

INTERMEDIATE CERTIFICATE EXAMINATION, 1983

MATHEMATICS - HIGHER COURSE - PAPER II (300 marks)

MONDAY, 13 JUNE - MORNING 9.30 to 12.00

SECTION A (100 marks)

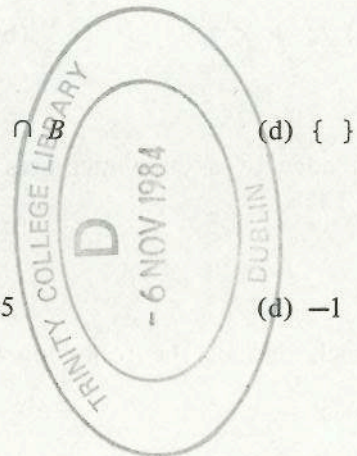
Examination Number

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. IR£220 was taxed at 55p in the IR£. The amount of tax in IR£ is
 (a) 121 (b) 12·10 (c) 100 (d) 110
2. $66_x + 1 = 100_x$, then x is
 (a) 6 (b) 7 (c) 8 (d) 10
3. The radii of two circles are in the ratio 2:1. Then, the ratio of their areas is
 (a) 2:1 (b) 4:1 (c) $\pi:2$ (d) 16:1
4. $64^{-\frac{2}{3}}$ is
 (a) 2^{-4} (b) 2^4 (c) $\frac{1}{4}$ (d) 4
5. In which one of the following is the mean equal to the mode
 (a) 0, 3, 3 (b) 3, 3, 4 (c) 3, 3, 3 (d) 2, 2, 3
6. $(0.6 \times 10^{-5})(12 \times 10^3)$ is
 (a) 0.072 (b) 0.72 (c) 7.2 (d) 72
7. $(A \Delta B) \Delta (B \Delta A)$ is
 (a) A (b) B (c) $A \cap B$ (d) $\{ \}$
8. $\log_2 0.5$ is
 (a) 2 (b) 1 (c) 0.5 (d) -1
9. If $p * q = p - \frac{1}{q}$ then $0 =$
 (a) $-\frac{1}{7} * 7$ (b) $\frac{1}{7} * \frac{1}{7}$ (c) $\frac{1}{7} * 7$ (d) $7 * 7$



10. The sum of the first 4 terms of a sequence is 8 and the sum of the first five terms is 10. Then the 4th term

- (a) can't be found (b) is 2 (c) is 8 (d) is 10

11. $f: x \rightarrow 2x^2 - 1$
 $g: x \rightarrow 2x + 1$
then $fg(-1)$ is

- (a) -1 (b) 0 (c) 1 (d) 3

12. $\{x \mid x^2 = x\}$ is

- (a) $\{ \}$ (b) $\{1\}$ (c) $\{0, 1\}$ (d) $\{0, -1\}$

13. $(x - 1)$ is a factor of $x^3 - 1$. The other factor is

- (a) $x^2 - 1$ (b) $x^2 + 1$ (c) $x^2 + x - 1$ (d) $x^2 + x + 1$

14. $\frac{1}{x-1} - \frac{1}{x+1} =$

- (a) $\frac{2}{x^2 + 1}$ (b) $\frac{-2}{1 - x^2}$ (c) $\frac{-2}{x^2 + 1}$ (d) $\frac{2}{1 - x^2}$

15. The graph of $f: x \rightarrow x^2 - x - 6$ cuts the x -axis at

- (a) 2 and 3 (b) -2 and 3 (c) 2 and -3 (d) -2 and -3

16. Which of the following is not a rational number ?

- (a) $\sin 30^\circ$ (b) $\log_2 8$
(c) length of a circle of radius 1 (d) area of a square of side 1

17. The relation "is perpendicular to" on the set of all straight lines is

- (a) reflexive (b) symmetric
(c) transitive (d) an equivalence relation

18. If $t = \frac{x - 2y}{z}$ then y is

- (a) $tz + x$ (b) $\frac{tz - x}{2}$ (c) $x - tz$ (d) $\frac{x - tz}{2}$

19. An edge of a cube measures $x - 2$. The surface area of the cube is

- (a) $(x - 2)^3$ (b) $6(x - 2)$ (c) $\frac{(x - 2)^2}{6}$ (d) $6(x - 2)^2$

20. Which one of the following is false if $x + 1 > y$?

- (a) $y - x < 1$ (b) $x > y - 1$
(c) $x > y - 2$ (d) $-x > 1 - y$

AN ROINN OIDEACHAIS
INTERMEDIATE CERTIFICATE EXAMINATION, 1983

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MATHEMATICS - HIGHER COURSE - PAPER II

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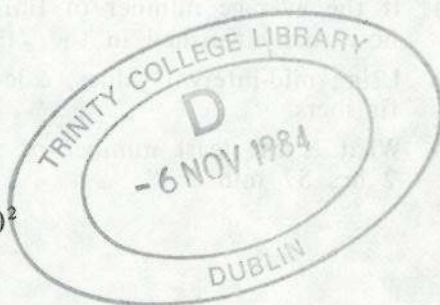
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SECTION B (200 marks)

Attempt QUESTION 1 and THREE other questions (50 marks each)

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

1. (a) If $s = \frac{1}{p} + \sqrt{q^2 + r^2}$,
find the value of p , as accurately as the Tables (P.20 - P.27) allow, when
 $s = 6.995$, $q = 3.489$ and $r = 8.7 \times 10^{-1}$.
- (b) At the end of a certain time-interval, the temperature of water in a bath had fallen by $\frac{1}{3}$ the temperature it had at the beginning of the interval. At the end of three consecutive such intervals the temperature was 24° . Calculate the temperature of the water at the beginning of the first interval.
2. (a) Solve:
$$\frac{x+4}{x-1} - \frac{x+5}{x+1} = \frac{2}{x^2-1}$$
and verify your answer.
- (b) Factorise
- (i) $15x^2 + x - 6$
 - (ii) $pq - rs - rq + ps$
 - (iii) $(p+2q)^2 - (p-3q)^2$
- (c) Solve, correct to one decimal place
$$2x^2 - 5x - 4 = 0.$$
3. (a) $R = \{(1, 3) (2, 4) (2, 6) (4, 5) (6, 9)\}$
 $S = \{(2, 4) (3, 4) (4, 9) (6, 1)\}$
where R and S are relations.
Write out the couples of (i) $R \circ S$ (ii) $S \circ R$.
Say, giving a reason, whether or not each is a function.
- (b) f and g are defined on \mathbf{R} :
 $f: x \rightarrow 2x^2$
 $g: x \rightarrow 3x - 1$.
- (i) Evaluate $f(3)$, $f(-3)$, $g(3)$, $g(-3)$.
 - (ii) Find the values of x for which $f(x) = g(x)$.
Verify that one of these values also satisfies
$$fg(x) = gf(x)$$
where these are composite functions.



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4. Complete the following table and draw the graph of the function

$$f: x \rightarrow 2x^2 - 3x - 8$$

in the domain $-3 \leq x \leq 4$, $x \in \mathbb{R}$.

x	-3	-2	-1	0	1	2	3	4
$f(x)$	19		-3		-9			12

- Using the graph, estimate the values of x for which $f(x) = 0$.
- State the range of values of x for which $2x^2 - 3x - 1 \leq 7$.
- Find a value of $k < 0$ for which $f(x) = k$ has no solution.
Find the least value of k for which a solution exists and write down the corresponding value of x .

5. In a marathon, the winner completed the race in $2\frac{1}{2}$ hours exactly.

Four more runners completed the race within a five minute interval. In the next such interval, eight runners finished. The table shows the numbers who finished in six consecutive five-minute intervals:

Time Interval in Minutes	0-5	5-10	10-15	15-20	20-25	25-30
Number of runners who finished	5	8	12	15	40	20

(0-5 means ≥ 0 but < 5 , etc)

- Illustrate the data by a bar-chart.
 - State the modal interval.
 - If the average number of finishers for the 5th, 6th and 7th intervals was 33, how many finished in the 7th interval ?
 - Using mid-interval values, calculate the mean race-time of the first 25 finishers.
 - What is the least number of runners who could have finished the marathon in 2 hrs 57 min ?
6. (a) Solve

$$2x + 5y = 35$$

$$\frac{2x}{5} - \frac{5y}{2} = -7.$$

- (b) In a class of 50 pupils
- 31 studied mathematics
 - 21 studied physics
 - 22 studied biology
 - 3 studied all three subjects
 - 2 studied none of the three
 - 7 studied biology and physics, and
 - 13 studied biology and mathematics.

Draw a Venn diagram to illustrate the data.

How many studied mathematics only ?

7. The normal speed of a boat is x km per hour. The boat travels 112 km against a river current which slows the boat's normal speed by 3 km per hour. On the return journey, the current increases the boat's normal speed by 3 km per hour.

If the total travelling time was 22 hours, calculate the boat's normal speed.