Leaving Certificate 2011

Marking Scheme

MATHEMATICS

Foundation Level
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<td>55</td>
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</table>
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

Part (i) 10 marks

Find \( \sqrt{132.9} \), correct to two decimal places.

(i) 10 marks

<table>
<thead>
<tr>
<th>Blunders (-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1  ( \sqrt{1329} = [36.455545...] = 36.46 )</td>
</tr>
<tr>
<td>B2  ( \sqrt{13.29} = [3.6455545...] = 3.65 )</td>
</tr>
<tr>
<td>B3  ( \sqrt{132.9} = [1.152822...] = 1.15 )</td>
</tr>
<tr>
<td>B4  ( \sqrt{0.1329} = [0.36455545...] = 0.36 )</td>
</tr>
<tr>
<td>B5  Root other than square root indicated and correctly worked ( \sqrt[3]{132.9} = 5.10 )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Slips (-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1 Incorrect or omitted rounding off</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Misreadings (-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1  ( \sqrt{123.9} = [11.131037...] = 11.13 )</td>
</tr>
<tr>
<td>M2  ( \sqrt{139.2} = [11.79830...] = 11.80 )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attempts (4 marks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1  ( (132.9)^2 = 17662.41 )</td>
</tr>
<tr>
<td>A2  ( \frac{132.9}{2} = 66.45 )</td>
</tr>
<tr>
<td>A3  ( (132.9) \times 2 = 265.8 )</td>
</tr>
<tr>
<td>A4  Work at estimating answer: ( \sqrt{132.9} = 11 ) or 12</td>
</tr>
<tr>
<td>A5  Any work at finding or estimating another root with work shown</td>
</tr>
<tr>
<td>A6  An incorrect figure correctly rounded off to two decimal places</td>
</tr>
<tr>
<td>A7  Any other answers as B1, B2, B3 and B4 but with misplaced point and no work shown</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Worthless (0 marks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1  Incorrect answer with no work other than those in scheme</td>
</tr>
</tbody>
</table>
Part (ii)  

Find the exact value of $14.32 - 2.6 \div 0.4$.

\[
\begin{array}{c|c|c|c}
\text{(ii)} & \text{10 marks} & \text{Att 4} \\
\hline
14.32 - 2.6 \div 0.4 &= 14.32 - 6.5 &= 7.82\\
* & \text{Accept correct answer with no work} & \\
* & \text{Accept $39\frac{1}{50}$ or $7\frac{41}{50}$ for full marks} & \\
\hline
\end{array}
\]

Blunders (-3)
B1 Errors in precedence: $14.32 - 2.6 = 11.72 \div 0.4 = 29.3$
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. $14 - 3 \div 1$
A2 Work towards some correct step e.g. long division begun
A3 29 only

Worthless (0 marks)
W1 Incorrect answer with no work other than those in scheme
Part (iii) 10 marks Att 4

Find \((4.2)^3 - (2.8)^2\), correct to one decimal place.

\[
(4.2)^3 - (2.8)^2 = 74.088 - 7.84 = 66.248 = 66.2
\]

* Accept correct answer with no work

Blunders (-3)
B1 \((4.2)^3 - (2.8)^2 = 74.088... - 784 = -709.912 = -710\)
B2 \((4.2)^3 - (2.8)^2 = 74088... - 7.84 = 74080.16 = 74080.2\)
B3 \((4.2)^3 - (0.28)^2 = 74.088... - 0.0784 = 74.0096 = 74.0\)
B4 Cube not found
B5 Square not found
B6 No subtraction

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

Misreadings (-1)
M1 \((4.2)^3 - (8.2)^2 = 74.088... - 67.24 = 6.848 = 6.8\)
M2 \((2.4)^3 - (2.8)^2 = 13.824... - 7.84 = 5.984 = 6.0\)

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 cube or square evaluated e.g. 4.2 – 2.8 = 1.4

Worthless (0 marks)
W1 Incorrect answer with no work other than those in scheme
A concert hall has 1200 seats.
For one concert 1050 seats were occupied.
What percentage of the seats were occupied?

\[
\frac{1050}{1200} \times 100 = 87.5\%
\]

* Accept correct answer with no work

**Blunders (-3)**

B1 \[\frac{1200 \times 100}{1050} = 114.28\]

B2 \[\frac{1050 \times 100}{1200} \text{ and stops}\]

B3 Errors in establishing \[\frac{1050 \times 100}{1200}\] (all three elements must be present, otherwise attempt marks only)

**Misreading (-1)**

M1 Finds percentage of seats unoccupied e.g. \[\frac{150 \times 100}{1200} = 12.5\]

**Attempts (4 marks)**

A1 Writes down \[\frac{1050}{1200}\] and stops

A2 Writes down \[1050 \times 100\] and stops

A3 \[1200 - 1050 = 150\] and stops

**Worthless (0 marks)**

W1 \[1200 + 1050 = 2250\]
Part (v) 10 marks Att 4

Find the value in euro of 600 South African rand given that €1 = 9.674 South African rand.

\[
\frac{600}{9.674} = €62.0219 = €62.02
\]

* Accept correct answer with no work
* Accept candidates degree of rounding
* 6202 cent – 9 marks

Blunders (-3)
B1 \(600 \times 9.674 = 5804.4\)
B2 \(\frac{9.674}{600} = 0.0161233\)
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
W2 600 ± 9.674 with or without an answer.
Find the number of seconds in 24 hours.

$$24 \times 60 \times 60 = 86400$$

* Accept correct answer with no work

**Blunders (-3)**
- B1: $24 \times 60 \times 60$ and stops
- B2: $24 \times 60 = 1440$ and stops
- B3: $60 \times 60 = 3600$ and stops
- B4: $24 \div 60 \div 60 = 0.0066$

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

**Attempts (4 marks)**
- A1: $24 \times 60$ and stops
- A2: $60 \times 60$ and stops
- A3: Writes 60 seconds = 1 minute and / or 60 minutes = 1 hour

**Worthless (0 marks)**
- W1: Incorrect answer with no work other than those in scheme
Part (vii) 10 marks Att 4

Find the exact value of \( \frac{1}{(0.5)^2} + \frac{1}{(0.25)^2} \).

\[
\frac{1}{(0.5)^2} + \frac{1}{(0.25)^2} = \frac{1}{0.25} + \frac{1}{0.0625} = 4 + 16 = 20
\]

* Accept correct answer with no work

Blunders (-3)

B1 \((0.5)^2 + (0.25)^2 = 0.25 + 0.0625 = 0.3125\)

B2 \(\frac{1}{(0.5)} + \frac{1}{(0.25)} = 2 + 4 = 6\)

B3 \(\frac{1}{(0.5)} + \frac{1}{(0.25)^2} = \frac{1}{0.25} + 4 = 4 + 4 = 8\)

B4 Use of wrong operator (−) giving the answer 12 or −12

Slips (-1)

S1 Numerical slips to a maximum of 3

Attempts (4 marks)

A1 Converts 0.5 to \(\frac{1}{2}\) or 0.25 to \(\frac{1}{4}\).

A2 \(0.5 + 0.25 = 0.75\) or \(\frac{3}{4}\)

A3 \((0.5)^2 = 0.25\) and / or \((0.25)^2 = 0.0625\)

Worthless (0 marks)

W1 Incorrect answer with no work other than those in scheme
Part (viii) 10 marks  

Write \( \frac{8}{11} - \frac{3}{7} \) as a decimal, correct to three decimal places.

\[
\begin{align*}
\frac{8}{11} - \frac{3}{7} &= 0.7272 - 0.4285 = 0.2987 = 0.299 \\
\frac{8}{11} - \frac{3}{7} &= \frac{56 - 33}{77} = \frac{23}{77} = 0.299
\end{align*}
\]

* 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 (\( \times, +, + \)) giving answers 0.3120, 1.697, 1.156

B4 \(\frac{8}{11} - \frac{3}{7} = 0.757\)

**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 (ix) 10 marks Att 4

Find \( \left( \frac{37.6 + 5.92}{0.85} \right)^2 \), correct to the nearest integer.

\[
\left( \frac{37.6 + 5.92}{0.85} \right)^2 = \left( \frac{43.52}{0.85} \right)^2 = 51.2^2 = 2621.44 = 2621
\]

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

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

Part (x) 10 marks Att 4

Find \( \frac{(3.68 \times 10^5) - (2.1 \times 10^4)}{3.8 \times 10^3} \), correct to three significant figures.

\[
\frac{(3.68 \times 10^5) - (2.1 \times 10^4)}{3.8 \times 10^3} = \frac{368000 - 21000}{3800} = \frac{347000}{3800} = 91.315 = 91.3
\]

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

Award marks as follows:
- 10 marks: Fully correct answer
- 4 marks: Answer of some merit
- 0 marks: Otherwise
**QUESTION 2**

<table>
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<tr>
<th>Part (a)</th>
<th>10 (5, 5) marks</th>
<th>Att (2, 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part (b)</td>
<td>20 (10, 5, 5) marks</td>
<td>Att (4, 2, 2)</td>
</tr>
<tr>
<td>Part (c)</td>
<td>20 (5, 5, 10) marks</td>
<td>Att (2, 2, -)</td>
</tr>
</tbody>
</table>

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

(a) (i) Change 6.3 kilometres to metres.
(ii) Change 8245 grams to kilograms.

<table>
<thead>
<tr>
<th>(a)</th>
<th>10 (5, 5) marks</th>
<th>Att (2, 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>(6.3 \times 1000 = 6300 \text{ metres})</td>
<td></td>
</tr>
<tr>
<td>(ii)</td>
<td>(\frac{8245}{1000} = 8.245 \text{ kilograms})</td>
<td></td>
</tr>
</tbody>
</table>

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

**Blunders (-3)**
- B1 Incorrect conversion factor
- B2 Misuse of conversion factor e.g. \(6.3 \div 1000 = 0.0063\)
- B3 Misuse of conversion factor e.g. \(8245 \times 1000 = 8245000\)

**Slips (-1)**
- S1 Numerical slips to a maximum of 3
- S2 Answer given as 8 kg 245 g

**Attempts (2 marks)**
- A1 Any use of given data (covers both parts)
- A2 6030 or 6003 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)

The following information was used to calculate the cost of electricity used by Emma.
- Previous meter reading: 72 010
- Present meter reading: 73 485
- Cost per unit: 15 cent.

(i) Calculate the number of units of electricity used between these two readings.
(ii) Calculate the cost of the units used.
(iii) A standing charge of €24·75 and VAT of €33·21 are added to the cost of the units. Find the total cost of Emma’s electricity bill.

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

| Units used 73 485 – 72 010 = 1475 units |

* Accept correct answer with no work

**Blunders (-3)**
- B1 Adds the two readings e.g. 145 495

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

**Attempts (4 marks)**
- A1 Gives 72 010 or 73 485 as answer

**Worthless (0 marks)**
- W1 Incorrect answer with no work other than those in scheme
(b) (ii) 5 marks Att 2

<table>
<thead>
<tr>
<th>Cost = $1475 \times 0.15 = \text{€221.25.}</th>
</tr>
</thead>
</table>

* Accept correct answer with no work
* Accept candidates answer from part (i)
* Accept answer in € or cents

**Blunders (-3)**
B1 \(1475 \div 15 = 98.333\)

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

**Attempts (2 marks)**
A1 Multiplies some random number by 15
A2 Some correct step

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

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(b) (iii) 5 marks Att 2

<table>
<thead>
<tr>
<th>Total cost = \text{€}221.25 + \text{€}24.75 + \text{€}33.21 = \text{€279.21.}</th>
</tr>
</thead>
</table>

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

**Blunders (-3)**
B1 Subtracts instead of adds
B2 Omits one of the three charges e.g. \(24.75 + 33.21 = 57.96\)

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

**Attempts (2 marks)**
A1 Writes down \(24.7 + 33.21\) and stops or similar
A2 Some correct step

**Worthless (0 marks)**
W1 Incorrect answer with no work other than those in scheme
(c) Sam earns €550 a week. His rate of tax is 20% and he has tax credits of €75 a week.

(i) How much tax does Sam pay each week?

(ii) Sam also pays other deductions of €91.50 each week.

Find his weekly take-home pay

(iii) What percentage of his total pay does Sam take home each week?

(c) (i) 5 marks

<table>
<thead>
<tr>
<th></th>
<th>5 marks</th>
<th>Att 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>€550 \times 0.2 = €110</td>
<td></td>
</tr>
<tr>
<td></td>
<td>€110 – €75 = €35</td>
<td></td>
</tr>
</tbody>
</table>

* Accept correct answer with no work

**Blunders (-3)**
- B1 Error in calculating percentage e.g. €550 \times 1.2
- B2 Mishandles tax credit
- B3 Subtraction not completed
- B4 Errors in establishing \[
\frac{550 \times 20}{100}
\] (all three elements must be present, otherwise attempt marks only)

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

**Attempts (2 marks)**
- A1 Some effort at getting a percentage

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

<table>
<thead>
<tr>
<th>5 marks</th>
<th>Att 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>€550 - (€35 + €91.50) = €550 - €126.50 = €423.50</td>
<td></td>
</tr>
</tbody>
</table>

* Accept correct answer with no work
* Accept candidates answer from part (i)
* €35 will recoup marks if necessary for part (i)
* €423.50 will recoup marks if necessary for part (i)

**Blunders (-3)**
B1 Uses a tax other than that calculated in (c) (i) above
B2 Fails to subtract (once only)
B3 Subtraction not completed

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

**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

(c) (iii)  

<table>
<thead>
<tr>
<th>10 marks</th>
<th>Hit or Miss</th>
</tr>
</thead>
</table>
| \[
\frac{423.50}{550} \times 100 = 77\%
\] |             |

* Accept correct answer with no work
* Accept candidates answer from part (ii)
QUESTION 3

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

(a) Seán estimates that he will get €200 by selling his DVDs. He actually gets €184.
   (i) Find the error in the estimate.
   (ii) Calculate the percentage error, correct to one decimal place.

(a) (i) 5 marks Att 2

(i) Error = 200 – 184 = €16

* Accept correct answer with no work

Blunders (-3)
B1 200 – 184 and stops

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

Attempts (2 marks)
A1 Some use of given data

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

(a) (ii) 5 marks Att 2

(ii) Percentage error = \( \frac{16}{184} \times 100 = 8.69\% = 8.7\% \)

* Accept correct answer with no work

Blunders (-3)
B1 Errors in establishing \( \frac{16}{184} \times 100 \) [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
S2 Incorrect or no rounding-off

Attempts (2 marks)
A1 Some use of given data

Worthless (0 marks)
W1 Incorrect answer with no work other than those in scheme
(b) A raffle ticket costs €1. Caoimhe pays 40 cent and Aoife pays 60 cent of the cost. They share a prize in the ratio of how much each paid. Caoimhe gets €160.

(i) How much does Aoife get?
(ii) How much is the total prize they share?

\[
\begin{array}{l}
\text{(i) } \frac{40}{100} = 160 \Rightarrow \frac{1}{100} = 4 \Rightarrow \frac{60}{100} = 4 \times 60 = 240 \\
\end{array}
\]

* Accept correct answer without work

Blunders (-3)
B1 Error in establishing ratios (each time)

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

Attempts (4 marks)
A1 \( \frac{40}{100} \) and / or \( \frac{60}{100} \) and / or 4

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

(ii) \( €160 + €240 = €400 \)

* Accept correct answer without work
* Accept answer from (b)(i)

Blunders (-3)
B1 Subtracts instead of adds
B2 Fails to add

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

Attempts (2 marks)
A1 Some correct work
A2 Adds some random number to 160

Worthless (0 marks)
W1 Incorrect answer with no work other than those in scheme
Part (c) 25 (10, 15) marks  

**Tom bought a television set for €1100.**  
At the end of the first year the television set is worth €935.

(i) Find the annual rate of depreciation
(ii) At this rate of depreciation, how much will the television set be worth at the end of 3 years?  
Give your answer correct to the nearest euro.

### (c) (i) 10 marks Hit or Miss

(i) \[
\frac{935}{1100} \times 100 = 85\% \\
\text{Depreciation } 100 - 85 = 15\% \\
\]

* Accept correct answer without work

### (c) (ii) 15 marks Att 6

(ii) \[
F = P(1 - i)^t = 1100(1 - 0.15)^3 = 1100(0.85)^3 = €675.54 = €676 \\
\]

or

Second year: \[935(0.85) = €794.75\]
Third year: \[794.75(0.85) = €675.54 = €676\]

* Accept correct answer without work
* Accept answer from (c)(i)

**Blunders (-3)**

B1 Error in substitution into formula (each time)
B2 Error in manipulation of formula
B3 \[935 \div 0.85 = 1100\] (each time)
B4 Incorrect number of years

**Slips (-1)**

S1 Numerical slips to a maximum of 3
S2 Decimal error
S3 Answer not correct to nearest euro

**Attempts (6 marks)**

A1 Some correct substitution into formula
A2 Fails to multiply out in formula method

**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 \( x \)

\[ 3x - 7 = 6x + 8 \]

(a) 10 marks  Att 4

\[ 3x - 7 = 6x + 8 \Rightarrow -6x + 3x = 7 + 8 \Rightarrow -3x = 15 \Rightarrow x = -5 \]

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

Blunders (-3)
B1 Blunders in grouping terms e.g. \( 3x - 7 = -4x \) [each time]
B2 Transposition errors [once only]
B3 \( -3x = 15 \Rightarrow x \neq -5 \) OR \( 3x = -15 \Rightarrow x \neq -5 \)
B4 Each step omitted e.g. \( -3x = 15 \) and stops
B5 \( x = -5 \) without work

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

Attempts (4 marks)
A1 Some correct work
A2 Effort at trial and error by substitution

Worthless (0 marks)
W1 Incorrect answer without work
Part (b)  20 (15, 5) marks  Att (6, 2)

(b) Solve the simultaneous equations
\[ x + 2y = 4 \]
\[ 2x + 3y = 5. \]

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

\[
\begin{align*}
  x + 2y &= 4 \quad \times 2 \quad \Rightarrow \quad 2x + 4y = 8 \\
  2x + 3y &= 5 \quad \times 1 \quad \Rightarrow \quad 2x + 3y = 5 \\
  \downarrow & \quad \downarrow \\
  x + 2y &= 4 \quad \Rightarrow \quad x + 2(3) = 4 \quad \Rightarrow \quad x = 4 - 6 \quad \Rightarrow \quad x = -2 \\
  y &= 3
\end{align*}
\]

* 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 (\( x = -2 \)) or the first equation in terms of \( y \) only (\( y = 3 \))
B2 \(- y = -3 \Rightarrow y \neq 3 \)
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
The cost of a blue mobile phone is €12 less than the cost of a pink mobile phone. Let $x$ be the cost of a pink mobile phone.

(i) Write an expression in $x$ for the cost of a blue mobile phone.

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

(iii) Solve this equation to find the cost of a pink mobile phone.

---

Cost of blue mobile phone: $x - 12$

**Blunders (-3)**

B1 $x + 12$ or $12 - x$

B2 $12x$

**Attempts (4 marks)**

A1 Some use of the data given e.g. $\frac{x}{12}$, $\frac{12}{x}$

**Worthless (0 marks)**

W1 No use of $x$ or 12

W2 $x = 12$ and stops

---

$2x + 4(x - 12) = 840$

* Accept candidates answer from part (i)

**Blunders (-3)**

B1 Each price omitted

B2 $6x - 48$ only

**Attempts (2 marks)**

A1 A spurious equation in $x$ involving 840

A2 $2x$ or $4(x - 12)$ or $4x$

**Worthless (0 marks)**

W1 No use of $x$
(c) (iii)  

\[
2x + 4(x - 12) = 840 \Rightarrow 2x + 4x - 48 = 840 \Rightarrow 6x = 840 + 48 = 888 \Rightarrow x = \text{€148}
\]

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

* 2x + 4x - 48 or 2x + 4x - 48 = 840 as starting work can earn marks for parts (i) and (ii)

**Blunders (-3)**
B1 Incorrectly formed equation
B2 Blunders in grouping terms e.g. 6x - 48 = -42x (each time)
B3 Transposition error(s) (once only)
B4 6x = 888 \(\Rightarrow x \neq 148\)
B5 Each step omitted
B6 Correct answer without work
B7 Distribution error

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

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

**Worthless (0 marks)**
W1 Incorrect answer without work
QUESTION 5

<table>
<thead>
<tr>
<th>Part (a)</th>
<th>10 (5, 5) marks</th>
<th>Att (2, 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part (b)</td>
<td>20 (10, 10) marks</td>
<td>Att (4, 4)</td>
</tr>
<tr>
<td>Part (c)</td>
<td>20 (5, 10, 5) marks</td>
<td>Att (2, -, 2)</td>
</tr>
</tbody>
</table>

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

(a) (i) Write down all the whole number factors of 24.
(ii) List which of these numbers are multiples of 3.

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

(i) 1, 2, 3, 4, 6, 8, 12, 24
(ii) 3, 6, 12, 24

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 \( x^2 + 4x - 12 = 0 \).
(ii) Solve the quadratic equation \( 3x^2 - 6x + 2 = 0 \), correct to two decimal places.

(b) (i) 10 marks Att 4

\[ x^2 + 4x - 12 = 0 \Rightarrow (x + 6)(x - 2) = 0 \Rightarrow x = -6 \text{ or } x = 2 \]

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

\[ 3x^2 - 6x + 2 = 0 \]

\[ \Rightarrow x = \frac{6 \pm \sqrt{(-6)^2 - 4(3)(2)}}{2 \times 3} \]

\[ = \frac{6 \pm \sqrt{12}}{6} * \]

\[ = \frac{6 \pm 3.464}{6} \]

\[ \Rightarrow x = \frac{9.464}{6} \text{ or } x = \frac{2.536}{6} \]

\[ \Rightarrow x = 1.577 \text{ or } x = 0.422 \]

\[ \Rightarrow x = 1.58 \text{ or } x = 0.42 \]

* Maximum deductions beyond point * is 3 marks

* 6 ± \sqrt{negative number} 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 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. \((x \ ))(x \ )\)
A4 Appearance of the variable in the answer
A5 Identifies \(a\) or \(b\) or \(c\)

**Worthless (0 marks)**
W1 Quadratic reduced to linear
(c) (i) Solve $3x + 6 < 24, \quad x \in \mathbb{Z}$.

(ii) Solve $6 - 4x \leq 10, \quad x \in \mathbb{Z}$.

(iii) Write down all the values of $x$ which satisfy both of the above inequalities.

<table>
<thead>
<tr>
<th>(c) (i)</th>
<th>5 marks</th>
<th>Att 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3x + 6 &lt; 24 \Rightarrow 3x &lt; 18 \Rightarrow x &lt; 6$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Blunders (-3)
- B1 Blunders in grouping terms e.g. $3x + 6 = 9x$ [each time]
- B2 Transposition errors [once only]
- B3 Each step omitted e.g. $3x < 18$ and stops
- B4 $x < 6$ without work
- B5 Replaces inequality with equality sign

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

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

Attempts (4 marks)
- A1 Some correct work
- A2 Effort at trial and error by substitution

Worthless (0 marks)
- W1 Incorrect answer without work

<table>
<thead>
<tr>
<th>(c) (ii)</th>
<th>10 marks</th>
<th>Hit or Miss</th>
</tr>
</thead>
<tbody>
<tr>
<td>$6 - 4x \leq 10 \Rightarrow -4x \leq 4 \Rightarrow x \geq -1$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(c) (iii)</th>
<th>5 marks</th>
<th>Att 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>${-1, 0, 1, 2, 3, 4, 5}$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 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 Partial listing of answers to (i) or (ii) or both
QUESTION 6

A music shop sells CDs and DVDs. The graph shows the number of each sold over six days. For example, on Tuesday, 50 CDs and 10 DVDs were sold.

(i) 10 marks

How many CDs were sold on Friday?

(i) 10 marks

60

Blunders (-3)

B1 Gives 80 as answer
B2 60 + 80 = 140

Worthless (0 marks)

W1 Incorrect answer without work other than those in the scheme

(ii) 10 marks

How many more CDs than DVDs were sold on Saturday?

(ii) 10 marks

90 – 60 = 30

* Accept correct answer without work

Blunders (-3)

B1 90 + 60 = 150

Worthless (0 marks)

W1 Incorrect answer without work other than those in scheme
On which days of the week was the number of DVDs sold greater than the number of CDs sold?

<table>
<thead>
<tr>
<th>(iii)</th>
<th>10 marks</th>
<th>Att 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wednesday, Friday</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Accept correct answer without work

Blunders (-3)
B1 Only one of the correct days given
B2 Monday, Tuesday, Thursday & Saturday

Attempts (4 marks)
A1 Monday, Tuesday & Thursday

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

Find the average number of CDs sold per day?

<table>
<thead>
<tr>
<th>(iv)</th>
<th>10 marks</th>
<th>Att 4</th>
</tr>
</thead>
</table>
| \[
\frac{40 + 50 + 20 + 70 + 60 + 90}{6} = \frac{330}{6} = 55
\] |

* Accept correct answer without work

Blunders (-3)
B1 Stops at \( \frac{330}{6} \)
B2 90 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 330 or candidates answer

Worthless (0 marks)
W1 Incorrect answer without work other than those in scheme
The shop sells each CD for €8 and each DVD for €12. Find in euro the total amount of sales over the six days.

<table>
<thead>
<tr>
<th>10 marks</th>
<th>Att 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>The shop sells each CD for €8 and each DVD for €12. Find in euro the total amount of sales over the six days.</td>
<td></td>
</tr>
</tbody>
</table>

\[
330 \times 8 + (20 + 10 + 30 + 50 + 80 + 60) \times 12 \\
= 2640 + 250 \times 12 \\
= 2640 + 3000 \\
= \text{€5640} 
\]

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

**Blunders (-3)**
B1 Divides instead of multiplies \(330/8 = 41.25\)
B2 Writes \(2640 + 3000\) and stops
B3 Writes \(2640 - 3000 = -360\)

**Misreadings (-1)**
M1 Takes €12 for price of CD and €8 for price of DVD

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

**Attempts (4 marks)**
A1 Some correct work
A2 Some use of 250
A3 \(330 \times 8\) or \(2640\) and stops
A4 \(330 + 250\) and / or \(580\)

**Worthless (0 marks)**
W1 Incorrect answer without work other than those in scheme
**QUESTION 7**

<table>
<thead>
<tr>
<th>Graph</th>
<th>30 (20, 10) marks</th>
<th>Att (8, 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Values</td>
<td>20 (5, 5, 5, 5) marks</td>
<td>Att (2, 2, 2, 2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>20 marks</th>
<th>Att 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graph</td>
<td>10 marks</td>
<td>Att 4</td>
</tr>
</tbody>
</table>

**Draw the graph of the function**

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

**Table method**

<table>
<thead>
<tr>
<th>( x )</th>
<th>(-3)</th>
<th>(-2)</th>
<th>(-1)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 2x^2 )</td>
<td>18</td>
<td>8</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>(-x)</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>(-5)</td>
<td>-5</td>
<td>-5</td>
<td>-5</td>
<td>-5</td>
<td>-5</td>
<td>-5</td>
<td>-5</td>
</tr>
<tr>
<td>( f(x) )</td>
<td>16</td>
<td>5</td>
<td>-2</td>
<td>-5</td>
<td>-4</td>
<td>1</td>
<td>10</td>
</tr>
</tbody>
</table>

* 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 | -5 treated as 5 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
---|---|---
\[ f(x) = 2x^2 - x - 5 \]
\[ f(-3) = 2(-3)^2 - (-3) - 5 = 16 \]
\[ f(-2) = 2(-2)^2 - (-2) - 5 = 5 \]
\[ f(-1) = 2(-1)^2 - (-1) - 5 = -2 \]
\[ f(0) = 2(0)^2 - (0) - 5 = -5 \]
\[ f(1) = 2(1)^2 - (1) - 5 = -4 \]
\[ f(2) = 2(2)^2 - (2) - 5 = 1 \]
\[ f(3) = 2(3)^2 - (3) - 5 = 10 \]

**Blunders (-3)**
- **B1** Consistent errors in the evaluation of \( 2x^2 \)
- **B2** \(-5 \) 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** \(-5 \) consistently treated as 5 in the evaluation
* Accept values from candidates work
* Fully correct graph drawn with no work shown: award 30 marks

**Blunders (-3)**
B1 Blunders in scales on axis or axes (once only)

**Slips (-1)**
S1 Each point from table plotted incorrectly
S2 Each pair of successive points not joined to a maximum of 3
S3 Not a smooth curve
S4 The graph of the function is not in the conventional position or orientation

**Attempts (4 marks)**
A1 At least two of the candidates points plotted
A2 Any U-shaped graph
A3 Axes drawn
Values 20 (5, 5, 5, 5) marks Att (2, 2, 2, 2)

Use your graph to estimate
(i) the value of $f(2.5)$
(ii) the minimum value of $f(x)$
(iii) the values of $x$ for which $f(x) = 7$
(iv) the range of values of $x$ for which $f(x)$ is increasing.

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

(i) $f(2.5) = 5$
(ii) $-5.1$
(iii) $x = -2.2, x = 2.7$
(iv) $0.2 < x \leq 3$

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

**Blunders (-3)**
B1 Extra value, applies in parts (i) and (ii)
B2 $f(x) = 7$ treated as $f(7)$
B3 Value omitted, applies in part (iii).

**Slips (-1)**
S1 Answers indicated correctly on axis but not specified
S2 Increasing 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 (ii)

**Attempts (2 marks)**
A1 Effort at reading value(s) from graph
A2 Correctly solving equation algebraically, part (iii)
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 marks

(a)

The area of the triangle shown is 39 cm².
The perpendicular height of the triangle is 6 cm.

Find \( a \), the length of the base of the triangle.

\[
\text{Area} = \frac{1}{2} \times a \times h
\]
\[
39 = \frac{1}{2} \times a \times 6
\]
\[
3a = 39
\]
\[
a = 13 \text{ cm}
\]

Slips (-1)
S1 Error in substitution

Attempts (4 marks)
A1 Correct formula without substitution
A2 Incorrect answer of some merit
(b) A damaged section of wallpaper is shown in the diagram.

Offsets of lengths 5, 7, 6, 8, 10, 9 and 12 cm are measured at intervals of 6 cm along the horizontal line as shown.

(i) Use Simpson’s rule to estimate the area of the damaged section of wallpaper.

(ii) What is the area of the smallest rectangle of wallpaper that can be used to cover the damaged section?

(b) (i) 35 marks Att 14
(ii) 5 marks Att 2

(i) Area = \( \frac{1}{3} \left( \text{First} + \text{Last} + \text{T.O.F.E} \right) \)

\[ = \frac{6}{3} (5 + 12 + 2(6 + 10) + 4(7 + 8 + 9)) = 2(17 + 32 + 96) = 290 \text{ cm}^2 \]

(ii) \( (6 \times 6) \times 12 = 432 \text{ cm}^2 \)

Blunders (-3)
B1 Uses four odd and twice even, \( 4(6 + 10) + 2(7 + 8 + 9) \)
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 Incorrect substitution

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

Attempts (14, 2 marks)
A1 Gives Simpson’s Formula only
A2 Copies diagram
QUESTION 2

Part (a)  20 marks  Att 8

(a) A cylinder has a radius of 3 cm and a height of 5 cm.

Calculate the volume of the cylinder, correct to the nearest cm³.

Volume = \( \pi r^2 h = \pi \times 3^2 \times 5 = 45\pi = 141.3 = 141 \text{ cm}^3 \)

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 \( \pi \)

Attempts (8 marks)
A1 Correct formula without substitution

Part (b)  10 marks  Att 4

(b) The diagram shows a formal pond in a garden.

Calculate the area of the pond

Area = \( 4 \times (6.5 + 3.5) + 3 \times 3.5 = 40 + 10.5 = 50.5 \text{ m}^2 \)

or Area = \( 7 \times 10 - 3 \times 6.5 = 70 - 19.5 = 50.5 \text{ m}^2 \)

Blunders (-3)
B1 Incorrect substitution

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

Attempts (4 marks)
A1 Defines area
(c) The diameter of a solid cone is 18 cm and the height is 20 cm.

Find the volume of the cone, in terms of \( \pi \).

(ii) The cone is melted down and recast as 15 identical spheres of radius \( r \).

Find the value of \( r \).

(i) Volume = \( \frac{1}{3} \pi r^2 h = \frac{1}{3} \pi \times 9^2 \times 20 = 540\pi \) cm\(^3\)

(ii) Volume = \( 15 \times \frac{1}{3} \pi r^3 = 540\pi \)

\[ r^3 = \frac{540 \times 3}{15 \times 4} = 27 \quad \Rightarrow \quad r = 3 \text{ cm} \]

Blunders (-3)

B1 Incorrect substitution

B2 Error in balancing equation

Slips (-1)

S1 Numerical errors to a maximum of 3

S2 Omits \( \pi \) or gives answer as 1696.46 or 1695.6 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) In the triangle $ABC$
\[ |AB| = |AC| \text{ and } \angle DAC = 138^\circ \]

Find the value of $x$ and the value of $y$.

\[
x + 138 = 180 \Rightarrow x = 42 \]
\[
2y = 138 \Rightarrow y = 69
\]

or
\[
2y + x = 180 \Rightarrow 2y + 42 = 180 \Rightarrow 2y = 138 \Rightarrow y = 69
\]

Blunders (-3)
B1 Geometrical error
B2 Error in balancing equation

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 lines \( m \) and \( n \) are parallel.

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

\[ \begin{align*}
\text{(i)} & \quad p = 115 \\
\text{(ii)} & \quad q = 30 \\
\text{(iii)} & \quad r + 115 = 180 \Rightarrow r = 65 \\
\text{(iv)} & \quad r + q + s = 180 \Rightarrow 65 + 30 + s = 180 \Rightarrow s = 85
\end{align*} \]

Blunders (-3)
B1 Geometrical error

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

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

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

(c) The diagram shows a circle with centre at \( O \).
\([AB]\) is a diameter of the circle.
\( |AB| = 15 \text{ cm} \) and \( |BC| = 12 \text{ cm} \).

(i) Find \( |\angle BCA| \).
(ii) Find \( |CO| \).
(iii) Find \( |AC| \).

\[ \begin{align*}
\text{(i)} & \quad |\angle BCA| = 90^\circ \\
\text{(ii)} & \quad |CO| = 7.5 \text{ cm} \\
\text{(iii)} & \quad |AC|^2 + |CB|^2 = |AB|^2 \\
& \quad \Rightarrow |AC|^2 = 15^2 - 12^2 = 225 - 144 = 81 \Rightarrow |AC| = 9 \text{ cm}.
\end{align*} \]

Blunders (-3)
B1 Geometrical error

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

Attempts (4, 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) $P(1, 3)$ and $Q(6, -2)$ are two points. Find the length of $[PQ]$.

\[ |PQ| = \sqrt{(6 - 1)^2 + (-2 - 3)^2} = \sqrt{(5)^2 + (-5)^2} = \sqrt{25 + 25} = \sqrt{50} \text{ or } 5\sqrt{2} \]

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 (6 marks)
A1 Draws axes

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

(b) $A$ is the point $(1, 4)$ and $B$ is the point $(-3, -2)$.

(i) Plot the points $A$ and $B$ on graph paper.
(ii) Find the slope of $AB$.
(iii) Find the equation of the line $AB$.

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

(i) $A$

(ii) Slope = $\frac{-2 - 4}{-3 - 1} = \frac{-6}{-4} = \frac{3}{2}$

(iii) Equation: $y - 4 = \frac{3}{2}(x - 1)$ or $3x - 2y + 5 = 0$

Blunders (-3)
B1 Each point omitted
B2 Incorrect substitution once only
B3 Mathematical error

Slips (-1)
S1 Error in scales
S2 Each incorrectly plotted point

Attempts (4, 2, 2 marks)
A1 Draws axes
(c) The line \( l \) has equation \( 5y = 2x + 4 \).
The point \( R \) has co-ordinates \((3, 2)\).

(i) Show that the point \( R \) lies on the line \( l \).

(ii) Find the slope of the line \( l \).

(iii) Find the equation of the line \( k \) that is perpendicular to \( l \) and passes through the point \( R \).

\begin{center}
\begin{tabular}{|c|c|c|}
\hline
Part (c) & 15 (5, 5, 5) marks & Att (2, 2, 2) \\
\hline
\hline
(c) (i) & 5 marks & Att 2 \\
(ii) & 5 marks & Att 2 \\
(iii) & 5 marks & Att 2 \\
\hline
\end{tabular}
\end{center}

\begin{align*}
\text{(i) } & 5y = 2x + 4 \quad \Rightarrow \quad 5(2) = 2(3) + 4 \quad \Rightarrow \quad 10 = 10. \\
\text{(ii) } & 5y = 2x + 4 \quad \Rightarrow \quad y = \frac{2}{5} x + \frac{2}{5} \quad \Rightarrow \quad \text{slope} = \frac{2}{5} \\
\text{(iii) } & \text{Slope } l = \frac{2}{5} \quad \text{Slope } k = -\frac{5}{2} \quad y - 2 = -\frac{5}{2}(x - 3) \quad \text{or} \quad 5x + 2y - 19 = 0
\end{align*}

\textit{Blunders (-3)}
B1 Incorrect substitution once only
B2 Incorrect slope of \( l \)
B3 Incorrect slope of \( k \)
B4 Error in balancing equation

\textit{Slips (-1)}
S1 Numerical errors to a maximum of 3

\textit{Attempts (2, 2, 2 marks)}
A1 Draws axes
**QUESTION 5**

<table>
<thead>
<tr>
<th>Part (a)</th>
<th>20 (10, 10) marks</th>
<th>Att (4, 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part (b)</td>
<td>10 marks</td>
<td>Att 4</td>
</tr>
<tr>
<td>Part (c)</td>
<td>20 (10, 10) marks</td>
<td>Att (4, 4)</td>
</tr>
</tbody>
</table>

(a) The diagram shows a right angled triangle with sides of length 8, 15 and 17 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) $\tan A = \frac{8}{15}$
(ii) $\cos B = \frac{8}{17}$

**Blunders (-3)**
B1 Uses incorrect numerator or denominator each time  
B2 Inversion of fraction

**Slips (-1)**
S1 Calculates the angle approximately, $A = 28^\circ$ or $B = 61^\circ$  
S2 Answer not in fraction form

**Attempts (4, 4 marks)**
A1 Defines $\tan$ or $\cos$ and stops
Part (b) 10 marks
(b) Find the measure of the angle $D$ in the diagram, correct to the nearest degree.

\[
\sin D = \frac{4}{7} \Rightarrow D = \sin^{-1}\left(\frac{4}{7}\right) = 34.8^\circ = 35^\circ
\]

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

Part (c) 20 (10, 10) marks
(c) A taut cable is 10 m long and joins the top of a vertical flagpole to a point on level ground 4 m from the bottom of
the flagpole.

(i) Calculate $h$, the height of the flagpole.
Give your answer correct to two decimal places.

(ii) Find the measure of the angle $X$.
Give your answer to the nearest degree.

(c) (i) 10 marks
c (ii) 10 marks
(i) \[
h^2 + 4^2 = 10^2 \Rightarrow h^2 + 16 = 100 \Rightarrow h^2 = 84 \Rightarrow h = \sqrt{84} = 9.165 = 9.17
\]

(ii) \[
\cos X = \frac{4}{10} \Rightarrow X = \cos^{-1}\left(\frac{4}{10}\right) = 66.42^\circ = 66^\circ
\]

Blunders (-3)
B1 Any error in Pythagoras
B2 Incorrect trigonometric ratio
B3 Error in balancing equation

Slips (-1)
S1 Fails to round-off
S2 Wrong mode

Attempts (4, 4 marks)
A1 Measures from diagram
**QUESTION 6**

<table>
<thead>
<tr>
<th>Part (a)</th>
<th>10 marks</th>
<th>Att 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part (b)</td>
<td>20 (5, 5, 5, 5) marks</td>
<td>Att (2, 2, 2, 2)</td>
</tr>
<tr>
<td>Part (c)</td>
<td>20 (5, 5, 5, 5) marks</td>
<td>Att (2, 2, 2, 2)</td>
</tr>
</tbody>
</table>

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

(a) A certain car is available with a petrol or diesel engine. Each of these is available in five different colours and three different engine sizes. How many different versions of this car are available?

\[ 2 \times 5 \times 3 = 30 \]

**Blunders (-3)**

B1 2 + 5 + 3 = 10 or 10 written down
B2 2! etc

**Slips (-1)**

S1 Numerical errors to a maximum of 3

**Attempts (4 marks)**

A1 Incorrect answer of some merit

---

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

(b) A box contains eight red tickets, four blue tickets and five yellow tickets. One ticket is drawn at random from the box. Find the probability that the ticket drawn is

(i) blue
(ii) red
(iii) red or yellow
(iv) not yellow.

\[
\begin{align*}
(i) & \quad \frac{4}{17} \\
(ii) & \quad \frac{8}{17} \\
(iii) & \quad \frac{8 + 5}{17} = \frac{13}{17} \\
(iv) & \quad \frac{17 - 5}{17} = \frac{12}{17}
\end{align*}
\]

**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) 4 (ii) 8 (iii) 13 (iv) 12 merits 17 marks or
Ans: (i) \( \frac{1}{4} \) (ii) \( \frac{1}{8} \) (iii) \( \frac{1}{13} \) (iv) \( \frac{1}{12} \) merits 17 marks
The age of each student in a group of 60 students was recorded. The information is given in the table below.

<table>
<thead>
<tr>
<th></th>
<th>16 years</th>
<th>17 years</th>
<th>18 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>11</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Girls</td>
<td>15</td>
<td>13</td>
<td>5</td>
</tr>
</tbody>
</table>

A student is chosen at random. Find the probability that the student is
(i) a girl
(ii) 16 years of age
(iii) a boy who is 17 years of age
(iv) younger than 18 years of age.

\[
(i) \quad \frac{15 + 13 + 5}{60} = \frac{33}{60} \quad \text{or} \quad \frac{11}{20} \\
(ii) \quad \frac{11 + 15}{60} = \frac{26}{60} \quad \text{or} \quad \frac{13}{30} \\
(iii) \quad \frac{12}{60} \quad \text{or} \quad \frac{1}{5} \\
(iv) \quad \frac{60 - 9}{60} = \frac{51}{60}
\]

**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) \( \frac{1}{33} \) (ii) \( \frac{1}{26} \) (iii) \( \frac{1}{12} \) (iv) \( \frac{1}{51} \) merits 17 marks
QUESTION 7

Part (a)  5 marks  Att 2

(a) The mode of the numbers 5, 6, 4, 5, 6, 3, x is 5. Find the value of x.

\[ x = 5 \]

Slips (-1)
S1 Misreads mode as mean

Attempts (2 marks)
A1 Incorrect answer of some merit

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

(b) The table below shows the number of emails sent by 40 students during one week.

<table>
<thead>
<tr>
<th>Number of emails</th>
<th>0 – 5</th>
<th>6 – 10</th>
<th>11 – 15</th>
<th>16 – 20</th>
<th>21 – 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of students</td>
<td>2</td>
<td>10</td>
<td>13</td>
<td>12</td>
<td>3</td>
</tr>
</tbody>
</table>

(i) Copy and complete the cumulative frequency table:

<table>
<thead>
<tr>
<th>Number of emails</th>
<th>( \leq 5 )</th>
<th>( \leq 10 )</th>
<th>( \leq 15 )</th>
<th>( \leq 20 )</th>
<th>( \leq 30 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(ii) Draw the cumulative frequency curve.
Use your cumulative frequency curve to estimate
(iii) the median number of emails sent
(iv) the number of students who sent more than 18 emails.
Median = 13 emails
Number of students = 40 – 34 = 6

**Blunders (-3)**
B1. Plots on the midpoints
B2. Points not joined
B3. Uses wrong axis for median

**Slips (-1)**
S1. Error in scales, one slip
S2. Each incorrect or omitted value in the table
S3. Each incorrectly plotted point
S4. Joins points with straight lines
S5. Median not specified
S6. Fails to subtract reading in (iv)

**Attempts (2, 4, 2, 2 marks)**
A1. Incorrect answer of some merit
(c) (i) Find the mean of the numbers 2, 5, 12, 13.

(ii) Find the standard deviation of the numbers 2, 5, 12, 13, correct to two decimal places.

(c) 20 (15, 5) marks

(i) Mean = \[ \frac{\sum x}{n} = \frac{2 + 5 + 12 + 13}{4} = \frac{32}{4} = 8 \]

(ii) Standard Deviation = \[ \sqrt{\frac{\sum d^2}{n}} \]

\[ = \sqrt{\frac{(2 - 8)^2 + (5 - 8)^2 + (12 - 8)^2 + (13 - 8)^2}{4}} \]

\[ = \sqrt{\frac{36 + 9 + 16 + 25}{4}} = \sqrt{\frac{86}{4}} = 4.636 = 4.64 \]

**Blunders (-3)**
B1 Incorrect substitution

**Slips (-1)**
S1 Numerical errors to a maximum of 3
S2 Error in rounding

**Attempts (6, 2 marks)**
A1 Any addition
A2 Work on SD or defines SD
**QUESTION 8**

**Part (a)** 10 marks  
(a) Construct a triangle \( \triangle XYZ \) where \( |XY| = 6 \text{ cm}, \angle ZXY = 60^\circ \) and \( \angle ZYX = 40^\circ \).

**Blunders (-3)**  
B1 Each omitted side  
B2 Incorrect angle \( \pm 5^\circ \)

**Slips (-1)**  
S1 Given side outside tolerance of \( \pm 1 \text{ cm} \)

**Part (b)** 20 (10, 10) marks  
(b) The diagram shows a square patterned tile.  
(i) How many axes of symmetry does the tile have?  
(ii) What is the smallest angle of rotation about the centre that will map the tile onto itself?

(b) 20 (10, 10) marks  
(i) 4  
(ii) 90°

**Blunders (-3)**  
B1 Answer greater than 4  
B2 Incorrect angle

**Slips (-1)**  
S1 Each symmetry omitted
The rectangle \( PQRS \) is the image of the rectangle \( ABCD \) under an enlargement with centre \( O \).

The scale factor is 1.5.

\[ |AB| = 3 \text{ cm} \quad \text{and} \quad |QR| = 9 \text{ cm}. \]

(i) Calculate \( |PQ| \).

(ii) Calculate \( |BC| \).

(iii) Find the area of the rectangle \( PQRS \).

\[
\begin{align*}
(i) & \quad |PQ| = 1.5 \times |AB| = 1.5 \times 3 = 4.5 \text{ cm} \\
(ii) & \quad 1.5 \times |BC| = |RQ| = 9 \Rightarrow |BC| = \frac{9}{1.5} = 6 \text{ cm} \\
(iii) & \quad \text{Area of rectangle } PQRS = 4.5 \times 9 = 40.5 \text{ cm}^2
\end{align*}
\]

**Blunders (-3)**

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

**Misreadings(-1)**

M1 Treats \( ABCD \) as the image rectangle

**Slips (-1)**

S1 Numerical errors to a maximum of 3

**Attempts (4, 2, 2 marks)**

A1 Incorrect answer of some merit
Ba choir marcanna de réir an ghnáth ráta a bhronnadh ar iarrthóirí nach ngnóthaíonn níos mó ná 75% d’iomlán na marcanna don pháipéar. Ba choir freisin an marc bónais sin a shlánú sios.

Déantar an cinneadh agus an riomhaireacht faoin marc bónais i gcás gach páipéar leithligh.

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

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

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