Ticket Sales

Living in or by a metropolitan area has certain advantages. Entertainment opportunities are almost boundless in a major city. Events occur almost every night, from sporting events to the ballet. Tickets to these events are not available long; and quantity of tickets demanded can often be modeled by quadratic equations.

Application Practice

Answer the following questions. **You must use Equation Editor or MathType when writing mathematical expressions or equations**. Working in a new MS Word file, provide solutions and answers to all problems, clearly labeling your work. **You must show your steps or provide verbal explanations (where appropriate) to receive full credit. Use textbook examples as your guide as to what level of detail is expected**.

1. Suppose you are an event coordinator for a large performance theater. One of the hottest new Broadway musicals has started to tour and your city is the first stop on the tour. You need to supply information about projected ticket sales to the box office manager. The box office manager uses this information to anticipate staffing needs until the tickets sell out. You provide the manager with a quadratic equation that models the expected number of ticket sales for each day *n*. ($n = 1$ is the day tickets go on sale, Day 1).

$$f(n) = -4.2n^2 + 84n + 336$$

[**Note:** Function f(n) "maps" the days (dates) when tickets are sold to the corresponding number of tickets sold on each specific day (date), so f(15) would denote the number of tickets sold on the 15th day of ticket sales]

a. Does the graph of this equation open up or down? How did you determine this?

b. Describe what happens to the tickets sales as time passes.

c. Use the quadratic equation to determine the last day that tickets will be sold.

Note. Write your answer in terms of the number of days after ticket sales begin.

d. Will tickets peak or be at a low during the middle of the sale? How do you know? After how many days will the peak or low occur?

e. How many tickets would be sold on Day 4? On Day 13? On Day 32?

f. How many tickets will be sold on the day when the peak or low occurs?

g. What is the point of the vertex? How does this number relate to your answers in parts d. and f?

h. How many solutions are there to the equation $0 = -4.2n^2 + 84n + 336$? How do you know?

i. What do the solutions represent? Is there a solution that does not make sense? If so, in what ways does the solution not make sense?

j. (Optional – advanced) How many tickets in total will be sold during the entire period when tickets are sold?

[**Hint:** One can, of course, take this problem "heads on", calculating the number of tickets sold on each day that tickets are sold (e.g. for all n when f(n)>0). However, this will involve way too

much work, as you probably have seen in e. We need to "speed up" the process. How? Well, if a constant number of tickets (e.g. 100 tickets) were sold on days 1 through k, we know that the total number of tickets sold would be 100*k. You should use your answer to c. above as your actual k.

What if ticket sales were proportional to the day number, e.g. 1 ticket sold on Day 1 and k tickets sold on Day k? Formula for the sum of an arithmetic progression (specific to this case) would yield the number of tickets to be $S_k = \frac{1}{2}(1+k)\cdot k$. Now if the proportionality coefficient were to be not 1 but some "b", then the formula would simply be: $S_k = \frac{1}{2}(1+k)\cdot k \cdot b$ (do you see why?)

The most challenging is probably the formula for the total number of tickets sold if ticket sales were directly proportional to the square of the day number: $SS_k = \frac{k(k+1)(2k+1)}{6}$. Try this formula to see if it works for the first few sums of squares (e.g. 1+4+9, here k would be 3).

Of course, if there was a proportionality coefficient different from 1, say "a", then the formula would simply be: $SS_k = \frac{k(k+1)(2k+1)}{6}\cdot a$

Now, all you have to do would be to understand that the quadratic function's three separate elements may be evaluated separately using the above formulas for the entire domain of days when tickets are sold, and the total can be arrived at much quicker than taking the problem "head on"]

Now that you have completed this assignment, remember to check carefully whether you have answered all questions posed, whether you have provided appropriate detail in writing out your answers, and whether you used Equation Editor (or MathType) to write your equations and/or expressions. I know, learning new tools can be time-consuming and frustrating, but the sooner your learn them, the easier it will be for you in the future! After double-checking, submit the file through the Assignments link. **Remember to submit your Certificate of Originality with your work as a separate attachment**. Good luck!