ICE - Function Notation

In order to cash in on Star Trek fans' need to own everything remotely connected with the show "Star Trek," companies like The Franklin Mint create and market dinner plates featuring Star Trek characters and scenes. Some of the plates in the 2001 collection are shown in Figure 1[1].

Figure 1: Examples of Star Trek collector plates from the Franklin Mint's 2001 collection. The plates feature Seven of Nine, Lt. Uhura and the principal characters from the original series. The third plate should be a big seller among Star Trek plate afficionados, as it is the first ever talking plate, featuring the voice of William Shatner.

Some plates are sold directly to the public, either through Franklin Mint catalogs, through the Franklin mint web site, or via direct mailings of advertising pamphlets. Plates are also sold through retail outlets such as gift stores, which often carry a surprisingly wide range of Star Trek merchandise (including replicas of weapons and equipment, statues of characters, even holiday ornaments for decorating trees - see Figure 2[2]).

Figure 2: The Limited Edition 2001 "Seven of Nine" tree ornament.

Generally, these independent stores have to pay for at least some of their advertising - for example, in the form of advertisements on local TV stations, or in the form of mass mailings of pamphlets or catalogs to potential customers in the local area. In this activity, you will determine the advertising strategy for a plate retailer.

---

[1] Image source: http://www.franklinmint.com

[2] Image source: http://annshallmark.tripod.com/

Let n(x) represent the number of plates that a retailer can sell when $x are spent on advertising. Let P(n) represent the money earned on the sale of n plates, before advertising costs are accounted for (i.e. the revenue). The functions n and P are defined by the graphs shown in Figure 3.
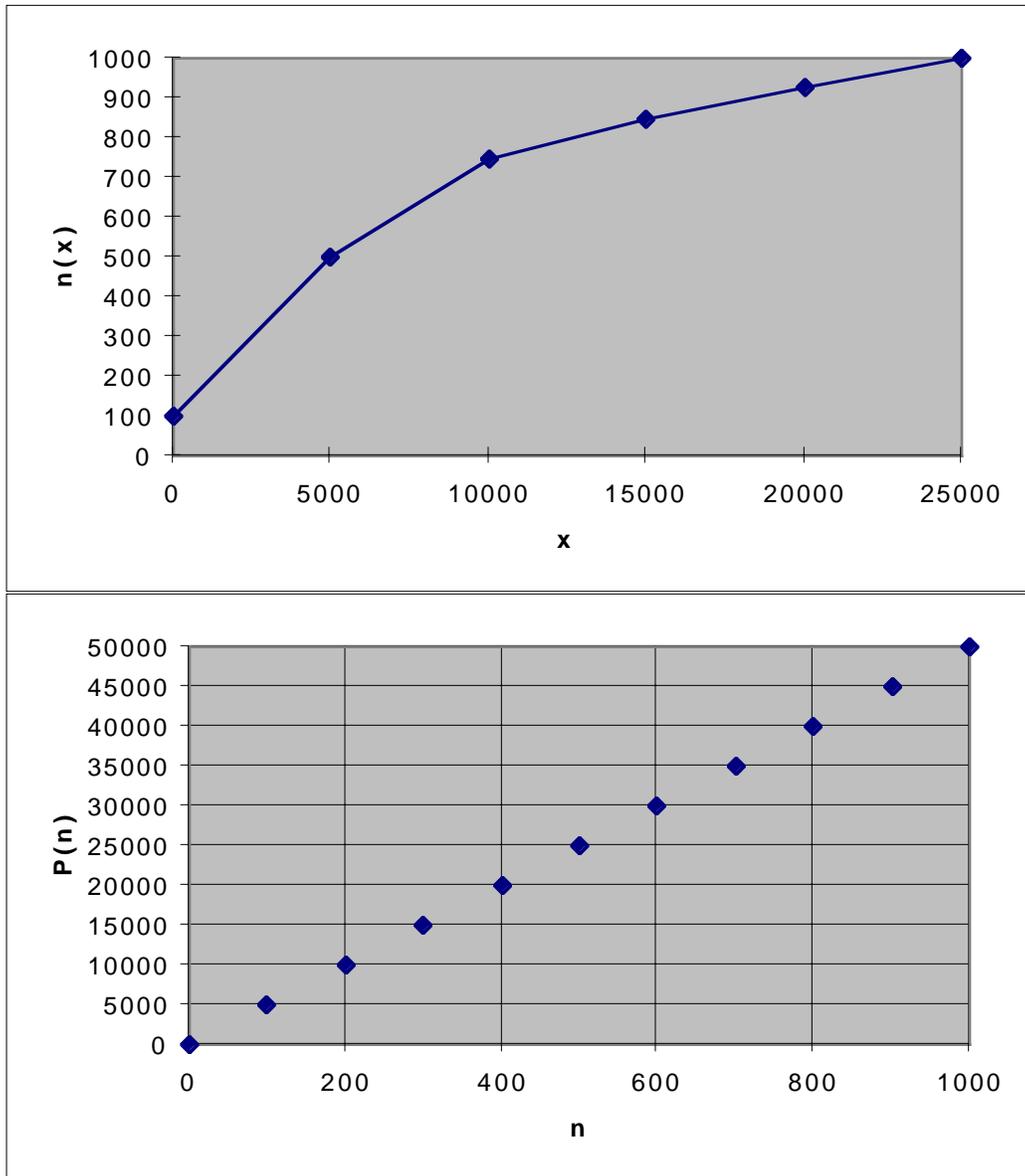

Figure 3: Functions describing sales of Star Trek plates.

- *What is special or unusual about the average rate of change of the function P? Evaluate and give a practical interpretation of the average rate of change of P.*

- **Describe the appearance of the graph of n(x) in words. What does the graph tell you about the relationship between sales and advertising?**

- **Using the graphs of n(x) and P(n), complete the tables given below.**

x	0	5000	10000	15000	25000
n(x)					

n	100	500	750	850	1000
P(n)					

x	0	5000	10000	15000	25000
P(n(x))					

- **Profit is usually defined to be the difference of revenue and cost. Use the axes given below to plot a graph of profit as a function of the amount of money spent on advertising.**

Profit
(thousands $)

Money spent
on advertising
(thousands $)

5   10   15   20   25
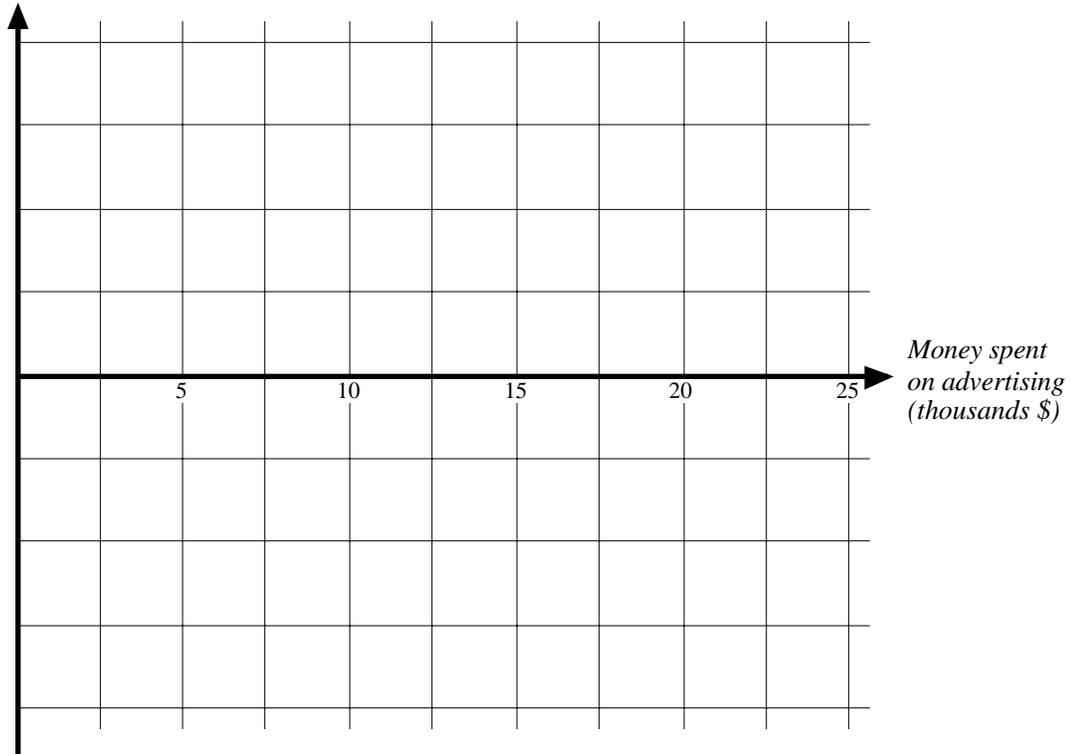
- **Based on your calculations, how much money would you advise the company to spend on advertising?**