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University Examinations 2023/2024

SECOND YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN ECONOMICS

BEC 3251: MATHEMATICS FOR ECONOMISTS II

DATE: APRIL 2024 **TIME: 2 HOURS**

INSTRUCTIONS: *Answer question **one** and any other **two** questions*

QUESTION ONE (30 MARKS)

a) Find the total differentials for the following: (10 marks)

(i) $z = f(x, y) = \frac{x^2}{y^2}$

(ii) $z = x^3 y^2$

(iii) $z = x^5$

(iv) $z = 4x^2 + 5xy - 3y^3$

b) Find the inverse of the following matrix (4 marks)

$$A = \begin{bmatrix} 5 & 3 \\ 2 & 7 \end{bmatrix}$$

c) Find producers surplus and consumer surplus given the following functions and equilibrium prices (8 marks)

(i) $P = 3 + Q^2;\ P_e = 19$

(ii) $P = 50 - 0.5Q;\ P_e = 30$

d) (i) State Euler's Theorem (2 marks)

(ii)Demonstrate Euler's theorem for the following production functions: (6 marks)

A) $Q = AK^{\frac{2}{3}}L^{\frac{8}{5}}$

B) $Q = AK^{\alpha}L^{\beta}$

QUESTION TWO (20 MARKS)

a) (i) Clearly differentiate between strictly monotonic increasing and monotonic increasing functions (use diagrams) (4 marks)

(ii)Outline three of the conditions that may be fulfilled for strictly monotonic increasing functions (6 marks)

b) Find the sign of the following quadratic form by making use of the Hessian determinant of the quadratic form (10 marks)

(i) $Q = f(x,y) = -4x^2 + 6xy - 3y^2$

(ii) $Q = f(u,v,w) = -6u^2 + 2uv - 3v + 4vw - 2w^2$

QUESTION THREE (20 MARKS)

a) Discuss five properties of exponential functions with arbitrary bases (5 marks)

b) Solve for x (8 marks)

(i) $\ln(3\sqrt{x+30} = 2$

(ii) $2e^{2x-100} = 300$

(iii) $4e^{x} = 160$

(iv) $3\ln x + 7 = 16$

c) Find the second order total differentials for the following functions (7 marks)

(i) $z = f(x,y) = x^2y^2$

(ii) $z = f(x,y) = x^3 + y^3$

QUESTION FOUR (20 MARKS)

a) Evaluate the following integrals (6 marks)

(i) $\int 3\sqrt{44}dx$

(ii) $\int x^3 dx$

(iii) $\int x^{\frac{3}{4}} dx$

(iv) $\int \frac{1}{x^4} dx$

b) Discuss the properties of matrix multiplication (4 marks)

c) Find Y and r by Cramer's rule given the following IS-LM models (10 marks)

Goods Market

Y=C+I

C=200+0.2Y

I=8-0.3r

Money Market

Md=100+0.15Y-0.25r

Ms=120

QUESTION FIVE (20 MARKS)

a) You are given the following matrices

$$A = \begin{bmatrix} 3 & 2 & 1 \\ 4 & 2 & 4 \\ 5 & 7 & 6 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 2 & 3 & 5 \\ 8 & 9 & 6 \end{bmatrix}$$

(i) In which order are the two matrices comfortable with respect to multiplication (2 marks)

(ii) Get the product from your answer in (i) (4 marks)

b) Compute the derivatives of the following

(i) $y = e^{x2} + 4x$ (2 marks)

(ii) $y = \ln(3x^3 - 2x^2)$ (2 marks)

(iii) $y = \log_3 x$ (2 marks)

c) Define the following terms

(i) Implicit functions (2 marks)

(ii) Composite functions (2 marks)