

10. [13 points] The blockbuster action movie *Mildred's Adventures with Calculus!* was just released. During the first week after the premiere, 2.5 million people went to see it. The studio has conducted a study to gauge the impact of the film on audiences, and found that: *the number of tickets sold in a given week is 60% of the number of tickets sold the previous week.* Assume that this process repeats every week.

- a. [5 points] Let p_k be the number of movie tickets, in millions, sold during the k th week after the premiere of the movie. Determine p_2 , p_3 and a formula for p_k .

Solution:

$$p_1 = 2.5$$

$$p_2 = 2.5(0.6)$$

$$p_3 = 2.5(0.6)^2$$

$$p_k = 2.5(0.6)^{k-1}.$$

- b. [6 points] A movie ticket costs \$8. Let T_n be the total amount of money earned in ticket sales, in millions of dollars, during the first n weeks the movie has been exhibited. Determine T_3 and a closed formula for T_n . Show all your work.

Solution:

$$T_1 = 8(2.5)$$

$$T_2 = 8(2.5 + 2.5(0.6))$$

$$T_3 = 8(2.5 + 2.5(0.6) + 2.5(0.6)^2)$$

$$T_n = 8(2.5 + 2.5(0.6) + 2.5(0.6)^2 + \cdots + 2.5(0.6)^{n-1})$$

$$T_n = 8(2.5) \frac{1 - (0.6)^n}{1 - .6} = 50(1 - (0.6)^n)$$

- c. [2 points] Determine the value of $\lim_{n \rightarrow \infty} T_n$.

Solution: $\lim_{n \rightarrow \infty} T_n = \lim_{n \rightarrow \infty} 50(1 - (0.6)^n) = 50$