# Coimisiún na Scrúduithe Stáit
# State Examinations Commission

**JUNIOR CERTIFICATE EXAMINATION, 2008**

**MATHEMATICS – HIGHER LEVEL**

**PAPER 1 (300 marks)**

**THURSDAY, 5 JUNE – MORNING, 9:30 to 12:00**

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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)** ✍ Given that the speed of sound in air is 330 metres per second, express this speed in km/h.

**(b)** **(i)** ✍ Wendy estimates the value of 527 + 889 + 436 by rounding each number to the nearest hundred.
Find the estimated value.

**(ii)** Three students rent a house for a period of 8 months.
The refuse charges are €16·80 per month.
The electricity bill amounts to €84 every two months.
The television and broadband charges are €324 for the period of the rental.

✍ How much should each of the three students pay monthly for these charges?

**(c)** **(i)** Walter borrows €5000 for three years at 4% per annum compound interest.
He repays €1800 at the end of each of the first two years.

✍ How much must he repay at the end of the third year to clear his loan?

**(ii)** Walter wishes to pay off his loan in equal instalments at the end of the first and second year. The rate remains at 4% per annum compound interest.

✍ How much would he need to repay, at the end of each year, to clear his loan after two years? Give your answer correct to the nearest cent.

**2.** **(a)** A is the set of prime numbers less than 13.

**(i)** List the elements of the set A.

B = {1, 3, 5, 7, 9, 11}.

**(ii)** Write down the elements of the set B \ A.

**(b)** Two brands of blackcurrant squash drinks contain concentrated juice and sugar.
In brand A, the ratio of concentrated juice to sugar is 19:1.
In brand B, the ratio of concentrated juice to sugar is 9:1.

**(i)** ✍ What is the volume of concentrated juice in 500 ml of brand A?

**(ii)** ✍ What is the volume of sugar in 300 ml of brand B?

500 ml of brand A is mixed with 300 ml of brand B.

**(iii)** ✍ What is the ratio of the concentrated juice to the sugar in the mixture?

**(c)** In 2006, the average costs of running a car for the year were as follows:
road tax €485, petrol €1440, servicing €650 and insurance €425.

**(i)** ✍ What was the total cost of running the car in 2006?

In 2007, the petrol costs went up by 5%, the cost of servicing went up by 15% and the cost of insurance went down by 10%.

**(ii)** ✍ Given that the total running costs increased by 4·6% in 2007, calculate the percentage (%) increase in the road tax for 2007, giving your answer correct to one decimal place.

**3.** **(a)** When 23 is added to 4 times a certain number, the answer is 11.

✍ Find this number.

**(b)** An examination paper consists of 40 questions.

5 marks are given for each correct answer.

3 marks are deducted for each incorrect answer.

Kenny answered all 40 questions, getting $x$ correct and getting $y$ incorrect.

His total score for the examination was 56 marks.

**(i)** Write two equations to represent the above information.

**(ii)** ✍ Solve these equations to find how many questions Kenny answered correctly.

**(c)** **(i)** ✍ Express in its simplest form:

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

**(ii)** ✍ Hence, or otherwise, solve the equation:

$$\frac{1}{2x-3} - \frac{1}{x+3} = 2,$$

giving your answers correct to two decimal places.

**4.** **(a)** ✍ Given that $f(x) = kx + 8$ and that $f(9) = 44$, find the value of $k$.

**(b)** **(i)** Factorise $28x^2 - 3x - 1$.

**(ii)** ✍ Solve $\frac{-47x - 30}{7} = x^2$.

**(c)** In a certain week, $x$ people shared equally in a club lotto prize of €2000.

**(i)** Write down an expression in $x$ for the amount that each person received.

The following week, $x + 1$ people shared equally in the prize of €2000.

**(ii)** Write down an expression in $x$ for the amount that each person received that week.

In the second week, each winner received €100 less.

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

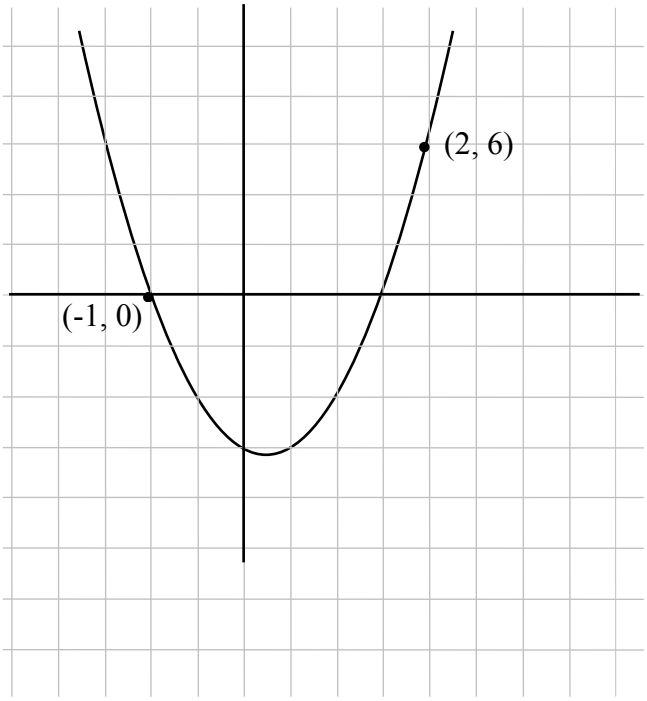
**(iv)** ✍ Solve this equation to find the value of $x$.

**5.** **(a)** ✍ Given that $3d = b(c + a)$, write $c$ in terms of $a$, $b$ and $d$.

**(b)** **(i)** ✍ When $x = \frac{1}{2}$, find the value of $\frac{3}{x+2} - \frac{1}{2x+4}$.

**(ii)** ✍ Divide $6x^3 - 13x^2 + 27x - 14$ by $3x - 2$.

**(c)** Let $f$ be the function $f: x \to 4x^2 + bx + c$, $x \in \mathbf{R}$ and $b, c \in \mathbf{Z}$.
The points (2, 6) and (-1, 0) lie on the graph of $f$, as shown in the diagram.



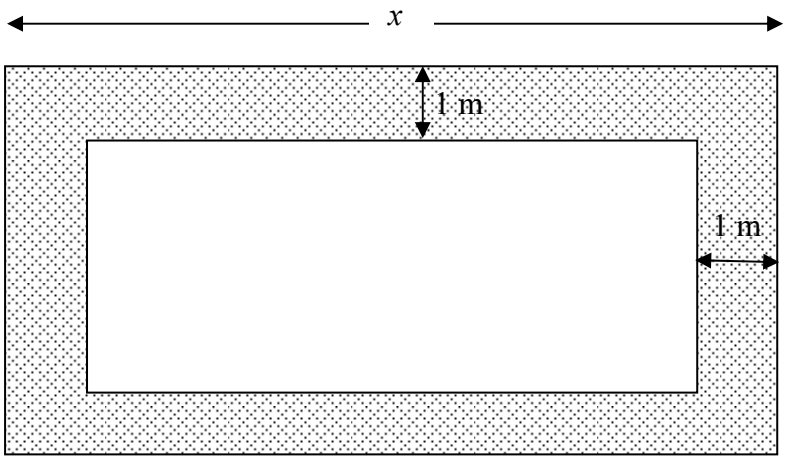

**(i)** ✍ Find the value of $b$ and the value of $c$.

**(ii)** ✍ Solve $f(x) = -6$.

**6.** **(a)** The diagram shows a rectangular garden of perimeter 24 m.

The length of the garden is $x$ m.

Write down an expression in $x$ for the width of the garden.




**(b)** Paving of width 1 m is placed around the garden as shown.

**(i)** Write expressions in $x$ for the length and width of the inner section.

**(ii)** ✍ Show that the area, in $m^2$, of the inner section is $-x^2 + 12x - 20$.

**(c)** The area of the inner section is represented by the function:

$f : x \to -x^2 + 12x - 20$.

**(i)** ✍ Draw the graph of $f$ for $2 \le x \le 10$, $x \in \mathbf{R}$.

**(ii)** Write down the maximum possible area of the inner section.

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