



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2015

Marking Scheme

Mathematics

Foundation Level

Note to teachers and students on the use of published marking schemes

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

Future Marking Schemes

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

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Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2015

Mathematics

Foundation Level

Friday 5 June Afternoon 2:00 – 4:30

300 marks

Model Solutions

Note: The model solutions for each question are not intended to be exhaustive – there may be other correct solutions. Any examiner unsure of the validity of the approach adopted by a particular candidate to a particular question should contact his / her advising examiner.

Instructions

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

Section A	200 marks	8 questions
Section B	100 marks	2 questions

Answer all ten questions.

Write your answers in the spaces provided in this booklet. You may lose marks if you do not do so. 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 *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 all necessary work is not clearly shown.

You may lose marks if the appropriate units of measurement are not included, where relevant.

You may lose marks if your answers are not given in simplest form, where relevant.

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

Answer **all eight** questions from this section.

Question 1

(25 marks)

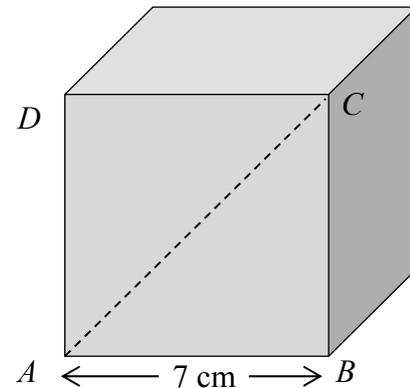
(a) The diagram shows a cube with 7 cm sides.

(i) Find the volume of the cube.

$$7^3 = 343 \text{ cm}^3$$

(ii) Find the length of the diagonal $[AC]$, correct to one decimal place.

$$\sqrt{7^2 + 7^2} = 9.9 \text{ cm}$$



(b) Which number in the list below does **not** have the same value as the other three numbers? Give a reason for your answer.

0.25

$\frac{1}{4}$

2.5

25%

Answer: 2.5

Reason: The other are smaller than 1 and $0.25 = \frac{1}{4} = 25\%$

(c) Aoife buys an item on eBay for €45 and later sells it for €63. Calculate her profit as a percentage of the cost price.

$$\text{Profit} = €63 - €45 = €18$$

$$\% \text{ Profit} = \frac{18}{45} = 40\%$$

Question 2**(25 marks)**

- (a) Conor earns €32 000 per year. He pays income tax at a rate of 20%. Conor has tax credits of €3300. Find the amount of income tax that Conor pays.

$$20\% \text{ of } 32000 = 6400$$
$$\text{Tax} = 6400 - 3300 = \text{€}3100$$

- (b) Coffee is sold in two different sized jars. Jar A contains 200 g and is sold at €5.80 per jar. Jar B contains 150 g and is sold at €4.65 per jar. Which jar is the best value for money? Give a reason for your answer.

$$\frac{580}{200} = 2.9$$

$$\frac{465}{150} = 3.1$$

Answer: Jar A

Reason: Per gram the coffee is the cheaper

Question 3**(25 marks)**

All of the digits 5, 3, 6, and 1 are used to write down a four-digit whole number.
Each digit is used only once.

- (a) (i) What is the biggest four-digit number that can be written?

6531

- (ii) What is the smallest four-digit number that can be written?

1356

- (b) Shane is driving from Cavan to Belfast. The journey is estimated to be 162 km.
He travels at an average speed of 72 km/h.

- (i) How long will it take him to get there? Give your answer in hours and minutes.

$$\frac{162}{72} = 2.25$$

2 hours and 15 minutes

- (ii) Shane leaves Cavan at 2:55 p.m. What time should he expect to arrive in Belfast?

$$2.55 + 2.15 = 5.10 \text{ p.m.}$$

- (iii) Shane's car uses 1 litre of petrol for every 15 km travelled. A litre of petrol costs 149.9 cent.

Find the cost of the petrol used on the journey.

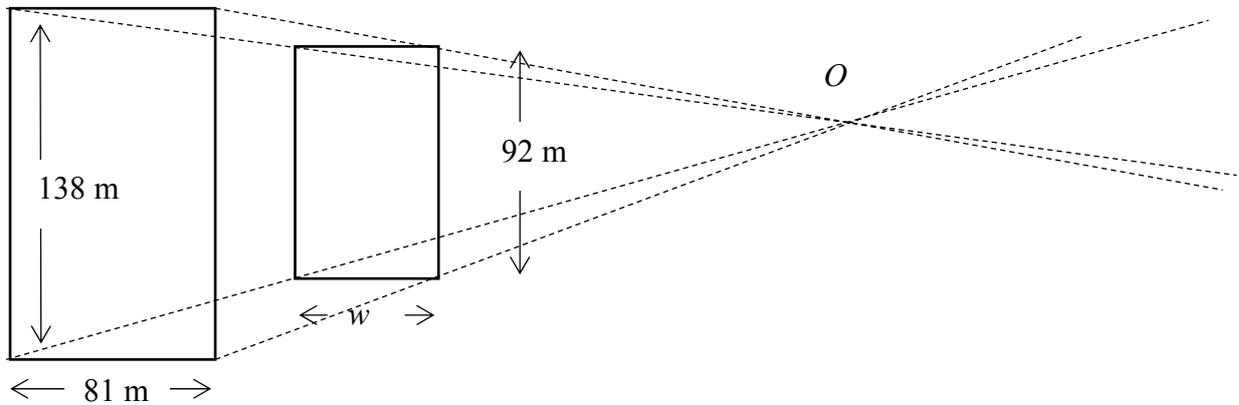
Give your answer in euro and cent.

$$\frac{162}{15} = 10.8$$
$$10.8 \times 1.499 = \text{€}16.19$$

Question 4**(25 marks)**

A local park has two pitches; one for seniors, the other for juveniles. The senior pitch is an enlargement of the juvenile pitch. The scale factor is k ($k > 1$).

- (a) Construct the centre of the enlargement on the diagram below and label it O .



- (b) Find k , the scale factor of the enlargement.

$$\frac{138}{92} = 1.5$$

- (c) Find the value of w , the width of the juvenile pitch.

$$\frac{81}{1.5} = 54$$

- (d) Find the ratio $\frac{\text{area of senior pitch}}{\text{area of juvenile pitch}}$.

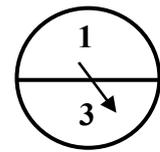
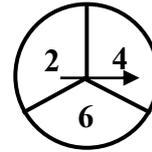
$$\frac{138 \times 81}{92 \times 54} = \frac{11178}{4968} \text{ or } \frac{9}{4} \text{ or } 2.25$$

Or

$$k^2 = 1.5^2 = 2.25$$

Question 5**(25 marks)**

Each of two fair spinners is divided into sections as shown. The spinners are spun at the same time and the scores are then added.



- (a) Complete the table below to show all possible outcomes.

		First spinner		
		2	4	6
Second spinner	1	3	5	7
	3	5	7	9

- (b) Find the probability of getting the following outcomes:

- (i) 3

$$P(3) = \frac{1}{6}$$

- (ii) 3 or 9.

$$P(3 \text{ or } 9) = \frac{2}{6} \text{ or } \frac{1}{3}$$

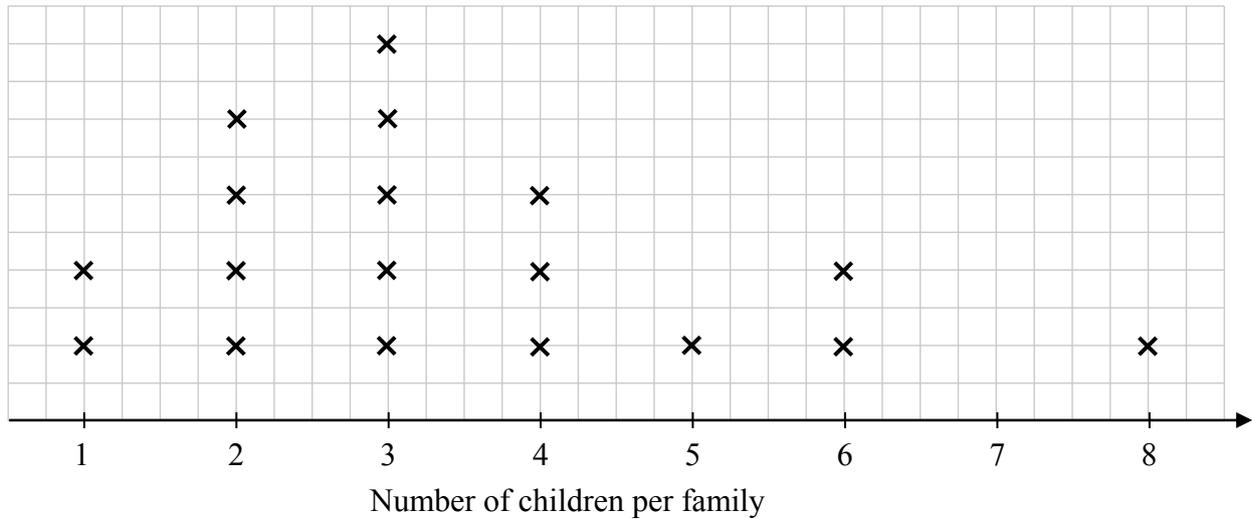
- (c) Caleb says “An outcome of 5 is as likely as an outcome of 7”. Is he correct? Give a reason for your answer.

Answer: YES

Reason: Two out of 6 in each case

Question 6**(25 marks)**

In a survey, 18 students were asked how many children are in their family. The results are shown in the line plot below.



(a) What is the mode of the data?

Mode = 3

(b) (i) Find the total number of children in the 18 families.

$$1(2) + 2(4) + 3(5) + 4(3) + 5(1) + 6(2) + 8(1) = 62$$

(ii) Find the mean number of children per family, correct to one decimal place.

$$\frac{62}{18} = 3.4$$

(c) Which of the two numbers, the mode or the mean, do you think is the best single number to describe this data? Give a reason for your answer.

Mode
Because it is a whole number

Or

Mean
Because it is got from all the families

Question 7**(25 marks)**

- (a) (i) Mary creates a pattern of numbers using the instructions in the table below. The first number, 5, is filled in for you. Complete the table for the next three numbers.

Instruction	First Number	Second Number	Third Number	Fourth Number
Starting Number	5	6	7	8
Multiply by 4	5×4	6×4	7×4	8×4
Subtract 3 from your answer	$20 - 3$	$24 - 3$	$28 - 3$	$32 - 3$
Outcome	17	21	25	29

- (ii) Mary picks a starting number and using the instructions gets an outcome of 45. Find the number she picked.

$$45 + 3 = 48$$

$$48/4 = 12$$

- (b) A, B, and C are whole numbers. The numbers are placed in rows and added together as shown in the table.

Row	Numbers	Total
Row 1	$A + A + A$	$= 21$
Row 2	$A + A + B$	$= 23$
Row 3	$A + B + C$	$= 18$

Find the value of A, of B, and of C.

$$A = \frac{21}{3} = 7$$

$$B = 23 - 14 = 9$$

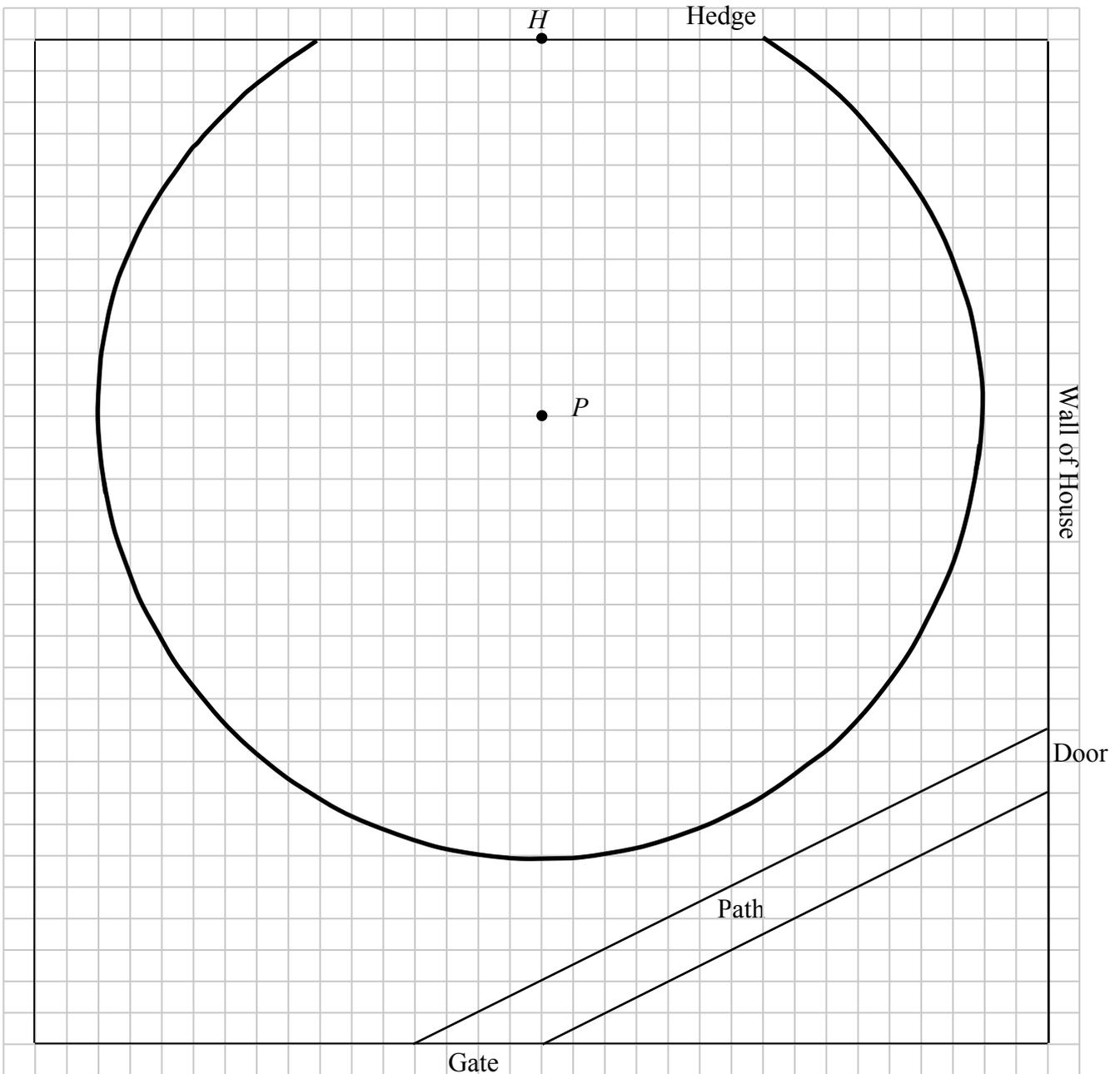
$$C = 18 - 16 = 2$$

Question 8

(25 marks)

Below is a scale diagram of the front garden of a house. The length of each square in the grid represents 0.5 m. The length of each side of the garden is 16 m. P shows the location of a post which is 6 metres from the hedge at H . A dog is tied to the post by a leash which is 7 m long.

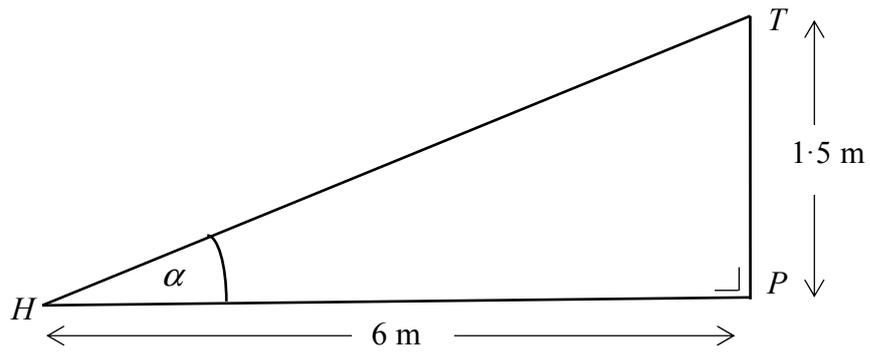
- (a) (i) Use your compass to construct all the points in the garden which are 7 m from P



- (ii) A delivery man is worried about the dog but the house owner assures him that the dog cannot reach the path. Is the house owner correct? Give a reason for your answer.

The line drawn with the compass doesn't cut the path so the owner is correct.

- (b) The diagram below shows the vertical post $[PT]$ and the point H which is on the ground. The measurements are as shown. (Diagram not drawn to scale.)



Find $|\angle\alpha|$, correct to the nearest degree.

$$\tan \alpha = \frac{1.5}{6} = 0.25$$
$$\alpha = \tan^{-1}(0.25) = 14^\circ$$

Answer **Question 9** and **Question 10** from this section.

Question 9**(50 marks)**

Chris needed to repair the pump in his well. He telephoned two companies and asked them about their fees. The first company, *Well Well Ltd.*, said they have a callout fee of €50 and a fee of €30 per hour after that. The second company, *Well Mended Ltd.*, said they don't have a callout fee, just a fee of €40 per hour. Both companies estimated that the work could take up to 8 hours.

(a) Complete the tables below showing the fees for each company.

<i>Well Well Ltd.</i>	
Time (Hours)	Fee (€)
0	50
1	80
2	110
3	140
4	170
5	200
6	230
7	260
8	290

<i>Well Mended Ltd.</i>	
Time (Hours)	Fee (€)
0	0
1	40
2	80
3	120
4	160
5	200
6	240
7	280
8	320

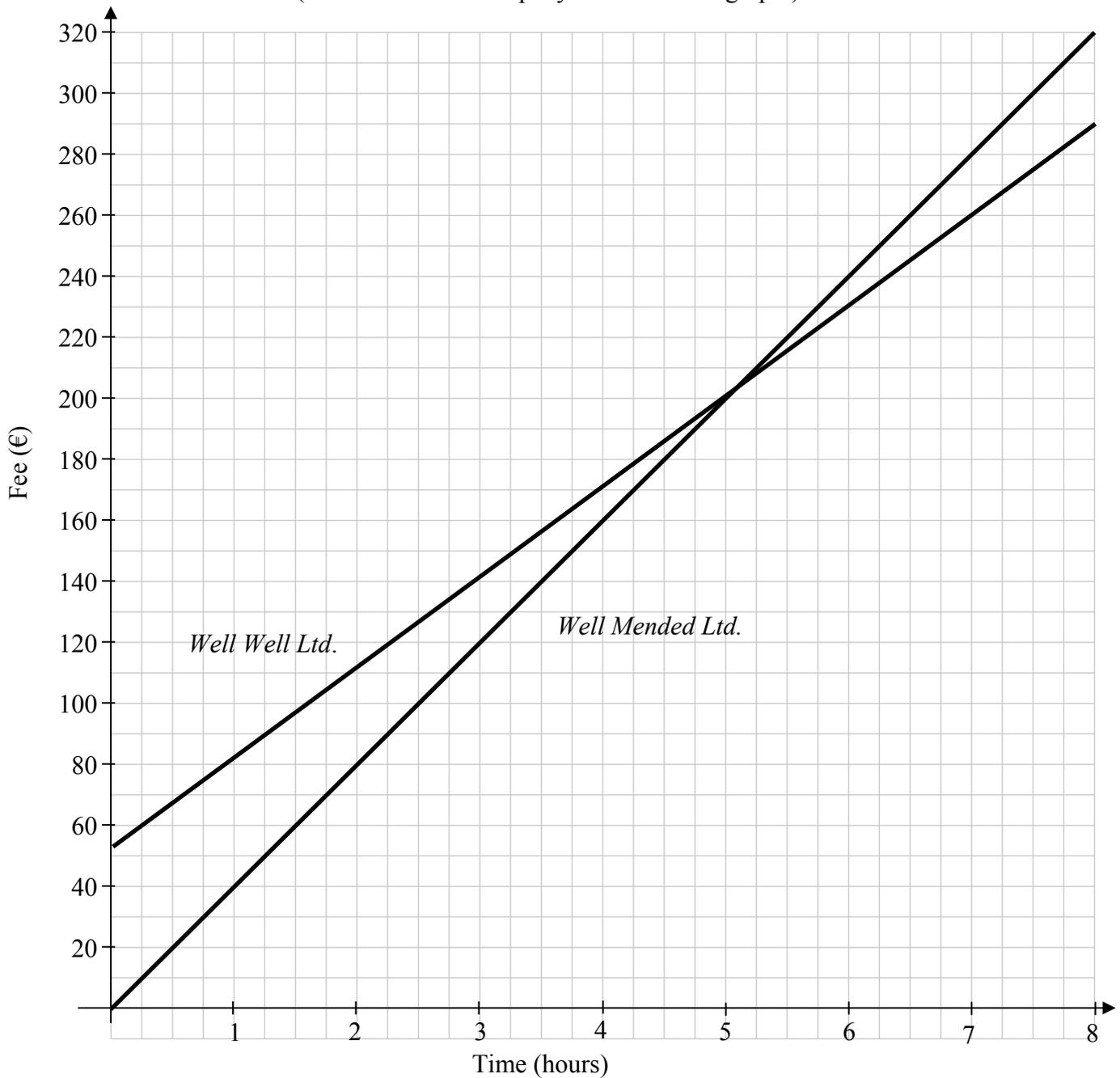
(b) The job took 7 hours. Which company would have charged Chris the least amount of money?

Well Well ltd

(c) Write down a formula to represent the fee to be paid to *Well Well Ltd.* for any given number of hours work. State clearly the meaning of any letters used in your formula.

$$y = 30x + 50$$

(d) On the axes below, draw the graphs of the fees that each of the two companies charge, over the first 8 hours. (Put the relevant company name on each graph.)



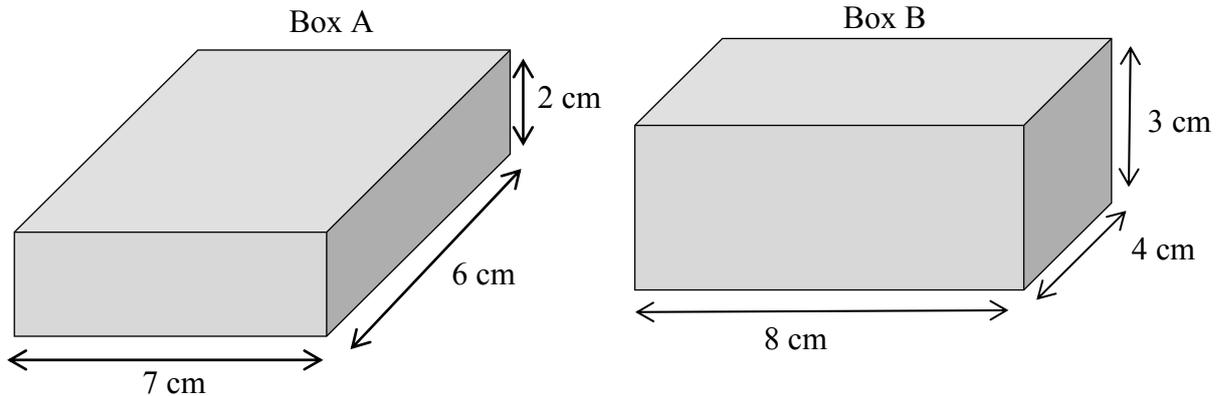
(e) What are the co-ordinates of the point of intersection of your two graphs? Explain what each of the two numbers mean in the context of the question.

Point: (5, 200)

Explanation: If the job takes 5 hours both companies will charge €200.

Question 10**(50 marks)**

Geraldine's company, TLC Ltd., makes rectangular cardboard boxes with lids. Two of the company's boxes, Box A and Box B, with their dimensions given, are shown below. Geraldine has been told that both boxes have the same surface area.



- (a) (i) Show that both boxes have the same surface area.

Surface area of Box A	Surface area of Box B
$A:$ $2(7 \times 2) = 28$ $2(7 \times 6) = 84$ $2(6 \times 2) = 24$ $= 136 \text{ cm}^2$	$B:$ $2(8 \times 3) = 48$ $2(4 \times 3) = 24$ $2(8 \times 4) = 64$ $= 136 \text{ cm}^2$

- (ii) Geraldine wants to use the box with the greater volume. Find which box has the greater volume.

Volume of Box A

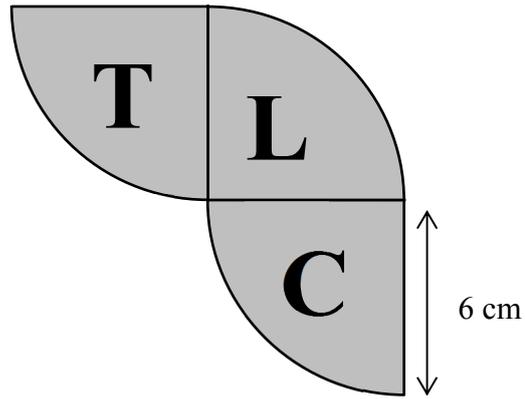
Volume of Box B

$$A: \quad 7 \times 6 \times 2 = 84 \text{ cm}^3$$

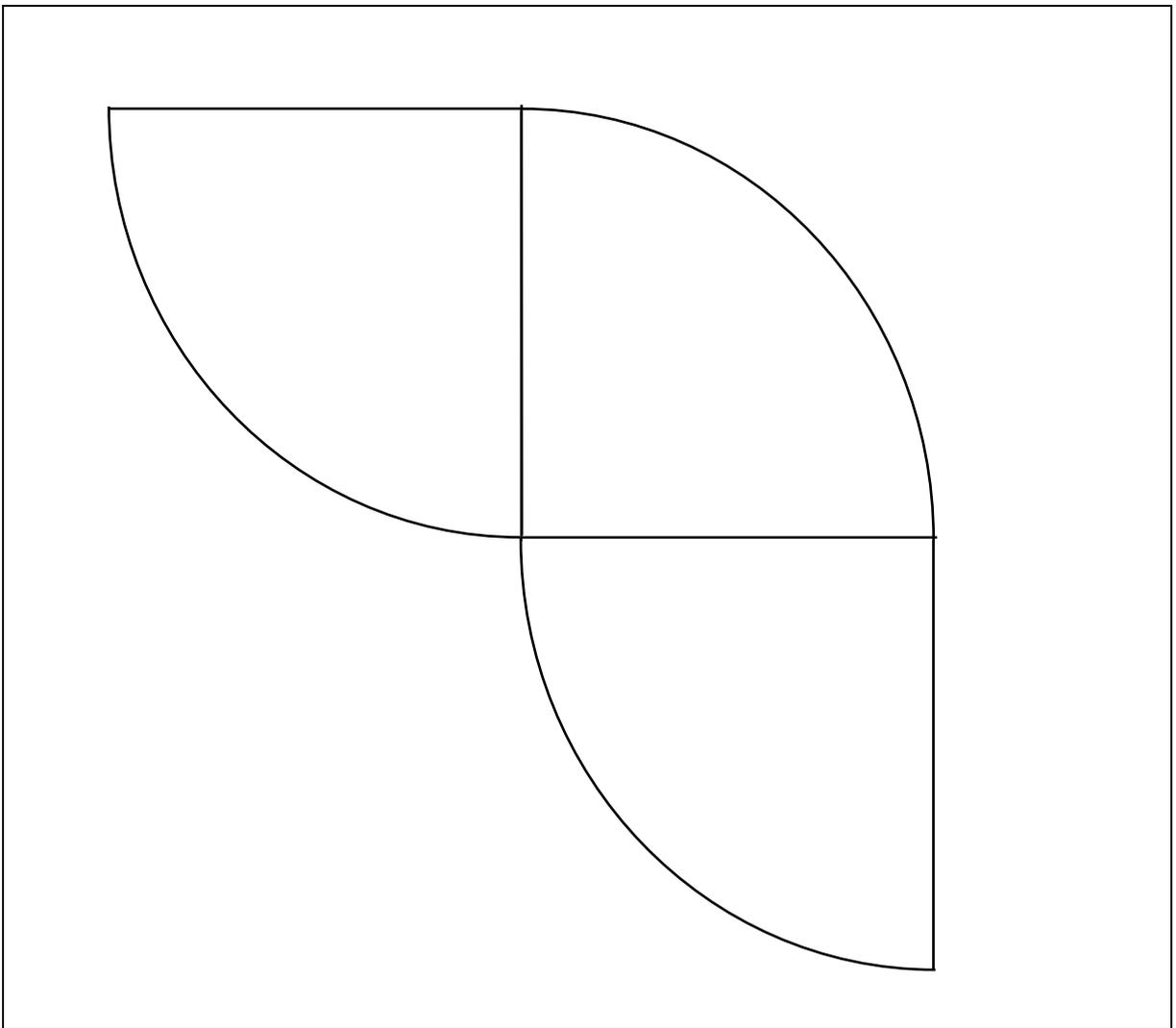
$$B: \quad 8 \times 4 \times 3 = 96 \text{ cm}^3$$

Answer: Box B

- (b) The diagram below shows the logo for Geraldine's company, TLC Ltd. Each letter is contained in a quarter circle of radius 6 cm.



- (i) Construct the full sized logo in the grid below. (You do not need to include the letters.)



- (ii) Find the length of the perimeter of this logo. Give your answer correct to the nearest whole number.

$$P = \frac{3}{4} \times (2 \times \pi \times 6) + 6 + 6 = 40 \text{ cm}$$

- (iii) Find the area of the logo. Give your answer correct to three decimal places.

$$\text{Area} = \frac{3}{4} \times (\pi \times 6^2) = 84.857 \text{ cm}^2$$

- (iv) The material used to construct the logo costs €0.25 per cm^2 . Find the cost of constructing 50 logos, correct to the nearest euro.

$$\text{Cost} = 84.857 \times 0.25 \times 50 = \text{€}1061$$

Marking Scheme – Section A and Section B

Structure of the marking scheme

Candidate responses are marked according to different scales, depending on the types of response anticipated. Scales labelled A divide candidate responses into two categories (correct and incorrect). Scales labelled B divide responses into three categories (correct, partially correct, and incorrect), and so on. The scales and the marks that they generate are summarised in this table:

Scale label	A	B	C	D	E
No of categories	2	3	4	5	6
5 mark scales		0, 3, 5	0, 2, 4, 5		
10 mark scales	0, 10	0, 5, 10	0, 4, 8, 10	0, 2, 5, 8, 10	
15 mark scales		0, 7, 15	0, 6, 12, 15	0, 4, 7, 11, 15	
20 mark scales					
25 mark scales					

A general descriptor of each point on each scale is given below. More specific directions in relation to interpreting the scales in the context of each question are given in the scheme, where necessary.

Marking scales – level descriptors

A-scales (two categories)

- incorrect response
- correct response

B-scales (three categories)

- response of no substantial merit
- partially correct response
- correct response

C-scales (four categories)

- response of no substantial merit
- response with some merit
- almost correct response
- correct response

D-scales (five categories)

- response of no substantial merit
- response with some merit
- response about half-right
- almost correct response
- correct response

E-scales (six categories)

- response of no substantial merit
- response with some merit
- response almost half-right
- response more than half-right
- almost correct response
- correct response
-

In certain cases, typically involving incorrect rounding, omission of units, a misreading that does not oversimplify the work or an arithmetical error that does not oversimplify the work, a mark that is one mark below the full-credit mark may also be awarded. Thus, for example, in *scale 10C*, 9 marks may be awarded. Rounding and units penalty to be applied only once in each section (a), (b), (c) etc. Throughout the scheme indicate by use of * where an arithmetic error occurs.

Summary of mark allocations and scales to be applied

Section A

Question 1	
(a)	10C
(b)	10B
(c)	5C
Question 2	
(a)	15D
(b)	10B
Question 3	
(a)	15C
(b)	10D
Question 4	
(a)	5C
(b)	5B
(c)	5B
(d)	10C
Question 5	
(a)	10C
(b)	10C
(c)	5B
Question 6	
(a)	5B
(b)(i)	10C
(b)(ii)	5C
(c)	5B
Question 7	
(a)(i)	10C
(a)(ii)	5B
(b)	10C
Question 8	
(a)(i)	15B
(a)(ii)	5B
(b)	5C

Section B

Question 9	
(a)	15C
(b)	10A
(c)	5B
(d)	15D
(e)	5B
Question 10	
(a)(i)	5C
(a)(ii)	10C
(b)(i)	15C
(b)(ii)	5C
(b)(iii)	5C
(b)(iv)	10C

Detailed marking notes

Section A

Question 1

- (a) Scale 10C (0, 4, 8, 10)
Low partial credit:
Work of relevance in either part
- High partial credit:*
One correct answer
Work of relevance in both parts
- (b) Scale 10B (0, 5, 10)
Partial credit:
Correct answer with no reason or incorrect reason given
Meaningful attempt at a correct reason
- (c) Scale 5C (0, 2, 4, 5)
Low partial credit:
Work of relevance
- High partial credit:*
Calculates profit correctly

Question 2

- (a) Scale 15D (0, 4, 7, 11, 15)
Low partial credit:
Work of relevance
- Middle partial credit*
Calculates 20% correctly of incorrect taxable income
- High partial credit:*
Subtracts tax credit initially and continues
- (b) Scale 10B (0, 5, 10)
Partial credit:
Work of relevance

Question 3

- (a) Scale 15C (0, 6, 12, 15)
Low partial credit:
Any four digit number using the given digits in either part

High partial credit:
One correct answer
- (b) Scale 10D (0, 2, 5, 8, 10)
Low partial credit:
Work of relevance in any part

Middle partial credit
One correct answer using answer in previous part
Work of relevance in two parts

High partial credit:
Two correct answers
Work of relevance in three parts

Question 4

- (a) Scale 5C ((0, 2, 4, 5)
Low Partial credit:
One correct ray

High partial credit:
Two correct rays not extended
- (b) Scale 5B (0, 3, 5)
Partial credit:
Work of relevance
- (c) Scale 5B (0, 3, 5)
Partial credit:
Work of relevance
- (d) Scale 10C (0, 4, 8, 10)
Low Partial credit:
Calculates one area correctly or work of relevance

High Partial credit:
Calculates both areas correctly

Question 5

- (a) Scale 10C (0, 4, 8, 10)
Low partial credit:
One correct entry

High partial credit:
Two correct entries
- (b) Scale 10C (0, 4, 8, 10)
Low Partial credit:
One numerator or denominator correct

High partial credit:
One correct answer
Work of relevance in both parts
- (c) Scale 5B (0, 3, 5)
Partial credit:
Correct answer with no reason or incorrect reason given
Meaningful attempt at a correct reason

Question 6

- (a) Scale 5B (0, 3, 5)
Partial credit:
5 given as answer
- (b) (i) Scale 10C (0, 4, 8, 10)
Low Partial credit:
Work of relevance

High partial credit:
Formulates fx correctly
- (ii) Scale 5C (0, 2, 4, 5)
Low partial credit:
Work of relevance

High partial credit:
Formulates fraction correctly
- (c) Scale 5B (0, 3, 5)
Partial credit:
Correct answer with no reason or incorrect reason given
Meaningful attempt at a correct reason

Question 7

- (a) (i) Scale 10C (0, 4, 8, 10)
Low partial credit:
One correct entry or work of relevance

High partial credit:
One correct row or column
- (ii) Scale 5B (0, 3, 5)
Partial credit:
Work of relevance
- (b) Scale 10C (0, 4, 8, 10)
Low partial credit:
One correct answer

High partial credit:
Two correct answers

Question 8

- (a) (i) Scale 15B (0, 7, 15)
Partial credit:
Any circle drawn
- (ii) Scale 5B (0, 3, 5)
Partial credit:
Correct answer with no reason or incorrect reason given
Meaningful attempt at a correct reason
- (b) Scale 5C (0, 2, 4, 5)
Low partial credit:
Formulates tan or work of relevance

High partial credit:
 $\alpha = \tan^{-1}(0 \cdot 25)$

Section B

Question 9

- (a) Scale 15C (0, 6, 12, 15)
Low Partial credit:
One correct entry in either table

High Partial credit:
One correct table
- (b) Scale 10A (0, 10)
- (c) Scale 5B (0, 3, 5)
Partial credit:
Effort at formula
- (d) Scale 15D (0, 4, 7, 11, 15)
Low partial credit:
One point plotted correctly

Middle partial credit
One company plotted correctly, ≥ 6 hours

High partial credit:
Both companies plotted correctly, ≥ 6 hours for each company
- (e) Scale 5B (0, 3, 5)
Partial credit:
Work of relevance

Question 10

(a) (i) Scale 5C (0, 2, 4, 5)

Low partial credit:

Calculates area of one side

High partial credit:

Calculates area of one box

(ii) Scale 10C (0, 4, 8, 10)

Low partial credit:

Volume formula

High partial credit:

Calculates volume of one box

(b) (i) Scale 15C (0, 6, 12, 15)

Low partial credit:

Constructs a circle of radius 6 cm

High partial credit:

Constructs one sector of radius 6 cm

(ii) Scale 5C (0, 2, 4, 5)

Low partial credit:

Formula for perimeter of a circle or work of relevance

High partial credit

Calculates perimeter of a circle

(iii) Scale 5C (0, 2, 4, 5)

Low partial credit:

Formula for area of a circle

High partial credit

Calculates area of a circle

(iv) Scale 10C (0, 4, 8, 10)

Low partial credit:

Work of relevance

High partial credit:

Answer (iii) used in relevant calculation

Marcanna breise as ucht freagairt trí Ghaeilge

(Bonus marks for answering through Irish)

Ba chóir marcanna de réir an ghnáthráta a bhronnadh ar iarrthóirí nach ngnóthaíonn níos mó ná 75% d'iomlán na marcanna don pháipéar. Ba chóir freisin an marc bónais sin a shlánú **síos**.

Déantar an cinneadh agus an ríomhaireacht faoin marc bónais i gcás gach páipéir ar leithligh.

Is é 5% an gnáthráta agus is é 300 iomlán na marcanna don pháipéar. Mar sin, bain úsáid as an ghnáthráta 5% i gcás iarrthóirí a ghnóthaíonn 225 marc nó níos lú, e.g. $198 \text{ marc} \times 5\% = 9.9 \Rightarrow \text{bónas} = 9 \text{ marc}$.

Má ghnóthaíonn an t-iarrthóir níos mó ná 225 marc, ríomhtar an bónas de réir na foirmle $[300 - \text{bunmharc}] \times 15\%$, agus an marc bónais sin a shlánú **síos**. In ionad an ríomhaireacht sin a dhéanamh, is féidir úsáid a bhaint as an tábla thíos.

Bunmharc	Marc Bónais
226	11
227 – 233	10
234 – 240	9
241 – 246	8
247 – 253	7
254 – 260	6
261 – 266	5
267 – 273	4
274 – 280	3
281 – 286	2
287 – 293	1
294 – 300	0

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