

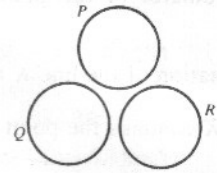
INTERMEDIATE CERTIFICATE EXAMINATION, 1987

MATHEMATICS – HIGHER COURSE – PAPER II (300 marks)

SECTION A (100 marks)

1.  $1011_2 + 1110_2 + 1101_2 =$
- (a)  $11000_2$                       (b)  $11111_2$                       (c)  $10110_2$                       (d)  $100110_2$
2. IR£60 is divided between  $X$ ,  $Y$  and  $Z$  in the ratio 3 : 5 : 7.  $Y$ 's share is
- (a) 14                      (b) 20                      (c) 28                      (d) 38.
3. A loss of 5% is made on selling an item for IR£5700. The intended selling price was
- (a) 5415                      (b) 6000                      (c) 6085                      (d) 6415.
4.  $2.4 \times 10^3 \times 0.2 \times 10^{-5}$  expressed in scientific notation is
- (a)  $0.48 \times 10^{-2}$                       (b)  $4.8 \times 10^{-1}$                       (c)  $4.8 \times 10^{-2}$                       (d)  $4.8 \times 10^{-3}$ .
5.  $x^2 - 10$  is divided by  $x - 3$ . The remainder is
- (a) -1                      (b) 0                      (c) 1                      (d) -7.

6.  $P, Q$  and  $R$  are sets as shown  
 $(P \triangle Q) \triangle (Q \triangle R) \triangle (R \triangle P) =$



- (a)  $\{ \}$  (b)  $P \cup Q$  (c)  $Q \cup R$  (d)  $R \cup P$

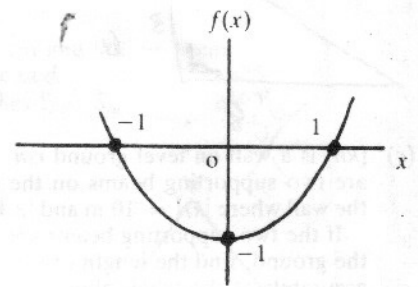
7.  $\left(\frac{8}{27}\right)^{-\frac{1}{3}} =$

- (a)  $\frac{2}{3}$  (b)  $\frac{2\sqrt{3}}{9}$  (c)  $1\frac{1}{3}$  (d)  $1\frac{1}{2}$

8. The  $n$ th term of a sequence is  $\frac{1}{n} - \frac{1}{n+1}$ . The sum of the first three terms is

- (a)  $\frac{1}{2}$  (b)  $\frac{3}{4}$  (c)  $\frac{5}{4}$  (d)  $\frac{3}{2}$

9. The graph of a function  $x \rightarrow f(x)$  is shown.  
 The function could be



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

10.  $F$  is the function  $\{(p,q), (q,r), (r,s)\}$ . The composite function,  $F \circ F$  is

- (a)  $\{(p,r), (q,s)\}$  (b)  $\{(p,q), (q,r), (r,s)\}$  (c)  $\{(q,p), (r,q), (s,r)\}$   
 (d)  $\{(p,p), (q,q), (r,r), (s,s)\}$

11.  $\log_{10}x = k$  and  $\log_{10}y = m$ . Then  $\log_{10}\frac{x}{y} =$

- (a)  $k-m$  (b)  $m-k$  (c)  $\frac{m}{k}$  (d)  $\frac{k}{m}$

12. The mean of 3, 7, 8,  $x$ ,  $y$  is 6. Then  $x^2+2xy+y^2 =$

- (a) 6 (b) 12 (c) 36 (d) 144

13. If  $x * y = x^2 - 2y$ , the solution set of  $x * x = 0$  is

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

14.  $R = \{(x,y), (y,y), (z,x), ( , )\}$  is a transitive relation. The missing couple is

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

15. Two spheres have their surface areas in the ratio 4:1. Their corresponding volumes are in the ratio

- (a) 2:1 (b) 4:1 (c) 8:1 (d) 16:1

16.  $\sqrt{2x-3} = 0.2$ . Then  $x =$

- (a) -1.48 (b) 1.7 (c) 3.5 (d) 1.52

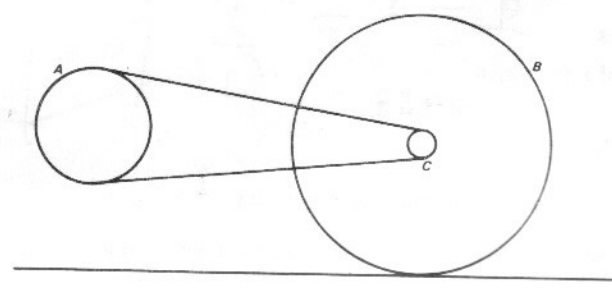
17. Two numbers sum to 50. Their product is  $k$ . Which one of the following represents this?  
 (a)  $x(50+x) = k$       (b)  $x(x-50) = k$       (c)  $x(50-x) = k$       (d)  $x^2+50x+k = 0$
18.  $\frac{x^3-y^3}{x-y} =$   
 (a)  $x^2+y^2$       (b)  $x^2+xy+y^2$       (c)  $x^2-xy+y^2$       (d)  $x^2-xy-y^2$
19. If  $p = \frac{q-r}{t}$ , then  $r =$   
 (a)  $tp-q$       (b)  $q-tp$       (c)  $\frac{tp}{q}$       (d)  $\frac{-tp}{q}$
20. If  $x-y > 1$ , then which of the following can represent the set  $\{x,y\}$ ?  
 (a)  $\{4;1.5\}$       (b)  $\{3,4\}$       (c)  $\{4.5;1\}$       (d)  $\{3,2\}$

$p = \frac{q-r}{t}$   
 $-pt = r$   
 $\frac{-pt}{-1} = r$   
 $t(p) = (q-r)$   
 $t(p) = q-r$   
 $p = \frac{q-r}{t}$

$x-y > 1$

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 MATHEMATICS — HIGHER COURSE — PAPER II  
 SECTION B (200 marks)  
 Attempt QUESTION 1 and THREE other questions

1. (a) If  $s(p^2-p) = 1$ , find the value of  $s$ , as accurately as the Tables allow, when  $p = 0.3478$ .  
 (b)



The wheel  $B$  is the back wheel of a bicycle which is driven using wheels  $A$  and  $C$ . The wheel  $C$  makes one complete turn for every complete turn of wheel  $B$ . The radii of the wheels  $A, B, C$  are, respectively, 14 cm, 35 cm and 7 cm.  
 In a journey of 1100 m, find how many complete turns of wheel  $A$  are made. Take  $\pi = \frac{22}{7}$ .

2. (a) Factorise:  
 (i)  $3x^2-x-10$ .  
 (ii)  $3ax-5b-3bx+5a$   
 (b) Solve as accurately as the Tables allow  $x^2-5x+1 = 0$ .  
 Hence solve correct to two places of decimals  $x^4-5x^2+1 = 0$ .

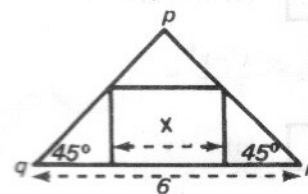
3.  $f$  and  $g$  are two functions:  
 $f: x \rightarrow 2x$   
 $g: x \rightarrow x^2+1$   
 For what value(s) of  $x$  is  
 (i)  $(f \circ g)(x) = (g \circ f)(x)$ ?  
 (ii)  $f^{-1}(x) = g^{-1}(x)$ ?  
 Find the range of values of  $x$  for which  $g(x) > f(x)$ .  
 Show that  $f(x+y) = f(x)+f(y)$  and investigate if  $g(x+y) = g(x)+g(y)$ .

4. A rectangle, of base length  $x$  is inscribed in a triangle  $pqr$  in which

$$|qr| = 6, \quad |\angle pqr| = 45^\circ = |\angle prq|.$$

Show that the height of the rectangle is

$$\frac{6-x}{2}$$

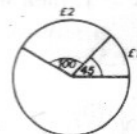


Express the area,  $A$ , of the rectangle in terms of  $x$ .  
Graph  $f: x \rightarrow A$  in the domain  $0 \leq x \leq 6$

Using the graph, estimate the value of  $x$  which gives the largest possible area for the rectangle.

5. The incomplete table and pie-chart shows the number of seats in a theatre and their respective cost.

Price per seat in IR£	£1	£2	£3	£4
Number of seats	135	$x$	390	$y$



The measures of the angles showing IR£1 and IR£2 seats in the pie-chart are respectively  $45^\circ$  and  $100^\circ$ .

Calculate:

- the total number of seats.
- the value of  $x$  and the value of  $y$ .

Find, if all seats are paid for,

- the total money paid.
- the mean price paid per seat.

6. (a) Without using Tables

- find the value of  $x$  for which

$$9^{x+4} = 3.$$

- Simplify  $\log_4 2 + \log_4 32$

so as to express your answer without the logarithm.

- (b) In a class of 40 students, 13 study Japanese, 24 study Russian and 17 study Arabic.  
3 study all three languages.  
7 study Japanese and Russian.  
1 studies Japanese and Arabic but not Russian.  
4 do not study any of these languages.

- Illustrate this data in a Venn diagram.
- How many study Russian and Arabic?
- How many study Arabic only?

7. (a) Solve the simultaneous equations

$$x + 7y - 10 = 0$$

$$\frac{2x-1}{2} - \frac{3y-1}{5} = x$$

- (b) A farmer's wife had two kinds of egg trays to store the day's produce. One tray held six eggs more than the other. When six smaller trays were used one egg was left over. When four of the larger kind were used, seven eggs were left over.

Set out an algebraic equation to illustrate this situation and hence calculate the number of eggs.