

## INTERMEDIATE CERTIFICATE EXAMINATION, 1985

## MATHEMATICS - HIGHER COURSE - PAPER II (300 marks)

MONDAY, 17 JUNE - MORNING, 9.30 to 12

## SECTION A (100 marks)

Examination Number

Attempt all questions. You should not spend more than 50 minutes on this section. Answer each question by writing either (a), (b), (c), (d) in the box under each question number. If you wish to change an answer, cross out your first choice and write your new answer near the box. Mathematics tables may be obtained from the Superintendent. This paper must be enclosed in your answer book.

1. The greatest number from the following is

- (a)  $10_5$                       (b)  $100_4$                       (c)  $1000_3$                       (d)  $10000_2$

2. If  $p = 9$ ,  $q = 16$ , then  $(p^{\frac{1}{2}} + q^{\frac{1}{2}})(p + q)^{\frac{1}{2}} =$ 

- (a) 35                      (b) 7                      (c) 5                      (d)  $\frac{9}{16}$

3. The ratio of the volumes of three cones of equal height are 4 : 9 : 16. The ratio of the areas of their bases is

- (a) 2 : 3 : 4                      (b) 4 : 9 : 16                      (c) 8 : 27 : 64                      (d)  $\frac{1}{4} : \frac{1}{9} : \frac{1}{16}$

4. A bill of IR£12.30 includes V.A.T. at 23%. The VAT alone is IR£

- (a) 10.70                      (b) 10                      (c) 9                      (d) 2.30

5.  $\frac{1}{\sqrt{0.1} - 0.06} =$ 

- (a) 50                      (b) 5                      (c) 0.5                      (d) 0.02

6. If  $A = \{p, q\}$  then  $A \times A$  is

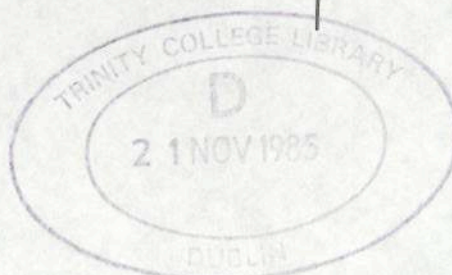
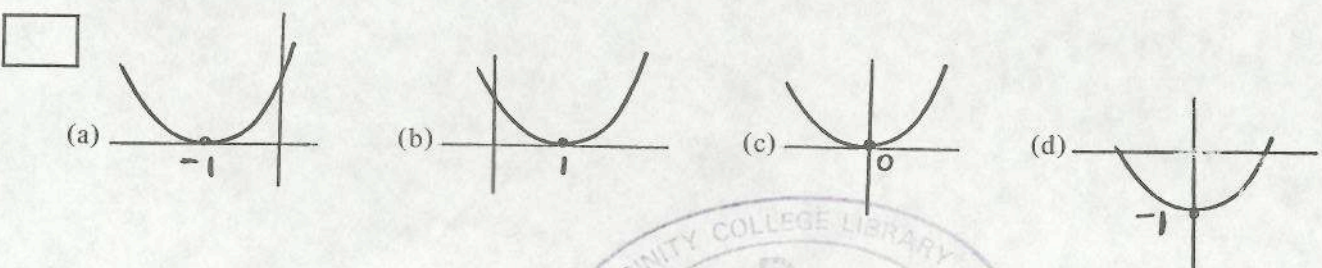
- (a)  $\{p, q\}$                       (b)  $\{(p, q), (q, p)\}$   
 (c)  $\{(p, p), (q, q)\}$                       (d)  $\{(p, p), (q, q), (p, q), (q, p)\}$

7.  $(\frac{1}{3})^x =$ 

- (a)  $3^x$                       (b)  $(-3)^x$                       (c)  $3^{\frac{1}{x}}$                       (d)  $3^{-x}$

8.  $(p^{\frac{1}{2}} + q^{\frac{1}{2}})(p^{\frac{1}{2}} - q^{\frac{1}{2}}) =$ 

- (a)  $p + q$                       (b)  $p - q$                       (c)  $p^2 + q^2$                       (d)  $p^2 - q^2$

9. The graph of  $f : x \rightarrow x^2 - 1$  is

OVER →



10.  $R = \{(p, p), (p, q), (q, p)\}$  is a relation defined on  $\{p, q\}$ .  $R$  is
- (a) reflexive                      (b) symmetric                      (c) transitive                      (d) none of these
11. 0.00085 in scientific notation is
- (a)  $85 \times 10^{-5}$                       (b)  $8.5 \times 10^{-5}$                       (c)  $8.5 \times 10^{-4}$                       (d)  $85 \times 10^{-4}$
12. If  $f : x \rightarrow 2x$ , then  $f(x + 1) - f(x - 1) =$
- (a)  $-4$                       (b)  $0$                       (c)  $2$                       (d)  $4$
13. If the  $n$ th term of a sequence is  $\frac{n(n + 1)}{2}$ . The sequence is
- (a) 1, 2, 4 ...                      (b) 1, 3, 6 ...                      (c) 1, 3, 12 ...                      (d) 1, 2, 3 ...
14. If  $\#A = 5$ ,  $\#B = 7$ , then  $\#(A \triangle B)$  is
- (a) odd                      (b) even                      (c) less than 2                      (d) greater than 12
15. If  $\log_3 x = -1$ , then  $x$  is
- (a)  $\frac{1}{3}$                       (b)  $-\frac{1}{3}$                       (c) 1                      (d) 3
16. If  $p * q = \frac{q}{1 + pq}$ , then  $2 * \frac{1}{2} =$
- (a)  $\frac{1}{4}$                       (b) 1                      (c) 2                      (d)  $\frac{1}{2}$
17. The mean of  $\frac{1}{7}, \frac{1}{5}, \frac{1}{3}, \frac{2}{3}, \frac{4}{5}, \frac{6}{7}$  is
- (a)  $\frac{1}{2}$                       (b)  $\frac{1}{6}$                       (c)  $\frac{1}{4}$                       (d)  $\frac{1}{3}$
18. If  $f : x \rightarrow x - 1$ , then  $f \circ f$  is  $x \rightarrow$
- (a)  $x - 2$                       (b)  $2x - 2$                       (c)  $2x - 1$                       (d)  $2x$
19. The height  $h$  of a cylinder is equal in length to the diameter of its base. Its volume is
- (a)  $\pi h^3$                       (b)  $\frac{1}{2} \pi h^3$                       (c)  $\frac{1}{4} \pi h^3$                       (d)  $\frac{1}{8} \pi h^3$
20. If  $xy < 0$ , which one of the following is possible ?
- (a)  $x > 0$  and  $y > 0$                       (b)  $x = 0$   
(c)  $y = 0$                       (d)  $x > 0$ .



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INTERMEDIATE CERTIFICATE EXAMINATION, 1985

M.44

MATHEMATICS - HIGHER COURSE - PAPER II

MONDAY, 17 JUNE - MORNING, 9.30 to 12

SECTION B (200 marks)

Attempt QUESTION 1 and THREE other questions

Marks may be lost if all your work is not clearly shown.

1. (a) If  $\omega^2 = t^2 - \frac{1}{u}$ , given  $t = 4.489$  and  $u = 0.2576$ , find the value of  $\omega$  as accurately as the Tables allow.
- (b) A political party received 9.1% of the votes cast in an election. This was 15% more than the party received in the previous election. What percentage of the vote did the party receive in the previous election? Give the answer correct to the nearest percent.

2. (a) If  $313_5 = 123_n$ , find  $n$ .
- (b) Write down the factors of  $x^2 - 8x - 84$ .  
Hence, or otherwise, solve  
 $(x^2 - 5x)^2 - 8(x^2 - 5x) - 84 = 0$ .
- (c) Solve  $4x^2 - 10x + 5 = 0$  and give the answer correct to two places of decimals.

3. (a) If the relation  
 $S = \{(x, y) \mid x + 3y = 12, \text{ where } x, y \in \mathbb{N}\}$ ,

write

- (i)  $S$  as a set of couples  
(ii) the couples of  $S \circ S$ , the composite relation.

- (b)  $f$  and  $g$  are function:

$$f : x \rightarrow \frac{12 - x}{3}$$

$$g : x \rightarrow 12 - 3x$$

- (i) find  $f \circ g$  and  $g \circ f$ , where these are composite functions and express each in function notation.  
(ii) find  $(f \circ f) \circ g$  and  $f \circ (f \circ g)$ .

4. The function  $f : x \rightarrow 3 + 2x - x^2$ ,  $x \in \mathbb{R}$  is defined in the domain  $-2 \leq x \leq 4$ .

- (i) In your answerbook, complete the table:

$x$	-2	-1	0	1	2	3	4
$f(x)$	-5						-5

- (ii) Draw the graph of  $f$ .  
(iii) Using the same axes and scales, sketch the image of  $f$  under the translation  
 $(0, 0) \rightarrow (-2, 0)$ .  
Use a dotted line for the image.  
(iv) Write, in the form  $x = k$ , the axis of symmetry of the two graphs taken together.  
(v) State the range of values of  $x$  for which  
 $-3 \leq x(2 - x) \leq 0$ .



5. (a) The table shows the daily intake, in IR£ of a shopkeeper on each day of a particular week. It also shows the 3-point moving averages over the same week:

DAY	Mon.	Tues.	Wed.	Thur.	Frid.	Sat.	Sun.
INTAKE	103	$x$	$y$	172	212	$z$	$t$
3-point moving average		132	$p$	180	205	$q$	

Calculate each of  $x$ ,  $y$ ,  $z$  and  $p$ .

If the total income for the week was IR£1300, calculate  $t$  and  $q$ .

- (b) The mean age of a class of 30 pupils is  $x$  years. When five new pupils join the class, the mean age remains unchanged. Express in terms of  $x$  the mean age of the five new pupils.

6. (a) Solve for  $x$

$$\frac{1}{2x - 3} + \frac{x - 9}{(2x + 1)(2x - 3)} = \frac{1}{2x + 1}$$

- (b) Two runners set out with others to run a race. The first ran at 7 km/hr but retired with 9 km to go. The second ran at 9 km/hr but retired with 7 km to go. They retired at exactly the same time. How long was the race from start to finish?

- (c) If  $x + y = 1$ , prove that  $x^3 + y^3 = 1 - 3xy$ .

7. (a) In a survey of 120 children, each was asked two questions:

Q. A: Did you eat sweets yesterday?

Q. B: Did you eat fruit yesterday?

The set of children who answered yes to Q. A was taken as set  $A$  and those who answered yes to Q. B were taken as being in set  $B$ .

There were 72 children in  $A$

70 children in  $B$ .

16 children said they had eaten neither.

Find the number of children in each of the sets

- (i)  $A \cup B$   
 (ii)  $A \setminus B$   
 (iii)  $B \setminus A$   
 (iv)  $A \cap B$ .

Illustrate the data and your answers in a Venn diagram.

- (b) If  $p = \log_{10} 5$ , express in terms of  $p$

- (i)  $\log_{10} \sqrt{5}$   
 (ii)  $\log_{10} 2.5$   
 (iii)  $\log_{10} 4$   
 (iv)  $\log_5 4$ .