Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2013

Marking Scheme

Mathematics
(Project Maths – Phase 3)

Ordinary 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.

Contents *Page*

Paper 1

Paper 2

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate Examination, 2013

Mathematics
(Project Maths – Phase 3)

Paper 1

Ordinary Level

Model Solutions – Paper 1

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.

Question 1 **(20 marks)**

(a) Change 5000 g to kilograms.

5000 / 1000 = 5 (kg)

(b) Change 2·7 m to centimetres.

(2·7)100 = 270 (cm)

(c) Change 8000 cm^3 to litres.

8000 / 1000 = 8 (litres)

(d) Change 4 m^2 to cm^2.

(4)(100)(100)= 40 000 (cm^2)

Question 2 **(20 marks)**

Three students completed a test but got their results in different ways. The teacher told Karen that she got 0·7 of the questions correct. John was told he got 80% of the questions correct. David was told he got $\frac{3}{4}$ of the questions correct.

(a) Which student got the best result? Give a reason for your answer.

John

0·7 =70% ¾ =75%

Both < 80%

(b) There were twenty questions on the test. How many questions each did Karen, John and David answer correctly?

0·7 × 20 = 14

80% × 20 = 16

¾ × 20 = 15

(c) Find the mean number of correct answers.

$$\frac{14 + 16 + 15}{3} = \frac{45}{3} = 15$$

[4]

Question 3 **(20 marks)**

Barra is comparing the cost of electricity supplied by two companies.
He used 510 units last month.

(a) Fill in the following tables:

GRIDPOWER	€
Standing charge	9·47
18·5 cent per unit	**94·35**
Sub-total	**103·82**
13·5% VAT	**14·02**
Total	**117·84**

ELECTROLINE	€
No standing charge	
First 50 units free Then 25 cent per unit	**115**
Sub-total	**115**
13·5% VAT	**15·53**
Total	**130·53**

510 × 18·5 = 94·35

510 – 50 = 460 × 0·25 = 115

(b) What is the difference between the bills of the two companies?

130·53 – 117·84 = €12·69

(c) Barra contacted the more expensive company. The company offered him a 10% discount off his total bill.
In your opinion, from which company should Barra get his electricity?
Give a reason for your answer.

Electroline

because its cheaper

130·53 - 10% = 117·48

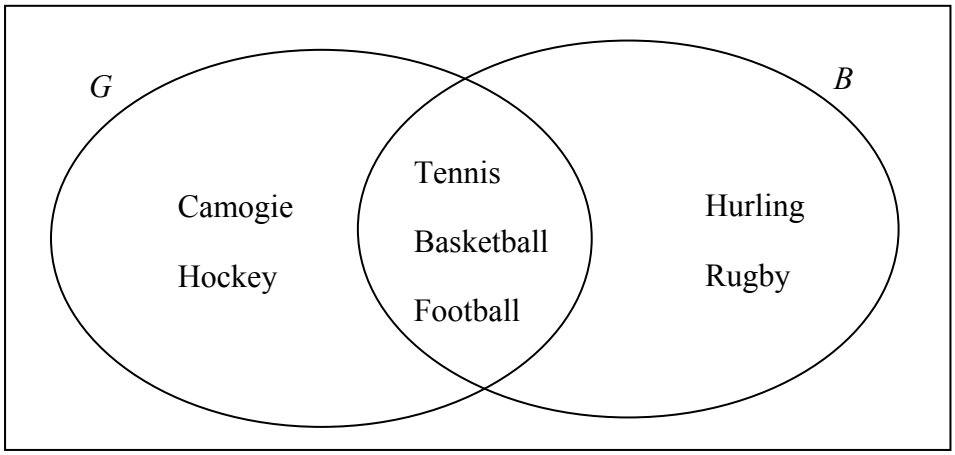
117·84 – 117·48 = 36 cent difference

Note: Accept either company if a reasonable reason given

[5]

Question 4 **(25 marks)**

The sports played by a set of girls G and a set of boys B in a Limerick school are shown in the Venn diagram.



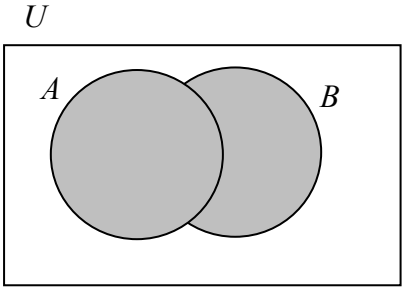
(a) Describe the region of the diagram where camogie and hockey are located.

Girls only or G\B or U\B

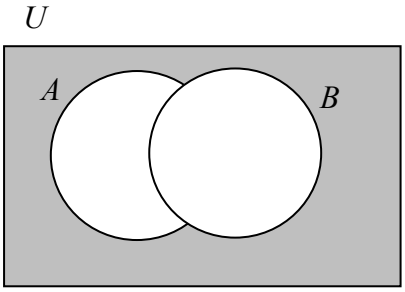
(b) Describe the region of the diagram where tennis, basketball and football are located.

Girls and Boys both play or G∩B

(c) **(i)** In the Venn diagram, shade the set $A \cup B$.



(ii) In the Venn diagram, shade the set $(A \cup B)'$, where $(A \cup B)'$ is the complement of $A \cup B$.

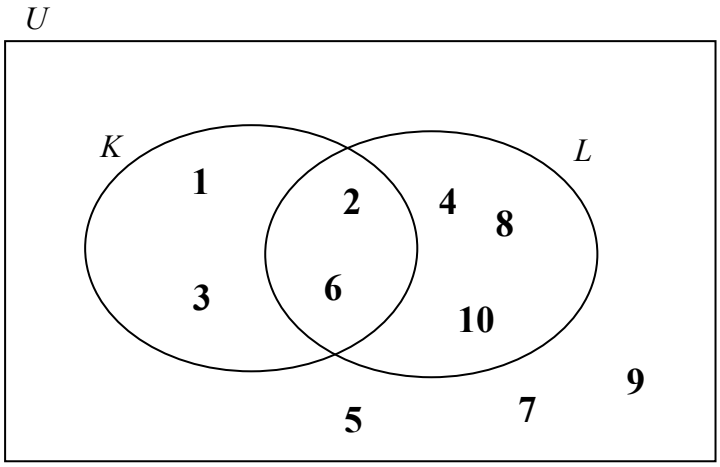


[6]

Question 5 **(20 marks)**

U= { Natural numbers from 1 to 10 inclusive } K = { Factors of 6 } L= { Even numbers }

(a) Fill in the Venn diagram below:



(b) Use ✓ to indicate whether each of the following statements is true or false.
Give a reason for each answer.

(i) $K \cap L = \{\ \}$

True ☐ False ☑

K∩L = {2, 6}

(ii) $K \neq L$

True ☑ False ☐

K ={1, 2, 3, 6}, L= {2, 4, 6, 8, 10}. These are not equal.

(iii) $K \cup L = U$

True ☐ False ☑

***K* ∪ *L* does not include 5, 7, 9.**

[7]

Question 6 **(15 marks)**

Kathy and Jack Byrne have four children. A family ticket for the cinema costs €19·50. A family ticket is for two adults and two children. A single adult ticket costs €7·25 and a single child ticket costs €4·50.

(a) What is the total cost of a family ticket and two child tickets?

19·50 + 2(4·50) = €28·50

(b) If an individual ticket was bought for each member of the family, what would be the extra cost?

2(7·25) + 4(4·50) = €32·50

32·50 - 28·50 = €4 extra

Question 7 **(15 marks)**

Pat is a waiter at a restaurant. He is paid €8·65 per hour. He can also get tips. Last week he worked for 22 hours. Pat's wages plus tips were €235·50 in total for the week.

How much did Pat make on tips last week?

22 × 8·65 = €190·30

Tips: 235·50 - 190·30 = €45·20

Question 8 **(20 marks)**

(a) Croke Park in Dublin holds 82 300 people when full.

During a football match a reporter estimated that the stadium was 40% full.

How many people were estimated to be at the game?
Give your answer correct to the nearest 100 people.

82 300 × 40% = 32 920

= 32 900 to nearest 100

(b) Eight people ate at a restaurant. Each meal was approximately the same cost.
The bill was €128. A service charge of 10% was then added.

Michelle said "€15 each is enough to pay the bill and service charge".

(i) Do you agree with her estimate? Yes ☐ No ✓
Give a reason for your answer.

Bill: 128 + 10 % = €140·80

Cost each: 140·80 ÷ 8 = €17·60

So €15 each is not enough

Bill: 128 + 10 % = €140·80

15 × 8 = €120

So €15 each is not enough

(ii) Can you suggest a better estimate? Give a reason for your answer.

€18 (or an amount ≥ €17·60)

Cost each: €17·60

20·80 ÷ 8 = €2·60 so need at least this much extra each.

[9]

Question 9 **(15 marks)**

(a) Find the next three terms in each sequence.

(i) 2, 5, 8, **__11__** , **__14__** , **__17__**

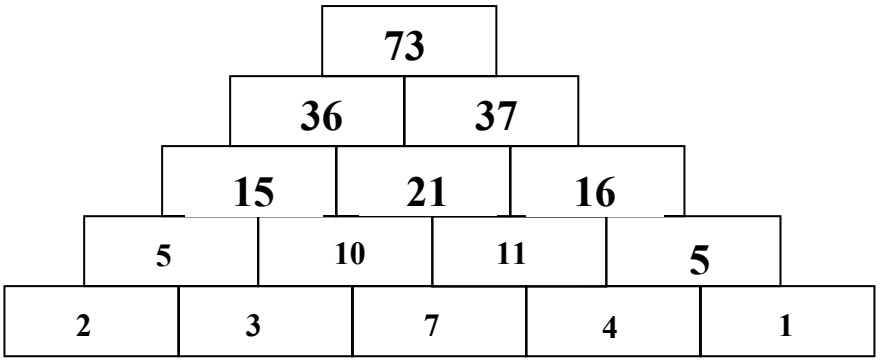
(ii) 16, 12, 8, **__4__** , **__0__** , **__– 4__**

(iii) 1, 4, 9, 16, **__25_** , **_36___** , **__49__**

(b) The first eight Fibonacci numbers are 0, 1, 1, 2, 3, 5, 8, 13.
Fibonacci numbers are found by adding the previous two numbers to get the next one.
5 was found by adding the two numbers before it (2 + 3).
8 was found by adding the two numbers before it (3 + 5).
13 was found by adding the two numbers before it (5 + 8).
Find the next three Fibonacci numbers:

0, 1, 1, 2, 3, 5, 8, 13, **__21__** , **_34___** , **_55___** .

(c) In a number pyramid you add the two numbers in the lower blocks to find the number in the block above (for example 2 + 3 = 5).
Complete the number pyramid by filling in the empty spaces.



Question 10 **(30 marks)**

(a) Find the values of the following expressions if $x = 3$ and $y = 5$.

(i) $5x + 4y$

$5(\mathbf{3}) + 4(\mathbf{5}) = \mathbf{15 + 20 = 35}$

(ii) $x^2 + y^2$

$(\mathbf{3})^{\mathbf{2}} + (\mathbf{5})^{\mathbf{2}} = \mathbf{9 + 25 = 34}$

(b) **(i)** Multiply $5(3a - 4b)$.

$\mathbf{15}\,\boldsymbol{a} \mathbf{- 20}\,\boldsymbol{b}$

(ii) Multiply $x(x - y) + y(x + y)$. Write the answer in its simplest form.

$\boldsymbol{x^2 - xy + xy + y^2}$

$\boldsymbol{= x^2 + y^2}$

(c) Factorise fully each of the following:

(i) $4xy - 6x^2y^2$

$= 2xy\,(\ \mathbf{2 - 3}\boldsymbol{xy}\ )$

(ii) $2ax - ay + 2bx - by$

$\boldsymbol{a}\,(\ \mathbf{2}\boldsymbol{x} \mathbf{-}\ \boldsymbol{y}\ ) + \boldsymbol{b}\,(\ \mathbf{2}\boldsymbol{x} \mathbf{-}\ \boldsymbol{y}\ ) = (\ \boldsymbol{a} + \boldsymbol{b}\ )(\ \mathbf{2}\boldsymbol{x} \mathbf{-}\ \boldsymbol{y}\ )$

Question 11 **(5 marks)**

(a) Factorise the quadratic expression $x^2 - x - 12$.

$(x + 3)(x - 4)$

(b) Use the factors from part **(a)** to solve the equation $x^2 - x - 12 = 0$.

$(x + 3)(x - 4) = 0$

$x + 3 = 0 \qquad x - 4 = 0$

$x = -3 \qquad x = 4$

Question 12 **(15 marks)**

Clodagh tests the knowledge of her two younger sisters, Anna and Lauren.

(a) Clodagh says that the sum of two **consecutive** numbers is 35.
Anna answers that the numbers are 20 and 15. Lauren says the numbers are 17 and 18.

Which sister is right? Give a reason for your answer.

Lauren

17 and 18 are consecutive numbers

(b) Clodagh then says "When 8 is added to three times a number the result is 47".
Anna works out the correct answer, which is 13.

Show one method Anna could have used to get the correct answer.

$8 + 3x = 47$

$3x = 39$

$x = 13$

$47 - 8 = 39$

$39 \div 3 = 13$

(c) Solve the simultaneous equations

$$5x + 2y = 30$$
$$3x - 2y = 2$$

$5x + 2y = 30$

$3x - 2y = 2$

$8x = 32$

$x = 4$

$5(4) + 2y = 30$

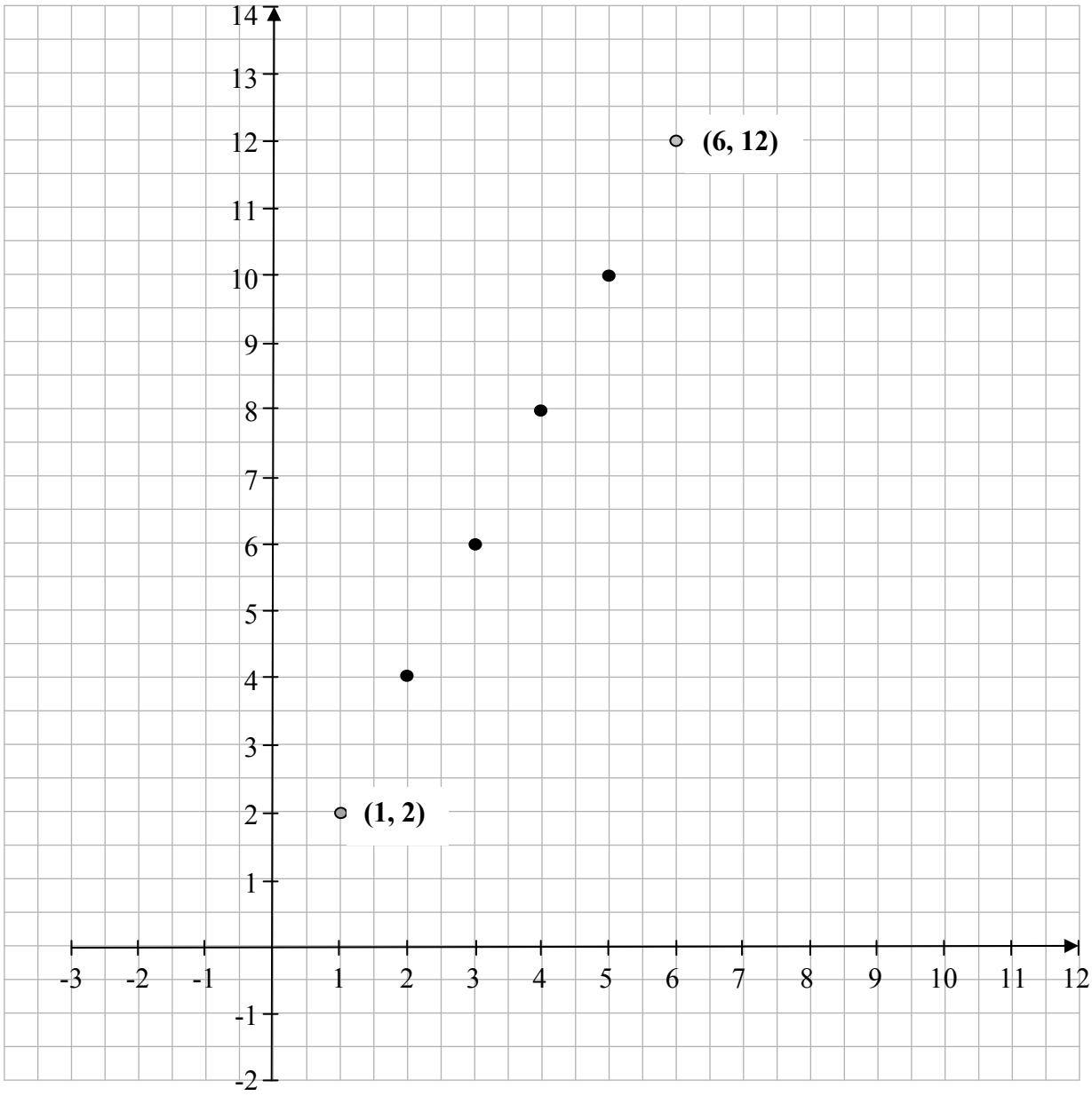
$2y = 30 - 20 = 10$

$y = 5$

Question 13 **(25 marks)**

{ (2, 4), (3, 6), (4, 8), (5 , 10) } are four couples of a function *f*.

(a) Plot the four couples.



(b) The function *f* is derived from a rule. Suggest a rule for *f*.

x*→2 *x

1st component is ½ (2nd component) etc.

(c) On your diagram in **(a)**, plot and label two other couples which could be got from the same rule.

For example : (1, 2) (6, 12)

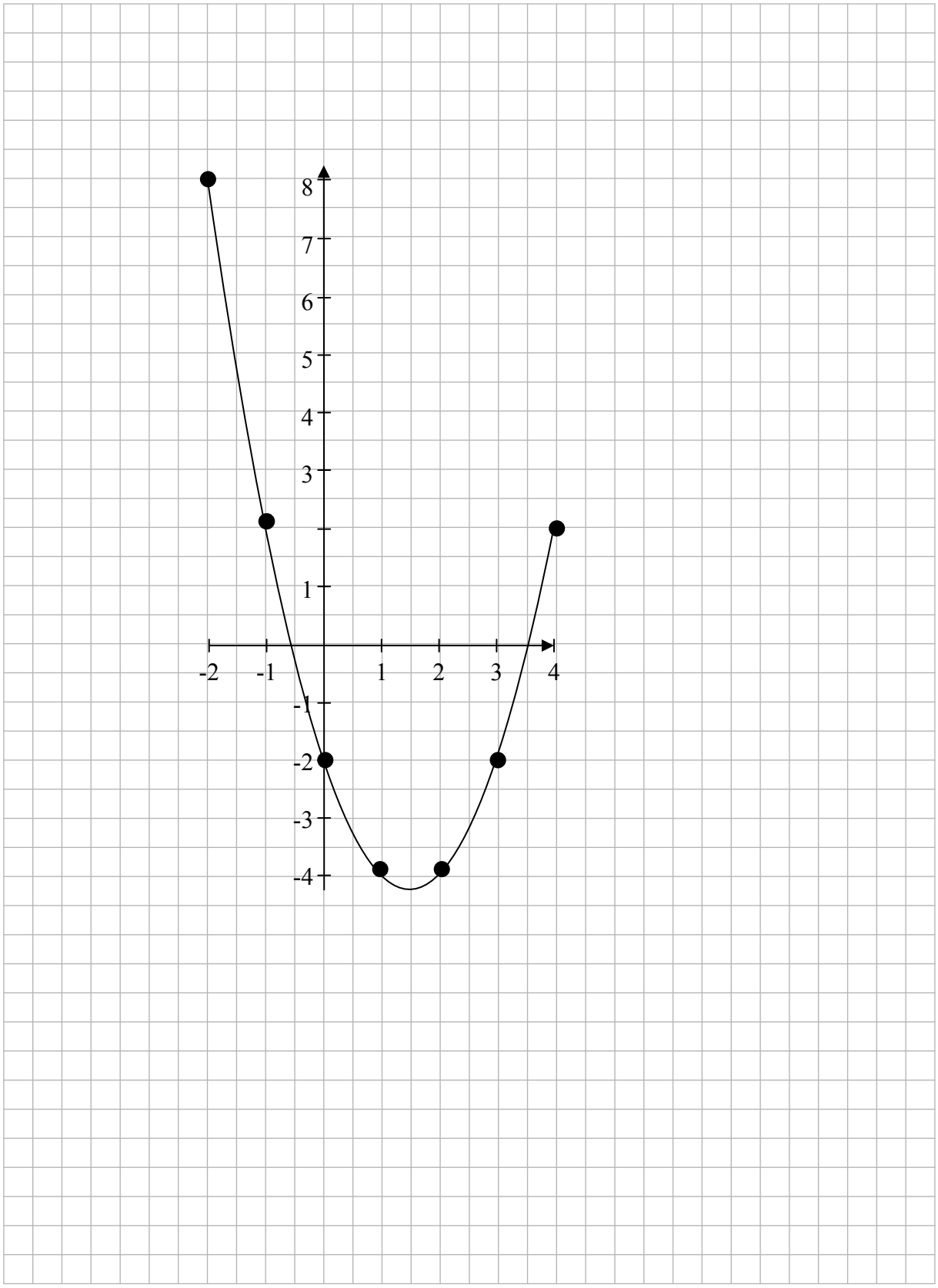
[14]

Question 14 **(30 marks)**

(a) Complete the following table for the function $f : x \mapsto x^2 - 3x - 2$ in the domain $-2 \le x \le 4$.

x	***f(x)***	**(*x*, *f(x)*)**
− 2	8	(–2 , 8)
− 1	**2**	**(–1 , 2)**
0	**–2**	**(0 , –2)**
1	**– 4**	**(1 , – 4)**
2	**– 4**	**(2 , – 4)**
3	**–2**	**(3 , –2)**
4	**2**	**(4 , 2)**

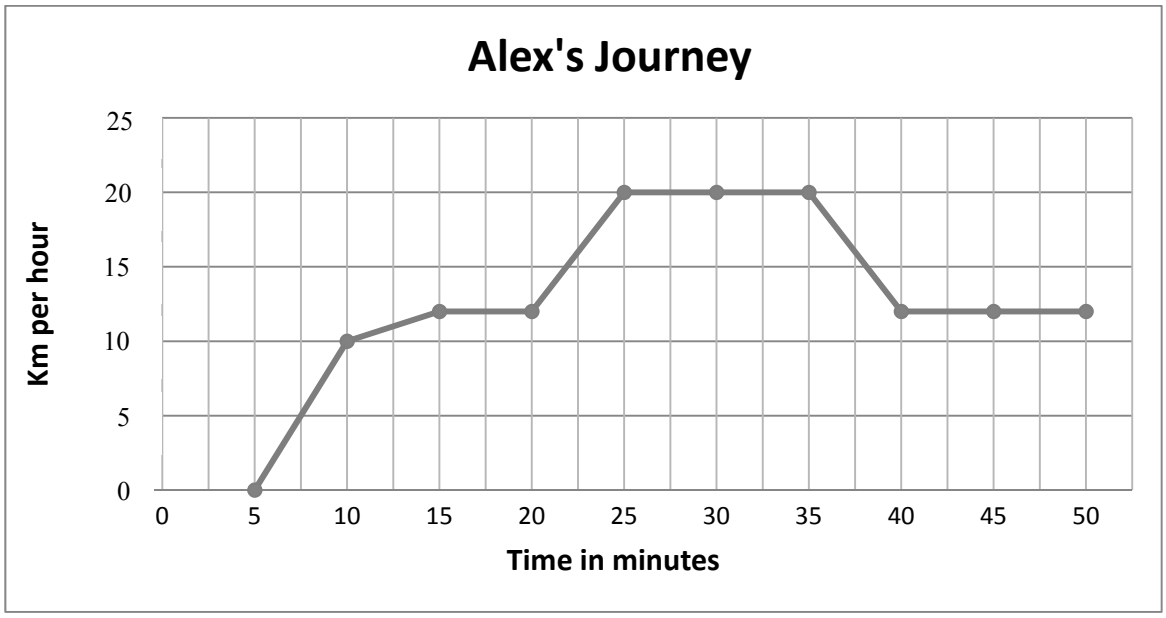
(b) Using the values obtained in **(a),** draw the graph of the function $f : x \mapsto x^2 - 3x - 2$ in the domain $-2 \leq x \leq 4$, $x \in \mathbb{R}$.



[16]

Question 15 **(25 marks)**

The graph below shows some details about a journey Alex made by bicycle.



Alex waited for his friend before he set off on his journey.

(a) How long did he wait before setting out?

5 minutes

(b) What was Alex's highest speed during the journey?

20 km/h

(c) For what length of time was Alex travelling at the highest speed?

10 minutes

(d) How far did Alex travel at the highest speed?

10 mins = $^1/_6$ hour

20 $\times ^1/_6 = 3\frac{1}{3}$ km.

Structure of the marking scheme Paper 1

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
No of categories	2	3	4
5 mark scale	0, 5	0, 3, 5	0, 3, 4, 5
10 mark scale	0, 10	0, 5, 10	0, 5, 8, 10
15 mark scale		0, 10, 15	0, 7, 12, 15

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 (no credit)
- correct response (full credit)

B-scales (three categories)

- response of no substantial merit (no credit)
- partially correct response (partial credit)
- correct response (full credit)

C-scales (four categories)

- response of no substantial merit (no credit)
- response with some merit (low partial credit)
- almost correct response (high partial credit)
- correct response (full credit)

In certain cases, typically involving incorrect rounding or omission of units, a mark that is one mark below the full-credit mark may also be awarded. Such cases are flagged with an asterisk.
Thus, for example, *scale 10C** indicates that 9 marks may be awarded.

Summary of mark allocations and scales to be applied Paper 1

Question 1 (a) 5B (b) 5B (c) 5B (d) 5B	**Question 2** (a) 10B (b) 5B (c) 5B	**Question 3** (a) 5B* (b) 10B* (c) 5B*	**Question 4** (a) 5B (b) 10B (c)(i) 5B (c)(ii) 5A	**Question 5** (a) 5B (b)(i) 5B (b)(ii) 5B (b)(iii) 5B
Question 6 (a) 10B (b) 5C	**Question 7** 15C	**Question 8** (a) 5B* (b)(i) 10B (b)(ii) 5B	**Question 9** (a) 5B (b) 5A (c) 5B	**Question 10** (a)(i), (a)(ii) } 15C (b)(i), (b)(ii) } 5C (c)(i), (c)(ii) } 10C
Question 11 (a), (b) } 5C	**Question 12** (a) 5B (b) 5B (c) 5C	**Question 13** (a) 15B (b) 5B (c) 5B	**Question 14** (a) 15C (b) 15C	**Question 15** (a) 10A* (b) 5A* (c) 5A* (d) 5B*

Detailed Marking Notes Paper 1

The * for units to be applied only if answer is fully correct.
The * to be applied once only per question.
The * penalty is not applied to currency solutions.

QUESTION 1

Note: Accept correct answer with/without work.
Accept correct answer with incorrect/no units.

(a) Scale 5B

Partial credit:

- Multiplication/Division by incorrect 10^{n}.
- Correct conversion factor.

(b) Scale 5B

Partial credit:
Multiplication/Division by incorrect 10^{n}.
Correct conversion factor.

(c) Scale 5B

Partial credit: Multiplication/Division by incorrect 10^{n}.
Correct conversion factor.

(d) Scale 5B

Partial credit: Multiplication/Division by incorrect 10^{n}.
Correct conversion factor.

[20]

QUESTION 2

Note: Accept correct answer(s) with/without work.

(a) Scale 10B

Note: Accept correct answer by name or associated fraction/decimal/%.

Full credit: Correct answer and reason(using specific decimals/%'s/fractions).

Partial credit: Correct answer with no reason/unsound reason.
Incorrect answer but gives a valid reason.
No answer but gives a correct reason.
A correct conversion.

(b) Scale 5B

Partial credit: Karen or John or David correct.
Use of 20 or 0.7 or 80% or $\frac{3}{4}$.

(c) Scale 5B

Note: Allow reasonable rounding based on candidates' **(b).**

Partial credit: Evidence of addition.
Evidence of division by 3.
Candidates' **(b)** totalled(without work).
Median identified with work.

QUESTION 3

Note: Accept correct answer with/without work.
***** is applied only once in this question(for incorrect/no rounding).

(a) Scale 5B*

Note: No penalty for "*No standing charge*" left unfilled.
"*No standing charge*" left unfilled counted as correct entry provided other work done for Electroline.

Partial credit: 1 correct entry.
Use of 9.47 or 18.5 or 50 or 25 or 13.5%.

(b) Scale 10B*

Note: Accept either company if a reasonable reason given.

Partial credit: Correct difference based on Standing charge/Unit costs/VAT.
Relevant answer not based on subtraction of values.
Total(Electroline) – Total(Gridpower) but fails to finish/finish correctly.

(c) Scale 5B*

Note: 10% must have been used for full credit.

Partial credit: Correct answer with no reason/unsound reason.
Incorrect answer but gives a valid reason.
No answer but gives a correct reason.
Use of 10%.

QUESTION 4

(a) Scale 5B

Note: Do not penalise candidate for incorrect set notation.

Partial credit: Incomplete/unsatisfactory description but with some value.

(b) Scale 10B

Note: Do not penalise candidate for incorrect set notation.

Partial credit: Incomplete/unsatisfactory description but with some value.

(c)(i) Scale 5B

Partial credit: A ∩ B shaded.

(c)(ii) Scale 5A

Note: Accept correct shading or shading based on candidates **(c)(i)**

QUESTION 5

Note: Do not penalise candidate for incorrect set notation.

(a) Scale 5B

Partial credit: $K = \{1, 2, 3, 6\}$ or $L = \{2, 4, 6, 8, 10\}$ listed.
2 correctly positioned entries on Venn diagram.

(b)(i) Scale 5B

Partial credit: Correct box with no reason/unsound reason.
Incorrect box but gives a valid reason.
No box but gives a correct reason.

(b)(ii) Scale 5B

Partial credit: Correct box with no reason/unsound reason.
Incorrect box but gives a valid reason.
No box but gives a correct reason.

(b)(iii) Scale 5B

Partial credit: Correct box with no reason/unsound reason.
Incorrect box but gives a valid reason.
No box but gives a correct reason.

QUESTION 6

Note: Accept correct answer with/without work.

(a) Scale 10B
Partial credit: Use of €19·50 or €7·25 or €4·50.

(b) Scale 5C
Low partial credit: Use of €7.25 or €4.50 or candidates' **(a).**

High partial credit: Candidates' **(b)** – Candidates' **(a)** but fails to subtract/subtract correctly.
Solution found involving 1 error.

QUESTION 7

Note: Accept correct answer with/without work.

Scale 15C.
Low partial credit: Use of €8.65 or 22 or €235.50.

High partial credit: €235·50 - €190·30 but fails to subtract/subtract correctly.
Solution found involving 1 error.

QUESTION 8

Note: Accept correct answer with/without work.

(a) Scale 5B*

Note: 32920 merits 4 marks.

Partial credit: Use of 82300 or 40%.

(b)(i) Scale 10B

Partial credit: Correct box with no reason/unsound reason.
Incorrect box but gives a valid reason.
No box but gives a correct reason.
Use of €128 or 10% or €15 or 8.

(b)(ii) Scale 5B

Note: Accept Yes/No as an answer provided a reason given.
€17·60 or €140·80 or €2·60 extra($\frac{20 \cdot 80}{8}$) must appear in **(b)(i) <u>OR</u> (b)(ii)** for full credit.

Partial credit: Correct answer with no reason/unsound reason.
Incorrect answer but gives a valid reason.
No answer but gives a correct reason.
Use of candidates **(b)(i).**

No credit: Yes/No with no reason.

QUESTION 9

(a) (i) and (ii) and (iii) Scale 5B

Partial credit: 1 correct entry.
Identifies correct difference (**i** or **ii**).
Identifies correct differences or indicates squaring (**iii**).

Full credit: 9 correct entries.

(b) Scale 5A

(c) Scale 5B

Partial credit: 1 correct entry.

Full credit: *7 correct entries.*

QUESTION 10

(a) (i) and (a)(ii) Scale 15C

Note: Accept correct answer with/without work.

Low partial credit: A correct substitution.
x and y mixed up but evaluated correctly(25 or 12 or 37) (**i**)

High partial credit: **(i)** OR **(ii)** correct.

Full Credit: **(i)** AND **(ii)** correct.

(b) (i) and (b)(ii) Scale 5C

Low partial credit: A term correctly multiplied.

High partial credit: **(i)** OR **(ii)** correct.

Full Credit: **(i)** AND **(ii)** correct.

(c) (i) and (c)(ii) Scale 10C

Low partial credit: A correct factorising.

High partial credit: **(i)** OR **(ii)** correct.

Full Credit: **(i)** AND **(ii)** correct.

QUESTION 11

Note: Accept correct answer with/without work.
Allow correct roots by trial and error provided both are verified.

(a) and (b) **Scale 5C**
Low partial credit: Any work of relevance.

High partial credit: **(a)** OR **(b)** correct.

Full Credit: **(a)** AND **(b)** correct.

QUESTION 12

(a) Scale 5B
Partial credit: Correct answer with no reason/unsound reason.
Incorrect answer but gives a valid reason.
No answer but gives a correct reason.

(b) Scale 5B

Note: Accept any suitable method(i.e. algebra or arithmetic).

Partial credit: Use of 13 or 8 or 3 or 47.

(c) Scale 5C

***Note**: Allow correct x and y by trial and error provided both are verified, into both equations for full marks.*

Low partial credit: Any work of relevance.

High partial credit: x or y correct.
Solution for x or y found involving 1 error.
Correct x and y without work.
Correct x and y by graphical means..

QUESTION 13

(a) Scale 15B

Tolerance: ± 1 box

Partial credit: *1 point* $(x,y)/(y,x)$ *plotted correctly.*

Full credit: 4 points plotted correctly, labelled/unlabelled.
(y,x) plotted correctly for 4 points

(b) Scale 5B
Partial credit: Incomplete/unsatisfactory explanation but with some value.

(c) Scale 5B
Partial credit: 1 correct point identified or plotted(labelled/unlabelled).

Full credit: 2 correct points plotted and labelled.

QUESTION 14

(a) Scale 15C

Note: Accept correct answer with/without work.

Low partial credit: 1 correct $f(x)$.
1 correct couple based on candidates $f(x)$.
An effort at calculating a point by substitution.

High partial credit: 4 correct $f(x)$'s.

(b) Scale 15C

Tolerance: ± 1 box

Low partial credit: *1 correct point plotted.*
Graduated axes.

High partial credit: 4 points plotted correctly, joined/unjoined.

Full credit: 7 points plotted correctly and joined in order on properly scaled axes

QUESTION 15

Note: ***** is applied only once in this question(for incorrect/omitted units).

(a) Scale 10A*

(b) Scale 5A*

(c) Scale 5A*

(d) Scale 5B*

Note: Allow reasonable rounding**.**

Partial credit: Use of candidates' **(b)** and candidates' **(c)**.
Effort to convert candidates' minutes in **(c)** into hours.
Any correct version of formula.
$\frac{3}{10}$.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate Examination, 2013

Mathematics
(Project Maths – Phase 3)

Paper 2

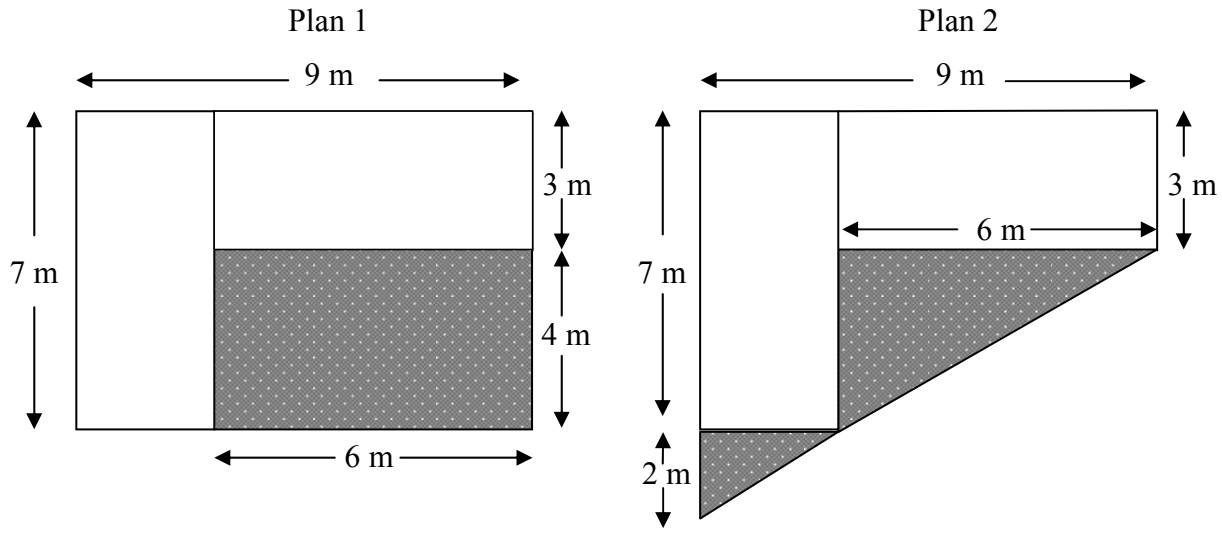
Ordinary Level

Model Solutions – Paper 2

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.

Question 1 **(20 marks)**

Niamh wants to extend her kitchen. She has two plans.
The extension is the shaded area in each plan.



(a) Find the area of the extension for each plan.

Plan 1

$4 \times 6 = 24\ m^2$

Plan 2

$\frac{1}{2}(2 \times 3) + \frac{1}{2}(6 \times 4) =$

$3 + 12 = 15\ m^2$

(b) Which plan adds the biggest area to the kitchen? Tick the correct box.

Plan 1 [✓] Plan 2 [ ]

(c) How many extra square metres would Niamh have if she uses this plan rather than the other plan?

$24 - 15 = 9\ m^2$

Question 2 **(30 marks)**

The data in the table below is taken from *CensusAtSchool*.
The data gives information about how students recycle soft drink cans.

Student	Gender	Age	Year	Location	Cans Bought	Cans Recycled
A	Female	12	1st Year	Dublin	6	2
B	Male	13	1st Year	Tipperary	0	0
C	Male	14	2nd Year	Cork	1	1
D	Female	15	5th Year	Cavan	0	0
E	Male	15	4th Year	Cork	2	1
F	Male	13	1st Year	Offaly	5	2
G	Female	17	5th Year	Westmeath	1	1
H	Male	17	5th Year	Westmeath	2	0
I	Male	13	1st Year	Mayo	1	1
J	Male	13	2nd Year	Galway	2	2
K	Male	17	5th Year	Kilkenny	5	5
L	Female	12	1st Year	Dublin	3	1
M	Female	17	6th Year	Kerry	2	1
N	Female	17	5th Year	Dublin	3	1

(a) How many students are in the sample?

14

(b) Complete the table below to show the **junior** students (1st to 3rd year) in the sample and to show how many cans they each bought and recycled.

Student	**A**	**B**	**C**	**F**	**I**	**J**	**L**
Cans Bought	**6**	**0**	**1**	**5**	**1**	**2**	**3**
Cans Recycled	**2**	**0**	**1**	**2**	**1**	**2**	**1**

(c) How many soft drink cans were bought by the junior students?

6 + 0 + 1 + 5 + 1 + 2 + 3 = 18

(d) How many soft drink cans were recycled by the junior students?

2 + 0 + 1 + 2 + 1 + 2 + 1 = 9

(e) Based on the data, would you conclude that the junior students from this sample are better at recycling than the senior students (4^{th} to 6^{th} year)?
Use calculations to justify your answer.

No

Student	D	E	G	H	K	M	N	Total
Cans Bought	0	2	1	2	5	2	3	15
Cans Recycled	0	1	1	0	5	1	1	9

Seniors recycled $^{9}/_{15}$ = 60%

Juniors recycled $^{9}/_{18}$ = 50%

Question 3 **(25 marks)**

A hurling match is played between Team A and Team B.
A player on Team A, Fiachra, has the ball and attempts to score.
The probability of Fiachra scoring a point is 0·6 and the probability of him scoring a goal is 0·1.

(a) Is Fiachra more likely to score a point or a goal?

A point

(b) What is the probability that Fiachra will not score a point in this attempt?

1 - 0·6 = 0·4 (or $^{2}/_{5}$)

A player on Team B, Peadar, has the ball and attempts to score. The probability of Peadar scoring a point is 0·7 and the probability of him scoring a goal is 0·2.

(c) Peadar is more likely to score than Fiachra.
Give a reason why this is true.

0·7>0·5 (point) and
0·2>0·1 (goal)

(d) A spectator says "Peadar will always score more than Fiachra in a game between the two teams".

Do you agree with the spectator?

Yes ☐ No ✓

Give a reason for your answer.

While the probability of Peadar scoring is higher, it does not mean that he will score(or score more) in any particular game.

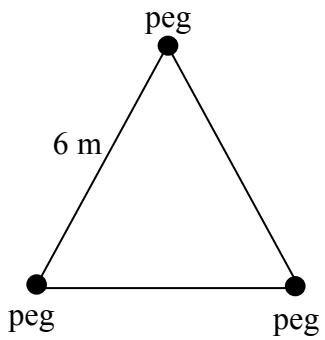
(e) A penalty is awarded to Team B.
The goalkeeper for Team A has saved 12 penalties out of 20 this season.

What is the probability that the goalkeeper will save the penalty based on his previous record?

$^{12}/_{20}$ = $^{3}/_{5}$ or 0·6

Question 4 **(15 marks)**

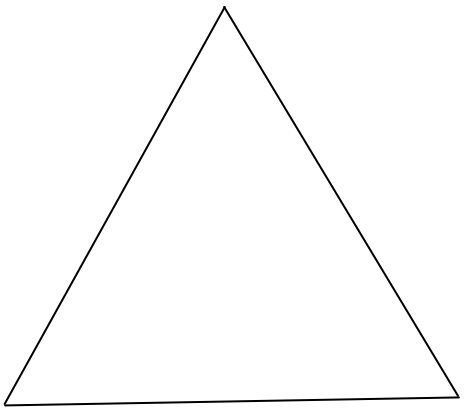
Amy is a scout. The scoutmaster has made an equilateral triangle with pegs and a rope as shown in the diagram. Amy measures one side of the triangle.
It is 6 m in length.



(a) Find the perimeter of the triangle.

6 + 6 + 6 = 18 m

(b) Construct an accurate scale diagram of the equilateral triangle in the space below.
Use a scale of 1 cm to represent 1 m.



Question 5 **(15marks)**

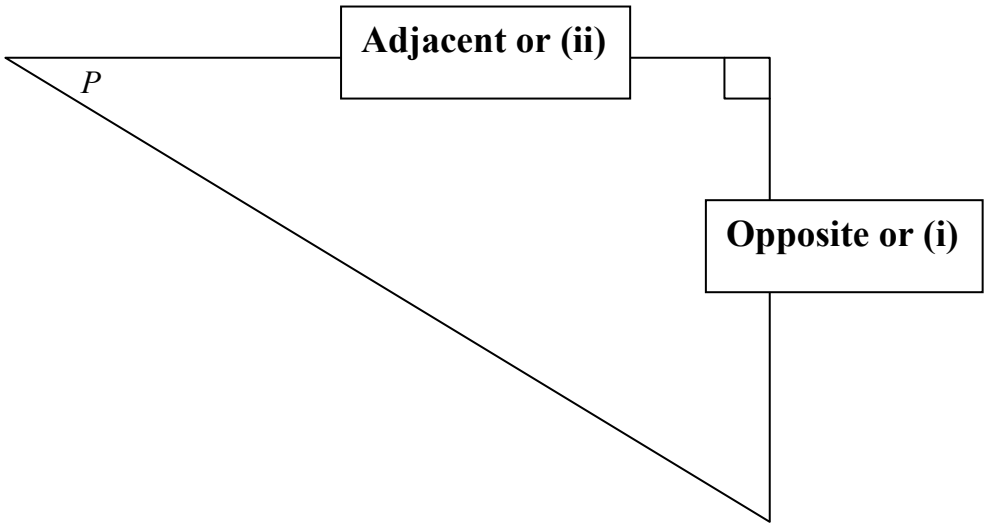
(a) Use your calculator to find the following trigonometric ratios.
Write each answer correct to four decimal places.

sin 25° = **0·4226**

cos 39° = **0·7771**

tan 40° = **0·8391**

(b) The angle *P* is shown in the triangle below.



(i) On the diagram, clearly label the side opposite the angle *P*.

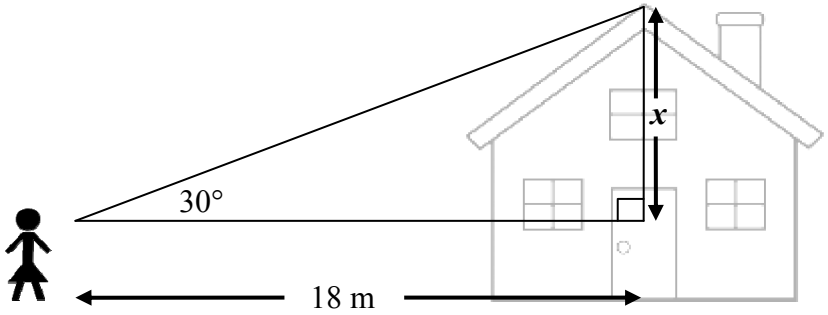
(ii) On the diagram, clearly label the side adjacent to the angle *P*.

(iii) If the length of the opposite side is 9 and the length of the adjacent side is 12, find the length of the hypotenuse.

$$H^2 = 12^2 + 9^2 = 225$$

$$H = \sqrt{225} = 15$$

Question 6 **(15 marks)**



Jasmine wants to find the height of her house. She measures the angle of elevation of the top of the roof using a clinometer. The angle is 30°. She is standing 18 m from the point on the ground directly below the apex of the roof. Jasmine draws the diagram above to show this information.

(a) Use Jasmine's measurements to find x.
Write your answer in metres correct to one decimal place.

Tan 30° = $^{x}/_{18}$

x = 18 tan 30

= 18(0·57735….)

= 10·3923

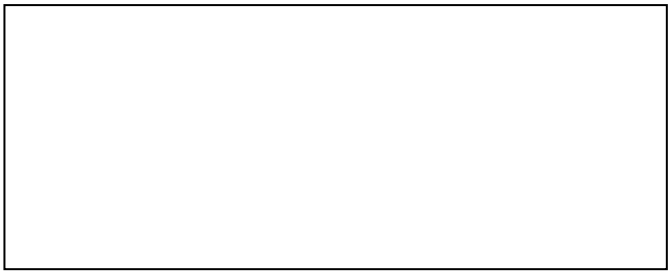
= 10·4 m

(b) What other information is needed to find the height of the house?

Jasmine's height

Question 7 **(20 marks)**

(a) The perimeter of a rectangle is 28 cm. The length of the rectangle is 9 cm. Find the width of the rectangle.



9 cm

2(l + w) =28

2(9+ w) =28

18 +2 w =28

2w =28 – 18 =10

w = 5 cm

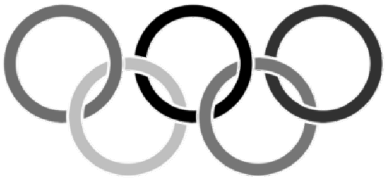
2(l + w) =28

9+ w =14

w = 14 - 9

= 5 cm

(b) The symbol for the Olympic Games is five intersecting rings. The rings represent the five continents which compete in the games. The radius of each ring is 4 m.
Find the total circumference of the five rings. Use $\pi = 3{\cdot}142$.



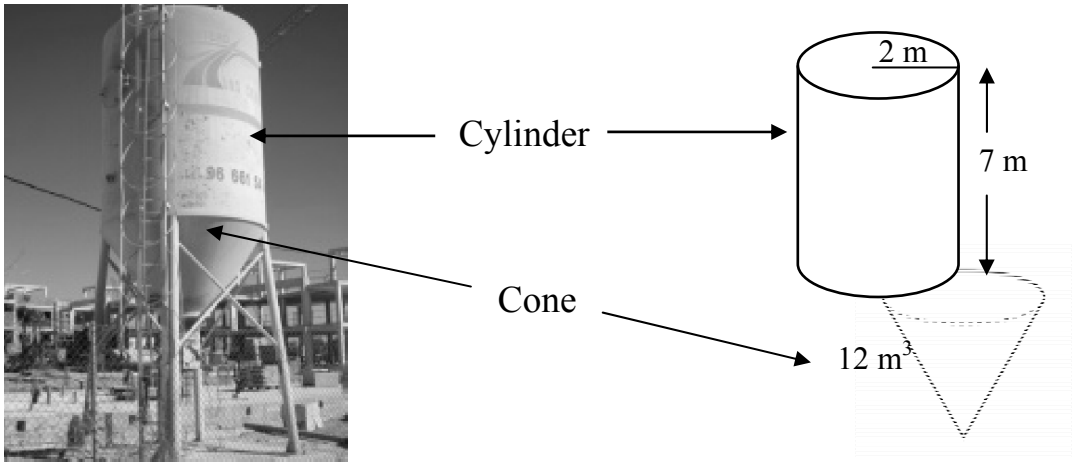
Circumference = 5(2πr)

= 5 × 2 × 3·142 × 4

= 125·68 m

Question 8 **(20 marks)**

Cement is stored in a silo in the shape of a cylinder on a cone as shown in the diagram.



(a) The height of the cylinder is 7 m and the radius is 2 m.
Find the volume of the cylinder. Use $\pi = 3{\cdot}142$.
Give your answer correct to the nearest m^3.

$$\mathbf{V = \pi r^2 h}$$

$$\mathbf{= 3{\cdot}142 \times 2^2 \times 7}$$

$$\mathbf{= 87{\cdot}976 = 88\ m^3}$$

(b) The volume of the cone is 12 m^3.
Find the total volume of cement in the silo when it is full. Give your answer correct to the nearest m^3.

$$\mathbf{V = 88 + 12}$$

$$\mathbf{= 100\ m^3}$$

$$\mathbf{V = 87{\cdot}976 + 12}$$

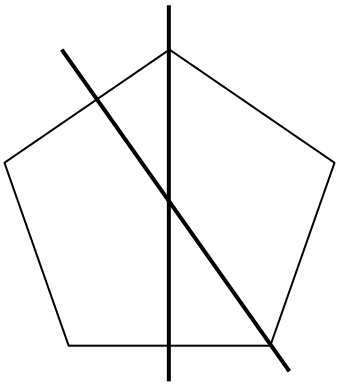
$$\mathbf{= 99{\cdot}976 = 100\ m^3}$$

(c) If 1 m^3 of cement weighs 2·5 tonnes, what is the total weight of the cement in the silo?

$$\mathbf{100 \times 2{\cdot}5 = 250\ tonnes}$$

Question 9 **(20 marks)**

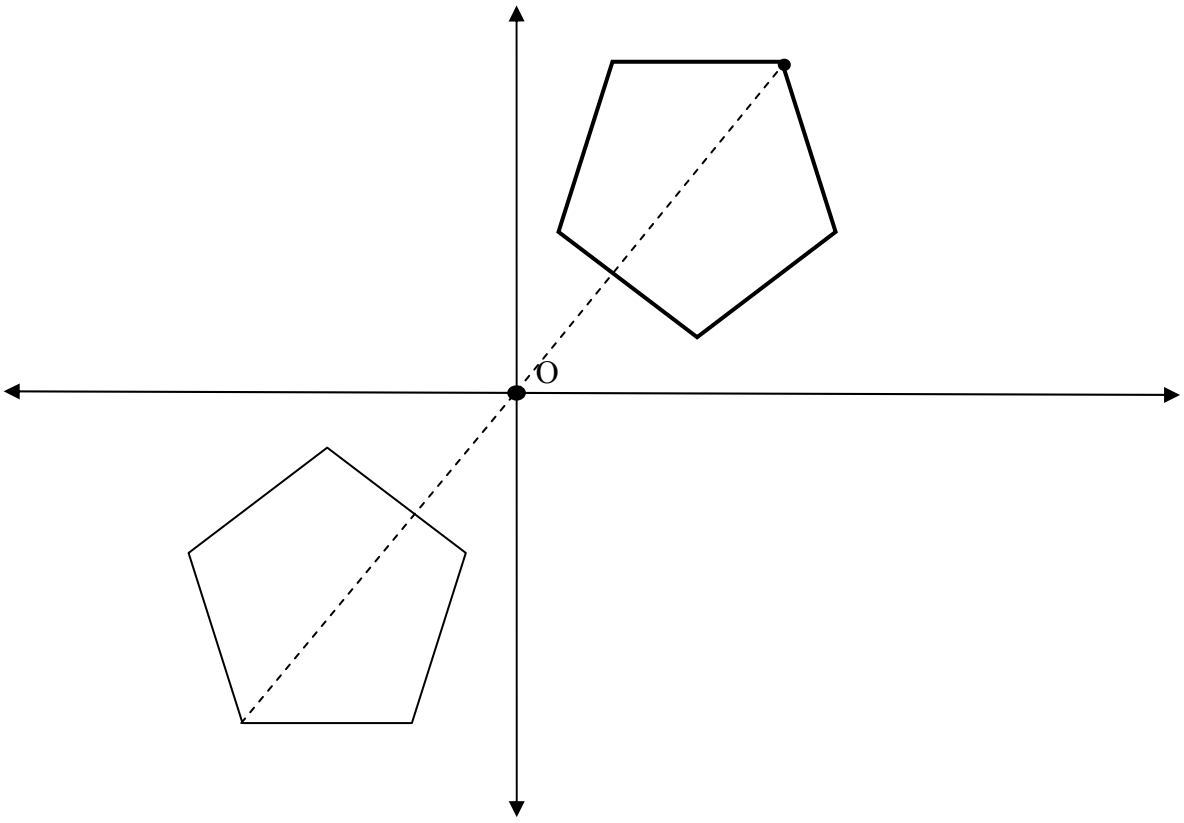
(a) Draw two axes of symmetry of the regular pentagon shown in the diagram below.



(b) What is the total number of lines of symmetry of a regular pentagon?

5

(c) Complete the image of the pentagon under a central symmetry in the origin.



Question 10 **(25marks)**

(a) Convert the following times to the 24 hour clock.

(i) 1.30 pm = **___13:30____**

(ii) 7.15 am = **____07:15___**

(iii) 9.50 pm = **___ 21:50___**

(b) An aeroplane leaves Shannon airport. It flies west for six and a half hours and lands at JFK airport in New York. The distance between the two airports is 4 596 km.
Find the average speed of the aeroplane in km/h.

Speed $= {}^{D}/_{T}$

$= 4596/6{\cdot}5$

$= 707({\cdot}076\ldots)$ **km/h**

(c) During the flight, the aeroplane uses 240 litres of fuel per minute.
How many litres of fuel were used in the flight?

6·5 h =390 min

240 × 390 = 93 600 litres

(d) For emergencies the aeroplane must carry 20% more fuel than it requires.
Find the total amount of fuel carried by the aeroplane.

93 600 × 120% =

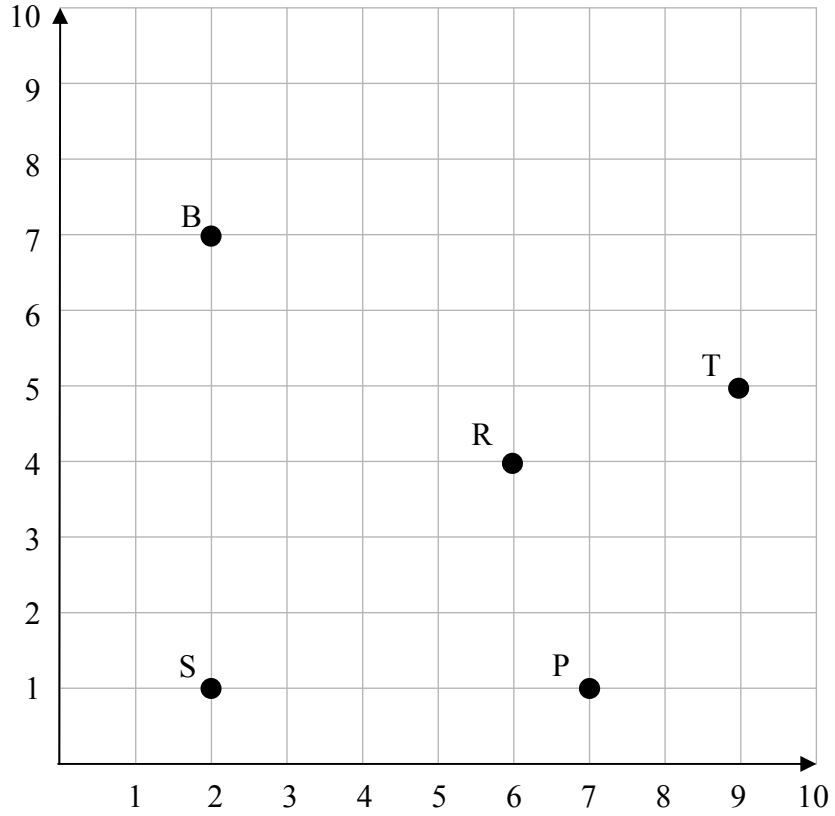
112 320 litres

93 600 × 20% = 18 720

93 600 + 18 720 = 112 320 litres

Question 11 **(30 marks)**

An archaeologist has discovered various items at a site. The site is laid out in a grid and the position of each item is shown on the grid. The items found are a brooch (B), a plate (P), a ring (R), a statue (S) and a tile (T).



(a) Write down the co-ordinates of the position of each item.

B = (2 , 7)

P = (**7** , **1**)

R = (**6** , **4**)

S = (**2** , **1**)

T = (**9** , **5**)

(b) Each square of the grid represents 1 m^2.
Find the total area of the grid.

$10 \times 10 = 100\ m^2$

(c) Which of the items is nearest to the tile (T)?

Ring (R)

(d) Find the distance between the brooch (B) and the statue (S).

6 (by inspection)

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

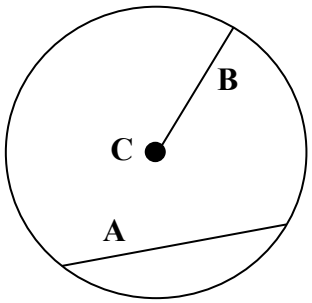
$$= \sqrt{(2-2)^2 + (7-1)^2} = \sqrt{36} = 6$$

(e) What is the slope of the line from the plate (P) to the brooch (B)?

$$\frac{7-1}{2-7} = -\frac{6}{5}$$

Question 12 **(35 marks)**

(a) Choose the correct terms for A, B and C from the following list:



radius

diameter

circumference

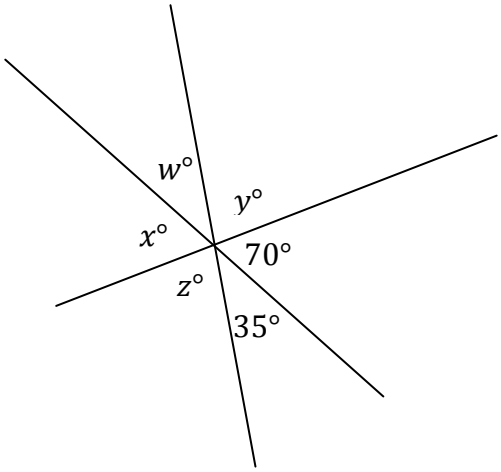
centre

chord

Write the answers into the grid.

A	**CHORD**
B	**RADIUS**
C	**CENTRE**

(b) Find the missing angles in the diagram. Write the answers into the grid.



x	**70°**
w	**35°**
y	**75°**
z	**75°**

70 + 35 = 105

180 - 105 = 75

(c) The measurements of the sides of four triangles are as follows:

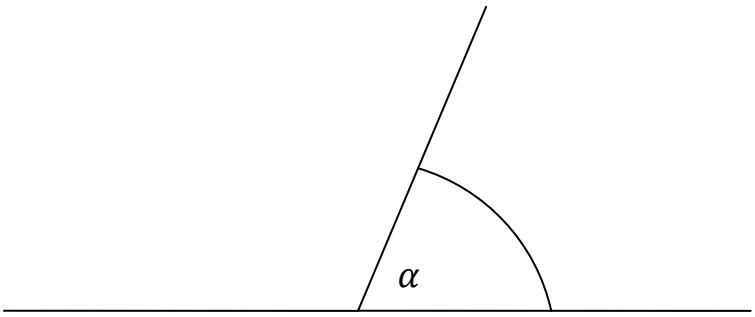
Triangle	Sides
A	5, 3, 4
B	5, 6, 5
C	5, 6, 7
D	5, 6, 8

Which triangle is isosceles? Give a reason for your answer.

B

B has two sides of equal length.

(d) Cian used a protractor to measure the angle α in the diagram below.
His answer was 100°.

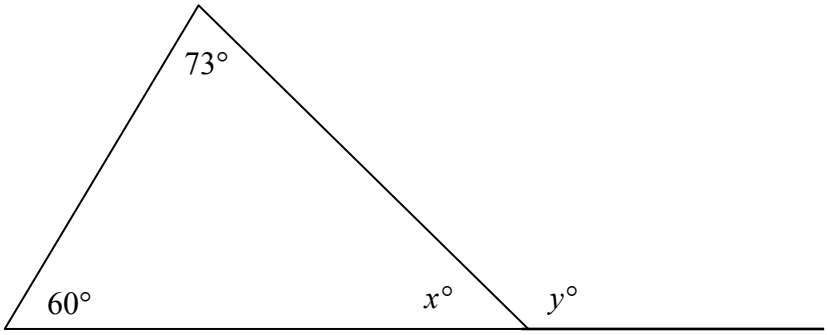


Do you agree or disagree with Cian's measurement? Give a reason for your answer.

Agree ☐ Disagree ☑

It is an acute angle (<90°)

(e) Theorems on your course can be used to find the measure of the angles in the diagram below.
Write down, in your own words, any theorem that you could use to find one of the missing angles.



Exterior angle = sum of 2 interior opposite angles

or **3 angles of a triangle add up to 180°**

(f) Find the measure of each of the missing angles in the diagram in part **(e)** above. Show your calculations.

73 + 60 = 133

180 – 133 = 47

$x°$ = **47°** $y°$ = **133°**

Question 13 **(30 marks)**

A group of students was asked how many text messages each had sent the previous day.
The results were:

14	32	6	17	19	15	3	35	42	25
9	28	34	18	40	11	16	28	31	7

(a) How many students were in the group? **20**

(b) Represent the data on a stem-and-leaf diagram.

	0	**3**	**6**	**7**	**9**										
	1	**1**	**4**	**5**	**6**	**7**	**8**	**9**							
	2	**5**	**8**	**8**											
	3	**1**	**2**	**4**	**5**										
	4	**0**	**2**												
										Key:	**2|5 =25**				

(c) Find the mode of the data.

28

(d) Find the mean of the data.

14 + 32+ 6 + 17 + 19 + 15 + 3 + 35 + 42 + 25 +
9 + 2 + 34 + 18 + 40 + 11 + 16 + 28 + 31+ 7

= 430

$^{430}/_{20} = 21{\cdot}5$

(e) What percentage of students sent more than 30 texts?

6 students sent > 30 texts

$^{6}/_{20} \times 100 = 30\%$

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
No of categories	2	3	4
2 mark scale	0, 2	0, 1, 2	
5 mark scale	0, 5	0, 3, 5	0, 3, 4, 5
10 mark scale	0, 10	0, 5, 10	0, 5, 8, 10
15 mark scale	0, 15	0, 10, 15	0, 10, 12, 15

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 (no credit)
- correct response (full credit)

B-scales (three categories)

- response of no substantial merit (no credit)
- partially correct response (partial credit)
- correct response (full credit)

C-scales (four categories)

- response of no substantial merit (no credit)
- response with some merit (low partial credit)
- almost correct response (high partial credit)
- correct response (full credit)

In certain cases, typically involving incorrect rounding or omission of units, a mark that is one mark below the full-credit mark may also be awarded. Such cases are flagged with an asterisk.

Thus, for example, *scale 10C** indicates that 9 marks may be awarded.

Summary of mark allocations and scales to be applied Paper 2

Question 1

(a) 10C*

(b) 5A

(c)5B

Question 2

(a)5A

(b)5B

(c)5B

(d) 5B

(e) 10C

Question 3

(a) 5 A

(b) 5 A

(c)5B

(d)5B

(e)5B

Question 4

(a)5B*

(b)10B

Question 5

(a)5C*

(b)(i) and (ii) 5 B

(b)(iii) 5 C

Question 6

(a)10C*

(b)5A

Question7

(a)10C*

(b)10C*

Question 8

(a)10C*

(b)5B*

(c)5C*

Question 9

(a)5B

(b)5A

(c)10C

Question 10

(a)5B

(b)5C

(c)10C

(d)5C*

Question 11

(a)5B

(b)5B

(c)5A

(d)5C

(e)10C

Question 12

(a)10C

(b)5C

(c)5B

(d)5B

(e)5A

(f)5C

Question 13

(a)5A

(b)10C

(c)5A

(d)5C

(e)5C

Detailed Marking Notes Paper 2

The * for units to be applied only if answered fully correct.
The * to be applied once only per question

QUESTION 1

The ∗ is only applied once in this question

(a) Scale 10 C *

High Partial Credit: Finds area of one plan correctly

Low partial Credit: Finds area of one triangle correctly (Plan 2)
Writes 4×6 or 9×7 or 7×3 or 6×3 (Plan 1)
Writes 6×4 or 3×2 or 9×9 or 9×6 or 7×3 or 6×3 or 9×3 or 4×3(Plan2)
Correct relevant formula .

(b) Scale 5 A

(c) Scale 5 B

Partial Credit: 24 – 15
Uses answer(s) from part (a) in this part
9 (or equivalent)

QUESTION 2

(a) Scale 5 A

(b) Scale 5 B

Partial Credit : One correct entry in table or one correct row in table .

(c) Scale 5 B

Partial Credit : Attempt at adding two or more numbers from correct list
or adding recycled list correctly in this part.

(d) Scale 5 B

Partial Credit : Attempt at adding two or more numbers from correct list
or adding bought list correctly in this part.

(e) Scale 10 C

High Partial Credit : Both percentages worked out correctly but no conclusion
or an incorrect conclusion given

Low Partial Credit : One of the percentages worked out correctly.
The number of cans that senior students bought calculated (15)
or an attempt at same .
The number of cans that senior students recycled calculated (9)
or an attempt at same .
Correct conclusion but no calculations .

QUESTION 3

(a) Scale 5 A

(b) Scale 5 A

(c) Scale 5 B

Partial Credit : Gets the probability of Peadar scoring as 0.9.
Gets the probability of Fiachra scoring as 0.7 .
States 0.2 > 0.1 or 0.7 > 0.6 .

(d) Scale 5 B

Partial Credit : Correct answer or valid explanation
Correct answer but unsound explanation
Incorrect answer but gives a valid explanation

(e) Scale 5 B

Partial Credit : A numerator of 12 .
A denominator of 20 .
Any correct statement regarding the probability of an event occurring
(e.g. P (E) = $\frac{number\ of\ favourable\ outcomes}{number\ of\ possible\ outcomes}$)

Question 4

(a) Scale 5 B*

Partial Credit : $6 + 6 + 6 \neq 18$.
Attempt at adding two sides i.e. 6 + 6
Incorrect mathematical operation .

(b) Scale 10 B

Allow tolerances of ± 0.1 cm in lengths and ± 2˚ in degree measurements

Partial Credit : Minimum of one side of 6 cm. and / or one angle of 60˚ correct within tolerance .

QUESTION 5

(a) Scale 5 C*

High Partial Credit : Two correct answers .
All answers correct but calculator in incorrect mode .

Low partial credit : One correct answer .
Gets cos or tan of 25˚ or sin or tan of 39˚ or cos or sin of 40˚ correctly

(b) (i) and (ii) Scale 5 B

Accept appropriate abbreviations for the sides (e. g. Opposite ≡ Opp ≡ O)

Partial Credit : One correct label .

(b) (iii) Scale 5 C

High Partial Credit : States $H^2 = 12^2 + 9^2$.

Low Partial Credit : Gets 12^2 and / or 9^2 .
Indicates clearly the correct hypotenuse on the diagram .
States hypotenuse is side directly across from 90˚ angle .
States Pythagoras ' Theorem correctly.
Correct relevant formula .

QUESTION 6

(a) Scale 10 C*

High Partial Credit : $0.577350269 = \frac{x}{18}$.
Use of sin 30˚ or cos 30˚ and finishes correctly .

Low Partial Credit : tan 30˚ = 0.577350269 .
$\frac{x}{18}$.
States tan = $\frac{opposite}{adjacent}$. (see note in Question 5 (b) (i) and (ii))
Tan 30 ˚ .
Correct relevant formula .

(b) Scale 5 A

QUESTION 7

(a) Scale 10 C *

High Partial Credit : $28 = 2(9) + 2$ (width) or $14 = 9 +$ width

Low Partial Credit : $2(9)$ or $9 + 9$.
States perimeter = 2 (length) + 2 (width) .
$28 = 2$ (length + width) or 14 = length + width .

(b) Scale 10 C *

High Partial Credit : Gets circumference of one ring correctly .
Incorrect circumference of ring after using correct formula and then multiplies correctly .
$\pi \neq 3.142$.

Low Partial Credit : Multiplies by 5 .
4 and / or 3.142 substituted correctly into correct relevant formula or into incorrect relevant formula , i.e. πr^2
3.142×4 or 2×4 or 3.142×2 or 3.142×8 .
Correct relevant formula.

QUESTION 8

(a) Scale 10 C*

High Partial Credit : $(3.142)(2)^2(7)$.
$\pi \neq 3.142$.

Low Partial Credit : One or two of 3.142 , 2 or 7 substituted correctly into the correct formula or into incorrect relevant formula i.e. $2\pi r h$ or πr^2 .
3.142×2^2 (or 4) or 2^2 (or 4) $\times 7$ or 3.142×7.
Correct relevant formula.

(b) Scale 5 B*

Partial Credit : $88 + 12 \neq 100$
Use of 88 and / or 12
Substituting $r = 2$ into correct volume of cone formula.

(c) Scale 5 C*

High Partial Credit : $100 \times 2.5 \neq 250$.

Low Partial Credit : Use of 100 and / or 2.5 .

QUESTION 9

(a) Scale 5 B

Full Credit : Two correct axes of symmetry.

Partial Credit : One correct axis of symmetry.

(b) Scale 5 A

(c) Scale 10 C

Allow a tolerance of ± 0.1 cm. in lengths.

Full Credit : All image points correct and image of pentagon drawn .

High Partial Credit : Images of all points correct but image of pentagon not formed .
Two or three image points correct.

Low Partial Credit : One correct image point.
Finds correct image of pentagon by symmetry in either axes.

QUESTION 10

(a) Scale 5 B

Partial Credit : One time correct .

(b) Scale 5 C

High Partial Credit : $\frac{4596}{6.5}$.
Takes 6 hours 30 minutes as 6.3 hours and continues correctly (729 . 52)

Low Partial Credit : Use of 4596 and / or 6.5.
Speed = $\frac{distance}{time}$ or S = $\frac{D}{T}$.

(c) Scale 10 C

High Partial Credit : $240 \times 390 \neq 93\,600$
240×390 .
93 600 .

Low Partial Credit : Use of 240 and / or 390 .
Changes 6.5 hours to 390 minutes .

(d) Scale 5 C*

High Partial Credit : $93\,600 + 18\,720 \neq 112\,320$
$120\,\% \times 93\,600 \neq 112\,320$
$93\,600 + 18\,720$.
$120\,\% \times 93\,600$.

Low Partial Credit : $20\,\% \times 93\,600 = 18\,720$
$20\,\% = \frac{1}{5}$.
Use of 93 600 .

Use of 20 % .

QUESTION 11

(a) Scale 5 B

Partial Credit : One point correct.
All points correct but interchanges *x* and *y* co-ordinates.

(b) Scale 5 B*

Partial Credit : $10 \times 10 \neq 100$.
10×10.
Use of 10

(c) Scale 5 A

(d) Scale 5 C

High Partial Credit : $\sqrt{36}$.

Low Partial Credit : Any correct substitution into correct distance formula .
Correct relevant formula.

(e) Scale 10 C

High Partial Credit : $\frac{1-7}{7-2}$.

Low Partial Credit : Any correct substitution into correct slope formula.
States slope $= \frac{rise}{run}$ or similar.
Correct relevant formula.

QUESTION 12

(a) Scale 10 C

High Partial Credit : Two correct answers.

Low Partial Credit : One correct answer.

(b) Scale 5 C

High Partial Credit : Two or three correct answers .

Low Partial Credit : One correct answer .

(c) Scale 5 B

Partial Credit : Correct answer but no reason or incorrect reason given .

(d) Scale 5 B

Partial Credit : Correct answer or valid explanation .
Correct answer but unsound explanation.
Incorrect answer but gives a valid explanation.

(e) Scale 5 A

(f) Scale 5 C

High Partial Credit : One correct answer .
Two correct answers without work.

Low Partial Credit : $x^\circ + 73^\circ + 60^\circ = 180^\circ$.
$y^\circ = 60^\circ + 73^\circ$.
$x^\circ + y^\circ = 180^\circ$.
One correct answer without work.

QUESTION 13

(a) Scale 5 A

(b) Scale 10 C

High Partial Credit : All entries in diagram correct but no key given .
Key given but one entry omitted.

Low Partial Credit : At least five correct entries with / without key.

(c) Scale 5 A

(d) Scale 5 C

High Partial Credit : $\frac{430}{20}$ or similar .

Low Partial Credit : Denominator of 20 or numerator of 430 .
Attempt at addition of any two numbers in list.
Correct relevant formula.

(e) Scale 5 C

High Partial Credit : $\frac{6}{20} \times 100 \neq 30$.

$\frac{6}{20} \times 100$.

Low Partial Credit : Numerator = 6 .
Denominator = 20 .
Multiplies by 100 .

BONUS MARKS FOR ANSWERING THROUGH IRISH

Bonus marks are applied separately to each paper as follows:

If the mark achieved is 225 or less, the bonus is 5% of the mark obtained, rounded ***down***.
(e.g. 198 marks × 5% = 9.9 ⇒ bonus = 9 marks.)

If the mark awarded is above 225, the following table applies:

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