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MARKING SCHEME

LEAVING CERTIFICATE EXAMINATION 2006

MATHEMATICS – FOUNDATION LEVEL – 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.

NOTES ON APPLYING THE SCHEME, A.T.B.L. MATHEMATICS PAPER 1.

Question 1

- Computational decimal error: Blunder (–3).
- Misplacement of decimal point when a number is being transferred onwards in a question. [Transfer decimal error]: Slip (–1).
- Arithmetic slips (–1), if calculation by hand is shown, to a maximum of (–3) in each operation.
- Incorrect or omitted rounding off: Blunder (–3).
- Misreading refers to a misreading of the question that does not oversimplify the problem. The misreading must be clear and obvious.
- Incorrect or omitted units (except monetary units): Slip (–1) per question.

All Other Questions (except Q.3)

- Computational decimal error: Slip (–1).
- Misplacement of decimal point when a number is being transferred onwards in a question. [Transfer decimal error]: Slip (–1)
- Arithmetic slips (–1), if calculation by hand is shown, to a maximum of (–3) in each operation.
- Incorrect or omitted rounding off: Slip (–1)
- Misreading refers to a misreading of the question that does not oversimplify the problem. The misreading must be clear and obvious.
- Incorrect or omitted units (except monetary units): Slip (–1) per question.
- If a worthless answer in one part of a question is used in another part of that question, then that part's mark is the attempt mark at most.

Note: Specified instances cited within the scheme take precedence over the above notes: e.g. taking $\sqrt{63}$ as $\sqrt{6 \cdot 3}$ is treated as a Blunder (–3), not as a misreading (–1), within the scheme.

QUESTION 1

Each part **10 marks** **Att 4**

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

(i) Find $\sqrt{63}$, correct to two decimal places.

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

(i) $\sqrt{63} = 7 \cdot 9372 \ldots = \mathbf{7 \cdot 94}$

* Accept correct answer with no work.

Blunders (-3)

B1 Incorrect or omitted rounding-off.

B2 $\sqrt{6 \cdot 3} = [2 \cdot 509 \ldots] = 2 \cdot 51$.

B3 $\sqrt{\cdot 63} = [0 \cdot 793 \ldots] = 0 \cdot 79$.

Misreadings (-1)

M1 Find $\sqrt{36} = 6$. [+ B1]

Attempts (4 marks)

A1 $63^2 = 3969$.

A2 $\frac{63}{2} = 31 \cdot 5$.

A3 Work at estimating answer: $\sqrt{63} = 7$ or $\sqrt{63} = 8$.

A4 Rounds off an incorrect figure correctly.

A5 Any other answers without work, containing 2509…or 251…, 793…or 79..

Worthless (0 marks)

W1 Incorrect answers with no work, other than those in scheme.

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

(ii) Find the exact value of $(13{\cdot}2 - 4{\cdot}8)^2$.

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

(ii) $(13{\cdot}2 - 4{\cdot}8)^2 = (8{\cdot}4)^2 =$ **70·56**

* Accept correct answer with no work.

Blunders (-3)

B1 $(13\cdot 2)^2 - (4\cdot 8)^2 = 174\cdot 24 - 23\cdot 04 = 151\cdot 2$.

B2 Power $(\in N)$ greater than 2, indicated and correctly worked.

B3 Uses a wrong operator $(+, \times, \div)$ giving answers (324, 4014·4896, 7·5625),
Other wise attempt mark if some work of merit is shown.

Misreadings (-1)

M1 Finds $(84)^2 = 7056$ *or* $(0{\cdot}84)^2 = 0{\cdot}7056$.

Attempts (4 marks)

A1 $8\cdot 4 \times 2 = 16\cdot 8$.

A2 $\sqrt{8\cdot 4} = 2\cdot 89827.....$ rounded/not rounded off.

A3 $8\cdot 4 \times 10^2 = 840$.

A4 Work at estimation e.g. 64.

A5 Stops at $8\cdot 4$ or $(8\cdot 4)^2$.

Worthless (0 marks)

W1 Incorrect answers with no work, other than those in scheme.

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

(iii)	Find $(1{\cdot}75)^4$, correct to one decimal place.

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

(iii)	$(1\cdot 75)^4 = 9\cdot 37890625 = 9\cdot 4$

* Accept correct answer with no work.

Blunders (-3)

B1 Incorrect or omitted rounding-off.

B2 Power $(\in N)$ greater than 1 (other than 4) indicated and correctly worked.

Misreadings (-1)

M1 Finds $(1{\cdot}57)^4 = [6{\cdot}07573\ \ldots] = 6{\cdot}1$ or $(17{\cdot}5)^4 = [93789{\cdot}0625] = 93789{\cdot}1$.

Attempts (4 marks)

A1 $1\cdot 75\times 4 = 7$.

A2 $\sqrt[4]{1\cdot 75} = 1\cdot 15016...$ rounded/not rounded off.

A3 $1{\cdot}75 \times 10^4 = 1750$.

A4 Work at estimation e.g. 16.

Worthless (0 marks)

W1 Incorrect answers with no work, other than those in scheme.

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

(iv) Find the exact value of $\frac{7}{0{\cdot}4} - \frac{3}{0{\cdot}25}$.

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

(iv) $17{\cdot}5 - 12 = 5{\cdot}5$

or $\frac{1\cdot 75 - 1\cdot 2}{0\cdot 4 \times 0\cdot 25} = \frac{0\cdot 55}{0\cdot 1} = 5\cdot 5$.

* Accept correct answer with no work.

Blunders (-3)

B1 Commutative error: Ans. = –5 ·5.

B2 Error in calculating fraction (each time if different error) e.g. $\frac{3}{0\cdot 25} = 0\cdot 083333....$

B3 No subtraction.

B4 Adds (Ans 29·5).

Attempts (4 marks)

A1 Works towards estimate.

A2 1 correct step eg $\frac{7}{0\cdot 4} = 17\cdot 5$ or $= \frac{70}{4}$.

A3 Gets common denominator: $0\cdot 4 \times 0\cdot 25$ and stops.

A4 Correctly evaluates an incorrect fraction e.g. $\frac{7}{0\cdot 5} = 14$ and stops.

Worthless (0 marks)

W1 Subtracts numerators or denominators or similar e.g. $\frac{4}{0\cdot 15}$ and stops

W2 Incorrect answers with no work, other than those in scheme.

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

(v) Find $12\cdot5\%$ of $€25\cdot79$, correct to the nearest cent.

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

(v) $\dfrac{25\cdot79\times12\cdot5}{100}=3\cdot22375=$ **€3·22** $\quad 25\cdot79\times0\cdot125=3\cdot22375=$ **€3·22**

* Accept correct answer with no work.

* An answer of 206·32 is found from $25\cdot79\div12\cdot5$ followed by use of the percentage key $\Rightarrow$ 7 mks.

* An answer of 2·0632 is found from $25\cdot79\div12\cdot5$ followed by use of the percentage key and then the "=" key $\Rightarrow$ 3 mks.

* An answer of 322·375 is found from $25\cdot79\times12\cdot5$ followed by use of the percentage key and then the "=" key $\Rightarrow$ 7 mks. [See B1]

Blunders (-3)

B1 Incorrect or omitted rounding off.

B2 $25\cdot79\times1\cdot125=29\cdot01375=29\cdot01$.

B3 $25\cdot79\times0\cdot875=22\cdot56625=22\cdot57$.

B4 $\dfrac{25\cdot79\times12\cdot5}{100}$ or $25\cdot79\times0\cdot125$ and stops. [+B1]

Attempts (4 marks)

A1 $\dfrac{25\cdot79}{12\cdot5}$, $\dfrac{12\cdot5}{25\cdot79}$ or $\dfrac{25\cdot79}{100}$ or similar.

A2 $\dfrac{12\cdot5}{100}$ or $0\cdot125$ written and stops.

A3 Gets 1% (= 0·2579) and stops.

Worthless (0 marks)

W1 $25\cdot79\pm12\cdot5$.

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

(vi) Find the value of 525 Polish zloty in euro, given that €1 is worth 4·2 Polish zloty.

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

(vi) $\frac{525}{4 \cdot 2} =$ **€125.**

* Accept correct answer with no work.

Blunders (-3)

B1 $525 \times 4 \cdot 2 = 2205$.

B2 $\frac{4 \cdot 2}{525} = 0 \cdot 008$.

B3 Division not finished or finished incorrectly.

Attempts (4 marks)

A1 $\frac{1}{4 \cdot 2}$ or $\frac{1}{4 \cdot 2} = 0 \cdot 238 \ldots$

A2 $\frac{1}{525}$ or $\frac{1}{525} = 0 \cdot 0019 \ldots$

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

(vii) Express $2\frac{3}{5}-\frac{5}{7}$, as a decimal, correct to two decimal places.

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

(vii) $2\cdot 6-0\cdot 71428...=1\cdot 8857...=1\cdot 89$

$$\frac{13}{5}-\frac{5}{7}=\frac{91-25}{35}=\frac{66}{35}=1\frac{31}{35}=1\cdot 8857...=1\cdot 89.$$

*Accept correct answer with no work.

Blunders (-3)

B1 Incorrect or no rounding off.
B2 Error(s) in converting fraction to decimal. (Once only).
B3 No subtraction.
B4 Uses wrong operator (×, ÷, +) giving answers (1·857/1·86, 3·64/3·64, 3·314/3·31).

Attempts (4 marks)

A1 Effort at converting either of the given fractions to a decimal.
A2 Converts a fraction (written) to a decimal correctly eg $2\frac{1}{3}=2\cdot 3333\ldots.$
A3 A correct calculation.
A4 1 < Ans.< 2 (in either decimal or fraction form). [See B4]

Worthless (0 marks)

W1 Incorrect answer with no work shown, other than those in scheme.
W2 Subtracts numerators and /or denominators or similar.

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

(viii) The cost of a CD player is €125. A student is given a €15 reduction on the price. Express this reduction as a percentage of the cost.

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

(viii) $\frac{15}{125} \times 100 = 12\%$

* Accept correct answer with no work.

Blunders (-3)

B1 $\frac{125}{15} = 8 \cdot 333333...$ and continues.

B2 Omits multiplication by 100.

B3 $\frac{15}{100} \times 125 = 18 \cdot 75\%$.

B4 $\frac{110}{125} \times 100$ and continues.

Attempts (4 marks)

A1 $\frac{15}{125}$ or $\frac{125}{15}$ and stops.

A2 $\frac{110}{125}$ or $\frac{125}{110}$ and stops.

Worthless (0 marks)

W1 Incorrect answer with no work shown, other than those in scheme.

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

(ix) Find the exact value of

$$\frac{88{\cdot}8\times10^{4}+1{\cdot}47\times10^{5}}{2{\cdot}3\times10^{3}}$$

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

(ix) $\dfrac{103\cdot5\times10^{4}}{2\cdot3\times10^{3}}=45\times10=450$ or $\dfrac{888000+147000}{2300}=\dfrac{1035000}{2300}=450$

* Accept correct answer with no work.

Blunders (-3)

B1 Error in precedence.
B2 Each omitted or incorrect step if slips not clear.
B3 Misplaced decimal or wrong order of magnitude each time.
B4 Inverts fraction 0·002222 …

Attempts (4 marks)

A1 $10^4 = 40$ and/or $10^5 = 50$ and/or $10^3 = 30$ used.
A2 Some work towards approximation.
A3 One or more powers cancelled correctly and stops.
A4 One or more power expanded correctly e.g. 10 ×10 ×10 ×10 ×10.

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

(x) Find, correct to two significant figures, the value of

$$\frac{19{\cdot}5 \times 7{\cdot}64}{8{\cdot}26 - 3{\cdot}24}$$

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

(x) $$\frac{148 \cdot 98}{5 \cdot 02} = 29 \cdot 67729 = 30$$

*Accept correct answer with no work.

Blunders (-3)

B1 Incorrect or no rounding off to significant figures.
B2 Error in precedence.
B3 Decimal error.
B4 Each omitted step e.g. $\frac{148 \cdot 98}{5 \cdot 02}$ and stops.[+B1]
B5 Inverted fraction: 0·0336… = 0·03.

Slips (-1)

S1 Numerical errors.

Misreadings (-1)

M1 Clear and obvious misreading.

Attempts (4 marks)

A1 Any correct step e.g. 8·26 – 3·24 = 5·02.
A2 Some work towards estimating answer.

QUESTION 2

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

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

(a) A metal bar is cut into two pieces. One piece is 1·35 metres and the other is 85 centimetres.
How long was the bar before it was cut?

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

(a) 1·35 + 0·85 = 2·20 m 135 + 85 = 220 cm.

* Accept correct answer with no work.

Blunders (-3)

B1 Adds without conversion. [+S1]
B2 1·35 ÷100 or 85 ×100 and continues.
B3 No addition and stops.
B4 Subtracts lengths (0·5 m or 50 cm). [+S1]

Slips (-1)

S1 Incorrect or omitted units.
S2 Incorrect conversion factor.

Attempts (4 marks)

A1 Indication of addition (1·35 + 85) and stops.
A2 135 or 0·85 and stops.

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

(b) Ciara is paid €11·50 per hour. She works a 38 hour week.
(i) Find her gross income for the week.
(ii) Ciara's weekly tax credit is €62 and her tax rate is 20%.
Find the amount of tax payable by Ciara.
(iii) What is Ciara's weekly take home pay?

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

(b)(i) $11{\cdot}50 \times 38 = €437$

* Accept correct answer without work.

Slips(-1)
S1 Decimal error.
S2 Arithmetic errors.

Attempts (2 marks)
A1 Some use of the given data.

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

(b)(ii) $437 \times 0.2 = 87{\cdot}4$ $87{\cdot}4 - 62 =$ **€25·4**

* Accept correct answer without work.
* 411·6 only as the answer all parts $\Rightarrow$ 14 marks (2 × B (-3)).
* 437 and 411·6 as the answers all parts $\Rightarrow$ 17 (5 +12) marks (B (-3)).
* $437 + 62 - 87 \cdot 4 = 411{\cdot}6$ as the answers all parts $\Rightarrow$ 17 (5 +7 +5) marks (B (-3)).

Blunders (-3)
B1 Error in calculating % e.g. 437 ×1·20
B2 Adds tax credit to gross tax. (149·4).

Slips (-1)
S1 Decimal error.

Attempts (4 marks)
A1 Any mishandling or ignoring of the Tax Credit other than B2.
A2 Some effort at getting %.

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

(b)(iii) $437 - 25{\cdot}4 =$ **€411·6**

* Accept candidates figures from **(i)** and **(ii)**
* Accept correct answer without work.

Blunders (-3)
B1 Uses wrong Gross wage e.g. 87·4 –25·4.
B2 Uses a Tax other than that calculated in **b (ii)** above.
B3 Adds Tax.
B4 Subtraction not completed.

Attempts (2 marks)
A1 437 – a spurious number.

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

(c) The distance from Dublin to Galway is 220 km. A bus travels from Dublin to Galway, stopping in Athlone. The average speed of the bus from Dublin to Athlone is 65 km/h. It reaches Athlone in two hours, then completes the journey to Galway.

(i) What is the distance from Dublin to Athlone?

(ii) What is the distance from Athlone to Galway?

(iii) If the bus travels from Athlone to Galway at an average speed of 60 km/h, how long will this part of the journey take? Give your answer in hours and minutes.

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

(c) (i)	$65 \times 2 = 130\,\text{km}$

* Accept correct answer with no work.

Blunders (-3)

B1 Incorrect formula giving $\frac{65}{2} = 32 \cdot 5.$

Slips (-1)

S1 Incorrect or omitted units.

Attempts (2 marks)

A1 Some use of the given data e.g. 65×1 or 65.

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

(c)(ii)	220 –130 = 90 km

* Accept correct answer with no work. * Accept candidate's answer from part **(i)**.

Blunders (-3)

B1 220 + 130 and continues.

Slips (-1)

S1 Incorrect or omitted units.

S2 Arithmetic errors.

Attempt (2 marks)

A1 Some use of the given data.

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

(c)(iii)	$\frac{90}{60} = 1 \cdot 5$ h = 1h 30 m

* Accept correct answer with no work. * Accept candidate's answer from part **(ii)**.

Blunders (-3)

B1 Incorrect formula giving 90×60 or $\frac{60}{90}$ and continues.

Slips (-1)

S1 Incorrect or omitted units.

S2 Incorrect conversion or no conversion to hours and minutes.

S3 Arithmetic errors.

Attempt (4 marks)

A1 Some use of the given data.

A2 1 hour < answer < 2 hours.

QUESTION 3

Part (a)	**10 (5, 5)marks**	**-**
Part (b)	**20 (10, 10) marks**	**-**
Part (c)	**20 (5, 5, 10) marks**	**-**

Note: The marking of Question 3 is not based on slips, blunders and attempts. In the case of each part, descriptions or typical examples of work meriting particular numbers of marks are described. The mark awarded must be one of the marks indicated. For example, in part **(a)(ii),** descriptions are given for work meriting 0, 3 or 5 marks. It is therefore not permissible to award 1, 2 or 4 marks for this part.

Part (a) **10 (5, 5) marks** **-**

(a) Emer estimated that she had 90 cent in small coins. In fact, she had 87 cent.
(i) Find the error in her estimate.
(ii) Find the percentage error, correct to two decimal places.

(a)(i) **5 marks**

(i) Error = 90 – 87 = 3 cent.

5 marks: 90 – 87 or 3.
0 marks: Otherwise.

(a)(ii) **5 marks**

(ii) Percentage error $= \frac{3}{87} \times 100 = 3 \cdot 448.. = 3{\cdot}45\%.$

5 marks: 3·45.
Accept correct answer without work.

3 marks: Correct expression, unfinished or finished incorrectly e.g. $\frac{3 \times 100}{87}$ and stops.
Incorrect expression, finished correctly.
Incorrect or omitted rounding off e.g. 3·44 or 3·448

0 marks: Otherwise.

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

(b) Martin and Siobhán shared a prize of €168. Martin received €72 and Siobhan received €96.

(i) Express the ratio of Martin's share to Siobhán's share in its simplest form.

(ii) If Martin's share were increased by €12, how much would Siobhán receive?
Express Siobhán's new share as a fraction of €168 in its simplest form.

(b)(i) **10 marks**

(b) (i) Martin : Siobhán = 72 : 96 = 3 : 4.

10 marks: $3 : 4$ or $\frac{3}{4}$ or $3\ \ 4$

7 marks: The given ratio is correct but is not in its simplest form.
The given ratio is reversed, simplified or not.

4 marks: 72:168 or 96:168, simplified or not.

0 marks: Otherwise.

(b)(ii) Siobhán's share **5 marks**
…as fraction **5 marks**

(b)(ii) Martin = 72 + 12 = €84 $\Rightarrow$ Siobhán = 96 – 12 = €84.

Siobhán's share as fraction of €168: $\frac{84}{168} = \frac{1}{2}$.

Siobhán's new share
5 marks: 96 – 12 or 84.

3 marks: Martin's share explicitly stated.
Interpretation of an increase of 12 to Martin as an increase of 16 to Siobhán.
0 marks: Otherwise.

Siobhán's share as fraction of 168.
* Accept candidate's answer for Siobhán's new share.
5 marks: $\frac{1}{2}$.
3 marks: The correct fraction but not in its simplest form.
$\frac{16}{168}$ or $\frac{12}{168}$ simplified or not.
2 only.
0 marks: Otherwise.

Part (c) **20 (5, 5, 10) marks**

(c) €6250 was invested for three years at a fixed rate of compound interest. At the end of the first year it was worth €6500.

(i) How much interest did it earn in the first year?

(ii) What was the annual rate of interest?

(iii) How much will the investment be worth at the end of the three years? Give your answer correct to the nearest euro.

(c)(i) **5 marks**

(c)(i) $6500 - 6250 = €250$.

5 marks: $6500 - 6250$ or 250.

0 marks: Otherwise.

(c)(ii) **5 marks**

(c)(ii) $\frac{250}{6250} \times 100 = 4\%$.

5 marks: 4%. Accept correct answer without work.

3 marks: Correct expression, unfinished or finished incorrectly e.g. $\frac{250}{6250} \times 100$.

Incorrect expression, finished correctly.

0 marks: Otherwise.

(c)(iii) **10 marks**

(c) (iii) $A = 6250(1 + 0 \cdot 04)^3 = 6250(1 \cdot 04)^3 = 6250(1 \cdot 124864) = 7030 \cdot 4 = €7030$

or End 1st yr: 6500 $\Rightarrow$ End 2nd yr: $6500 \times 1 \cdot 04 = €6760$

$\Rightarrow$ End 3rd yr: $6760 \times 1 \cdot 04 = 7030 \cdot 4 = €7030$

* Accept candidate's answer from **(c)(i)**.

10 marks: Fully correct solution.

9 marks: Fails to round an otherwise correct solution.

7 marks: Correct method but error in completing e.g. calculation error.
Expression finished correctly but number of years out by one.
Correct answer without work.

4 marks 7000 without work [Simple Interest]
Any other work of merit.

0 marks Otherwise.

QUESTION 4

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

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

(a) Solve $4x - 12 = 3 - x$

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

(a) $4x + x = 3 + 12 \Rightarrow 5x = 15 \Rightarrow x = 3$

* Award full marks for a correct answer by T + E with verification.

Blunders (-3)

B1 Blunders in grouping terms e.g. $4x - 12 = -8x$. (Each time).
B2 Transposition error(s). (Once only).
B3 Each step omitted.
B4 $x = 3$ without work.

Attempts (4 marks)

A1 Some correct work.
A2 Effort at T+E by substitution.

Worthless (0 marks)

W1 incorrect answer without work.

Part (b) **20 (15, 5) marks** **Att (6, 2)**

(b) Solve the simultaneous equations

$$x + 5y = 26$$

$$3x - y = 14$$

First variable found **15 marks** **Att 6**
Second variable **5 marks** **Att 2**

(b)

$$\begin{array}{rl} x + 5y = 26 & 6 + 5y = 26 \\ \underline{15x - 5y = 70} & 5y = 20 \\ 16x \quad = 96 & \Rightarrow y = 4 \\ \Rightarrow x = 6 & \end{array}$$

* Random x picked, y calculated (or vice-versa) – award 5 marks.
* Substitution of correct values in both equations and verification shown – Award 20 marks.

Blunders(-3)
B1 Error(s) in establishing the first equation in terms of x only [$16x = 96$] or the first equation terms of y only [$16y = 64$].
B2 Blunder in substitution e.g. y value for x.
B3 Transposition error(s). (Once only).

*Attempts -First variable- (**6** marks).*
A1 Effort at equalising coefficients of x's or y's.
A2 Effort at cancelling one variable or combining variables.
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 or second effort at combining variables.

*Attempts (**8** marks).*
A6 Attempt at finding a solution by T + E.
A7 Correct answers with no work shown.
A8 Any correct work, even in the context of an approach of no merit (Att6 or Att6 + Att2).

Worthless (0 marks)
W1 Incorrect answer(s), no work shown.

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

(c) Aoife and John are the same age as each other and Frank is 2 years older than them. Let Aoife's age be x years.

(i) Write an expression for Frank's age in terms of x.

(ii) Write an expression in x for the sum of their three ages.

(iii) In four years time the sum of their ages will be 65. What age is John now?

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

(c) (i) $x+2$

Blunders (-3)

B1 $2x,\ x^2$.

Slips (-1)

S1 $x-2$.

Attempts (2 marks)

A1 Assigns a numerical value to x that is then used to find a numerical value for Frank's age.

Worthless (0 marks)

W1 $\frac{x}{2}, \frac{2}{x}, 2-x.$

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

(c) (ii) $(x)+(x)+(x+2)=3x+2.$

* Accept candidate's answer from **(c)(i)**.

Blunders(-3)

B1 Each one of three terms omitted.

B2 each incorrect extra term.

B3 $x(x)(x+2)$.

Attempts (4 marks)

A1 $3x$.

A2 $5x$ or $6x$.

A3 $x^3+2,\ 2x^3$.

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

(c) (iii) $(x+4)+(x+4)+(x+2+4)=3x+14=65 \Rightarrow x=17$

*Accept answer from candidate's work in (c)(i) and (c)(ii).

*Accept correct answer 17 without work.

Blunders(-3)

B1 A term omitted.

B2 Each incorrect extra term.

B3 Error(s) in solving the equation.

Attempts (2 marks)

A1 Some effort at 4 years time.

A2 Effort at T+E.

A3 Some use of 65.

QUESTION 5

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

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

(a) (i) Write down the whole number factors of 36.

(ii) Write down the factors of 36 that are multiples of 6.

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

(i) 1, 2, 3, 4, 6, 9, 12, 18, 36.

(ii) 6, 12, 18, 36.

Slips (-1)
S1 Each omitted or incorrect entry, provided at least one is correct. (to a max of –3)

Attempts (2 marks)
A1 At least one correct entry, each part.
A2 Defines multiple of 6 in **(ii)**.

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

(b) (i) Solve the quadratic equation $x^2 + 6x + 5 = 0$.

(ii) Solve the quadratic equation $x^2 + 4x - 1 = 0.$, correct to two decimal places.

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

(i) $x^2 + 6x + 5 = 0.$ => $(x + 5)(x + 1) = 0$ => $x = -5$ and $x = -1.$

Blunders(-3)
B1 Last step omitted.
B2 Sign error(s) in factors (Once only).
B3 Sign error(s) in solution (Once only)).
B4 Incorrect factors and continues.
B5 Errors in using formula as in **(ii)**.

*** without work**

2 correct answers, both verified:	full marks
2 correct answer and one verified:	1 × B (-3)
2 correct answers, neither verified:	Att 4 marks
1correct answer, and verified:	Att 4 marks
1 correct answer but not verified:	0 marks

Attempts(4 marks)
A1 Effort at finding factors.
A2 Attempt at T + E.

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

(ii) $x^2 + 4x - 1 = 0 \Rightarrow x = \dfrac{-(4) \pm \sqrt{(4)^2 - 4(1)(-1)}}{2(1)} \Rightarrow \dfrac{-4 \pm \sqrt{16+4}}{2} \Rightarrow \dfrac{-4 \pm \sqrt{20}}{2}$ *

$$\Rightarrow x = \frac{-4 \pm 4 \cdot 472..}{2} = 0 \cdot 236... or -4 \cdot 236... \Rightarrow x = 0 \cdot 24 \quad or \quad x = -4 \cdot 24.$$

* Maximum deductions beyond this point is 3 marks.

Blunders (-3)

B1 Incorrect choice of constants (*a, b, c*) applied once (consistent error).
B2 Incorrect substitution into formula, subject to S2 below.
B3 Blunder in application of formula.
B4 Omits ± in formula.

Slips(-1)

S1 Slips in signs on substitution into formula.
S2 Sign of coefficient incorrectly extracted, prior to substitution. (Applied each time).
S3 16 + 4 = 12.
S4 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)(x) or guide no. = –1.
A4 No quadratic: e.g. $x + 4x - 1 = 0$ and continues with some correct work.
A5 Appearance of the variable in the answer.

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

(c) To calculate the time required to roast a chicken the recommendation is:
"45 minutes per kilogram of weight, plus 20 minutes extra".
When x is the weight in kilograms, this rule can be written as:
Roasting time (in minutes) = $45x + 20$.

(i) How long will it take to roast a 2·2 kg chicken?
Give your answer in hours and minutes.

(ii) If it takes an hour and twenty minutes to roast a particular chicken, calculate.
the weight of the chicken.

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

(i) $45(2 \cdot 2) + 20 = 99 + 20 = 119$ minutes = 1 hour 59 minutes.

Blunders (-3)
B1 45(2·2) + 45(20) = 99 + 900 = 999 minutes. (16 hr 39 min.)
B2 45(2·2) + 20(2·2) = [65(2·2)] = 99 + 44 = 143 minutes. (2hr 23 min.)
B3 45(2·2) = 99 minutes only. (1 hr 39 min.)
B4 2 kg instead of 2·2 kg.
B5 45 and 20 reversed: 20(2·2) + 45 = 89 minutes (1 hr 29 min.)

Slips (-1)
S1 Incorrect or omitted units.
S2 Not in hours and minutes.

Attempts (4 marks)
A1 45(2·2) and stops.
A2 $45x + 20 = 2 \cdot 2$ stops or continues.

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

(ii) $45x + 20 = 80 \Rightarrow 45x = 60 \Rightarrow x = 1\frac{1}{3}$ kg or $80 - 20 = 60 \Rightarrow \frac{60}{45} = \frac{4}{3} = 1\frac{1}{3}$ kg.

* Accept correct worked solution, even if the variable x is not used.

Blunders (-3)
B1 No subtraction of 20 from 80 $\Rightarrow \frac{80}{45} = \frac{16}{9} = 1 \cdot 777 \ldots$
B2 1 hour 20 minutes as 1·20 hours, or 120 min.
B3 Errors in solving $45x + 20 = 80$ as **Q.4 (a)**.

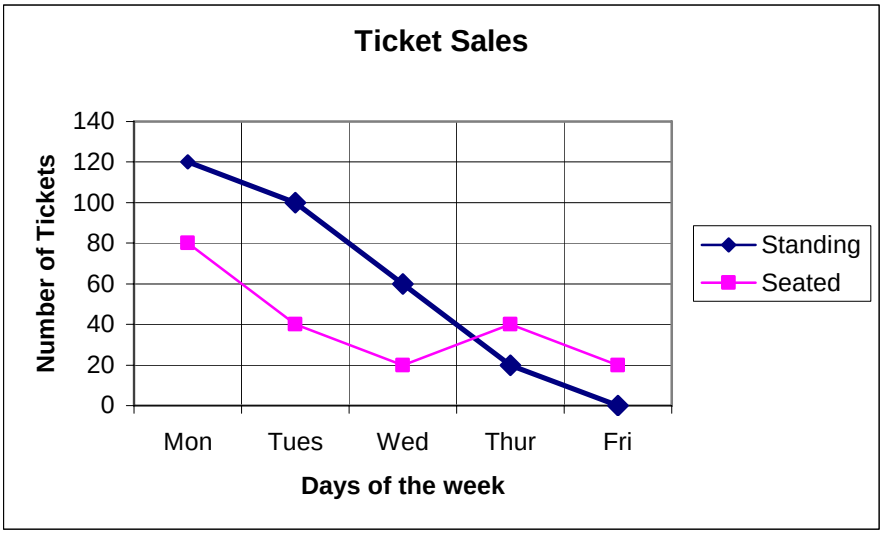
Slips (-1)
S1 Incorrect or omitted units.

Attempts (4 marks)
A1 Effort at solving equation by T + E.
A2 $45(80) + 20$ stops or continues.
A3 1< Ans. < 2 without work.

QUESTION 6

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

6. A music store sold tickets for a concert. Tickets were of two types: *seated* and *standing*.
All the store's allocation of tickets were sold over 5 days.
The graph below shows the breakdown of sales.
For example, on Tuesday the store sold 40 *seated* and 100 *standing* tickets.



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

(i) How many *seated* tickets were sold on Wednesday?

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

(i) **20**

Blunders (-3)
B1 Wednesday's Standing tickets given (60).
B2 Wednesday's total sales given as **20** + 60 or **20** + 60 = 80.

Attempts (4marks)
A1 80 or 40 given.

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

(ii) Find the total number of tickets sold on Monday.

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

(ii) $120 + 80 = \mathbf{200}$.

* Accept correct answer without work.

Blunders (-3)

B1 Addition indicated but not done.

B2 Subtracts [120– 80] or 40.

Attempts (4marks)

A1 120 or 80 given.

A2 Totals for other days given.

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

(iii) What percentage of all the tickets sold were *seated* tickets?

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

(iii) Seated tickets = 80 + 40 + 20 + 40 + 20 = 200

Total tickets = 200 +(120 + 100 + 60 + 20 + 0) = 200 + 300 = 500

$$\%: \frac{200}{500} \times 100 = 40\%$$

Blunders (-3)

B1 Incorrect number of seated tickets.

B2 Incorrect total number of tickets.

B3 Omits or mishandles % calculation.

B4 Correct answer without work.

Slips (–1)

S1 Clear and obvious arithmetic error.

Attempts (4 marks)

A1 Finds 200 and stops.

A2 Finds 300 and stops.

A3 Finds 500 and stops.

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

(iv) On what day was the last *standing* ticket sold?

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

(iv) Thursday

Blunders (-3)

B1 Uses last Seated ticket giving Friday as answer.

Worthless (0 marks)

W1 *Other incorrect answer.*

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

(v) *Standing* tickets cost €35, and there is a booking charge of €5 added to the price. Express the booking charge as a percentage of the price the customer pays.

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

(v) 35 + 5 = 40 (paid by customer)

%: $\frac{5}{40} \times 100 = 12 \cdot 5\%$

* Accept correct answer without work.

Blunders (-3)

B1 $\frac{5}{35} \times 100 = 14 \cdot 2857..\%$.

B2 5 used as denominator.

B3 100 omitted or incorrectly used.

B4 Calculation not performed.

B5 $\frac{35}{40} \times 100 = 87 \cdot 5.$

Attempts (4 marks)

A1 Finds 40 and stops.

QUESTION 7

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

Table / evaluation	**20 marks**	**Att 8**
Graph	**10 marks**	**Att 4**

Draw the graph of the function

$$f : x \to 3x^2 + 6x - 5 \text{ for } -3 \le x \le 1,\ x \in \mathbf{R}.$$

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

x	**-3**	**-2**	**-1**	**0**	**1**
$3x^2$	27	12	3	0	3
$+6x$	-18	-12	-6	0	6
-5	-5	-5	-5	-5	-5
$f(x)$	**4**	**–5**	**–8**	**–5**	**4**

* 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 such as $3x^2 = (3x)^2$, or $-5 = 5x$ or x-5. Otherwise slips applied.

Misreadings (-1)

M1 $+ 6x$ treated as $- 6x$ across the line.

M2 -5 treated as 5 across the line.

Slips (-1)

S1 Each incorrect or omitted value in body of table.

S2 Each incorrect or omitted y / $f(x)$ value, calculated from candidate's work.

Attempt (8 marks)

A1 Any four correct calculated values in the table.

A2 Function treated as linear e.g. $3x^2 = 6x$.

OR

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

$f(-3) = 3(-3)^2 + 6(-3) - 5 = 27 - 18 - 5 = 4$

$f(-2) = 3(-2)^2 + 6(-2) - 5 = 12 - 12 - 5 = -5$

$f(-1) = 3(-3)^2 + 6(-1) - 5 = 3 - 6 - 5 = -8$

$f(0) = 3(0)^2 + 6(0) - 5 = 0 - 0 - 5 = -5$

$f(1) = 3(1)^2 + 6(1) - 5 = 3 + 6 - 5 = 4$

Blunders (-3)

B1 Consistent errors in the evaluation of $3x^2$ or $6x$.

B2 -5 omitted from the evaluation.

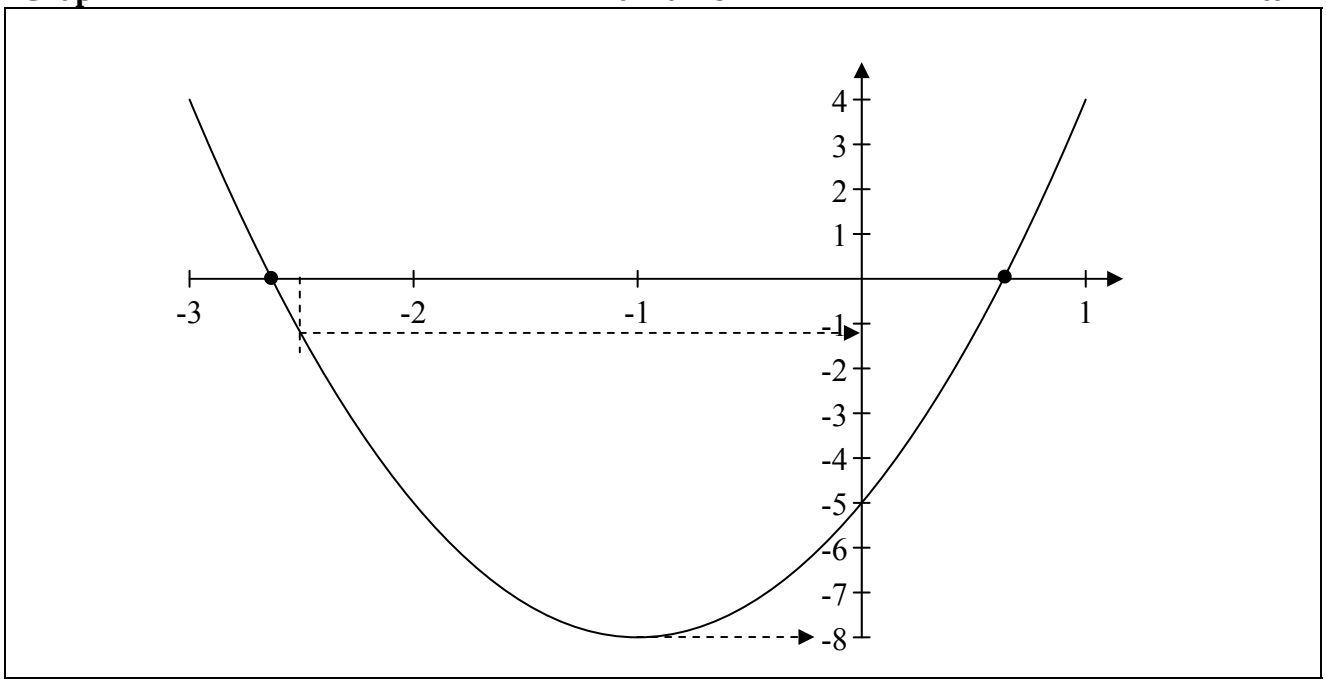
B3 Each incorrect $f(x)$ value when no work is shown to a max of $3(-3)$ provided that at least one $f(x)$ value is correct . All $f(x)$ values incorrect $\Rightarrow$ 0 marks. Otherwise slips applied.

Misreadings (-1)
M1 + 6x consistently treated as – 6x in the evaluation.
M2 – 5 consistently treated as 5 in the evaluation.

Slips (-1)
S1 Each incorrect or omitted value from the evaluation after substitution
S2 Each incorrect or omitted $f(x)$ value, calculated from candidate's work.

Attempt (8 marks)
A1 Any four correct calculated values in the function evaluation.
A2 Function treated as linear e.g. $3x^2 = 6x$.

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



* Accept values from candidate's table.
* Fully correct graph drawn with no work shown: Award 30 marks.

Blunders (-3)
B1 Points joined in incorrect order.
B2 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 maximum –3.
S3 Not a smooth curve.
S4 The graph of the function is not in the conventional position or orientation.

Attempts (4marks)
A1 At least two of candidate's points plotted.
A2 Any ∪ -shaped graph.
A3 Axes Drawn.

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

Use your graph to estimate

(i) the minimum value of $f(x)$

(ii) the value of $f(-2{\cdot}5)$

(iii) the roots of $f(x)=0$

(iv) the range of values of x for which $f(x)$ is increasing.

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

(i) -8
(ii) $-1{\cdot}25$
(iii) $0{\cdot}6$ and $-2{\cdot}6$
(iv) $-1 < x \leq 1$

* Accept candidate's values from graph.
* Allow tolerance ± 0.2 units on x-axis, ± 0.5 units on y-axis.

Blunders (-3)
B1 Each value outside tolerance.
B2 Value omitted, or extra value. Applies in parts **(iii)** and **(iv)**.
B3 Uses $f(x) = -2{\cdot}5$ in part **(ii)**.

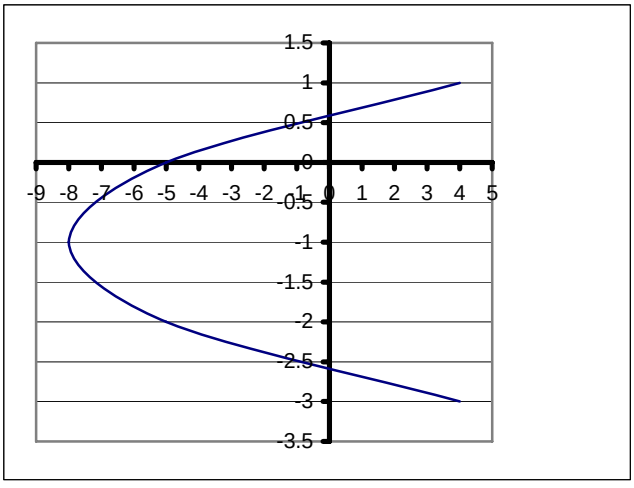
Misreading (-1)
M1 Gives the value of x corresponding to the minimum of $f(x)$ in part **(i)**.

Slips(-1)
S1 Answers indicated correctly on axes, but not specified.

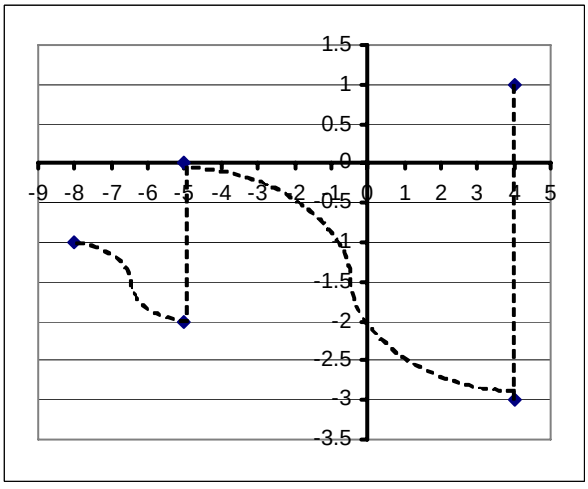
Attempt(2 marks)
A1 Effort at reading value(s) from graph.
A2 Correctly solving equation algebraically: part **(iii)**.
A3 Calculating $f(-2{\cdot}5)$: part **(ii)**.

Note these cases:

Graph: S4(–1) only.



Graph: S4 (–1) +B1(–3)



MARKING SCHEME

LEAVING CERTIFICATE EXAMINATION 2006

MATHEMATICS – FOUNDATION LEVEL – PAPER 2

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. 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

Part (a)	**10 (5, 5) marks**	**Att (2, 2)**
Part (b)	**40 marks**	**Att 16**

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

(a) A rectangle is twice as long as it is wide. The width of the rectangle is 6 cm.
(i) Find the length of the rectangle.
(ii) Find the area of the rectangle.

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

(i) Length = 6 x 2 cm = 12 cm

(ii) Area = 12 x 6 cm^2 = 72 cm^2

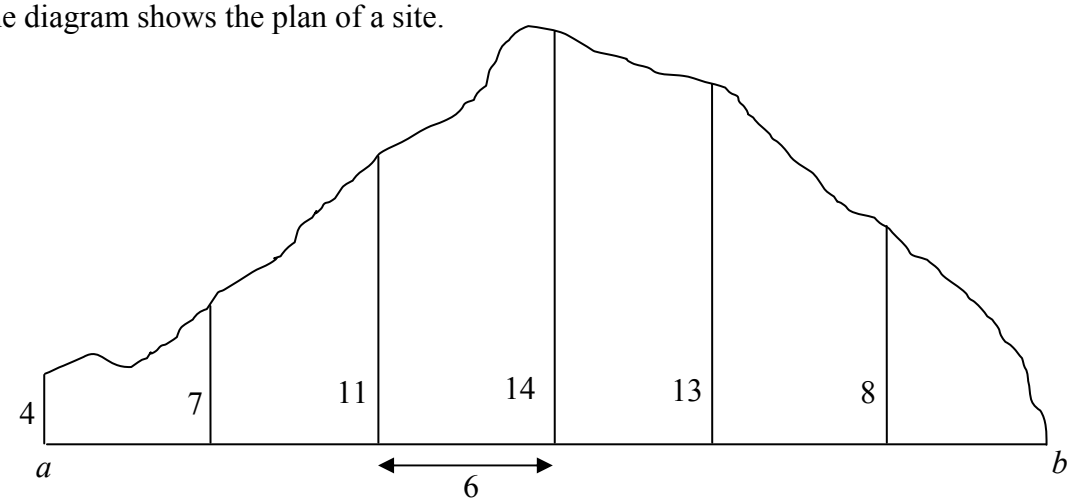
Blunders (-3)
B1 Incorrect length
B2 Incorrect substitution.

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

Attempts (2, 2)
A1 Defines length or area.
A2 Calculates perimeter.

Part(b) **40 marks** **Att 16**

(b) The diagram shows the plan of a site.



Offsets of lengths 4, 7, 11, 14, 13 and 8 metres are measured at intervals of 6 metres along [*ab*] as shown. Calculate the area of the site using Simpson's rule.

(b) **40 marks** **Att 16**

$$Area = \frac{1}{3} width\left[First + last + 2(odd) + 4(even)\right]$$

$$Area = \frac{6}{3}\left[4 + 0 + 2(11 + 13) + 4(7 + 14 + 8)\right]$$

$$Area = 2\left[4 + 2(24) + 4(29)\right] = 2\left[4 + 48 + 116\right] = 2(168)$$

$$Area = 336m^2$$

Blunders (-3)

B1 Uses four odd and twice even e.g. 2(29) + 4(24) = 58 + 96

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.

Slips (-1)

S1 Each incorrect or omitted altitude

S2 Numerical errors to a max of 3.

Attempts (16)

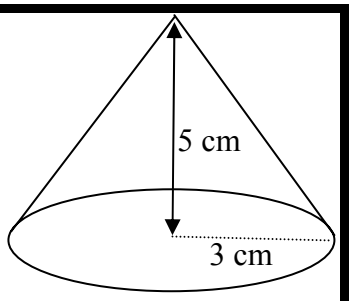
A1 Gives Simpson's Formula only.

QUESTION 2

Part (a)	**20 marks**	**Att 8**
Part (b)	**30 (10, 10, 10) marks**	**Att (4, 4, 4)**

Part(a) **20 marks** **Att 8**

(a) The diagram shows a cone.
The radius is 3 cm.
The height is 5 cm.
Calculate the volume of the cone,
correct to the nearest whole number.
Take $\pi = 3{\cdot}14$.



(a) **20 marks** **Att 8**

$$Volume = \frac{\pi r^2 h}{3} = \frac{3.14 \times 3^2 \times 5}{3} = 47.1 cm^3 \approx 47 cm^3$$

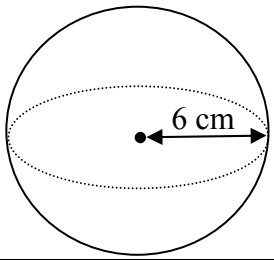
Blunders (-3)
B1 Incorrect substitution.

Slips (-1)
S1 Numerical errors to a max of 3
S2 Error in rounding
S3 Uses $\pi = \frac{22}{7}$ or leaves in terms of π.

Attempts (8)
A1 Correct formula without substitution.

Part(b) **30 (10, 10, 10) marks** **Att (4, 4, 4)**

(b) **(i)** A sphere has a radius of 6 cm.
Calculate the volume of the sphere
in terms of π.



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

$$Volume = \frac{4\pi r^3}{3} = \frac{4 \times \pi \times 6^3}{3} = 288\pi\, cm^3$$

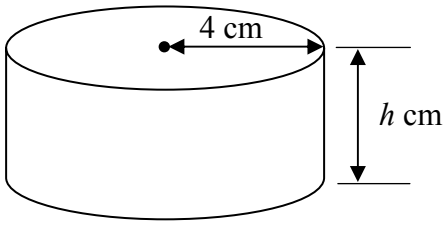
Blunders (-3)
B1 Incorrect substitution.

Slips (-1)
S1 Numerical errors to a max of 3
S2 Omits π or gives answer as 904.7 or 904.32.

Attempts (4)
A1 Correct formula without substitution.

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

(ii) The radius of a cylinder is 4 cm and its height is h cm.
Calculate the volume of the cylinder in terms of h and π.



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

$$Volume = \pi r^2 h = \pi \times 4^2 \times h = 16\pi h \, cm^3$$

Blunders (-3)
B1 Incorrect substitution.

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

Attempts (4)
A1 Correct formula without substitution.

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

(iii) The volume of the cylinder in part **(ii)** is half the volume of the sphere in part **(i)**.
Calculate h, the vertical height of the cylinder.

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

$$16\pi h = 144\pi$$

$$\Rightarrow h = \frac{144\pi}{16\pi} = 9$$

Blunders (-3)
B1 Incorrect volume of cylinder
B2 Error in balancing equation.

Slips (-1)
S2 Numerical errors to a max of 3.

Attempts (4)
A1 Correct formula without substitution
A2 Correct volume of cylinder and stops.

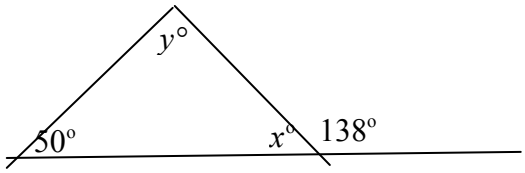
QUESTION 3

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

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

(a) The diagram shows a triangle.

Find the value of x and the value of y.



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

Ans : $x = 42^\circ, y = 88^\circ$

Blunders (-3)

B1 Sum of internal angles $\neq 180^\circ$

B2 Straight angle $\neq 180^\circ$.

Slips (-1)

S1 Numerical errors to a max of 3.

Attempts (2, 2)

A1 Incorrect answer of some merit.

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

(b) The lines K and L are parallel.

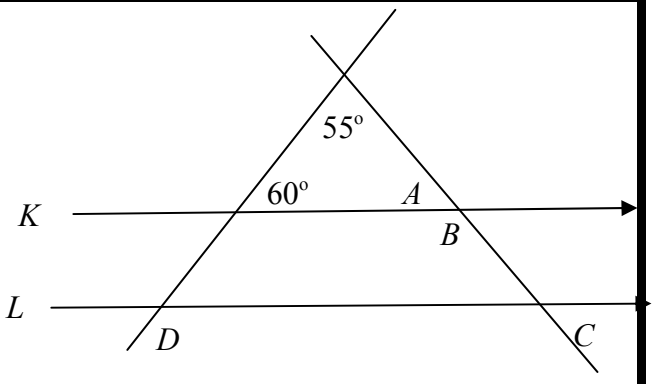
Find

(i) the measure of the angle A

(ii) the measure of the angle B

(iii) the measure of the angle C

(iv) the measure of the angle D.



Each part **5 marks** **Att 2**

Ans: (i) $A = 65^\circ$ (ii) $B = 115^\circ$ (iii) $C = 65^\circ$ (iv) $D = 120^\circ$

Blunders (-3)

B1 Sum of internal angles $\neq 180^\circ$

B2 Straight angle $\neq 180^\circ$.

Slips(-1)

S1 Numerical errors to a max of 3.

Attempts (2, 2, 2, 2)

A2 Incorrect answer of some merit.

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

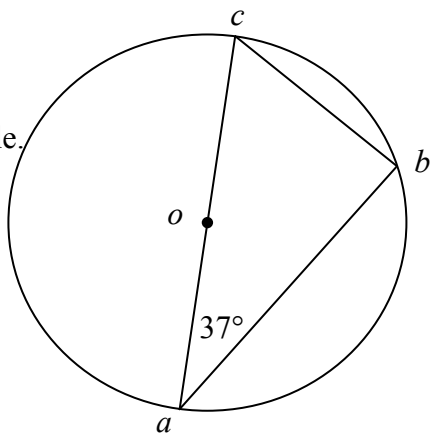
(c) The diagram shows a circle with centre o.
$|ac| = 10$ cm.

(i) Write down the length of the radius of the circle.

(ii) Write down the measure of the angle $\angle abc$.

(iii) Write down the measure of the angle $\angle acb$.

(iv) $|bc| = 6$ cm. Calculate $|ab|$.



Each part **5 marks** **Att 2**

Ans: (i) r = 5cm (ii) $|\angle abc| = 90^\circ$ (iii) $|\angle acb| = 53^\circ$ (iv) $|ab| = 8$ cm

Blunders (-3)

B1 $r \neq 5cm$

B2 $|\angle abc| \neq 90^\circ$

B3 Any error in Pythagoras.

Slips (-1)

S1 Numerical errors to a max of 3.

Attempts (2, 2, 2, 2)

A1 Incorrect answer of some merit.

QUESTION 4

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

(a) $p(3,\ -1)$ and $q(7,\ 2)$ are two points.
Find the length of [*pq*].

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

(a) $Length = \sqrt{(7-3)^2 + (2+1)^2} = \sqrt{(4)^2 + (3)^2} = \sqrt{25}$ or 5

Blunders (-3)
B1 No square root
B2 Incorrect substitution once only.

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

Attempts(4)
A1 Draws axes.

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

(b) *a* is the point $(1,\ -3)$ and *b* is the point $(-1,\ 5)$.
(i) Find the co-ordinates of the midpoint of [*ab*].
(ii) Find the slope of the line *ab*.
(iii) Find the equation of the line *ab*.

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

(i) $Midpo\text{int} = \left(\frac{1-1}{2}, \frac{-3+5}{2}\right) = \left(\frac{0}{2}, \frac{2}{2}\right)$ or (0,1)

(ii) $Slope = \frac{5+3}{-1-1} = \frac{8}{-2}$ or -4

(iii) $y-(-3) = -4(x-1)$ or $4x + y - 1 = 0$

Blunders (-3)
B1 Omits 2 in midpoint formula
B2 Incorrect substitution once only.

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

Attempts(4, 2, 2)
A1 Draws axes.

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

(c) The line K has equation $y = -2x + 7$.

The point c has co-ordinates $(5, -3)$.

(i) Show that the point c lies on the line K.

(ii) Write down the slope of K.

(iii) Find the equation of the line M, which passes through the point $(-1, 4)$ and is perpendicular to K.

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

(i) $y = -2x + 7 \Rightarrow -3 = -2(5) + 7 \Rightarrow -3 = -3$

(ii) -2

(iii) $y - 4 = \frac{1}{2}(x + 1)$ or $x - 2y + 9 = 0$

Blunders (-3)

B1 In (ii) gives slope as $2, \pm 1, \pm 7, \pm\frac{1}{2}, \pm\frac{7}{2}, \pm\frac{2}{7}$

B2 Incorrect substitution once only.

Slips (-1)

S1 Numerical errors to a max of 3.

Attempts (4, 2, 2)

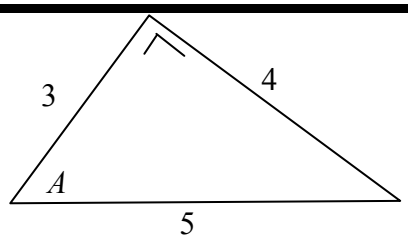
A1 Draws axes.

QUESTION 5

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

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 and an angle named A.



(i) Write down $\sin A$ as a fraction.

(ii) Write down $\cos A$ as a fraction.

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

$$\sin A = \frac{4}{5} \qquad \cos A = \frac{3}{5}$$

Blunders (-3)

B1 Uses incorrect numerator or denominator each time, unless error is consistent.

Slips (-1)

S1 Calculates the angle approx 53^0

S2 Answer not in fraction form.

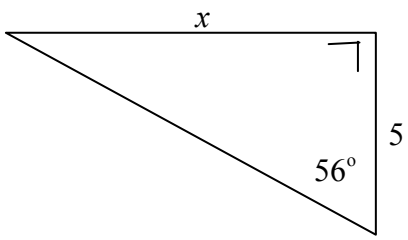
Attempts(4, 4)

A1 Defines *cos* or *sin.*

Note: $\sin A = \frac{3}{5}$ *and* $\cos A = \frac{4}{5}$ merits 19 marks.

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

(b) Calculate the value of x in the diagram.
Give your answer correct to one decimal place.



(b) **15 marks** **Att 6**

$$\tan 56^\circ = \frac{x}{5} \quad \Rightarrow \quad x = 5\tan 56^\circ \quad \Rightarrow \quad x = 7.412 \approx 7.4$$

Blunders (-3)

B1 Incorrect trig ratio

B2 Error in balancing equation.

Slips (-1)

S1 Fails to round off

S2 Wrong mode.

Wrong mode:
Rad: $x = -3.056 \approx -3.1$
Grad: $x = 6.043 \approx 6.0$

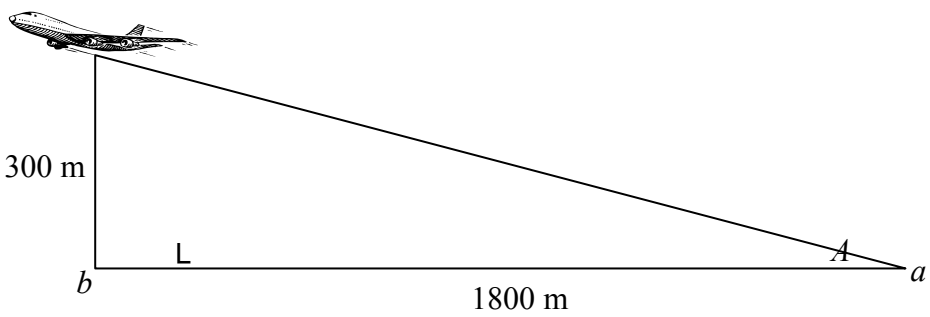
Attempts (6)

A1 Measures from diagram.

A2 Evaluates $\sin 56^\circ$, $\cos 56^\circ$ *or* $\tan 56^\circ$.

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

(c)



An aeroplane takes off at a point *a*.
At another point *b*, which is 1800 m from *a*, the plane is 300 m above the ground, as shown.
Calculate the measure of the angle *A*, correct to the nearest degree.

(c) **15 marks** **Att 6**

$$\tan A = \frac{300}{1800} \quad \Rightarrow \quad A = \tan^{-1}\left(\frac{300}{1800}\right) \quad \Rightarrow \quad A = 9.462^\circ \approx 9^\circ$$

Blunders (-3)
B1 Incorrect trig ratio
B2 Error in balancing equation.

Wrong mode
Rad: A = 0.16 ≈ 0
Grad: A = 10.5 ≈ 11

Slips (-1)
S1 Fails to round off
S2 Numerical errors to a max of 3
S3 Wrong mode.

Attempts (6)
A1 Measures from diagram.

QUESTION 6

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

6. (a) A pupil must choose one subject out of each of the following subject groups:

Language Group	*Business Group*	*Science Group*
French	Accounting	Physics
German	Economics	Chemistry
Spanish		Biology

How many different subject selections are possible?

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

Ans : $3 \times 2 \times 3$ *or* 18

Blunders (-3)
B1 3 + 2 + 3 = 8 or 8
B2 3! Etc
B3 3 by 3 +2 by 2 +3 by 3 or similar
B4 3 by 2 or 3 by 3.

Slips (-1)
S1 Numerical errors to a max of 3
S2 $4 \times 3 \times 4 = 48$ or 48.

Attempts (4)
A1 Answer = 11.

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

(b) John's pencil case contains four black pens, three blue pens, two red pens and one green pen. John takes one pen at random from the case.
Find the probability that it is
(i) a red pen
(ii) a blue pen
(iii) a black or a red pen
(iv) not a black pen.

Each Part **5 marks** **Att 2**

$Ans: (i)\frac{2}{10} \quad (ii)\frac{3}{10} \quad (iii)\frac{6}{10} \quad (iv)\frac{6}{10}$

Blunders(-3)
B1 Incorrect #(S) apply once only
B2 Incorrect #(E)
B3 Inverted fraction
B4 No division.

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

Attempts (2, 2, 2, 2)
A1 Any incorrect fraction less than 1.

Answers:(i) 2 (ii) 3 (iii) 6 (iv) 6 merits 17 marks

or

Answers:(i) $\frac{1}{2}$ (ii) $\frac{1}{3}$ (iii) $\frac{1}{6}$ (iv) $\frac{1}{6}$ merits 17 marks

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

(c) A girl tosses a coin and rolls a die and records the results as follows. She writes "H,3" if she gets a head on the coin and a 3 on the die.

(i) Write down all the possible outcomes.

(ii) Find the probability she gets a head and an even number.

(iii) Find the probability she gets a tail and a number less than 3.

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

Ans: $(i)\ H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6 \quad (ii)\ \frac{3}{12} \quad (iii)\ \frac{2}{12}$

Blunders (-3)

B1 Incorrect #(S) apply once only

B2 Incorrect #(E)

B3 Inverted fraction

B4 No division.

Slips (-1)

S1 Numerical errors to a max of 3.

Attempts (4, 2, 2)

A1 Any incorrect fraction less than 1

A2 HT or similar.

QUESTION 7

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

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

(a) Write down the median of the five numbers 4, 7, 10, 11, 13.

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

Median = 10

Blunders(-3)
B1 Median = 3.

Slips(-1)
S1 Calculates mean correctly.

Attempts(4)
A1 Gives number other than 10 from list.
A2 4 + 7 + 10 + 11 + 13 or 45 or 22.5.

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

(b) The following table is a record of the number of CDs owned by each of 80 students

Number of CDs	0 - 5	6 - 10	11 - 15	16 - 20	21 - 25
Number of students	11	15	28	20	6

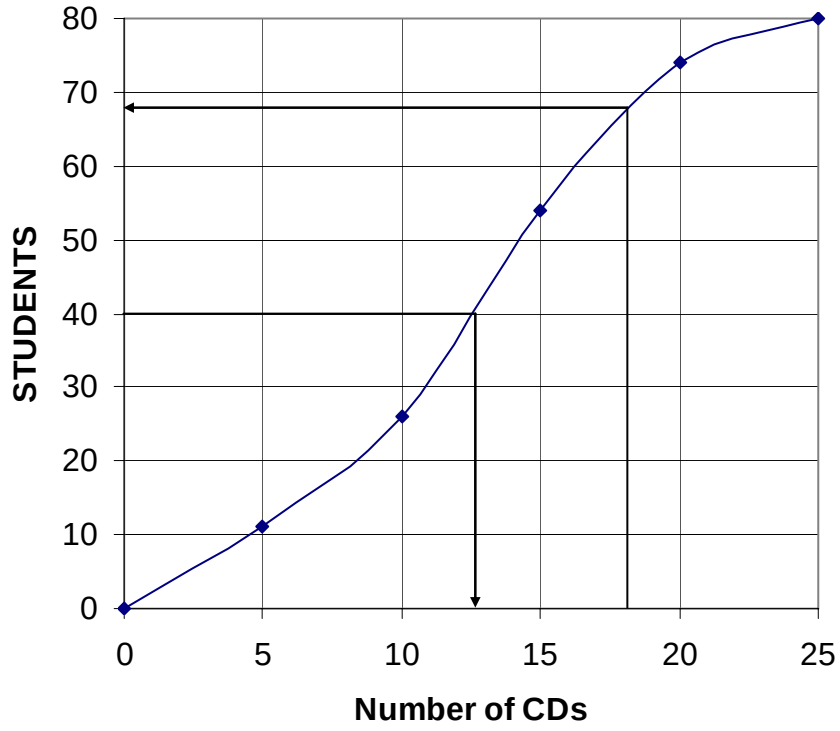
Copy and complete the cumulative frequency table below. Draw the cumulative frequency curve with the number of students on the vertical axis.

Number of CDs	≤ 5	≤ 10	≤ 15	≤ 20	≤ 25
Number of students					

Use your curve to estimate
(i) the median number of CDs owned by the students
(ii) the number of students who own less than 18 CDs.

Cumulative Table	**5 marks**	**Att 2**
Curve	**10 marks**	**Att 4**
(i)	**5 marks**	**Att 2**
(ii)	**5 marks**	**Att 2**

Number of CDs	≤ 5	≤ 10	≤ 15	≤ 20	≤ 25
Number of students	11	26	54	74	80



(i) Median = 12.5
(ii) 68

Tolerance of ± 2

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 Median not specified
S3 Each incorrectly plotted point
S4 Reverses axes
S5 Joins points with straight lines.

Attempts (2, 4, 2, 2)
A1 Draws axes only
A2 Copies table.

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

(c) **(i)** Find the mean of the numbers 7, 10, 13, 18.

(ii) Find the standard deviation of the numbers 7, 10, 13, 18, correct to two decimal places.

Mean **5 marks** **Att 2**
Standard Deviation **10 marks** **Att 4**

x	Mean	d	d^2
7	12	5	25
10	12	2	4
13	12	1	1
18	12	6	36
$\Sigma x = 48$			$\Sigma d^2 = 66$

$$\text{Mean} = \frac{\sum x}{n} = \frac{7+10+13+18}{4} = \frac{48}{4} \text{ or } 12$$

$$\text{Standard Deviation} = \sqrt{\frac{\sum d^2}{n}} = \sqrt{\frac{25+4+1+36}{4}} = \sqrt{\frac{66}{4}} = 4.062 \approx 4.06$$

Blunders (-3)
B1 7 + 10 + 13 + 18 or 48 and stops.

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

Attempts (2, 4)
A1 Any addition
A2 Work on SD table or defines SD.

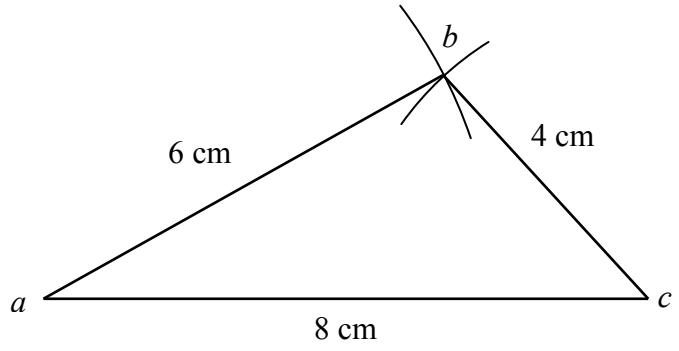
QUESTION 8

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

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

(a) Construct a triangle *abc* with $|ac| = 8$ cm, $|bc| = 4$ cm and $|ab| = 6$ cm.

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



Blunders(-3)
B1 Each omitted side.

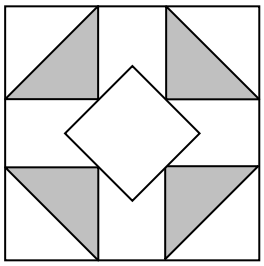
Slips (-1)
S1 Each side outside tolerance of ± 1 cm
S2 Units other than cm.

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

(b) The diagram shows a patterned square tile.

(i) How many axial symmetries does the tile have?

(ii) How many rotational symmetries does the tile have?



Each part **10 marks** **Att 4**

Ans:(i) 4 (ii) 4

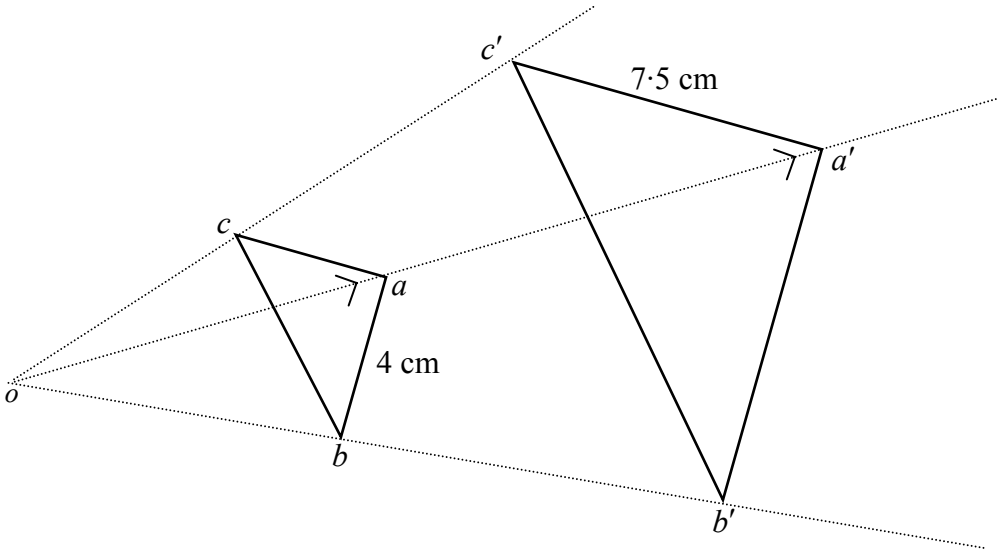
Do not penalise omission of identity (rotational symmetry through 0°).

Blunders(-3)
B1 Answer greater than 4

Slips (-1)
S1 Each symmetry omitted.

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

(c)



The right-angled triangle *a′b′c′* is the image of the right-angled triangle *abc* under an enlargement with centre *o*.
The scale factor is 2·5.

(i) Find the length of $[ac]$.

(ii) Find the length of $[a'b']$.

(iii) Find the area of the triangle *abc*.

(iv) Find the area of the triangle *a′b′c′*.

Each part **5 marks** **Att 2**

$(i)\ |ac| = \frac{7.5}{2.5} = 3cm$ $(ii)\ |a'b'| = 4 \times 2.5 = 10cm$

$(iii)\ Area\ abc = \frac{4 \times 3}{2} = 6cm^2$ $(iv)\ Area\ a'b'c' = 6 \times 2.5 \times 2.5\ or\ \frac{10 \times 7.5}{2} = 37.5cm^2$

Blunders(-3)
B1 Uses incorrect scale factor
B2 Does not square scale factor
B3 Error in area formula.

Slips (-1)
S1 Numerical errors to a max of 3
S2 Multiplication for division or vice versa.

Attempts (2, 2, 2, 2)
A1 Incorrect answer of some merit.

BONUS MARKS FOR ANSWERING THROUGH IRISH

Bonus marks are applied separately to each paper as follows:

If the mark achieved is less than 226, the bonus is 5% of the mark obtained, rounding *down*.
(e.g. 198 marks × 5% = 9.9 ⇒ bonus = 9 marks.)

If the mark awarded is 226 or above, the following table applies:

Marks obtained	Bonus
226 – 231	11
232 – 238	10
239 – 245	9
246 – 251	8
252 – 258	7
259 – 265	6
266 – 271	5
272 – 278	4
279 – 285	3
286 – 291	2
292 – 298	1
299 – 300	0