AN ROINN OIDEACHAIS AGUS EOLAÍOCHTA

JUNIOR CERTIFICATE EXAMINATION, 1998

MATHEMATICS — HIGHER LEVEL — PAPER 1 (300 marks)

THURSDAY, 11 JUNE – MORNING, 9.30 to 12.00

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

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

1. (i) In a sale the price of a piece of furniture was reduced by 10%. The sale price was IR£1125. What was the price before the sale?

 (ii) A cyclist started a journey of 56 km at 1015 hours and finished the journey at 1135 hours. Calculate the average speed of the cyclist in km/hr.

 (iii) The length of circle A is 6π cm. The length of circle B is 10π cm.

 Calculate

 $$\frac{\text{area of circle A}}{\text{area of circle B}}.$$

 (iv) Evaluate

 $$\frac{1}{\sqrt{0.25}} + (0.3)^2.$$

 (v) If $\dfrac{p}{q} = \dfrac{q}{t} + 1$, express t in terms of p and q.

 (vi) Find the value of n for which

 $$3^{2n+1} = 243.$$

 (vii) Solve the equation

 $$(x + 3)^2 = (x + 1)(2x + 3).$$

 (viii) If $x * y = 2x - y$, find the value of a for which

 $$(3a * 2a) * a = 35.$$

 (ix) Simplify

 $$\frac{2 + \sqrt{3}}{2 - \sqrt{3}}$$

 and write your answer in the form $a + c\sqrt{b}$ where $a, b, c \in \mathbf{N}$.
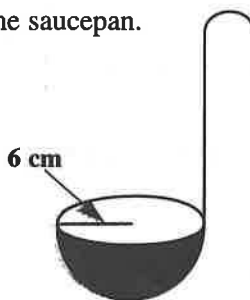
 (x) Find the solution set of

 $$x + 4 \geq 3x - 2, \quad x \in \mathbf{N}.$$

2. **(a)** **(i)** Soup is contained in a cylindrical saucepan which has internal radius of length of 14 cm. The depth of the soup is 20 cm.

Calculate, in terms of π, the volume of soup in the saucepan.

(ii) A ladle in the shape of a hemisphere with internal radius of length 6 cm is used to serve the soup.

Calculate, in terms of π, the volume of soup contained in one full ladle.

6 cm

(iii) The soup is served into cylindrical cups each with internal radius of length of 4 cm. One ladleful is placed in each cup.
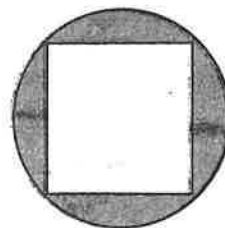
Calculate the depth of the soup in each cup.

(iv) How many cups can be filled from the contents of the saucepan if each cup must contain exactly one full ladle?

(b) A square is inscribed in a circle as shown in the diagram.

The length of the radius of the circle is 7 cm.

Calculate the area of the shaded region.

Take $\pi = \dfrac{22}{7}$

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

(i) $6a^2 + 2ab + 3ac + bc$

(ii) $10x^2 - 3x - 1$

(iii) $5x^2 - 125y^2$.

(b) **(i)** Write the following as a single fraction:

$$\frac{3}{x+2} + \frac{6}{x-4}, \qquad x \neq -2, x \neq 4.$$

(ii) Evaluate your answer when $x = 1$.

(c) **(i)** Solve, correct to one decimal place, the equation

$$5 - 3x - x^2 = 0.$$

(ii) Using your answers to part **(i)**, or otherwise, find correct to one decimal place the two values of y for which

$$(2y + 1)^2 + 3(2y + 1) - 5 = 0.$$

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4. **(a)** The following cumulative frequency table shows the distribution of scores obtained by 28 people in a quiz:

Score	<10	<20	<40	<60	<70
Number of People	5	8	18	26	28

(i) Copy and complete the following frequency distribution table:

Score	0 – 10	10 – 20	20 – 40	40 – 60	60 – 70
Number of People					

(Note: 0 - 10 means 0 or more but less than 10, etc.)

(ii) Draw the histogram of this distribution.

(iii) What is the greatest number of people who could have scored 50 or higher?

(iv) Using mid-interval values calculate, correct to one place of decimals, the mean of the distribution.

(b) The average (mean) age in a group of 6 pupils is 10 years and 9 months.

When a new pupil joins the group the average age drops to 10 years and 3 months.

Calculate, in years and months, the age of the new pupil.

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

From your graph estimate

(i) the minimum value of $f(x)$

(ii) the roots of the equation $2x^2 - 3x - 5 = 0$.

(b) Consider the function $g : x \rightarrow \dfrac{4}{x + 3}$.

(i) Calculate the value of $g(5)$ and the value of $g(^1/_3)$.

(ii) For what real value of x is $g(x)$ not defined?

(iii) Find the value of $g^{-1}(- 2)$.

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6. **(a)** Solve the simultaneous equations

$$2x + 7y = 3$$
$$x + y = \frac{x - 2y + 1}{2}.$$

(b) Solve each of the following for x:

    (i) $\log_2 32 = x$

    (ii) $\log_3 x = -4$.

(c) A rectangular garden measures 10 m by 8 m.

There is a flower bed in the centre of the garden.

The flower bed is surrounded on all sides by a path which is x m wide, as shown in the diagram.

    (i) Write down an expression in x which represents the area of the flower bed.

    (ii) Calculate the value of x if the path covers 40% of the total area of the garden.