AN ROINN OIDEACHAIS M.44(a)

INTERMEDIATE CERTIFICATE EXAMINATION, 1977

MATHEMATICS - HIGHER COURSE - PAPER II (300 marc)

TUESDAY, 14 JUNE - MORNING, 9.30 to 12

SECTION A (100 marks)

Examination Number

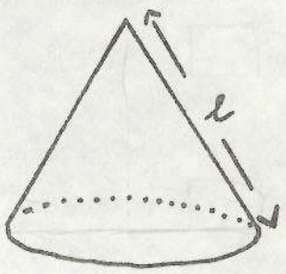
Attempt all questions. You should not spend more than 50 minutes on this section.
Answer each question by writing one of (a), (b) (c), (d) in the box under each question number.
If you wish to change an answer, cross out your first choice and write your new answer near the box.
Mathematics tables may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

THIS PAPER MUST BE ENCLOSED IN YOUR ANSWER BOOK

1. $144_5 + 321_5$ is

(a) 465_5 (b) 520_5 (c) 1020_5 (d) 1120_5

2. The area of the curved surface of a cone is 220 cm^2. The diameter of the base of the cone is of length 20 cm. Then ℓ, taking $\pi = \frac{22}{7}$, is



(a) 3·5 cm. (b) 7 cm
(c) 70 cm (d) 700 cm

3. The total cost of an article including VAT at 20% is £33. The cost excluding VAT is

(a) £26.40 (b) £6.60 (c) £39.60 (d) £27.50

4. The Compound Interest on £200 for 2 years at 10% per annum is

(a) £242 (b) £240 (c) £42 (d) £40

5. S is a square of side 10 cm long. P is a square whose area is half of S. The length of a side of P in cm is:

(a) 5 (b) $\frac{5}{\sqrt{2}}$ (c) $\frac{\sqrt{2}}{5}$ (d) $5\sqrt{2}$

6. A shopkeeper makes a profit of 25% by selling an article for £30. If he offers a discount of 10% on this selling price his profit will then be

(a) £27.00 (b) £4·50 (c) £3·00 (d) £2·00

7. The three point moving averages calculated from the sequence of numbers $4, x, 5, y$, are 5, 6. The value of y is

(a) 5 (b) 7 (c) 4 (d) 6

8. $A = \{p, q, r, s\}$ $B = \{t, q, p\}$. Then $\#\left[(A \triangle B) \setminus (B \triangle A)\right]$ is

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

OVER →

9. Let $x \star y = 2xy + x^2$. Then $(3 \star 0) \star 4$ is

(a) 345 (b) 27 (c) 153 (d) 117

10. The value $x = -3$ does not satisfy one of the following equations. Which one ?

(a) $x^2 + 5x + 6 = 0$ (b) $x^2 - 5x + 6 = 0$.
(c) $3x^2 + 8x - 3 = 0$ (d) $x^2 + 2x - 3 = 0$.

11. $(15{\cdot}75)^2 - (14{\cdot}25)^2$ is

(a) 45 (b) 44·85 (c) 15 (d) 46·5

12. $\frac{1}{x} - \frac{1}{x-1}$ is equal to

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

13. $\{1, 2, 3, 4\}$ is the domain of the function $x \to x^3$. The range of the inverse function is

(a) $\{1, 8, 27, 64, \}$ (b) $\{1, \sqrt[3]{2}, \sqrt[3]{3}, \sqrt[3]{4}\}$
(c) $\{1, 2, 3, 4\}$ (d) cannot be found.

14. The function f is defined as $x \to 2x + 3$, $x \in \mathbf{R}$. Then $f^2(3)$, where f^2 means f after f, is

(a) 15 (b) 36 (c) 81 (d) 21

15. The n^{th} term of a sequence is $T_n = 2^n + \log_{10}(3n + 1)$. The third term is

(a) 7 (b) 8 (c) 9 (d) 10

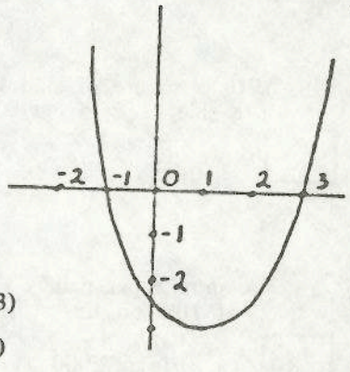
16. If $\log_2 x = 3$ and $\log_2 y = 5$, then $\log_2 y^x$ is

(a) 125 (b) 256 (c) 40 (d) 15

17. If the factors of $8p^3 + 27q^3$ are $(2p + 3q)(4p^2 + X + 9q^2)$, then X is

(a) $6pq$ (b) $-6pq$ (c) $12pq$ (d) $-12pq$

18. The graph of the function $x \to f(x)$ is shown in the diagram.



Then $f(x)$ is

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

19. If $n > t$, which one of the following is not true for ALL $n, t, \in$ N ?

(a) $n + 1 > t$ (b) $n > t - 1$ (c) $n > t + 1$ (d) $1 - t > -n$.

20. The sum of two numbers is 9 and their product is 20. The quadratic equation whose solution gives these two numbers is:

(a) $x^2 + 9x - 20 = 0$. (b) $x^2 + 20x - 9 = 0$.
(c) $x^2 - 20x + 9 = 0$. (d) $x^2 - 9x + 20 = 0$.

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SECTION B (200 marks)

Attempt QUESTION 1 and THREE other questions

1. (a) Use square root tables, page 22 to page 25, or otherwise, to find $\sqrt{1{\cdot}512}$ and hence deduce $\sqrt{151{\cdot}2}$. Give both answers correct to three significant figures.

(b) If $p = \dfrac{2q + qx^2}{t}$, find the value of x to two significant figures, when

$p = 76{\cdot}6,\ q = 16{\cdot}5,\ t = 33.$

(c) The radius of the base of a cone is of length 3·14 cm. The height of the cone is also 3·14 cm.
Find, to one place of decimals, the volume of the cone, given $\pi = 3{\cdot}14$.

(50 marks)

2. (a) Solve the equation

$$y^2 - 6y + 5 = 0$$

and deduce the value of t for which

$$(t - \tfrac{6}{t})^2 - 6(t - \tfrac{6}{t}) + 5 = 0.$$

(b) Find, correct to two places of decimals, the roots of the equation

$$2x^2 - 3x - 4 = 0.$$

(40 marks)

3. The functions : $f : x \to x^2 + 1$

$g : x \to 2x$

are defined in the domain $x \in \mathbb{R}$.

Find: (i) $f(2)$ and $g(2)$

(ii) $fg(2)$ and $gf(2)$ where fg and gf are composite functions

(iii) for what value of x is $f(x) = g(x)$.

Verify that

$$g(h + k) = g(h) + g(k)$$

and investigate if

$$f(h + k) = f(h) + f(k).$$

(40 marks)

4. In a 100 km motor cycle race two compeditors A and B begin the race together. B's average speed is 5 kilometres per hour greater than A's and B finishes the race 5 minutes before A. Find the average speed of A and the average speed of B.

How many kilometres of a start should A need in the race so that they both would finish exactly together ?

(50 marks)

OVER →

5. Using the same axes and scales draw the graphs of the functions:

$$f : x \to \quad x^2 + 3x - 3$$

$$g : x \to \quad x - 2$$

in the domain $-4 \leqslant x \leqslant 2$, $x \in \mathbf{R}$.

Use the graph

(i) to solve $x^2 + 3x - 3 = 0$

(ii) to find the minimum value of $x^2 + 3x - 3$

(iii) to find the domain of values of x for which $f(x) < g(x)$

(iv) to solve $x^2 + 2x - 1 = 0$.

(50 marks)

6. (a) Solve the simultaneous equations

$$3x + 2y + 4 = 0$$

$$\frac{x - 2(y - 5)}{3} = \frac{3x - 4(x + 2y)}{5}$$

(b) If $x = \log_{10} 2$ and $y = \log_{10} 3$, express in terms of x and y

(i) $\log_{10} 6$ (ii) $\log_{10} 5$ (iii) $\log_{10} 15$

(50 marks)

7. (a) In a particular group of pupils 6 was the mean size of shoe worn. The following data only was available:

shoe size	4	5	6	7	8
number of pupils	3		15	2	5

How many pupils wore size 5 ?

(b) If $P = \{1, 2, 3\}$, $Q = \{2, 4\}$, find the elements of the set X in the equation

$$(P \Delta P) \Delta X = P \Delta Q.$$

(c) If $\frac{1}{u} - \frac{1}{v} = \frac{1}{f}$,

express $(v - u)$ in terms of f and u only.

(50 marks)