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(Department of Education).

**BRAINNSE AN MHEADHON-OIDEACHAIS**  
(Secondary Education Branch).

LEAVING CERTIFICATE EXAMINATION, 1940.

PASS.  
**MATHEMATICS**  
(ALGEBRA)

TUESDAY, 18th JUNE.—AFTERNOON, 3 TO 5.30 P.M.

Seven questions may be answered.

Mathematical Tables may be obtained from the Superintendent.

1. Solve for  $x$ ,  $y$ ,  $z$  the simultaneous equations :

$$\left. \begin{aligned} 3x + 4y - 2z &= 2 \\ 7x - 2y + 8z &= -9 \\ 6x + 5y + 4z &= 12 \end{aligned} \right\}$$

[28 marks.]

2. Factorise fully the following :

- (i)  $6x^2 + 5xy - 6y^2$  ;  
(ii)  $6x^2 + 5xy - 6y^2 + 12x + 18y$  ;  
(iii)  $(a - b - c)^3 - a^3 + b^3 + c^3$ .

[28 marks.]

3. What is the 20th term of the series 3, 7, 11, 15, etc. ? What is the sum of the first 20 terms ? How many terms must be taken so that their sum is 465 ?

[28 marks.]

4. Prove that  $\log_b a = \log_{10} a \div \log_{10} b$ .

(a) Find  $x$  approximately if  $\log_x 49 = 3.5$ .

[28 marks.]

5. Find two numbers expressed by the same two digits in different orders whose sum is equal to the square of the sum of the two digits, and whose difference is equal to five times the square of the smaller digit.

[28 marks.]

6. If  $a + b + c = 0$  prove that  $a^3 + b^3 + c^3 = 3abc$ .  
Factorise  $(a - x)^3 + (b - x)^3 + (2x - a - b)^3$ .

[28 marks.]

7. The 4th term and the 7th term of a Geometrical Progression are 4 and  $-\frac{4}{125}$  respectively. Find the first term and the common ratio.

Find an expression for the sum of the first 20 terms.

[29 marks.]

8. Find the maximum value of the expression  $6 + 8x - 3x^2$ .

What is the value of  $x$  when the expression is of maximum value?

[29 marks.]

9. If  $\alpha, \beta$  represent the roots of the equation  $ax^2 + bx + c = 0$ , prove

(i) that  $(\alpha - 1), (\beta - 1)$  are the roots of  $a(x + 1)^2 + b(x + 1) + c = 0$ ;

(ii) that  $3\alpha, 3\beta$  are the roots of  $a\left(\frac{x}{3}\right)^2 + b\left(\frac{x}{3}\right) + c = 0$ .

Express in terms of  $\alpha, \beta$  the roots of the equation  $a(2x + 3)^2 + b(2x + 3) + c = 0$ .

[29 marks.]

10. Draw a rough graph of the function  $x^3 - 7x + 3$ .

Write a short account of how the function varies in sign and in magnitude as the value of  $x$  changes from  $-3$  to  $+3$ .

[29 marks.]