

INTERMEDIATE CERTIFICATE EXAMINATION, 1978

MATHEMATICS - HIGHER COURSE - PAPER II (300 marks)

TUESDAY, 13 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 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. $534_7 \times 3_{10} =$

(a) 2235_7

(b) 1602_7

(c) 2225_7

(d) 2325_7

2. $A = \{1, 2\}$, $B = \{2, 3\}$, $C = \{3, 4\}$. Then $\# \left((A \times B) \cup (B \times C) \right)$ is

(a) 1

(b) 4

(c) 8

(d) 6

3. John spent $\frac{2}{3}$ of his pocket money on a book. He spent $\frac{2}{5}$ of the remainder on sweets and had 15p left. His original amount was

(a) £2.25

(b) £1.12 $\frac{1}{2}$

(c) 45p

(d) 75p

4. £10 is divided between A and B in the ratio of their ages. A is 12 years old and gets £4. What age is B?

(a) 30

(b) 18

(c) 8

(d) 6

5. A solid metal sphere of diameter 18 cm is melted down and recast as a solid cylinder of the same diameter. The height in cm of the cylinder is

(a) 12

(b) 9

(c) 18

(d) 96

6. If $2.85 \times y = 0.00057$. Then $y =$

(a) 50

(b) 0.02

(c) 0.002

(d) 0.0002

7. A person earning £3,500 has a tax free allowance of £1,500. He pays tax on the remainder at 35%. If the rate of tax is increased to 40% and his tax free allowance is increased to £1,800, his tax changes by

(a) £5

(b) £20

(c) £375

(d) £700

8. The mean of four numbers is 5. When another number is included the mean is 6. This last number is

(a) 1

(b) 6

(c) 5

(d) 10

9. $\frac{1}{(n+1)(n+3)}$ is equal to

(a) $\frac{1}{n+1} - \frac{1}{n+3}$

(b) $\frac{1}{n+3} - \frac{1}{n+1}$

(c) $\frac{1}{2(n+3)} - \frac{1}{2(n+1)}$

(d) $\frac{1}{2(n+1)} - \frac{1}{2(n+3)}$

10. $T_n = n + n(n - 1)$ is the general term of a sequence. T_{n-1} is the term before T_n .
Then T_{n-1} is

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

11. $(x^4 - 1) \div (x - 1)$ is

- (a) $x^3 - 1$ (b) $x^3 + 1$ (c) $(x + 1)(x^2 - 1)$ (d) $(x + 1)(x^2 + 1)$

12. $(32)^{\frac{3}{5}} =$

- (a) $19\frac{1}{5}$ (b) 6 (c) 9 (d) 8

13. $\log_{64} 16 =$

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

14. The compound interest on £500 for 2 years at 10% per annum is

- (a) £50 (b) £55 (c) £100 (d) £105

15. The function $f : x \rightarrow 2x + 3$ is defined on \mathbb{R} . Then $f^{-1}(21)$ is

- (a) $7\frac{1}{2}$ (b) 45 (c) $13\frac{1}{2}$ (d) 9

16. If $\{x, y, z\} \Delta A = \{z\}$, then the set A is

- (a) ϕ (b) $\{z\}$ (c) $\{x, y\}$ (d) $\{x, y, z\}$

17. The functions $f : x \rightarrow 2x + 5$ and $g : x \rightarrow \frac{1}{2}x - 5$ are defined on \mathbb{R} . If fg is the composite function, then $fg(4)$ is

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

18. Let $p * q = p - \frac{1}{q}$, then $1 * (2 * -1)$ is

- (a) $\frac{2}{3}$ (b) 0 (c) $-\frac{2}{3}$ (d) 2

19. (3, 2) and (2, 5) are couples of a transitive relation. Which of the following couples must also be a couple of the relation ?

- (a) (2, 2) (b) (3, 5) (c) (5, 3) (d) (2, 3)

20. If $xy > x$, which one of the following is not true ?

- (a) $x > 0$ then $y > 1$ (b) x and y can be negative
(c) $x < 0$ then $y < 1$ (d) $x > y$ then $xy < 0$

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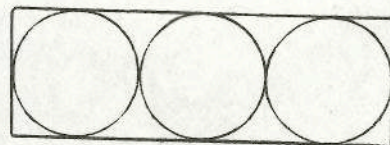
SECTION B (200 marks)

Attempt QUESTION 1 and THREE other questions

1. (a) Evaluate $\sqrt{\frac{a^3 - b^3}{a^2 - b^2}}$, correct to two significant figures,

if $a = 5.018$ and $b = 4.982$.

- (b) Three table tennis balls are packed in a closed cylindrical container, as shown in the diagram. What fraction of the interior volume of the container is taken up by the table-tennis balls ?



(50 marks)

2. (a) Find the values of x for which

(i) $6x^2 - x - 12 = 0$

(ii) $6(x - \frac{1}{2})^2 - (x - \frac{1}{2}) - 12 = 0$

- (b) Find correct to two significant figures the values of x for which

$$6x^2 - x - 12 = 4.$$

(40 marks)

3. The function $f : x \rightarrow 4x + 3$ is defined on \mathbf{R} . Find (i) $f(0)$, (ii) $f(3)$, (iii) $f^2(0)$, where f^2 means f after f .

For what value of x is $f^2(x) = f(x)$?

Indicate on the number line the solution set of values of x for which

$$f(x) \geq f^2(x).$$

(40 marks)

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4. Draw the graph of the function $f : x \rightarrow 3 - 5x - x^2$ in the domain $-6 \leq x \leq 1$ where $x \in \mathbb{R}$.

Find from your graph as accurately as you can

- (i) the maximum value of $f(x)$
- (ii) the values of x for which
 - + (a) $3 > x^2 + 5x$
 - + (b) $x^2 + 5x - 1 = 0$.

(50 marks)

5. (a) Solve for x and y :

$$\begin{aligned} 3x &= y - 4 \\ 3y &= 34 - 2x \end{aligned}$$

- (b) Solve for x :

$$\log_2 (1 + x) - \log_2 (1 - x) = 3 .$$

- (c) If $4^x = 8$ and $y^x = 4$, find the value of

$$y^{2k}, \text{ where } k = x^2.$$

(50 marks)

6. (a) A nine word spelling test was administered to a class of 50 pupils. The results are shown in the frequency table:

Number of words spelt correctly	1	2	3	4	5	6	7	8	9
Number of pupils	1	1	2	19	13	12	1	1	0

- (i) What is the mode of the data ?
- (ii) How many pupils had more than three but less than seven spellings correct ?
- (iii) How many pupils had three or more spellings wrong ?
- (iv) The same test administered to similar classes in many schools resulted in a mean of 4 words correctly spelt per pupil. Is the above class better or worse than average ?
Give a reason for your answer.

- (b) Find the set of values of p which simultaneously satisfy

$$\begin{aligned} 3p + 4 &\leq p^2 \\ p^2 &\leq 16 \end{aligned}$$

(50 marks)

7. Two exactly similar rooms were papered, one with wallpaper A the other with wallpaper B.

One room required £14 worth of A. The other room required £18 of B, a roll of which cost £1 more than a roll of A.

The number of rolls of B was one less than the number of rolls of A.

How many rolls of A were used ?

(50 marks)