# THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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**MAIN EXAMINATION**

**JANUARY – APRIL 2019 TRIMESTER**

**FACULTY OF COMMERCE**

**DEPARTMENT OF ACCOUNTING AND FINANCE**

**SPECIAL EXAMINATION**

**CID 081: INTERMEDIATE BUSINESS MATHEMATICS**

| **Date: JANUARY 2019** | **Duration: 2 Hours** |
|---|---|
| **INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions** | |

Q1. a) The weekly cost to produce *x* widgets is given by

$$C(x) = 75,000 + 100x - 0.03x^2 + 0.000004x^3 \qquad 0 \le x \le 10000$$

and the demand function for the widgets is given by,

$$p(x) = 200 - 0.005x \qquad 0 \le x \le 10000$$

Determine the marginal cost, marginal revenue and marginal profit when 2500 widgets are sold and when 7,500 widgets are sold. Assume that the company sells exactly what they produce. **(10 marks)**

b) A committee of four (4) must be chosen from 3 women and 4 men. Calculate:

a) In how many ways the committee can be chosen
b) In how many ways 2 men and 2 women can be chosen
c) Probability that the committee consists of 2 men and 2 women.
d) The probability that committee consists of at least of 2 women.

**(10 marks)**

c) Integrate the following:

a) ∫{(3x – 1)(3x + 1)}dx
b) ∫$3e^x$ – 5x)dx **(10 marks)**

Q2. a) Write down the first five terms of the sequence given by $u_n = (-1)^{n+1}/n$ **(3 marks)**

b) An Arithmetic Progression (AP) is given by *k, 2k/3, k/3, 0, ….*

i) Find the sixth term. **(2 marks)**
ii) Find the *nth* term. **(2 marks)**

iii) If the $20^{th}$ term is equal to 15, find *k.* **(3 marks)**

c) Find the sum of the Arithmetic series with the first term 1, common difference 3, and last term 100. **(3 marks)**

c) An Arithmetic progression has 3 as its first term. Also the sum of the first 8 terms is twice the sum of the first 5 terms. Find the common difference. **(3 marks)**

d) How many terms in the geometric progression, 1, 1.1, 1.21, 1.331, …will be needed so that the sum of the first n terms is greater than 20? **(4 marks)**

Q3. Differentiate the following;

a) $\frac{d}{dx}(e^{3x^2})$ **(5 marks)**

b) $\frac{d}{dx}(e^{x^3+2x})$ **(5 marks)**

c) In $(2x^3 + 5x^2 - 3)$ **(5 marks)**

d) If $u = 2x^2 + 3xy + 4y^2$ find $\frac{du}{dx}$ and $\frac{du}{dy}$ **(5 marks)**

Q4. a) Four firms P, Q, R and S submit tenders for two jobs 1 and 2 each of which must go to a different firm. List the possible ways that the jobs can be allocated. **(5 marks)**

b) Out of the five people in an office A, B, C, D and E say, just three are to be selected to go to an exhibition. In how many ways can the three be chosen? **(5 marks)**

c) How many ways are there of arranging 3 different jobs between 5 men, when any man can do only one job? What is the probability that man A will be doing job 1? **(5 marks)**

d) Use the binomial theorem to expand

a) $(1 + x)^4$

b) $(1 – 3x)^4$ **(5 marks)**

## CID 081 INTERMEDIATE BUSINESS MATHEMATICS FORMULAE

1. $0! = 1$
2. ${}^nP_r$ or ${}_nP_r = \frac{n!}{(n-1)!}$
3. ${}^nP_n = n!$
4. $n! = n(n-1)(n-2)(n-3)…1$

5. ${}^{n}P_r = n(n-1)(n-2)(n-3)\ldots [n-(r-1)]$
6. ${}^{n}C_r$ or ${}_{n}C_n = \frac{n(n-1)(n-2)(n-3)\ldots[n-(r-1)]}{r!}$
7. ${}^{n}C_r = \frac{n!}{r!(n-1)!}$ Where r = 0.1,2,3… n
8. ${}^{n}C_0 = 1$
9. ${}^{n}C_n = 1$
10. ${}^{n}C_{n-r} = {}^{n}C_r$, where r = 0,1,2,3… n
11. ${}^{n}C_r + {}^{n}C_{r-1} = {}^{n+1}C_r$
12. ${}^{n}C_{n-r} = \frac{n!}{(n-1)!r!}$ 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 +…) = $\frac{du}{dx} + \frac{dv}{dx} + \frac{dw}{dx} + \ldots$
18. $\frac{d}{dx}$ (u - v) = $\frac{du}{dx} - \frac{dv}{dx}$
19. $\frac{d}{dx}$ (u - v - w -…) = $\frac{du}{dx} - \frac{dv}{dx} - \frac{dw}{dx} - \ldots$
20. $\frac{d}{dx}$ (uv) = u$\frac{dv}{dx}$(v) +v $\frac{du}{dx}$(u)
21. $\frac{d}{dx}(\frac{u}{v}) = \frac{v\frac{du}{dx}u - u\frac{dv}{dx}v}{v^2} = \frac{Dr)(\frac{du}{dx}(Nr) - (Nr)\frac{dv}{dx}(Dr)}{(Dr)^2}$
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 $\int uvdx$ = $uv^1 + u'v^2 + u''v^3 - u'''v^4$ - …

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

*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***