THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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MAIN EXAMINATION

SEPTEMBER – DECEMBER 2019 TRIMESTER

SCHOOL OF BUSINESS

DEPARTMENT OF ACCOUNTING AND FINANCE

ODEL PROGRAMME

CMS 121: BUSINESS MATHEMATICS

Date: DECEMBER 2019	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and any other TWO Questions	

Q1. a) In an analysis of 100investors of stock market, the following information was found regarding the share investments in companies A, B and C.

40 investors have shares of company A.
42 investors have shares of company B.
39 investors have shares of company C.
18 investors have shares of both companies A and B.
25 investors have shares of both companies B and C.
12 investors have shares of all three companies.
20 investors have shares of company A only.

You are required to, answer the following questions. You are required to; You may use Venn diagram or any other suitable method:

i. Out of the investors who do not have shares of company B, how many investors have shares of company C. **(5 Marks)**

ii. How many investors have shares of exactly two of the above three companies. **(5 Marks)**

b) If the cost of marking x units is C USD$ where $C = 10 + 9x^{2/3}$, at what number of units with marginal cost be UDS$ 0.90? **(5 Marks)**

Q2. When the selling price of a product is Rs.3.50 04, the demand will be 250 units per day. When the price is increased to Rs.5.50 per unit, the demand will be reduced to 50 units per day.
Assuming a linear relationship between number of units in demand per day & selling price per unit.

(i) Write down the demand function. **(7 Marks)**
(ii) Write down the revenue function. **(7 Marks)**
(iii) Find the quantity of which maximizes the total revenue. **(6 Marks)**

Q3. a) A company that produces mirrors for telescopes estimates the values for the following functions when 1200 mirrors are produced: $R(1200) = \$30,000$, $C(1200) = \$23,000$, $MR(1200) = \$400$, and $MC(1200) = \$100$. Due to a change in the economy, the revenue function decreased by \$5000 and cost increased by 10%. Determine the revenue, cost, marginal revenue, and marginal cost under the new economic conditions if 1200 mirrors are produced. **(10 Marks)**

b) The Demand and Supply function for a good are given as:
Demand function: P = 200 – 0.75q
Supply function: P = 20 + 0.75q
Calculate the equilibrium price and quantity algebraically and graphically. **(10 Marks)**

Q4. i) Solve the following simultaneous equations:

a) x – y + z = 2
x + 2y – 2z = -1
-x + 2y + 2z = 9 **(2.5 Marks)**

b) 3y + y – z = 2
X + 2y – z = 2
5x + 3y + z = 14 **(2.5 Marks)**

c) 38 + 2p = 6q
5p + 8q = 89 **(2.5 Marks)**

d) 5x – 2y = 7
3x + 8q = 21 **(2.5 Marks)**

ii) Differentiate

a) $3x^5 + 4x^3 - x - 3$ **(2.5 Marks)**
b) $3x^2 + 2\sqrt{x}$ **(2.5 Marks)**
c) $4 + \frac{3}{x}$ **(2.5 Marks)**

d) $\frac{2x+\sqrt{x}}{x^2}$ **(2.5 Marks)**

CMS 121 BUSINESS MATHEMATICS FORMULAR

1. $0! = 1$
2. ^nP_r or $_nP_r = \frac{n!}{(n-1)!}$
3. $^nP_n = n!$
4. $n! = n(n-1)(n-2)(n-3)\ldots1$
5. $^nP_r = n(n-1)(n-2)(n-3)\ldots [n-(r-1)]$
6. ^nC_r or $_nC_n = \frac{n(n-1)(n-2)(n-3)\ldots[n-(r-1)]}{r!}$
7. $^nC_r = \frac{n!}{r!(n-1)!}$ Where r = 0.1,2,3… n
8. $^nC_0 = 1$
9. $^nC_n = 1$
10. $^nC_{n-r} = {}^nC_r$, where r = 0,1,2,3… n
11. $^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$
12. $^nC_{n-r} = \frac{n!}{(n-1)!r!}$ where r = 0,1,2,3… n
13. $\frac{d}{dx}(x^n) = nx^{n-1}$
14. $\frac{d}{dx}$ (constant) = 0 (zero)
15. $\frac{d}{dx}$ (constant x function) = constant x $\frac{d}{dx}$ x function
16. $\frac{d}{dx}(u + v) = \frac{du}{dx} + \frac{dv}{dx}$
17. $\frac{d}{dx}(u + v + w + \ldots) = \frac{du}{dx} + \frac{dv}{dx} + \frac{dw}{dx} + \ldots$
18. $\frac{d}{dx}(u - v) = \frac{du}{dx} - \frac{dv}{dx}$
19. $\frac{d}{dx}(u - v - w - \ldots) = \frac{du}{dx} - \frac{dv}{dx} - \frac{dw}{dx} - \ldots$
20. $\frac{d}{dx}(uv) = u\frac{dv}{dx}(v) + v\frac{du}{dx}(u)$
21. $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx}u - u\frac{dv}{dx}v}{v^2} = \frac{Dr)(\frac{du}{dx}(Nr) - (Nr)\frac{dv}{dx}(Dr)}{(Dr)^2}$

22. $\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$

23. $\frac{d}{dx}(a^x) = a^x \log a$

24. $\frac{d^2y}{dx^2} = \frac{d}{dx}.\frac{dy}{dx}$

25. $\frac{d}{dx}(uvw) = uv\frac{dw}{dx} + uw\frac{dv}{dx} + vw\frac{du}{dx}$

26. $\int x^n\,dx = \frac{x^{n+1}}{n+1} + c$

27. $\int \frac{1}{x}\,dx = \log_e x + c$

28. $\int e^{ax}\,dx = \frac{e^{ax}}{a} + c$

29. $\int a^x\,dx = \frac{a^x}{\log a} + c$

30. $\int k\,dx = kx + c$

31. $\int e^x\,dx = e^x + c$

32. $\int 1.\,dx = x + c$

33. $\int (ax+b)^n\,dx = \frac{1}{a}.\frac{(ax+b)^{n+1}}{(n+1)} + c$

34. $\int \frac{dx}{ax+b} = \frac{1}{a}.\log(ax+b) + c$

35. $\int e^{ax+b}\,dx = \frac{1}{a}.e^{ax+b} + c$

36. $\int u\frac{dv}{dx}\,dx = uv - \int v\frac{du}{dx}\,dx + c$ OR $\int uv\,dx = uv^1 + u'v^2 + u''v^3 - u'''v^4 - \ldots$

37. $\int_{-a}^{a} f(x)\,dx = \begin{cases} 2\int_0^a f(x)\,dx = if\ f(x) is\ even \\ 0 \quad\quad if\ f(x) is\ 0dd \end{cases}$

38. $\int_a^h f(x)\,dx = [g(x) + c]_a^h$

$= \{g(b) + c\} - \{g(a) + c\}$

= g(b) – g(a)

39. $\int \frac{f'(x)}{f(x)} dx$ where f'(x) is the derivative of f(x)

Put f(x) = t, then f'(x)dx = dt

Thus $\int \frac{f'(x)}{f(x)} dx = \int \frac{dt}{t}$ log t = log f(x)

40. $\int [f(x)]^n f'(x) dx, n \neq -1$ put f(x) = t, then f'(x)dx = dt

Thus $[f(x)]^n f'(x) dx = \int t^n dt = \frac{t^{n+1}}{n+1} = \frac{[f(x)]^{n+1}}{n+1}$

41. $\int f'(ax + b) dx$, put (ax + b) = i, then adx = dt, dx = $\frac{dt}{a}$

Thus $\int f'(ax + b) dx = \int f'(t) \frac{dt}{a} = \frac{1}{a} \int f'(t) dt = \frac{1}{a} [f(t)] = \frac{f(ax+b)}{a}$

42. Revenue = price times quantity
R(x) = Px

43. Profit = revenue minus cost
P(x) = R(x) – C(x)

44. Breakeven point (BEP)
Revenue = Cost
R(x) = C(x)
Profit = zero (0)
P(x) = 0

END