Coimisiún na Scrúduithe Stáit
State Examinations Commission

LEAVING CERTIFICATE 2010

MARKING SCHEME

MATHEMATICS
(PROJECT MATHS)

FOUNDATION LEVEL

Contents

Introduction

The Foundation Level Mathematics examination for candidates in the 24 initial schools for *Project Maths* shared a common Paper 1 and two common questions on Paper 2 with the examination for all other candidates. The marking scheme used for these common elements was identical for the two groups.

This document contains the complete marking scheme for both papers for the candidates in the 24 schools.

Readers should note that, as with all marking schemes used in the state examinations, the detail required in any answer is determined by the context and the manner in which the question is asked, and by the number of marks assigned to the question or part. Requirements and mark allocations may vary from year to year.

Marking scheme for Paper 1

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 $\sqrt{93 \cdot 4}$, correct to one decimal place.

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

$$\sqrt{93.4} = 9.66... = \mathbf{9.7}$$

*   Accept correct answer with no work

Blunders (-3)

B1 $\sqrt{934} = [30.561413...] = 30.6$

B2 $\sqrt{9.34} = [3.056141...] = 3.1$

B3 $\sqrt{0.934} = [0.966436...] = 1.0$

B4   Root other than square root indicated and correctly worked e.g. $\sqrt[3]{93.4} = 4.5$

Slips (-1)
S1   Incorrect or omitted rounding off

Misreadings (-1)
M1 $\sqrt{94.3} = [9.710818...] = 9.7$
M2 $\sqrt{39.4} = [6.276941...] = 6.3$

Attempts (4 marks)
A1 $(93.4)^2 = 8723.56$

A2 $\dfrac{93.4}{2} = 46.7$

A3 $(93.4) \times 2 = 186.6$

A4   Work at estimating answer: $\sqrt{93 \cdot 4} = 9$ or 10
A5   Any work at finding or estimating another root with work shown
A6   An incorrect figure correctly rounded off to one decimal place
A7   Any other answers as B1, B2, B3 and B4 but with misplaced point and no work shown.

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 $15 \cdot 5 - 3 \cdot 8 \times 2 \cdot 6$.

(ii)   **10 marks**   **Att 4**

$15 \cdot 5 - 3 \cdot 8 \times 2 \cdot 6 = 15.5 - 9.88 = \mathbf{5.62}$

*   Accept correct answer with no work

Blunders (-3)
B1   Errors in precedence: $15.5 - 3.8 = 11.7 \times 2.6 = 30.42$
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

Slips (-1)
S1   Numerical slips to a maximum of 3

Misreadings (-1)
M1   A clear and obvious numerical misreading not involving the decimal point

Attempts (4 marks)
A1   Work at estimating the answer e.g. $16 - 4 \times 3$
A2   Work towards some correct step e.g. long multiplication begun
A3   30 only

Worthless (0 marks)
W1   Incorrect answer with no work other than those in scheme

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

Find $\dfrac{5}{\sqrt{2}} + (1\cdot6)^2$, correct to the nearest whole number.

(iii) **10 marks** **Att 4**

$$\dfrac{5}{\sqrt{2}} + (1\cdot6)^2 = 3.53 + 2.56 = 6.09 = \mathbf{6}$$

* Accept correct answer with no work

Blunders (-3)

B1 $\dfrac{5}{\sqrt{2}} + (1\cdot6)^2 = 3.5355... + 256 = 259.5355 = 260$

B2 $\dfrac{5}{\sqrt{0.2}} + (1\cdot6)^2 = 11.1803 + 2.56 = 13.7403 = 14$

B3 $\dfrac{5}{\sqrt{2}} + (0.16)^2 = 3.5355... + 0.0256 = 3.56 = 4$

B4 Square root not found
B5 Square not found
B6 Division omitted
B7 No addition
B8 Error in precedence e.g. $(5 + (1\cdot6)^2) \div \sqrt{2} = 5.345 = 5$
B9 $5 + (1.6)^2 \div \sqrt{2} = 6.81 = 7$
B10 $\sqrt{2} = 1 \Rightarrow \dfrac{5}{1} + 2.56 = 7.56 = 8$

Slips (-1)
S1 Numerical slips to a maximum of 3
S2 Incorrect or omitted rounding off

Misreadings (-1)

M1 $\dfrac{5}{\sqrt{2}} + (6.1)^2 = 3.5355... + 37.21 = 40.7455 = 41$

M2 $\dfrac{2}{\sqrt{5}} + (1.6)^2 = 0.8944 + 2.56 = 3.4544 = 3$

Attempts (4 marks)
A1 Work at estimating the answer
A2 Any other answers as B1, B2 and B3 but with misplaced decimal point and no work shown.
A3 No square root or square evaluated

Worthless (0 marks)
W1 Incorrect answer with no work other than those in scheme

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

> The price of a jacket is €60·80.
> This price is reduced by 15%.
> Find the reduced price.

(iv)   **10 marks**   **Att 4**

$\dfrac{60.80 \times 15}{100} = €9.12$ or $60.80 \times 0.15 = €9.12$ Reduced price = $€60.80 - €9.12 = \textbf{€51.68}$	Reduced price = $€60.80 \times 0.85 = \textbf{€51.68}$ **OR** $\dfrac{60.80 \times 85}{100} = \textbf{€51.68}$

*   Accept correct answer with no work

*   An answer of 71.53 is found from $60.80 \div 85$ followed by use of percentage key $\Rightarrow$ 7 marks

*   An answer of 0.72 is found from $60.80 \div 85$ followed by use of percentage key and the "=" key $\Rightarrow$ 4 marks

*   5168 (no units) $\Rightarrow$ 10 marks

Blunders (-3)

B1 $\dfrac{€60.80 \times 85}{100}$ or $€60.80 \times 0.85$ and stops

B2   Gets €9.12 and stops or adds to 60.80

B3 $€60.80 \times 1.15 = 69.92$

B4   Errors in establishing $\dfrac{€60.80 \times 85}{100}$ (all three elements must be present otherwise attempt marks only)

Attempts (4 marks)

A1   Gets 1% (= 0.6) and stops

A2 $60.80 - 15$

Worthless (0 marks)

W1 $60.80 + 15$

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

Find the value in euro of 700 AUD (Australian Dollars) given that €1 = 1·72 AUD.

(v)   **10 marks**   **Att 4**

$$\frac{700}{1.72} = €406.976 = €406.98 \qquad \frac{700}{0.0172} = 40\,697.67443 = 40\,697.67 = €406.98$$

*   Accept correct answer with no work e.g. 406 or 407
*   Accept candidates degree of rounding
*   40 698 cent – 9 marks

Blunders (-3)
B1 $700 \times 1.72 = 1204$

B2 $\dfrac{1.72}{700} = 0.002457$

B3   Division not finished or finished incorrectly

Slips (-1)
S1   Answer given in cents

Attempts (4 marks)
A1   Some use of the given data

Worthless (0 marks)
W1   Incorrect answer with no work other than those in scheme

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

Write $\dfrac{7}{19} + \dfrac{2}{9}$ as a decimal, correct to three decimal places.

(vi)   **10 marks**   **Att 4**

$\dfrac{7}{19} + \dfrac{2}{9} = \dfrac{63+38}{171} = \dfrac{101}{171} = \mathbf{0.591}$	$0.368421052 + 0.222222222 = 0.590643274 = \mathbf{0.591}$

*   Accept correct answer with no work

Blunders (-3)
B1   Error(s) in converting fraction to decimal (only once)
B2   No addition
B3   Use of wrong operator indicated $(\times, \div, -)$ giving answers (0.0818 /0.082, 1.6578 / 1.658, 0.1461 / 0.146)

Slips (-1)
S1   Numerical slips to a maximum of 3
S2   Incorrect or no rounding off

Attempts (4 marks)
A1   Effort at converting either of the given fractions to a decimal
A2   Correctly converts a fraction (written) to a decimal and stops
A3   A correct calculation
A4 $0 <$ answer <1 (in decimal form)
A5   An incorrect number correctly rounded off

Worthless (0 marks)
W1   Incorrect answer with no work other than those in scheme

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

> A bus journey begins at 11:30 and ends at 13:15.
> The bus travels at an average speed of 80 km per hour.
> What distance does the bus travel?

(vii)   **10 marks**   **Att 4**

> Time = 1.75 hours
> Distance = $80 \times 1.75 =$ **140 km**

*   Accept correct answer with no work

Blunders (-3)
B1   Error in evaluation of journey time
B2   Treating 1 hour 45 mins as 1.45 hours $\rightarrow$ 116 km as answer
B3   Misuse of $S = \dfrac{D}{T}$ e.g. $80 \div 1.75 = 45.71\,\text{km}$
B4 80×1.75 and stops

Slips (-1)
S1   Numerical slips to a maximum of 3

Attempts (4 marks)
A1   Evaluation of journey time and stops
A2   Some use of given data
A3 $S = \dfrac{D}{T}$ 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**

> Find the total cost of
> > 3 loaves of bread at €1·20 each
> > 4 litres of milk at 89 cent per litre
> > 2·5 kg of oranges at 78 cent per kg.

(viii) | **10 marks** | **Att 4**

$$\text{Cost} = 1.20 \times 3 + 0.89 \times 4 + 0.78 \times 2.5 = 3.60 + 3.56 + 1.95 = \text{€9.11}$$

*   Accept correct answer with no work
*   Accept 911 cent as correct answer

Blunders (-3)
B1 $4 \times 89 = 356$ and fails to convert to euro if working in euro
B2 $2.5 \times 78 = 195$ and fails to convert to euro if working in euro
B3 $3 \times 1.20 = 3.60$ and fails to convert to cents if working in cents
B4   Divides instead of multiplying (once)
B5   Written $3 \times 1.20 + 4 \times 0.89 + 2.5 \times 0.78$ and stops

Slips (-1)
S1   Numerical slips to a maximum of 3

Attempts (4 marks)
A1   Writes 3×1.20 or similar and stops
A2   Writes 3.60 or similar and stops

Worthless (0 marks)
W1   Incorrect answer with no work other than those in scheme

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

Find $\dfrac{(2{\cdot}78 \times 10^3) + (2{\cdot}96 \times 10^2)}{1{\cdot}42 \times 10^2}$, correct to three significant figures.

(ix)   **10 marks**   **Att 4**

$$\frac{(2{\cdot}78 \times 10^3) + (2{\cdot}96 \times 10^2)}{1{\cdot}42 \times 10^2} = \frac{2780 + 296}{142} = \frac{3076}{142} = 21.6619 = \mathbf{21.7}$$

$$\frac{3.076 \times 10^3}{1{\cdot}42 \times 10^2} = 2.166197183 \times 10^1 = 21.66197183 = \mathbf{21.7}$$

*   Accept correct answer with no work

Blunders (-3)
B1   Error in precedence
B2   Each omitted or incorrect step if steps not clear
B3   Misplaced decimal or wrong order of magnitude each time
B4   Inverts final fraction giving 0.04616… as answer
B5   Any incorrect rounding off within the working (once only)
B6   21.6619 and stops.

Slips (-1)
S1   Numerical slips to a maximum of 3
S2   Answer not correct to three significant figures

Attempts (4 marks)
A1 10^3 treated as 30, 10^2 treated as 20
A2   Some work towards estimation
A3 10^4 written as $10 \times 10 \times 10 \times 10$ and / or likewise with 10^2
A4   An incorrect number correctly rounded off to three significant figures

Worthless (0 marks)
W1   Incorrect answer with no work other than those in scheme

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

Find $\dfrac{27 \cdot 9 + 15 \cdot 4}{(3 \cdot 4)^3}$, correct to two decimal places.

(x)   **10 marks**   **Att 4**

$$\frac{27 \cdot 9 + 15 \cdot 4}{(3 \cdot 4)^3} = \frac{43.3}{39.304} = 1.101 = \mathbf{1.10}$$

*   Accept correct answer with no work

Blunders (-3)
B1   Error in precedence (once only)

B2 $\dfrac{39.304}{43.3} = 0.907713625$

B3   The use of a wrong operator (or operators) is indicated (once only)

B4   Any step omitted e.g. $\dfrac{43.3}{39.304}$ and stops

B5   Any incorrect rounding off within the working (once only)

B6   Any error involving working out $(3 \cdot 4)^3$

Slips (-1)
S1   Numerical slips to a maximum of 3
S2   Incorrect or no rounding off

Misreading (-1)
M1   Clear and obvious misreading not involving the decimal point

Attempts (4 marks)
A1   Work at estimating the answer
A2   An incorrect number correctly rounded off to two decimal places

Worthless (0 marks)
W1   Incorrect answer with no work other than those in scheme

QUESTION 2

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

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

(a)   **(i)**   Change   8·57 kg to grams.
       (ii)   Change   7904 cm to metres.

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

     (i) $8.57 \times 1000 =$ **8570 grams**

     (ii) $\dfrac{7904}{100} =$ **79.04 metres**

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

Blunders (-3)
B1   Incorrect conversion factor
B2   Misuse of conversion factor e.g. $8.57 \div 1000 = 0.00857$
B3   Misuse of conversion factor e.g. $7904 \times 100 = 790\ 400$

Slips (-1)
S1   Numerical slips to a maximum of 3
S2   Answer given as 79 m 4 cm

Attempts (2 marks)
A1   Any use of given data (covers both parts)
A2   8057 without work.

Worthless (0 marks)
W1   Incorrect answer with no work other than those in scheme

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

(b)	Henry works for 40 hours in a particular week.
	He is paid €12.50 per hour for the first 35 hours.
	He is paid €18·50 per hour for the remaining hours.
	(i) Find Henry's gross pay for the week.
	(ii) Henry's tax rate is 20% and he has tax credits of €72 per week.
	Calculate the tax payable by Henry.
	(iii) Find Henry's take-home pay.

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

Gross pay = €12.50 × 35 + €18.50 × 5 = 437.50 + 92.5 = **€530.00**

*   Accept correct answer with no work

Blunders (-3)
B1   Fails to add the two calculated part wages
B2   Subtracts the two calculated part wages
B3   No multiplier of €18.50 giving €437.50 + €18.50 = €456

Slips (-1)
S1   Decimal error
S2   Numerical slips to a maximum of 3

Attempts (4 marks)
A1   Any one of the multiplications and stops
A2 $12.50 \times 40 = 500$ or $18.50 \times 40 = €740$
A3   Any use of $€12.50 + €18.50 = €31$

Worthless (0 marks)
W1   Incorrect answer with no work other than those in scheme

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

Tax payable = €530.00 × 0.20 − €72 = €106 − €72 = **€34**.

*   Accept correct answer with no work
*   Accept candidates answer from part (i)
*   Marks lost by giving gross tax as answer to part (ii) can be recouped in (iii) if (iii) is worked correctly

Blunders (-3)
B1   Error in calculating % e.g. €530 × 1.20
B2   Adds tax credits to gross tax (€178)

Slips (-1)
S1   Decimal error
S2   Numerical slips to a maximum of 3

Attempts (2 marks)
A1   Any mishandling or ignoring of the tax credit other than B2
A2   Some effort at getting a %

Worthless (0 marks)
W1   Incorrect answer with no work other than those in scheme

(b) (iii)   **5 marks**   **Att 2**

Take home pay = €530 − €34 = **€496.**

*   Accept correct answer with no work
*   Accept candidates answer from parts (i) and (ii)
*   €34 will recoup marks if necessary from part (ii)
*   €496 without €34 will recoup marks if necessary for part (ii)

Blunders (-3)
B1   Uses a tax other than that calculated in (b) (ii) above
B2   Adds tax
B3   Subtraction not completed

Slips (-1)
S1   Numerical slips to a maximum of 3

Attempts (2 marks)
A1   Some spurious number subtracted from gross wage.

Worthless (0 marks)
W1   Incorrect answer with no work other than those in scheme

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

(c)   A train travels a distance of 281 km from Cork to Dublin.
The train travels at an average speed of 80 km/h for the first 90 minutes of the journey.
(i)   Find the distance the train travels in this time.
The train travels the remaining distance at an average speed of 92 km/h.
(ii)   Find the total time for the journey from Cork to Dublin
(iii)   Find the average speed of the train over the whole journey, correct to the nearest km/h.

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

$$\text{Distance} = 80 \times \frac{90}{60} = \textbf{120 km.}$$

*   Accept correct answer with no work

Blunders (-3)
B1   Error in evaluation of journey time

B2   Misuse of $S = \dfrac{D}{T}$ e.g. $80 \div 1.5 = 53.33$

Slips (-1)
S1   Numerical slips to a maximum of 3

Attempts (4 marks)
A1 80×90 and stops

A2 $\dfrac{80}{60}$ and stops

A3   Some use of given data

A4 $S = \dfrac{D}{T}$ or $D = S \times T$ written down and no more

Worthless (0 marks)
W1   Incorrect answer with no work other than those in scheme

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

Remaining distance = 281 − 120 = 161km $Time \ Taken = \frac{60}{92} \times 161 = 105 \ mins$ Total time = 90 + 105 = **195 mins** or **3 hours 15 mins**	Remaining distance = 281 − 120 = 161km $t = \frac{d}{s}$ $t = \frac{161}{92} = 1.75 \ hours \ or \ 105 \ minutes$ Total time = 90 + 105 = **195 mins** or **3 hours 15 mins**

*   Accept correct answer with no work
*   Accept candidates answer from part (i)

Blunders (-3)
B1   Adds instead of subtracts for distance
B2   Error in evaluation of journey time (fails to add 90)

B3   Misuse of $S = \frac{D}{T}$ e.g. $161 \times 92 = 14 \ 812$

Slips (-1)
S1   Numerical slips to a maximum of 3

Attempts (2 marks)
A1   Adds 90 to any number
A2   Some correct step e.g. $281 - 120$

A2 $S = \frac{D}{T}$ or $D = S \times T$ written down and no more

Worthless (0 marks)
W1   Incorrect answer with no work other than those in scheme

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

$Average \ speed = \frac{281}{1.5 + 1.75} = 86.46 = \mathbf{86 \ km/h}$

*   Accept correct answer with no work
*   Accept candidates answer from part (ii)

Blunders (-3)
B1   Error in evaluation of journey time e.g. 195 minutes = 3.15 hours

B2   Misuse of $S = \frac{D}{T}$ e.g. $281 \times 3.25 = 913.25$

Slips (-1)
S1   Numerical slips to a maximum of 3
S2   Incorrect or omitted rounding off to nearest km/h

Attempts (2 marks)
A1   Some use of given data

A2 $S = \frac{D}{T}$ or $D = S \times T$ written down and no more

QUESTION 3

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

Part (a)	**15 (10, 5) marks**	**Att (4, 2)**

(a) A student estimated the height of a building as 5·4 m. The actual height of the building is 4·8 m.
    (i) Find the error in the estimate.
    (ii) Find the percentage error.

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

    (i)   Error $= 5.4 - 4.8 = \textbf{0.6 m}$

*   Accept correct answer with no work

Blunders (-3)
B1   5.4 – 4.8 and stops

Slips (-1)
S1   Numerical slips to a maximum of 3

Attempts (4 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**

    (ii)   Percentage error $= \dfrac{0.6}{4.8} \times 100 = \textbf{12.5\%}$

*   Accept correct answer with no work

Blunders (-3)

B1   Errors in establishing $\dfrac{0.6}{4.8} \times 100$ [all three elements must be present otherwise attempt mark only]
B2   Incorrect or incomplete answer or no answer [use candidates answer from (a)(i)]

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

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

(b)   Helen borrowed €4000 at 5·5 % per annum compound interest.
        She paid back €1000 at the end of the first year.
        How much did she owe at the end of the second year?

(b) Amount Year 1	**10 marks**	**Att 4**
Principal Year 2	**5 marks**	**Att 2**
Amount Year 2	**5 marks**	**Att 2**

$$A = 4000\left(1+\frac{5.5}{100}\right)^{1} = 4000(1.055) = 4220 \qquad 4220-1000=3220$$

$$A = 3220\left(1+\frac{5.5}{100}\right)^{1} = 3220(1.055) = \textbf{€3397.10}$$

*   Accept correct answer with no work

* $A = 4000\left(1+\frac{5.5}{100}\right)^{1} = 4220 \rightarrow 10$ marks

* $3220 \rightarrow 15$ marks

* $A = 3397.1 \rightarrow 20$ marks

Amount Year 1   **10 marks**   **Att 4**

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=2*

Attempts (4 marks)

A1 $\dfrac{4000}{5.5} = 727.27$

A2 $(4000)(5.5) = 22000$

A3 $\dfrac{4000}{0.055} = 72727.27$

Principal Year 2   **5 marks**   **Att 2**

Blunders (-3)
B1   Fails to subtract or mishandles €1000

Amount Year 2   **5 marks**   **Att 2**

*   Use candidates answer to simplification of $A = 4000\left(1+\frac{5.5}{100}\right)^{1}$

Blunders (-3)

B1 $\dfrac{4000}{1.055} = 3791.46$ or $\dfrac{4000}{0.9450} = 4232.80$

B2 $4000(0.945)^{1} = 3780$

Slips (-1)
S1   Numerical slips to a maximum of 3

Worthless (0 marks)
W1   Incorrect answer with no work other than those in scheme

<p align="center">**OR**</p>

(b) Amount year 1   **10 marks**   **Att 4**
     Principal year 2   **5 marks**   **Att 2**
     Amount year 2   **5 marks**   **Att 2**

Year 1	Amount	=	$4000 \times 1.055 = €4220$
Less Repayment			$4220 - 1000 = 3220$ (Principal year 2)
Year 2	Amount	=	$3220 \times 1.055 = $ **€3397.10**

OR

Principal year 1	4000	
Compound Interest year 1	220	$\Leftarrow \dfrac{4000 \times 5.5}{100}$
Amount at end year 1	4220	
Less Repayment	1000	
Principal year 2	3220	
Compound interest year 2	177.10	$\Leftarrow \dfrac{3220 \times 5.5}{100}$
Amount at end year 2	**3397.10**	

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*   Accept correct answer with no work
*   Amount year 1 = 4220 → 10 marks
*   Principal for year 2 = 3220 → 15 marks
*   Amount year 2 = 3397.10 → 20 marks

Amount Year 1   **10 marks**   **Att 4**

Blunders (-3)
B1 $4000 \times 1.55 = 6200$

B2   Errors in establishing $\dfrac{4000 \times 5.5}{100}$ [all 3 elements must be present; otherwise attempt
      only]
B3   Stops at interest and fails to find amount
B4   Subtracts interest to find amount

Slips (-1)
S1   Numerical slips to a maximum of 3

Attempts (4 marks)
A1   Some use of 100 in attempt to find %

Worthless (0 marks)
W1   Incorrect answer with no work other than those in scheme

Principal Year 2   **5 marks**   **Att 2**
*   Use candidates answer for amount at end of year 1

Blunders (-3)
B1   Adds instead of subtracts €1000

Slips (-1)
S1   Numerical slips to a maximum of 3

Amount Year 2   **5 marks**   **Att 2**

*   Use candidates answer for principal for year 2

Blunders (-3)
B1   Errors in calculating percentage
B2   Using a principal other than that calculated in (ii)
B3   Stops at interest and fails to find amount
B4   Subtracts interest to find amount. Do not penalise if B4 in year 1.

Slips (-1)
S1   Numerical slips to a maximum of 3

Worthless (0 marks)
W1   Incorrect answer with no work other than those in scheme

Part (c)	**15 (10, 5) marks**	**Att (4, 2)**

> **(c)** A shop-owner agrees to contribute €7 for every €50 collected by his customers who are raising funds for facilities in a school.
>   **(i)** The customers raise €900 in the first week.
>   How much does the shop-owner contribute?
>   **(ii)** At the end of the fund raising the total amount raised was €1995.
>   How much of this was collected by the customers?

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

> (i) $\dfrac{900}{50} \times 7 = \mathbf{€126}$

*   Accept correct answer without work

Blunders (-3)

B1   Errors in establishing $\dfrac{900}{50} \times 7$ [all 3 elements must be present otherwise attempt mark]

Slips (-1)
S1   Numerical slips to a max of -3

Attempts (4 marks)
A1   Some use of given data e.g. $900 \div 50 = 18$

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

> (ii) $\dfrac{1995}{57} \times 50 = \mathbf{€1750}$

*   Accept correct answer without work

Blunders (-3)

B1   Errors in establishing $\dfrac{1995}{57} \times 50$ [all 3 elements must be present otherwise attempt mark]

Slips (-1)
S1   Numerical slips to a maximum of 3

Attempts (2 marks)
A1   Some use of given data e.g. 1995×50

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

$$4x - 9 = 7x + 15.$$

(a)	10 marks	Att 4

$$4x - 9 = 7x + 15 \Rightarrow 7x - 4x = -9 - 15 \Rightarrow 3x = -24 \Rightarrow x = -8$$

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

Blunders (-3)
B1   Blunders in grouping terms e.g. $4x - 9 = -5x$ [each time]
B2   Transposition errors [once only]
B3 $-3x = 24 \Rightarrow x \neq -8$ or $-24 = 3x \Rightarrow x \neq -8$
B4   Each step omitted e.g. $-3x = 24$ and stops.
B5 $x = -8$ 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)**

(b) Solve the simultaneous equations:

$$3x + 2y = 1$$
$$5x + 3y = 3.$$

(b) First Variable Found   **15 marks**   **Att 6**
      Second Variable   **5 marks**   **Att 2**

$$3x + 2y = 1 \quad \times 3 \quad \Rightarrow \quad 9x + 6y = 3$$
$$5x + 3y = 3 \quad \times 2 \qquad\qquad \underline{10x + 6y = 6}$$
$$\qquad\qquad\qquad\qquad\qquad -x \quad = -3 \Rightarrow x = 3$$
$$3x + 2y = 1 \Rightarrow 3(3) + 2y = 1 \Rightarrow 2y = -8 \Rightarrow y = -4$$

*   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 ($x = 3$) or the first equation in terms of y only ($y = -4$)
B2 $-x = -3 \Rightarrow x \ne 3$
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)**

(c)   **(i)**   Solve $3x - 1 \leq 14, \quad x \in \mathbb{Z}$.

      (ii)   Solve $5 - 4x < 13, \quad x \in \mathbb{Z}$.

      (iii)   Plot on a number line the values of x which satisfy both of the above inequalities.

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

$$3x - 1 \leq 14 \quad \Rightarrow 3x \leq 15 \quad \Rightarrow \boldsymbol{x \leq 5}$$

Blunders (-3)
B1   Blunders in grouping terms e.g. $3x - 1 = 2x$ [each time]
B2   Transposition errors [once only]
B3   Each step omitted e.g. $3x \leq 15$ and stops
B4 $x \leq 5$ without work
B5   Replaces inequality with equality sign

Slips (-1)
S1   Numerical slips to a maximum of 3

Misreadings (-1)
M1   Uses $<$ instead of $\leq$

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**

$$5 - 4x < 13 \quad \Rightarrow -4x < 8 \quad \Rightarrow \boldsymbol{x > -2}$$

Blunders (-3)
B1   Blunders in grouping terms e.g. $5 - 4x = 1x$ [each time]
B2   Transposition errors [once only]
B3   Each step omitted e.g. $-8 < 4x$ and stops
B4   Error in inequality sign $4x < 8 \Rightarrow x < -2$
B5 $x > -2$ without work
B6   Replaces inequality with equality sign. Do not penalise if B5 incurred in (i)

Slips (-1)
S1   Numerical slips to a maximum of 3

Misreadings (-1)
M1   Uses $\leq$ instead of $<$

Attempts (2 marks)
A1   Some correct work
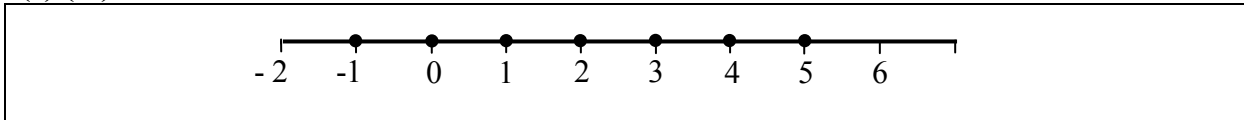A2   Effort at trial and error by substitution

Worthless (0 marks)
W1   Incorrect answer without work

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

```
       •    •    •    •    •    •    •
  - 2  -1   0    1    2    3    4    5    6
```

*   Accept candidates answers from (i) and (ii)
*   If equality used in (i) or (ii) then attempt mark 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   At least one correct entry
A2   Listing of answers to (i) or (ii) or both.

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 3

(a)	**(i)**	Write down all the whole number factors of 30.
	(ii)	List which of these numbers are prime numbers.

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

> (i) **1, 2, 3, 5, 6, 10, 15, 30**
> (ii) **2, 3, 5**

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)

(b)	**(i)**	Solve the quadratic equation $x^2 + 6x + 8 = 0$.
	(ii)	Solve the quadratic equation $2x^2 - 5x - 4 = 0$, correct to two decimal places.

(b) (i)	10 marks	Att 4

> $x^2 + 6x + 8 = 0 \Rightarrow (x+2)(x+4) = 0 \Rightarrow x = -2$ or $x = -4$

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**

$$2x^2 - 5x - 4 = 0$$

$$\Rightarrow x = \frac{5 \pm \sqrt{(-5)^2 - 4(2)(-4)}}{2 \times 2}$$

$$= \frac{5 \pm \sqrt{57}}{4} \ *$$

$$= \frac{5 \pm 7.5498}{4}$$

$$\Rightarrow x = \frac{12.5498}{4} \ \text{or} \ x = \frac{-2.5498}{4}$$

$$\Rightarrow x = 3.13745 \ \text{or} \ x = -0.63745$$

$$\Rightarrow \boldsymbol{x = 3.14} \ \textbf{or} \ \boldsymbol{x = -0.64}$$

*   Maximum deductions beyond point * is 3 marks

* $\dfrac{5 \pm \sqrt{\text{negative number}}}{2 \times 2}$ cannot earn final 3 marks

Blunders (-3)
B1   Blunders in application of formula

Slips (-1)
S1   Slip in substitution into formula to a maximum of 3
S2 $25 + 32 = -7$
S3   Incorrect or omitted rounding off, each time

Attempts (4 marks)
A1   Effort at substitution into formula
A2   Incorrect formula with substitution
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)**

(c)   At a restaurant an adult's meal costs €8 more than a child's meal.
Let x be the price of a child's meal.
    (i)   Write an expression in x for the price of an adult's meal.

The total cost of the meals for 5 adults and 4 children is €103.
    (ii)   Write this information as an equation in x.
    (iii)   Solve this equation to find the price of a child's meal.

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

>   Adult meal costs $x + 8$

Blunders (-3)
B1 $x - 8$ or $8 - x$
B2 $8x$

Attempts (4 marks)
A1   Assigns a numerical value to x that is then used to find a numerical value for the price of an adult's meal.

A2   Some use of the data given e.g. $\dfrac{x}{8}, \dfrac{8}{x}$

Worthless (0 marks)
W1   No use of x or 8
W2 $x = 8$ and stops

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

> $5(x + 8) + 4x = 103$

*   Accept candidates answer from part (i)

Blunders (-3)
B1   Each price omitted
B2 $9x + 40$ only

Attempts (2 marks)
A1   A spurious equation in x

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

$$5(x+8)+4x=103 \Rightarrow 5x+40+4x=103 \Rightarrow 9x=63 \Rightarrow x=7$$

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

* $5x+40+4x$ or $5x+40+4x=103$ as starting work can earn marks for parts (i) and (ii)

Blunders (-3)
B1   Incorrectly formed equation
B2   Blunders in grouping terms e.g. $9x+40=49x$ (each time)
B3   Transposition error(s) (once only)
B4 $9x=63 \Rightarrow x \neq 7$
B5   Each step omitted
B6   Correct answer without work

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 6

Part (i)	15 marks	Att 6
Part (ii)	10 marks	Att 4
Part (iii)	10 marks	Att 4
Part (iv)	10 marks	Att 4
Part (v)	5 marks	Att 2

The bar chart shows the number of newspapers sold from Monday to Saturday in a shop. For example, on Thursday, 25 newspapers were sold.
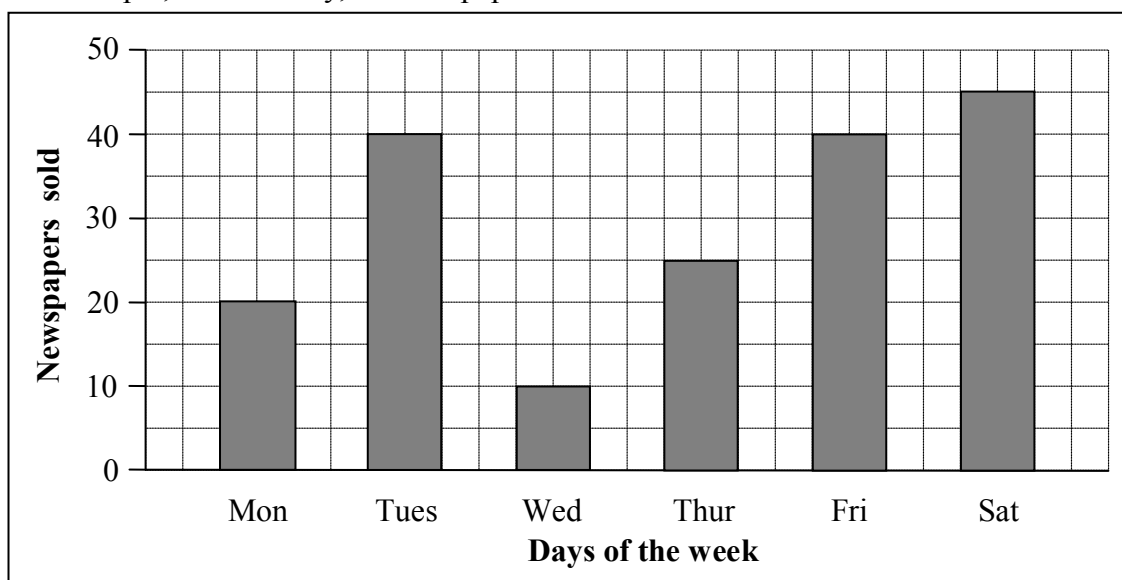
(i)	**15 marks**	**Att 6**

On what day was the lowest number of newspapers sold?

(i)	**15 marks**	**Att 6**

Wednesday

Blunders (-3)
B1   Saturday, the greatest, given as the least

Worthless (0 marks)
W1   Incorrect answer without work, other than those in the scheme

(ii)	**10 marks**	**Att 4**

On which two days were the same number of newspapers sold?

(ii)	**10 marks**	**Att 4**

Tuesday and Friday

Blunders (-3)
B1   Only one of the correct days given

Worthless (0 marks)
W1   Incorrect answer without work

(iii)   **10 marks**   **Att 4**

> What was the difference between the number of newspapers sold on Saturday and on Monday?

(iii)   **10 marks**   **Att 4**

$$45 - 20 = 25$$

*   Accept correct answer without work

Blunders (-3)
B1   Each incorrect amount
B2 $45 + 20 = 65$

Slips (-1)
S1   Numerical slips to a maximum of 3

Attempts (4 marks)
A1   Value(s) with no further work

Worthless (0 marks)
W1   Incorrect answer without work, other than those in scheme

(iv)   **10 marks**   **Att 4**

> What was the average number of newspapers sold per day over the 6 days from Monday to Saturday?

(iv)   **10 marks**   **Att 4**

$$\frac{20 + 40 + 10 + 25 + 40 + 45}{6} = \frac{180}{6} = 30$$

*   Accept correct answer without work

Blunders (-3)

B1   Stops at $\dfrac{180}{6}$

B2   40 the mode given as the average

Slips (-1)
S1   Each omitted amount, or incorrect amount, provided at least one is correct
S2   Uses a divisor other than 6.
S3   Numerical slips to a maximum of 3

Attempts (4 marks)
A1   Stops at 180 or candidates answer

Worthless (0 marks)
W1   Incorrect answer without work, other than those in scheme

(v)   **5 marks**   **Att 2**

> If the average number of newspapers sold per day over the 7 days (including Sunday) of that week was 35, how many newspapers were sold on Sunday?

(v)   **5 marks**   **Att 2**

> Sold that week $35 \times 7 = 245$
> Sold on Sunday $= 245 - 180 = 65$

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

Blunders (-3)
B1   Divides instead of multiplies e.g. $35 \div 7 = 5$
B2   Writes 245 – 180 and stops
B3   Writes 245 + 180 = 425

Slips (-1)
S1   Numerical slips to a maximum of 3

Attempts (2 marks)
A1   Some correct work
A2   Some use of 180
A3 35×7 and stops

Worthless (0 marks)
W1   Incorrect answer without work, other than those in scheme

QUESTION 7

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

Draw the graph of the function
$$f : x \rightarrow 2x^2 - 6x - 7, \text{ for } -1 \le x \le 4, \ x \in \mathbb{R}.$$

Table method   **20 marks**   **Att 8**

x	-1	0	1	2	3	4
$2x^2$	2	0	2	8	18	32
$-6x$	6	0	-6	-12	-18	-24
-7	-7	-7	-7	-7	-7	-7
$f(x)$	1	-7	-11	-11	-7	1

*   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 -7 treated as 7 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 $2x^2 = 4x$ or x

$$f(x) = 2x^2 - 6x - 7$$
$$f(-1) = 2(-1)^2 - 6(-1) - 7 = 1$$
$$f(0) = 2(0)^2 - 6(0) - 7 = -7$$
$$f(1) = 2(1)^2 - 6(1) - 7 = -11$$
$$f(2) = 2(2)^2 - 6(2) - 7 = -11$$
$$f(3) = 2(3)^2 - 6(3) - 7 = -7$$
$$f(4) = 2(4)^2 - 6(4) - 7 = 1$$

Blunders (-3)

B1   Consistent errors in the evaluation of $2x^2$
B2 -7 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 -7 consistently treated as 7 in the evaluation.
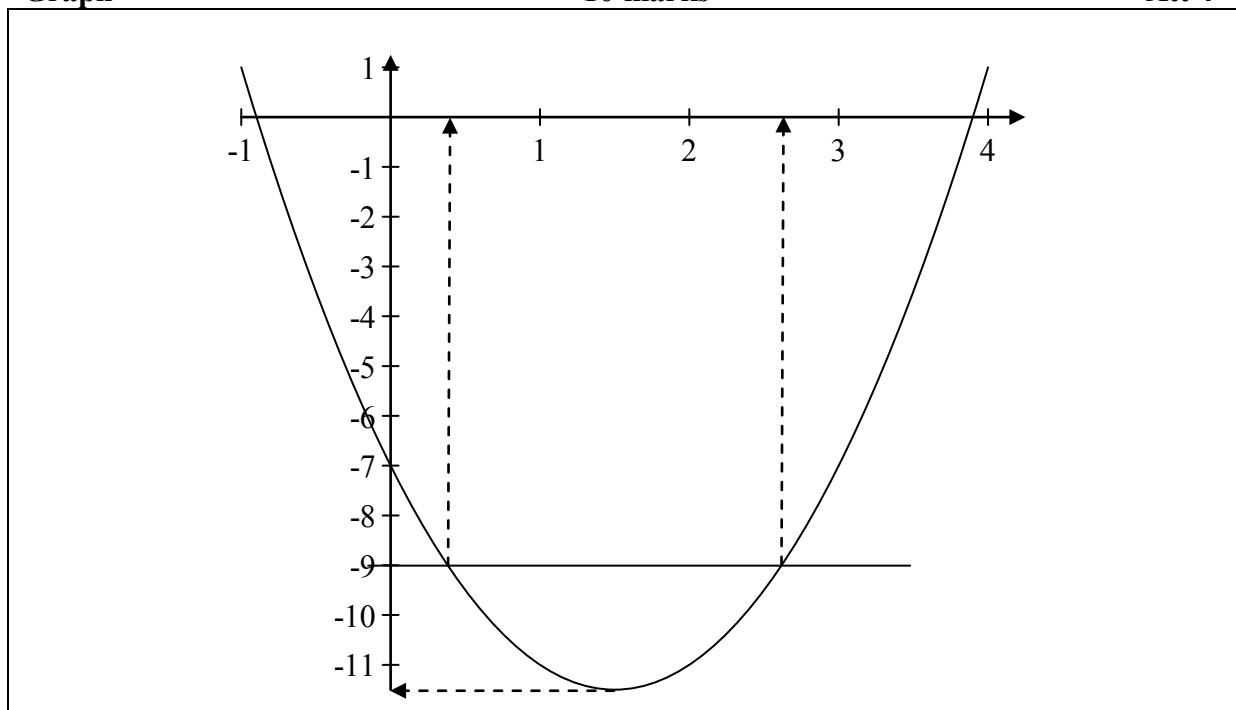
*   Accept values from candidates work
*   Fully correct graph drawn with no work shown: award 30 marks

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

Values   **20 (5, 5, 5, 5) marks**   **Att (2, 2, 2, 2)**

> Use your graph to estimate
> **(i)**   the minimum value of $f(x)$
> **(ii)**   the roots of $f(x) = 0$
> **(iii)**   the values of x for which $f(x) = -9$
> **(iv)**   the range of values of x for which $f(x)$ is decreasing.

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

> (i) -11.3
> (ii) $x = -0.9$, $x = 3.9$
> (iii) $x = 0.4$, $x = 2.6$
> (iv) $-1 \le x < 1.5$

*   Accept candidates values from graph
*   Allow tolerance of ± 0.3 units on x-axis, ± 0.5 on y-axis

Blunders (-3)
B1   Value omitted or extra value applies in parts (i) and (ii)
B2 $f(x) = -9$ treated as $f(-9)$

Slips (-1)
S1   Answers indicated correctly on axis but not specified
S2   Decreasing part of graph indicated but no x value written down

Misreadings (-1)
M1   Gives the value of x corresponding to the minimum of $f(x)$ in part (i)

Attempts (2 marks)
A1   Effort at reading value(s) from graph
A2   Correctly solving equation algebraically; part (ii)

LEAVING CERTIFICATE 2010

MARKING SCHEME

MATHEMATICS
(PROJECT MATHS)
PAPER 2

FOUNDATION LEVEL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination

Mathematics (Project Maths)

Paper 2

Foundation Level

Monday 14 June   Morning 9:30 – 12:00

300 marks

Model Solutions – Paper 2

Note that 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.

The solutions for section 0 are incorporated into the marking scheme for Section 0.
See pages 48 to 52.

Section A	Concepts and Skills	100 marks

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

Question 3 (25 marks)

(a) A school canteen has the "lunch special" shown.
The following sandwiches and drinks are available.

Sandwich	**Drink**
chicken	tea
cheese	hot chocolate
tuna	fruit drink
salad	
egg	

Lunch special:
Any sandwich & any drink

€3

(i) What is the total number of different options available?

$5 \times 3 = 15$

(ii) Orla doesn't like tuna or tea. How many different options does she have?

$4 \times 2 = 8$

(b) A fair spinner is divided into nine equal sections.
The sections are numbered as shown.
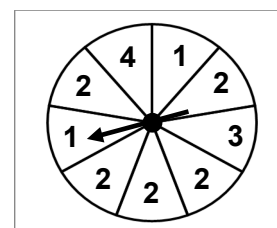
Michael says:
"There's a greater than even chance that you'll get a 2."

State whether Michael is correct and give a reason for your answer.

Answer: Michael is correct.

Reason: The probability of getting a 2 is $\frac{5}{9}$, which is greater than $\frac{1}{2}$.

Question 4 **(25 marks)**

Robert has a bag of sweets.
The chart shows the number of red, orange and green sweets in the bag.

Robert picks one sweet at random from the bag.
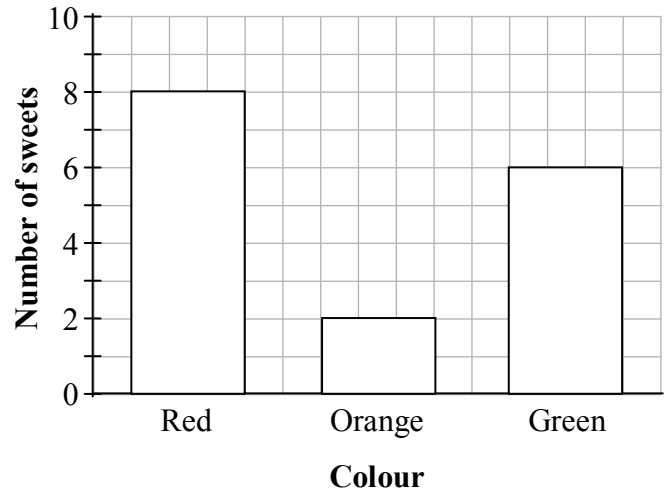
(a) What is the probability that Robert picks a red sweet?

$$P(\text{Red}) = \frac{8}{16} = \frac{1}{2}$$

(b) What is the probability that Robert does not pick an orange sweet?

$$P(\text{Not orange}) = \frac{14}{16} = \frac{7}{8}$$

or

$$P(\text{Not orange}) = 1 - \frac{2}{16} = \frac{14}{16} = \frac{7}{8}$$

(c) The sweet that Robert picks is red. He eats it. He then picks another sweet at random from the bag. Is the probability that this second sweet is red *greater than*, *less than*, or *the same as* the original probability that the first sweet was red? Explain your answer.

Answer: less than
Explanation:
The chance of picking a red sweet was $\frac{1}{2} = 0.5$. It is now $\frac{7}{15} = 0.47$

Question 5 (25 marks)

(a) The diagram shows a triangle and three parallel lines.
Find the value of x and the value of y.
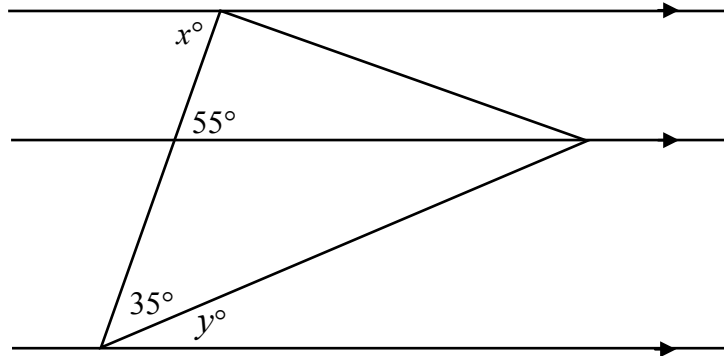
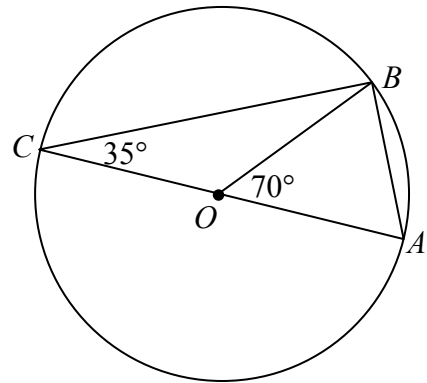
Answer: $x = 55^0$ $\qquad$ $y = 55^0\text{-}35^0 = 20^0$.

(b) $[AC]$ is a diameter of a circle with centre O.
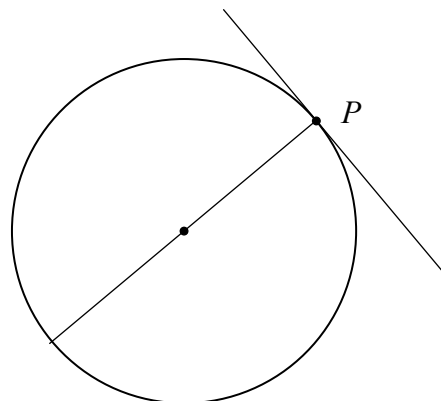B is a point on the circle.

(i) Find $|\angle ABC|$.

Answer: $|\angle ABC| = 90^0$

(ii) Find $|\angle ABO|$.

Answer: $|\angle ABO| = (180^\circ - 70^\circ) \div 2 = 110^\circ \div 2 = 55^\circ$
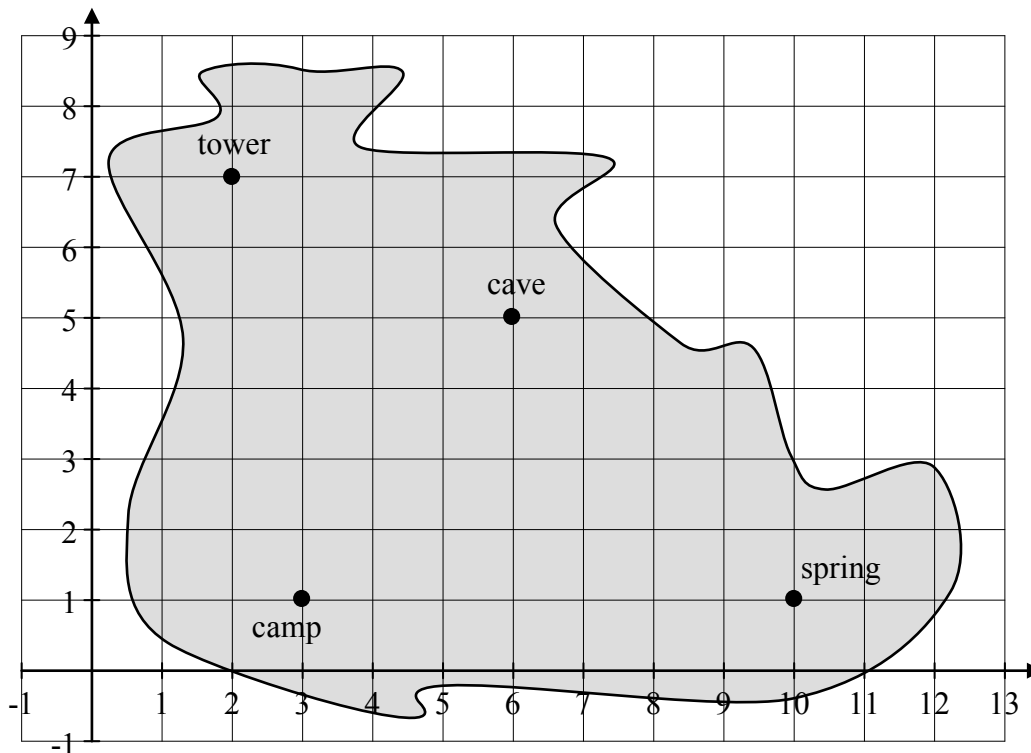
(c) On the diagram, show how to construct
the tangent to the circle at the point P.

Question 6   **(25 marks)**

A map of an island used in a computer game is shown. A co-ordinate grid covers the map.

(a) Write down the co-ordinates of the cave and the camp.

> Cave (6, 5)   camp (3, 1)

(b) Find the co-ordinates of the point that is exactly halfway between the cave and the camp.

$$\left(\frac{6+3}{2}, \frac{5+1}{2}\right) = (4.5, 3)$$

(c) Two teams are racing to get to the spring. The red team is at the cave. The blue team is at the point (5, 4). Use the distance formula to decide which team is closer to the spring.

> Spring to the cave: $\sqrt{(10-6)^2 + (1-5)^2} = \sqrt{16+16} = \sqrt{32}$.
>
> (5,4) to the spring: $\sqrt{(10-5)^2 + (1-4)^2} = \sqrt{25+9} = \sqrt{34}$
>
> The red team is closer.

Answer Question 7 and Question 8 from this section.

Question 7   **Probability and Statistics**   **(50 marks)**

(a)   Gary's class was doing a project. They went to the computer room to get information from the internet. Gary recorded the time, in minutes, that each of them spent on the internet. These are his results.

45	32	29	34	32
26	30	32	20	36
27	42	18	24	18
15	38	27	34	19

(i)   Display the data in a stem-and-leaf plot.

1	5, 8, 8, 9
2	0, 4, 6, 7, 7, 9
3	0, 2, 2, 2, 4, 4, 6, 8
4	2, 5 Key: 4|5 = 45 minutes

(ii)   What percentage of the students spent less than twenty minutes on the internet?

$$\frac{4}{20} = 20\%$$

(iii)   Deirdre asks Gary how long the class spent on the internet. Gary gave an answer that started: "Most of them spent…"
Complete Gary's answer to give a good summary of the data in one sentence.

"Most of them spent between 20 and 40 minutes.

(b) The marks Mary got in her maths tests for a term are listed in the table.

Test	Test 1	Test 2	Test 3	Test 4	Test 5
Mark	85	92	78	54	82

(i) What is Mary's median mark for the term?

Ranked data: {54, 78, 82, 85, 92}

Median = 82

(ii) Calculate Mary's mean mark for the term.

$$\text{Mean mark} = \frac{85 + 92 + 78 + 54 + 82}{5} = 78.2$$

(iii) Which one of Mary's marks is out of line with the others?

Answer: 54

(iv) Which do you think is a fairer summary of Mary's work for the term: the mean or the median? Give a reason for your answer.

Answer: Median   OR   Mean

Reason: The median is more.   The mean takes full account of
          typical of her usual   how good or bad all her results
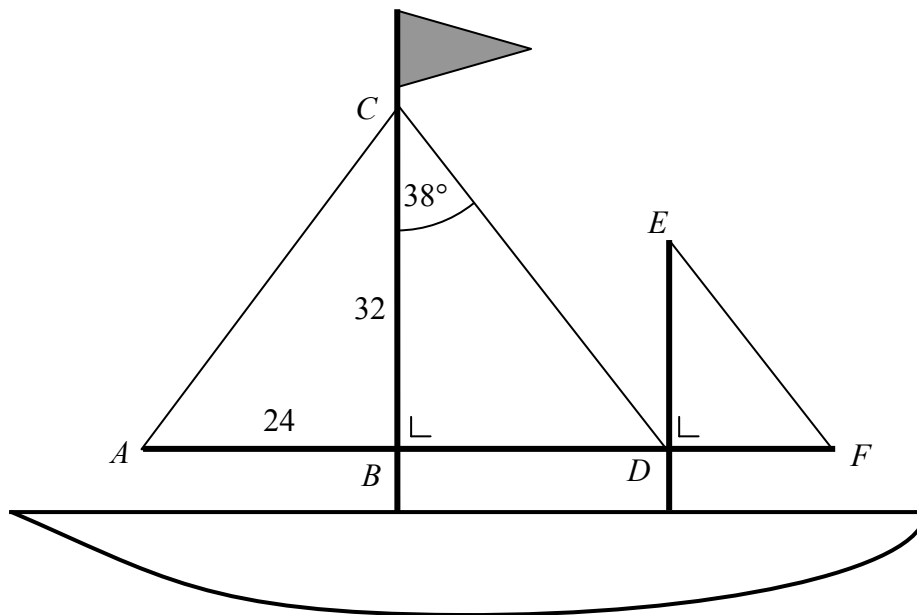   standard.   were.

Question 8   **Geometry and Trigonometry**   **(50 marks)**

Seán is making a toy boat. His design is shown below. He is working on the sails.
$|AB| = 24$ cm, $|BC| = 32$ cm and $|\angle BCD| = 38°$.

(a)   Use Pythagoras' theorem to find $|AC|$.

$$|AC|^2 = |AB|^2 + |BC|^2$$
$$|AC|^2 = 24^2 + 32^2$$
$$= 576 + 1024$$
$$= 1600$$
$$|AC| = 40 \text{cm}.$$

(b)   Use triangle BCD to find $|BD|$. Give your answer correct to the nearest centimetre.

$$\tan 38^0 = \frac{|BD|}{32}$$
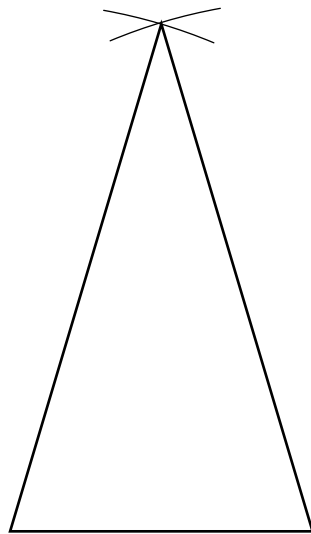$$|BD| = 32 \tan 38^0$$
$$= 25 \text{ cm (to the nearest cm)}.$$

(c) The sail *DEF* is a reduction of *BCD*. The scale factor is $\frac{3}{5}$. Find $|DF|$.

$$|DF| = 25 \times \frac{3}{5} = 15cm$$

(d) Find the total distance from *A* to *F*.

$|AF| = 24 + 25 + 15 = 64\text{cm}$

(e) Seán needs to make an accurate drawing of the flag at the top of the mast. The flag is a triangle with sides of length 7 cm, 7 cm, and 4 cm.
Construct this triangle accurately in the space below.

Marking scheme for Section 0 (Questions 1 & 2) of Paper 2

N.B. This page applies only to Questions 1 & 2.

The scheme for these questions is identical to that used for candidates who are not involved in Project Maths.

GENERAL GUIDELINES FOR EXAMINERS – PAPER 2

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.

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

Part (a)	15 (10, 5) marks	Att (4, 2)
Part (b)	35 (30, 5) marks	Att (12, 2)

Part (a)	**15 (10, 5) marks**	**Att (4, 2)**

(a) A rectangular field is 150 m long and 90 m wide.

Find

(i) the area of the field

(ii) the length of the perimeter of the field.

150 m

90 m

(a) (i)	**10 marks**	**Att 4**
(a) (ii)	**5 marks**	**Att 2**

(i) Area $= ab = 150 \times 90 = 13\ 500\ \text{m}^2$

(ii) Length $= 2(a + b) = 2(150 + 90) = 480\ \text{m}$
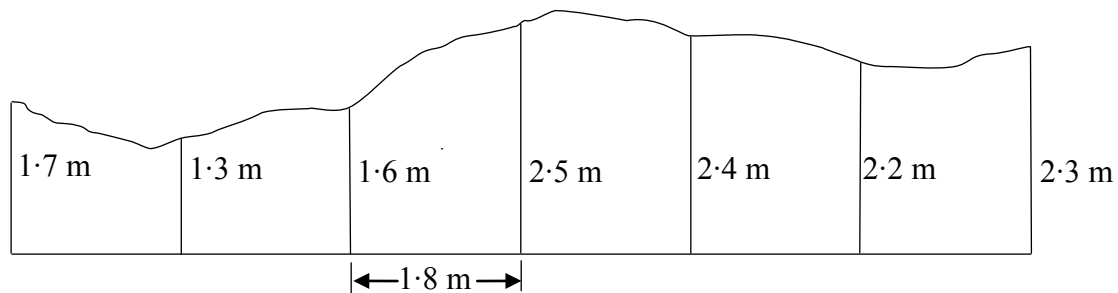
Blunders (-3)
B1 Incorrect substitution

Slips (-1)
S1 Numerical errors to a maximum of 3

Attempts (4, 2 marks)
A1 Defines area
A2 Defines perimeter

(b)   One side of an old garden fence is shown in the diagram.

1·7 m   1·3 m   1·6 m   2·5 m   2·4 m   2·2 m   2·3 m

|←—1·8 m—→|

The height of the fence is measured as 1·7, 1·3, 1·6, 2·5, 2·4, 2·2, and 2·3 metres at intervals of 1·8 metre along the base of the fence as shown.

(i)   Use Simpson's rule to calculate the area of the side of the fence in m^2.

(ii)   The owner paints this side of his fence.
One tin of paint covers 5·4 square metres.
How many tins of paint does he use?

(b) (i)	**30 marks**	**Att 12**
(ii)	**5 marks**	**Att 2**

(i)   Area = $\frac{h}{3}\left(\text{First} + \text{Last} + \text{T.O.F.E}\right)$

$$= \frac{1.8}{3}\left(1.7 + 2.3 + 2(1.6 + 2.4) + 4(1.3 + 2.5 + 2.2)\right) = 0.6\left(4 + 8 + 24\right) = 21.6 \text{ m}^2.$$

(ii)   Number of tins = $\dfrac{21.6}{5.4} = 4$ tins.

Blunders (-3)
B1   Uses four odd and twice even, $4\left(1.6 + 2.4\right) + 2\left(1.3 + 2.5 + 2.2\right)$
B2   Omits 2 or 4 in the formula or both
B3   Omits *h* or uses an incorrect *h* or does not divide *h* by 3
B4   Multiplies by 5.4

Slips (-1)
S1   Numerical errors to a maximum of 3
S2   Each incorrect or omitted height

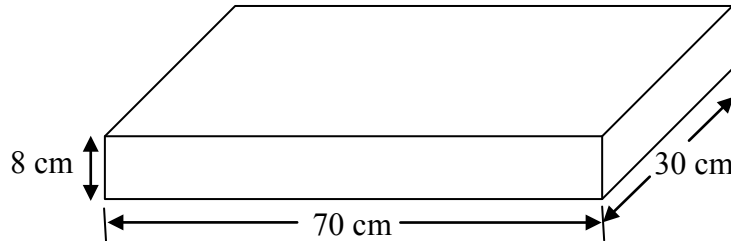*Attempts (12, 2 marks)*
A1   Gives Simpson's rule only
A2   Copies diagram

QUESTION 2

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

Part (a)	10 marks	Att 4

(a)   The diagram shows a rectangular block 70 cm long, 30 cm wide and 8 cm high.
Calculate the volume of the rectangular block.

8 cm

30 cm

70 cm

(a)	10 marks	Att 4

Volume = abc = $70 \times 30 \times 8$ = $16\,800 \, \text{cm}^3$

Blunders (-3)
B1   Incorrect substitution
B2   Addition for multiplication

Slips (-1)
S1   Numerical errors to a maximum of 3

Attempts (4 marks)
A1   Correct formula without substitution

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

(b)   The diagram shows a circle inscribed in a square.
The radius of the circle is 8 cm.

   (i)   Find the area of the circle.
Give your answer correct to the nearest cm^2.

   (ii)   Find the area of the square.

8 cm
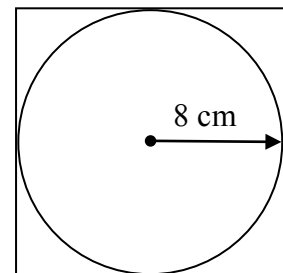
(b) (i)	10 marks	Att 4
(ii)	10 marks	Att 4

(i)   Area = $\pi r^2 = \pi \times 8^2 = 201.06 \approx 201 \, \text{cm}^2$

(ii)   Area = $a^2 = 16^2 = 256 \, \text{cm}^2$.

Blunders (-3)
B1   Incorrect substitution

Slips (-1)
S1   Numerical errors to a maximum of 3
S2   Error in rounding or gives answer in terms of π

Attempts (4, 4 marks)
A1   Defines area

(c)   A container in the shape of an inverted cone is filled with water.

The diameter of the cone is 9 cm and the height is 12 cm.

(i)   Find the volume of water in the container, in terms of π.

The water is then poured into a cylindrical can of diameter 6 cm.

(ii)   Find h, the depth of water in the can.
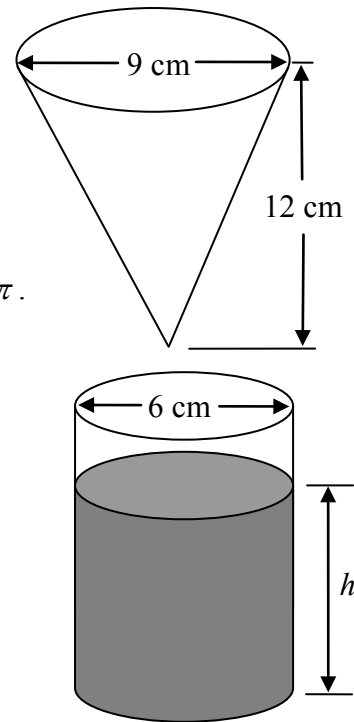
(c) (i)   **15 marks**   **Att 6**
    (ii)   **5 marks**   **Att 2**

(i)   Volume = $\frac{1}{3}\pi r^2 h = \frac{1}{3} \times \pi \times 4.5^2 \times 12 = 81\pi$ cm^3

(ii)   Volume = $\pi r^2 h = 81\pi \Rightarrow \pi \times 3^2 \times h = 81\pi \Rightarrow h = 9$ cm

Blunders (-3)
B1   Incorrect substitution
B2   Error in balancing equation

Slips (-1)
S1   Numerical errors to a maximum of 3
S2   Omits π or gives answer as 254.469 or 254.34 or similar

Attempts (6, 2 marks)
A1   Correct formula without substitution

Marking scheme for Sections A and B of Paper 2

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
5 mark scale	0, 5	0, 3, 5	0, 2, 4, 5
10 mark scale		0, 6, 10	0, 4, 8, 10

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

Section A

Question 3
(a)(i) 10C
   (ii) 5C
(b) 10C

Question 4
(a) 10C
(b) 10C
(c) 5C

Question 5
(a) 10C
(b)(i) 5C
   (ii) 5C
(c) 5C

Question 6
(a) 10C
(b) 10C
(c) 5C

Section B

Question 7
(a)(i) 10C
   (ii) 5C
   (iii) 10B
(b)(i) 5C
   (ii) 5C
   (iii) 10B
   (iv) 5B

Question 8
(a) 10C*
(b) 10C*
(c) 10C*
(d) 10C*
(e) 10C

Detailed marking notes

Section A

Question 3
(a) (i)   Scale 10C

            High partial credit: Complete list of options without stating 15.
                                         States 5×3 without evaluating.
                                         5 + 3 = 8(incorrect operation)
            Low partial credit: Partial list of different options.

    (ii)   Scale 5C

            High partial credit: Complete list of options without stating 8.
                                         States 4×2 without evaluating.
            Low partial credit: Partial list of different options, but must not include
                                         tuna or tea.
                                         4 + 2 = 6(incorrect operation)

(b)   Scale 10C

            High partial credit: Writes down $\dfrac{5}{9}$ without correct answer.

                                         Correct answer with no reason.
                                         Incorrect answer but gives a valid reason. "The chance of
                                         getting a 2 is 4/9.
            Low partial credit: Mentions "50-50 chance", ½, 50%.

Question 4
(a)   Scale 10C
            High partial credit: Finds 8 and 16 from graph.
                                         Correct numerator or correct denominator.
            Low partial credit: Correctly reads 8 from the graph.
                                         Mentions "likely"

       Accept 50-50, evens, 50%

(b)   Scale 10C
            High partial credit: Finds the probability of picking an orange sweet.
                                         Finds 14 and 16 from the graph.
                                         Greater than 50-50, Very likely, etc

            Low partial credit: Finds the number of orange sweets in the bag.

(c)   Scale 5C
            High partial credit: Correct answer, no reason or unsound reason.
                                         States the number of red sweets left in the bag and the total
                                       number of sweets left in the bag.
            Low partial credit: States the number of red sweets left in the bag.

Question 5
(a)　Scale 10C.
　　　　High partial credit:　　One correct.

　　　　Low partial credit:　　Subtracts 55° from 180°. Subtracts 35° from 180°.

(b)　(i)　Scale 5C
　　　　High partial credit:　　Measures angle and gets $88° \leq |\angle ABC| \leq 92°$, but not 90°.
　　　　　　　　　　　　　　Subtracts 70° from 180° or 35° from 180°

　　　　Low partial credit:　　Mentions diameter or radius or semi-circle.

　　(ii)　Scale 5C
　　　　High partial credit:　　Subtracts 70° from 180°.
　　　　　　　　　　　　　　Subtracts 110° from 180°.

　　　　Low partial credit:　　Mentions isosceles triangle.
　　　　　　　　　　　　　　Angles at the base of an isosceles triangle equal in measure.

(c)　Scale 5C
　　　　High partial credit:　　Accurate tangent without radius shown.
　　　　　　　　　　　　　　Inaccurate construction with radius shown.

　　　　Low partial credit:　　Inaccurate construction without radius shown.
　　　　　　　　　　　　　　Radius only.

Question 6
(a)   Scale 10C
        High partial credit: The co-ordinates of one point given correctly.
                                              x and *y* reversed i.e. (5, 6) and (1, 3).
                                              Correct co-ordinates of tower and spring.

        Low partial credit: Circles cave and camp in diagram.
                                              Co-ordinates of tower or spring.

(b)   Scale 10C
        High partial credit: Reads inaccurately from diagram e.g. (4, 3).
                                              Substitutes incorrectly into formula and finishes.
                                            Correctly bisects [camp, cave], but gives no co-ordinates.

        Low partial credit: Shows midpoint on diagram, but not in the correct position.
                                              Identify the correct formula.

      Accept answer read from diagram. Accept (3, 4·5) if consistent with work in Part (a).

(c)   Scale 5C
        High partial credit: Answer without conclusion.
                                              Calculates one distance correctly.

        Low partial credit: Correctly formula written down.
                                              Correct answer from diagram or without supporting
                                            calculations.

Question 7

(a) (i) Scale 10C
        High partial credit: Incomplete plot with 4 or fewer points missing and/or incorrect.

        Low partial credit: Correct stem.

        Accept plot without key. Leaves do not need to be ordered. Stem can be ordered in either direction.

    (ii) Scale 5C
        High partial credit: Gives answer as a fraction or decimal.

        Low partial credit: Counts the correct number of students who spent less than 20 minutes, either from original data or from their own stem and leaf.
                                      Gives the correct total number of students.

    (iii) Scale 10B
        Partial credit: Statement without reference to data.

(b) (i) Scale 5C
        High partial credit: Gives middle number without ranking the data.

        Low partial credit: Ranks the data.
                                     Finds the mean.

    (ii) Scale 5C
        High partial credit: Sums correctly but fails to divide by 5.
                                     Sums incorrectly and divides by 5 correctly.
        Low partial credit: Divides one data point by 5.
                                     Any correct step- adding two numbers.

    (iii) Scale 10B
        Partial credit: Gives 92 as the outlier.

    (iv) Scale 5B
        Partial credit: Answer without justification or incorrect justification.

Question 8
(a)   Scale 10C*

        High partial credit: $|AC|^2 = 24^2 + 32^2$ and stops.

        Low partial credit: States theorem of Pythagoras.
                                         Any use of 24 or 32.

(b)   Scale 10C*
        High partial credit: Sets up correctly.
                                         Finds |CD|.

        Low partial credit: Finds $\tan 38°, \cos 38°$ or $\sin 38°$.

(c)   Scale 10C*

        High partial credit: Finds $\dfrac{3}{5}$ of 32, 24 or |AC|
        Low partial credit: Stating *CDB* and *EDF* are equiangular.

(d)   Scale 10B*
        Partial credit: 24 added to anything.

        Accept candidate's answer from previous parts.

(e)   Scale 10C
        High partial credit: One side correct.
        Low partial credit: Any triangle drawn

Marcanna breise as ucht freagairt trí Ghaeilge

(Bonus marks for answering through Irish)

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

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

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

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

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