



ཤེས་རིག་སྒྲུབ་ལག་།
 ལྷ་ཉིག་ཐང་འབྲིང་རིམ་སློབ་ཁྱེད་ལྷན་ཁག་།



**MOTITHANG HIGHER SECONDARY
 SCHOOL THIMPHU THROMDE**

“Every child is **inspired** to learn and **empowered** with
wisdom to excel in life”

BHSEC TRIAL EXAMINATIONS 2020

BUSINESS MATHEMATICS

Invigilator’s initial
 Marks: 100

Time: 3.15 Hours

Name: Class & Sec. Roll No.:

For Teacher’s Use Only																											
Section s	Section A	Section B																									
Questions	Qn 1	Qn 2		Qn 3		Qn 4		Qn 5		Qn 6		Qn 7		Qn 8		Qn 9		Qn 10		Qn 11		Qn 12		Qn 13		Qn 14	
		a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
Marks	30	4	3	3	4	4	3	3	4	4	3	4	3	3	4	3	4	3	4	3	4	4	3	4	3	4	3
Marks Awarded																											
Total Marks Awarded								Marker’s Initial																			

b) Differentiate $2x^2 + 1$ with respect to $x^4 - 3$.

[3]

Question 3

a) Show that the triangle with vertices $A(3, 5, -4)$, $B(-1, 1, 2)$, $C(-5, -5, -2)$ is isosceles. [3]

b) Evaluate $\int \frac{3x^2 - 5x + 1}{x^2 - 2x - 3} dx$.

[4]

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Question 4

a) Find the inverse of $\begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$.

[4]

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- b) A letter is chosen at random from the letters of the word 'MATHEMATICS'. What is the probability that the letter will be: [3]
- i) M?
 - ii) A vowel?
 - iii) M or a vowel?

Question 5

- a) Find the least number of years for which an annuity of Nu. 1500 per annum interest runs in order that its amount just exceeds Nu. 30,000 at 9% compounded annually. [3]

- b) The regression equations of two variables x and y are $5y - 2x + 7 = 0$ and $7x - 4y - 8 = 0$. Find which equation is meant for Y on X and which one is X on Y. Also, find the coefficient of correlation for two series.

[4]

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Question 6

a) If $f(x) = \frac{\sqrt{x+2} + \sqrt{x-2}}{\sqrt{x+2} - \sqrt{x-2}}$, find $f'(2)$.

[4]

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b) The total revenue from the sale of x units of a product is given by $R(x) = 20x + 5x^2 - 3x^3$.

Find:

- i. The average revenue,
- ii. The marginal revenue and
- iii. Actual revenue from selling 10 units.

[3]

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Question 7

- a) A company sells its product at Nu. 10 per unit. The variable costs are estimated to run 30% of total revenue received. If the fixed costs for the product are Nu. 35,000, find
- i) The total revenue,
 - ii) The total cost function,
 - iii) The quantity company must sell to overcome the fixed cost.
 - iv) The break-even point.

[4]

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- b) Nine counters numbered from 2 to 10 are put in a bag. One counter is selected at random. What is the probability of getting a counter with
- i. An odd number,
 - ii. A multiple of 3 and
 - iii. A number 5.
- [3]

Question 8

- a) If the coordinates of A and B be $(2, 3, 4)$ and $(1, -2, 1)$ respectively, prove that OA is perpendicular to OB , where O is the origin. [3]

b) Find anti-derivatives of the following questions

[4]

i. $(3-2x)(x-5)$

ii. $\frac{2x-3}{x^2-3x+2}$

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Question 9

- a) Find the maximum profit that a company can make if the profit function is given by

$$P(x) = 41 + 24x - 18x^2.$$

[3]

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b) Calculate the a Pearson's coefficient between the age of husband and wife

Age of husband: 35 34 40 43 56 20 38

Age of wife: 32 30 31 32 53 20 33

[4]

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Question 10

a) $\int \frac{x}{\sqrt{x+3}} dx.$

[4]

a) If $y = x^4 + 3x^2 + 7$, find $\left. \frac{d^2y}{dx^2} \right|_{x=2}.$

[3]

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Question 11

a) If $A = \begin{bmatrix} 2 & 3 \\ 0 & -4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 3 & -1 \end{bmatrix}$, find $(AB)^T$. [3]

- b) If price of an item is Nu. 1561. A person purchased it paying a cash of Nu. 300 and the balance with due interest, in 3 half-yearly equal instalments. If the dealer charges interest at the rate of 10% per annum compounded half-yearly, find the value of each instalment. [4]

Question 12

- a) How much should a company set aside at the end of each year if it has to buy a machine expected to cost Nu. 100,000 at the end of 4 years and interest rate 5% per annum compounded annually. [4]

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- b) Solve the following system of equations [3]
- $$2x - 3y = 1$$
- $$3x - 2y = 4$$

Question 13

- a) Find the line of regression y on x from the following data. [4]

x	0	1	2	3	4	5	6
y	2	1	3	2	4	3	5

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b) Find $\frac{dy}{dx}$ if $y = \sqrt{\frac{x+1}{x-1}}$.

[3]

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Question 14

- a) The total cost function for x units is given by $C(x) = \sqrt{6x+5} + 2500$. Show that the marginal cost decreases as the output x increases. [4]

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- b) A bag contains 5 white, 7 red, 8 black balls. If four balls are drawn one by one without replacement, find the probability of getting all white balls. [3]

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MATHEMATICAL FORMULAE

Coordinate Geometry

$$D = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$$

$$(x, y, z) = \left(\frac{m_1 x_2 + m_2 x_1}{m_1 + m_2}, \frac{m_1 y_2 + m_2 y_1}{m_1 + m_2}, \frac{m_1 z_2 + m_2 z_1}{m_1 + m_2} \right)$$

$$a_1 x + b_1 y + c_1 z = 0, a_2 x + b_2 y + c_2 z = 0$$

$$\frac{x}{b_1 c_2 - b_2 c_1} = \frac{y}{c_1 a_2 - c_2 a_1} = \frac{z}{a_1 b_2 - a_2 b_1}$$

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

Commercial Mathematics

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

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

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

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

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

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

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

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

Algebra

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

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

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

$$AA^{-1} = A^{-1}A = I$$

$$A^{-1} = \frac{1}{|A|} \cdot \text{adj}A$$

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

Calculus

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

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

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

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

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

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

Data and probability

$$\bar{x} = \frac{\sum x}{n}, \bar{y} = \frac{\sum y}{n}$$

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

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

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

$$r = 1 - \frac{6 \sum d^2}{n(n^2 - 1)}, \text{ correction factor} = \frac{1}{12}(m^3 - m)$$

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

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

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

$$Y - \bar{Y} = \frac{\text{Cov}(X, Y)}{\sigma_x^2} (X - \bar{X}) = r \frac{\sigma_y}{\sigma_x} (X - \bar{X})$$

$$X - \bar{X} = \frac{\text{Cov}(X, Y)}{\sigma_y^2} (Y - \bar{Y}) = r \frac{\sigma_x}{\sigma_y} (Y - \bar{Y})$$

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

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

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

$$P(A) + P(\bar{A}) = 1$$

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

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

Roughwork

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