University of Eswatini

Main Examination, 2020/2021

BASS I

Title of Paper : Elementary Quantitative Technique I

Course Code : MAT101

Time Allowed : Three (3) Hours

Instructions

1. This paper consists of TWO sections.
   a. SECTION A(COMPULSORY): 40 MARKS
      Answer ALL QUESTIONS.
   b. SECTION B: 60 MARKS
      Answer ANY THREE questions.
      Submit solutions to ONLY THREE questions in Section B.
2. Each question in Section B is worth 20%.
3. Show all your working.
4. Special requirements: None

THIS PAPER SHOULD NOT BE OPENED UNTIL PERMISSION HAS BEEN GIVEN BY THE INVIGILATOR.

SECTION A: ANSWER ALL QUESTIONS

A1. (a) Simplify $\dfrac{4v^2 - 4v - 15}{6v^2 + 13v + 6}$ [5]

(b) Solve the following simultaneous equation

$$\begin{aligned} x - \frac{3}{4}y &= \frac{1}{4} \\ 3x + y &= 17 \end{aligned}$$

[4]

(c) Simplify

$$\frac{(a^{-2}b)^3}{x^4y^{-2}} \times \frac{x^5y^{-3}}{a^{-4}b^3}$$

[3]

(d) Find the sum of the first $25th$ term of $-6, 1, 8, ...$ [4]

(e) Use the binomial to expand $(x + \frac{1}{x})^4$. [5]

(f) Given the matrix

$$C = \begin{pmatrix} 3 & -4 & 0 \\ 3 & 0 & -3 \\ 8 & 2 & -1 \end{pmatrix}$$

(i) Find the minors M_{11}, M_{12} and M_{13} of the matrix C

(ii) Find the cofactors α_{11} α_{12} and α_{13} of the matrix C

(iii) Find the determinant of C using the minors M_{11}, M_{12} and M_{13}. [3,3,2]

(g) Use synthetic division to find the quotient and remainder when $P(x) = x^3 + 2x^2 + 3x - 4$ is divided by $s(x) = x + 3$. [4]

(h) Express as a single logarithm $\log(x+3) - 2\log(x-2) + \log x^3$. [3]

(i) Solve for x in $4^{x-2}.8^{1-x} = \frac{1}{16}$. [4]

SECTION B: ANSWER ANY 3 QUESTIONS

B2. (a) Given the matrices

$$A = \begin{pmatrix} 1 & -2 & 1 \\ 4 & 0 & 2 \end{pmatrix} \quad B = \begin{pmatrix} 1 & 2 \\ -3 & 0 \\ 1 & -1 \end{pmatrix}$$

Compute the following

(i) AB. [4]

(ii) $B^T A^T$. [4]

(iii) $4A - 2B^T$. [3]

(iv) $5A + 4B^T$. [3]

(b) Use Cramer's rule to solve

$$\begin{aligned} 4x + 3y &= 11 \\ 3x - 2y &= 21 \end{aligned}$$

[6]

B3. (a) If $x + 3$ is a factors of $P(x) = x^3 + Ax^2 + Bx - 6$ and a remainder of -8 is left when $P(x)$ is divided by $x - 1$ find the values of A and B [5]

(b) Find all real roots the equation

$$2x^4 + 3x^3 - 4x^2 - 3x + 2 = 0.$$

[5]

(c) Solve each of the following equations

i. $\log_2 x + \log_2(x - 2) = 3$.

ii. $4\log_x 2 - \frac{1}{2}\log_x 4 = 2 - \frac{1}{3}\log_x 8$.

[4,6]

B4. (a) The sum of the series $1 + 8 + 15 + \ldots$ is 396. How many terms does the series. [5]

(b) Write out expression of $(2x - y)^6$ [5]

(c) Find the coefficient of x^{15}. Is there a term in x^{22} in the expansion?

$$\left(\frac{3}{2}x^2 - \frac{1}{3x}\right)^9.$$

[10]

B5. (a) Prove that

i. $\dfrac{\cos 2\theta}{1+\sin 2\theta} = \dfrac{\cos\theta - \sin\theta}{\cos\theta + \sin\theta}$ [6]

ii. $\tan\theta + \cot\theta = \sec\theta\csc\theta$ [5]

iii. $\dfrac{\sin\theta}{\csc\theta - \cot\theta} = 1 + \cos\theta$ [5]

(b) Find $\cot\theta$ and $\sec\theta$ given that $\csc\theta = 4$. [4]

B6. (a) Express $\sin 3\theta$ in terms of $\sin\theta$. [6]

(b) The population of a city grows according to the formula

$$P(t) = 20,000e^{0.04t}$$

where t is the number of years from year 2000. Estimate the population of the city in 2012. [4]

(c) Consider the straight line H given by $18x + 3y = -10$

i. Find the $y-$intercept of H.

ii. Find the gradient (slope) of H.

iii. Find the equation of a line parallel of H passing through the point $(-2, 1)$.

[3,3,4]

END OF EXAMINATION