 120$
It is not necessary to use the full capacity if partial utilization is more profitable.

The net contribution for a painted widget is $100; the net contribution for a painted gadget varies, some months as low as $40 but other months as high as $210.

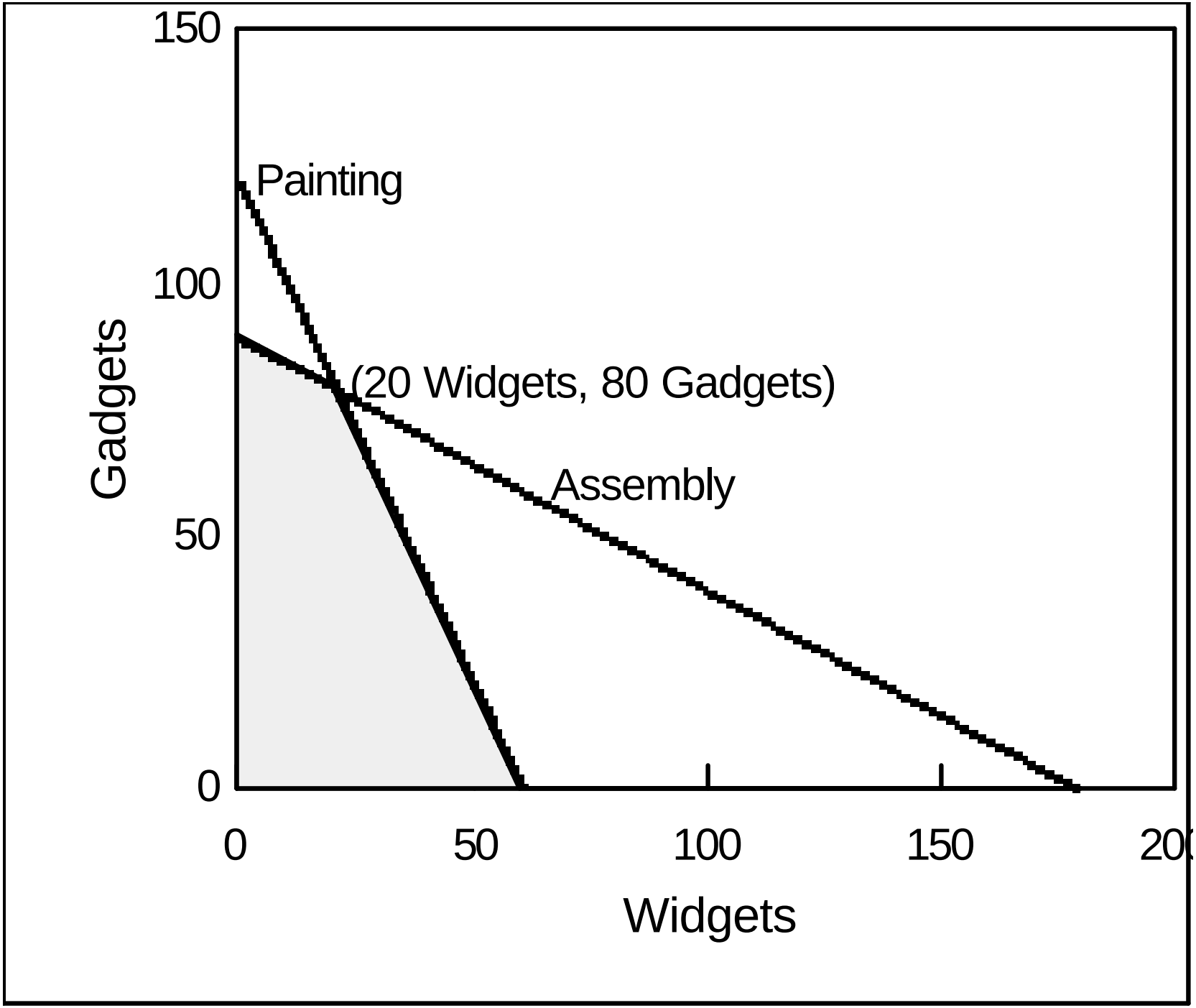
QUESTION: How many widgets and gadgets should you produce per day?

ANSWER:
If the contribution per gadget is less than $50, make 60 widgets and no gadgets. (60 is the most widgets you can paint; there is some idle assembly capacity)

If the contribution per gadget is between $50 and $200, make 20 widgets and 80 gadgets. (This is the only way to completely utilize both assembly and painting capacity)

If the contribution per gadget is over $200, make 90 gadgets and no widgets. (90 is the most gadgets you can assemble; there is some idle painting capacity.)

This problem is a bit more complicated, though still far simpler than the ones LP was invented for. The graph below and the LINDO printouts on the following pages illustrate the solution when the going price for a gadget is $75. By the end of this course, you will be able to set up and interpret problems like this almost effortlessly!


150
100
50
0
Gadgets
Painting
(20 Widgets, 80 Gadgets)
Assembly
0
50
100
150
Widgets