Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate Examination 2016

Mathematics

Paper 1
Ordinary Level

Friday 10 June – Afternoon 2:00 to 4:00

300 marks

Examination number

Centre stamp

Running total	

For examiner			
Question	Mark	Question	Mark
1		11	
2		12	
3		13	
4		14	
5			
6			
7			
8			
9			
10		Total	

Grade

Instructions

There are 14 questions on this examination paper. Answer **all** questions.

Questions do not necessarily carry equal marks. To help you manage your time during this examination, a maximum time for each question is suggested. If you remain within these times you should have about 10 minutes left to review your work.

Write your answers in the spaces provided in this booklet. You may lose marks if you do not do so. You may ask the superintendent for more paper. Label any extra work clearly with the question number and part.

The superintendent will give you a copy of the *Formulae and Tables* booklet. You must return it at the end of the examination. You are not allowed to bring your own copy into the examination.

You will lose marks if you do not show all necessary work.

You may lose marks if you do not include the appropriate units of measurement, where relevant.

You may lose marks if you do not give your answers in simplest form, where relevant.

Write the make and model of your calculator(s) here:

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

(a) **(i)** Write down the **biggest** possible six-digit number.

(ii) Write down the **smallest** possible six-digit number that does **not** start with 0.

(b) Write in the missing number in each of the following sequences.

(i) 3, 5, 7, 9, ☐.

(ii) 1, 4, 9, 16, ☐.

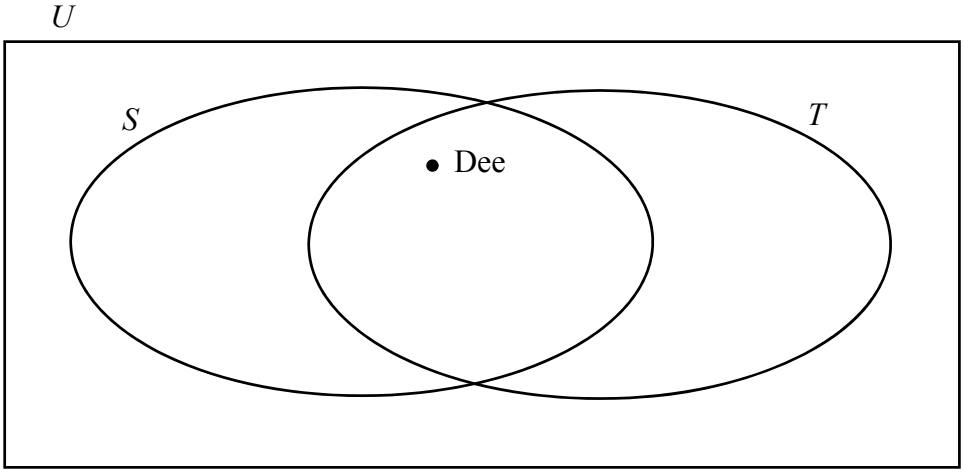
(iii) 2, 4, 8, 16, ☐.

(iv) ☐, 10, 13, 16, 19.

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

Dee, Máire, Ray, Evan, and Fiona all use Snapchat (S).
Dee, Máire, and Ray use Twitter (T).
Zach doesn't use Snapchat or Twitter.

(a) Use this information to complete the Venn diagram below, where U is the universal set.



(b) List the elements of each of the following two sets, where S' is the complement of the set S.

(i) $S \cap T =$

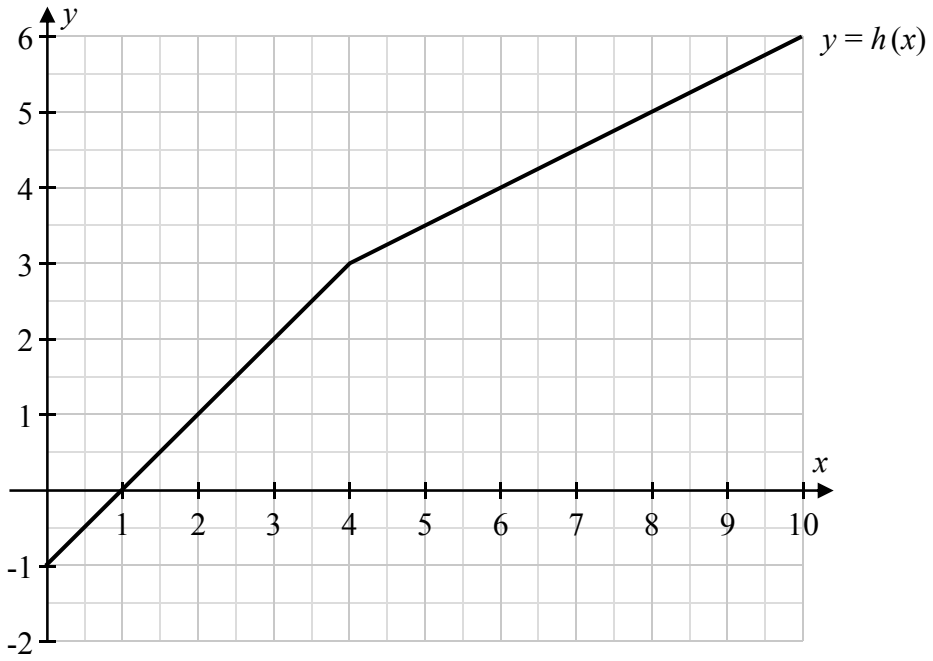
(ii) $S' =$

(c) Put a tick (✓) in the correct box in each row of the table below, to show whether each statement is true or false.

Statement	Tick **one** only for each statement	
	True	**False**
$\# S = 3$		
Dee $\in T$		
$S \cup T = T \cup S$		
$T \subset S$		
$S \setminus T = \{\ \}$		

Question 3 **(Suggested maximum time: 5 minutes)**

The graph of the function $y = h(x)$ is shown on the co-ordinate grid below.
The graph is made up of two line segments.

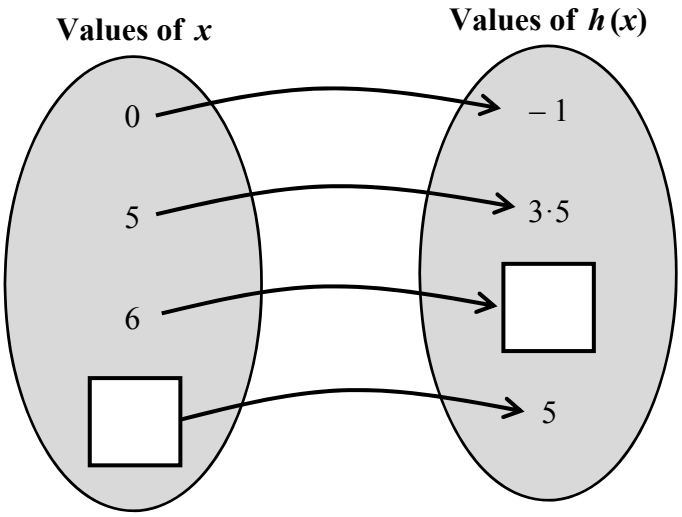


(a) Use the graph to answer the following questions.

(i) Find the value of $h(4)$. $h(4) =$ ☐

(ii) What number must ☺ represent, if $h(☺) = 1$? ☺ = ☐

(b) Use the graph above to fill in the two missing values in the arrow diagram below, which shows the values of $h(x)$ for the given values of x.



Question 4 **(Suggested maximum time: 5 minutes)**

Gary's gross income is €2450 per month (i.e. before tax is deducted).
He pays tax at a rate of 20% on his gross income.

(a) Work out Gary's **gross tax** per month.

Gary has a tax credit of €275 per month.

(b) Work out Gary's **net income** per month (i.e. after tax is deducted).

Question 5 **(Suggested maximum time: 10 minutes)**

Paula runs a plumbing business.

(a) She charges a basic call-out fee of €40.
She also charges €30 for each hour, or part of an hour, that a job lasts.

Paula spent 2 hours and 45 minutes on a job.
Work out the total charge for this job.

(b) Paula is ordering parts from the UK.
One part costs £24·83 sterling.
The exchange rate is €1 = £0·71 sterling.

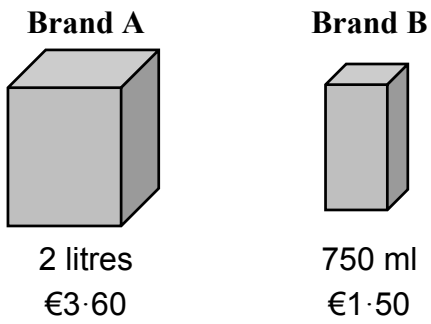
Work out the cost of this part, in euro. Give your answer correct to two decimal places.

(c) The total charge for the parts, **before VAT**, is €330.
€75·90 VAT is charged on the parts.

Find the **percentage rate of VAT** charged on the parts.

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

A shop sells two brands of orange juice, **Brand A** and **Brand B**, as shown.



(a) Find the price per litre of **Brand A** (i.e. the price of 1 litre of Brand A).

(b) Find which brand, **A** or **B**, is cheaper, per litre. Show all of your work.

Cheaper brand, per litre =

(c) Samantha needs to buy **at least 5 litres** of orange juice.

Find the **lowest price** that she could pay to do this.
She can buy **Brand A**, **Brand B**, or a **combination** of both.
Justify your answer fully.

Lowest price =

Question 7 **(Suggested maximum time: 5 minutes)**

The attendance at the Ireland v Romania game in the 2015 Rugby World Cup was $89\,267$.

(a) Hugo rounded $89\,267$ to the **nearest 10**.
Write down Hugo's estimate of the attendance.

(b) Danny rounded $89\,267$ to **2 significant figures**.
Write down Danny's estimate of the attendance.

(c) Jenny rounded $89\,267$ to $89\,300$.
Write down Jenny's estimate in the form $\boldsymbol{a \times 10^n}$, where $1 \leq a < 10$ and $n \in \mathbb{N}$.

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

(a) Multiply out and simplify $(x + 9)(2x - 1)$.

(b) Factorise fully $3ax + ay + 3cx + cy$.

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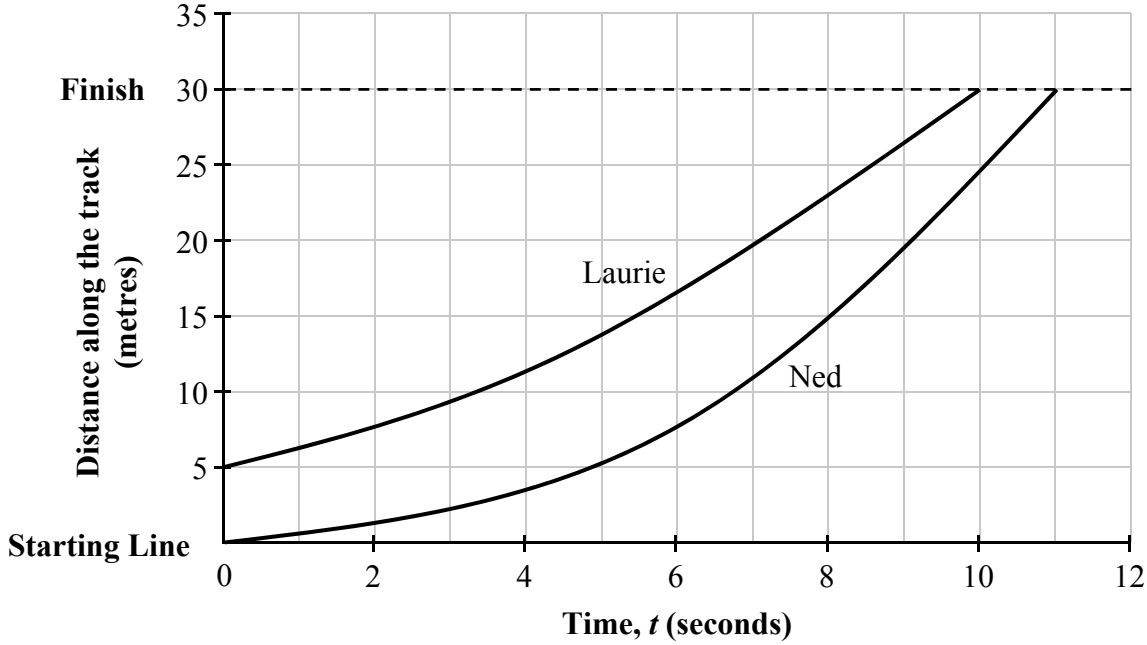
Question 9 **(Suggested maximum time: 10 minutes)**

Ned and Laurie had a race. Laurie was given a head start, so she ran a shorter distance than Ned. The graphs below show the distance along the track, in metres, that each of them was from the starting line after t seconds of the race.



(a) What **distance** did **Ned** run during the race? Ned's distance = ☐ m

(b) What **distance** did **Laurie** run during the race? Laurie's distance = ☐ m

(c) How many **seconds** did it take **Laurie** to finish the race? Answer = ☐ seconds

(d) Work out **Laurie's** mean **speed** during the race, in metres per second.

(e) Ned says: "I ran at the same speed for the whole race."
Is Ned correct? Give a reason for your answer.

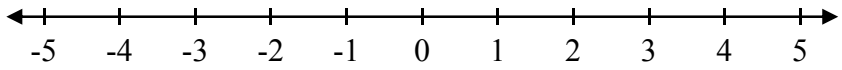
Answer:

Reason:

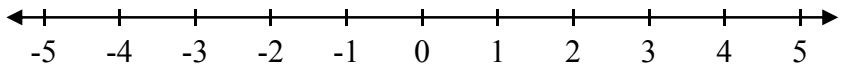
Question 10 **(Suggested maximum time: 5 minutes)**

Graph each of the following inequalities on the number line given.
Note: x is an element of a different set ($\mathbb{N}$, $\mathbb{Z}$, or $\mathbb{R}$) in each case.

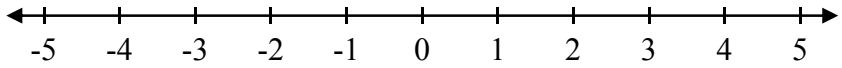
(a) $x < 4$, where $x \in \mathbb{N}$.



(b) $x < 4$, where $x \in \mathbb{Z}$.



(c) $x < 4$, where $x \in \mathbb{R}$.



Question 11 **(Suggested maximum time: 5 minutes)**

Fill in the table by writing each expression in the form 2^p, where $p \in \mathbb{N}$.
One has already been filled in for you.

Expression	In the form 2^p, where $p \in \mathbb{N}$
$8 =$	2^3
$32 =$	
$2 \times 2 \times 2 \times 2 \times 2 \times 2 =$	
$2^7 \times 2^{10} =$	
$(2^6)^4 =$	

Question 12 **(Suggested maximum time: 10 minutes)**

The letter J stands for Jake's age, in years.

(a) Fill in the table by writing an algebraic term, in terms of J, to match each description. Two have already been filled in for you.

Description	Algebraic term
Jake's age now.	J
Jake's age in 2 years' time.	$J + 2$
Jake's age in 5 years' time.	
Jake's age 4 years ago.	
Twice Jake's age.	
One third of Jake's age.	

(b) Solve this equation:

$$5M + 2 = 2M + 35.$$

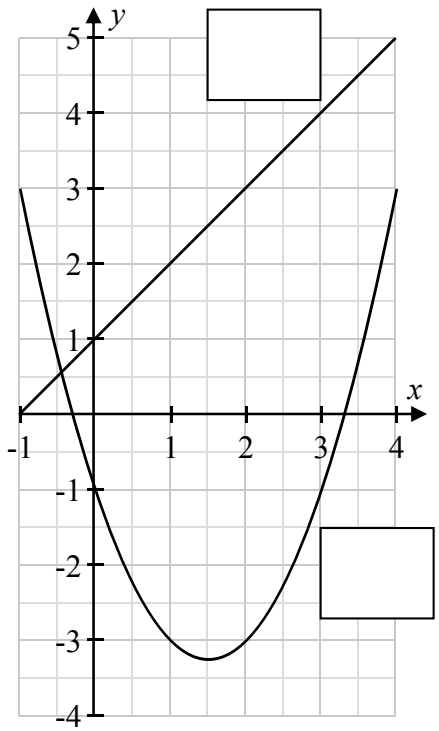
Question 13 **(Suggested maximum time: 10 minutes)**

The graphs of the functions $f(x)$ and $h(x)$ are shown on the co-ordinate grid on the right.

The functions are:

$$f(x) = x + 1$$

$$h(x) = x^2 - 3x - 1.$$



(a) Match the functions to the graphs by writing $f(x)$ or $h(x)$ in the box next to the corresponding graph.

(b) For one of the functions above, give a reason for your answer in part **(a)**.

Function:

Reason for your answer:

(c) Use the graphs to estimate the solution of the equation $x + 1 = x^2 - 3x - 1$, between -1 and 4.

$x =$

(d) Work out the value of $h(8)$.

Remember that $h(x) = x^2 - 3x - 1$.

Question 14 **(Suggested maximum time: 10 minutes)**

(a) **(i)** Factorise $x^2 + 6x - 7$.

$x^2 + 6x - 7 = (\ x + 7\ )(\qquad\qquad)$

(ii) Using the factors from part **(a) (i)**, or otherwise, solve the equation:

$$x^2 + 6x - 7 = 0.$$

(b) Solve the following simultaneous equations.

$$3x + 2y = 39$$
$$x + 2y = 25$$

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