Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION, 2004

MATHEMATICS – HIGHER LEVEL

PAPER 1 (300 marks)

THURSDAY, 10 JUNE – MORNING, 9:30 to 12:00

Attempt **ALL** questions.

Each question carries 50 marks.

Graph paper may be obtained from the superintendent.

The symbol ✍ indicates that supporting work must be shown to obtain full marks.

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1. **(a)** The area of a house covers 205 m^2.

The area of the site for the house covers 1025 m^2.

✍ What is the ratio of the area of the house to the area of the site?

Give your answer in the form 1 : *n,* where $n \in \mathbf{N}$.

(b) **(i)** Evaluate $(6 \cdot 3 \times 10^9) + (5 \cdot 8 \times 10^{10})$.

Express your answer in the form $a \times 10^n$, where $n \in \mathbf{N}$ and $1 \leq a < 10$.

(ii) John has a gross income per fortnight of €1750.
The standard rate of income tax is 20% and the higher rate is 42%.
He has tax credits of €105 per fortnight and his standard rate cut-off point is €1295 per fortnight.

✍ After tax is paid, what is John's net income per fortnight?

(c) **(i)** ✍ By rounding to the nearest whole number, estimate the value of

$$\frac{131 \cdot 5 - 1 \cdot 73 \times \sqrt{0 \cdot 64}}{35 \cdot 4 - (5 \cdot 1)^2}.$$

Then, evaluate $\frac{131 \cdot 5 - 1 \cdot 73 \times \sqrt{0 \cdot 64}}{35 \cdot 4 - (5 \cdot 1)^2}$, correct to two decimal places.

(ii) ✍ Simplify $\left(\sqrt{12} + \frac{1}{\sqrt{12}}\right)\left(\sqrt{12} - \frac{1}{\sqrt{12}}\right)$, without the use of a calculator.

Express your answer in the form $\frac{a}{b}$, where $a, b \in \mathbf{N}$.

2. **(a)** ✍ Write 44 100 as a product of its prime factors.

(b) **(i)** ✍ The price of a playstation game is €59 · 99.

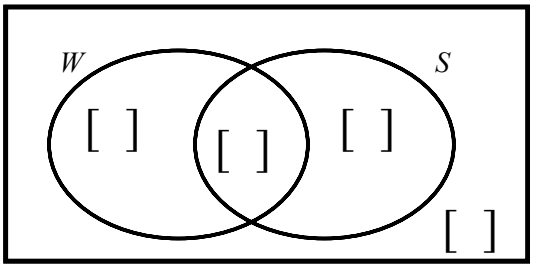
In a sale the price of this playstation game is reduced to €49 · 99.

What is the percentage reduction on the original price of the game in the sale?

Give your answer correct to the nearest whole number.

(ii) ✍ Simplify $\dfrac{125^{\frac{1}{3}} \times 5^2}{5^3 \times 25^{\frac{5}{2}}}$ into the form 5^n, where $n \in \mathbf{Z}$.

(c) **(i)** A leisure centre has 110 members. The weights room (W) is used by 82 members and the swimming pool (S) is used by 57 members. 15 members do not use either facility.



✍ Copy the Venn diagram into your answerbook and complete it to show the number of members in each part of each set.

(ii) U is the universal set and A and B are two subsets of U.

$\#U = u$

$\#A = a$

$\#B = b$

$\#(A \cap B) = x$

$\#((A \cup B)') = y$.

✍ Represent this information on a Venn diagram and hence express u in terms of a, b, x and y.

✍ Show that if $a > b$, then the minimum possible value of u is $y + a$.

3. **(a)** ✍ Solve $3(x-4)-2(5x-3)=8$.

(b) **(i)** ✍ Evaluate $\frac{2x+1}{4} - \frac{3x-4}{3}$, when $x = \frac{1}{2}$.

Express your answer in the form $\frac{a}{b}$, where $a, b \in \mathbf{N}$.

(ii) ✍ Given that $2(2q-7p) = q(3p-q)$, express p in terms of q.

(c) **(i)** ✍ Solve the equation $x^2 - 8x + 11 = 0$ and give your answers correct to two decimal places.

(ii) ✍ Hence, find the two values of $t \in \mathbf{R}$ for which

$$\left(\frac{1}{t}\right)^2 - 8\left(\frac{1}{t}\right) + 11 = 0.$$

Give your answers correct to two decimal places.

4. **(a)** ✍ Divide $x^3 + x^2 - 12x$ by $x + 4$.

(b) **(i)** Factorise $9x^2 - 64y^2$.

(ii) ✍ Factorise $3xy - 10x - 10b + 3by$.

(iii) Factorise $6x^2 - 7x - 24$.

(c) A youth club is organising an outing to a park. The total cost of entry for club members to the park is €42.

(i) Taking x to be the number of club members, write an expression in x to represent the cost of entry per member.

If two club members decided not to go on the outing, the total cost of entry to the park would be €35.

(ii) Write an expression in x to represent the cost of entry per member in this case.

The cost of entry per member, in this case, would be increased by €1.

(iii) Write an equation in x to represent the above information.

(iv) ✍ Solve this equation to find the number of members in the club.

5. **(a)** ✍ Graph on the number line the solution set of

$$-9 \leq 2x - 5 < 7, \quad x \in \mathbf{Z}.$$

(b) Marie has €25 made up of 20 cent coins and 50 cent coins. She has 104 coins in total.

(i) Taking x to be the number of 20 cent coins and y to be the number of 50 cent coins, write down two equations in x and y to represent this information.

(ii) ✍ Solve the equations to find the number of each type of coin Marie has.

(c) Let f be the function $f : x \to x^2 + bx + c, \ x \in \mathbf{R}$ and $b, c \in \mathbf{Z}$.

The points (2, -6) and (0, 6) lie on the graph of f.

(i) ✍ Find the value of b and the value of c.

(ii) ✍ k is a positive real number and $(k, -k)$ is a point on the graph.

Find the two possible values of k.

6. The perimeter of a rectangle is 14 m. The width of the rectangle is x m.

(a) ✍ Write an expression in x for the length of the rectangle.

(b) **(i)** ✍ Show that the area, in m^2, of the rectangle is $7x - x^2$.

(ii) ✍ Let f be the function $f: x \to 7x - x^2$.

Draw the graph of f for $0 \leq x \leq 7,\ x \in \mathbf{R}$.

(c) Use your graph from part **(b)** to estimate:

(i) ✍ the area of the rectangle when the width is $1 \cdot 5$ m

(ii) ✍ the maximum possible area of the rectangle

(iii) ✍ the two possible values of the width of the rectangle when the area is 4 m^2.

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