BUSINESS MATHEMATICS

(Three hours and a quarter)

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*Answer **Question 1** from Section **A** and **10** questions from Section **B**.*
All working, including rough work, should be done on the same sheet adjacent to the rest of the answer.
The intended marks for questions or parts of questions are given in brackets [].

Mathematical formulae are given at the end of this question paper.
The use of calculator (fx-82/ fx-100) is allowed.

SECTION A

(Answer **ALL** questions)

Directions: *Read the following questions carefully. For each question there are four alternatives, A, B, C and D. Choose the correct alternative and write it in your answer sheet.*

Question1. **[2×15 = 30 marks]**

(i) The number of ways of forming four digits numbers with the digits 2,3,5,7 and 9 without repetition is

A 26.

B 60.

C 120.

D 210.

(ii) The derivative of $\log(5x-6)$ is

A $5x-6$

B $\frac{1}{5x-6}$

C $\frac{5x-6}{5}$

D $\frac{5}{5x-6}$

(iii) The cost function $C(x)$ of a function is given by $C(x)=\frac{1}{2}x^3+3x^2-7x+16$, the average cost at $x=4$ is

A 10.

B 17.

C 15.

D 98.

(iv) The regression equation x on y is $40x+18y=210$ and the regression equation y on x is $8x-10y+66=0$. What is the value of y, when $x=3$?

A 11

B 9

C 8

D 5

(v) The value of the determinant $\begin{vmatrix} 2 & 3 & 4 \\ 1 & 0 & 5 \\ 6 & 2 & 1 \end{vmatrix}$ is

A 59.

B -99.

C 115.

D 75.

(vi) $\int (3x+7)^4 dx$ is equal to

A $12(3x+7)^3+C$

B $\frac{(3x+7)^5}{5}+c$

C $\frac{(3x+7)^5}{15}+c$

D $3(3x+7)^5+c$

(vii) What is the amount of an annuity of Nu.8000 payable at the end of each year fo
at 5% p.a compounded annually?

A Nu 376498

B Nu 393023

C Nu 412675

D Nu 425621

(viii) There are 13 questions in a question paper. The number of ways a candidate can select 10 questions from the question paper is

A 715

B 66

C 120

D 286

(ix) The distance between the points A(2, -1, 3) and B (1, -3, 1) is

A 4

B 2

C 9

D 3

(x) $\int \frac{x}{x^2+3}\,dx$ is

A $\frac{1}{2}\log(x^2+3)+c$.

B $\log(x^2+3)+c$.

C $2\log(x^2+3)+c$.

D $\frac{1}{3}\log(x^2+3)+c$.

(xi) If $A = \begin{bmatrix} 2 & 3 & 1 \\ 2 & -1 & 2 \\ 6 & 4 & -3 \end{bmatrix}$ the co-factor of the element 4 is

A -2.

B 2.

C -8.

D 8.

(xii) Pasang wishes to create a fund to provide a cash prize of Nu 3000 for the first rank holder in BHSEC every year. If the fund is invested at 6% p.a compound interest the amount to be invested is

A Nu 50,000

B Nu 30,000

C Nu 18,000

D Nu 60,000

(xiii) The derivative of the function $y = x^{\cos x}$ is

A $(\log x.\sin x + \frac{\sin x}{x})$.

B $x^{\cos x}(\frac{\cos x}{x} - \log x \sin x)$.

C $x^{\cos x}(\frac{\sin x}{x} + \log x \cos x)$.

D $(\frac{\cos x}{x} - \log x \sin x)$.

(xiv) The equation $25x^2 - 16y^2 = 400$ represents a

A hyperbola.

B parabola.

C ellipse.

D circle.

(xv) The standard deviation of the data 6, 7, 12, 13 and 22 is

A 0

B 5.7

C 6.5

D 32.7

SECTION B

Answer any 10 questions. All questions in this section have equal marks [7×10 =70]

Question 2

(a) A round table conference is to be held among delegates of 24 countries. In how many ways can they be seated if three particular delegates are

(i) always together

(ii) never together **[3]**

(b) Following are the marks obtained by 9 students in Accountancy and Business Mathematics.

Marks in Accountancy	35	23	47	17	10	43	9	16	28
Marks in Business Mathematics	30	33	45	23	8	49	12	40	31

Interpret the result using rank correlation coefficient. **[4]**

Question 3

(a) At the beginning of each quarter Nu 1300 is deposited in to a savings account that pays interest at the rate of 6% per annum compounded quarterly. Find the balance in the account at the end of 5 years. **[3]**

b) Solve the system of equations **[4]**

$$2x - 3y + z = 1$$
$$x + 2y - z = 1$$
$$3x - y + 2z = 6$$

Question 4

(a) Solve $\int x^3 \log x \, dx$

(b) Find the adjoint of the matrix

$$P = \begin{bmatrix} 2 & 0 & -4 \\ 1 & 3 & 5 \\ 2 & -6 & -7 \end{bmatrix}$$ and verify that $P(adjP) = (adjP)P$ **[4]**

Question 5

(a) The mean marks in Biology of 150 students was 63. The mean marks of 85 boys was 60. Find the mean marks of the girls. **[3]**

(b) Calculate the inter- quartile range and quartile deviation from the data given below **[4]**

Marks	0 - 10	10 - 20	20 -30	30 -40	40 -50
No. of students	4	15	28	10	7

Question 6

(a) Manju Tamang buys a laptop promising to pay Nu 1500 at the end of every month for the next three years. If money is worth 9% per annum, converted monthly, what will be the price of the laptop at present? **[3]**

(b) Find the co- ordinate of vertex, focus, directrix and the length of the latus rectum of the parabola $y^2 = 20x$ **[4]**

Question 7

(a) If ${}^{n}C_{10} = {}^{n}C_{12}$, determine the value of n and hence find ${}^{n}C_{5}$ **[3]**

(b) If $4x - 5y + 33 = 0$ and $20x - 9y - 107 = 0$, are two lines of regression. Find the mean values of x and y and the regression coefficient of X on Y. **[4]**

Question 8

(a) Five cards are drawn from a full pack of cards. Find the probability that
i) all are clubs.
ii) there is one card of each suit. **[3]**

(b) Find, for what values of x the following expression is maximum and minimum respectively, $y = x^3 - 3x^2 + 15$
Find also the maximum and minimum values.

Question 9

(a) Show that the triangle with vertices $A(4,2,4)$, $B(10,2,-2)$, and $C(2,0,-4)$ is equilateral. **[3]**

(b) The demand function of a monopolist is given by $P = 75 - 2x + 3x^2$. Find the
i. Revenue function
ii. Marginal revenue function
iii. Marginal revenue when $x = 25$ **[4]**

Question 10

(a) Find $\frac{dy}{dx}$, *if* $x^3 + 8xy + y^3 = 13$ **[3]**

(c) Using the properties of determinants show that

$$\begin{vmatrix} x & a & a \\ a & x & a \\ a & a & x \end{vmatrix} = (x+2a)(x-a)^2$$ **[4]**

Question 11

(a) Find the equation of the ellipse with axes along the x-axis and the y-axis which passes through the points $P(4,3)$ and $Q(6,2)$ **[3]**

(b) Evaluate $\int \frac{x+7}{(x+4)(x-2)}\,dx$ **[4]**

Question 12

(a) Differentiate w.r.to x $e^x . \log(\sin 2x)$ **[3]**

(b) Find the least number of years for which an annuity of Nu.2500 must run in order that its amount just exceeds Nu.32000 at 7% p.a compounded annually. **[4]**

Question 13

(a) Show that the line joining $A(3,4,2)$ and $B(5,7,3)$ is perpendicular to the line joining $C(6,-2,-9)$ and $D(4,-1,-8)$ [

(b) Differentiate $y = \sin\left(\frac{1+x^2}{1-x^2}\right)$ **[4]**

Question 14

(a) Evaluate $\int\left(\frac{4x^3+2x^2+3x+5}{x}\right)dx$ **[3]**

(b) Find the maximum profit that a company can make if the profit function is given by $P(x)=\frac{1}{3}x^3+\frac{5}{2}x^2+6x+500$. **[4]**

MATHEMATICS FORMULAE

Co-ordinateGeometry

$$D=\sqrt{\left(x_2-x_2\right)^2+\left(y_2-y_1\right)^2+\left(z_2-z_1\right)^2}$$

$$(x,y,z)=\left(\frac{m_1x_2+m_2x_1}{m_1+m_2},\frac{m_1y_2+m_2y_1}{m_1+m_2},\frac{m_1z_2+m_2z_1}{m_1+m_2}\right)$$

$$a_1x+b_1y+c_1z=0 \text{ and } a_2x+b_2y+c_2z=0$$

$$\frac{x}{b_1c_2-b_2c_1}=\frac{y}{c_1a_2-c_2a_1}=\frac{z}{a_1b_2-a_2b_1}$$

$$\cos\theta=\pm\frac{a_1a_2+b_1b_2+c_1c_2}{\sqrt{a_1^{\,2}+b_1^{\,2}+c_1^{\,2}}\sqrt{a_2^{\,2}+b_2^{\,2}+c_2^{\,2}}}$$

Algebra

$$a^2-b^2=(a+b)(a-b)$$

$$(a\pm b)^2=a^2\pm 2ab+b^2$$

$$\text{In the quadratic equation } ax^2+bx+c=0,\ x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

$${}^{n}p_r=\frac{n!}{(n-r)!}$$

$${}^{n}C_r=\frac{n!}{r!(n-r)!}$$

$$C_{ij}=(-1)^{i+j}M_{ij}$$

$$A\,A^{-1}=A^{-1}A=I$$

$$A^{-1}=\frac{1}{\det A}\cdot adjA$$

$$x=\frac{|D_x|}{|D|},\ y=\frac{|D_y|}{|D|},\ z=\frac{|D_z|}{|D|}$$

Commercial Mathematics

$$A=\frac{a}{i}(1+i)\left[(1+i)^n-1\right]$$

$$P=\frac{a}{i}\left[1-(1+i)^{-n}\right]$$

$$A(x)=\frac{C(x)}{x},\ M(x)=\frac{d}{dx}(C(x))$$

$$C(x)=F+V(x)$$

$$R(x)=xG(x)$$

$$P(x)=R(x)-C(x)$$

$$MC=\frac{d}{dx}(C(x))$$

CALCULUS

$y=x^n$, $y'=nx^{n-1}$,

$y=cf(x)$, $y'=cf'(x)$,

$$If\ y=u\pm v,\ then\ \frac{dy}{dx}=\frac{du}{dx}\pm\frac{dv}{dx}$$

$$If\ y=uv,\ then\ \frac{dy}{dx}=u\frac{dv}{dx}+v\frac{du}{dx}$$

$$If\ y=\frac{u}{v},\ then\ \frac{dy}{dx}=\frac{v\frac{du}{dx}-u\frac{dv}{dx}}{v^2}$$

$$\frac{dy}{dx}=\frac{dy}{du}\times\frac{du}{dx}$$

$$\int uv\,dx=u\int v\,dx-\int\left(\frac{du}{dx}\int v\,dx\right)dx.$$

Data and Probability

$$\overline{X}=\frac{\sum fx}{\sum f}$$

$$Median=l_1+\frac{l_2-l_1}{f_1}(m-c)$$

$$\sigma=\sqrt{\frac{\sum\left(x_i-\overline{x}\right)^2}{n}}\ or\ \sqrt{\frac{\sum x^2}{n}-\left(\frac{\sum x}{n}\right)^2}$$

$$\sigma=\sqrt{\frac{\sum fx^2}{\sum f}-\left(\frac{\sum fx}{\sum f}\right)^2}$$

$$\overline{X}=\frac{m\overline{x_1}+n\overline{x_2}}{m+n}$$

$$\sigma_{12}=\sqrt{\frac{n_1\sigma_1^{\,2}+n_2\sigma_2^{\,2}+n_1d_1^{\,2}+n_2d_2^{\,2}}{n_1+n_2}}$$

$$\mathrm{Cov}(X,Y)=\frac{1}{n}\sum(X-\bar{X})(Y-\bar{Y})$$

$$r=\frac{\sum(x-\bar{x})(y-\bar{y})}{\sqrt{\sum(x-\bar{x})^2\sum(y-\bar{y})^2}}=\frac{n\sum xy-\sum x\sum y}{\sqrt{n\sum x^2-\left(\sum x\right)^2}\sqrt{n\sum y^2-\left(\sum y\right)^2}}$$

$$r=\frac{\sum(x-\bar{x})(y-\bar{y})}{n\sigma_x\sigma_y}$$

$$r=1-\frac{6\sum d^2}{n(n^2-1)}$$

$$r=\sqrt{b_{xy}.b_{yx}}$$

$$b_{YX}=r\frac{\sigma_y}{\sigma_x}=\frac{n\sum xy-\sum x\sum y}{n\sum x^2-\left(\sum x\right)^2}$$

$$b_{XY}=r\frac{\sigma_x}{\sigma_y}=\frac{n\sum xy-\sum x\sum y}{n\sum y^2-\left(\sum y\right)^2}$$

$$Y-\bar{Y}=\frac{\mathbf{cov}(X,Y)}{\sigma_x^{\,2}}\left(X-\bar{X}\right)\;=\;r\frac{\sigma_x}{\sigma_y}\left(X-\bar{X}\right)$$

$$X-\bar{X}=\frac{\mathbf{cov}(X,Y)}{\sigma_x^{\,2}}\left(Y-\bar{Y}\right)\;=\;r\frac{\sigma_y}{\sigma_x}\left(Y-\bar{Y}\right)$$

$$\mathrm{b}_{xy}\times\mathrm{b}_{yx}=r\frac{\sigma_x}{\sigma_y}\times\;r\frac{\sigma_y}{\sigma_x}$$

$$\sum y=na+b\sum x$$

$$\sum xy=a\sum x+b\sum x^2$$

$$y-\bar{y}=b_{yx}\left(x-\bar{x}\right)$$

$$x-\bar{x}=b_{xy}\left(y-\bar{y}\right)$$

$$P\left(A\cup B\right)=P\left(A\right)+P\left(B\right)-P\left(A\cap B\right)$$

$$P\left(A\right)+P\left(\overline{A}\right)=1$$

$$P\left(B/A\right)=\frac{P\left(A\cap B\right)}{P\left(A\right)}$$

$$P\left(A/B\right)=\frac{P\left(A\cap B\right)}{P\left(B\right)}$$

Rough Work

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