Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION, 2012

MATHEMATICS – HIGHER LEVEL

PAPER 1 (300 marks)

FRIDAY, 8 JUNE – AFTERNOON, 2.00 to 4.30

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)** **(i)** List the divisors of 30.

(ii) State which of these divisors are prime numbers.

(b) **(i)** €900 is invested for two years at 3% per annum compound interest.

✍ Find the value of the investment at the end of the second year.

(ii) John has a gross weekly wage of €600.
After tax his net weekly wage is €554.

✍ Calculate his tax credits if he is taxed at the standard rate of 20%.

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

$$\frac{3\cdot 89\times 7\cdot 24\ -\ \sqrt{8\cdot 94}}{8\cdot 52-3\cdot 65}\ .$$

(ii) ✍ Evaluate $\dfrac{3\cdot 89\times 7\cdot 24\ -\ \sqrt{8\cdot 94}}{8\cdot 52-3\cdot 65}$, correct to two decimal places.

(iii) ✍ Simplify $\sqrt{5}\left(\sqrt{2}+\sqrt{5}\right)-\sqrt{8}\left(\sqrt{2}-\sqrt{5}\right)$ without the use of a calculator.

Express your answer in the form $a+b\sqrt{c}$, where $a, b, c \in \mathbb{N}$.

2. **(a)** Fuel consumption in a car is measured in litres per 100 km.

Alan's car travels 1250 km on a tank of 68 litres.

✍ Calculate his car's fuel consumption in litres per 100 km.

(b) $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$ is the universal set.

$P = \{3, 5, 6, 8, 10\}$, $Q = \{2, 4, 6, 8, 10, 12\}$ and $R = \{2, 5, 6, 7, 9, 12\}$ are three subsets of U.

(i) Represent the above information on a Venn diagram.

Hence list the elements of:

(ii) $(P \cup Q \cup R)'$

(iii) $(P \cap Q) \setminus R$.

(c) An electronics company imports tablet computers from China at a cost of 696 Yuan (元) per tablet.

(i) ✍ Find the cost of each tablet, in euro, if €1 = 8·7元.

The company must also pay a shipping cost on each tablet imported.

By selling a tablet at €105·40, the company can make a profit of 24%.

(ii) ✍ Find the shipping cost per tablet.

The company imports 1000 tablets from China. It sells 600 of them at €105·40 each (i.e. at a profit of 24%) and the remainder at a profit of 15%.

(iii) ✍ Find the overall profit, in euro, made by the company.

3. **(a)** ✍ Given that 1 billion is a thousand million, find the sum of €3·6 billion and €700 million.

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

(b) **(i)** ✍ Simplify $\dfrac{6x^2 - 17x + 12}{3x - 4}$.

(ii) ✍ Factorise $4c^2 - 3d - 2cd + 6c$.

(iii) ✍ Express in its simplest form:

$$\frac{5}{x-3} - \frac{3}{x-2}.$$

(c) Roisín cycled from Wicklow to Bray, a distance of 30 km.
She left Wicklow at 10:30 and arrived in Bray at 12:20,
having stopped in Greystones for 20 minutes.
Greystones is 22 km from Wicklow.

(i) Roisín's average speed between Wicklow and Greystones was x km/h.
Write an expression in x for the time taken for this part of her journey.

(ii) Her average speed for the second part of her journey, between Greystones and Bray, was 6 km/h slower than her speed between Wicklow and Greystones.
Write an expression in x for the time it took to complete the second part of her journey.

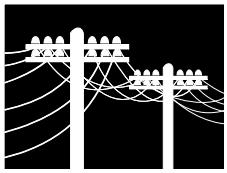
(iii) Write an equation in x to represent the above information.

(iv) ✍ Solve the equation to find Roisín's speed for each part of the journey.

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

$$4 - x \geq 2x - 5, \; x \in \mathbb{N}.$$

(b) Electricity is charged to a consumer at a day rate and at a night rate.
Day rate units are charged at 14 cent per unit
and night rate units are charged at 7 cent per unit.



A consumer uses a total of 1100 units for a billing period, at a cost of €129·50.

(i) By letting x equal the number of day rate units used and y equal the number of night rate units used, write two equations to represent the above information.

(ii) ✍ Solve these equations to find the number of each type of unit used.

(c) **(i)** ✍ Solve the equation $x^2 - 6x + 4 = 0$,

giving your answer in the form of $a \pm \sqrt{b}$, where $a, \; b \in \mathbb{N}$.

(ii) ✍ Hence, or otherwise, find two values for p for which

$$(3 + p)^2 - 6(3 + p) + 4 = 0.$$

(iii) ✍ Show that the sum of the two values of p is zero.

5. **(a)** ✍ Given that $4d = \frac{2c}{3} + \frac{a}{5}$, write a in terms of c and d.

(b) **(i)** ✍ Find the value of $3x^2 - 5x + \frac{4}{x}$, when $x = \frac{2}{3}$.

(ii) ✍ Solve the equation $\frac{x-1}{3} - \frac{5x+2}{4} = 1$.

(c) Let f be the function $f: x \to 10 - x - 2x^2$.

(i) ✍ Draw the graph of f for $-3 \leq x \leq 3,\ x \in \mathbb{R}$.

(ii) Use your graph to estimate the maximum value of $f(x)$.

(iii) Use your graph to estimate the values of x for which $f(x) = 6$.

6. **(a)** Let g be the function $g : x \to 2^{x-3}$.

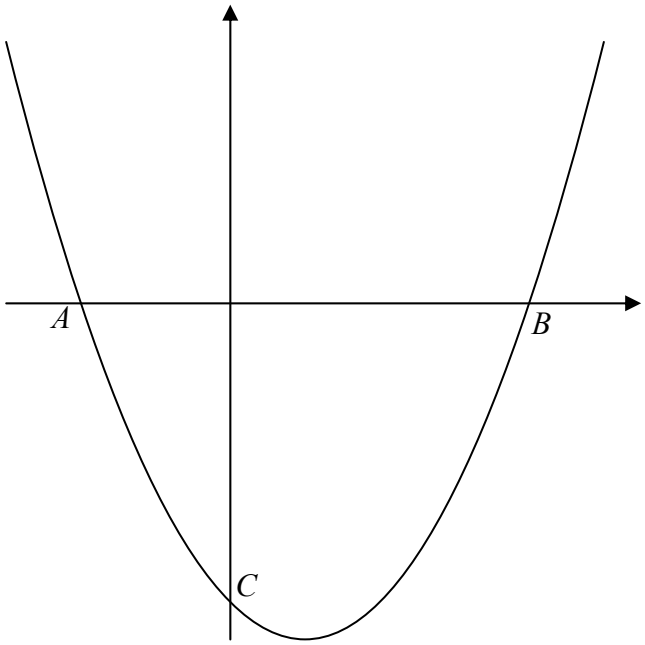
✍ Find the value of $g(3)$.

(b) Let f be the function $f : x \to x^2 - 3x$.

(i) ✍ Express $f(t)$ and $f(2t + 1)$ in terms of t.

(ii) ✍ Hence, find the values of t for which $f(t) = f(2t + 1)$.

(c) The diagram shows part of the graph of the function $f : x \to x^2 - 2x - 8,\ x \in \mathbb{R}$.



(i) The graph intersects the x axis at A and B and the y axis at C.

✍ Find the co-ordinates of A, B and C.

(ii) Hence, write down the range of values of x for which $x^2 - 2x - 8 \leq 0$.

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