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# University of Swaziland



## Supplementary Examination – July 2014

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### 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.**

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**Section A**  
**Answer ALL Questions in this section**

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

- i. A *polynomial* [2 marks]  
 ii. The *half-life* of a quantity that decays exponentially [2 marks]  
 iv. An *arithmetic progression* [2 marks]

**b.** Simplify

i.  $\frac{x+2}{3} + \frac{x-3}{2}$  [5 marks]

ii.  $1 + \frac{2}{x-2}$  [5 marks]

iii.  $\frac{12a^3}{b^{-2}} \div \frac{18a^3}{b^2}$  (expressing your answer in terms of positive indices) [5 marks]

iv.  $\frac{a-a^2}{a^2-1}$  [7 marks]

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

- i.  ${}_{20}C_4$  [1 marks]  
 ii.  $\log 10,540$  [3 marks]  
 iii.  $\ln 0.21$  [1 marks]

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

$$x^2 - 9x - 1 = 0. \quad [5 \text{ marks}]$$

**c.** Solve the simultaneous equations

$$\begin{aligned} 2x + 3y &= 3 \\ 5x + 4y &= 11 \end{aligned} \quad [7 \text{ marks}]$$

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

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


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## Section B

Answer ANY 2 Questions in this section

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**B.1** a. Given that

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

work out

i.  $2B^T + 3C$  [2 marks]

ii.  $AC$  [4 marks]

iii.  $B^T C^T$  [4 marks]

b. Use Cramer's rule to solve

$$\begin{array}{rcl} x + y + z & = & 4 \\ 2x - y & & = 0 \\ x & - & 2z = -1. \end{array} \quad [15 \text{ marks}]$$

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**B.2** a. For the GP

2, 6, 18, ...

find

i. the formula for the  $n$ -th term [2 marks]

ii. the 9th term using the formula in i. [2 marks]

iii. the sum of the first 9 terms [4 marks]

b. Find the value of

i.  $4 + 8 + 12 + 14 + 20 + \dots + 2,000$  [4 marks]

ii.  $\sum_{n=0}^{40} (3n + 10)$  [6 marks]

c. Given that  $x + 3$  is a factor of the polynomial

$$P(x) = x^3 + Ax^2 - 4x + 12,$$

find the value of  $A$ .

[7 marks]

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**B.3**

a. Consider the straight line between  $A(2, -1)$  and  $B(0, -9)$ . 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

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

c. In the binomial expansion of

$$(1 + x)^{22},$$

find

- i. the first 4 terms [5 marks]
- ii. the 11th term [3 marks]

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**B.4**

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

- i.  $3^x = 256$  [3 marks]
- ii.  $7^x = 560$  [4 marks]
- iii.  $\log(3x + 1) = 1$  [4 marks]
- iv.  $\ln(3x - 10) - \ln 2 = 0$  [5 marks]

b. The value of machinery bought on 01 Jan 2014 depreciates according to the formula

$$V(t) = 25,000e^{-0.05t},$$

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

- i. value of the machinery after 8 years [3 marks]
  - ii. the half-life of the machinery. [6 marks]
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