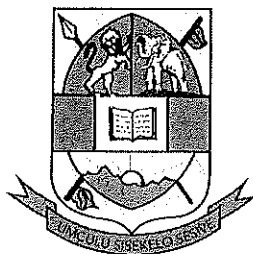

UNIVERSITY OF ESWATINI



RE-SIT EXAMINATION, 2019/2020

BASS

Title of Paper : Elementary Quantitative Techniques I

Course Number : MAT101

Time Allowed : Three (3) Hours

Instructions

1. This paper consists of SEVEN (7) questions in TWO sections.
 - (a) Section A is **COMPULSORY** and is worth 40%. Answer ALL questions in this section.
 - (b) Section B consists of FIVE questions, each worth 20%. Answer ANY THREE (3) questions in this section.
2. Show all your working.
3. Start each new major question (A1, A2, B2, ..., B7) on a new page and clearly indicate the question number at the top of the page.
4. Non-programmable calculators may be used (unless otherwise stated).

Special Requirements: NONE

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

SECTION A
ANSWER ALL QUESTIONS

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QUESTION A1

- (a) Use synthetic division to find the quotient and remainder when $P(x) = x^4 - x^3 - 3x^2 + 4x + 4$ is divided by $d(x) = x + 2$ (5 marks)
- (b) Solve the simultaneous equations
 $5x - 2y = 9$
 $4x + 5y = -6$ (5 marks)
- (c) Find the sum of first 10 terms of the following progressions
(i) $3, 7, 11, 15, \dots$
 $\frac{-1}{3}, \frac{2}{3}, \frac{-4}{3}, \frac{8}{3}, \dots$ (5 marks)
- (d) Find an equation of a straight line through the point $(-1, -1)$ and perpendicular to $2x - 3y = 12$ (5 marks)

QUESTION A2

- (a) Consider the matrices
 $A = \begin{pmatrix} 4 & -3 \\ 1 & 2 \end{pmatrix}$ $B = \begin{pmatrix} 2 & -5 \\ 3 & 6 \\ 1 & -4 \end{pmatrix}$ $C = \begin{pmatrix} 8 & -2 & 3 \\ -1 & 5 & -4 \end{pmatrix}$
Find (i) $|A|$ (ii) $A^T B^T$ (iii) BC (iv) $C^T B^T$ (12 marks)
- (b) Use Cramer's rule to solve
 $3x + 4y + z = 7$
 $4x + 3y - 2z = -5$
 $x + 2y + 4z = 20$ (8 marks)

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SECTION B

QUESTION B3

- (a) (i) Find the first five terms of the infinite binomial expansion

$$(1 + 2x)^{20} \quad (5 \text{ marks})$$

- (ii) Find the middle term of the binomial expansion

$$\left(2x^2 + \frac{1}{x}\right)^{12} \quad (5 \text{ marks})$$

- (b) Find the equations of the following lines and express your answer in the form $y = mx + c$

- (i) Line through $(-1, 4)$ which is parallel to the line through $(1, -1)$ and $2, 3$
(5 marks)

- (ii) Line through $(-1, -2)$ which is perpendicular to the line $2x + 3y - 4 = 0$
(5 marks)

QUESTION B4

- (a) Given the following matrices

$$A = \begin{pmatrix} -3 & 5 \\ 2 & -1 \end{pmatrix} \quad B = \begin{pmatrix} -5 & 1 & 2 \end{pmatrix}$$

$$C = \begin{pmatrix} 1 & 3 \\ -1 & 0 \\ 4 & -2 \end{pmatrix} \quad D = \begin{pmatrix} -2 & 9 & 6 \\ -3 & 3 & 4 \\ 2 & -2 & 1 \end{pmatrix} \quad E = \begin{pmatrix} 3 & -2 & 4 \\ 2 & 1 & 5 \end{pmatrix}$$

Compute

- (i) AE
- (ii) BC
- (iii) $E^T + C$
- (iv) BE^T
- (v) $|D|$

(10 marks)

- (b) (i) Given that $\sin A = \frac{3}{5}$ and $\cos A$ is negative

Find $\sin 2A$ and $\tan 2A$ (5 marks)

- (ii) Prove the following identity

$$\frac{2 \tan \theta}{1 + \tan^2 \theta} = 2 \sin \theta \cos \theta$$

(5 marks)

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QUESTION B5

- (a) Prove the following identities

(i) $\sec x - \sin x \tan x = \cos x$

(ii) $\sin \theta + \cos \theta \cot \theta = \operatorname{cosec} \theta$

(10 marks)

- (b) Given that $\cot \theta = -2$ and that the terminal side is in quadrant IV, find the remaining five trigonometric ratios of θ .

(10 marks)

QUESTION B6

- (a) Use synthetic division to find the quotient and the remainder

(i) $(x^3 - 7x^2 - 13x + 3) \div (x + 2)$

(ii) $(2x^4 + 3x^2 - 1) \div (x - 3)$

(14 marks)

- (b) (i) Find the 10th constant term of the binomial expansion

$$\left(x + \frac{1}{x^2}\right)^{12}$$

- (ii) Use the quadratic formula to solve

$$6x^2 - 13x - 5 = 0$$

(6 marks)

QUESTION B7

- (a) (i) Use synthetic division to find the quotient and remainder

$$(4x^4 - x^2 - 6x - 9) \div (x - 3)$$

(5 marks)

- (ii) Use long division to find the quotient and remainder

$$(x^3 - 7x^2 - 13x + 3) \div (x + 2)$$

(5 marks)

- (b) Prove the following identities

(i) $(\tan \theta + \cot \theta)(\cos \theta + \sin \theta) = \operatorname{csc} \theta + \sec \theta$

(5 marks)

(ii) $\sec x - \sin x \tan x = \cos x$

(5 marks)