2011. M228



Coimisiún na Scrúduithe Stáit State Examinations Commission

### Leaving Certificate Examination, 2011

# Mathematics (Project Maths – Phase 2)

### Paper 2

### Ordinary Level

Monday 13 June Morning 9:30 – 12:00

300 marks

Examination number

Centre stamp

For ex	aminer
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
Total	

Grade

Running total

#### Instructions

There are **two** sections in this examination paper.

Section A	Concepts and Skills	150 marks	6 questions
Section B	Contexts and Applications	150 marks	2 questions

Answer all eight questions, as follows:

In Section A, answer:

Questions 1 to 5 and

#### either Question 6A or Question 6B.

In Section B, answer Question 7 and Question 8.

Write your answers in the spaces provided in this booklet. There is space for extra work at the back of the booklet. You may also 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 booklet of *Formulae and Tables*. You must return it at the end of the examination. You are not allowed to bring your own copy into the examination.

Marks will be lost if all necessary work is not clearly shown.

Answers should include the appropriate units of measurement, where relevant.

Answers should be given in simplest form, where relevant.

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

#### **Section A**

Answer all six questions from this section.

#### **Question 1**

**(a)** 

(25 marks) The points A(6, 1) and B(2, -1) are shown 3 on the diagram. 2 Find the equation of the line AB. A\_ 1 2 • *B* 3 -2 1 4 5 -1 6 -1 -2 -3 -4

#### The line *AB* crosses the *y*-axis at *C*. Find the co-ordinates of *C*. **(b)**

Find the ratio  $\frac{|AB|}{|AC|}$ , giving your answer in the form  $\frac{p}{q}$ , where p and q are whole numbers. (c)

running page Page 3 of 19 Leaving Certificate 2011

#### Question 2

A circle  $c_1$  has centre (0, 0) and diameter 8 units.

(a) Show  $c_1$  on a co-ordinate diagram.

#### (b) Find the equation of $c_1$ .


(c) Prove that the point (3, 2) is inside  $c_1$  and that the point (3, 3) is outside it.



(d) Another circle,  $c_2$ , has centre (0, 1) and just touches the circle  $c_1$ . Show  $c_2$  on your diagram in part (a) above and find the equation of  $c_2$ .



#### (25 marks)

#### **Question 3**

A plastic toy is in the shape of a hemisphere. When it falls on the ground, there are two possible outcomes: it can land with the flat side facing down or with the flat side facing up. Two groups of students are trying to find the probability that it will land with the flat side down.

(a) Explain why, even though there are two outcomes, the answer is not necessarily equal to  $\frac{1}{2}$ .

 	 								_						

- (b) The students estimate the probability by experiment. Group A drops the toy 100 times. From this, they estimate that it lands flat side down with probability 0.76. Group B drops the toy 500 times. From this, they estimate that it lands flat side down with probability 0.812.
  - (i) Which group's estimate is likely to be better, and why?

(ii) How many times did the toy land flat side down for Group B?

(iii) Using the data from the two groups, what is the best estimate of the probability that the toy lands flat side down?

page running

#### **Question 4**

Below is a stem-and-leaf plot showing the number of sweets in each of nineteen packets of sweets.

- 2 2 2 3 5 6 7 6 8 8 89 9 9 9 9 0 0 0 0 1 1 3 2 Key: 2 | 5 means 25 sweets.
- (a) What is the *median* number of sweets?

Answer:

#### (b) What is the *range* of the data?

(c) Find the *interquartile range* of the data.

(d) The sentences below describe the type of data shown in the stem-and-leaf plot above. Delete the incorrect word in each pair of brackets.

"This is a set of [univariate / bivariate] data. The data are [discrete / continuous]."

#### (25 marks)

#### **Question 5**

(a) Find the volume of a cylinder of radius 6 mm and height 20 mm.

Give your answer in two forms, as follows:

- (i) in terms of  $\pi$ , and
- (ii) correct to two decimal places.



(b) A solid rectangular block measures  $60 \text{ mm} \times 35 \text{ mm} \times 20 \text{ mm}.$ 

Cylindrical holes of radius 6 mm are drilled, one at a time, through the block, in the direction shown.

After how many holes will more than half of the original block have been removed?





Project Maths, Phase 2 Paper 2 – Ordinary Level

#### **Question 6**

Answer either 6A or 6B.

#### **Question 6A**

(a) Show clearly how to construct the centroid of the triangle below.
(Note: all instruments are permitted. If you are using measurements, show your measurements and calculations.)



(b) State what is meant by the word *axiom*, and explain why axioms are needed in order to prove theorems.



OR

#### **Question 6B**

In the diagram, *ABCD* is a cyclic quadrilateral and *ABCF* is a parallelogram.

Show that *DEFG* is a cyclic quadrilateral.



										 					_	 

page running

Answer Question 7 and Question 8.

#### **Question 7**

One of the items of information gathered in a census is the size of every household. The size of the household is the number of people living in it. The following table shows the number of "Permanent Private Households" of each size in Ireland, according to the census held in various years from 1926 to 2006. For the purposes of this question, you should ignore the fact that there are also other types of household in Ireland.

	1	2	3	4	5	6	7	8	9	≥10	All sizes
	person	people	people	people	people	people	people	people	people	people	
1926	51,537	98,437	102,664	96,241	82,324	65,310	48,418	33,297	21,089	23,361	622,678
1946	68,881	118,738	116,401	103,423	84,437	62,955	44,028	28,503	17,970	17,318	662,654
1966	88,989	139,541	114,436	97,058	79,320	61,068	42,512	27,098	16,550	20,732	687,304
1986	176,017	195,647	143,142	155,534	127,336	83,657	44,139	23,088	8,438	7,884	964,882
2006	326,134	413,786	264,438	243,303	136,979	54,618	15,141	5,050	1,719	1,128	1,462,296

(Source: Central Statistics Office, http://www.cso.ie/statistics/HousingandHouseholds.htm)

Use the information in the table to answer the following: **(a)** 

In 1966, how many households had exactly 8 people living in them? **(i)** 

Answer:

In 1986, how many **people** lived in households of exactly 7 people? (ii)

(iii) Calculate, correct to one decimal place, an estimate of the mean number of people per household in 2006.

eaving	Certificate	2011	

(75 marks)

(b) Conor, Fiona, and Ray were each asked, separately, to make a presentation about the patterns they could see in the data. They each spoke for one minute and showed one slide. The slides they made are shown below. By considering the slides, state the main point or points that each of them was trying to make.





Fi	on	a w	28	trv	ino	to	sha	าม				
11	011	u vv	us	u y	<u>6</u>	, 10	5110		•••			







Project Maths, Phase 2 Paper 2 – Ordinary Level

(c) A household is randomly selected from among all the households in 2006. What is the probability that it has seven or eight people?

(d) 1000 households are to be randomly selected from among all the households in 2006. Let X represent the number of 4-person households selected. Find E(X), the expected value of X.

(e) Mary wonders whether there are differences in size between the households in South Dublin and those in Dublin City. She gets the relevant data for 2006 and makes the following charts.



(i) Describe what differences there are, if any, between the two distributions above.

## (ii) There are approximately 81,000 households in South Dublin. Approximately how many people live in 4-person households in South Dublin?

#### (iii) What is the median size for a household in Dublin City?

(iv) A person is selected at random from among all those living in Dublin City. Which is more likely: that the person lives alone, or that the person lives in a three-person household? Explain your answer.

page	running

#### (75 marks)

#### **Question 8**

The tables in a primary school classroom are like the one in the photograph. The top of the table is in the shape of a trapezium, as shown in the diagram below the photograph.

The measurements are as follows:

$$|AD| = 140 \text{ cm}$$
  
 $|BC| = 70 \text{ cm}$   
 $|AB| = |DC|$   
 $|\angle ADC| = |\angle DAB| = 60^{\circ}.$ 



(a) Show that |AB| = 70 cm.

			_												

A

(b) Find the distance between the parallel sides [*AD*] and [*BC*]. Give your answer in centimetres, correct to one decimal place.



Some of the tables are painted with a yellow and (c) blue pattern as shown. What fraction of the surface is yellow? Show your work.





Two of the tables, painted as in part (c) above, are arranged to form a hexagon. (d) Prove that the yellow area is a rectangle.



Leaving Certificate 2011

Project Maths, Phase 2 Paper 2 – Ordinary Level (e) Twelve of the tables are arranged as six hexagons in a classroom, as shown in the diagram. The clearance between neighbouring tables is 2 metres and the clearance to the side walls is 1.5 metres, as shown.

Find the total width of the classroom, in metres, correct to two decimal places.







(f) The tops of the trapezium tables are made of wood. The wood is 1.6 cm thick. Each cubic centimetre of the wood weighs 0.75 grams. Each table also has a metal frame weighing 6 kilograms. How much does each table weigh? Give your answer in kilograms, correct to one decimal place.


page	running

### You may use this page for extra work.

-																				
																	n		runn	ina

### You may use this page for extra work.

	 	 		 		 		 _										
								 					 			_		
															n		rupp	ing



Leaving Certificate 2011 – Ordinary Level

### Mathematics (Project Maths – Phase 2) – Paper 2

Monday 13 June Morning 9:30 – 12:00