# Coimisiún na Scrúduithe Stáit
# State Examinations Commission

**JUNIOR CERTIFICATE EXAMINATION, 2010**

**MATHEMATICS – HIGHER LEVEL**

**PAPER 1 (300 marks)**

**FRIDAY, 11 JUNE – AFTERNOON, 2.00 to 4.30**

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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)** The price of a litre of petrol on the 1st of August was €1·20.

The price on the 1st September was €1·17.

✍ Calculate the percentage decrease over this period.

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

$$\frac{3\cdot 8}{4\cdot 23} \;+\; (2\cdot 97)^3 \;\div\; \sqrt{9\cdot 16}\,.$$

Then, evaluate $\dfrac{3\cdot 8}{4\cdot 23} + (2\cdot 97)^3 \div \sqrt{9\cdot 16}$,

correct to one decimal place.

**(ii)** ✍ By putting the largest number first, place the following numbers in order: $\dfrac{7}{6}, \quad \dfrac{\sqrt{6}}{2}, \quad (1\cdot 11)^2, \quad \sqrt{1\cdot 3456}\,.$

**(c)** **(i)** The standard rate of income tax is 20% and the higher rate is 41%.

The standard rate cut-off point is €36 500.

Aisling has a gross income of €47 500 and total tax credits of €1830.

✍ Calculate Aisling's net income.

**(ii)** The following year Aisling's gross income increases.

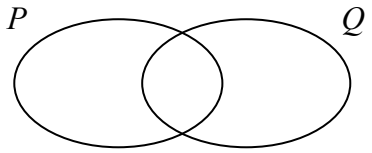
The tax rates, cut-off point and tax credits remain unchanged.

Her net tax now amounts to €15 105.

✍ What is her new gross income?

**2.** **(a)** $P$ is the set of divisors of 12. $Q$ is the set of divisors of 9.

✍ Using this information copy and complete the Venn diagram.




**(b)** A group of 100 students were asked if they had a presence on particular social networking websites $A$, $B$ and $C$.

24 students had a presence on $A$ only, 40 had a presence on $B$ and 50 had a presence on $C$.

14 students had a presence on $A$ and $B$ but not on $C$.

18 students had a presence on $A$ and $C$ but not on $B$.

8 students had a presence on $B$ and $C$ but not on $A$.

4 students stated that they did not have a presence on any of the websites.

**(i)** ✍ Using $x$ to represent the number of students who had a presence on all three websites, construct a Venn diagram and solve for $x$.

**(ii)** ✍ Hence, calculate the ratio of students with a presence on $B$ only to the students with a presence on $C$ only.

**(c)** €2000 was invested at $r$% for 2 years compound interest.

A tax of 25% was deducted each year from the interest gained.

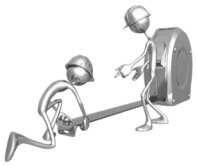
At the end of the first year the investment amounted to €2030, after tax was deducted.

**(i)** ✍ Calculate the rate of interest $r$%.

**(ii)** ✍ Find the amount of the investment at the end of 2 years, after tax has been deducted.

**3.** **(a)** ✍ Write the reciprocal of 10 000 in the form $1 \times 10^n$, where $n \in \mathbf{Z}$.

**(b)** A builders' supplier sells two types of copper pipes.



One has a narrow diameter and costs €$x$ per length.

The other has a wider diameter and costs €$y$ per length.

Tony buys 14 lengths of the narrow diameter pipes and 10 lengths of the wider diameter pipes at a cost of €555.

Gerry buys 12 lengths of the narrow diameter pipes and 5 lengths of the wider diameter pipes at a cost of €390.

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

**(ii)** ✍ Solve these equations to find the cost of a length of each type of copper pipe.

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

$$\frac{3}{x+1} - \frac{2}{x+4}.$$

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

$$\frac{3}{x+1} - \frac{2}{x+4} = \frac{1}{3},$$

giving your answers in the form $a \pm b\sqrt{b}$, where $a, b \in \mathbf{N}$.

**4.** **(a)** ✍ Solve $3(x-2)-5(x-3) = 1$.

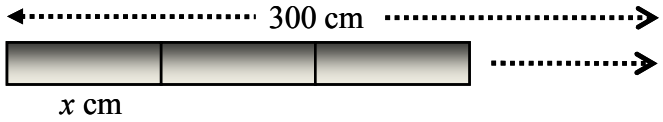
**(b)** **(i)** ✍ Simplify fully

$$(3x-4)(2x^2+5x-2).$$

**(ii)** ✍ List the elements of the solution set of

$$-5 \leq 3x-2 < 7, \quad x \in \mathbf{Z}.$$

**(c)** Rectangular tiles are to be placed side by side on a wall.
Each tile has a length of $x$ cm.
$\frac{300}{x}$ of these tiles are required.




**(i)** If each tile was 1 cm longer, write down an expression in $x$ for the number of tiles that would now be required.

**(ii)** If the longer tiles were used, the number of tiles required would decrease by 10.

✍ Write an equation in $x$ to represent this information.

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

**5.** **(a)** ✍ Given that $c = \sqrt{y - x}$, write $x$ in terms of $c$ and $y$.

**(b)** **(i)** ✍ When $m = \frac{2}{5}$ and $n = \frac{5}{4}$, find the value of $\frac{1}{2m} - \frac{1}{3n}$.

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

**(ii)** ✍ Use factors to simplify $\frac{3x^2 - 19x - 14}{x^2 - 49}$.

**(c)** Let $f$ be the function $f: x \to -x^2 - 4x + 5,\ x \in \mathbf{R}$.

**(i)** ✍ Find the co-ordinates of the points where the graph of $f(x)$ cuts the $x$-axis.

**(ii)** ✍ Solve $f(x) = f(x + 1)$.

**6.** **(a)** Let $h$ be the function $h : x \to \sqrt{x+4}$.

✍ Show that $h(0) > h(-4)$.

**(b)** Let $f$ be the function $f : x \to x^2 + 5x$ and let $g$ be the function $g: x \to x + 2$.

✍ Using the same axes and scales, draw the graph of $f$ and the graph of $g$, for $-5 \leq x \leq 1$, $x \in \mathbf{R}$.

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

**(i)** ✍ The minimum value of $f(x)$

**(ii)** ✍ The values of $x$ for which $f(x) = g(x)$

**(iii)** The range of values of $x$ for which $f(x) \leq g(x)$.

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