Monmouth COLLEGE

- Name: _____
- Date: _____
- Section: _____

# ECON 300: Intermediate Price Theory

## Problem Set #5 - Part #2

## Fall 2024

**Problem 1. The Cost Minimization Problem**

Suppose that your firm is producing output $Q$ with using two inputs, labor $L$ and capital $K$. The wage is given as $w$ and rent is given as $r$. The firm following technology:

$$F(L, K) = L^{\frac{1}{2}} K^{\frac{1}{2}}$$

1.A. Find the Marginal Product of Labor $(MP_L)$.

- $MP_L =$

1.B. Find the Marginal Product of Capital $(MP_K)$.

- $MP_K =$

1.C. Find the Marginal Rate of Technical Substitution $(MRTS_{LK})$

- $MRTS_{LK} =$

1.D. Find the firm's optimal ratio of inputs $L$ and $K$.

1.E. Given a production quota of 100, what is the optimal quantities of $L$ and $K$ that minimizes the firm's production costs?

**Problem 1. The Cost Minimization Problem (continued)**

Suppose that your firm is producing output $Q$ with using two inputs, labor $L$ and capital $K$. The wage is given as $w$ and rent is given as $r$. The firm following technology:

$$F(L, K) = L^{\frac{1}{2}} K^{\frac{1}{2}}$$

1.F. Given a production quota of $\bar{Q}$, what is the optimal quantities of $L$ and $K$ that minimizes the firm's production costs?

1.G. Find the firm's total cost function $TC(Q)$.

1.H. Find the firm's average total cost function $ATC(Q)$.

1.I. Find the firm's marginal cost function $MC(Q)$.

**Problem 2. The Profit Maximization Problem**

Suppose that a firm is operating in a perfectly competitive factor and output market where the unit price of the firm's output is given as $P = 200$. The firm's total cost function is given as:

$$TC(Q) = Q^2 - 10Q + 2500$$

2.A Find the firm's total revenue function $TR(Q)$.

2.B Find the firm's marginal revenue function $MR(Q)$.

2.C Find the firm's marginal cost function $MC(Q)$.

2.D If the firm finds that their marginal revenue is greater than their marginal cost of production at the current level of output, should they change their level of output? Why?

**Problem 2. The Profit Maximization Problem (continued)**

Suppose that a firm is operating in a perfectly competitive factor and output market where the unit price of the firm's output is given as $P = 20$. The firm's total cost function is given as:

$$TC(Q) = Q^2 - 10Q + 2500$$

2.E What is the firm's profit maximizing level of output?

2.F What is the firm's production cost associated with the profit maximizing quantity?

- Score: _____
- Extra Credit: _____