
University of Swaziland



Final Examination – November 2013

BASS I

Title of Paper : Elementary Quantitative Techniques I

Course Number : MS011

Time Allowed : Two (2) hours

Instructions:

1. This paper consists of 2 sections.
2. Answer ALL questions in Section A.
3. Answer ANY 2 (out of 4) questions in Section B.
4. Show all your working.

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

Section A
Answer ALL Questions in this section

A.1 a. Give a concise definition of each of the following terms.

- i. The *transpose* of a matrix. [2 marks]
- ii. The *half-life* of a quantity that decays exponentially. [2 marks]
- iv. A *geometric progression*. [2 marks]

b. Simplify

- i. $\frac{2x + 9}{3} + \frac{x - 6}{2}$, [5 marks]
- ii. $\frac{1}{x + 2} + \frac{1}{x - 2}$, [5 marks]
- iii. $\frac{30a^2b^{-4}}{x^{-2}y^3} \div \frac{18a^{-3}b^2}{x^4y^2}$ (expressing your answer in terms of positive indices), [5 marks]
- iv. $\frac{a^2 - a - 2}{2a^2 + a - 1}$, [7 marks]

A.2 a. Use a calculator to compute (for non-exact answers, express correct to 3 s.f.)

- i. ${}_{45}C_3$, [1 marks]
- ii. $\log_5 4\,500$, [3 marks]
- iii. $\ln 3\,000$. [1 marks]

b. Use the *quadratic formula* to solve (expressing your answer correct to 3 s.f.)

$$2x^2 = 29x + 3. \quad [5 \text{ marks}]$$

c. Solve the simultaneous equations

$$\begin{aligned} 7x + 5y &= 32, \\ 3x + 4y &= 23. \end{aligned} \quad [7 \text{ marks}]$$

d. Use *synthetic division* to find the quotient and remainder of

$$\frac{x^3 - x^2 + x - 1}{x - 2}. \quad [5 \text{ marks}]$$

Section B

Answer ANY 2 Questions in this section

B.1 a. Given that

$$A = \begin{pmatrix} 1 & -1 \\ 2 & 3 \end{pmatrix}, \quad B = \begin{pmatrix} -2 & 1 \\ 0 & 3 \end{pmatrix}, \quad C = \begin{pmatrix} 1 & 0 & -1 \\ 2 & 3 & 5 \end{pmatrix},$$

work out

- i. $2A + B^T$, [2 marks]
- ii. $A^T B$, [4 marks]
- iii. $C^T A$. [4 marks]

b. Use Cramer's rule to solve

$$\begin{array}{rcl} x + 2y + 3z & = & 0 \\ 3x - y & = & 2 \\ 2x & + & z = -1. \end{array} \quad [15 \text{ marks}]$$

B.2 a. For the GP

3, 6, 12, ...

find

- i. the formula for the n -th term, [2 marks]
- ii. the 12th term using the formula in i., [2 marks]
- iii. the sum of the first 12 terms. [4 marks]

b. Find the value of

- i. $5 + 10 + 15 + 20 + 25 + \dots + 1,000$ [4 marks]
- ii. $\sum_{n=0}^{60} (4n + 7)$ [6 marks]

c. Given that $x + 1$ is a factor of the polynomial

$$P(x) = x^3 + Ax^2 + Bx + 1,$$

while dividing $P(x)$ by $x - 2$ leaves a remainder of 15, find the values of A and B . [7 marks]

B.3

a. Consider the straight line between $A(-7, 8)$ and $B(1, -8)$. Find

- i. the length of AB correct to 3 s.f., [2 marks]
- ii. the gradient of AB , [2 marks]
- iii. the equation of AB , [4 marks]
- iv. the coordinates of the midpoint of AB . [2 marks]

b. Use the *binomial theorem* to expand and simplify term by term

$$(3x + 2)^4. \quad [7 \text{ marks}]$$

c. In the binomial expansion of

$$(1 - 2x)^{18},$$

find

- i. the first 4 terms, [5 marks]
- ii. the 9th term. [3 marks]

B.4

a. Solve (for non-exact answers, express correct to 3 s.f.)

- i. $3^{x-2} = 243$, [3 marks]
- ii. $5^x = 900$, [4 marks]
- iii. $\log_3(4x + 1) = 2$, [4 marks]
- iv. $\log x - \log 5 = 2$. [5 marks]

b. On 01 January 2013, a sum of E7,500 was invested in an account that pays an interest of 8.5% per annum compounded continuously. The total amount in the account is given by

$$A(t) = 7,500e^{0.085t},$$

where t is the number of years after 01 January 2013. Find the

- i. total amount after 5 years, [3 marks]
 - ii. the date when the total amount doubles. [6 marks]
-