The Co-operative University of Kenya

END OF SEMESTER EXAMINATIONS

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN FINANCE, BACHELOR OF COOPERATIVE BUSINESS AND BACHELOR OF COOPERATIVES AND COMMUNITY DEVELOPMENT

COURSE CODE: BMAT 1105

UNIT TITLE: MANAGEMENT MATHEMATICS II

DATE: DECEMBER, 2019 Time: 2 Hours

INSTRUCTIONS

1. Answer question **ONE** and any other **TWO (2)** questions
3. Scientific Calculators and non-programmable calculators may be used
4. Use the provided statistical tables where applicable

QUESTION ONE

(a) Define the following terms

(i.) Price elasticity of demand (**2** *marks*)

(ii.) Cross Elasticity of Demand (**2** *marks*)

(iii.) Optimization (**2** *marks*)

(iv.) Marginal Analysis (**2** *marks*)

(b) b. The price of two commodities are represented by the following equation. Calculate the values of X and Y using matrices.

$2x - 2y - 3 = 0$

$8y = 7x + 2$ (**8** *marks*)

(c) Find the derivative of the functions below

i. $f(x) = \frac{x-1}{x+2}$ (**4** *marks*)

ii. $y = \frac{5e^x}{3e^x+1}$ (**4** *marks*)

(d) Explain three applications of derivatives in real life situation (**6** *marks*)

QUESTION TWO

(a) Differentiate the following function using Quotient rule

$f(x) = \frac{4\sqrt{x}}{x^2-2}$ (**6** *marks*)

(b) A cinema charges \$8 per ticket for evening screenings and sells 250 tickets a night on average. They estimate that the price elasticity of demand for tickets is (−) 1.6. Calculate the expected number of tickets sold if they reduce the ticket price to \$7 (**6** *marks*)

(c) Define the term Input-output analysis ("$I-O$") (**2** *mark*)

(d) Define the Marginal analysis and explain how the management uses it in Business set-up (**6** *mark*)

QUESTION THREE

(a) A local council raises the price of car parking from £3 per day to Â£5 per day and finds that usage of car parks contracts from 1,200 cars a day to 900 cars per day. Calculate the price elasticity of demand for this price change and calculate whether total revenue from the car park rises or falls. (**7** *marks*)

Integrate

(b) Integrate $\int 5e^x dx$ (**3** *mark*)

(c) The demand function for a certain product is linear and defined by the equation $p(x) = 10 - \frac{x}{2}$ where x is the total output. Find the level of production at which the company has the maximum revenue. (**10** *mark*)

QUESTION FOUR

(a) Suppose the market demand and supply of widgets is given by the following equations:
Market Demand for Widgets: $P = 100 - Q$
Market Supply of Widgets: $P = 3Q + 20$
where P is the price per unit and Q is the quantity demanded.

i. What is the equilibrium price and equilibrium quantity of widgets? (**3** *marks*)

ii. Describe what happened to the supply curve due to this change in production costs. What is the equation for the new supply curve? (**4** *marks*)

(b) Define Profit optimization and explain the importance of profit optimization in Business (**4** *marks*)

(c) Solve the following system of equations (**6** *marks*)
$3x + y = \hat{a}3$
$x = \hat{a}y + 3$

(d) Find f'_x and f'_y in the equation
$f(x, y) = 2x^2 + 4xy$ (**3** *marks*)

Solutions to Exam

(i.).

$$Priceelasticityofdemandisaneconomicmeasureofthechangeinthequantity$$
$$demandedorpurchasedofaproductinrelationtoitspricechange.$$

(ii.).

$$Thecrosselasticityofdemandisaneconomicconceptthatmeasurestheresponsiveness$$
$$inthequantitydemandedofonegoodwhenthepriceforanothergoodchanges.$$

(iii.).

$Optimizationidtheprocessofmeasuringtheefficiency, productivityandperformanceofabusiness.$

(iv.).

$$Marginalanalysisisanexaminationoftheadditionalbenefitsofanactivitycompared$$
$$totheadditionalcostsincurredbythatsameactivity.$$

0b. writing the equation in the form
$ax + by = c$
$2x - 2y = 3$ $7x - 8y = -2$
$\begin{bmatrix} 2 & -2 \\ 7 & -8 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ -2 \end{bmatrix}$
Determinant
$=(z \times -8) - (-2 \times 7) = -2$
Inverse
$= -\frac{1}{2} \begin{bmatrix} -8 & 2 \\ -7 & 2 \end{bmatrix} = \begin{bmatrix} 4 & -1 \\ 3.5 & -1 \end{bmatrix}$

$$\begin{bmatrix} 4 & -1 \\ 3.5 & -1 \end{bmatrix} \begin{bmatrix} 2 & -2 \\ 7 & -8 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 & -1 \\ 3.5 & -1 \end{bmatrix} \begin{bmatrix} 3 \\ -2 \end{bmatrix}$$

$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 14 \\ 12.5 \end{bmatrix}$

so $x = 14; y = 12.5$

i.. let $g = x + 2$ and $f = x - 1$
$g' = 1$; $f' = 1$
$f'(x) = \frac{(x+2)1-(x-1)1}{(x+2)^2}$
$= \frac{x+2-x+1}{(x+2)^2}$
$= \frac{3}{x^2+4x+4}$

ii.. $y' = \frac{5e^x(3e^x+1)-(5e^x)(3e^x)}{(3e^x+1)^2}$
$= \frac{15e^{2x}+5e^x-15e^{2x}}{(3e^x+1)^2}$
$= \frac{5e^x}{(3e^x+1)^2}$

0d. Any three explained answers

Business

economics

Biology

Chemistry

Physics

0a.

QUESTION TWO

(a) let $f = 4x^{\frac{1}{2}}$ and
$g = x^2 - 2$
$f' = \frac{f'g - fg'}{g^2}$
$f' = 4(\frac{1}{2})x^{-\frac{1}{2}}$ and $g' = 2x$
next
$= \frac{2(x^{-\frac{1}{2}})(x^2-2)-4x^{\frac{1}{2}}(2x)}{x^2-2}$
$= \frac{2x^{\frac{3}{2}}-4x^{-1/2}-8x^{3/2}}{(x^2-2)^2}$

(b) ped = % change in quantity demanded / % change in price
% change in price = 12.5%
If Ped = (−) 1.6 then ticket sales will rise by $1.6x12.5\% = 20\%$
20% of 250 is 50 extra tickets
Expected tickets sold rises to 300

(c) Input-output analysis ("$I - O$") is a form of macroeconomic analysis based on the interdependencies between economic sectors or industries.

(d) Marginal analysis is a cost-benefit study of a business activity to see if the additional benefits gained by taking an action is worth the cost incurred to take the action. Management uses this to analyze the complexities of a system with respect to its variables and find a way to maximize profits.

0a.

QUESTION THREE

(a) % change in price = (+) 66.7%
% change in demand = (−)25%
$PED = \frac{-25}{66.7}$
$= 0.375(i.e.demandispriceinelastic)$

Total revenue:
£3 per day revenue $= £3 \times 1,200 = £3,600$
£5 per day revenue $= £5 \times 900 = £4,500$
Revenue rises when $Ped < 1$ and a business raises their average selling price.

(b) $\int 5e^x dx$
$= 5 \int e^x dx$
$= 5e^x + C$

(c) The revenue is defined by the formula
$R(x) = xp(x)$
Hence,
$R(x) = x(10â\frac{x}{}2) = 10xâ\frac{x^2}{2}$.
We see that $R(x)$ is a parabola curved downward. It has a maximum at the following point:
$R'(x) = (10x - \frac{x^2}{2})' = 10 - x$
$R'(x) = 0$
$10 - x = 0$
$x = 10$
As the second derivative of the function $R(x)$is negative, the point $x = 10$ is a point of maximum.
Thus, the maximum revenue is attained at the production rate $x = 10$.

0a.

QUESTION FOUR

(a) i. $100âQ = 3Q + 20$
$4Q = 80$ $Qe = 20$
$Pe = 100â20 = \$80$ per unit

(b) (a) The new supply curve will shift to the left but be parallel to the initial supply curve: the two curves will have the same slope. Thus, the new supply curve will be $P = bâ + 3Q$. We also know that the supply curve has shifted vertically up by 20 units since costs have risen at each quantity by \$20. Thus, the new y-intercept of the supply curve will be equal to the initial y-intercept plus 20: the new supply curve will be $P = 40 + 3Q$.

(b) Maximizing or minimizing some function relative to some set, often representing a range of choices available in a certain situation. The function allows comparison of the different choices for determining which might be $âbest.â$

(c) The second equation is solved for x, so we can substitute the expression $-y + 3$ minus, y, plus, 3 in for x in the first equation:
$3x + y = -3$
$3(-y + 3) + y = -3$
$-3y + 9 + y = -3$
$-2y = -12$
$y = 6$

(d) $f_x^{'} = 4 + 4y$
$f_y^{'} = 0 + 4x = 4x$