AN ROINN OIDEACHAIS M.44(a)

INTERMEDIATE CERTIFICATE EXAMINATION, 1976

MATHEMATICS - HIGHER COURSE - PAPER II (300 marks)

MONDAY, 14 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 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. $332_4 = x_{10}$ Then x is

(a) 248 (b) 1328 (c) 62 (d) 8

2. P sells an article to Q at a loss of 25%. If Q paid £24 for it, what did P pay for it ?

(a) £30 (b) £18 (c) £32 (d) £49

3. The mass of a circular cylinder of radius r and height $2h$ is 40 grammes. The mass in grammes of a similar cylinder of radius $2r$ and height h is

(a) 40 (b) 80 (c) 60 (d) 160

4. A person is required to pay $\frac{7}{10}$ of full rates. When rates are at £7·50 in the £, the person pays £105. The rateable valuation is

(a) £50 (b) £15 (c) £20 (d) £25

5. Income Tax is at a rate of 38·5 p in the £. A person has a weekly allowance of £10 and pays £15·40 tax per week. His weekly wage is

(a) £50 (b) £60 (c) £40 (d) £55

6. The mean of two numbers x and y is 2. The mean of three numbers x, y and z is 3. Then z is

(a) 1 (b) 7 (c) 5 (d) not given

7. $K = \{3, 7, p, q, r\}$ $\#(K \setminus T) = 3$. Then T is

(a) $\{3, 7, p\}$ (b) $\{r, 7, 4\}$ (c) $\{q, x, y\}$ (d) $\{p, q, r, 3\}$

8. Let $p * q = \frac{2p}{q} + 1$. If $x = -1$, $y = 2$, $z = 1$, then $(x * y) * z$ is equal to

(a) 3 (b) 0 (c) 2 (d) 1

9. Which of the following points is on both the lines $3x - y + 4 = 0$ and $5x + y + 4 = 0$?

(a) (1, 7) (b) (-2, 6) (c) (1, -1) (d) (-1, 1)

OVER →

10. $(x + y)^2$ multiplied by $(x - y)^2$ is equal to

☐ (a) $x^2 + y^2$ (b) $x^4 - 2x^2y^2 + y^4$

(c) $x^4 + y^4$ (d) $x^4 + 2x^3y + 4x^2y^2 + 2xy^3 + y^4$

11. $81^{\frac{3}{4}}$ is equal to

☐ (a) 27 (b) 243 (c) 54 (d) 9

12. 3 and 5 are the roots of

☐ (a) $x^2 + 2x - 15 = 0$ (b) $x^2 - 2x - 15 = 0$

(c) $x^2 - 8x + 15 = 0$ (d) $x^2 + 8x + 15 = 0$

13. f is the function $x \to 3x + 1$. Then f^{-1}, the inverse function is

☐ (a) $x \to 3x - 1$ (b) $x \to \frac{x-1}{3}$ (c) $x \to \frac{x+1}{3}$ (d) $x \to \frac{x}{3}$

14. The functions f and g are defined on R: $f : x \to 3x$ and $g : x \to \frac{x}{3}$. Then $fg(3)$ is

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

15. If $\log_t x = 8$ and $\log_t y = 2$, then $\log_y x$ is

☐ (a) 3 (b) 4 (c) 16 (d) 10

16. If $2\log_{10} x + 3 = \log_{10} x + \log_{10} 500$, then x is

☐ (a) 100 (b) $\frac{1}{100}$ (c) 2 (d) $\frac{1}{2}$

17. The third term of a sequence is $\frac{13}{4}$. Which one of the following could be the general term ?

☐ (a) $n - \frac{1}{n+1}$ (b) $(n + 1) + \frac{1}{n}$ (c) $(n + 1) - \frac{1}{n}$ (d) $n + \frac{1}{n+1}$.

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

☐ (a) $(x - y)(x^2 + xy + y^2 - 1)$ (b) $(x + y)(x^2 - xy + y^2 - 1)$

(c) $(x + y)(x^2 + y^2 - 1)$ (d) $(x + y)(x^2 - 2xy + y^2)$

19. If $x < -2$ and $x \in R$, which one of the following is false ?

☐ (a) $4 - x^2 < 0$ (b) $x > 4x$ (c) $x^2 \neq 0$ (d) $x^2 + 2 < 20$.

20. The number of couples (x,y) for $x \in \mathbf{N}$, $y \in \mathbf{N}$, which satisfy $x + y \leqslant 4$ is

☐ (a) 5 (b) 10 (c) 15 (d) 8.

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SECTION B (200 marks)

Attempt **QUESTION 1** and **THREE** other questions

1. (a) Using the tables, page 20 to page 27, or otherwise, find, correct to two significant figures, the value of:-

$$\sqrt{x^2 + y^2}$$

when $x = 11{\cdot}42$ and $y = 0{\cdot}926$.

(b) Using logarithmic tables, or otherwise, calculate, correct to three significant figures, the value of:-

$$\sqrt{\frac{x^3 z}{w}}$$

where $x = 4{\cdot}718$, $z = 0{\cdot}2123$, $w = 17{\cdot}6$.

(40 marks)

2. Find, correct to two places of decimals, the roots of the equation

$$\frac{3x - 2}{x + 2} - \frac{x}{x - 2} = 5.$$

(40 marks)

3. f is the function $x \to x(x-6)$ for $x \in R$.

(i) Write down the value of $f(0)$ and find the values of x for which $f(x) = 0$.

(ii) Draw the graph of the function in the domain $0 \leqslant x \leqslant 6$.

(iii) g is a function of the form $x \to ax + b$ for $x \in R$.

If $f(1) = g(1)$ and $f(6) = g(6)$, find the value of a and the value of b.

(iv) Using your graph, or otherwise, find the domain of values of x for which $f(x) \geqslant g(x)$.

(40 marks)

OVER

4. In December, 1975 a girl spent £3 buying cups. She noticed that the price per cup had increased by 20p since December, 1974 and so she bought four cups more for £3 in 1974 than she bought in 1975. How much did each cup cost in 1974, assuming each cost the same amount ?

(40 marks)

5. The number of customers requesting service at a Post Office counter between 11 a.m. and 12 noon was recorded each day for six days and the data is shown in the following table:-

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Number of Customers	20	12	31	23	42	25

(i) Calculate the 3-point moving averages.

(ii) Using the same axes and the same scales, draw trend graphs to illustrate both the data and the moving averages.

(50 marks)

6. (i) Find three linear factors of $ax^2 + y^2 - x^2 - ay^2$.

(ii) Solve the simultaneous equations

$$3x - 4 = 5y$$
$$y - 2x = 2$$

and draw a rough graph to illustrate your answer.

(iii) If $y = \log_{10} \frac{3 + x}{3 - x}$, find

(a) the value of x for which $y = 0$
(b) a value of $x > 0$ for which there is no y
(c) a value of $x < 0$ for which there is no y.

(50 marks)

7. (i) Use a Venn diagram, or otherwise, to explain what is meant by the symmetric difference (Δ) of two sets and say why Δ is commutative.
Use the sets

$$A = \{1, 2, 3\}, \quad B = \{2, 3\}, \quad C = \{3\}$$

to verify that Δ is associative.
Use a diagram, or otherwise, to find the set X for which $A \Delta X = B$.

(ii) P and Q are sets. Investigate if it is possible to simplify $P \Delta (P \cup Q)$ without knowing whether or not $P \cap Q = \phi$.

(60 marks)