



**First Year Entrance Exam**  
**English curriculum**

**Subject : Mathematics**  
**Duration : 2 Hours**

**Exercise 1 : 11 marks**

- i. The binary operation  $*$  is defined over the set  $S = \{0,1,2,3,4\}$  as  $a*b = (a+b+1) \bmod 5$
- a- Draw an operation table for the S under  $*$  3 marks
  - b- State the identity element. 1 mark
  - c- Name the inverse of each element of S 2 marks
  - d- Determine with reasons if S forms a group under the operation  $*$  2 marks
- ii. A linear transformation T is defined as  $T:(x,y) \rightarrow (2x-y, -x+2y)$
- a. Write down the matrix M representing T. 1 mark
  - b. Find the point whose image is (11,7) under the transformation T 2 marks

**Exercise 2 : 13 marks**

A function  $f$  is defined by  $f(x) = \frac{x+2}{(x+1)(x-2)}$ .

- a. State the domain of definition  $D_f$  of  $f$ . 2 marks
- b. Find the intercept(s) of the graph  $y = f(x)$  2 marks
- c. Find the asymptotes of the curve  $y = f(x)$  2 marks
- d. Find the turning point 3 marks
- e. Obtain a variation table of  $f$  and Sketch the curve  $y = f(x)$  4 marks

**Exercise 3 : 13 marks**

- (i)  $f(x)$ , where  $f(x) = (x+1)(x+3)Q(x) + ax + b$ , is a polynomial of degree three.
- a. Given that  $f(x)$  leaves remainders 8 and -24 when divided by  $(x+1)$  and  $(x+3)$  respectively, find the remainder when  $f(x)$  is divided by  $(x+1)(x+3)$ . 5 marks
  - b. Given that  $(x+2)$  is a factor  $f(x)$  and that the graph of  $f(x)$  passes through the point with coordinates (0, 6), find  $Q(x)$ . 4 marks
- (ii) The real roots of the equation  $x^2 + 6x + \alpha$  differ by  $2p$ , where  $p$  is a non-zero real number. Show that  $p^2 = 9 - \alpha$  4 marks

**Exercise 4 : 10 marks**

The variable  $x$  and  $y$  are related by a relation of the form  $y = \log(ax + b)$ , where  $a$  and  $b$  are constants. Approximate values of  $y$  corresponding to given values of  $x$  given in the table

X	1	2	3	4	5
y	0.857	0.924	0.982	1.033	1.079

BY drawing a suitable linear graph, estimate to one d.p.;

- a. The values of  $a$  and  $b$
- b. The value of  $y$  when  $x = 1.5$  10 marks

**Exercise 5 : 13 marks**

5. Given that  $Z_1 = 2 - 2i\sqrt{3}$  and  $Z_2 = 2\sqrt{3} + 2i$ . Find:

a-  $\frac{Z_1}{Z_2}$  in the form  $a + ib$ , 4 marks

b-  $\arg(Z_2)^4$  and  $|(Z_2)^6|$  3 marks

c- Given that  $Z = e^{i\beta}$ , show that  $z^n + z^{-n} = 2\cos n\beta$ . Use this result to express  $\cos^5 \beta$  in terms of multiples of  $\beta$ . 6 marks

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