AN ROINN OIDEACHAIS M.44(a)

INTERMEDIATE CERTIFICATE EXAMINATION, 1980

MATHEMATICS - HIGHER COURSE - PAPER II (300 marks)

MONDAY, 16 JUNE - MORNING, 9.30 to 12

Examination Number

SECTION A (100 marks)

Attempt all questions. You should not spend more than 50 minutes on this section.
Answer each question by writing one of (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. $132_4 \times 2_4$ is

(a) 330_4 (b) 330_{10} (c) 60_4 (d) 264_4

2. $(x - y)^3 =$

(a) $x^3 - y^3$ (b) $x^3 + 3x^2y - 3xy^2 - y^3$
(c) $x^3 - 3x^2y - 3xy^2 - y^3$ (d) $x^3 - 3x^2y + 3xy^2 - y^3$

3. The factors of $x^3 - y^3$ are

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

4. $201^2 - 199^2$ is

(a) 4 (b) 1800 (c) 19 200 (d) 800

5. The prices of two items are in the ratio $2\frac{1}{2} : 1\frac{1}{5}$. The more expensive item costs £5. The other item costs

(a) £1.33 (b) £2.50 (c) £2.40 (d) £1.66$\frac{1}{2}$

6. The solution set of $x^2 + 4x - 5 = 0$ is

(a) $\{-5, -1\}$ (b) $\{-5, 1\}$ (c) $\{5, -1\}$ (d) $\{-2, 3\}$

7. $\log_2 8 + \log_5 25$ is equal to

(a) 0·301 (b) 5 (c) 1·301 (d) 9

8. f is $x \to 2x - 3$. Then f^{-1} is $x \to$

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

9. If $R = \{(x, x), (y, y), (x, y), (y, x), (z, x), (\ ,\ )\}$ and R is a transitive relation, then the missing couple is

(a) (z, y) (b) (y, z) (c) (z, z) (d) (x, z)

10. If $S = \{(p, p), (q, q), (p, q), (q, p)\}$ then one of the following is false. S is

(a) reflexive (b) transitive (c) a function (d) symmetrical

OVER →

11. $\left(\frac{1}{27}\right)^{\frac{2}{3}}$ is equal to

(a) $\frac{1}{9}$ (b) $\frac{1}{3}$ (c) 27 (d) -9

12. If $A = \{1, 2, 3\}$ and $B = \{x, y\}$ then $\#(A \times B)$ is

(a) 2 (b) 6 (c) 3 (d) 5

13. If $p^2 + q^2 = 1$, then p cannot be equal to one of the following. Which one ?

(a) $-\frac{1}{2}$ (b) $\frac{1}{2}$ (c) $\frac{4}{3}$ (d) $-\frac{3}{4}$

14. If $a * b = 2b - 3a$ then $2 * (-3)$ is

(a) 13 (b) -12 (c) -5 (d) 0

15. The nth term of a sequence is given by $T_n = n^2 - 16 + \frac{1}{n}$. Then T_{n-1}, the term immediately before T_n, is

(a) $(n-1)^2 - 16 + \frac{1}{n-1}$ (b) $n^2 - 17 + \frac{1}{n}$

(c) $n^2 - 15 + \frac{1}{n}$ (d) $(n-1)^2 - 17 + \frac{1}{n-1}$

16. If $s = ut + \frac{1}{2}ft^2$, then f is equal to

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

17. If 1 litre of a liquid has a mass of 1 kilogramme (kg), then 1 cubic metre of the same liquid has a mass of

(a) 10 000 kg (b) 1000 kg (c) 100 kg (d) 10 kg

18. A cyclist goes from A to B, a distance of 10 kilometres, in a half an hour, then from B to C, a distance of 3 kilometres in one sixth of an hour. The cyclist's average speed per hour from A to C is x km/hr. x is

(a) 19 (b) 20 (c) 18 (d) 19·5

19. $P = \{x, y, z, t\}$ and $Q = \{y, z, p, r\}$. If $P \Delta X = Q$, then X is

(a) $\{p, r, t, x\}$ (b) $\{x, y, z, t\}$ (c) $\{y, z, p, r\}$ (d) $\{t\}$

20. If $\frac{1}{x} > -\frac{1}{2}$, then one of the following is false:

(a) $x < -2$ (b) $x > \frac{1}{2}$ (c) $x > -2$ (d) $x > 2$

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SECTION B (200 marks)

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

1. (a) If $\frac{2gm}{c^2r} = 1$, find the value of r

when $g = 7 \times 10^{-11}$, $m = 6 \times 10^{14}$ and $c = 3 \times 10^8$.

Give your answer in the form $\frac{a}{b}\ 10^d$, where $a, b, d, \in \mathbf{Z}$.

(b) If $x = 83{\cdot}34$ and $y = 19{\cdot}44$, find the value of

$$\frac{1}{\sqrt{\frac{1}{x} + \frac{1}{y}}}$$

as accurately as the tables allow.

2. (a) Solve $10t^2 - 7t - 12 = 0$.

Hence, or otherwise, solve

$$12 + 7(t + \tfrac{3}{2}) - 10(t + \tfrac{3}{2})^2 = 0.$$

(b) Calculate, correct to two places of decimals, the values of x for which

$$3x^2 - 6x - 8 = 0.$$

3. f and g are functions defined on $\mathbf{R} \setminus \{0\}$.

$f : x \to x^2 - 1$

$g : x \to (x - 1)^2$.

(i) Evaluate $f(3)$ and $g(3)$.

(ii) Investigate if $gf(3) = fg(3)$ where fg and gf are composite functions.

(iii) If $4f(x) + 3 = f(kx)$, find the two values of k.

(iv) Express $g(x + 1)$ in terms of $f(x)$.

(v) Find a function h for which $g(x) = f(x) - 2h(x)$.

OVER →

4. Draw a graph of the function $x \to x^2 - 2x - 7$ for $x \in \mathbf{R}$ in the domain $-2 \leqslant x \leqslant 4$.

Find from your graph the values of x for which

(i) $x^2 - 2x - 7 = 0$

(ii) $x^2 - 2x - 1 = 0$.

Using your graph, find the range of values of x for which $x^2 < 2(x + 1)$.

5. (a) Solve the simultaneous equations

$$2x - 3y + 5 = 0$$

$$\frac{x - y}{3} = \frac{y - 1}{3} - \frac{x}{2} .$$

(b) Solve for x $\quad 5^{2x+1} \div 5^{1-x^2} = 5^{15}, \quad x \in \mathrm{N}$

and check your answer.

(c) Justify the statement

$$\log_r a = \frac{\log_{10} a}{\log_{10} r} .$$

Hence, use the tables to find the value of $\log_3 5$ correct to 1 decimal place.

6. A farmer A sold a certain number of sheep, all of equal value, and made a total profit of £300. Another farmer B also sold sheep, all of equal value. He made a profit of £1 per sheep more than A but sold two sheep fewer than A. He made a total profit of £323.

Find the profit per sheep that A recorded. Find also the number of sheep that B sold.

7. A set of people were asked to count the number of items carried in their pockets. The mean number of items per person was 5. Find, using the table below, the number of people who carried exactly three items.

Items	0	1	2	3	4	5	6	7	8	9
People	2	0	2		1	7	6	5	3	0

If the people are put into 3 categories:

(i) those with 3 items or fewer

(ii) those with 7 items or more

(iii) the remainder,

calculate the number of items in each category.

A piechart is drawn illustrating the number of items in each category. Show clearly how to calculate the measures of the three angles at the centre of this piechart.