

QUESTION

Consider the following information regarding the production of a good and its demand curve. The production function is given by $Q = 100L + 0.05L^2$, where Q is the quantity of the good produced and L is the quantity of labor used. The demand curve is given by $P = 100 - 0.005Q$, where P is the price of the good. The marginal cost of production is constant at $MC = 10$.



ANSWER

The profit function is given by $\pi = PQ - MCQ = (100 - 0.005Q)Q - 10Q = 100Q - 0.005Q^2 - 10Q = 90Q - 0.005Q^2$. The profit function is a downward-opening parabola. The profit is maximized when the derivative of the profit function with respect to Q is equal to zero. The derivative of the profit function with respect to Q is $\frac{d\pi}{dQ} = 90 - 0.01Q$. Setting the derivative equal to zero, we get $90 - 0.01Q = 0$. Solving for Q , we get $Q = 9000$. The profit is maximized when the quantity produced is 9000. The labor used to produce 9000 units of the good is $L = 20$. The profit is $\pi = 90(9000) - 0.005(9000)^2 = 810000 - 405000 = 405000$.