



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2012

Marking Scheme

Mathematics
(Project Maths – Phase 1)

Foundation Level

Contents

Page

Paper 1

General Guidelines for Examiners – Paper 1	2
Question 1	3
Question 2	13
Question 3	18
Question 4	23
Question 5	27
Question 6	31
Question 7	34

Paper 2

Model Solutions	39
Structure of the marking scheme	54
Summary of mark allocations and scales to be applied	55
Detailed marking notes	56
Marcanna breise as ucht freagairt trí Ghaeilge	65

GENERAL GUIDELINES FOR EXAMINERS – PAPER 1

1. Penalties of three types are applied to candidates' work as follows:

- Blunders - mathematical errors/omissions (-3)
- Slips - numerical errors (-1)
- Misreadings (provided task is not oversimplified) (-1).

Frequently occurring errors to which these penalties must be applied are listed in the scheme. They are labelled: B1, B2, B3,..., S1, S2,..., M1, M2,...etc. These lists are not exhaustive.

2. When awarding attempt marks, e.g. Att(3) note that

- any *correct, relevant* step in a part of a question merits at least the attempt mark for that part
- if deductions result in a mark which is lower than the attempt mark, then the attempt mark must be awarded
- a mark between zero and the attempt mark is never awarded.

3. Worthless work is awarded zero marks. Some examples of such work are listed in the scheme and they are labelled as W1, W2,...etc.

4. The phrase “hit or miss” means that partial marks are not awarded – the candidate receives all of the relevant marks or none.

5. The phrase “and stops” means that no more work is shown by the candidate.

6. Special notes relating to the marking of a particular part of a question are indicated by an asterisk. These notes immediately follow the box containing the relevant solution.

7. The sample solutions for each question are not intended to be exhaustive lists – 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.

8. Unless otherwise indicated in the scheme, accept the best of two or more attempts – even when attempts have been cancelled.

9. The *same* error in the *same* section of a question is penalised *once* only.

10. Particular cases, verifications and answers derived from diagrams (unless requested) qualify for attempt marks at most.

11. A serious blunder, omission or misreading results in the attempt mark at most.

12. Do not penalise the use of a comma for a decimal point, e.g. €5.50 may be written as €5,50.

QUESTION 1

Each Part	10 marks	Att 4
------------------	-----------------	--------------

Part (i)	10 marks	Att 4
-----------------	-----------------	--------------

Find $(0.62)^3$, correct to two decimal places.

(i)	10 marks	Att 4
------------	-----------------	--------------

$$(0.62)^3 = 0.238328 = 0.24$$

* Accept correct answer with no work shown

Blunders (-3)

B1 0.38 given as answer with or without work

B2 Power higher than cube indicated and correctly worked e.g. $(0.62)^4 = 0.1477 = 0.15$

Slips (-1)

S1 Incorrect or omitted rounding off

S2 Decimal error

Misreadings (-1)

M1 $\sqrt[3]{0.26} = 0.0175 = 0.02$

Attempts (4 marks)

A1 $\sqrt[3]{0.62} = 0.8527$

A2 $0.62 \div 3 = 0.206$

A3 $0.62 \times 3 = 1.86$

A4 An incorrect figure correctly rounded off to two decimal places

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

Part (ii)

10 marks

Att 4

Find the exact value of $(5.9)^2 - \sqrt{67.24}$.

(ii)

10 marks

Att 4

$$(5.9)^2 - \sqrt{67.24} = 34.81 - 8.2 = 26.61$$

- * Accept correct answer with no work shown
- * Accept $26\frac{61}{100}$ or $\frac{2661}{100}$ for full marks

Blunders (-3)

- B1 Incorrect operator indicated and used
- B2 Square not found and continues
- B3 Square root not found and continues
- B4 No subtraction

Misreadings (-1)

- M1 A clear and obvious numerical misreading e.g. $(9.5)^2 - \sqrt{67.24} = 90.25 - 8.2 = 82.05$

Slips (-1)

- S1 Numerical slips to a maximum of 3
- S2 Decimal error

Attempts (4 marks)

- A1 Work at estimating the answer
- A2 $5.9 - 67.24 = -61.34$

Worthless (0 marks)

- W1 Incorrect answer with no work other than those in scheme

Part (iii)

10 marks

Att 4

Orla spent $\frac{1}{4}$ of her money.

She then had €11.25 left.

How much money did she start with?

(iii)

10 marks

Att 4

$$\frac{11.25}{3} \times 4 = 15$$

* Accept correct answer with no work shown

Blunders (-3)

B1 $\frac{3}{11.25} \times 4 = 1.06$

B2 $\frac{11.25}{4} \times 3 = 8.43$

B3 Errors in establishing $\frac{11.25}{3} \times 4$ (all 3 elements must be present, otherwise attempt marks only)

Misreadings (-1)

M1 $\frac{11.25}{3} \times 4 = 15.36$

Slips (-1)

S1 Numerical slips to a maximum of 3

S2 Decimal error

Attempts (4 marks)

A1 Writes down $\frac{11.25}{3}$ and / or 3.75 and stops

A2 Writes down 11.25×4 and / or 45 and stops

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

Part (iv)

10 marks

Att 4

Find the exact value of $\frac{2\frac{1}{2} + 5 \times 3\frac{1}{2}}{4}$.

(iv)

10 marks

Att 4

$$\frac{2\frac{1}{2} + 5 \times 3\frac{1}{2}}{4} = \frac{2\frac{1}{2} + 17\frac{1}{2}}{4} = \frac{20}{4} = 5$$

* Accept correct answer with no work shown

Blunders (-3)

- B1 Error in precedence e.g. $2\frac{1}{2} + 5 = 7\frac{1}{2} \times 3\frac{1}{2} = 26\frac{1}{4} \div 4 = 6.56$
- B2 A step omitted [may also occur in B1]
- B3 The use of the wrong operator or operators is indicated (once only)
- B4 A different order of the numbers indicated and worked out correctly

Misreadings (-1)

- M1 A clear and obvious misreading

Slips (-1)

- S1 Numerical slips to a maximum of 3
- S2 Decimal error

Attempts (4 marks)

- A1 Work at estimating the answer e.g. $\frac{2 + 5 \times 3}{4}$
- A2 Some correct step e.g. $5 \times 3\frac{1}{2} = 17\frac{1}{2}$
- A3 Some use of given data

Worthless (0 marks)

- W1 Incorrect answer with no work other than those in scheme

Part (v)

10 marks

Att 4

In a sale, the price of clothes is reduced by 30%.
A dress sells for €84 in the sale.
What was the price before the sale?

(v)

10 marks

Att 4

70% = €84
1% = €1.20
100% = €120.

- * Accept correct answer with no work shown
- * Award attempt mark for some relevant work

Award marks as follows:

- 10 marks: Fully correct answer
- 4 marks: Answer of some merit
- 0 marks: Otherwise

Part (vi)

10 marks

Att 4

Find the exact value of $\frac{120}{40.25 - (4.5)^2}$.

(vi)

10 marks

Att 4

$$\frac{120}{40.25 - (4.5)^2} = \frac{120}{40.25 - 20.25} = \frac{120}{20} = 6.$$

* Accept correct answer with no work shown

Blunders (-3)

B1 $\frac{120}{(40.25 - 4.5)^2} = \frac{120}{(35.75)^2} = \frac{120}{1278.06} = 0.093$

B2 Each omitted or incorrect step if steps not clear

B3 Inverts final fraction giving $\frac{1}{6}$ as the answer

Slips (-1)

S1 Numerical slips to a maximum of 3

S2 Decimal error

Attempts (4 marks)

A1 Some relevant work e.g. $(4.5)^2 = 20.25$

A2 Some work towards estimation

A3 $(4.5)^2 = 4.5 \times 4.5$ and stops

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

Part (vii)

10 marks

Att 4

A bus journey of 175 km began at 10:30 and finished at 14:00.
Find the average speed for the journey.

(vii)

10 marks

Att 4

10:30 to 14:00 = 3.5 hours
Average speed = $\frac{175}{3.5} = 50$ km/h

* Accept correct answer with no work shown

Blunders (-3)

- B1 Error in evaluation of journey time e.g. $\frac{175}{3.3} = 53.03$ or $\frac{175}{3.7} = 47.29$
B2 $175 \times 3.5 = 612.5$
B3 $175 \div 3.5$ and stops

Slips (-1)

- S1 Numerical slips to a maximum of 3
S2 Decimal error

Attempts (4 marks)

- A1 3.5 and stops
A2 Some use of given data
A3 $S = \frac{D}{T}$ or $D = S \times T$ written down and no more

Worthless (0 marks)

- W1 Incorrect answer with no work other than those in scheme

Part (viii)

10 marks

Att 4

Alice is 12 years old and Liam is 9 years old.
Divide 35 sweets between Alice and Liam in the ratio of their ages.

(viii)

10 marks

Att 4

$$12 + 9 = 21.$$

$$\text{Alice: } \frac{12}{21} \times 35 = 20$$

$$\text{Liam: } \frac{9}{21} \times 35 = 15 \quad \text{or} \quad 35 - 20 = 15$$

* Accept correct answer with no work shown

Blunders (-3)

B1 Each omitted or incorrect step if steps not clear

B2 $\frac{12}{21} \times 35 = 20$ or $\frac{35}{21} \times 9 = 15$ and stops

Slips (-1)

S1 Numerical slips to a maximum of 3

S2 Decimal error

Attempts (4 marks)

A1 $12 + 9$ and/or 21 and stops

A2 Some relevant work e.g. $\frac{12}{21}$

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

Part (ix)

10 marks

Att 4

Find $\frac{(6.1 \times 10^5) - (7.2 \times 10^3)}{2.3 \times 10^4}$, correct to three decimal places.

(ix)

10 marks

Att 4

$$\frac{(6.1 \times 10^5) - (7.2 \times 10^3)}{2.3 \times 10^4} = \frac{610000 - 7200}{23000} = \frac{602800}{23000} = 26.20869 = 26.209$$

- * Accept correct answer with no work shown
- * Award attempt mark for some relevant work

Award marks as follows:

- 10 marks: Fully correct answer
- 4 marks: Answer of some merit
- 0 marks: Otherwise

Part (x)

10 marks

Att 4

Find $\frac{(5.6 + 12.4) \times 20.75}{16.8 - 9.3}$, correct to the nearest integer.

(x)

10 marks

Att 4

$$\frac{(5.6 + 12.4) \times 20.75}{16.8 - 9.3} = \frac{18 \times 20.75}{7.5} = \frac{373.5}{7.5} = 49.8 = 50.$$

* Accept correct answer with no work shown

Blunders (-3)

B1 Error in precedence (once only) e.g. $\frac{5.6 + 12.4 \times 20.75}{16.8 - 9.3} = 35$

B2 Each omitted or incorrect step if steps not clear

Slips (-1)

S1 Numerical slips to a maximum of 3

S2 Answer not correct to nearest integer

S3 Decimal error

Attempts (4 marks)

A1 Some work towards estimation

A2 An incorrect number correctly rounded to the nearest integer

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

QUESTION 2

Part (a)	10 marks	Att 4
Part (b)	20 (5, 5, 10) marks	Att (2, 2, 4)
Part (c)	20 (5, 5, 10) marks	Att (2, 2, 4)

Part (a) **10 marks** **Att 4**

A glass rod 15 cm long falls and breaks into two pieces.
One piece is 63 mm long.
Find the length, in cm, of the other piece.

(a) **10 marks** **Att 4**

$$150 \text{ mm} - 63 \text{ mm} = 87 \text{ mm} = 8.7 \text{ cm}$$

or

$$15 \text{ cm} - 6.3 \text{ cm} = 8.7 \text{ cm}$$

- * Accept correct answer with no work shown
- * Accept answers given without units

Blunders (-3)

B1 Incorrect conversion factor (once only)

B2 $15 + 6.3 = 21.3$

Slips (-1)

S1 Numerical slips to a maximum of 3

S2 Answer given in incorrect units e.g. 87 mm

Attempts (4 marks)

A1 Any use of given data

A2 $63 - 15$ and/or 48

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

Part (b)

20 (5, 5, 10) marks

Att (2, 2, 4)

- Shane works 7.5 hours a day on five days of the week.
He begins work at 08:30 and has a lunch break of one hour.
- (i) At what time does he finish work?
 - (ii) He is paid €11.80 per hour.
Calculate his pay for the five days.
 - (iii) He has 32% of his pay deducted for taxes.
Find his take-home pay.

(b) (i)

5 marks

Att 2

08:30 + 7:30 + 1:00 = 17:00 or 5 o'clock

* Accept correct answer with no work shown

Blunders (-3)

B1 Time conversion error e.g. $8:30 + 1 + 7:50 = 17:20$ or $5:20$ or $8.3 + 1 + 7.5 = 16.8$

B2 Omits the one hour lunch break giving an answer of 16:00

Slips (-1)

S1 Decimal error

S2 Numerical slips to a maximum of 3

Attempts (2 marks)

A1 Some use of the given data

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

(b) (ii)

5 marks

Att 2

$$\text{€}11.80 \times 7.5 \times 5 = \text{€}442.50$$

* Accept correct answer with no work shown

Blunders (-3)

B1 Each omitted or incorrect step

Slips (-1)

S1 Decimal error

S2 Numerical slips to a maximum of 3

Attempts (2 marks)

A1 Some use of the given data

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

(b) (iii)

10 marks

Att 4

$$\frac{442.5 \times 68}{100} = \text{€}300.9$$

or

$$\frac{442.5 \times 32}{100} = \text{€}141.6 \qquad \text{€}442.5 - \text{€}141.6 = \text{€}300.9$$

* Accept correct answer with no work shown

* Accept candidates answer from part (i)

Blunders (-3)

B1 Error in calculating %

B2 Gets €141.6 and fails to finish

B3 Errors in establishing $\frac{442.5 \times 68}{100}$ (all 3 elements must be present, otherwise attempt marks only)

Slips (-1)

S1 Numerical slips to a maximum of 3

S2 Decimal error

Attempts (4 marks)

A1 Some correct step

A2 68 and stops

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

Part (c)**20 (5, 5, 10) marks****Att (2, 2, 4)**

A company employs 20 office workers and 325 production workers.

The company hires 6 more office workers and 39 more production workers.

(i) After the hiring, how many workers does the company employ?

(ii) Find the percentage increase in the number of workers the company employs.
Give your answer correct to the nearest percentage.

(iii) The weekly wage for an office worker is €427.50 and for a production worker is €463.
Find the total weekly wage bill for the company, after the hiring.

(c) (i)**5 marks****Att 2**

$$20 + 325 + 6 + 39 = 390$$

* Accept correct answer with no work shown

Blunders (-3)

B1 Adds only three correct values

B2 Fails to add

Slips (-1)

S1 Numerical slips to a maximum of 3

Attempts (2 marks)

A1 $20 + 325$ and/or 345

A2 $20 + 6$ and/or 26

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

(c) (ii)

5 marks

Att 2

$$\frac{45}{345} \times 100 = 13.04 = 13\%$$

* Accept correct answer with no work shown

Blunders (-3)

B1 Error in calculating %

B2 Errors in establishing $\frac{45}{345} \times 100$ (all 3 elements must be present otherwise attempt marks only)

Slips (-1)

S1 Numerical slips to a maximum of 3

S2 Decimal error

S3 Incorrect or no rounding off

Attempts (2 marks)

A1 Some attempt at getting a %

A2 45 and/or 345 or 100

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

(c) (iii)

10 marks

Att 4

$$26 \times 427.50 + 364 \times 463 = 11\,115 + 168\,532 = \text{€}179\,647$$

* Accept correct answer with no work shown

* Accept candidates answer from part (i) if relevant

Blunders (-3)

B1 Fails to add

B2 Error in worker totals e.g. $20 + 39 = 59$; $325 + 6 = 331$ and continues correctly

Misreadings (-1)

M1 $26 \times 463 + 364 \times 427.5 = 167\,648$

Slips (-1)

S1 Numerical slips to a maximum of 3

S2 Decimal error

Attempts (4 marks)

A1 26 and/or 364 and stops

A2 Some correct step

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

QUESTION 3

Part (a)	10 (5, 5) marks	Att (2, 2)
Part (b)	20 marks	Att 8
Part (c)	20 (5, 10, 5) marks	Att (2, 4, 2)

Part (a) **10 (5, 5) marks** **Att (2, 2)**

Gemma estimates that there are 300 jelly beans in a jar.
There are actually 273 jelly beans in the jar.

- (i) Find the error in the estimate.
- (ii) Calculate the percentage error, correct to one decimal place.

(a) (i) **5 marks** **Att 2**

$$\text{Error} = 300 - 273 = 27$$

* Accept correct answer with no work shown

Blunders (-3)

B1 300 – 273 and stops

Slips (-1)

S1 Numerical slips to a maximum of 3

Attempts (2 marks)

A1 Some use of given data

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

(a) (ii) **5 marks** **Att 2**

$$\text{Percentage error} = \frac{27}{273} \times 100 = 9.89\% = 9.9\%$$

* Accept correct answer with no work shown

* Accept candidates answer from part (i)

Blunders (-3)

B1 Errors in establishing $\frac{27}{273} \times 100$ (all three elements must be present otherwise attempt mark only)

B2 Stops at $\frac{27}{273} \times 100$

Slips (-1)

S1 Numerical slips to a maximum of 3

S2 Decimal error

S3 Incorrect or no rounding off

Attempts (2 marks)

A1 Some use of given data

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

Part (b)

20 marks

Att 8

€6300 is invested for four years at 3% per annum compound interest.
Find the total value of the investment at the end of four years.
Give your answer correct to the nearest euro.

(b)

20 marks

Att 8

$$\begin{aligned} A &= 6300(1 + 0.03)^4 \\ A &= 6300(1.03)^4 \\ A &= 6300(1.12550881) \\ A &= 7090.7055 \\ &= \text{€}7091 \end{aligned}$$

* Accept correct answer with no work shown

Blunders (-3)

- B1 Error in formula as written by student or incorrect formula e.g. depreciation
- B2 Error in substituting into formula, once only e.g. $n = 3$ and/or $r = 4$
- B3 Each step missing

Slips (-1)

- S1 Numerical slips to a maximum of 3
- S2 Decimal error
- S3 Incorrect or no rounding off

Attempts (8 marks)

- A1 Some use of given data
- A2 $\frac{3}{100}$
- A3 $P = 6300$
- A4 Effort at simple interest

Worthless (0 marks)

- W1 Incorrect answer with no work other than those in scheme

OR

Principal year 1	6300	
Interest year 1	189	$\leftarrow \frac{6300 \times 3}{100}$
Amount at end year 1	6489	
Interest year 2	194.67	$\leftarrow \frac{6489 \times 3}{100}$
Amount at end year 2	6683.67	
Interest year 3	200.51	$\leftarrow \frac{6683.67 \times 3}{100}$
Amount at end year 3	6884.18	
Interest year 4	206.52	$\leftarrow \frac{6884.18 \times 3}{100}$
Amount at end year 4	7090.70	= €7091

* Accept correct answer with no work shown

Blunders (-3)

- B1 Error in establishing the interest
- B2 Subtracts the interest to find the amount

Slips (-1)

- S1 Numerical slips to a maximum of 3
- S2 Decimal error
- S3 Incorrect or no rounding off

Attempts (8 marks)

- A1 Some use of 100 in an attempt to find %
- A2 Some correct step

Worthless (0 marks)

- W1 Incorrect answer with no work other than those in scheme

Part (c)

20 (5, 10, 5) marks

Att (2, 4, 2)

A car travels an average of 100 km on 5.5 litres of diesel.

The car driver buys 60 litres of diesel at €1.629 per litre.

(i) Find the cost of the diesel.

(ii) How far, to the nearest kilometre, will the car travel on the 60 litres of diesel assuming the average consumption of diesel?

(iii) Find the cost per kilometre, correct to the nearest cent.

(c) (i)

5 marks

Att 2

$$60 \times 1.629 = \text{€}97.74$$

* Accept correct answer with no work shown

Blunders (-3)

B1 Incorrect operator

Slips (-1)

S1 Numerical slips to a maximum of 3

S2 Decimal error

Attempts (2 marks)

A1 Some use of given data

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

(c) (ii)

10 marks

Att 4

$$\frac{60}{5.5} \times 100 = 1090.9 = 1091 \text{ km}$$

* Accept correct answer with no work shown

Blunders (-3)

B1 Errors in establishing $\frac{60}{5.5} \times 100$ (all 3 elements must be present otherwise attempt mark)

Slips (-1)

S1 Numerical slips to a maximum of 3

S2 Decimal error

S3 Incorrect or no rounding off

Attempts (4 marks)

A1 Some use of given data e.g. 60×100

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

(c) (iii)

5 marks

Att 2

$$\frac{97.74}{1091} = 0.0895 = \text{€}0.09 \text{ or } 9 \text{ cent}$$

* Accept correct answer with no work shown

* Accept candidates answers from parts (i) and (ii)

Blunders (-3)

B1 Wrong operator

B2 $\frac{1091}{97.74}$ and or 11.16

Slips (-1)

S1 Numerical slips to a maximum of 3

S2 Decimal error

S3 Incorrect or no rounding off

Attempts (2 marks)

A1 Writes down 97.74 and/or 1091 and stops

A2 Some correct step

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme

QUESTION 4

Part (a)	10 marks	Att 4
Part (b)	20 (15, 5) marks	Att (6, 2)
Part (c)	20 (10, 5, 5) marks	Att (4, 2, 2)

Part (a)	10 marks	Att 4
-----------------	-----------------	--------------

Solve for x

$$2x + 9 = 5x - 3$$

(a)	10 marks	Att 4
------------	-----------------	--------------

$$2x + 9 = 5x - 3 \Rightarrow 12 = 3x \Rightarrow x = 4$$

* Award full marks for correct answer by trial and error with verification

Blunders (-3)

- B1 Blunders in grouping terms e.g. $2x + 9 = 11x$ [each time]
- B2 Transposition errors [once only]
- B3 $3x = 12 \Rightarrow x \neq 4$
- B4 Each step omitted e.g. $3x = 12$ and stops
- B5 $x = 4$ without work

Slips (-1)

- S1 Numerical slips to a maximum of 3

Attempts (4 marks)

- A1 Some correct work
- A2 Effort at trial and error by substitution

Worthless (0 marks)

- W1 Incorrect answer without work

Part (b)

20 (15, 5) marks

Att (6, 2)

Solve the simultaneous equations

$$2x - 3y = 7$$

$$x + 4y = 9.$$

(b) First Variable Found

15 marks

Att 6

Second Variable

5 marks

Att 2

$$\begin{array}{rcl} 2x - 3y = 7 & \times 1 & \Rightarrow 2x - 3y = 7 \\ x + 4y = 9 & \times -2 & \Rightarrow -2x - 8y = -18 \\ \hline & & -11y = -11 \Rightarrow y = 1 \end{array}$$

$$x + 4y = 9 \Rightarrow x + 4(1) = 9 \Rightarrow x = 9 - 4 \Rightarrow x = 5$$

* Random x picked, y calculated (or vice versa) – Award 5 marks (second variable found)

* Substitution of correct values in both equations shown – Award 15 + 5 marks

Blunders (-3)

B1 Error(s) in establishing the first equation in terms of x only ($x = 5$) or the first equation in terms of y only ($y = 1$)

B2 $-11y = -11 \Rightarrow y \neq 1$

B3 Blunder in substitution e.g. y value for x

B4 Transposition error in finding second variable (once only)

Attempts – First variable (6 marks)

A1 Effort at equalising coefficients of x 's or y 's

A2 Effort at cancelling one variable

A3 Effort at writing x in terms of y (or vice versa)

Attempts – Second variable (2 marks)

A4 Effort at substituting first variable

A5 Effort at cancelling second variable

Attempts (6+2)

A6 Correct answer with no work shown

Worthless (0 marks)

W1 Incorrect answer without work

Part (c)

20 (10, 5, 5) marks

Att (4, 2, 2)

An orange costs 5 cent more than an apple.

Let x cent be the cost of an orange.

(i) Write an expression in x for the cost of an apple.

The total cost of 14 oranges and 12 apples is €7.98.

(ii) Write this information as an equation in x .

(iii) Solve this equation to find the cost of an orange.

(c) (i)

10 marks

Att 4

$$x - 5$$

Blunders (-3)

B1 $x + 5$ or $5 - x$

B2 $5x$

Attempts (4 marks)

A1 Some use of the data given $\frac{x}{5}$ or $\frac{5}{x}$

Worthless (0 marks)

W1 No use of the x or the 5

W2 $x = 5$ and stops

(c) (ii)

5 marks

Att 2

$$14x + 12(x - 5) = 798$$

* Accept candidates answer from part (i)

Blunders (-3)

B1 Each price omitted

B2 $26x - 60$ only

B3 $14x + 12(x - 5) = 7.98$

Midreading (-1)

M1 $12(x) + 14(x - 5) = 798$

Attempts (2 marks)

A1 A spurious equation in x involving 7.98 or 798

A2 $14x$ or $12(x - 5)$ or $12x$

Worthless (0 marks)

W1 No use of x

(c) (iii)

5 marks

Att 2

$$14x + 12(x - 5) = 798 \Rightarrow 14x + 12x - 60 = 798 \Rightarrow 26x = 798 + 60 = 858 \Rightarrow x = 33 \text{ cent}$$

- * Accept candidates answers from parts (i) and (ii)
- * $14x + 12x - 60 = 798$ as starting work can earn marks for parts (i) and (ii)

Blunders (-3)

- B1 Incorrectly formed equation
- B2 Blunders in grouping terms e.g. $26x - 60 = -34x$ (each time)
- B3 Transposition error(s) (once only)
- B4 $26x = 858 \Rightarrow x \neq 33$
- B5 Each step omitted
- B6 Correct answer without work
- B7 Distribution error

Slips (-1)

- S1 Numerical slips to a maximum of 3

Attempts (2 marks)

- A1 Some correct work
- A2 Effort at trial and error by substitution

Worthless (0 marks)

- W1 Incorrect answer without work

QUESTION 5

Part (a)	10 (5, 5) marks	Att (2, 2)
Part (b)	20 (10, 10) marks	Att (4, 4)
Part (c)	20 (10, 5, 5) marks	Att (4, 2, 2)

Part (a) **10 marks** **Att (2, 2)**

- (i) Write down the first five multiples of 3 and the first five multiples of 5.
(ii) Hence, or otherwise, write down the lowest common multiple of 3 and 5.

(a) (i) **5 marks** **Att 2**
(a) (ii) **5 marks** **Att 2**

- (i) 3, 6, 9, 12, 15 and 5, 10, 15, 20, 25
(ii) LCM = 15.

Slips (-1)

S1 Each omitted or incorrect entry provided at least one is correct [to a maximum of 3]

Attempts (2 marks)

A1 At least one correct entry, each part

Part (b) **20 (10, 10) marks** **Att (4, 4)**

- (i) Solve the quadratic equation $x^2 - 2x - 15 = 0$.
(ii) Solve the quadratic equation $4x^2 - 3x - 2 = 0$, correct to two decimal places.

(b) (i) **10 marks** **Att 4**

$$x^2 - 2x - 15 = 0 \Rightarrow (x - 5)(x + 3) = 0 \Rightarrow x = 5 \text{ or } x = -3.$$

Blunders (-3)

- B1 Last step(s) omitted
B2 Sign error in factors (once only)
B3 Sign errors in solution (once only)
B4 Incorrect relevant factors and continues
B5 Errors in using formula as in (ii)

Attempts (4 marks)

- A1 Effort at finding factors
A2 Attempt at trial and error

Worthless (0 marks)

- W1 Quadratic reduced to linear

(b) (ii)

10 marks

Att 4

$$\begin{aligned}4x^2 - 3x - 2 &= 0 \\ \Rightarrow x &= \frac{3 \pm \sqrt{(-3)^2 - 4(4)(-2)}}{2 \times 4} \\ &= \frac{3 \pm \sqrt{9 + 32}}{8} \\ &= \frac{3 \pm \sqrt{41}}{8} * \\ &= \frac{3 \pm 6.403}{8} \\ \Rightarrow x &= \frac{9.403}{8} \text{ or } x = \frac{-3.403}{8} \\ \Rightarrow x &= 1.175 \text{ or } x = -0.425 \\ \Rightarrow x &= \mathbf{1.18} \text{ or } x = \mathbf{-0.43}\end{aligned}$$

* Maximum deductions beyond point * is 3 marks

* $\frac{3 \pm \sqrt{\text{negative number}}}{2 \times 4}$ cannot earn final 3 marks

Blunders (-3)

B1 Blunders in application of formula e.g. $(-3)^2 = 6$

Slips (-1)

S1 Slip in substitution into formula to a maximum of 3

S2 Incorrect or omitted rounding off, each time

S3 Decimal error

Attempts (4 marks)

A1 Effort at substitution into formula

A2 Incorrect formula with substitution and stops

A3 Attempt at finding factors e.g. $(x \quad)(x \quad)$

A4 Appearance of the variable in the answer

A5 Identifies *A* or *B* or *C*

Worthless (0 marks)

W1 Quadratic reduced to linear

Part (c)

20 (10, 5, 5) marks

Att (4, 2, 2)

- (i) Solve $4x - 7 \leq 9$, $x \in \mathbb{Z}$.
(ii) Solve $3 - 2x < 7$, $x \in \mathbb{Z}$.
(iii) Write down all the values of x which satisfy both of the above inequalities.

(c) (i)

10 marks

Att 4

$$4x - 7 \leq 9 \Rightarrow 4x \leq 16 \Rightarrow x \leq 4$$

Blunders (-3)

- B1 Blunder in grouping terms e.g. $4x - 7 = -3x$ (each time)
- B2 Transposition errors (once only)
- B3 Each step omitted e.g. $4x \leq 16$ and stops
- B4 $x \leq 4$ without work
- B5 Replaces inequality with equality sign

Misreadings (-1)

- M1 Uses $<$ instead of \leq

Slips (-1)

- S1 Numerical slips to a maximum of 3

Attempts (4 marks)

- A1 Some correct work
- A2 Effort at trial and error by substitution

Worthless (0 marks)

- W1 Incorrect answer without work

(c) (ii)

5 marks

Att 2

$$3 - 2x < 7 \Rightarrow -2x < 4 \Rightarrow x > -2.$$

Blunders (-3)

- B1 Blunder in grouping terms e.g. $6 - 4x = 2x$ (each time)
- B2 Transposition errors (once only)
- B3 Each step omitted e.g. $-2x < 4$ and stops
- B4 Error in inequality sign e.g. $-2x < 4 \Rightarrow x < -2$
- B5 $x > -2$ without work
- B6 Replaces inequality with equality sign

Misreadings (-1)

- M1 Uses \leq instead of $<$

Slips (-1)

- S1 Numerical slips to a maximum of 3

Attempts (2 marks)

- A1 Some correct work
- A2 Effort at trial and error by substitution

Worthless (0 marks)

- W1 Incorrect answer without work

(c) (iii)

5 marks

Att 2

$\{-1, 0, 1, 2, 3, 4\}$

- * Accept candidates answers from parts (i) and (ii)
- * If equality used in (i) or (ii), then attempt at most here

Slips (-1)

S1 Each entry omitted or incorrect provided at least one is correct [to a maximum of 3]

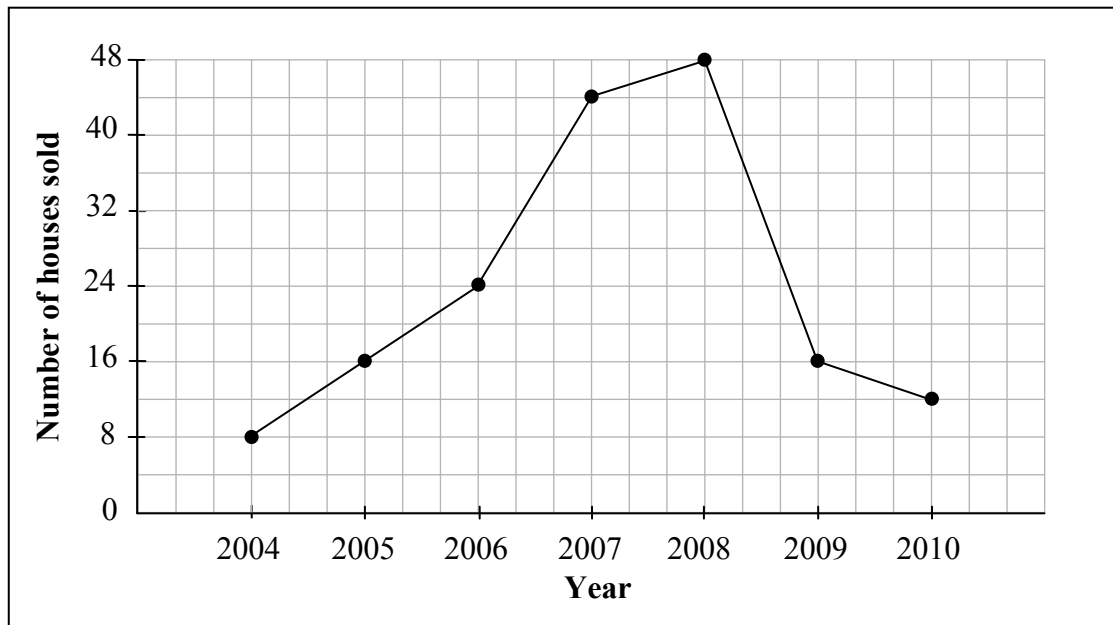
Attempts (2 marks)

A1 Partial listing of answers to (i) or (ii) or both

QUESTION 6

Part (i)	10 marks	Att 4
Part (ii)	10 marks	Att 4
Part (iii)	10 marks	Att 4
Part (iv)	10 marks	Att 4
Part (v)	10 marks	Att 4

The graph below shows the number of houses sold by an estate agent each year from 2004 to 2010. For example in 2006 the estate agent sold 24 houses.



(i) 10 marks Att 4

How many houses were sold in 2007?

(i) 10 marks Att 4

44 houses.

* Accept correct answer without work shown

Worthless (0 marks)

W1 Incorrect answer without work

(ii) 10 marks Att 4

In which two years were the same number of houses sold?

(ii) 10 marks Att 4

2005 and 2009.

* Accept correct answer without work shown

Blunders (-3)

B1 Only one of the correct years given

Attempts (4 marks)

A1 16 given as answer

Worthless (0 marks)

W1 Incorrect answer without work

(iii)

10 marks

Att 4

What was the difference in the number of houses sold in 2008 and 2009?

(iii)

10 marks

Att 4

2008.....48

2009.....16 $48 - 16 = 32$

* Accept correct answer without work shown

Blunder (-3)

B1 $48 + 16 = 64$

Misreading (-1)

M1 Wrong year taken and indicated

Attempts (4 marks)

A1 48 and or 16 without work

Worthless (0 marks)

W1 Incorrect answer without work, other than those in scheme

(iv)

10 marks

Att 4

Find the average number of houses sold per year from 2004 to 2010.

(iv)

10 marks

Att 4

$$\frac{8 + 16 + 24 + 44 + 48 + 16 + 12}{7} = \frac{168}{7} = 24.$$

* Accept correct answer without work shown

* Accept candidates answer from previous work if used

Blunder (-3)

B1 Stops at $\frac{168}{7}$

B2 16 given as the average

Slips (-1)

S1 Each omitted number or incorrect number, provided at least one is correct

S2 Uses a divisor other than 7

S3 Numerical slips to a maximum of 3

Attempts (4 marks)

A1 Stops at 168 or candidates answer

Worthless (0 marks)

W1 Incorrect answer without work, other than those in scheme

(v)

10 marks

Att 4

If the average number of houses sold per year by the estate agent from 2004 to 2011 was 23, how many houses did he sell in 2011?

(v)

10 marks

Att 4

$$23 \times 8 = 184$$

$$184 - 168 = 16$$

- * Accept correct answer without work shown
- * Accept candidates work from part (iv)

Blunder (-3)

B1 Divides instead of multiplies e.g. $23 \div 8 = 2.876$

B2 Writes $184 - 168$ and stops

B3 Writes $184 + 168 = 352$

Slips (-1)

S1 Numerical slips to a maximum of 3

Attempts (4 marks)

A1 Some correct work

A2 Some use of 168

A3 23×8 and stops

Worthless (0 marks)

W1 Incorrect answer without work, other than those in scheme

QUESTION 7

Graph Values	30 (20, 10) marks 20 (5, 5, 5, 5) marks	Att (8, 4) Att (2, 2, 2, 2)
---------------------	--	--

Evaluation	20 marks	Att 8
Graph	10 marks	Att 4

Draw the graph of the function

$$f : x \rightarrow 3x^2 - 5x - 1, \quad \text{for } -2 \leq x \leq 3, \quad x \in \mathbb{R}.$$

Table method	20 marks	Att 8
---------------------	-----------------	--------------

x	-2	-1	0	1	2	3
$3x^2$	12	3	0	3	12	27
$-5x$	10	5	0	-5	-10	-15
-1	-1	-1	-1	-1	-1	-1
$f(x)$	21	7	-1	-3	1	11

* Accept correct $f(x)$ values without work

Blunders (-3)

- B1 x values added on when calculating $f(x)$ values
- B2 Consistent errors across full line otherwise slips apply
- B3 $f(x)$ not evaluated for an x value in domain or some x value omitted

Slips (-1)

- S1 Each incorrect or omitted value in the body of the table
- S2 Each incorrect or omitted $y / f(x)$ value from candidates work

Misreadings (-1)

- M1 -1 treated as 1 across the line

Attempts (8 marks)

- A1 Any four values in the table
- A2 Function treated as linear e.g. $x^2 = 2x$ or x or $3x^2 = 6x$ or x

$$f(x) = 3x^2 - 5x - 1$$

$$f(-2) = 3(-2)^2 - 5(-2) - 1 = 21$$

$$f(-1) = 3(-1)^2 - 5(-1) - 1 = 7$$

$$f(0) = 3(0)^2 - 5(0) - 1 = -1$$

$$f(1) = 3(1)^2 - 5(1) - 1 = -3$$

$$f(2) = 3(2)^2 - 5(2) - 1 = 1$$

$$f(3) = 3(3)^2 - 5(3) - 1 = 11$$

Blunders (-3)

B1 Consistent errors in the evaluation of $3x^2$

B2 -1 omitted from the evaluation

B3 Each incorrect $f(x)$ value when no work is shown to a maximum of 3 provided that at least one $f(x)$ value is correct

All $f(x)$ values incorrect without work \rightarrow 0 marks. Otherwise slips applied when work is shown

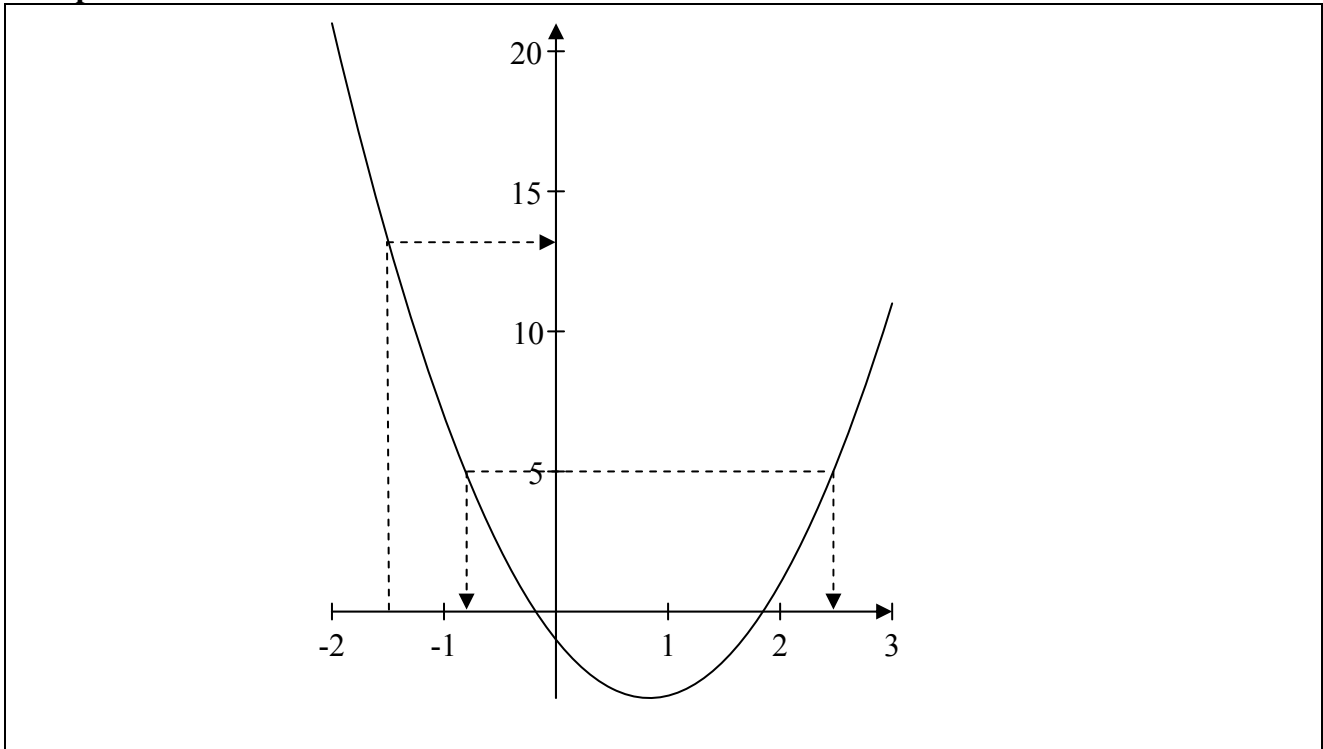
Slips (-1)

S1 Each incorrect or omitted value from the evaluation after substitution

S2 Each incorrect or omitted $f(x)$ value, calculated from candidates work

Misreadings (-1)

M1 -1 consistently treated as 1 in the evaluation.



* Accept values from candidates work

* Fully correct graph drawn with no work shown: award 30 marks

Blunders (-3)

B1 Blunders in scales on axis or axes (once only)

Slips (-1)

S1 Each point from table plotted incorrectly

S2 Each pair of successive points not joined to a maximum of 3

S3 Not a smooth curve

S4 The graph of the function is not in the conventional position or orientation.

Attempts (4 marks)

A1 At least two of the candidates points plotted

A2 Any U shaped graph

A3 Axes drawn

Use your graph to estimate

- (i) the value of $f(-1.5)$
- (ii) the minimum value of $f(x)$
- (iii) the values of x for which $f(x) = 5$
- (iv) the range of values of x for which $f(x)$ is less than 0.

(i)	5 marks	Att 2
(ii)	5 marks	Att 2
(iii)	5 marks	Att 2
(iv)	5 marks	Att 2

(i) $f(-1.5) = 13.3$

(ii) -3.1

(iii) $x = -0.8, x = 2.5$

(iv) $-0.2 < x < 1.9$

* Accept candidates values from graph

* Allow tolerance of ± 0.3 units on x -axis, ± 0.5 on y -axis

Blunders (-3)

B1 Extra value applies in parts (i) and (ii)

B2 $f(x) = 5$ treated as $f(5)$

B3 Value omitted, applies in part (iii)

Slips (-1)

S1 Answers indicated correctly on axis but not specified

S2 Part of graph where $f(x)$ is less than zero, indicated but no x value written down

Misreadings (-1)

M1 Gives the value of x corresponding to the minimum of $f(x)$ in part (ii)

Attempts (2 marks)

A1 Effort at reading value(s) from graph

A2 Correctly solving equation algebraically; part (iii) and (iv)



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination, 2012

Mathematics
(Project Maths – Phase 1)

Paper 2

Foundation Level

Monday 11 June Morning 9:30 – 12:00

300 marks

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.

Instructions

There are **three** sections in this examination paper:

Section A	Concepts and Skills	100 marks	4 questions
Section B	Contexts and Applications	100 marks	2 questions
Section C	Area and Volume (old syllabus)	100 marks	2 questions

Answer **all eight** questions, as follows:

In Section A, answer

Questions 1 to 3 and
either Question 4A **or** Question 4B.

In Section B, answer Questions 5 and 6.

In Section C, answer Questions 7 and 8.

Write your answers in the spaces provided in this booklet. You will 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.

A sheet of formulae will also be given to you by the superintendent.

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:

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

Question 1

(25 marks)

- (a) Which of the following best describes how likely it is that each of the following events occurs? Write the letter corresponding to the correct answer in each box in the table.

- A. Impossible or almost impossible
- B. Not very likely
- C. About 50% likely
- D. Very likely
- E. Certain or almost certain.

<i>Event</i>	<i>How likely</i>
A baby will be born in Ireland tomorrow.	E
If you pick one card from an ordinary pack of cards you will pick the queen of hearts.	B
There will be 400 days in the year 2013.	A
If a coin is tossed you will get a head.	C
It will not rain in Ireland during the month of November.	B
If two ordinary dice are thrown, the sum of the numbers will be 1.	A

- (b) A small business employs 1 manager, 4 technicians, 2 technical assistants and 2 secretaries. The manager is paid €1020 a week, the technicians are each paid €800 a week, the technical assistants are each paid €500 a week and the secretaries are each paid €450 a week. Find the difference between the mean weekly wage and the median weekly wage.

$$\text{Mean} = \frac{1020 \times 1 + 800 \times 4 + 500 \times 2 + 450 \times 2}{1 + 4 + 2 + 2} = \frac{6120}{9} = \text{€}680$$

$$\text{Median} = \text{€}800$$

$$\text{Difference } \text{€}800 - \text{€}680 = \text{€}120$$

Question 2**(25 marks)**

John has two bags. In one bag there are two balls numbered 1 and 2. In the other bag there are three balls numbered 5, 6 and 7.

John picks one ball at random from each bag and records the two numbers drawn.

- (a) How many different possible outcomes are there?

$$2 \times 3 = 6$$

- (b) What is the probability that the outcome will be the balls numbered 1 and 5?

$$\frac{1}{6}$$

- (c) What is the probability that both numbers drawn will be odd?

$$\frac{2}{6} = \frac{1}{3}$$

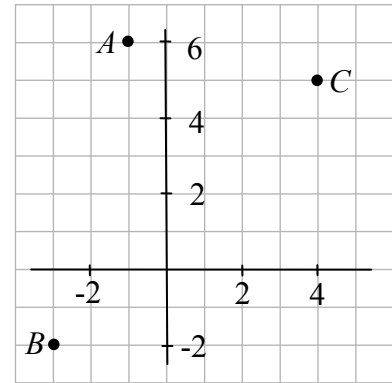
- (d) What is the probability that at least one of the numbers will be odd?

$$\frac{5}{6}$$

Question 3**(25 marks)**The diagram shows the points A , B and C .

- (a) Write down the co-ordinates of

$$\begin{aligned} A &(-1, 6) \\ B &(-3, -2) \\ C &(4, 5) \end{aligned}$$



- (b) Find the co-ordinates of the midpoint of $[BC]$.

$$\text{Midpoint } [BC] = \left(\frac{-3+4}{2}, \frac{-2+5}{2} \right) = \left(\frac{1}{2}, \frac{3}{2} \right)$$

- (c) Find the slope of AB .

$$\text{Slope } AB = \frac{-2-6}{-3+1} = \frac{-8}{-2} = 4$$

- (d) The point X has co-ordinates $(7, 17)$.
Is the line AB parallel to the line CX ? Give a reason for your answer.

$$\begin{aligned} \text{Slope } CX &= \frac{17-5}{7-4} = \frac{12}{3} = 4 \\ \text{Slope of } AB &= \text{slope of } CX \Rightarrow \text{line } AB \text{ is parallel to line } CX. \end{aligned}$$

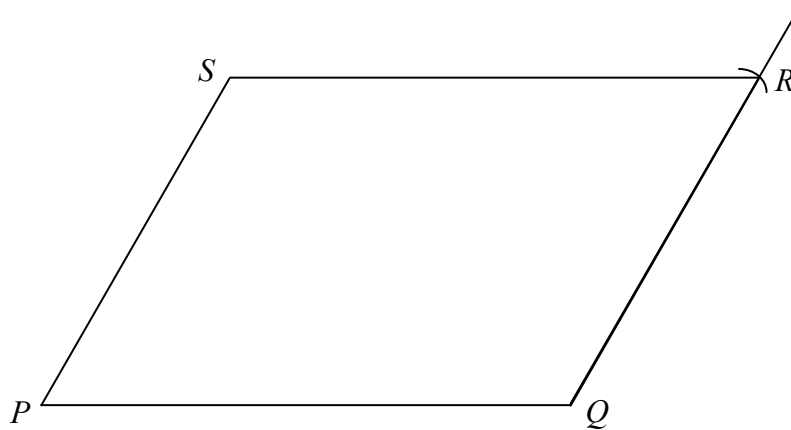
Question 4

(25 marks)

Answer **either** 4A **or** 4B.

Question 4A

- (a) Construct a parallelogram $PQRS$ in which $|PQ| = 7$ cm, $|QR| = 5$ cm and $|\angle PQR| = 120^\circ$. Show all the construction lines clearly.



- (b) Use your protractor to measure the angle RSP .

$ \angle RSP = 120^\circ$

- (c) Explain how you could use the measurement in part (b) to check the accuracy of your construction.

Opposite angles in a parallelogram are equal in measure.
--

If $ \angle RSP = 120^\circ = \angle PQR $, then the construction is accurate.

OR

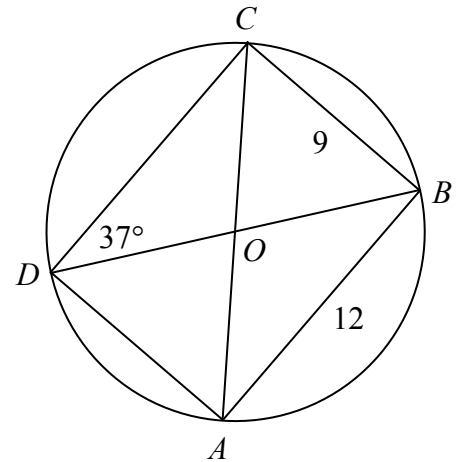
Question 4B

$ABCD$ is a parallelogram.

A circle of centre O passes through the four vertices of the parallelogram.

The diagonals of the parallelogram intersect at O .

$|AB| = 12$, $|BC| = 9$ and $|\angle CDB| = 37^\circ$.



(a) Write down $|\angle BCD|$.

$$|\angle BCD| = 90^\circ$$

(b) Calculate $|DB|$.

$$\begin{aligned} |DB|^2 &= |BC|^2 + |CD|^2 = 9^2 + 12^2 = 225 \\ \Rightarrow |DB| &= \sqrt{225} = 15 \end{aligned}$$

(c) Name two isosceles triangles in the diagram.

$$\triangle OAB, \triangle OBC, \triangle OCD, \triangle ODA$$

(d) Find $|\angle BOC|$.

$$\begin{aligned} |\angle BOC| &= |\angle OCD| + |\angle CDO| = 37^\circ + 37^\circ = 74^\circ \\ \text{or} \\ |\angle DOC| &= 180^\circ - (37^\circ + 37^\circ) = 106^\circ \\ |\angle BOC| &= 180^\circ - |\angle DOC| = 180^\circ - 106^\circ = 74^\circ \end{aligned}$$

(e) Find the area of the triangle ABD .

$$\text{Area } \triangle ABD = \frac{1}{2} |AD| \times |AB| = \frac{1}{2} (9)(12) = 54 \text{ square units}$$

Answer Question 5 and Question 6 from this section.

Question 5**(50 marks)**

A researcher is investigating the number of hours that Leaving Certificate students in Ireland spend studying each week. The researcher asks the Principal in her old school to pick some students to be surveyed. Each student was asked how many hours they spent studying, on average, each week.

The results are as follows:

9	14	13	17	8
6	8	19	12	9
7	18	13	14	21
6	22	11	6	16
9	7	13	11	22

(a) Complete the following table:

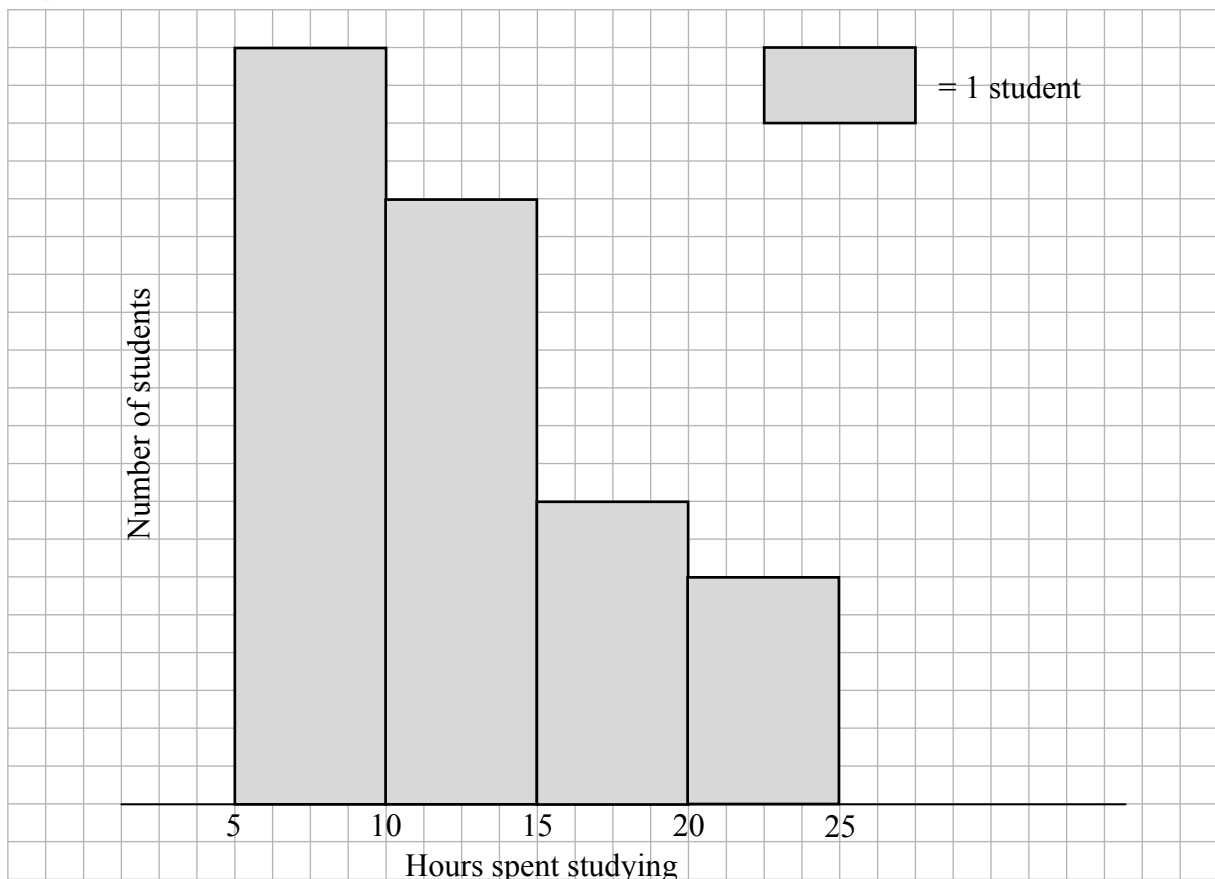
Hours spent studying	5 – 10	10 – 15	15 – 20	20 – 25
Number of students	10	8	4	3

Note: “5 – 10” means at least 5 but less than 10, etc.

(b) How many students took part in the research?

Answer: 25 students

(c) Represent the data using a suitable chart.



- (d) A student is picked at random from the group. What is the probability that this student spends less than 10 hours a week studying.

$$\frac{10}{25} = \frac{2}{5}$$

- (e) A sample should always be chosen in a way that represents the population fairly. Otherwise, the sample may be *biased*. Give one reason why the sample in this case might be biased.

Students *picked* by an individual, rather than random selection.

Students picked from one school only.

- (f) State one thing the researcher could have done to avoid bias in the sample.

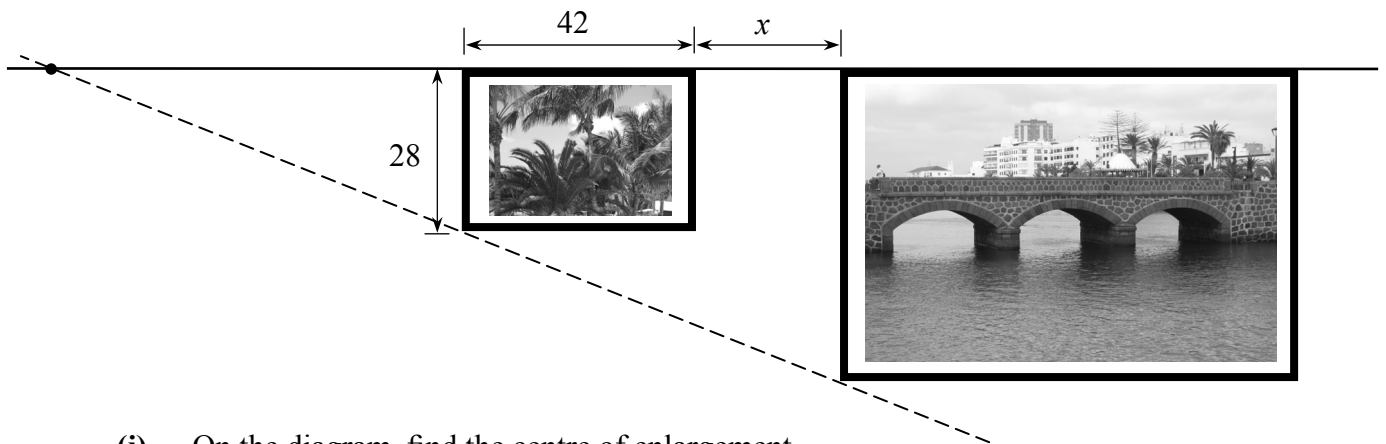
Select students at random.

Select students from a variety of schools which are geographically spread.

Question 6**(50 marks)**

(a) John hangs two pictures from a horizontal rail.

The smaller picture frame is a rectangle measuring 42 cm by 28 cm. The larger picture frame is an enlargement of the smaller picture frame. The scale factor of the enlargement is 2.



(i) On the diagram, find the centre of enlargement.

(ii) Find the measurements of the larger picture.

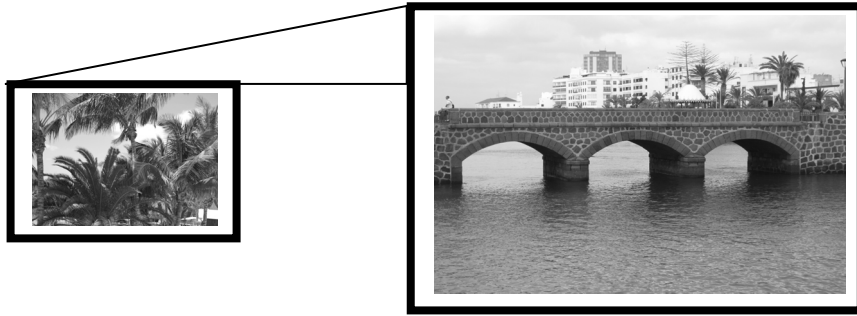
$$42 \times 2 = 84 \text{ cm}$$

$$28 \times 2 = 56 \text{ cm}$$

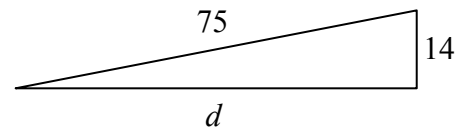
(iii) The centre of enlargement is 70 cm from the nearest corner of the smaller picture. Find x , the distance between the two pictures.

$$70 + 42 + x = 140 \Rightarrow x = 140 - (70 + 42) = 28 \text{ cm}$$

- (b) John decides that the pictures might look better if he moves the larger one across and up. To arrange them, he drew the triangle shown and noted the measurements, in centimetres.

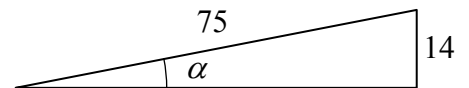


- (i) Use Pythagoras' theorem to find the length d , correct to the nearest cm.



$$\begin{aligned}75^2 &= 14^2 + d^2 \\ \Rightarrow d^2 &= 75^2 - 14^2 = 5625 - 196 = 5429 \\ \Rightarrow d &= 73.68 \approx 74 \text{ cm}\end{aligned}$$

- (ii) Find the angle α , correct to the nearest degree.



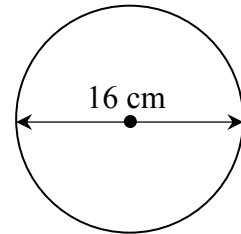
$$\begin{aligned}\sin \alpha &= \frac{14}{75} = 0.1866\dots \\ \Rightarrow \alpha &= 10.75 \approx 11^\circ\end{aligned}$$

Answer Question 7 and Question 8 from this section.

Question 7

(50 marks)

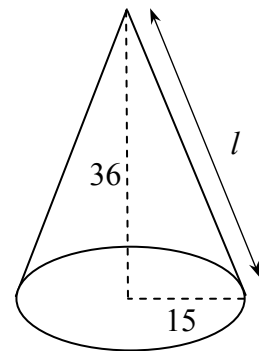
- (a) A disc has a diameter of 16 cm.
Find the area of the disc, correct to the nearest cm^2 .



$$\pi r^2 = \pi(8)^2 = 64\pi = 201.06 = 201 \text{ cm}^2$$

- (b) The diagram shows a cone with a base radius of 15 mm and a height of 36 mm.

- (i) Find the volume of the cone, correct to the nearest mm^3 .



$$\begin{aligned} \frac{1}{3} \pi r^2 h &= \frac{1}{3} \pi (15)^2 (36) = 2700\pi \\ &= 8482.3 = 8482 \text{ mm}^3 \end{aligned}$$

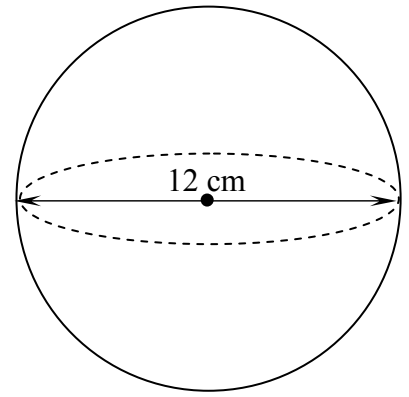
- (ii) Find l , the slant height of the cone.

$$\begin{aligned} l^2 &= 36^2 + 15^2 = 1296 + 225 = 1521 \\ \Rightarrow l &= \sqrt{1521} = 39 \text{ mm} \end{aligned}$$

(c) A solid wax sphere has a diameter of 12 cm.

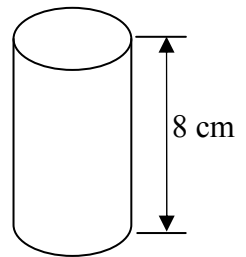
(i) Find the volume of the sphere in terms of π .

$$\frac{4}{3} \pi r^3 = \frac{4}{3} \pi (6)^3 = 288\pi \text{ cm}^3$$



(ii) A solid wax cylinder has a height of 8 cm.
The volume of wax in four of these cylinders
is the same as the volume of wax in the sphere.
Find the radius of the cylinder.

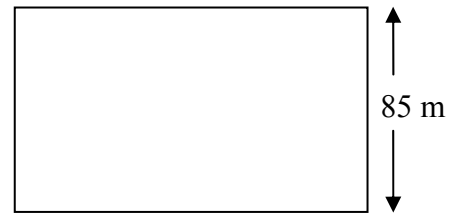
$$\begin{aligned} 4(\pi r^2 h) &= 288\pi \\ \Rightarrow 4\pi(r^2)(8) &= 288\pi \\ \Rightarrow 32r^2 &= 288 \\ \Rightarrow r^2 &= 9 \\ \Rightarrow r &= 3 \text{ cm} \end{aligned}$$



Question 8

(50 marks)

- (a) The perimeter of a rectangular playing field is 440 m. The length of the shorter side is 85 m.



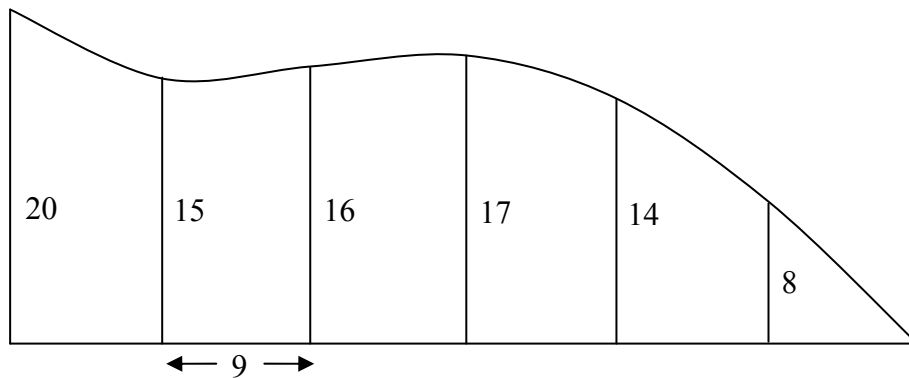
- (i) Find the length of the longer side.

$$2(l + 85) = 440 \Rightarrow l + 85 = 220 \Rightarrow l = 135 \text{ m}$$

- (ii) Find the area of the playing field.

$$A = 135 \times 85 = 11475 \text{ m}^2$$

- (b) A school yard is shown in the diagram.



Offsets of lengths 20 m, 15 m, 16 m, 17 m, 14 m, and 8 m are measured at intervals of 9 m, as shown.

- (i) Use Simpson's rule to estimate the area of the school yard.

$$\begin{aligned} A &= \frac{h}{3}(F + L + TOFE) \\ &= \frac{9}{3}(20 + 0 + 2(16 + 14) + 4(15 + 17 + 8)) \\ &= 3(20 + 60 + 160) \\ &= 720 \text{ m}^2 \end{aligned}$$

- (ii) The yard is resurfaced at a cost of €185 for every 10 square metres.
Find the cost of resurfacing the yard.

$$\text{Cost} = \frac{720}{10} \times 185 = \text{€}13320$$

Marking Scheme – Paper 2, Section A, Section B and Section C

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
No of categories	2	3	4	5
5 mark scales		0, 3, 5	0, 3, 4, 5	
10 mark scales		0, 5, 10	0, 5, 7, 10	
15 mark scales				0, 6, 9, 12, 15
20 mark scales			0, 15, 17, 20	0, 8, 12, 16, 20

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

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)

D-scales (five categories)

- response of no substantial merit (no credit)
- response with some merit (low partial credit)
- response about half-right (middle 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

Section A

Question 1

- (a) 20D
- (b) 5C

Question 2

- (a) 10C
- (b) 5C
- (c) 5C
- (d) 5C

Question 3

- (a) 10C
- (b) 5C
- (c) 5C
- (d) 5C

Question 4A

- (a) 15D
- (b) 5B
- (c) 5B

Question 4B

- (a) 5B
- (b) 5C
- (c) 5C
- (d) 5C
- (e) 5C

Section B

Question 5

- (a) 15D
- (b) 10B
- (c) 10C
- (d) 5C
- (e) 5B
- (f) 5B

Question 6

- (a) (i) 5B
- (a) (ii) 20C*
- (a) (iii) 10C*
- (b) (i) 10C*
- (b) (ii) 5C*

Section C

Question 7

- (a) 10C*
- (b) (i) 15D*
- (b) (ii) 5C*
- (c) (i) 15D*
- (c) (ii) 5C*

Question 8

- (a) (i) 10C*
- (a) (ii) 5C*
- (b) (i) 20C
- 10C*
- (b) (ii) 5C

Detailed marking notes

Section A

Question 1

(a) Scale 20D (0, 8, 12, 16, 20)

Low partial credit:

- One correct
- Any work of merit

Middle partial credit:

- Two or three correct answers

High partial credit:

- Four or five correct answers

(b) Scale 5C (0, 3, 4, 5)

Low partial credit:

- Any work of merit

High partial credit:

- Mean or median correct

Question 2

(a) Scale 10C (0, 5, 7, 10)

Low partial credit:

- Any work of merit

High partial credit:

- 2×3 without evaluating
- Answer of 5 given

(b) Scale 5C (0, 3, 4, 5)

Low partial credit:

- Any work of merit

High partial credit:

- Correct numerator or correct denominator
- Inverted fraction

(c) Scale 5C (0, 3, 4, 5)

Low partial credit:

- Any work of merit

High partial credit:

- Correct numerator or correct denominator
- Inverted fraction

(d) Scale 5C (0, 3, 4, 5)

Low partial credit:

- Any work of merit

High partial credit:

- Correct numerator or correct denominator
- Inverted fraction

Question 3

(a) Scale 10C (0, 5, 7, 10)

Low partial credit:

- One correct co-ordinate of a point

High partial credit:

- Any two points correct
- x and y co-ordinates obviously interchanged

(b) Scale 5C (0, 3, 4, 5)

Low partial credit:

- Shows midpoint on diagram
- Identifies the correct formula

High partial credit:

- Substitutes incorrectly into formula and finishes

(c) Scale 5C (0, 3, 4, 5)

Low partial credit:

- Identifies the correct formula

High partial credit:

- Substitutes incorrectly into formula and finishes

(d) Scale 5C (0, 3, 4, 5)

Low partial credit:

- Any meaningful attempt at a correct reason

High partial credit:

- Plots (7, 17) correctly

Question 4A

(a) Scale 15D (0, 6, 9, 12, 15)

Low partial credit:

- One side constructed
- Sketch diagram

Middle partial credit:

- Two sides constructed

High partial credit:

- Two sides and angle constructed

(b) Scale 5B (0, 3, 5)

Partial credit:

- Measures angle incorrectly

(c) Scale 5B (0, 3, 5)

Partial credit:

- Relevant geometrical statement

Question 4B

(a) Scale 5B (0, 3, 5)

Partial credit:

- Measures angle incorrectly

(b) Scale 5C (0, 3, 4, 5)

Low partial credit:

- Any use of 9 or 12

High partial credit:

- Pythagoras substituted correctly

(c) Scale 5C (0, 3, 4, 5)

Low partial credit:

- Identifies a triangle

High partial credit:

- One correct triangle

(d) Scale 5C (0, 3, 4, 5)

Low partial credit:

- Any work of merit

High partial credit:

- Finds $\angle DCO$ and $\angle DOC$

(e) Scale 5C (0, 3, 4, 5)

Low partial credit:

- Correct formula

High partial credit:

- Correctly substituted formula

Section B

Question 5

- (a) Scale 15D (0, 6, 9, 12, 15)

Low partial credit:

- 1 correct entry

Middle partial credit:

- 2 correct entries

High partial credit:

- 3 correct entries

- (b) Scale 10B (0, 5, 10)

Partial credit:

- Any work of merit

- (c) Scale 10C (0, 5, 7, 10)

Low partial credit:

- Any work of merit

High partial credit:

- Diagram mainly correct but with some error(s)

- (d) Scale 5C (0, 3, 4, 5)

Low partial credit:

- Any work of merit

High partial credit:

- Correct numerator or correct denominator or inverted fraction

- (e) Scale 5B (0, 3, 5)

Partial credit:

- Any meaningful attempt at a correct reason

- (f) Scale 5B (0, 3, 5)

Partial credit:

- Any meaningful attempt at a correct reason

Question 6

(a)(i) Scale 5B (0, 3, 5)

Partial credit:

- Any work towards finding the centre of enlargement.

(a)(ii) Scale 20C* (0, 15, 17, 20)

Low partial credit:

- Any use of scale factor

High partial credit:

- One correct dimension

(a)(iii) Scale 10C* (0, 5, 7, 10)

Low partial credit:

- Use of 70 and 42 or 84

High partial credit:

- Equation formulated correctly

(b)(i) Scale 10C* (0, 5, 7, 10)

Low partial credit:

- Any work of merit

High partial credit:

- Pythagoras substituted correctly

(b)(ii) Scale 5C* (0, 3, 4, 5)

Low partial credit:

- Any work of merit

High partial credit:

- $\alpha = \sin^{-1}\left(\frac{14}{75}\right)$ or similar

Section C

Question 7

(a) Scale 10C* (0, 5, 7, 10)

Low partial credit:

- Any work of merit e.g. formula written

High partial credit:

- Fully correct substitution but error(s) in calculation

(b)(i) Scale 15D* (0, 6, 9, 12, 15)

Low partial credit:

- Any work of merit e.g. formula written

Middle partial credit:

- Some correct substitution

High partial credit:

- Fully correct substitution but error(s) in calculation

(b)(ii) Scale 5C* (0, 3, 4, 5)

Low partial credit:

- Any work of merit e.g. formula written

High partial credit:

- Correct substitution but error(s) in calculation

(c)(i) Scale 15D* (0, 6, 9, 12, 15)

Low partial credit:

- Any work of merit e.g. formula written

Middle partial credit:

- Some correct substitution

High partial credit:

- Fully correct substitution but error(s) in calculation

(c)(ii) Scale 5C* (0, 3, 4, 5)

Low partial credit:

- Any work of merit e.g. formula written

High partial credit:

- Correct substitution but error(s) in calculation

Question 8

(a)(i) Scale 10C* (0, 5, 7, 10)

Low partial credit:

- Any work of merit e.g. formula written

High partial credit:

- Fully correct substitution but error(s) in calculation

(a)(ii) Scale 5C* (0, 3, 4, 5)

Low partial credit:

- Any work of merit e.g. formula written

High partial credit:

- Fully correct substitution but error(s) in calculation

(b)(i) *Substitution* Scale 20C (0, 15, 17, 20)

Low partial credit:

- Correct formula and no other meaningful work

High partial credit

- Correct formula with some correct substitution

Calculation Scale 10C* (0, 5, 7, 10)

Low partial credit:

- Part of calculations completed

High partial credit:

- Calculations mainly correct but with some error

(b)(ii) Scale 5C (0, 3, 4, 5)

Low partial credit:

- Any work of merit

High partial credit:

- Fully correct substitution but error(s) made in calculation

MARCANNA BREISE AS UCHT FREAGAIRT TRÍ GHAEILGE

(Bonus marks for answering through Irish)

Ba chóirmarcanna de réiranghnáthráta a bhronnadh iarrthóirínachgnóthaíonnníosmoná 75% d'iomlánamarcanna don pháipéar. Ba chóirfreisinan marc bónais sin a shlánúsíof.

Déantarancinneadhagus an ríomhaireachtfaoin marc bónais i gcásgachpáipéirarleithligh.

Is é 5% angnáthrátaagus is é 300 iomlánamarcanna don pháipéar. Mar sin, bainúsáid as an ngnáthráta 5% i gcásiarrthóirí a ghnóthaíonn 225 marc nóníoslú, e.g. $198 \text{ marc} \times 5\% = 9.9$
 \Rightarrow bónas = 9 marc.

Mághnóthaíonn an t-iarrthóirníosmoná 225 marc, ríomhtar an bónas de réirnafoirmle $[300 - \text{bunmharc}] \times 15\%$, agus an marc bónais sin a shlánúsíof. In ionadanríomhaireacht sin a dhéanamh, is féidirúsáid a bhaint as an táblathíos.

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

