



Coimisiún na Scrúduithe Stáit
State Examinations Commission

LEAVING CERTIFICATE 2010

MARKING SCHEME

MATHEMATICS

FOUNDATION LEVEL

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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
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Part (i)	10 marks	Att 4
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Find $\sqrt{93.4}$, correct to one decimal place.

(i)	10 marks	Att 4
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$$\sqrt{93.4} = 9.66\dots = \mathbf{9.7}$$

* Accept correct answer with no work

Blunders (-3)

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

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

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

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 $\sqrt{94.3} = [9.710818\dots] = 9.7$

M2 $\sqrt{39.4} = [6.276941\dots] = 6.3$

Attempts (4 marks)

A1 $(93.4)^2 = 8723.56$

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

A3 $(93.4) \times 2 = 186.6$

A4 Work at estimating answer: $\sqrt{93.4} = 9$ 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 $15.5 - 3.8 \times 2.6$.

(ii)

10 marks

Att 4

$15.5 - 3.8 \times 2.6 = 15.5 - 9.88 = \mathbf{5.62}$

* 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 $\frac{5}{\sqrt{2}} + (1.6)^2$, correct to the nearest whole number.

(iii)

10 marks

Att 4

$$\frac{5}{\sqrt{2}} + (1.6)^2 = 3.53 + 2.56 = 6.09 = 6$$

* Accept correct answer with no work

Blunders (-3)

B1 $\frac{5}{\sqrt{2}} + (1.6)^2 = 3.5355... + 256 = 259.5355 = 260$

B2 $\frac{5}{\sqrt{0.2}} + (1.6)^2 = 11.1803 + 2.56 = 13.7403 = 14$

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

B4 Square root not found

B5 Square not found

B6 Division omitted

B7 No addition

B8 Error in precedence e.g. $(5 + (1.6)^2) \div \sqrt{2} = 5.345 = 5$

B9 $5 + (1.6)^2 \div \sqrt{2} = 6.81 = 7$

B10 $\sqrt{2} = 1 \Rightarrow \frac{5}{1} + 2.56 = 7.56 = 8$

Slips (-1)

S1 Numerical slips to a maximum of 3

S2 Incorrect or omitted rounding off

Misreadings (-1)

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

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

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

$\frac{60.80 \times 15}{100} = €9.12 \text{ or } 60.80 \times 0.15 = €9.12$ <p>Reduced price = €60.80 – €9.12 = €51.68</p>	Reduced price = €60.80 × 0.85 = €51.68 OR $\frac{60.80 \times 85}{100} = \mathbf{€51.68}$
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- * 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 $\frac{€60.80 \times 85}{100}$ 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 $\frac{€60.80 \times 85}{100}$ (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

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

- * 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 $\frac{1.72}{700} = 0.002457$

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

(vi)

10 marks

Att 4

$$\frac{7}{19} + \frac{2}{9} = \frac{63 + 38}{171} = \frac{101}{171} = \mathbf{0.591}$$

$$0.368421052 + 0.222222222 = 0.590643274 = \mathbf{0.591}$$

* 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 $0 < \text{answer} < 1$ (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 $S = \frac{D}{T}$ e.g. $80 \div 1.75 = 45.71$ 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 $S = \frac{D}{T}$ 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

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

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

- * 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 $\frac{(2.78 \times 10^3) + (2.96 \times 10^2)}{1.42 \times 10^2}$, correct to three significant figures.

(ix)

10 marks

Att 4

$$\frac{(2.78 \times 10^3) + (2.96 \times 10^2)}{1.42 \times 10^2} = \frac{2780 + 296}{142} = \frac{3076}{142} = 21.6619 = \mathbf{21.7}$$

$$\frac{3.076 \times 10^3}{1.42 \times 10^2} = 2.166197183 \times 10^1 = 21.66197183 = \mathbf{21.7}$$

* 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 $\frac{27.9 + 15.4}{(3.4)^3}$, correct to two decimal places.

(x)

10 marks

Att 4

$$\frac{27.9 + 15.4}{(3.4)^3} = \frac{43.3}{39.304} = 1.101 = \mathbf{1.10}$$

* Accept correct answer with no work

Blunders (-3)

B1 Error in precedence (once only)

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

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

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

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

B6 Any error involving working out $(3.4)^3$

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) | $8.57 \times 1000 = \mathbf{8570 \text{ grams}}$ |
| (ii) | $\frac{7904}{100} = \mathbf{79.04 \text{ metres}}$ |

- * 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

$$\text{Gross pay} = €12.50 \times 35 + €18.50 \times 5 = 437.50 + 92.5 = \mathbf{€530.00}$$

* 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

$\text{Tax payable} = €530.00 \times 0.20 - €72 = €106 - €72 = \mathbf{€34}.$

- * 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. $€530 \times 1.20$
- 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

$\text{Take home pay} = €530 - €34 = \mathbf{€496}.$
--

- * 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

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

* Accept correct answer with no work

Blunders (-3)

B1 Error in evaluation of journey time

B2 Misuse of $S = \frac{D}{T}$ 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 $\frac{80}{60}$ and stops

A3 Some use of given data

A4 $S = \frac{D}{T}$ 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) (ii)

5 marks

Att 2

Remaining distance = $281 - 120 = 161\text{km}$ Time Taken = $\frac{60}{92} \times 161 = 105\text{ mins}$ Total time = $90 + 105 = \mathbf{195\text{ mins}}$ or 3 hours 15 mins	Remaining distance = $281 - 120 = 161\text{km}$ $t = \frac{d}{s}$ $t = \frac{161}{92} = 1.75\text{ hours or }105\text{ minutes}$ Total time = $90 + 105 = \mathbf{195\text{ mins}}$ or 3 hours 15 mins
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- * 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 = $\frac{281}{1.5 + 1.75} = 86.46 = \mathbf{86\text{ km/h}}$
--

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

Blunders (-3)

- B1 Error in evaluation of journey time e.g. $195\text{ minutes} = 3.15\text{ hours}$
- 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 = $5.4 - 4.8 = 0.6 \text{ m}$

* 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 = $\frac{0.6}{4.8} \times 100 = 12.5\%$

* Accept correct answer with no work

Blunders (-3)

B1 Errors in establishing $\frac{0.6}{4.8} \times 100$ [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**

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

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

- * 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 $\frac{4000}{5.5} = 727.27$
- A2 $(4000)(5.5) = 22000$
- A3 $\frac{4000}{0.055} = 72727.27$

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 $\frac{4000}{1.055} = 3791.46$ or $\frac{4000}{0.9450} = 4232.80$
- 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

	OR	
(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 × 1.055 = €4220
	Less Repayment		4220 – 1000 = 3220 (Principal year 2)
Year 2	Amount	=	3220 × 1.055 = €3397.10
OR			
Principal year 1			4000
Compound Interest year 1			220 ← $\frac{4000 \times 5.5}{100}$
Amount at end year 1			4220
Less Repayment			1000
Principal year 2			3220
Compound interest year 2			177.10 ← $\frac{3220 \times 5.5}{100}$
Amount at end year 2			3397.10

- * 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 × 1.55 = 6200

B2 Errors in establishing $\frac{4000 \times 5.5}{100}$ [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) $\frac{900}{50} \times 7 = \mathbf{€126}$

* Accept correct answer without work

Blunders (-3)

B1 Errors in establishing $\frac{900}{50} \times 7$ [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) $\frac{1995}{57} \times 50 = \mathbf{€1750}$

* Accept correct answer without work

Blunders (-3)

B1 Errors in establishing $\frac{1995}{57} \times 50$ [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

(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

$$\begin{array}{r} 3x + 2y = 1 \quad \times 3 \\ 5x + 3y = 3 \quad \times 2 \end{array} \Rightarrow \begin{array}{r} 9x + 6y = 3 \\ 10x + 6y = 6 \\ \hline -x = -3 \Rightarrow x = 3 \end{array}$$

$$3x + 2y = 1 \Rightarrow 3(3) + 2y = 1 \Rightarrow 2y = -8 \Rightarrow y = -4$$

- * 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 $-x = -3 \Rightarrow x \neq 3$
- 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 $3x - 1 \leq 14$, $x \in \mathbb{Z}$.
(ii) Solve $5 - 4x < 13$, $x \in \mathbb{Z}$.
(iii) Plot on a number line the values of x which satisfy both of the above inequalities.

(c) (i)

10 marks

Att 4

$$3x - 1 \leq 14 \Rightarrow 3x \leq 15 \Rightarrow x \leq 5$$

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

$$5 - 4x < 13 \Rightarrow -4x < 8 \Rightarrow x > -2$$

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

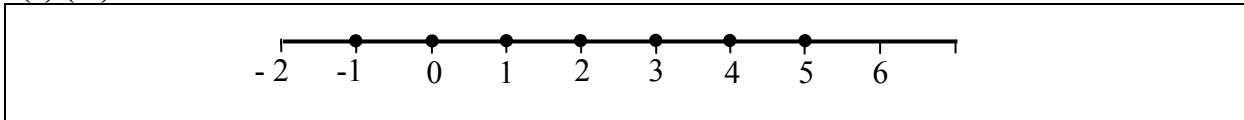
Worthless (0 marks)

- W1 Incorrect answer without work

(c) (iii)

5 marks

Att 2



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

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

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

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

$$\begin{aligned}2x^2 - 5x - 4 &= 0 \\ \Rightarrow x &= \frac{5 \pm \sqrt{(-5)^2 - 4(2)(-4)}}{2 \times 2} \\ &= \frac{5 \pm \sqrt{57}}{4} * \\ &= \frac{5 \pm 7.5498}{4} \\ \Rightarrow x &= \frac{12.5498}{4} \text{ or } x = \frac{-2.5498}{4} \\ \Rightarrow x &= 3.13745 \text{ or } x = -0.63745 \\ \Rightarrow x &= \mathbf{3.14} \text{ or } x = \mathbf{-0.64}\end{aligned}$$

* Maximum deductions beyond point * is 3 marks

* $\frac{5 \pm \sqrt{\text{negative number}}}{2 \times 2}$ 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. $\frac{x}{8}$, $\frac{8}{x}$ *Worthless (0 marks)*W1 No use of x or 8W2 $x = 8$ 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

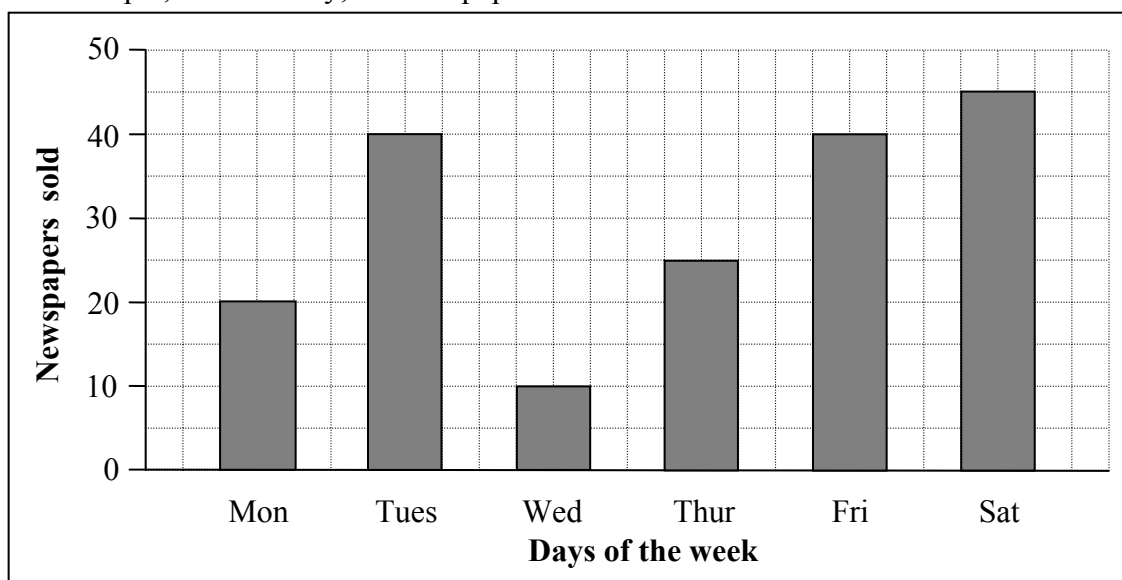
Worthless (0 marks)

- 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 $\frac{180}{6}$

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
 $f : x \rightarrow 2x^2 - 6x - 7$, for $-1 \leq x \leq 4$, $x \in \mathbb{R}$.

Table method	20 marks	Att 8
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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

Function evaluation method**20 marks****Att 8**

$$f(x) = 2x^2 - 6x - 7$$

$$f(-1) = 2(-1)^2 - 6(-1) - 7 = 1$$

$$f(0) = 2(0)^2 - 6(0) - 7 = -7$$

$$f(1) = 2(1)^2 - 6(1) - 7 = -11$$

$$f(2) = 2(2)^2 - 6(2) - 7 = -11$$

$$f(3) = 2(3)^2 - 6(3) - 7 = -7$$

$$f(4) = 2(4)^2 - 6(4) - 7 = 1$$

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

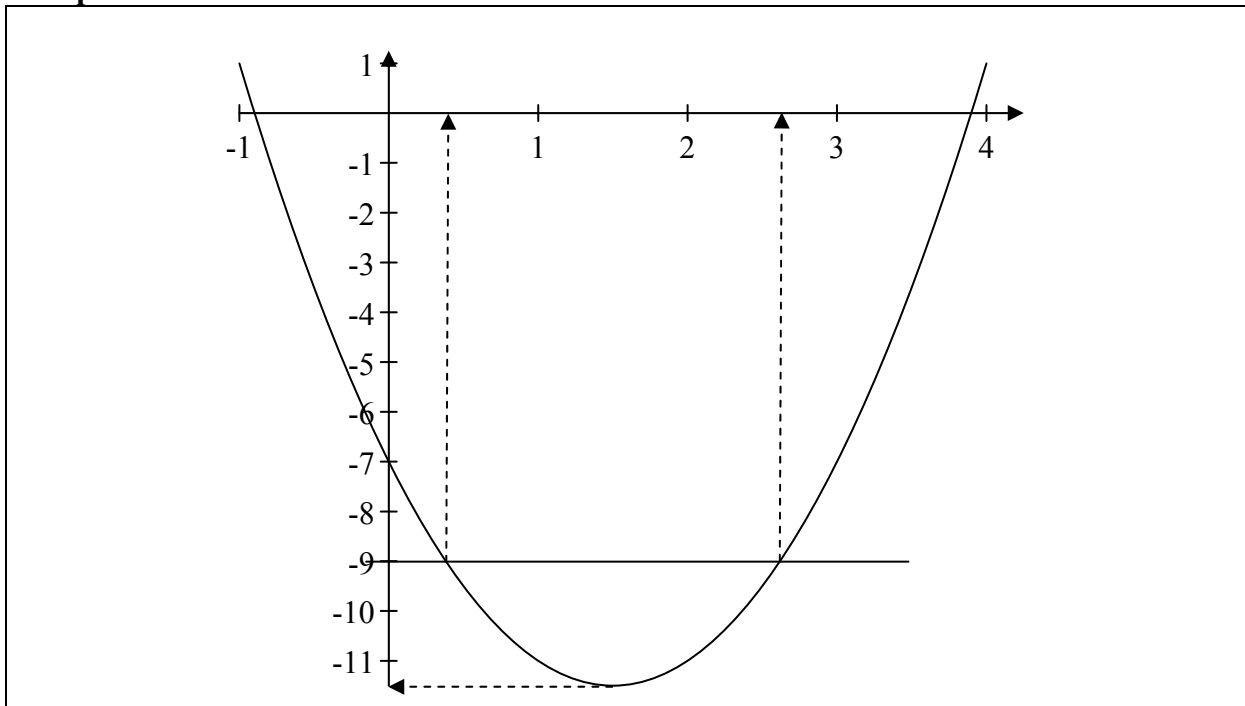
Slips (-1)

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.

Graph**10 marks****Att 4**

- * 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) $-1 \leq x < 1.5$

- * 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)



Coimisiún na Scrúduithe Stáit
State Examinations Commission

LEAVING CERTIFICATE 2010

MARKING SCHEME

MATHEMATICS – PAPER 2

FOUNDATION LEVEL

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)
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(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.



The diagram shows a rectangle with a horizontal top side labeled '150 m' and a vertical right side labeled '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)

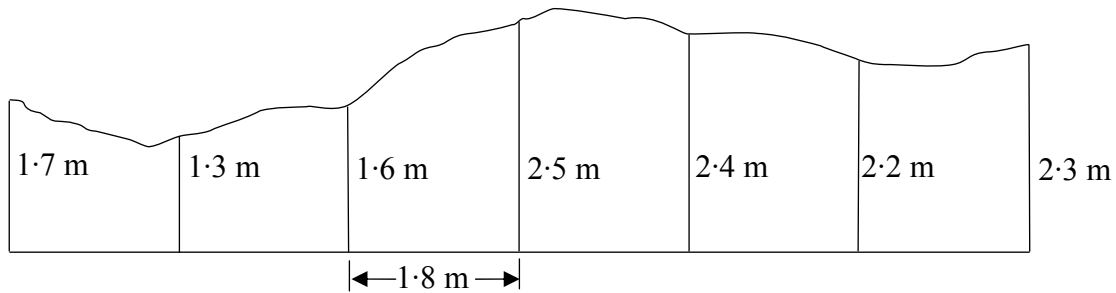
S1 Numerical errors to a maximum of 3

Attempts (4, 2 marks)

A1 Defines area

A2 Defines perimeter

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



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)
(ii)

30 marks

Att 12

5 marks

Att 2

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

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

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

Blunders (-3)

B1 Uses four odd and twice even, $4(1.6 + 2.4) + 2(1.3 + 2.5 + 2.2)$

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

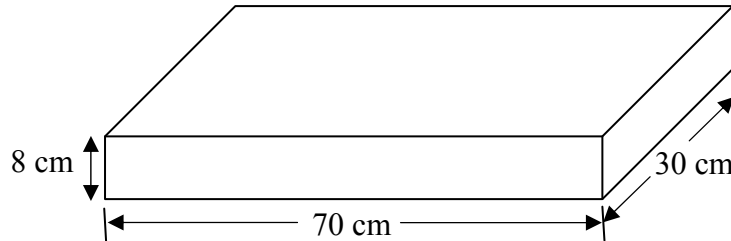
A2 Copies diagram

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.



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

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

Blunders (-3)

- B1 Incorrect substitution
- B2 Addition for multiplication

Slips (-1)

- S1 Numerical errors to a maximum of 3

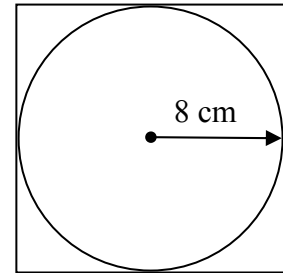
Attempts (4 marks)

- 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.



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

- (i) $\text{Area} = \pi r^2 = \pi \times 8^2 = 201.06 \approx 201 \text{ cm}^2$
- (ii) $\text{Area} = a^2 = 16^2 = 256 \text{ cm}^2$.

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

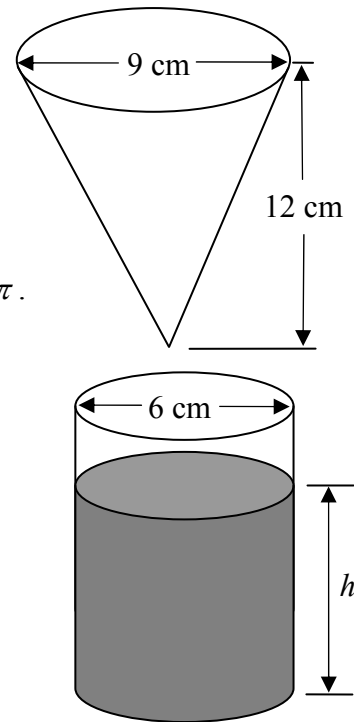
- (c) A container in the shape of an inverted cone is filled with water.

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)
(ii)

15 marks
5 marks

Att 6
Att 2

- (i) Volume = $\frac{1}{3}\pi r^2 h = \frac{1}{3} \times \pi \times 4.5^2 \times 12 = 81\pi \text{ cm}^3$
 (ii) Volume = $\pi r^2 h = 81\pi \Rightarrow \pi \times 3^2 \times h = 81\pi \Rightarrow h = 9 \text{ cm}$

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)

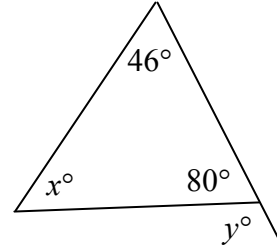
- A1 Correct formula without substitution

QUESTION 3

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

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

(a) Find the value of x and the value of y .



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

$$x + 46 + 80 = 180 \Rightarrow x = 54$$
$$y + 80 = 180 \Rightarrow y = 100$$

Blunders (-3)

B1 Geometrical error

Slips (-1)

S1 Numerical errors to a maximum of 3

Attempts (2, 2 marks)

A1 Incorrect answer of some merit

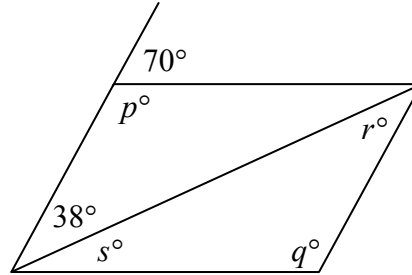
Part (b)

20 (5, 5, 5, 5) marks

Att (2, 2, 2, 2)

(b) The diagram shows a parallelogram

- (i)** Find the value of p .
- (ii)** Find the value of q .
- (iii)** Find the value of r .
- (iv)** Find the value of s .



(b)

20 (5, 5, 5, 5) marks

Att (2, 2, 2, 2)

- (i)** $p + 70 = 180 \Rightarrow p = 110$
- (ii)** $q = p = 110$
- (iii)** $r = 38$
- (iv)** $s + 38 = 70 \Rightarrow s = 32$

Blunders (-3)

B1 Geometrical error

Slips (-1)

S1 Numerical errors to a maximum of 3

Attempts (2, 2, 2, 2 marks)

A1 Incorrect answer of some merit

Part (c)

20 (10, 5, 5) marks

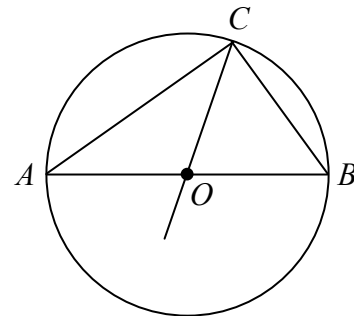
Att (4, 2, 2)

(c) The diagram shows a circle with centre at O .

$[AB]$ is a diameter of the circle.

$|\angle AOC| = 104^\circ$ and $|OC| = 6$ cm.

- (i)** Find $|\angle OBC|$.
- (ii)** Find $|\angle CAO|$.
- (iii)** Find $|AB|$.



(c)

20 (10, 5, 5) marks

Att (4, 2, 2)

- (i)** $|\angle OBC| + |\angle BCO| = 2|\angle OBC| = 104^\circ \Rightarrow |\angle OBC| = 52^\circ$
- (ii)** $|\angle CAO| = 90^\circ - 52^\circ = 38^\circ$
- (iii)** $|AB| = 2 \times 6 = 12$ cm.

Blunders (-3)

B1 Geometrical error

Slips (-1)

S1 Numerical errors to a maximum of 3

Attempts (4, 2, 2 marks)

A1 Incorrect answer of some merit

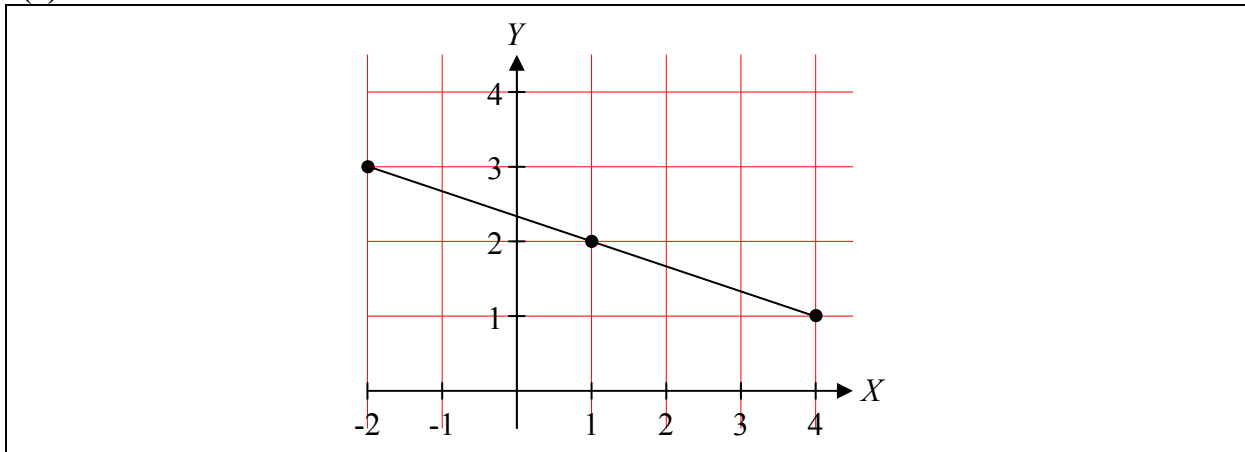
QUESTION 4

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

Part (a) **15 marks** **Att 6**

- (a) Plot the points $A(4, 1)$ and $B(-2, 3)$ on graph paper.
Show on your diagram the midpoint of $[AB]$.

(a) **15 marks** **Att 6**



Blunders (-3)

- B1 Error in scales
- B2 Each point omitted
- B3 Incorrect midpoint or no midpoint shown

Slips (-1)

- S1 Each incorrectly plotted point

Attempts (6 marks)

- A1 Draws axes

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

- (b)** $P(2, 4)$ and $Q(-3, 1)$ are two points.
- (i)** Find the length of $[PQ]$.
- (ii)** Find the slope of PQ .
- (iii)** Find the equation of the line PQ .

- | | | |
|----------------|-----------------|--------------|
| (b) (i) | 10 marks | Att 4 |
| (ii) | 5 marks | Att 2 |
| (iii) | 5 marks | Att 2 |

- (i)** Length = $\sqrt{(-3-2)^2 + (1-4)^2} = \sqrt{(-5)^2 + (-3)^2} = \sqrt{25+9} = \sqrt{34}$
- (ii)** Slope = $\frac{1-4}{-3-2} = \frac{-3}{-5}$ or $\frac{3}{5}$
- (iii)** Equation: $y-4 = \frac{3}{5}(x-2)$ or $3x-5y+14=0$

Blunders (-3)

- B1 No square root
- B2 Incorrect substitution once only
- B3 Mathematical error

Slips (-1)

- S1 Numerical errors to a maximum of 3

Attempts (4, 2, 2 marks)

- A1 Draws axes

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

- (c) The line l has equation $2y = 3x + 1$.
 The point R has co-ordinates $(1, 2)$.
- (i) Show that the point R lies on the line l .
 (ii) Write down the slope of l .
 (iii) Find the equation of the line k , which passes through the point $(4, -1)$ and is parallel to l .

- | | | |
|----------------|----------------|--------------|
| (c) (i) | 5 marks | Att 2 |
| (ii) | 5 marks | Att 2 |
| (iii) | 5 marks | Att 2 |

- (i) $2y = 3x + 1 \Rightarrow 2(2) = 3(1) + 1 \Rightarrow 4 = 4$.
- (ii) $2y = 3x + 1 \Rightarrow \text{slope} = \frac{3}{2}$
- (iii) $y + 1 = \frac{3}{2}(x - 4)$ or $3x - 2y - 14 = 0$

Blunders (-3)

- B1 Incorrect substitution once only
- B2 Incorrect slope of l
- B3 Incorrect slope of k
- B4 Error in balancing equation

Slips (-1)

- S1 Numerical errors to a maximum of 3

Attempts (2, 2, 2 marks)

- A1 Draws axes

QUESTION 5

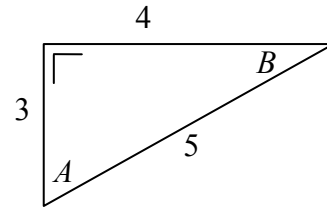
Part (a)	20 (10, 10) marks	Att (4, 4)
Part (b)	10 marks	Att 4
Part (c)	20 (10, 10) marks	Att (4, 4)

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

- (a) The diagram shows a right angled triangle with sides of length 3, 4 and 5 cm and angles named A and B .

Write as a fraction

- (i) $\tan A$
(ii) $\cos B$.



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

- (i) $\tan A = \frac{4}{3}$
(ii) $\cos B = \frac{4}{5}$

Blunders (-3)

- B1 Uses incorrect numerator or denominator each time
B2 Inversion of fraction

Slips (-1)

- S1 Calculates the angle approximately $A = 53^\circ$ or $B = 37^\circ$
S2 Answer not in fraction form

Attempts (4, 4 marks)

- A1 Defines *tan* or *cos* and stops

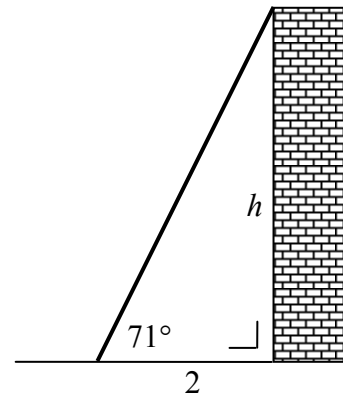
Part (b)

10 marks

Att 4

- (b) A ladder leans against the top of a wall.
The ladder makes an angle of 71° with the ground.
The foot of the ladder is 2 m from the base of the wall.

Find the height, h , of the wall.
Give your answer correct to one decimal place.



Part (b)

10 marks

Att 4

$$\tan 71 = \frac{h}{2} \Rightarrow h = 2 \times \tan 71 = 5.808 \approx 5.8 \text{ m}$$

Blunders (-3)

- B1 Incorrect trigonometric ratio
- B2 Error in balancing equation

Slips (-1)

- S1 Numerical errors to a maximum of 3
- S2 Fails to round off
- S3 Wrong mode

Attempts (4 marks)

- A1 Measures from diagram
- A2 Evaluates $\sin 71^\circ$, $\cos 71^\circ$ or $\tan 71^\circ$ and stops

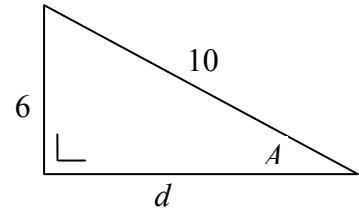
Wrong mode
Rad: $h = -6.155 \approx -6.2$
Grad: $h = 4.08 \approx 4.1$

Part (c)

20 (10, 10) marks

Att (4, 4)

- (c) (i) Find the length of the side d in the diagram.
- (ii) Find the measure of the angle A .
Give your answer to the nearest degree.



(c) (i)

10 marks

Att 4

(c) (ii)

10 marks

Att 4

(i) $6^2 + d^2 = 10^2 \Rightarrow 36 + d^2 = 100 \Rightarrow d^2 = 64 \Rightarrow d = 8$

(ii) $\sin A = \frac{6}{10} = 0.6 \Rightarrow A = 36.8^\circ \approx 37^\circ$

Blunders (-3)

- B1 Any error in Pythagoras
B2 Incorrect trigonometric ratio
B3 Error in balancing equation

Wrong mode
Rad: $x = 0.64 \approx 1$
Grad: $x = 40.9 \approx 41$

Slips (-1)

- S1 Fails to round off
S2 Wrong mode

Attempts (4, 4 marks)

- A1 Measures from diagram

Part (c)

20 (5, 5, 5, 5) marks

Att (2, 2, 2, 2)

- (c) In a class of 80 students, each student studies one language. The information is given in the table below.

	French	Spanish	German
Boys	12	20	5
Girls	16	24	3

A student is chosen at random. Find the probability that

- (i) the student is a boy
- (ii) the student studies French
- (iii) the student is a girl studying Spanish
- (iv) the student does not study German.

(c)

20 (5, 5, 5, 5) marks

Att (2, 2, 2, 2)

- (i) $\frac{37}{80}$
- (ii) $\frac{28}{80}$
- (iii) $\frac{24}{80}$
- (iv) $\frac{72}{80}$

Blunders (-3)

- B1 Incorrect n(S) apply once only
- B2 Incorrect n(E)
- B3 Inverted fraction
- B4 No division

Slips (-1)

- S1 Numerical errors to a maximum of 3

Attempts (2, 2, 2, 2 marks)

- A1 Incorrect answer of some merit

Ans:(i) 37 (ii) 28 (iii) 24 (iv) 72
merits 17 marks

or
Ans:(i) $\frac{1}{37}$ (ii) $\frac{1}{28}$ (iii) $\frac{1}{24}$ (iv) $\frac{1}{72}$
merits 17 marks

QUESTION 7

Part (a)	10 marks	Att 4
Part (b)	25 (5, 10, 5, 5) marks	Att (2, 4, 2, 2)
Part (c)	15 marks	Att 6

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

- (a) The mean of the five numbers
1, 5, x, 8, 9
 is 6. Find the value of x .

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

$$\frac{1 + 5 + x + 8 + 9}{5} = 6 \Rightarrow 23 + x = 30 \Rightarrow x = 7$$

Blunders (-3)

- B1 Error in forming equation
 B2 Error in balancing equation

Slips (-1)

- S1 Numerical errors to a maximum of 3

Attempts (4 marks)

- A1 Incorrect answer of some merit

Part (b) **25 (5, 10, 5, 5) marks** **Att (2, 4, 2, 2)**

- (b) A survey of the time spent by 50 teenagers on their mobile phones over a certain weekend gave the following information:



Number of minutes	0 – 10	10 – 20	20 – 30	30 – 40	40 – 60
Number of teenagers	7	8	22	10	3

Note: 10 – 20 means 10 minutes or more but less than 20 minutes.

- (i) Copy and complete the cumulative frequency table:

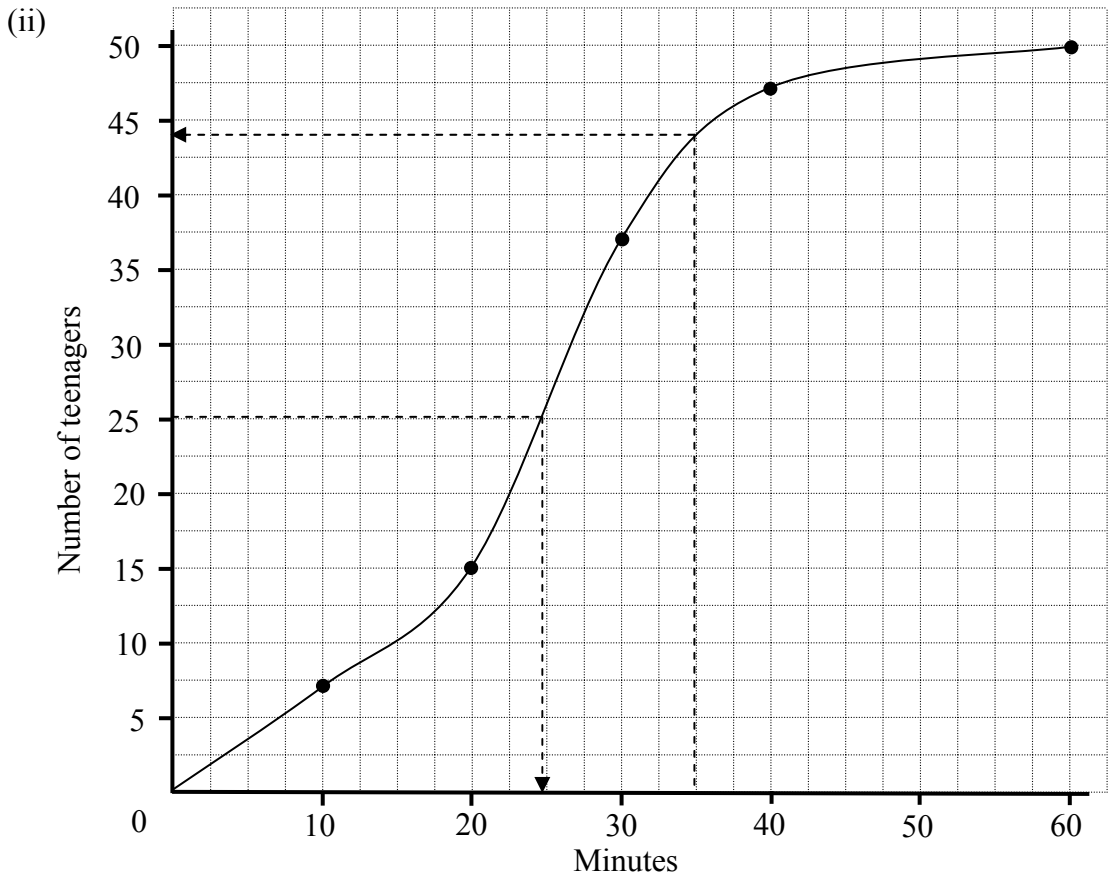
Number of minutes	< 10	< 20	< 30	< 40	< 60
Number of teenagers					

- (ii) Draw the cumulative frequency curve.
 Use your cumulative frequency curve to estimate
 (iii) the median number of minutes spent on the phone
 (iv) the number of teenagers who spent more than 35 minutes on the phone.

- (b) (i) 5 marks Att 2
 (b) (ii) 10 marks Att 4
 (b) (iii) 5 marks Att 2
 (b) (iv) 5 marks Att 2

(i)

Number of minutes	< 10	< 20	< 30	< 40	< 60
Number of teenagers	7	15	37	47	50



- (iii) Median = 25 minutes
 (iv) Number of teenagers = $50 - 44 = 6$

Blunders (-3)

- B1 Plots on the midpoints
- B2 Error in scales, one blunder
- B3 Points not joined
- B4 Uses wrong axis for median

Slips (-1)

- S1 Each incorrect or omitted value in the table
- S2 Each incorrectly plotted point
- S3 Joins points with straight lines
- S4 Median not specified
- S5 Fails to subtract reading in (iv)

Attempts (2, 4, 2, 2 marks)

- A1 Incorrect answer of some merit

Part (c)

15 marks

Att 6

(c) Find the standard deviation of the numbers
5, 7, 8, 12,
correct to two decimal places.

(c)

15 marks

Att 6

$$\text{Mean} = \frac{\sum x}{n} = \frac{5+7+8+12}{4} = \frac{32}{4} = 8$$

$$\begin{aligned} \text{Standard Deviation} &= \sqrt{\frac{\sum d^2}{n}} \\ &= \sqrt{\frac{(5-8)^2 + (7-8)^2 + (8-8)^2 + (12-8)^2}{4}} \\ &= \sqrt{\frac{9+1+0+16}{4}} = \sqrt{\frac{26}{4}} = 2.549 \approx 2.55 \end{aligned}$$

Blunders (-3)

B1 Incorrect substitution

Slips (-1)

S1 Numerical errors to a maximum of 3

Attempts (6 marks)

A1 Any addition

A2 Work on SD or defines SD

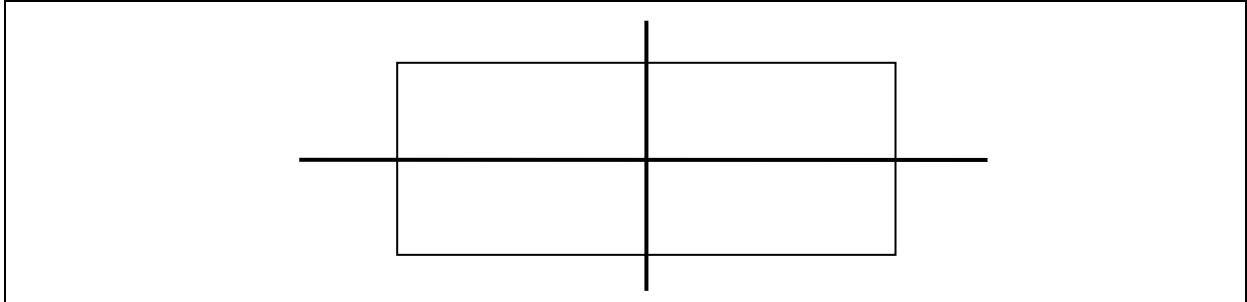
QUESTION 8

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

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

- (a) (i)** Draw a rectangle in your answer book.
(ii) Draw the two axes of symmetry of the rectangle.

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



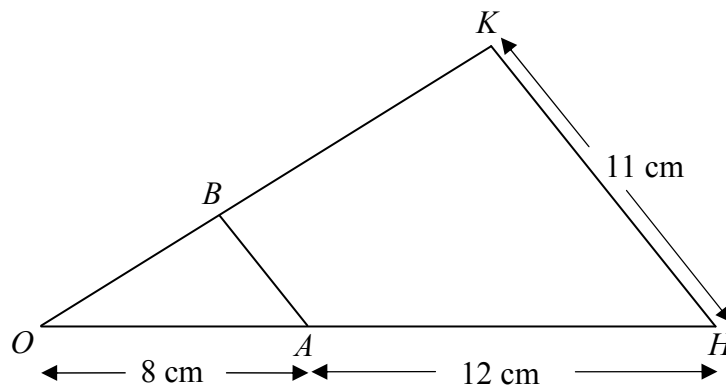
Blunders (-3)

- B1 Each omitted side
- B2 Incorrect angle
- B3 Opposite sides not equal

Slips (-1)

- S1 Each incorrect or omitted symmetry

(b)



The triangle OHK is the image of the triangle OAB under an enlargement of centre O .
 $|OA| = 8$ cm, $|AH| = 12$ cm and $|HK| = 11$ cm.

- (i) Find the scale factor of the enlargement.
 (ii) Find $|AB|$.
 (iii) The area of the triangle OAB is 18 cm².
 Find the area of the triangle OHK .

(b) (i)

10 marks

Att 4

(b) (ii)

5 marks

Att 2

(b) (iii)

5 marks

Att 2

$$(i) \text{ Scale factor} = \frac{|OH|}{|OA|} = \frac{8+12}{8} = 2.5$$

$$(ii) |AB| = \frac{|KH|}{2.5} = \frac{11}{2.5} = 4.4 \text{ cm}$$

$$(iii) \text{ Area } \Delta OHK = 18 \times 2.5^2 = 112.5 \text{ cm}^2$$

Blunders (-3)

- B1 Incorrect scale factor
 B2 Error in area formula
 B3 Does not square scale factor
 B4 No division

Misreadings(-1)

- M1 Treats OAB as the image triangle

Slips (-1)

- S1 Numerical errors to a maximum of 3

Attempts (4, 2, 2 marks)

- A1 Incorrect answer of some merit

Part (c)

20 (5, 15) marks

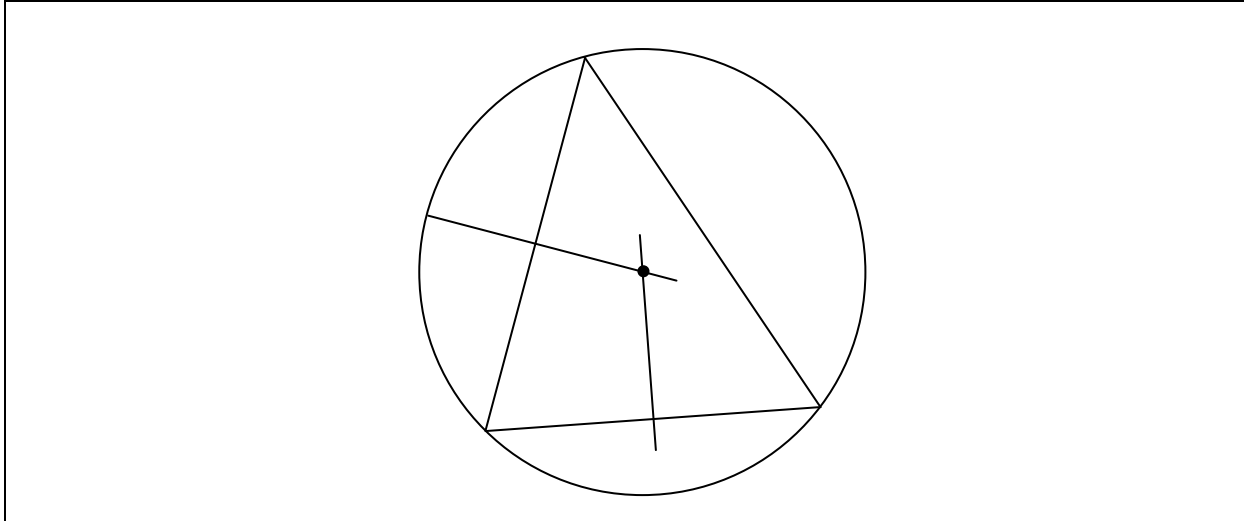
Att (2, 6)

- | | |
|----------|--|
| (c) (i) | Draw any triangle in your answer book. |
| (c) (ii) | Construct the circumscribed circle of this triangle. |

(c) (i)
(c) (ii)

5 marks
15 marks

Att 2
Att 6



Blunders (-3)

- B1 Each omitted side
- B2 Each bisector omitted
- B3 Draws bisectors only
- B4 Draws the incircle

Slips (-1)

- S1 Each vertex not on circle

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. $198 \text{ marc} \times 5\% = 9.9 \Rightarrow \text{bónas} = 9 \text{ marc}$.

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

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

