AN ROINN OIDEACHAIS

JUNIOR CERTIFICATE EXAMINATION, 1995

MATHEMATICS – HIGHER LEVEL – PAPER 1 (300 marks)

THURSDAY, 8 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 your work is not clearly shown.
Mathematics Tables may be obtained from the Superintendent.

1. *(i)* An auctioneer charges a fee of 2½% of the selling price of a house. If a house sells for IR£52 800, calculate the auctioneer's fee.

(ii) The surface area of a cube is 96 cm^2. Find the area of one face of the cube.

(iii) Anne walks a distance of 1.7 km to school from home. She walks at an average speed of 5.1 km/hr. What is the latest time she can leave home to be in school at 8.55 a.m. ?

(iv) Evaluate

$$\sqrt{(2.5)^2 - (0.7)^2}\,.$$

(v) Solve for x: $\quad x - \frac{2}{x} = 1.$

(vi) If $a = \frac{1}{b} + c$, express b in terms of a and c.

(vii) Find the value of x if $\log_x 2 = \frac{1}{3}$.

(viii) If $f : x \to 5x + 1$ and $g : x \to 2x + 1$, find the value of x for which

$$(fog)(x) = 26.$$

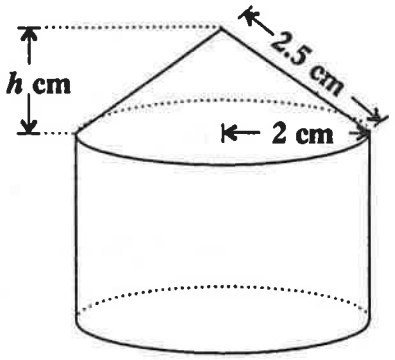
(ix) Express $\frac{(4 \times 10^3)^3}{8 \times 10^{-3}}$ in the form $a \times 10^b$, where

$1 \leq a < 10$ and $b \in \mathbf{Z}$.

(x) Graph on the number line the range of values of $x \in \mathbf{R}$ for which

$4 \leq 1 - 3x$.

2. *(a)* A small candle is in the shape of a cone which fits exactly on top of a cylinder as shown. The cylinder has a radius of length 2 cm. The slant length of the cone is 2.5 cm.



Calculate

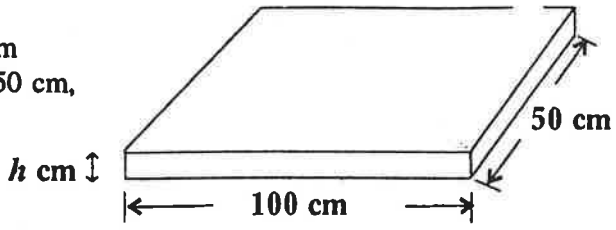
(i) the height, h, of the cone

(ii) the volume of the cone in terms of π.

The volume of the cylinder is 5 times the volume of the cone. Calculate the total height of the candle.

(b) The mass of a rectangular sheet of metal is 45 000 grammes. The mass of 1 cm^3 of this metal is 7.2 grammes.

The thickness of the sheet of metal is h cm and its length and width are 100 cm and 50 cm, respectively, as in the diagram. Calculate the value of h.



3. *(a)* Factorise each of the following:

(i) $24x^2 + x - 3$

(ii) $12a^2 - 8ab + 9ac - 6bc$.

(b) Solve for x:

$$\frac{x+1}{x-2} - \frac{x+2}{x-1} = \frac{1}{2}.$$

(c) Solve, correct to 2 places of decimals, the equation

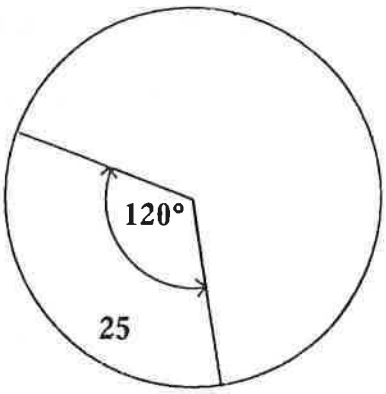
$3x^2 - 2x - 2 = 0$.

Hence, or otherwise, find, correct to 1 place of decimals, the values of x for which

$3(2x-1)^2 - 2(2x-1) - 2 = 0$.

4.

(a) A pie-chart, contrasting the values 25, 35 and x, shows 25 with an angle of 120° at the centre. Find the value of x.



(b) The cumulative frequency table below gives the range of marks obtained by 90 pupils in a test:

Marks	<20	<40	<60	<90	<100
Number of pupils	3	14	53	86	90

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

(ii) Use this curve to estimate the median.

(iii) Copy and complete the frequency distribution table below, from which the cumulative frequency table was obtained:

Marks	0–20	20–40	40-60	60-90	90–100
Number of pupils		11		33	

Note: 0-20 means 0 or more but less than 20 etc.

Draw the histogram of this distribution.

5. *(a)* Graph the function $f : x \to 2 - x - x^2$ in the domain $-3 \leq x \leq 2$, $x \in \mathbf{R}$.

Estimate from your graph

(i) the values of x for which

$$f(x) = -2$$

(ii) the value of k such that

$$f(k) = f(0.3), \quad k \neq 0.3$$

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

(b) $g : x \to ax^2 + bx + 1$ is a function defined on $\mathbf{R}$.
If $g(1) = 0$ and $g(2) = 3$, write down two equations in a and b.
Hence, calculate the value of a and the value of b.

6. *(a)* If $\log_2 3 = k$, express, in terms of k,

(i) $\log_2 27$

(ii) $\log_2 6$

(iii) $\log_2 \left(\frac{1}{3}\right)$.

(b) A survey was taken of 54 students, each of whom was studying one or more of the 3 subjects A, B and C.

6 students studied B and C.
5 students studied A and C.
3 times as many students studied A and B as studied all 3 subjects.
20 students altogether studied B.
17 students studied C only and 14 students studied A only.

Using x to represent those students who studied all 3 subjects, illustrate the above information in a Venn diagram.

Calculate the value of x.