

INTERMEDIATE CERTIFICATE EXAMINATION, 1988

MATHEMATICS – HIGHER COURSE – PAPER II (300 marks)

SECTION A (100 marks)

1. If $12_x - 3_x = 4_{10}$, then the base x is

- B (a) 4 (b) 5 (c) 7 (d) 9

2. A sold an article to B at a profit of $12\frac{1}{2}\%$. B then sold it to C at a profit of 10% . The percentage increase in price from A to C is

- d (a) 10% (b) $12\frac{1}{2}\%$ (c) $22\frac{1}{2}\%$ (d) 23.75%

112.5
11.25
23.75

3. Two spheres have the lengths of their radii in the ratio $2 : 3$. Their corresponding volumes are in the ratio

- C (a) $2 : 3$ (b) $4 : 9$ (c) $8 : 27$ (d) $16 : 81$

4. $x + 2$ is a factor of $x^3 + 8$. The other factor is

- D (a) $x^2 - 4$ (b) $x^2 + 4x + 8$ (c) $x^2 - 2x - 4$ (d) $x^2 - 2x + 4$

$$\frac{x^3+8}{x+2}$$

5. $(p^{\frac{1}{2}} + q^{\frac{1}{2}})(p^{\frac{1}{2}} - q^{\frac{1}{2}}) =$

- d (a) $2pq$ (b) $-2pq$ (c) $p + q$ (d) $p - q$

$$(x^2 - 2x + 4)(x + 2)$$

$$x^3 - 2x^2 + 4x + 2x^2 - 4x + 8$$

6. The n th term of a sequence is $2 - (1 - \frac{1}{n})^2$. The first three terms are

- A (a) $2, 1, -2$ (b) $2, -3, -8$ (c) $1, 2, 1$ (d) $2, 5, 10$

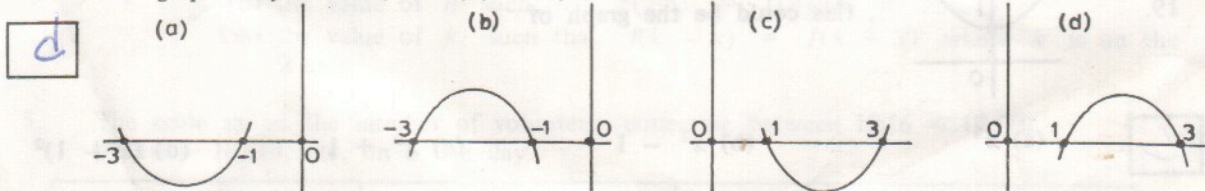
7. Let $x * y = x - y$. If $k * 5 = 3 * k$, then $k =$

- C (a) 0 (b) 2 (c) 4 (d) 6

8. $(4)^{-1\frac{1}{2}} =$

- B (a) $\frac{1}{2}$ (b) $\frac{1}{6}$ (c) $\frac{1}{16}$ (d) $\frac{1}{8}$

9. The graph of $f : x \rightarrow (1 - x)(x - 3)$ could be



10. If $R = \{(p, p) (r, r) (p, q) (q, p) (,)\}$ is a transitive relation on a set $\{p, q, r\}$, the missing couple is

- (a) (q, q) (b) (p, r) (c) (q, r) (d) (r, p)

11. The three-point moving averages for 1, 2, 3, 4, 5, 6 are

- (a) 0, 1, 2, 3 (b) 1, 2, 3, 4 (c) 2, 3, 4, 5 (d) 3, 4, 5, 6

$x \neq +3$

12. $f : x \rightarrow 7x + 3$. Then $f^{-1}(3) =$

$\frac{x-3}{7}$

C

(a) 24

(b) 7

(c) 0

(d) $\frac{1}{7}$

13. If $\log_x(\frac{1}{4}) = 4$, then $x =$

D

(a) $\frac{1}{2}$

(b) 1

(c) 2

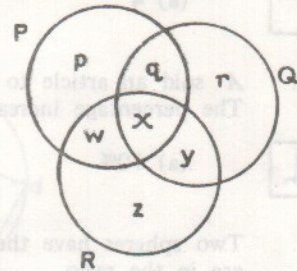
(d) $\frac{1}{\sqrt{2}}$

$x^4 = \frac{1}{4}$

$x^{\frac{1}{4}} = 4$

~~$x^4 = 4$~~

14. The elements of the sets P, Q, R are shown. Then $P \Delta Q \Delta R =$



B

(a) $\{p, q, r, w, y, z\}$

(b) $\{p, r, z\}$

(c) $\{p, r, x, z\}$

(d) $\{q, w, x, y\}$

15. If $x = \frac{3y+3}{z}$, then $y = \frac{xz-3}{3}$

B

(a) $\frac{xz}{3} - 3$

(b) $\frac{xz-3}{3}$

(c) $\frac{xz}{3} + 1$

(d) $3xz - 1$

16. $\{-2, 3\}$ is the solution set of

A

(a) $x^2 - x - 6 = 0$

(b) $x^2 - 5x - 6 = 0$

(c) $x^2 + x - 6 = 0$

(d) $x^2 + 5x - 6 = 0$

17. On a certain day $1 \text{ IR}\text{f} = \$1.631$ and $\$1 = \gamma 141$ (γ means a Japanese yen). The number of yen in $1 \text{ IR}\text{f}$ is

A

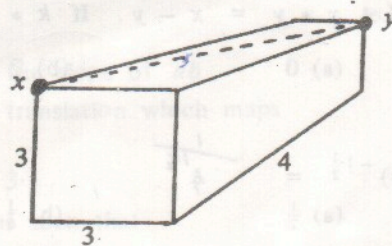
(a) 1.631×141

(b) $\frac{1.631}{141}$

(c) $\frac{141}{1.631}$

(d) 142.631

18. A solid rectangular block, $3 \times 3 \times 4$ is horizontal. A vertical cut along xy halves the block. The surface area of each half is



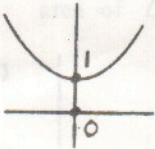
A

(a) 48

(b) 36

(c) 33

(d) 15

19.  , this could be the graph of

C

(a) x^2

(b) $x^2 - 1$

(c) $x^2 + 1$

(d) $(x-1)^2$

20. The values of x for which $(x-1)(x+2) > 0$ are

C

(a) $-1 < x < 2$

(b) $-2 < x < 1$

(c) $x < -2$ and $x > 1$

(d) $x > 1$ and $x > -2$

9
12
12
15

$x <$

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MATHEMATICS – HIGHER COURSE – PAPER II

SECTION B (200 marks)

Attempt QUESTION 1 and THREE other questions

$10 \times 15 = 150$
 $5 \times 15 = 75$
 $\underline{225}$

1. (a) If $p = \sqrt{q^2 - \frac{1}{r}}$, find the value of p , as accurately as the Tables allow, when $q = 5.252$ and $r = 0.055$.
- (b) 510 litres of a mixture of petrol and water contained 7.75% by volume of water. Some petrol evaporated leaving a mixture containing 8.5% by volume of water. How many litres of petrol evaporated?

2. (a) Factorise and solve for x :

$$12x^2 - 28x + 15 = 0.$$

Find four values of x for which

$$12p^2 - 28p + 15 = 0 \text{ where } p = x - \frac{1}{x}.$$

- (b) If $x^2 - 3x + 2a = 0$ has two identical values of x i.e. equal roots, find
 (i) the value of a
 (ii) the corresponding value of x .

3. (a) $R = \{(2, 4), (3, 2), (4, 3)\}$.
 Write down the couples of

- (i) $R \circ R$
 (ii) $R \circ R \circ R$.

S is a relation such that the couples of $S \circ R$ are $\{(2, 2), (3, 3), (3, 1), (4, 1)\}$.
 Write down four couples of S .

- (b) $f : x \rightarrow 4x + 6$ and $g : x \rightarrow \frac{x^2}{4} - 2$ are two functions defined for $x \in \mathbb{R}$.

Evaluate

- (i) $f \circ g(1)$
 (ii) $g \circ f(1)$

Find the values of x for which

$$f \circ g(x) = g \circ f(x).$$

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

From the graph estimate.

- (i) the value(s) of x for which $f(x) = 0$.
 (ii) the value of h such that $f(2.5) = f(h)$, $h \neq 2.5$.
 (iii) the value of k , such that $f(k - x) = f(k + x)$ where k is on the X -axis.

5. The table shows the number of volunteers collecting between IR£6 – IR£10, IR£10 – IR£14, etc, on a flag day.

IR£	6 – 10	10 – 14	14 – 18	18 – 22	22 – 26	26 – 30
Volunteers	3	9	11	13	10	4

By using mid-interval values, estimate the total money collected. Find the corresponding mean. How many volunteers certainly collected more than this mean?

If 6 – 10 means ≥ 6 and < 10 , etc, calculate the minimum total that could have been collected.

During a conversation some days after counting the money a committee member could not recall the exact total collected, but said it was one of two amounts: IR£920.50 or IR£819.50. Write down the correct amount collected and say why this is your choice.

6. (a) 50 girls answered a questionnaire on whether they played tennis, comogie or hockey. The following were the results:

- 7 played tennis only.
- 10 played comogie only.
- 4 played hockey only.
- 3 played none of these.

Some played all three games.

- 15 played tennis and hockey.
- 14 played hockey and comogie.
- 9 played comogie and tennis.

Calculate how many played

- (i) three games ?
- (ii) tennis and hockey only ?

Illustrate your answers by inserting appropriate numbers in a Venn diagram.

- (b) If $\log_a 8 = p$ and $\log_a 5 = q$ find in terms of p and q

- (i) $\log_a 3\frac{1}{5}$
- (ii) $\log_a \sqrt{20}$.

7. (a) Solve for x

$$\frac{4x - 2}{(3x - 1)(2x + 5)} - \frac{1}{2x + 5} = \frac{4}{3x - 1}$$

- (b) In a 60 km race, the last cyclist finished 20 minutes after the winner. The average speed of the last cyclist was 2 km/hour less than the winner's average speed.

Calculate the time taken by the winner to cycle the 60 km.

Volunteers	3	5 < 2(1-x)	14	14	14	14	10	10	10	10
IRL	0 - 10	10 - 14	14	14	14	14	10	10	10	10