math16503.mws
Maple 10 Worksheet for Problems in Math 165 - Calculus for Business.

First load plots and student:

```
> with( student):with (plots):
```

Chapter 1 Review Problem 16. p. 85 OPTIMAL SELLING PRICE

A manufacturer can produce bookcases at a cost of 80 dollars apiece. Sales figures indicate that if the bookcases are sold for x dollars apiece, approximately 150 - x will be sold each month. Express a manufacturer's monthly profit as a function of the selling price x, draw the graph, and estimate
the optimal selling price.

BEWARE: The text formulation of the Demand Function p = D(x) assumes that x is the NUMBER OF UNITS PRODUCED EACH MONTH, but the statement of the problem asks for the answer in terms of the PRICE.

So, after thinking about it, I used new names for the variables.

Let
p = selling price,
q = units produced each month
q = 150 - p, the [montly] demand as a function of price

The [monthly] Revenue is (number of units)*(price) = q * p = (150-p)*p, and
the Cost is 80*q = 80*(150 - p) dollars (dollars/month?).

The Profit is Revenue - Cost, so

```
> Revenue:= proc(p)
      description`Revenue at price p`;
      (150 - p) * p:
  end proc;
```

$$Revenue := \textbf{proc}(p)\ \textbf{description}\ \text{`}Revenue\ at\ price\ p\text{`};\ (150-p)*p\ \textbf{end proc} \quad (1)$$

```
> Cost:= proc(p)
      description`Cost at price p`;
      80 * (150 -p);
  end proc;
```

$$Cost := \textbf{proc}(p)\ \textbf{description}\ \text{`}Cost\ at\ price\ p\text{`};\ 12000-80*p\ \textbf{end proc} \quad (2)$$

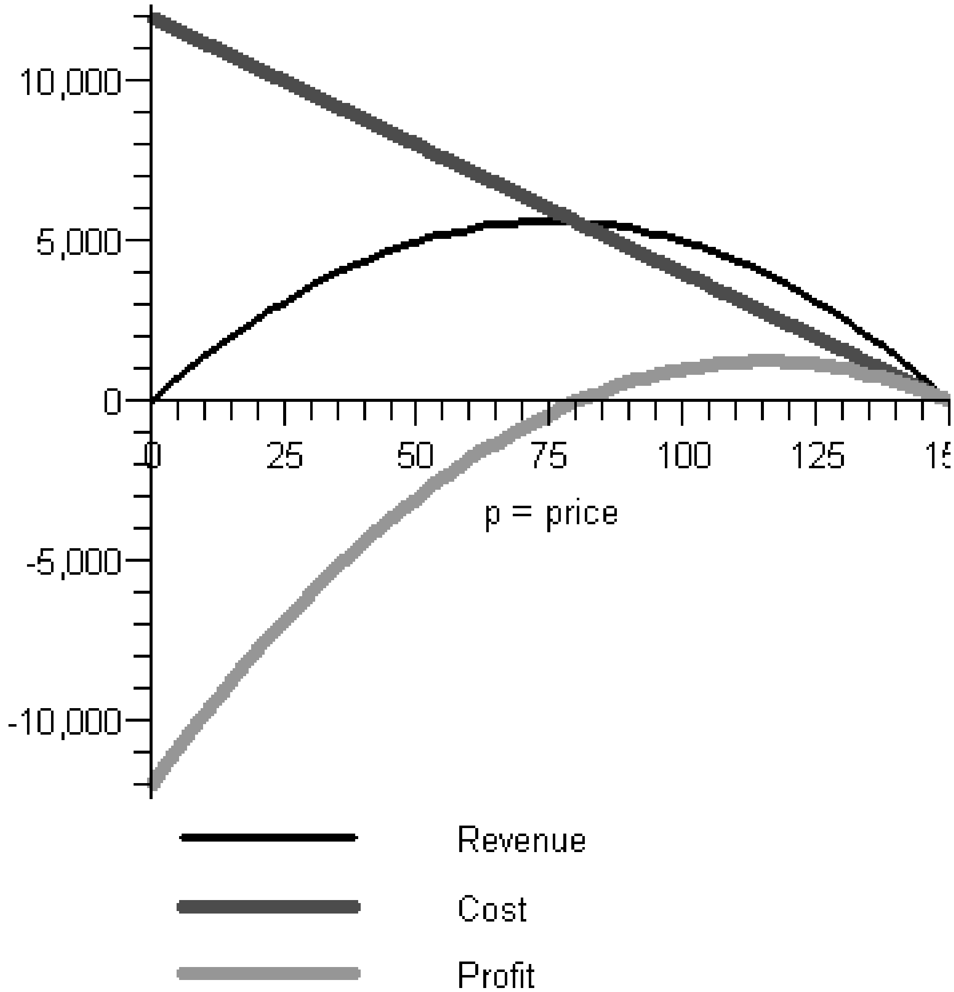
```
> Profit:= proc(p)
        description`Profit at price p`;
        Revenue(p) - Cost(p):
  end proc;
```

$$Profit := \textbf{proc}(p)\ \textbf{description}\ \text{`}Profit\ at\ price\ p\text{`};\ Revenue(p)-Cost(p)\ \textbf{end proc} \quad (3)$$

```
> simplify([Revenue(p),Cost(p),Profit(p)]);
```

$$\left[-(-150+p)\,p,\ 12000-80\,p,\ 230\,p-p^2-12000\right] \quad (4)$$

```
> plot([Revenue(p),Cost(p),Profit(p)],p = 0..150, color=[black,red,
green], thickness = [2,3,4],labels = [`p = price`,``],legend=
[Revenue,Cost,Profit]);
```




```
> maximize(Profit(p),p = 0..150,location);
```

$$1225, \{[\{p=115\}, 1225]\} \tag{5}$$

>

The maximum profit occurs when the price is 115 dollars, 35 units are produced, and the profit is 1225 dollars.