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UNIVERSITY OF ESWATINI



MAIN EXAMINATION, 2019/2020

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**BASS I, B.Ed I, B.Comm I**

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**Title of Paper** : Algebra, Trigonometry and Analytic Geometry

**Course Number** : MAT 107/MAT 121/MS 101

**Time Allowed** : Three (3) Hours

**Instructions**

1. This paper consists of SIX (6) questions in TWO sections.
2. Section A is **COMPULSORY** and is worth 40%. Answer ALL questions in this section.
3. Section B consists of FIVE questions, each worth 20%. Answer ANY THREE (3) questions in this section.
4. Show all your working.
5. Start each new major question (A1, B2 – B6) on a new page and clearly indicate the question number at the top of the page.
6. You can answer questions in any order.
7. Indicate whether you are full time or part time student and indicate your program on your answer booklet.

**Special Requirements: NONE**

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

**SECTION A [40 Marks]: ANSWER ALL QUESTIONS****QUESTION A1 [40 Marks]**

- a) Find the equation of a straight line passing through the points  $(-2, 2)$  and  $(4, 4)$  [5]
- b) Find the sum of 20 terms of an arithmetic progression  $3, 6, 9, 12, \dots$  [5]
- c) Write and simplify the first two terms in the expansion of  $(2x + y)^8$ . [5]
- d) Suppose that  $z = 2i - 1$ , find  $z^2$ . [5]
- e) Given that  $\sin(x) = 1$  and  $\cos(x) = \frac{1}{2}$ , find  $\tan(x)$ . [3]
- f) Express [5]

$$\log_5(x^2) + 6 \log_5(x - 1) - \log_5(x)$$

as a single logarithm with a coefficient of 1.

- g) Solve the following linear system of equations using Cramer's rule. [7]

$$7x - 2y = 23$$

$$5x - 4y = 19$$

- h) Find the zeros of the polynomial [5]

$$q(x) = (4x - 2)(x^2 + 2x + 1).$$

**SECTION B: ANSWER ANY THREE QUESTIONS****QUESTION B2 [20 Marks]**

- a) Find all the roots of the equation  $x^3 + 6x^2 - x = 30$ . [12]
- b) Prove that  $(1 - \cos(x))(1 + \sec(x)) = \sin(x) \tan(x)$  [8]

**QUESTION B3 [20 Marks]**

- a) Given that  $z_1 = 2 + 3i$  and  $z_2 = 4 + 6i$ , find  $\frac{z_2}{z_1}$ . [6]
- b) Find an equation of a circle that has radius  $r = 3$  and centered at  $(-3, 4)$ . [6]
- c) Given that  $\sin(A) = \frac{1}{2}$  and  $\cos(A) = \frac{1}{4}$ , find  $\sin(2A)$ . [4]
- d) Use synthetic division to find the quotient and remainder of  $p(x) = x^3 - 2x^2 + 5$  when divided by  $x + 3$ . [4]

**QUESTION B4 [20 Marks]**

- a) Solve the logarithmic equation [8]
- $$\log_2(x + 2) + \log_2(x - 5) = 3.$$
- b) What amount must Nhlanhla invest at 8% compounded continuously, to accumulate E460.00 at the end of 2 years? [12]

**QUESTION B5 [20 Marks]**

- a) Find the coefficient of the term involving  $x^8$  in the expansion of  $(2x^4 - 3)^4$ . [8]
- b) Solve the following linear system of equations using Cramer's rule. [12]

$$\begin{aligned}x + y - z &= 6 \\3x - 2y + z &= -5 \\x + 3y - 2z &= 14\end{aligned}$$

**QUESTION B6 [20 Marks]**

- a) Find the twenty first term of an arithmetic progression whose 9th term is 16 and 40th term is 47. [6]
- b) The first term of a geometric progression is 8 and the common ratio is 2. Find the sum of the first six terms. [6]
- c) Prove by mathematical induction that the following formula [8]

$$1 + 4 + 7 + \dots + (3n - 2) = \frac{n(3n - 1)}{2}$$

is valid for all positive integers.