

Optimal Ticket Price

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The carousel owner wants to set the ticket price for his attraction so that his profit is maximized. For simplicity, he sets the entry fee in multiples of 10 CZK. He knows that at the current price of 50 CZK, he can expect about 600 visitors per day. From previous years, he estimates that if the ticket price increases by 10 CZK, about 50 fewer visitors will come per day. Conversely, if the ticket price drops by 10 CZK, 50 more visitors will come. Additionally, to increase visitor interest, every third visitor will receive cotton candy worth 30 CZK at the carousel owner's expense.

Since the son of the carousel owner happens to be studying mathematics, he decides to help his father with this problem.

Exercise 1. After some thought, the son wrote the formula

$$y = (50 + 10x) \cdot (600 - 50x) - \frac{600 - 50x}{3} \cdot 30.$$

Interpret the individual parts of this formula.

Exercise 2. If we consider the previous formula as a function of the variable x , what type of function is it and what does its graph look like?

Exercise 3. At what ticket price would the owner make the maximum profit?

Exercise 4. How much is the maximum profit greater than the profit at the original ticket price?

Exercise 5. When creating the formula, the son simplified one aspect of the problem. Do you know which one? Could you solve the problem without this simplification? Compare your model with the one created by the son of the carousel owner.