AN ROINN OIDEACHAIS
JUNIOR CERTIFICATE EXAMINATION, 1993

MATHEMATICS – HIGHER LEVEL – PAPER 1 (300 marks)

THURSDAY, 10 JUNE – MORNING, 9.30 to 12.00

Attempt QUESTION 1 (100 marks) and FOUR other questions (50 marks each).

Marks may be lost if all necessary work is not clearly shown.
Mathematics Tables may be obtained from the Superintendent.

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1. *(i)* A journey of 18 km took 40 minutes.
Find the average speed in metres per second.

(ii) Tax at the rate of 28p in the IR£ was paid on the interest on an investment.

The tax paid was IR£145·60.

How much was the interest before tax ?

(iii) Solve $3x^2 - 6x - 5 = 0$.
Give your answers correct to one place of decimals.

(iv) $f : x \to 3x - 1$ and $g : x \to \frac{x}{2} + 1$.
Find $(f \circ g)(-1)$.

(v) Express x in terms of a and b when

$$\frac{b}{2x} = b - a, \qquad x \neq 0.$$

(vi) $\log_y 3 + \log_y 27 = 2$ where $y > 0$.
Find the value of y.

(vii) $a * b = ab + 2$

Find $2 * (3 * \frac{1}{3})$.

(viii) Show on the number line the range of values of x for which

$$-5 \leq 2x - 1 \leq 3, \quad x \in \mathbf{R}.$$

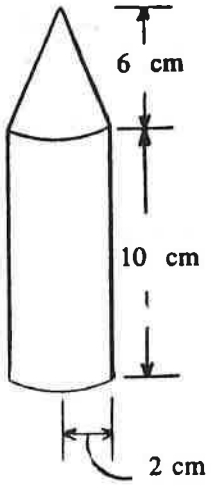
(ix) The age range of people in an area is

Age in Years	0-10	10-20	20-40
Number of People	6	8	10

Show this information on a histogram.

(x) Express $\frac{(6 \times 10^5)^2}{6 \times 10^{-7}}$ in the form 6×10^b where $b \in Z$.

2. *(i)* A candle is in the shape of a solid cone of height 6 cm on top of a solid cylinder of height 10 cm.



The cone and the cylinder each have a radius of length 2 cm.

Show that the volume of the candle is 48π cm^3.

(ii) A new candle is in the shape of a solid cone of height 3 cm on top of a solid cylinder of height 5 cm.
The cone and the cylinder each have a radius of length r *cm*.
The volume of the new candle is 6π cm^3 .
Find r.

(iii) Four of the larger candles are packed, cone parts uppermost, into the smallest possible rectangular box.
Find, in cm^3, the volume of empty space in the box, correct to one place of decimals.
Take $\pi = 3{\cdot}14$.

3. *(a)* Factorise

(i) $x^2 + x - 6$

(ii) $(6x - y)^2 - (2x - 3y)^2$.

(b) Solve the simultaneous equations:

$$10x - 3y = 22$$

$$\frac{2y - 4}{3} - \frac{2x + y}{2} = \frac{x - 13}{4}$$

(c) Solve

$$\frac{1}{(x + 3)(x - 2)} - \frac{3}{x + 3} = \frac{1}{x - 2}, \qquad x \neq -3,\ x \neq 2.$$

4. *(a)* The table below gives the distribution of marks gained by students in an examination:

Marks	0-20	20-40	40-50	50-60	60-80	80-100
Number of Students	6	18	20	26	18	12

[0 - 20 means 0 or more but less than 20 etc].

Complete the cumulative frequency table:

Marks	<20	<40	<50	<60	<80	<100
Number of Students						

Draw the cumulative frequency curve (ogive) from this table, putting numbers of students on the vertical axis.

Estimate from the curve;

(i) the median mark;

(ii) how many students were in the 65 – 85 mark range.

(b) A different number of students did another examination.

The mean mark, using mid-interval values from the following table was found to be 6.

Marks	2-4	4-6	6-10
Number of Students	3	y	7

Calculate the value of y.

5. Using the same axes and scales, draw the graphs of

(i) $f : x \to 5 - x - 2x^2$
(ii) $g : x \to 1 - x$

in the domain $-3 \leq x \leq 2$, $x \in \mathbf{R}$.

Estimate from your graphs

(iii) the maximum value of $f(x)$

(iv) the values of x for which $f(x) = g(x)$

(v) the range of values of x for which $2x^2 + x - 2 \leq 0$.

6. *(a)* $S = \{1, 2, 4, 7\}$, $T = \{2, 3, 6, 7\}$, $V = \{4, 5, 6, 7\}$

List the elements in

(i) $(S \setminus T) \cup (T \setminus S)$

(ii) $(S \cup T) \setminus (S \cap T)$

(iii) $(S \Delta T) \Delta V$.

(b) In the first week of a draw, x people shared equally in a prize of IR£80.

How much was each share, in terms of x ?

The following week, $x + 6$ people shared equally in the prize of IR£80.

Each share in the second week was IR£3 less than each share in the first week.

Write an equation in x to represent all the above information.

Solve the equation to find how many shared the prize in the first week.