Mock Exam 03-06 Preparation

Use this to practice for the mock exam.

Instructions

These practice problems will help you prepare for Mock Exam 03. They cover all key concepts from Section 03 and integrate material from previous sections.

Problem Set A: Quick Review (30 minutes)

Problem 1: Function Fundamentals (x)

For each function, determine the domain and range:

a) $f(x) = \frac{2x-3}{x+4}$

b) $g(x) = \sqrt{25 - x^2}$

c) $h(x) = 3x^2 - 12x + 7$

Problem 2: Linear Applications (x)

A company has cost function $C(x) = 3000 + 45x$ and revenue function $R(x) = 80x$.

a) Find the break-even point.
b) Calculate the profit when producing 150 units.
c) What is the contribution margin per unit?

Problem Set B: Exam-Style Problems (90 minutes)

Problem 3: Retail Business Optimization (xx)

A clothing retailer faces the following market conditions: - Demand function: $Q = 800 - 4p$ where p is price in CU - Fixed costs: 5,000 CU per month - Variable costs: $V(x) = 30x + 0.2x^2$ where x is quantity

a) Express price as a function of quantity. [3 pts.]

b) Derive the revenue function $R(x)$. [3 pts.]

c) Find the total cost function and calculate the cost of producing 100 units. [4 pts.]

d) Determine the profit-maximizing quantity using the vertex formula. [5 pts.]

e) If the retailer can only produce 150 units due to capacity constraints, should they produce at full capacity? Justify with calculations. [5 pts.]

Problem 4: Function Transformations and Analysis (xx)

A consulting firm's quarterly profit is modeled by $f(x) = -x^2 + 12x - 20$ (in thousands of CU), where x is the number of consultants.

a) Find the vertex and interpret its meaning. [4 pts.]

b) Determine the break-even points (where profit = 0). [3 pts.]

c) Due to market expansion, the profit function transforms to $g(x) = 1.2f(x) - 5$. Write the new function and find the new maximum profit. [5 pts.]

d) If the firm needs at least 10,000 CU profit, what range of consultants should they employ for:

- The original model
- The expanded model [4 pts.]

e) The HR department provides consultants according to $h(m) = 2m + 2$ where m is months of advance planning. Express quarterly profit as a function of planning time. [4 pts.]

Problem Set C: Comprehensive Review (60 minutes)

Problem 5: Supply Chain Integration (xxx)

A manufacturer has a three-stage production process:

Stage 1: Raw material cost: $C_1(x) = 20x + 0.1x^2$ Stage 2: Processing with 80% efficiency, additional cost: $C_2(y) = 50y + 1000$ Stage 3: Packaging at $3 per unit with fixed cost of 500

The market demand is $p = 120 - 2q$ where q is final quantity sold.

a) Express the total cost as a function of initial raw material quantity x. [5 pts.]

b) How much raw material is needed to produce 40 final units? [3 pts.]

c) Express revenue as a function of raw material quantity x. [4 pts.]

d) Find the profit function and determine the optimal raw material quantity. [6 pts.]

e) If raw material is limited to 60 units, what is the maximum achievable profit? [2 pts.]

Problem 6: Market Equilibrium with Functions (xxx)

Two competing firms have cost functions:

- Firm A: $C_A(x) = 2x^2 + 10x + 100$
- Firm B: $C_B(x) = x^2 + 20x + 80$

Market demand: $P = 100 - 0.5Q$ where $Q = q_A + q_B$

a) If Firm A produces 10 units and Firm B produces 15 units, what is the market price? [2 pts.]

b) Calculate each firm's profit at these production levels. [4 pts.]

c) If Firm B exits the market, express Firm A's profit as a function of its production and find the monopoly optimum. [7 pts.]

d) Compare the market price under monopoly versus the competitive scenario from part (a). [5 pts.]

Exam Preparation Checklist

Before the exam, ensure you can:

- ⍰ Find domain and range of various function types
- ⍰ Set up linear supply and demand functions
- ⍰ Find market equilibrium algebraically
- ⍰ Use the vertex formula for quadratic optimization
- ⍰ Apply function transformations to business scenarios
- ⍰ Compose functions for multi-step processes
- ⍰ Find and interpret inverse functions
- ⍰ Translate business problems into mathematical models
- ⍰ Interpret mathematical results in business context
- ⍰ Handle constraint optimization problems

> Tip
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> Remember: Show all work clearly, label units, and always interpret your results in the business context!