Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate Examination 2015
Supplementary Sample Questions

Mathematics

Higher Level

While the 2015 sample paper is intended to give candidates and teachers an idea of the structure, length, and level of difficulty of the 2015 examination paper, this section contains additional questions, generally of a problem-solving nature, to help candidates prepare for the 2015 and subsequent examinations. This section does not represent the overall difficulty or the balance of content that might be expected in a Junior Certificate *Mathematics* examination paper.

Higher Level Question 1 **(Suggested maximum time: 10 minutes)**

Below is a photograph of an island. The highest point on the island is 916 metres above sea level.

Using this information, and the photograph, estimate as accurately as possible the volume of the island that is above sea level. Give your answer in the form $a \times 10^n$, where $n \in \mathbb{Z}$ and $1 \leq a < 10$.

State clearly any assumptions that you make in finding your answer.

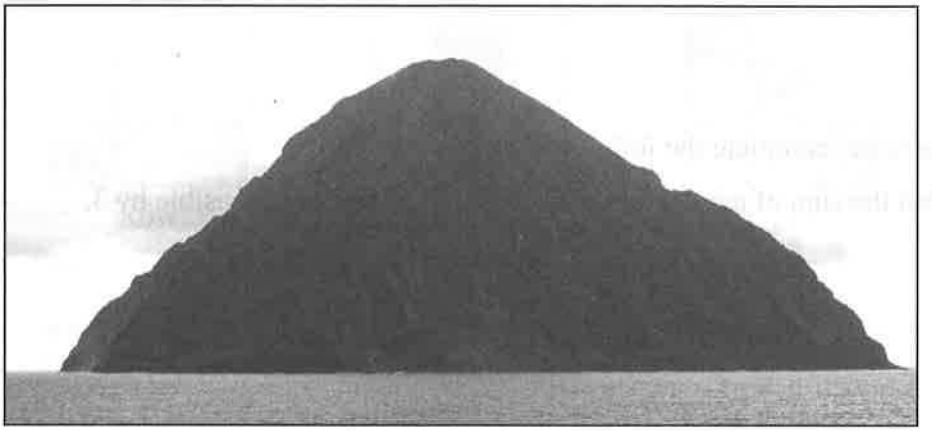


Photo: author: *Karakara* from *ja*, Wikimedia Commons. CC BY-SA 3.0. (Altered)

Higher Level Question 2 **(Suggested maximum time: 10 minutes)**

n is a natural number.

(a) Write down the next 3 natural numbers, in terms of n.

Hence, or otherwise, complete the following.

(b) Show that the sum of any 3 consecutive natural numbers is divisible by 3.

(c) Prove or disprove the following statement:

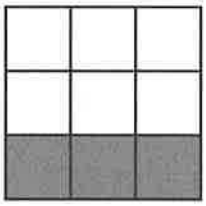
"The sum of any 4 consecutive natural numbers is **never** divisible by 4."

Higher Level Question 3 **(Suggested maximum time: 15 minutes)**

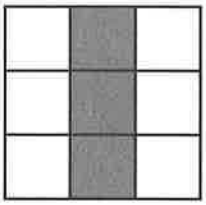
Noughts and Crosses is a two-person game played on a 3×3 grid, made up of 9 small squares.

We call each of the 3 rows, 3 columns, and 2 diagonals a *line*.

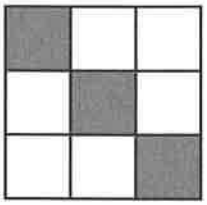
An example of one type of line is shaded in each of the 3×3 grids below.



Row

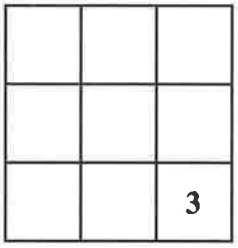


Column



Diagonal

(a) In the 3×3 grid below, write in each small square the number of different lines to which it belongs. One small square is already filled in for you – it belongs to 3 different lines.



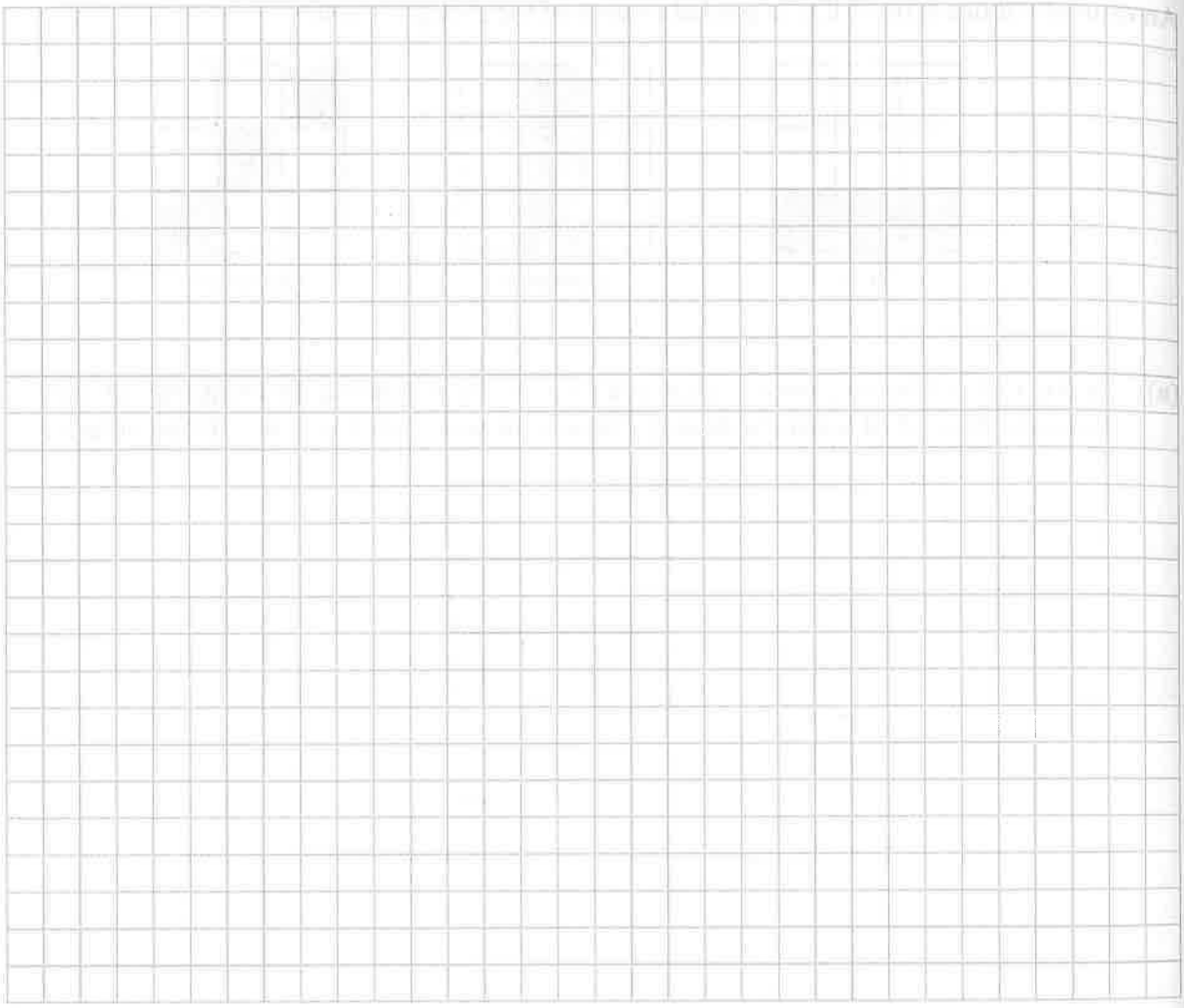
Imagine *Noughts and Crosses* played on an $n \times n$ grid, made up of n^2 small squares, where $n \geq 3, n \in \mathbb{N}$.

A *line* of this grid is one of its rows, one of its columns, or one of its 2 diagonals.

(b) What is the **minimum** number of lines to which each small square of the $n \times n$ grid must belong? Justify your answer.

(c) For certain values of n, the **maximum** number of different lines to which a small square can belong is 4, while for other values of n this **maximum** number is 3.

State for which values of n this maximum number is 4, and for which values of n this maximum number is 3. Justify your answer.



Higher Level Question 4 **(Suggested maximum time: 10 minutes)**

In a shop, the selling price of each item includes VAT at a fixed rate.

Show how the shopkeeper could calculate the amount of VAT charged on an item, if she knows the selling price of the item and the rate of VAT. Give an example if necessary.

Higher Level Question 5 **(Suggested maximum time: 5 minutes)**

Maisy writes down the following theorem:

"If a triangle has sides of length 3 cm, 4 cm, and 5 cm, then it is a right-angled triangle."

(a) State the **converse** of Maisy's theorem.

(b) Is the converse of Maisy's theorem true or false? Justify your answer.

Higher Level Question 6 **(Suggested maximum time: 10 minutes)**

(a) Factorise $5x - 15$ and $6 - 2x$.

$5x - 15 =$

$6 - 2x =$

If A and B are variable quantities, we say that A is **proportional to** B if the fraction $\frac{A}{B}$ is a constant.

(b) Using your answers to part **(a)** above, show that $5x - 15$ is proportional to $6 - 2x$.

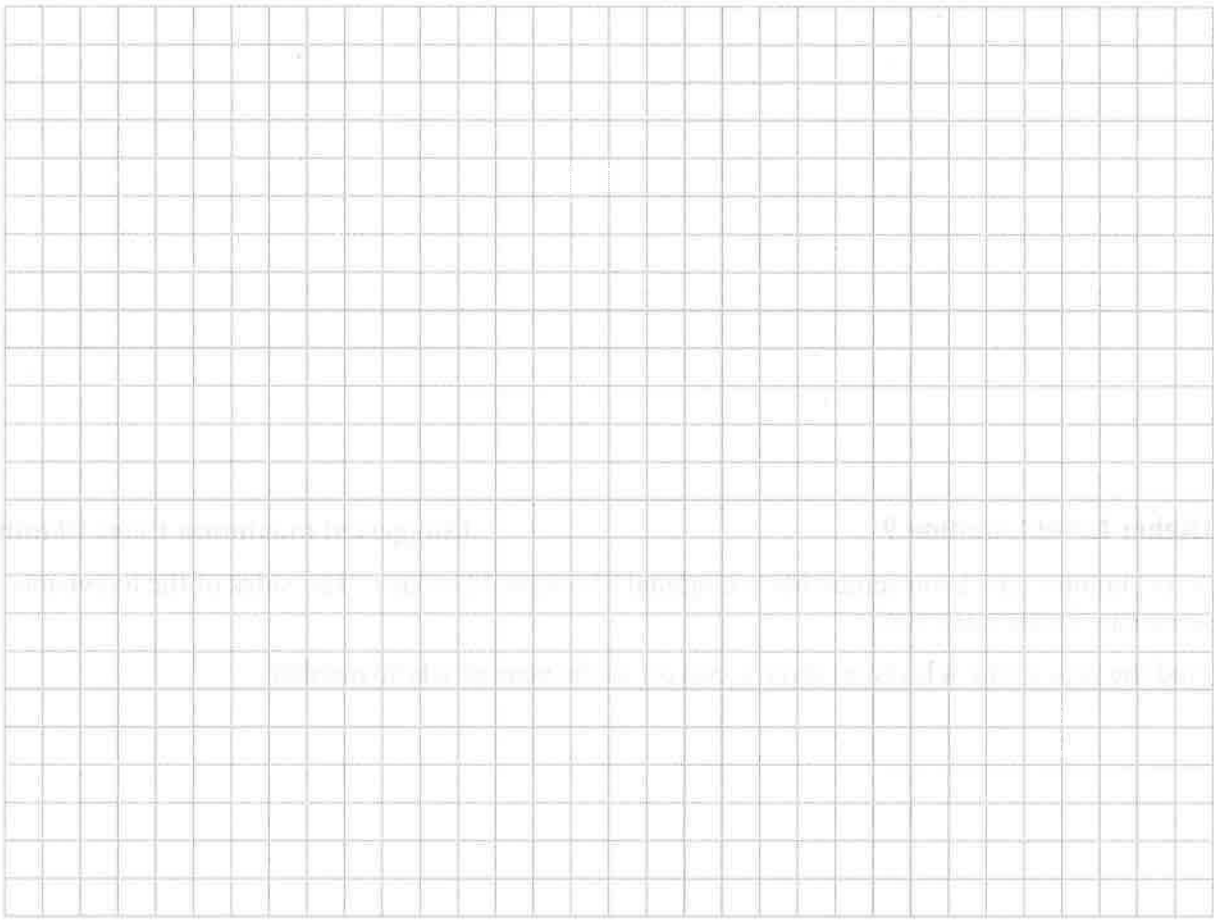
(c) Is $x^2 + 3x + 2$ proportional to $2x + 2$? Justify your answer.

Higher Level Question 7 **(Suggested maximum time: 10 minutes)**

Mark works two jobs – he works in Bob's Bakery and in Ciara's Café. He is paid €11·50 an hour for his work in Bob's Bakery, and €9·30 an hour for his work in Ciara's Café.

In one week he worked a total of 34 hours and was paid a total of €362·40.

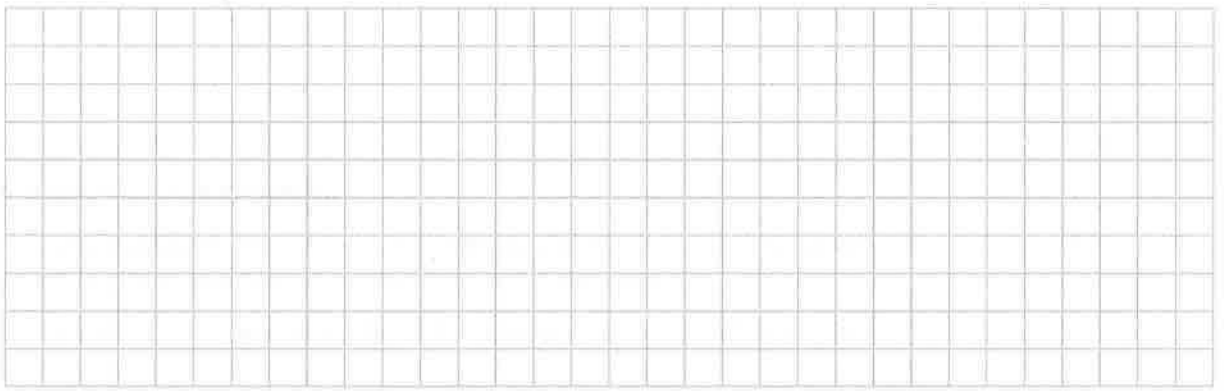
Find how many hours he worked in Bob's Bakery in this week.



Higher Level Question 8 **(Suggested maximum time: 5 minutes)**

(a) Give an **example** of a data set where this statement is false:

"minimum < **mean** < maximum".



(b) **Describe** for what kind of data sets this statement is false:

"minimum < **mean** < maximum".

Higher Level Question 9 **(Suggested maximum time: 10 minutes)**

A rectangular television screen has a diagonal of length 42 inches. The sides of the television screen are in the ratio 16:9.

Find the area of the television screen, correct to the nearest whole number.

Note to readers of this document:

These sample questions are intended to help candidates and teachers prepare for the June 2015 and subsequent Junior Certificate examinations in *Mathematics*.

They are intended to supplement the 2015 Sample Paper issued at Higher Level.