

MARKING SCHEME

JUNIOR CERTIFICATE EXAMINATION 2005

MATHEMATICS – ORDINARY LEVEL – PAPER 1

GENERAL GUIDELINES FOR EXAMINERS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

QUESTION 1

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

(i) $P = \{x, y, w\}$

Write down a subset of P that has one element

(i) $\{x\}$ or $\{y\}$ or $\{w\}$

Blunders (-3)

B1 Any inapplicable subset of P . [proper or improper]

Misreadings (-1)

M1 Subsets of P with two elements.

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

(ii) $P = \{x, y, w\}$

Write down a subset of P that has two elements.

(ii) $\{x, y\}$ or $\{x, w\}$ or $\{y, w\}$

Blunders (-3)

B1 Any inapplicable subset of P . (proper or improper)

Misreadings (-1)

M1 Subsets of P with one element.

Part (b)

20 (5, 5, 5, 5) marks

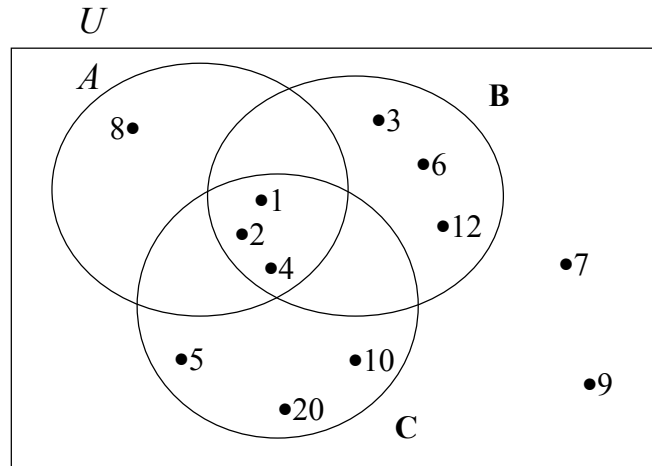
Att(2, 2, 2, 2)

U is the universal set.

$A = \{1, 2, 4, 8\}$,
the set of divisors of 8.

$B = \{1, 2, 3, 4, 6, 12\}$,
the set of divisors of 12.

$C = \{1, 2, 4, 5, 10, 20\}$,
the set of divisors of 20.



Part (b) (i)

5 marks

Att 2

(i) $A \cap C = \{1, 2, 4\}$

Blunders(-3)

B1 Any incorrect set of the elements of U other than the misreading as below.

Misreadings(-1)

M1 $A \cup C$ giving $\{1, 2, 4, 5, 8, 10, 20\}$.

Part (b) (ii)

5 marks

Att 2

(ii) $B' = \{5, 7, 8, 9, 10, 20\}$

Slips(-1)

S1 Each correct element omitted and/or each incorrect element included.

Attempts (2 marks)

A1 B or any proper subset of B .

Part (b) (iii)

5 marks

Att 2

(iii) $C \setminus (A \cap B) = \{5, 10, 20\}$

Blunders (-3)

B1 Any incorrect set of the elements of U other than the misreading as below.

Misreadings (-1)

M1 $(A \cap B) \setminus C$ giving the Null Set. (\emptyset)

Part (b) (iv)**5 marks****Att 2**

(iv) Using the Venn diagram above, or otherwise, find the highest common factor of 8, 12 and 20.

(iv) H.C.F. = 4

4 is the highest factor in $A \cap B \cap C$. Common factors are 1, 2, 4 \Rightarrow H.C.F. = 4.

Or $8 = 2 \times 2 \times 2$; $12 = 2 \times 2 \times 3$; $20 = 2 \times 2 \times 5$; \Rightarrow H. C. F = $2 \times 2 = 4$

Blunders (-3)

B1 An inapplicable element of U . [But see S1].

B2 A listing of elements of U with 4 included.

B3 Correct factors of 8 or 12 or 20 but no conclusion drawn re H.C.F.

Slips (-1)

S1 1 or 2 as H.C.F.

Misreadings (-1)

M1 L.C.M. given i.e. 120.

Attempts (2 marks)

A1 Incorrect factors of 8 and/or 10 and/or 20 e.g. $8 = 2 \times 3$.

Worthless (0)

W1 Any number $\notin U$ except 120. [See M1].

W2 A listing of elements of U with 4 not included.

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

M is the set of natural numbers from 1 to 20, inclusive.

(i) List the elements of M that are multiples of 3.

(i) 3, 6, 9, 12, 15, 18.

Slips (-1)

S1 Each correct element omitted and/or each incorrect element included.

Worthless (0)

W1 No applicable multiple of 3 appears.

Part (c) (ii)

5 marks

Att 2

(ii) M is the set of natural numbers from 1 to 20, inclusive.
List the elements of M that are multiples of 5.

(ii)

5, 10, 15, 20.

Slips (-1)

S1 Each correct element omitted and/or each incorrect element included.

Worthless (0)

W1 No applicable multiple of 5 appears.

Part (c) (iii)

5 marks

Att 2

(iii) Write down the lowest common multiple of 3 and 5.

(iii)

15
3, 6, 9, 12, 15, 18. 5, 10, 15, 20.

Or $3 \times 5 = 15$

- * Accept candidate's least common number from their incorrect answers in parts (i) and (ii) for full marks.
- * Accept an indication of candidate's L.C.M. for full marks.

Blunders (-3)

B1 An inapplicable multiple of 3 only and/or an inapplicable multiple of 5 only.

Misreadings (-1)

M1 H.C.F = 1.

Worthless (0)

W1 Numbers other than multiples of 3 or 5 (But see 1st*)

Part (c) (iv)

5 marks

Att 2

(iv) Express 10 as the sum of three prime numbers

(iv) $10 = 2 + 3 + 5.$

* Accept a listing of 2, 3, 5 for full marks.

Blunders (-3)

B1 Each correct prime constituent omitted and/or each incorrect constituent included.

Attempts (2 marks)

A1 Some attempt at product e.g. $1 \times 2 \times 5$. (But see W1)

Worthless (0)

W1 No applicable prime number appears i.e. 2 or 3 or 5 do not appear.

QUESTION 2

Part (a)	10 marks	Att 3
Part (b)	20 (5, 10, 5) marks	Att (2,3,2)
Part (c)	20 (5, 5, 10) marks	Att (2,2,3)

Part (a) **10 marks** **Att 3**

If 12 m² of carpet cost €504, find the cost of 15 m² of the same carpet.



(a)

$$\begin{aligned}
 12 \text{ m}^2 &\equiv 504 \\
 \Rightarrow 1 \text{ m}^2 &\equiv \frac{504}{12} = 42 \\
 \Rightarrow 15 \text{ m}^2 &\equiv 42 \times 15 = 630
 \end{aligned}$$

- * Correct answer without work \Rightarrow 7 marks.
- * $\frac{12}{15} \times 504 = 403 \cdot 2 \Rightarrow$ 7 marks (B1).
- * $\frac{4}{5} \times 504 = 403 \cdot 2 \Rightarrow$ 7 marks (B1).
- * Indicates $\frac{15}{12}$ or $\frac{5}{4}$ only and stops. \Rightarrow 4 marks. (No use of 504 (-3) and possible *Slips* (-3)).
- * $\frac{504}{12}$ or $\frac{504}{12} = 42$ and stops \Rightarrow 4 marks (No use of 15 (-3) and possible *Slips* (-3)).
- * 504×15 or $504 \times 15 = 7560 \Rightarrow$ 4 marks.
- * Incorrect answer without work \Rightarrow 0 marks.

Blunders (-3)

- B1 $\frac{12}{15} \times 504$ or $\frac{4}{5} \times 504$ and continues. [403 · 20 as answer.]
- B2 Divisor $\neq 12$ and continues. [But see B1]
- B3 Incorrect multiplier i.e. $\neq 15$ and continues. [But see B1]
- B4 Divisor $\neq 4$ and continues. [But see B1]
- B5 Incorrect multiplier i.e. $\neq 5$ and continues. [But see B1]
- B6 $15 : 12 = 504 : x$ and continues.
- B7 Error in decimal point.

Slips (-1)

- S1 Numerical errors (max -3).

Attempts (3 marks)

- A1 Divisor $\neq 12$ or $\neq 4$ e.g. $\frac{504}{15}$ or $\frac{504}{5}$ and stops.
- A2 Indicates $\frac{12}{15}$ or $\frac{4}{5}$ or $12 : 15$ or $504 : x$ only and stops.
- A3 6048 only. i.e. multiplies 504 by 12.
- A4 $\frac{1}{12}$ only appears

Worthless (0)

- W1 $504 + 15 = 519$.

(i) Simplify $\frac{a^9 \times a^5}{a^6 \times a^2}$, giving your answer in the form a^n , where $n \in \mathbb{N}$.

$$\text{(i)} \quad \frac{a^9 \times a^5}{a^6 \times a^2} = \frac{a^{14}}{a^8} = a^6.$$

$$\frac{a \times a \times a \times a \times a \times a \times a \times a \times a \times a \times a \times a \times a \times a}{a \times a \times a \times a \times a \times a \times a \times a} = a \times a \times a \times a \times a \times a = a^6.$$

- * $\frac{a^{14}}{a^8}$ and stops \Rightarrow 2 marks.
- * a^{14} and stops \Rightarrow 2 marks.
- * $a^3 \times a^3$ and stops \Rightarrow 2 marks.
- * Correct answer without work \Rightarrow 2 marks.

Blunders (-3)

- B1 Each error in calculation involving indices.
- B2 Each incorrect number of a 's in the extended form.
- B3 Each incorrect elimination in the extended form.
- B4 $a^3 \times a^3$ as an answer.


Slips (-1)

- S1 $\frac{a^{14}}{a^8} = 6$ or $\frac{a^{14}}{a^8} = \frac{1}{a^{-6}}$ as final answers.
- S2 $a \times a \times a \times a \times a \times a$ as answer.

Attempts (2 marks)

- A1 Some manipulation of indices e.g. $a^9 \times a^5 = a^{45}$ only.

(ii) By rounding each of these numbers to the nearest whole number, estimate the value of $\frac{56 \cdot 214}{2 \cdot 31 + 5 \cdot 79}$.

 (ii) $\frac{56 \cdot 214}{2 \cdot 31 + 5 \cdot 79}$ is approximately equal to:

$$\frac{\boxed{56}}{\boxed{2} + \boxed{6}} = \frac{\boxed{56}}{\boxed{8}} = \boxed{7}$$

* $\frac{56}{2+6}$ and stops \Rightarrow 4 marks.

* No penalty if the intermediate step between approximations and final answer not shown
e.g. $\frac{56}{8}$ not shown.

Blunders (-3)

B1 Error in rounding off to the nearest whole number (each time).

B2 Decimal point error in calculation of approximate value.

B3 An arithmetical operation other than indicated.

B4 $\frac{56}{2} + \frac{56}{6}$ and continues.

B5 $\frac{56}{2} + 6 = 28 + 6 = 34$.

Slips (-1)

S1 Numerical errors in arithmetical operations.

Attempts (3 marks)

A1 Only one or two approximations made to the given numbers.

Worthless (0)

W1 No approximations made to given numbers.

(iii) Using a calculator, or otherwise, find the exact value of $\frac{56 \cdot 214}{2 \cdot 31 + 5 \cdot 79}$.

(iii)
$$\frac{56 \cdot 214}{8 \cdot 1} = 6 \cdot 94$$

Blunders (-3)

B1 *Otherwise:* Error(s) in decimal point.

B2 *Otherwise:* $\frac{56 \cdot 214}{2 \cdot 31} + \frac{56 \cdot 214}{5 \cdot 79} = 24.335 + 9.709 = 34 \cdot 044$.

B3 *Otherwise:* $\frac{56 \cdot 214}{2 \cdot 31} + 5 \cdot 79 = 30 \cdot 12506494$.

B4 *Calculator:* Incorrect Answer.

Slips (-1)

S1 *Otherwise:* numerical errors in addition or division. (max -3).

Attempts (2 marks)

A1 Some correct calculation done.

(i) Using a calculator, or otherwise, find the exact value of: $49^{\frac{1}{2}}$

(i)

7

Blunders (-3)

B1 Mishandles $49^{\frac{1}{2}}$ e.g. $49^{\frac{1}{2}} = 2401$, $49^{\frac{1}{2}} = 24 \cdot 5$, $49^{\frac{1}{2}} = 49 \cdot 5$, $49^{\frac{1}{2}} = 98$, $49^{\frac{1}{2}} = \frac{99}{2}$.

B2 *Calculator*: Incorrect Answer.

B3 *Otherwise*: error in use of Maths. Tables e.g. $2 \cdot 214$ (wrong page).

Misreadings (-1)

M1 $49^{\frac{1}{2}} = \frac{1}{49^2} = \frac{1}{2401} = 0 \cdot 0004164$.

M2 $49^{\frac{1}{2}} = \sqrt[3]{49} = 3 \cdot 6593$.

Attempts (2 marks)

A1 $\sqrt{\quad}$ is mentioned.

(ii) Using a calculator, or otherwise, find the exact value of $\frac{1}{6 \cdot 4}$.

(ii)

$$\frac{1}{6 \cdot 4} = 0 \cdot 15625$$

Blunders (-3)

B1 $\frac{1}{6 \cdot 4} = \sqrt{6 \cdot 4} = 2 \cdot 529$ or $(6 \cdot 4)^2 = 40 \cdot 96$.

B2 $6 \cdot 4 \times 1 = 6 \cdot 4$ or $\frac{1}{24}$.

B3 *Calculator*: Incorrect Answer.

B4 *Otherwise*: Decimal point error in division or in use of Maths. Tables e.g. $\frac{1}{6 \cdot 4} = 1563$.

Slips (-1)

S1 *Otherwise*: numerical errors (max. of -3).

S2 *Maths. Tables*: $0 \cdot 1563$.

S3 Rounded off to $0 \cdot 2$, $0 \cdot 16$, $0 \cdot 156$, $0 \cdot 1563$.

S4 Incorrectly rounded off e.g. $0 \cdot 1562$, also attracts S3.

Attempts (2 marks)

A1 Some correct calculation done.

A2 $\frac{1}{6 \cdot 4} = \frac{10}{64}$ or $= \frac{5}{32}$ and stops.

(iii) Using a calculator, or otherwise, evaluate

$$\sqrt{65 \cdot 61} \times \frac{3 \cdot 14}{0 \cdot 47} - (2 \cdot 42)^2.$$

Give your answer correct to two decimal places.



(iii)

$$8 \cdot 1 \times 6 \cdot 6808511 - 5 \cdot 8564 \quad (3 \text{ marks})$$

$$= 54 \cdot 114894 - 5 \cdot 8564 \quad (6 \text{ marks})$$

$$= 48 \cdot 258494 \quad (9 \text{ marks})$$

$$= 48 \cdot 26. \quad (10 \text{ marks})$$

* Correct answer without work \Rightarrow 7 marks.

* Correct answer (without work) incorrectly rounded off \Rightarrow 6 marks. (See 1st * and S3).

Blunders (-3)

B1 Mishandles $\sqrt{65 \cdot 61}$ e.g. $(65 \cdot 61)^2 = 4304 \cdot 6721$.

B2 Mishandles $(2 \cdot 42)^2$ e.g. $2 \cdot 42 \times 2 = 4 \cdot 84$.

B3 An arithmetical operation other than a given one e.g. + for \times .

B4 $\frac{\sqrt{65 \cdot 61} \times 3 \cdot 14 - (2 \cdot 42)^2}{0 \cdot 47} = 41 \cdot 65$ (breaking order). [Check candidate's calculations]

B5 $\sqrt{65 \cdot 61} - (2 \cdot 42)^2 \times \frac{3 \cdot 14}{0 \cdot 47} = 14 \cdot 99$ (breaking order). [Check candidate's calculations]

B6 Error in decimal point.

Slips (-1)

S1 Numerical errors in arithmetical operations (to max-3).

S2 Each rounding off which would affect the final rounded off answer (max -3). [Check candidate's calculations]

S3 Fails to round off or incorrectly rounds off when giving final answer.

Attempts (3 marks)

A1 *Calculator*: incorrect answer without work.

A2 $\sqrt{65 \cdot 61} = 8 \cdot 1$ and stops.

A3 $\frac{3 \cdot 14}{0 \cdot 47} = 6 \cdot 680851064$ and stops.

A4 $\sqrt{65 \cdot 61} \times 3 \cdot 14 = 25 \cdot 434$ and stops.

A5 $(2 \cdot 42)^2 = 5 \cdot 8564$ and stops.

QUESTION 3

Part (a)	10 marks	Att 3
Part (b)	20 (10, 10) marks	Att (3, 3)
Part (c)	20 (10, 10) marks	Att (3, 3)

Part (a) **10 marks** **Att 3**

(a) Aoife bought 3 compact discs at €16.50 each and 2 magazines at €4.20 each. How much did she pay altogether?

<p> (a)</p> $16 \cdot 50 \times 3 = 49 \cdot 50$ $4 \cdot 20 \times 2 = 8 \cdot 40$ $\Rightarrow \text{total cost: } 49 \cdot 50 + 8 \cdot 40 = 57 \cdot 90.$	<p>or</p>	$16 \cdot 50 + 16 \cdot 50 + 16 \cdot 50 = 49 \cdot 50.$ $4 \cdot 20 + 4 \cdot 20 = 8 \cdot 40$ $\Rightarrow \text{total cost: } 49 \cdot 50 + 8 \cdot 40 = 57 \cdot 90.$
---	-----------	---

- * Accept 5790, 57.90 or 57.9 regardless of subsequent labelling or work.
- * Final addition step subject to maximum deduction of -3.
- * Adds $16 \cdot 50$ to $4 \cdot 20 = 20 \cdot 70$ and stops \Rightarrow 3 marks. [Oversimplification].
- * Correct answer without work \Rightarrow 7 marks.
- * Incorrect answer without work \Rightarrow 0 marks.


Blunders (-3)


- B1 Each missing product when finding items cost e.g. $16 \cdot 50$ not multiplied by 3.
- B2 Incorrect number of additions when finding items cost e.g. $16 \cdot 50 + 16 \cdot 50$ only.
- B3 Fails to find total cost i.e. no addition.
- B4 $49 \cdot 50 - 8 \cdot 40 = 41 \cdot 10$.
- B5 Error in decimal point.

Slips (-1)

- S1 Numerical errors (to max -3).

- (i) Patrick bought a car for €14 080 and sold it for €16 000.
Calculate his profit as a percentage of the selling price.

 (i) Profit: €16 000 – €14 080 = €1920

 Percentage of the selling price:

$$\frac{1920}{16000} \times 100 = 12\%$$

Profit: (5 marks)

- * Correct answer without work \Rightarrow 2 marks.
- * Incorrect answer without work \Rightarrow 0 marks.
- * $\frac{16000}{1920} + 100 = 8.3 + 100 = 108.3 \Rightarrow$ 2 marks.

Blunders (–3)

B1 Adds €14 080 to €16 000.

Slips (–1)

S1 Numerical errors in arithmetical operations.

Attempts (2 marks)

A1 Some indication of subtraction.

Percentage of selling price: (5 marks)

Blunders (–3)

B1 As percentage of cost price.

B2 Mishandles the calculation of profit as a percentage e.g. $\frac{16000}{1920} \times 100 = 833.3$.

B3 Error in decimal point.

B4 Illegal cancellation(s) in correct method of calculation of profit as a percentage.

Slips (–1)

S1 Numerical errors in arithmetical operations. (to a max –3).

Attempts (2 marks)

A1 Some use of 100 or of the given data or the calculated profit.

A2 "Profit"/"Selling Price" or "Profit"/"Selling Price" \times 100 and stops i.e. no substitution of values.

€6000 is invested at 5% per annum.
What is the amount of the investment at the end of one year?

✍ (ii)

1% = 60
5% = 300
Amount = €6300

$$I = \frac{P \times T \times R}{100} = \frac{6000 \times 1 \times 5}{100} = 300$$

Amount = €6300

6000×1.05
= 6300
Amount = €6300

6000 @ or + 5% = 300 (use of % button, calculator) ⇒ €6300 as total.

- * €300 (with work shown) and stops ⇒ 7 marks.
- * $6000 \times 5 = 30000$ and stops ⇒ 4 marks (B1 + B3).
- * $6000 \times 5 = 30000 + 6000 = 36000$ ⇒ 7 marks (B1).
- * Correct answer without work ⇒ 7 marks.
- * Incorrect answer without work ⇒ 0 marks.

Blunders (-3)

- B1 Mishandles 5%, e.g. 6000×5 or $6000 \div 5$ (6000 must be used).
- B2 Error in decimal point (once only).
- B3 Stops at interest i.e. fails to calculate amount.
- B4 Subtracts to calculate amount.
- B5 Incorrect substitution into formula and continues. [say $T = 2$: but 6000 must be used].
- B6 Illegal cancellation(s) in $\frac{6000 \times 1 \times 5}{100}$.
- B7 $6000 \times .05 = 300$ and stops.
- B8 $1.05 = 1.5$.

Slips (-1)

- S1 Numerical errors in arithmetical operations. (to a max -3)

Attempts (3 marks)

- A1 correct formula with or without substitution and stops.
- A2 some use of 100 in attempt to find percentage e.g. $5\% = \frac{5}{100}$ and stops.

3(c)

20(5, 5, 5, 5) marks

Att (2, 2, 2, 2)


Helen's weekly wage is €850.
 She pays income tax at the rate of 20% on the first €600 of her wage
 and income tax at the rate of 42% on the remainder of her wage.
 Helen has a weekly tax credit of €54.

Part (c) (i)

5 marks

Att 2

Calculate the tax payable at the rate of 20% on the first €600 of her wage.

<p> (i)</p> <p>1% = 6 20% = 120 Tax = €120.</p>	$\text{Tax} = \frac{600}{100} \times 20 = €120$	$600 \times 0.2 = €120.$
--	---	--------------------------

- * Correct answer without work \Rightarrow 2 marks.
- * Incorrect answer without work \Rightarrow 0 marks.

Blunders (-3)

- B1 Mishandles 20%, e.g. $600 \times 20 = 12000$ or $600 \div 20 = 30$.
- B2 Uses €850 instead of €600.
- B3 Error in decimal point.
- B4 Illegal cancellation(s) in correct method of calculation of tax.

Slips (-1)

- S1 Numerical errors in arithmetical operations. (to a max -3)

Attempts (2 marks)


- A1 Some use of 100 in attempt to find percentage e.g. $20\% = \frac{20}{100}$ and stops.

Part (c) (ii)

5 marks

Att 2

(ii) Calculate the tax payable at the rate of 42% on the remainder of her wage.

<p> (ii)</p> <p>Remainder of wage = €850 - €600 = €250</p>		
<p>1% = 2.5 42% = 105 Tax = €105</p>	$\text{Tax} = \frac{250}{100} \times 42 = €105$	$250 \times 0.42 = €105$

Blunders (-3)

- B1 Mishandles 42%, e.g. 250×42 or $250 \div 42$. (But no penalty if the error is as in Part (c) (i)).
- B2 Uses €850 or €600 instead of €250.
- B3 Error in decimal point.
- B4 Illegal cancellation(s) in correct method of calculation of tax.

Slips (-1)

- S1 Numerical errors in arithmetical operations. (to a max -3).

Attempts (2 marks)

- A1 Some use of 100 in attempt to find percentage e.g. $42\% = \frac{42}{100}$ and stops.

Part (c) (iii)

5 marks

Att 2

(iii)

Hence calculate Helen's gross tax.

(iii)

Helen's gross tax = €120 + €105 = €225

- * Incorrect answer without work \Rightarrow 0 marks.
- * Allow candidate's incorrect answers from parts **(i)** and **(ii)**.

Blunders (-3)

B1 €120 - €105 = €15.

B2 Misuse of tax credit.

Slips (-1)

S1 Numerical errors in arithmetical operations. (to a max -3).

Part (c) (iv)

5 marks

Att 2

(iv)

Calculate the tax payable by Helen.



(iv)

Tax payable = €225 - €54 = €171

- * No use of tax credit \Rightarrow 0 marks.
- * Incorrect answer without work \Rightarrow 0 marks.
- * Allow candidate's incorrect gross tax figure from Part **(iii)**.
- * 171 only \Rightarrow 2 marks.

Blunders (-3)

B1 Misuse of tax credit e.g. $225 + 54 = 279$.

Slips (-1)

S1 Numerical errors in arithmetical operations. (to a max -3)

QUESTION 4

Part (a)	10(5, 5) marks	Att (2, 2)
Part (b)	20(10, 10) marks	Att (3, 3)
Part (c)	20(5, 5, 5, 5) marks	Att (2, 2, 2, 2)

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

(i) If $x = 4$, find the value of: $5x + 3$



(i) $5x + 3 = 5(4) + 3 = 20 + 3 = 23$

- * $20 + 3 \Rightarrow 4$ marks.
- * Correct answer without work $\Rightarrow 2$ marks.
- * Incorrect answer without work $\Rightarrow 0$ marks.

Blunders (-3)

- B1 Incorrect numerical substitution for x and continues.
- B2 Leaves $5(4)$ in the answer.
- B3 Breaks order i.e. $[5(4 + 3) = 35]$.
- B4 $5(4)$ taken as 54 .

Slips (-1)

- S1 Numerical errors.(to a max -3).

Attempts (2 marks)

- A1 Substitution and stops e.g. $5(4)$ only.

Worthless (0)

- W1 Incorrect substitution for x and stops.

(ii) If $x = 4$, find the value of: $x^2 - x + 7$



(ii)

$$\begin{aligned} x^2 - x + 7 &= (4)^2 - 4 + 7 \\ &= 16 - 4 + 7 \\ &= 19 \end{aligned}$$

- * $16 - 4 + 7 \Rightarrow 3$ marks.
- * $16 - 4 + 7 = 16 - 11 = 5 \Rightarrow 4$ marks.
- * $12 + 7 \Rightarrow 4$ marks.
- * Correct answer without work $\Rightarrow 2$ marks.
- * Incorrect answer without work $\Rightarrow 0$ marks.

Blunders (-3)

- B1 Incorrect numerical substitution for x and continues.
- B2 Mishandles $(4)^2$ i.e. $(4)^2 = 8$ or leaves $(4)^2$ in answer.
- B3 Mishandles $-(4)$ i.e. $= 4$.
- B4 Breaks order i.e. $[16 - 1(4) = 15(4) = 60]$.
- B5 $-1(4)$ taken as $-1 + 4$.
- B6 $-1(4)$ clearly taken as -14 .

Slips (-1)

- S1 Numerical errors (to max -3).

Attempts (2 marks)

- A1 Substitution and stops i.e. $(4)^2 - (4) + 7$ only.
- A2 Incomplete substitution and continues or stops.
- A3 $4x$ substituted for x in both terms with x and continues or stops.

Part (b) (i)

10 marks

Att 3

(i) Multiply $(3x - 2)$ by $(4x + 5)$ and write your answer in its simplest form.



(i)

$$\begin{aligned}(3x - 2)(4x + 5) &= 3x(4x + 5) - 2(4x + 5) \\ &= 12x^2 + 15x - 8x - 10 \\ &= 12x^2 + 7x - 10.\end{aligned}$$

- * Correct answer without work \Rightarrow 7 marks.
- * Incorrect answer without work \Rightarrow 0 marks.

Blunders (-3)

B1 Each incorrect term or each term omitted on multiplication.

Slips (-1)

S1 Each incorrect term or each term omitted in final simplification. (to a max of -3)

Attempts (3 marks)

- A1 Any correct multiplication.
- A2 $3x(4x + 5) - 2(4x + 5)$ and stops.
- A3 $4x(3x - 2) + 5(3x - 2)$ and stops.

Worthless (0)

- W1 $(3x - 2) \pm (4x + 5)$ stops or continues.
- W2 Adding unlike terms before attempt at multiplication.

Part (b) (ii)

10 marks

Att 3

(ii) Write in its simplest form

$$(4x^2 - 3x + 7) + (x^2 - 2x - 8)$$



(ii)

$$(4x^2 - 3x + 7) + (x^2 - 2x - 8)$$

$$= 4x^2 - 3x + 7 + x^2 - 2x - 8$$

$$= 5x^2 - 5x - 1$$

* Stops after correct removal of brackets \Rightarrow 7 marks.

* Incorrect answer without work \Rightarrow 0 marks.

Blunders (-3)

B1 Each incorrect term or each term omitted on bracket removal.

Slips (-1)

S1 Each incorrect term or each term omitted in final simplification. (max -3)

Misreadings (-1)

M1 $(4x^2 - 3x + 7) \times (x^2 - 2x - 8)$. Apply B1 as each incorrect term or each term omitted on multiplication.

Attempts (3 marks)

A1 Any correct addition of a pair of like terms.

A2 $(4x^2 - 3x + 7) = 4x^2 - 3x + 7$ only or $(x^2 - 2x - 8) = x^2 - 2x - 8$ only.

A3 Treats as equation e.g. $4x^2 - x^2 - 3x + 2x + 7 + 8$.

Worthless (0)

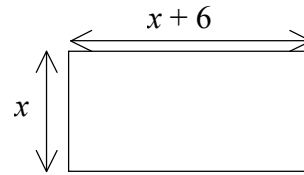
W1 Adding unlike terms before removal of brackets.

Part (c)

20 (5, 5, 5, 5) marks

Att (2, 2, 2, 2)

A rectangle has a length $(x + 6)$ cm and width x cm, as in the diagram



Part (c) (i)

5 marks

Att 2

(i) Find the perimeter of this rectangle in terms of x .



(i)

$$x + x + (x + 6) + (x + 6)$$

$$2(x + x + 6)$$

$$4x + 12$$

- * Accept either $x + x + (x + 6) + (x + 6)$ or $2(x + x + 6)$ for full marks.
- * If $x + x + (x + 6) + (x + 6)$ present give full marks for this section, irrespective of any subsequent errors within the section.
- * Brackets as above not required, accept $x + x + x + 6 + x + 6$.
- * Incorrect answer without work \Rightarrow 0 marks.
- * $4x + 12$ only \Rightarrow 2 marks.
- * $4x + 12$ and diagram as in Att 2 \Rightarrow 5 marks.

Blunders (-3)

B1 Adding only any two of the four sides required e.g. $x + (x + 6)$.

B2 $x \times (x + 6)$ or $x \times x$ or $(x + 6) \times (x + 6)$.

B3 $x + x + (x + 6)$.

B4 $x + (x + 6) + (x + 6)$.

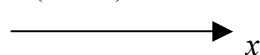
Slips (-1)

S1 Numerical errors. (max -3)

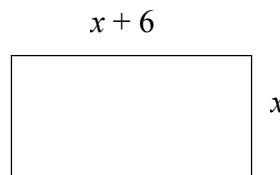
Attempts (2 marks)

A1 $P = 2(L + B)$ or $P = (L + B)$.

A2 Diagram as over:



x



Worthless (0)

W1 x only or $x + 6$ only.

$x + 6$

(ii) If the perimeter of the rectangle is 40 cm, write down an equation in x to represent this information.



(ii)

$$4x + 12 = 40.$$

- * Accept either $x + x + (x + 6) + (x + 6) = 40$ or $2(x + x + 6)$ or $4x + 12 = 40$ for full marks.
- * If $x + x + (x + 6) + (x + 6) = 40$ present give full marks for this section, irrespective of any subsequent errors within the section.
- * Accept candidate's incorrect perimeter from (c) (i) = 40 for full marks.

Blunders (-3)

B1 $x \times (x + 6) = 40$ [if not the candidate's expression above].

Slips (-1)

S1 An x or an $x + 6$ omitted in transcription from part (c) (i). (max -3)

Part (c) (iii)

5 marks

Att 2

(iii) Solve the equation that you formed in part (ii) above, for x .

	$x + x + (x + 6) + (x + 6) = 40$		
	$4x + 12 = 40$	$4x + 12 = 40$	
	(iii) $4x = 40 - 12$	$4x = 40 - 12$	$x + x + x + x = 40 - 6 - 6$
	$4x = 28$	$4x = 28$	$4x = 28$
	$x = 7$	$x = 7$	$x = 7$

- * Candidate's equation from (ii) must be progressed to the form " $ax = \dots$ " before any marks can be earned for this section.
- * $x = \frac{28}{4} \Rightarrow 4$ marks.
- * Correct Equation for part (ii) may be embedded in this section and would earn full marks for part (ii) if part (ii) is incorrect or vacant.
- * Correct answer without work $\Rightarrow 2$ marks.
- * Incorrect answer without work $\Rightarrow 0$ marks.

Blunders (-3)

B1 Error(s) in progressing equation (e.g. transposition).

B2 Adds 'x s to 'numbers' and continues e.g. $4x + 12 = 16x$.

Slips (-1)

S1 Errors in addition (to max -3).

S2 Error in division e.g. $x = \frac{28}{4} \Rightarrow x = 6$ (say).

S3 $\frac{28}{4}$ and stops.


Attempts (2 marks)

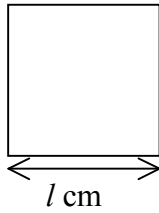
A1 $x + x + x + x = 40 - 6 - 6$ and stops.

A2 $4x$ only or 12 only appears and stops.

A3 Correct answer from arithmetical approach.

(iv) Find the area of the square with the same perimeter as the given rectangle.
Give your answer in cm^2 .

 (iv)



Perimeter of Square = $4l$

$$4l = 40$$

$$l = 10$$

$$\Rightarrow \text{Area of square} = 10 \times 10 = 100 \text{ cm}^2.$$

* Accept 100 as answer (no need for units).

* Correct answer without work \Rightarrow 2 marks.

Blunders (-3)

B1 $l \neq 10$ and continues.

Slips (-1)

S1 Numerical errors within correct approach (max-3).

Attempts (2 marks)

A1 $\frac{4x+12}{4}$ or $\frac{x+x+(x+6)+(x+6)}{4}$ and stops.

A2 Some use of 40 e.g. $(40)^2$ or $\sqrt{40}$.

Worthless (0)


W1 7×13 or $7 \times 13 = 91$.

QUESTION 5

Part (a)	10 marks	Att 3
Part (b)	20 (5, 5, 5, 5) marks	Att (2, 2, 2, 2)
Part (c)	20 (5, 5, 10) marks	Att (2, 2, 3)

Part (a) 10 marks Att 3

Solve the equation $5x - 6 = 3(x + 4)$

	$5x - 6 = 3x + 12$	(3 marks)
 (a)	$5x - 3x = 12 + 6$	(4 marks)
	$2x = 18$	(7 marks)
	$x = 9$	(10 marks)

- * $x = \frac{18}{2} \Rightarrow 9$ marks.
- * Correct answer without work $\Rightarrow 7$ marks.
- * Incorrect answer without work $\Rightarrow 0$ marks.

Blunders (-3)

- B1 Error in distributive law and continues, e.g. $3x + 4$ or $x + 12$ (once only).
- B2 Each error in progressing equation (e.g. transposition).

Slips (-1)

- S1 Error in division e.g. $x = \frac{18}{2} \Rightarrow x = 8$ (say).
- S2 Numerical errors (to max -3).
- S3 $\frac{18}{2}$ and stops.

Attempts (3 marks)

- A1 Adds or subtracts 'x's to 'numbers' and continues e.g. $5x - 6 = \pm x$ or $3(x + 4) = 3(5x) = 15x$.
- A2 $5x - 6 = 3x + 12$ and stops.
- A3 $3x$ appears and stops.
- A4 $5x = 3(x + 4) + 6$ and stops.

Worthless (0)

- W1 Adds or subtracts 'x's to 'numbers' and stops.

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

(i)	Factorise	$4ab + 8b$
------------	-----------	------------

(i)	$4b(a + 2)$
------------	-------------

* Accept $4(ab + 2b)$ or $b(4a + 8)$ or $2(2ab + 4b)$ for 5 marks.

Blunders (-3)

B1 An incorrect common factor.

B2 Stops after some correct effort at factorisation e.g. $4b(a) + 4b(2)$ or similar.

Slips (-1)

S1 Numerical errors when taking out a factor e.g. $4b(a + 4)$.


Attempts (2 marks)

A1 $4(ab)$ and /or $+8(b)$ or effort at brackets.

A2 Indication of common factor e.g. $4ab + 8b$.

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

(ii)	Factorise:	$ab + 2ac + 5b + 10c$
-------------	------------	-----------------------

	(ii) $ab + 2ac + 5b + 10c$ $a(b + 2c) + 5(b + 2c)$ $(b + 2c)(a + 5)$	$ab + 5b + 2ac + 10c$ $b(a + 5) + 2c(a + 5)$ $(a + 5)(b + 2c)$
---	---	--

* Correct answer without work \Rightarrow 2 marks.

* Incorrect answer without work \Rightarrow 0 marks.

Blunders (-3)

B1 Stops after first line of correct factorisation.

B2 Error(s) in factorising any pair of terms.

B3 Incorrect common factor and continues e.g. $a(b + 2c) + 5(b + c) = (b + 2c)(a + 5)$.
An instance of correct answer from incorrect work.

Slips (-1)

S1 $(b + 2c) \pm (a + 5)$.

S2 Correct second line of factorisation but gives $5a(b + 2c)$.

Attempts (2 marks)

A1 Pairing off, or indication of pairing off, and stops.

A2 Correctly factorises any pair and stops.

(iii) Factorise: $x^2 + 2x - 15$

(iii)

$$x^2 + 2x - 15$$

$$= x^2 + 5x - 3x - 15$$

$$= x(x + 5) - 3(x + 5) \quad (2 \text{ marks})$$

$$= (x + 5)(x - 3)$$

$$\begin{array}{ccc} x & & + 5 \\ & \searrow & \nearrow \\ & & \\ & \nearrow & \searrow \\ x & & - 3 \end{array} \Rightarrow (x + 5)(x - 3)$$

(2 marks)

- * Quadratic equation formula method is subject to *Slips* and *Blunders*.
- * Accept (with or without brackets) for 5 marks any of the following
 $(x + 5)$ and $(x - 3)$. (The word **and** is written down.)
 $(x + 5)$ or $(x - 3)$. (The word **or** is written down.)
- * Accept $(x + 5), (x - 3)$ for 5 marks.
- * Correct answer without work \Rightarrow 5 marks.

Blunders (-3)

- B1 Incorrect two term linear factors of $x^2 + 2x - 15$ formed from correct, but not applicable, factors of x^2 and ± 15 .
- B2 Correct cross method but factors not written.
- B3 $x(x + 5) - 3(x + 5)$ or $x(x - 3) + 5(x - 3)$ and stops.
- B4 Incorrect common factor and continues (applies to guide number method).

Slips (-1)

- S1 Uses quadratic equation formula, but has wrong signs in factors (once only).
- S2 Uses quadratic equation formula to find $x = -5$ and $x = 3$ and stops.
- S3 $(x + 5) \pm (x - 3)$.

Attempts (2 marks)

- A1 Correct factors of x^2 only.
- A2 Correct factors of -15 or $+15$ only.
- A3 $5x - 3x$ only appears.
- A4 Correct quadratic equation formula with or without substitution and stops.

(iv)	Factorise: $x^2 - y^2$
------	------------------------

(iv)	$(x + y)(x - y)$
------	------------------

- * Accept (with or without brackets) for 5 marks any of the following
 $(x + y)$ and $(x - y)$. [The word **and** is written down.]
 $(x + y)$ or $(x - y)$. [The word **or** is written down.]
- * Accept $(x + y), (x - y)$ for 5 marks.

Blunders (-3)

- B1 Incorrect two term linear factors of $x^2 - y^2$ formed from correct, but not applicable, factor of x^2 and $\pm y^2$.
- B2 $(y + x)(y - x)$.


Slips (-1)

- S1 Solves $x^2 = y^2$ to give $x = y$ and $x = -y$ and stops.
- S2 $(x + y) \pm (x - y)$.

Attempts (2 marks)

- A1 Correct factors of x^2 only.
- A2 Correct factors of y^2 or $-y^2$ only.
- A3 x or $\pm y$ appears.
- A4 $x^2 - y^2 = x.x - y.y$ and stops.
- A5 $(xy)(xy)$.
- A6 Mention of the difference of two squares.

- (i) Express $\frac{x+5}{4} + \frac{x+2}{3}$ as a single fraction.
Give your answer in its simplest form.

 (i)
$$\begin{aligned} & \frac{3(x+5) + 4(x+2)}{12} \\ &= \frac{3x+15+4x+8}{12} \\ &= \frac{7x+23}{12} \end{aligned} \quad (5 \text{ marks})$$

- * Adds numerators and then denominators i.e. $\frac{x+5}{4} + \frac{x+2}{3} = \frac{2x+7}{7} \Rightarrow 0$ marks.
- * All *Blunders* and *Slips* in the simplification of the numerator subject to a max. deduction (-3).
- * $\frac{3(x+5) + 4(x+2)}{12}$ and stops $\Rightarrow 2$ marks. (B3)
- * $\frac{3x+15+4x+8}{12}$ and stops $\Rightarrow 4$ marks. (S3)
- * $\frac{14x+46}{24} \Rightarrow 4$ marks. (S3)
- * $14x+46 \Rightarrow 3$ marks. (S1 and S3)

Blunders (-3)

- B1 Incorrect common denominator and continues.
- B2 Incorrect numerator from candidate's common denominator. e.g. $\frac{4(x+5) + 3(x+2)}{12}$.
- B3 No simplification of numerator.
- B4 Errors in distributive law. [See * 2]
- B5 Errors in sign when multiplying. [See * 2]

Slips (-1)

- S1 Correct common denominator implied.
- S2 Numerical errors in arithmetical operations.
- S3 Not in simplest form. [See * 4].

Attempts (2 marks)


- A1 12 only or a multiple of 12 only appears.
- A2 $\frac{5x}{4} + \frac{2x}{3} = \frac{15x+8x}{12}$.

Worthless (0)

- W1 $\left(\frac{x+5}{4}\right)\left(\frac{x+2}{3}\right)$ and stops.
- W2 $\frac{6x}{4} + \frac{3x}{3}$ and stops or $\frac{x+5}{4} + \frac{x+2}{3} = \frac{5x}{4} + \frac{2x}{3} = \frac{7x}{7} = x$.

(ii) Hence, or otherwise, solve the equation

$$\frac{x+5}{4} + \frac{x+2}{3} = \frac{5}{2}$$

<p> (ii)</p> $\frac{7x+23}{12} = \frac{5}{2}$ $14x+46 = 60$ $14x = 60 - 46$ $14x = 14$ $x = 1.$	$\frac{12(7x+23)}{12} = \frac{12(5)}{2}$ $7x+23 = 6(5)$ $7x+23 = 30$ $7x = 7$ $x = 1$	$\frac{7x+23}{12} - \frac{5}{2} = 0$ $\frac{2(7x+23) - 12(5)}{12} = 0$ $14x+46 - 60 = 0$ $14x - 14 = 0$ $14x = 14$ $x = 1$	$\frac{3(x+5) + 4(x+2) = 30}{12}$ $3x+15 + 4x+8 = 30$ $7x+23 = 30$ $7x = 30 - 23$ $7x = 7$ $x = 1$
--	---	--	--

* Candidate's equation must be of the form $\frac{ax+b}{c} = \frac{5}{2}$ if full marks are to be earned for this section.

* Correct trial and error \Rightarrow Att mark only.

* $\frac{x+5}{4} + \frac{x+2}{3} = \frac{5x}{4} + \frac{2x}{3} = \frac{7x}{7} = x$ from (i) and then $\frac{7x}{7} = \frac{5}{2}$ or $x = \frac{5}{2} \Rightarrow$ 2 marks.

* $\frac{5x}{4} + \frac{2x}{3} = \frac{15x+8x}{12}$ from (i) and then $\frac{15x+8x}{12} = \frac{5}{2}$ or $\frac{23x}{12} = \frac{5}{2} \Rightarrow$ 2 marks.

* $\frac{x+5}{4} + \frac{x+2}{3} = \frac{2x+7}{7}$ from (i) and then $\frac{2x+7}{7} = \frac{5}{2}$ etc can gain full marks.

* $\frac{x+5}{4} + \frac{x+2}{3} = \frac{5}{2} \Rightarrow 4x+20+3x+6=10$ etc \Rightarrow B2.

* $\frac{x+5}{4} + \frac{x+2}{3} = \frac{5}{2} \Rightarrow x+1.25+x+0.66=2.5$ etc \Rightarrow B2.

Blunders (-3)

B1 Error(s) in establishing an equation without fractions and continues.

B2 Error(s) in progressing equation (e.g. transposition).

Slips (-1)

S1 Error in division in final step to find x .

Attempts (2 marks)

A1 Adding unlike terms in progressing equation.

A2 Some effort at removal of fractions.

A3 Oversimplification e.g. $7x+23=5$ and continues.

A4 Oversimplification as a result of errors in part (i).

A5 Trial and error.

(iii) Solve for x and for y :

$$3x - y = 8$$

$$x + 2y = 5$$

(iii)	$\begin{array}{r} 3x - y = 8 \\ x + 2y = 5 \\ \hline 6x - 2y = 16 \\ x + 2y = 5 \\ \hline 7x = 21 \\ x = 3 \\ y = 1 \end{array}$	$\begin{array}{r} 3x - y = 8 \\ x + 2y = 5 \\ \hline 3x - y = 8 \\ 3x + 6y = 15 \\ \hline -7y = -7 \\ y = 1 \\ x = 3 \end{array}$	$\begin{array}{r} y = 3x - 8 \\ x + 2(3x - 8) = 5 \\ x + 6x - 16 = 5 \\ 7x = 5 + 16 \\ 7x = 21 \\ x = 3 \\ y = 1 \end{array}$
-------	--	---	---

- * Apply only one blunder deduction (B1 or B2) to any error(s) in establishing the first equation in terms of x only or the first equation in terms of y only.
- * Finding the second variable is subject to a maximum deduction (-3).

Blunders (-3)

- B1 Error(s) in establishing the first equation in terms of x only [$7x = 21$] or the first equation in terms of y only [$-7y = -7$] through elimination by cancellation.
- B2 Error(s) in establishing the first equation in terms of x only or the first equation in terms of y only through elimination by substitution.
- B3 Errors in transposition in solving the first one variable equation.
- B4 Errors in transposition when finding second variable.
- B5 Incorrect substitution when finding second variable.
- B6 Finds one variable only.

Slips (-1)

- S1 Numerical errors (max -3) in solving first one variable equation and when finding second variable.

Attempts (3 marks)


- A1 Attempt at transposition and stops.
- A2 Multiplies either equation by some number and stops.
- A3 Correct answers without algebraic work.

QUESTION 6

Part (a)	10 (5, 5) marks	Att (2,2)
Part (b)	30 (20, 10) marks	Att (7,3)
Part (c)	10 (5, 5) marks	Att (2,2)

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

(i)	$f(x) = 5x - 6.$	Find: $f(3)$
------------	------------------	--------------

	(i)	$f(3) = 5(3) - 6$	
		$= 15 - 6$	(4 marks)
		$= 9$	(5 marks)

- * Function concept correct:
 $f(3) = 5(3) - 6$ or $f(2) = 15 - 6$ i.e. multiplication of 3 by 5 is clearly indicated or is implied by subsequent work.
 Completion of $f(3)$ subject to maximum deduction of -1.
- * Correct function concept i.e. $5(3) - 6$ and stops \Rightarrow 4 marks.
- * Ignores x giving $5 - 6 = -1 \Rightarrow$ 0 marks.
- * $3[f(x)] = 15x - 18 \Rightarrow$ 0 marks.
- * Correct answer without work \Rightarrow 2 marks.

Blunders (-3)

B1 $f(3)$ incorrect: misunderstanding of the concept of a function.

Misreadings (-1)

M1 $f(-3)$ instead of $f(3)$.

Slips (-1)

S1 Numerical errors (to max -1).

Attempts (2 marks)

A1 Treats as equation and continues or stops.

Part (a) (ii)

5 marks

Att 2



(ii)

$$f(x) = 5x - 6.$$

$$f(-2)$$



(ii)

$$f(-2) = 5(-2) - 6$$

$$= -10 - 6$$

$$= -16$$

(5 marks)

- * Function concept correct:
 $f(-2) = 5(-2) - 6$ or $f(-2) = -10 - 6$ i.e. multiplication of -2 by 5 is clearly indicated or is implied by subsequent work.
Completion of $f(-2)$ subject to maximum deduction of -1 .
- * Correct function concept i.e. $5(-2) - 6$ and stops $\Rightarrow 4$ marks.
- * Ignores x giving $5 - 6 = -1 \Rightarrow 0$ marks.
- * $-2[f(x)] = -10x + 12 \Rightarrow 0$ marks.
- * Correct answer without work $\Rightarrow 2$ marks.

Blunders (-3)

B1 $f(-2)$ incorrect: misunderstanding of the concept of a function.

Misreadings (-1)

M1 $f(2)$ instead of $f(-2)$.

Slips (-1)

S1 Numerical errors and sign errors (to max -1).

Attempts (2 marks)

A1 Treats as equation and continues or stops.

Draw the graph of the function

$$f: x \rightarrow x^2 + x - 3$$

in the domain $-3 \leq x \leq 2$, where $x \in \mathbf{R}$.

$$\begin{aligned} f(-3) &= (-3)^2 + (-3) - 3 = 3 \\ f(-2) &= (-2)^2 + (-2) - 3 = -1 \\ f(-1) &= (-1)^2 + (-1) - 3 = -3 \\ f(0) &= (0)^2 + (0) - 3 = -3 \\ f(1) &= (1)^2 + (1) - 3 = -1 \\ f(2) &= (2)^2 + (2) - 3 = 3 \end{aligned}$$

or

x	-3	-2	-1	0	1	2
x^2	9	4	1	0	1	4
x	-3	-2	-1	0	1	2
-3	-3	-3	-3	-3	-3	-3
$f(x)$	3	-1	-3	-3	-1	3

Table**20 marks****Att 7**

* Each individual error in the rows other than the $f(x)$ row, apart from *Blunders* below, attracts a deduction of -1 subject to a maximum deduction of -3 per row. [$f(x)$ max(-6)]

Blunders (-3)

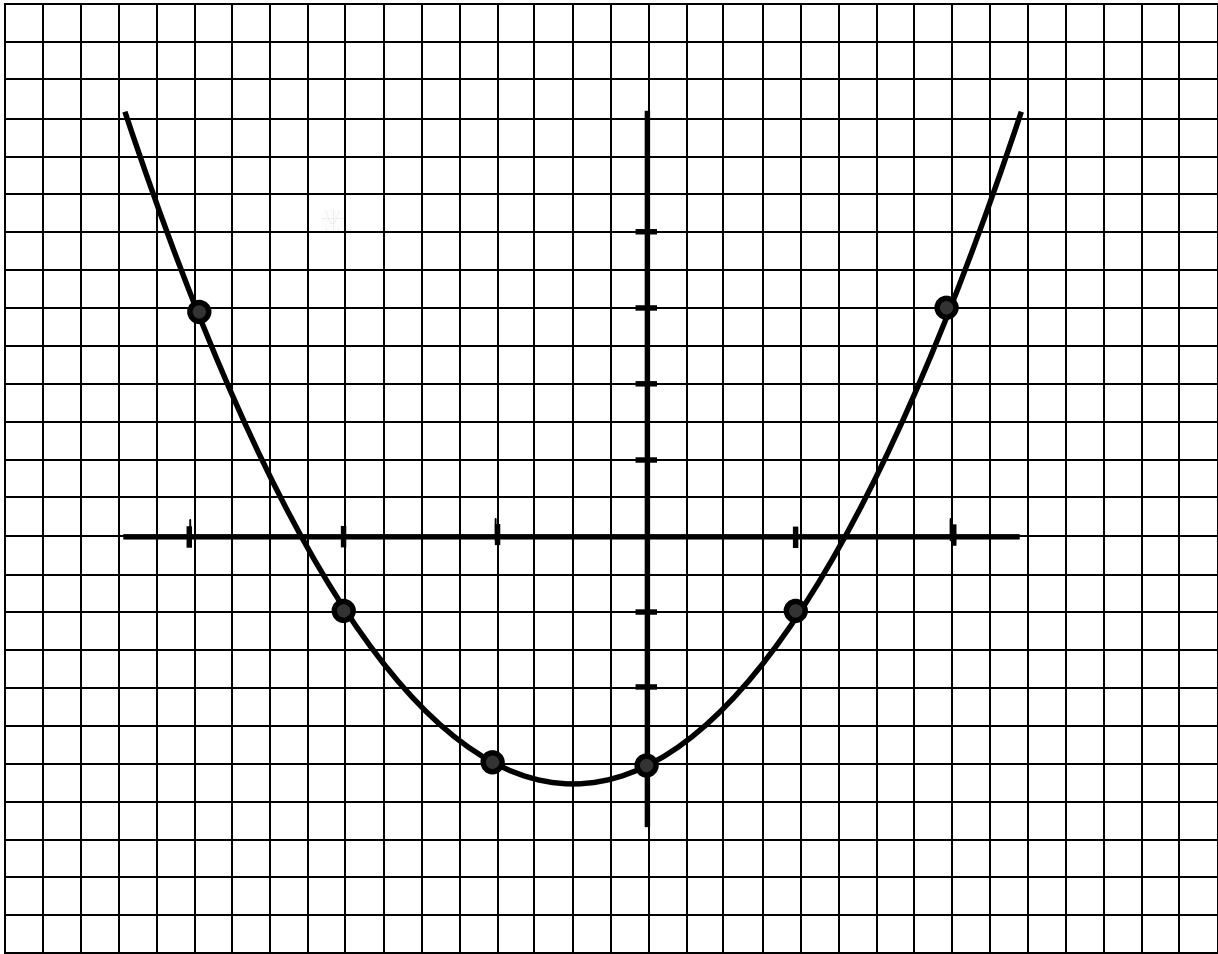
- B1 x^2 taken as $2x$ all the way. [In row headed x^2 by candidate]
- B2 x taken as $-x$ all the way. [In row headed x by candidate]
- B3 -3 calculated as $-3x$ all the way. [In row headed -3 by candidate]
- B4 Adds in top row when evaluating $f(x)$.
- B5 Omits '-3' row or omits 'x' row.
- B6 Omits a value in the domain each time to max of -9 (5 values missing \Rightarrow Att 7).
- B7 Each incorrect image without work.

Slips (-1)

- S1 Numerical *Slips* (to max -3) in any row other than $f(x)$ row.
- S2 Misreads '-3' as '+3' and places '+3' in the table or '+x' as '-x' and places '-x' in the table.
- S3 Each incorrect $f(x)$ value calculated by addition within columns in student's table (no limit). But note B4.

Attempts (7 marks)

- A1 Omits x^2 row from table or treats x^2 as x .
- A2 Table with only $f(x) = x^2$.
- A3 Any effort at calculating point(s).
- A4 One point only calculated and nothing else.



- * Att 7 + Att 3 \Rightarrow one point only calculated and graphed correctly.
- * Correct graph but no table \Rightarrow full marks, i.e. 30 marks.
- * Accept reversed co-ordinates (i) if axes not labelled or (ii) if axes are reversed to compensate (see B1 below).

Blunders (-3)

- B1 Reversed co-ordinates plotted against non-reversed axes (once only) [See 3rd *].
- B2 Axes not graduated uniformly (once only).
- B3 Points not joined or joined in incorrect order (once only).

Slips (-1)

- S1 Each point of candidate graphed incorrectly.
- S2 Each point from table not graphed (subject to N1).

Attempts (3 marks)

- A1 Graduated axes only (need not be labelled).

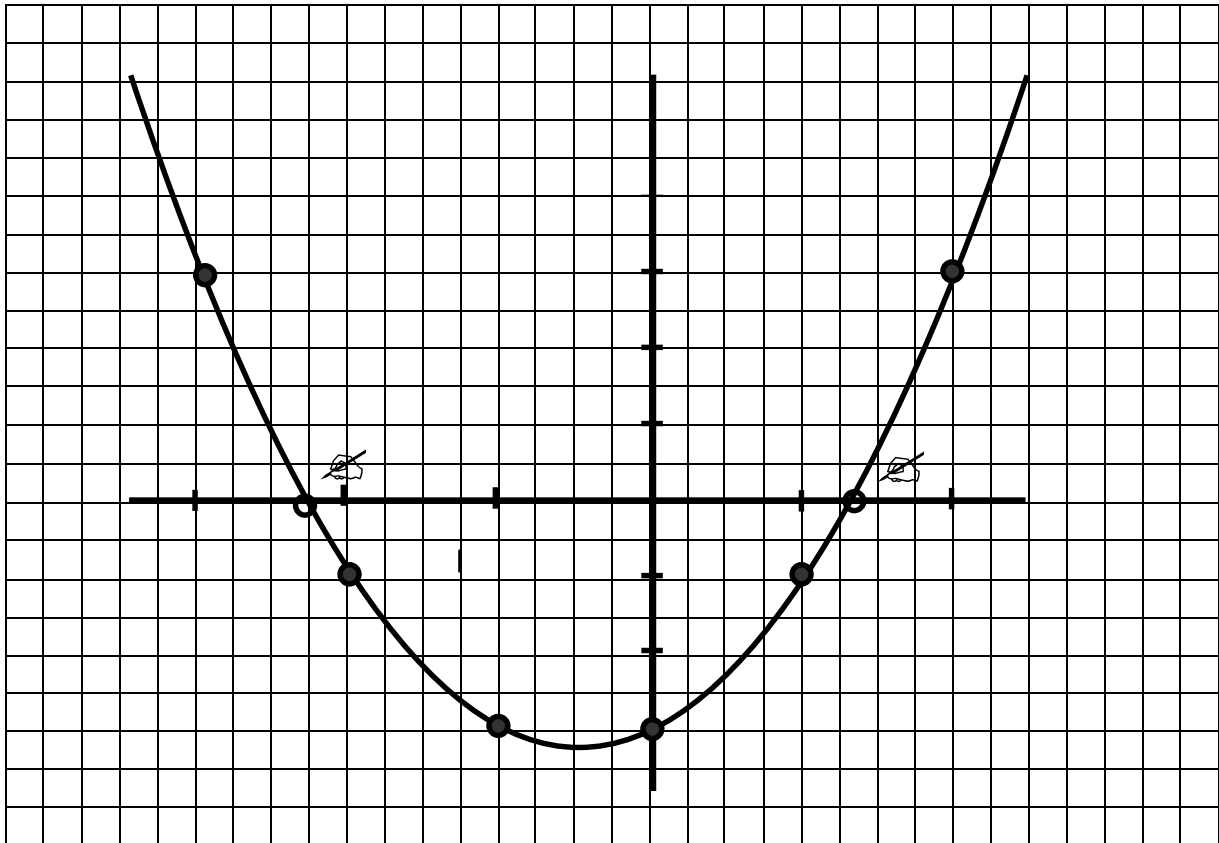
Use the graph drawn in 6(b) to estimate:

(i) the values of x for which $f(x) = 0$.

 (i)

Work to be shown on graph and answers written here.

$x = -2.3$ or $x = 1.3$



- * Correct answer (clearly consistent with graph) inside tolerance without graphical indication \Rightarrow 2 marks.
- * A candidate's incorrect graph can earn up to full marks for this section. [Use similar tolerances]

Blunders (-3)

- B1 Answer on diagram but outside of tolerance (± 0.25).
- B2 Fails to write down the answers.
- B3 Only one answer or indication.

Attempts (2 marks)

- A1 Algebraic evaluation.

Worthless (0)

- W1 Answers outside of tolerance without graphical indication.
- W2 $f(0)$ giving -3 as answer.

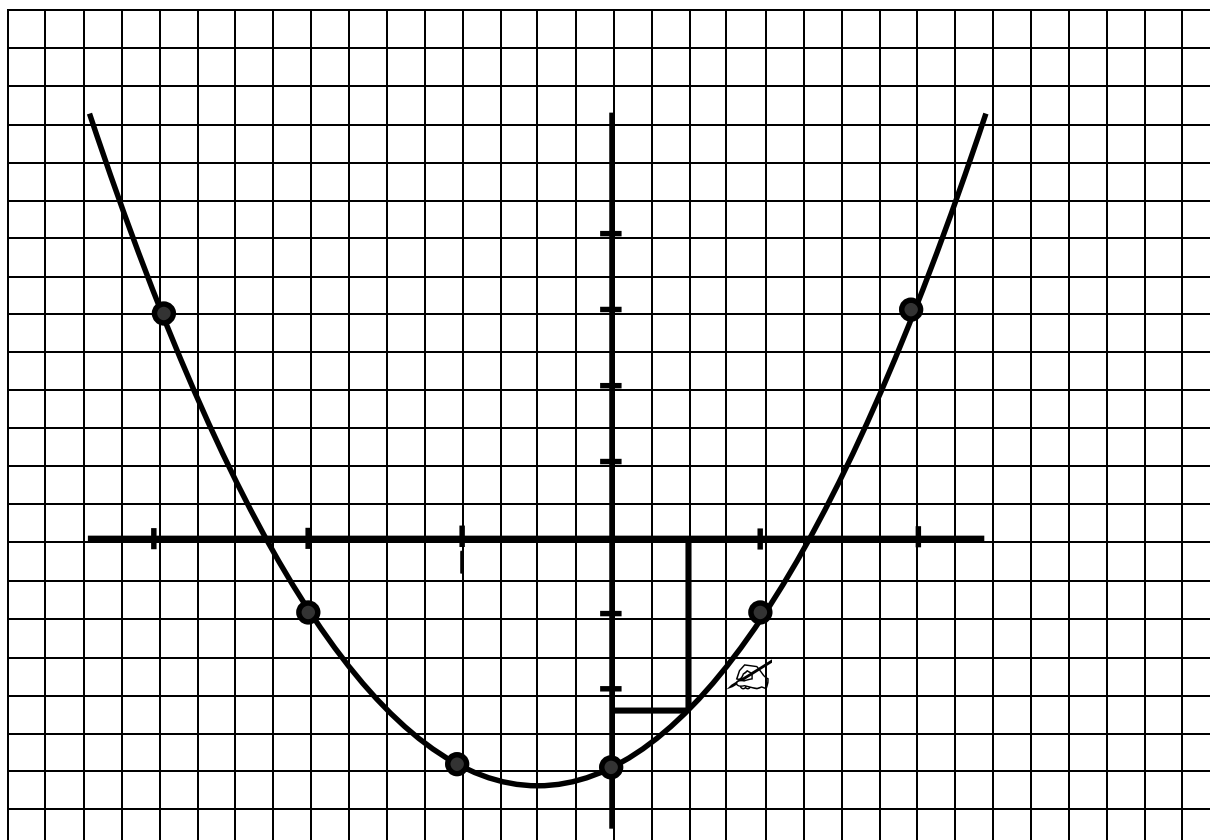
Use the graph drawn in 6(b) to estimate:

(ii) the value of $f(x)$ when $x = 0.5$.



(ii) Work to be shown on graph and answers written here

$$f(0.5) = -2.25$$



* Correct answer (clearly consistent with graph) inside tolerance without graphical indication
 \Rightarrow 2 marks.

* A candidate's incorrect graph can earn up to full marks for this section.
 (Use similar tolerances)

Blunders (-3)

B1 Answer on diagram but outside of tolerance (± 0.25).

B2 Fails to write down the answer.

Attempts (2 marks)

A1 Algebraic evaluation or calculator.

Worthless (0)

W1 Answer outside of tolerance without graphical indication.