

Economics Tripos Part 1 Paper 1
Microeconomics
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Supervision 3 (Producer Theory I): production functions; technology; cost functions; cost minimisation; profit maximisation; returns to scale

Reading: Varian's Intermediate Microeconomics, ch. 18-20

Short questions

1. a) What is a production function? State and explain the assumptions we make about a production function. Is it always concave?

b) Suppose that technology can be represented by the following production function: $f(x_1, x_2) = (4x_1^{0.4}x_2^{0.6})$.

i. Derive the isoquant for the production of 8 and 12 units respectively. Draw it.

ii. What is the slope of the isoquant?

iii. Interpret your results.

c) Does an increase in the price of one factor input always increase the cost of producing one unit of output? Explain.

2. a) Define decreasing, constant and increasing returns to scale in terms of the average production cost of a firm.

b) Does increasing returns to scale imply that the isoquants are concave?

c) If there are decreasing returns to individual factor inputs, does it follow that the technology as a whole exhibits decreasing returns to scale?

d) 'If a competitive firm exhibits constant returns to scale, then its long-run maximum profits must be zero'. Comment.

e) A production function that uses inputs that are perfect complements has to be constant returns to scale. Is this true/false/depends? Explain.

Problems

1. Write down the cost functions for the following production functions, assuming the prices of input factors x_1 and x_2 are w_1 and w_2 respectively.

a) $y = \min\{x_1, x_2^2\}$

b) $y = 2x_1 + 3x_2$

c) $y = x_1^{1/2}x_2^{1/2}$

2. Suppose we have a production technology $f(x_1, x_2) = (3\sqrt{x_1} + \sqrt{x_2})^2$. The prices of inputs are $w_1 = 1$ and $w_2 = 3$.

a) Write down the equation for the isocost curve. What is its slope?

b) What is the marginal rate of technical substitution when $y = 16$?

c) Write down the cost function.

d) Find the profit maximising level of output.

e) Find the unconditional factor demand functions.

f) Solve the cost minimisation problem subject to an arbitrary level of output (hint: minimise cost subject to $y = \bar{y}$).

g) Find the conditional factor demand functions.

h) When do a firm's profit maximisation and cost minimisation problems coincide?

3. Compare and contrast the producer's cost minimisation and consumer's utility maximisation problem.

Essay

1. In which way can producer theory shed light on the changes in the relative size of the formal and informal economy?