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Ondo-State, Nigeria
Department of Economics
2nd Semester 2018/2019 Examinations Questions



Course Code: ECO 208 *ECN 208*
Course Title: Mathematics for Economists II
Instruction: Attempt any THREE questions.
Time Allowed: 2 hours

Question 1

a) Outline:

- i. any two categorizations of optimization problems in Economics
- ii. the optimization conditions for the function $y = f(x)$

b) Determine the number of maintenance engineers (E) that will minimize the average cost of engineers when total cost is related to the number of engineers by the following equation:

$$TC = 3E^3 - 18E^2 + 4E \quad (20 \text{ marks})$$

Question 2

a) Distinguish between:

- i. differential calculus and integral calculus
- ii. indefinite integral and definite integral
- iii. ordinary DE and partial DE
- iv. order of a DE and degree of a DE
- v. Young's theorem and Euler's theorem

b) Evaluate:

i. $\int (X^6 + X^4 + X^2 + 4) dx$

ii. $\int \frac{\cos x}{1 + \sin x} dx$

iii. $\int (2ax + b)e^{ax^2 + bx + c} dx$

iv. Let $U = \int \frac{\sin x}{a \sin x + b \cos x} dx$ and $V = \int \frac{\cos x}{a \sin x + b \cos x} dx$

Find:

- i. $aU + bV$
- ii. $aV - bU$

(20 marks)

Question 3

a) Find the relative optima of the functions:

i. $z = x^2 + y^2 + 4x - 8y$

ii. $z = 4x + 6y - x^2 - y^2$

b) Max $z = xy + 2x$
x,y

s.t. $4x + 2y = 60$

(20 marks)

Question 4

a) Determine the order and degree of each of the following differential equations:

i. $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 - 2y = 0$

ii. $\frac{d^3y}{dx^3} = \frac{dy}{dx}$

iii. $\left(\frac{d^4y}{dx^4}\right)^2 - 4\frac{d^2y}{dx^2} + 4y = 0$

iv. $y - 2x\frac{dy}{dx} - y^2\left(\frac{dy}{dx}\right)^3 = 0$

v. $\frac{d^2y}{dx^2} - \frac{1}{x}\frac{dy}{dx} - 3x = 0$

b) Derive ordinary differential equations from the following equations:

i. $x^2 - e^y = a$ (where a is a constant)

ii. $y^2 - ax + a^2 = 0$ (where a is a constant)

(20 marks)

Question 5

a) Let $A = \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix}$

Find:

i. A^2

ii. A^3

iii. $f(A)$ where $f(x) = 2x^3 - 4x + 5$

b) Classify the following matrices by types:

$$(i) \begin{bmatrix} 5 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 5 \end{bmatrix}$$

$$(ii) \begin{bmatrix} 1 & 0 & 2 \\ 0 & 0 & 0 \\ 2 & 0 & 0 \end{bmatrix}$$

$$(iii) \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

$$(iv) \begin{bmatrix} 0 & 1 & 2 \\ -1 & 0 & -3 \\ -2 & 3 & 0 \end{bmatrix}$$

$$(v) \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \\ 13 & 14 & 15 & 16 \end{bmatrix}$$

(c) Let $X = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ and $A = \begin{pmatrix} a_{11} & 0 \\ 0 & a_{22} \end{pmatrix}$

find $X'AX$

(d) Obtain $\begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{vmatrix}$ using Sarrus rule

(20 marks)