2010. M128



Coimisiún na Scrúduithe Stáit State Examinations Commission

# Leaving Certificate Examination

# Mathematics (Project Maths) Paper 2

# Ordinary Level

Monday 14 June Morning 9:30 – 12:00

300 marks

Examination number

Centre stamp

Running total

For exa	aminer
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

Grade

#### Instructions

There are <b>three</b>	sections in this examination paper:		
Section 0	Area and Volume (old syllabus)	50 marks	1 question
Section A	Concepts and Skills	125 marks	5 questions
Section B	Contexts and Applications	125 marks	3 questions

Answer **all nine** questions, as follows: In Section 0, answer Question 1. In Section A, answer Questions 2, 3, 4, 5 and 6. In Section B, answer: Question 7

Question 7 Question 8 either Question 9A or Question 9B.

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.

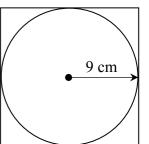
Answers should include the appropriate units of measurement, where relevant.

Answers should be given in simplest form, where relevant.

Section 0

- (a) A circle is inscribed in a square as shown. The radius of the circle is 9 cm.
  - (i) Find the perimeter of the square.

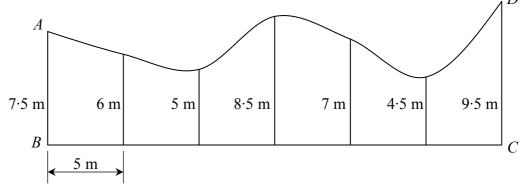
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#### (ii) Calculate the area of the square.

Area and Volume (old syllabus)

(b) The diagram shows a sketch of a field ABCD that has one uneven edge. At equal intervals of 5 m along [BC], perpendicular measurements are made to the uneven edge, as shown on the sketch.



(i) Use Simpson's rule to estimate the area of the field.

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# Project Maths, Paper 2 – Ordinary Level

(50 marks)

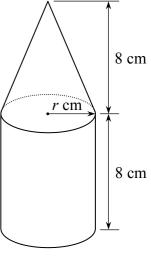
# (ii) The actual area of the field is 200 m<sup>2</sup>. Find the percentage error in the estimate.

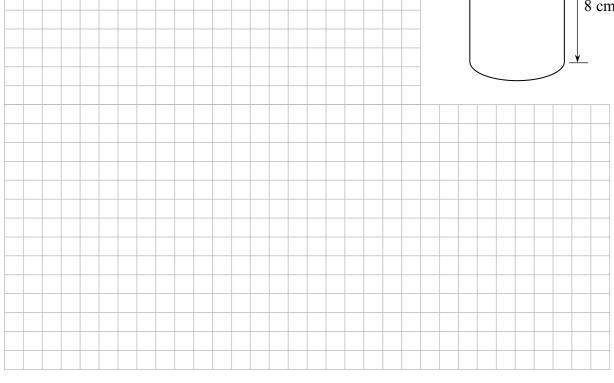

(c) (i) The diameter of a solid metal sphere is 9 cm. Find the volume of the sphere in terms of  $\pi$ .


(ii) The sphere is melted down. All of the metal is used to make a solid shape which consists of a cone on top of a cylinder, as shown in the diagram.

The cone and the cylinder both have height 8 cm. The cylinder and the base of the cone both have radius r cm.

Calculate *r*, correct to one decimal place.





#### Section A

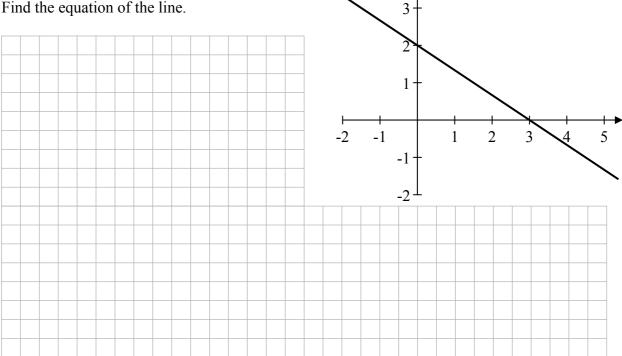
(25 marks)

Answer all five questions from this section.

#### **Question 2**

A line crosses the *x*-axis at x = 3**(a)** and the *y*-axis at y = 2.

Find the equation of the line.

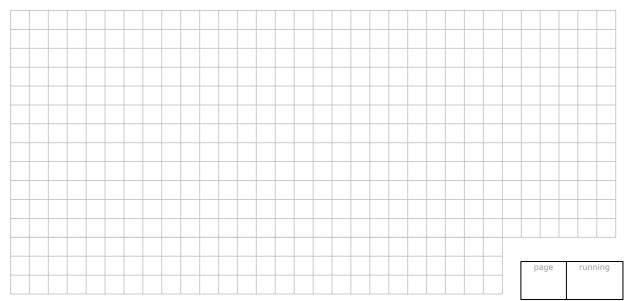


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The equations of two lines  $l_1$  and  $l_2$  are: **(b)** 

$$l_1: x+3y=8$$
  
 $l_2: 6x-2y=15.$ 

Determine whether these lines are perpendicular. Justify your answer clearly.

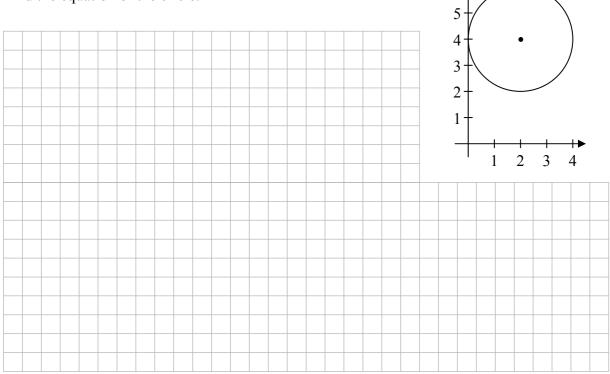


- (a) A circle has centre (0, 0) and passes through the point (3, 4).
  - (i) Find the equation of the circle.


#### (ii) Find the co-ordinates of the two points at which the circle crosses the *y*-axis.

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(b) A circle has centre (2, 4) and touches the *y*-axis. Find the equation of the circle.



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(a) Using a calculator, or otherwise, find the mean and standard deviation of the data in the following frequency table.

x	20	30	40	50
f	16	38	26	20

Mean =	Standard deviation =
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(b) Below is a stem-and-leaf plot of the heights of a group of students, in centimetres.

13	3	6 0 6 1 5				
13	5	6				
14	0	0	1			
14	6	6	7	8		
15	0	1	2	2	3	3
15	5	5	6	7		

Key: 13 | 3 means 133 cm.

(i) How many students are in the group?

Answer:

#### (ii) What is the *range* of heights in the group?


#### (iii) What percentage of the students are between 145 cm and 154 cm in height?

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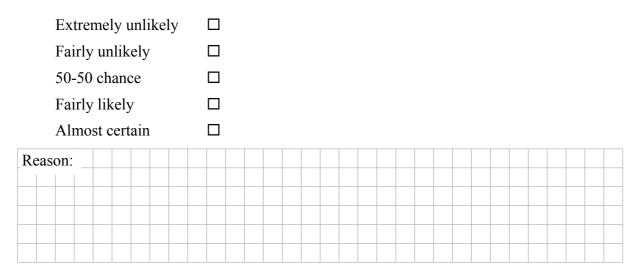
- (a) Helen has enough credit to download three songs from the internet. There are seven songs that she wants.
  - (i) How many different possible selections of three songs can she make?


# (ii) If there is one particular song that she definitely wants, how many different selections can she now make?

(b) (i) Two fair coins are tossed. What is the probability of getting two heads?

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(ii)	Tw	o fa	ir co	oins	are	e to	sse	d 1	00	0 ti	me	es.	Hc	W (	ofte	n w	oul	d ye	ou e	xpe	ect	to	get	tw	vo ł	nead	ds?	
(ii)		o fa		oins	are	e to	sse	d 1	00	0 ti	me	es.	Hc	W (	ofte	n w	voul	d yo	ou e	xpe	ect	to	get	tw	vo ł	nead	ds?	

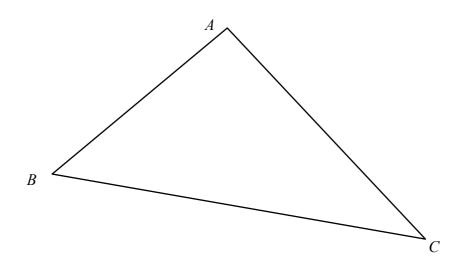
(c) Síle hands Pádraig a fair coin and tells him to toss it ten times. She says that if he gets ten heads then she will give him a prize. The first nine tosses are all heads. How likely is it that the last toss will also be a head? Tick the correct answer, and give a reason.



#### (25 marks)

#### **Question 6**

The diagram shows a triangle ABC in which |AB| = 6 cm, |CB| = 10 cm, and  $|\angle ABC| = 50^{\circ}$ .



### (a) Calculate the area of triangle ABC, correct to the nearest cm<sup>2</sup>.

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(b) Calculate the length of [AC], correct to one decimal place.

(c) The triangle A'BC' is the image of triangle ABC under the enlargement with centre B and scale factor 3. Find the area of A'BC', correct to the nearest cm<sup>2</sup>.

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(40 marks)

Answer Question 7, Question 8, and either Question 9A or Question 9B.

#### Question 7

**Section B** 

**Probability and Statistics** 

The table below gives motor insurance information for fully licensed, 17 to 20-year-old drivers in Ireland in 2007. All drivers who had their own insurance policy are included.

	Number of drivers	Number of claims	Average cost per claim
Male	9634	977	€6108
Female	6743	581	€6051

(Source: adapted from: Financial Regulator. Private Motor Insurance Statistics 2007.)

Questions (a) to (e) below refer to drivers in the table above only.

(a) What is the probability that a randomly selected **male** driver made a claim during the year? Give your answer correct to three decimal places.

(b) What is the probability that a randomly selected **female** driver made a claim during the year? Give your answer correct to three decimal places.


(c) What is the *expected value* of the cost of claims on a male driver's policy?

(d) What is the *expected value* of the cost of claims on a female driver's policy?

(e) The male drivers were paying an average of €1688 for insurance in 2007 and the female drivers were paying an average of €1024. Calculate the average surplus for each group, and comment on your answer.

(Note: the surplus is the amount paid for the policy minus the expected cost of claims.)

	Male	Female
Comment:		

(f) A 40-year-old female driver with a full license has a probability of 0.07 of making a claim during the year. The average cost of such claims is €3900. How much should a company charge such drivers for insurance in order to show a surplus of €175 per policy?


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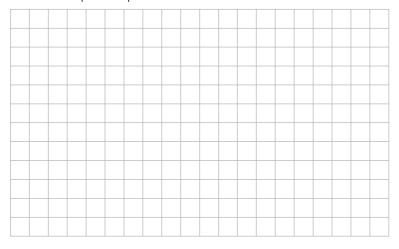
Windows are sometimes in the shape of a pointed arch, like the one shown in the picture.

A person is designing such an arched window. The outline is shown in the diagram below the picture.

The centre for the arc *AB* is *C* and the centre for the arc *AC* is *B*. |BD| = 2.4 metres and |DE| = 1.8 metres.

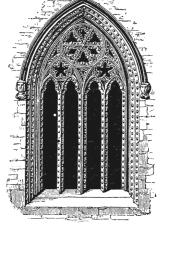
(a) Show that  $|\angle ABC| = 60^\circ$ .

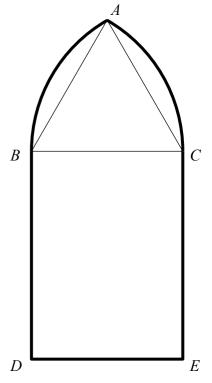
**Question 8** 



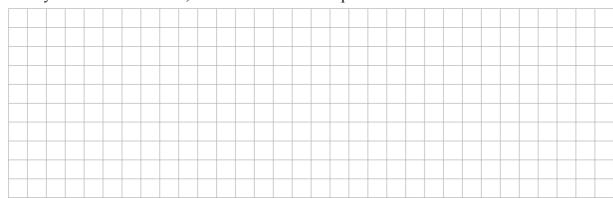
#### (b) Find the length of the arc *AB*. Give your answer in metres, correct to three decimal places.

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(c) Find the length of the perimeter of the window. Give your answer in metres, correct to two decimal places.



### (d) Find the height of the window.

Give your answer in metres, correct to two decimal places.

(e) Make an accurate scaled drawing below of the outline of the window, using the scale 1:30. That is, 1 cm on your diagram should represent 30 cm in reality.

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Students in two schools – one in County Kerry and the other in County Offaly – were arguing about which county had the nicest weather in the summer. They agreed to record the highest temperature at each school on ten randomly selected days during the summer of 2009. The results were as follows:

Temperatu	ire at Kerry sc	chool (/°C)	Temperatu	ure at Offaly s	chool (/°C)
18.5	17.2	17.8	22.1	18.0	19.1
17.6	17.5	17.2	17.2	18.4	18.6
17.1	16.9	16.9	19.8	19.0	17.6
17.1			17.0		

(a) Construct a back-to-back stem-and-leaf plot of the above data.

#### (b) State two differences between the two distributions.

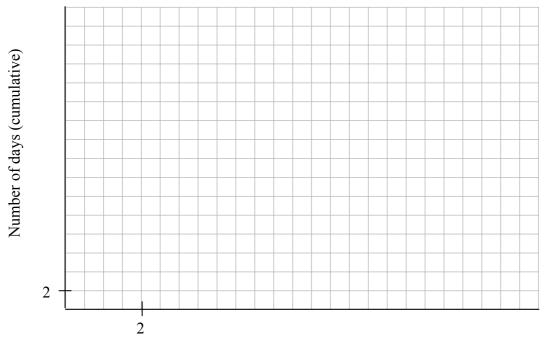
Difference 1:												
Difference 2:												

#### (c) Perform a *Tukey Quick Test* on the data, stating clearly what can be concluded.

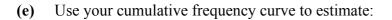
(d) The students in Offaly looked also at the amount of sunshine. They recorded the number of hours of sunshine each day in July 2009. The data are summarised in the table below.

Hours of sunshine	$\leq 2$	≤4	$\leq 6$	$\leq 8$	≤ 10	≤ 12
Number of days	11	12	20	29	30	31

Draw a cumulative frequency curve to represent this data, using the scale indicated.



#### Hours of sunshine



- (i) the median number of hours of sunshine
- (ii) the number of days with **more than** 7 hours of sunshine.



(f) The mean amount of sunshine per day in Offaly in July generally is 4.24 hours. A day is chosen at random from the days in July 2009, as described in part (d) above. What is the probability that the amount of sunshine on that day was less than the mean?


(Data in this question adapted from Monthly Weather Bulletin, July 2009, at www.met.ie.)

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#### **Question 9B**

(45 marks)

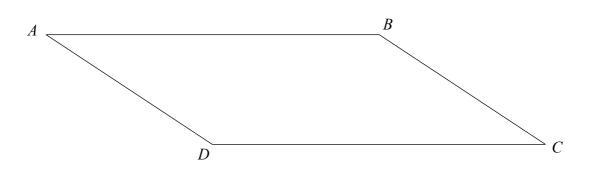
(a) The photograph shows the *Dockland* building in Hamburg, Germany.

The diagram below is a side view of the building. It is a parallelogram.

The parallelogram is 29 metres high. The top and bottom edges are 88 metres long.



Photo by NatiSythen. Wikipedia Commons. License: CC-SA



#### (i) Find the area of this side of the building.

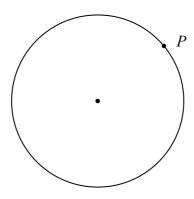
(ii) If |BD| = |AD|, find |BC|.



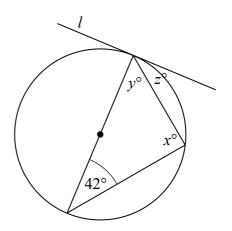

#### (iii) The lines BC and AD are parallel. Find the distance between these parallel lines.

(b) There is a theorem on your geometry course that can be used to construct the tangent to a circle at a given point on the circle. State this theorem and use it to construct the tangent to the circle shown at the point *P*.

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- (c) In the diagram, the line l is a tangent to the circle. Find the values of x, y and z.
  - x = \_\_\_\_\_ y = \_\_\_\_\_ z = \_\_\_\_\_



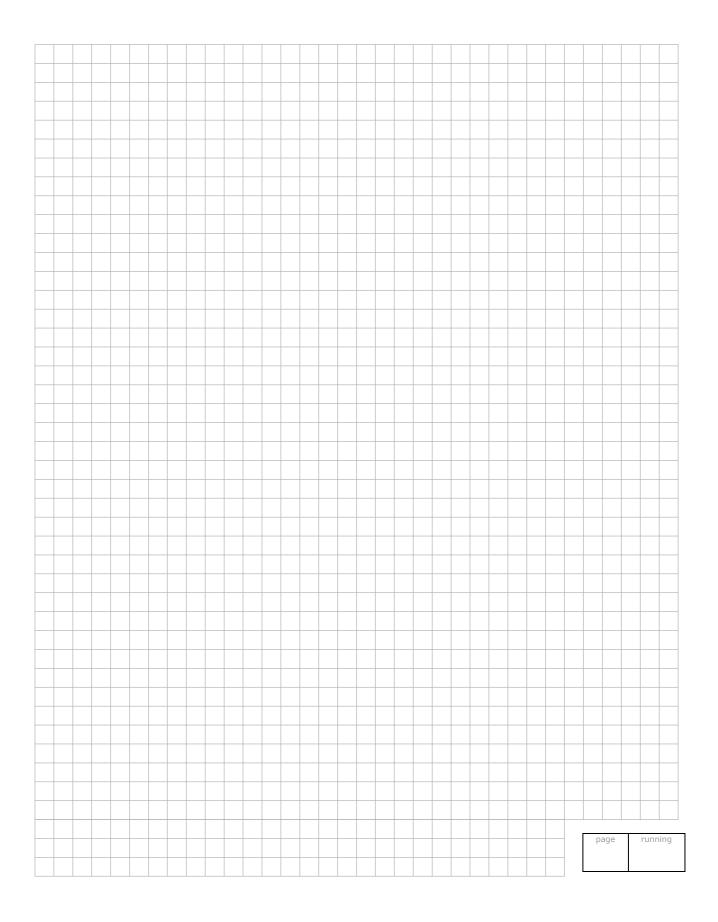
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Leaving Certificate – Ordinary Level

Mathematics (Project Maths) – Paper 2

Monday 14 June Morning 9:30 – 12:00