



Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION

2009

MARKING SCHEME

**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.

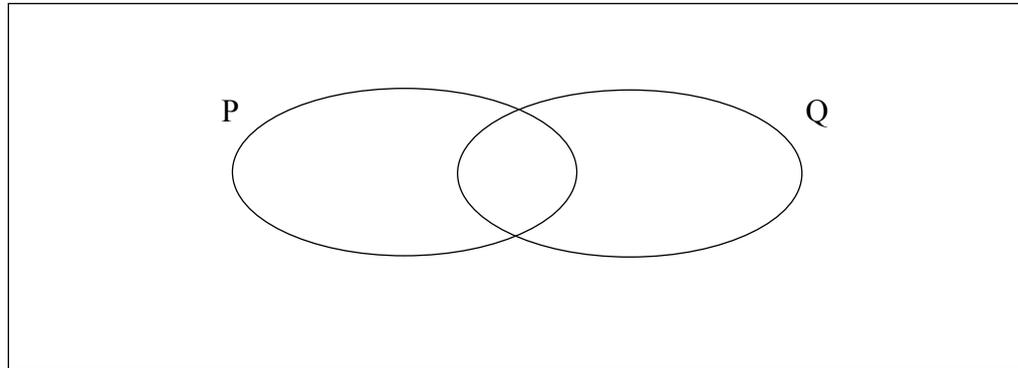
QUESTION 1

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

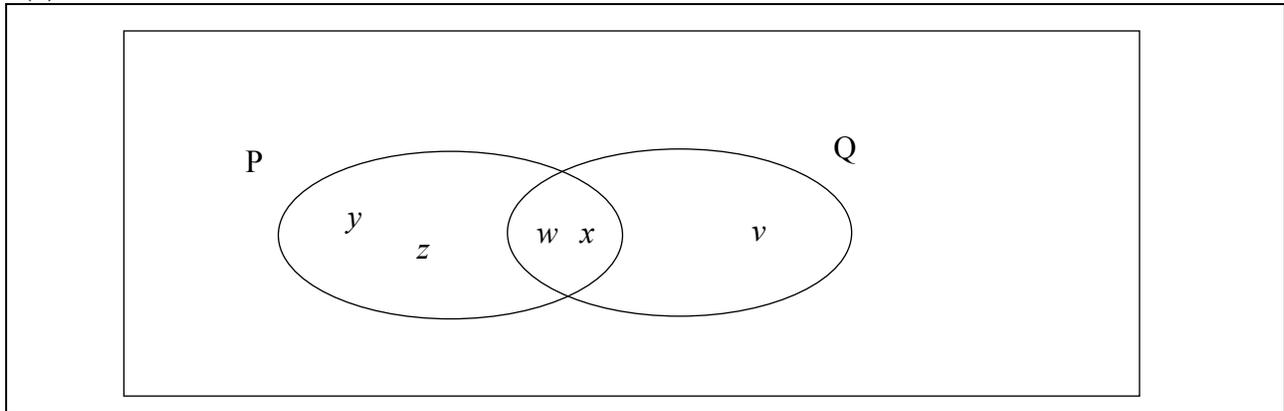
Part (a) **10 marks** **Att 3**

$$P = \{w, x, y, z\} \quad Q = \{v, w, x\}$$

Fill the elements of P and Q into the following diagram.



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



* • Not necessary

Slips (-1)

S1 Each element incorrectly filled into the diagram

S2 Each element omitted from the diagram but see W1

S3 Each unlisted element used

Misreadings (-1)

M1 Interchanging P and Q totally

Attempts (3 marks)

A1 Totally incorrect filling of the Venn diagram using given elements

Worthless

W1 No filling in of the Venn diagram or use of unlisted elements only

(b)

20(5,5,5,5) marks

Att 2,2,2,2

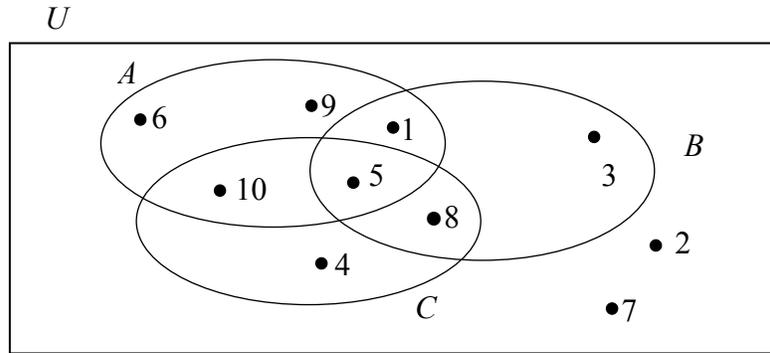
(b)

U is the universal set.

$$A = \{1, 5, 6, 9, 10\}$$

$$B = \{1, 3, 5, 8\}$$

$$C = \{4, 5, 8, 10\}$$



(i) List the elements of $B \cup C$.

(ii) List the elements of A' , the complement of the set A .

(iii) List the elements of $(B \cap C) \setminus A$.

(iv) Write down $\#B$.

(b)(i)

5 marks

Att 2

$$B \cup C = \{1, 3, 4, 5, 8, 10\}$$

Blunders (-3)

B1 Any incorrect set of the elements of B and C other than the misreading as below

Misreadings (-1)

M1 $B \cap C$ giving $\{5, 8\}$

Attempts (2 marks)

A1 2, 6, 9 or 7 appear in the answer

(b) (ii)

5 marks

Att 2

$$A' = \{2, 3, 4, 7, 8\}$$

Blunders (-3)

B1 Any incorrect set of elements of A' other than the misreadings below.

Misreadings (-1)

M1 $A \setminus B$ giving $\{6, 9, 10\}$. $A \setminus C$ giving $\{6, 9, 1\}$ or $A \setminus (B \cup C)$ giving $\{6, 9\}$.

Attempts (2 marks)

A1 2, 4, 7, 8 or 3 appear in the answer.

A2 A or any proper subset of A

(b) (iii)

5 marks

Att 2

$$(B \cap C) \setminus A = 8$$

Blunders (-3)

B1 Any incorrect set of elements of A and B and C other than the misreading as below.

Misreadings (-1)

M1 $(B \cup C) \setminus A$ giving $\{3, 4, 8\}$, $A \setminus (B \cap C)$ giving $\{1, 6, 9, 10\}$

Attempts (2 marks)

A1 2 or 7 appear in the answer.

(b) (iv)

5 marks

Att 2

$$\#B = 4$$

Blunders (-3)

B1 Any incorrect cardinal number of $B \leq 10$ other than the misreading as below.

Misreadings (-1)

M1 Set B giving $\{1, 3, 5, 8\}$.

M2 $\#B = 6$ i.e. $\#B'$

Attempts (2 marks)

A1 Some understanding of notation e.g. Cardinal numbers or number of elements

A2 $\#B = 17$ or 120

Worthless

W1 Any number greater than 10, but see A2

Part(c)

20(10,5,5) marks

Att3,2,2

1(c) In a survey, a group of students were asked if they were studying French or German at school.

80 of these students said they were studying French (F).

24 of these students said they were studying German (G).

15 of these students said they were studying both French and German.

11 of these students said they were studying neither of the two languages.

(i) Represent this information in the Venn diagram below.

(ii) How many students were in the group?

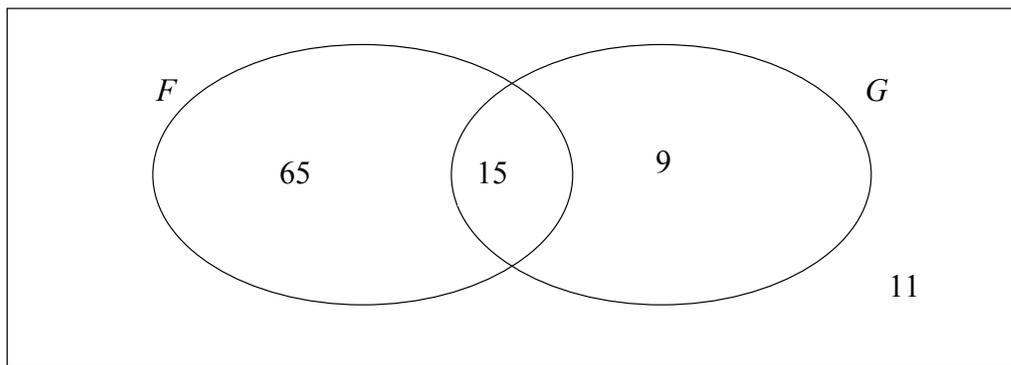
(iii) How many students did not study German?

(c)(i)

10 marks

Att 3

(c)(i)



* .Failing to subtract 15 from 80 and/or 24 is one blunder only(-3)

Blunders (-3)

B1 Each incorrect or omitted entry but see S1 and M1 below and * above

Slips (-1)

S1 Numerical errors, where work is clearly shown to a max of 3

Misreadings (-1)

M1 Interchanges French and German

Attempts (3 marks)

A1 Any one correct relevant entry

(c)(ii)

5 marks

Att 2

c(ii)	$65 + 15 + 9 + 11 = 100$
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- * Any correct answer written here in the space provided takes precedence over an incorrect Venn diagram (Subject to S1)
- * Accept candidate's work from previous part c(i)

Blunders (-3)

- B1 Any incorrect use of the given numbers or the numbers from an incorrect Venn diagram (Subject to S1)
- B2 Number of students = $11+15+24+80 = 130$

Slips (-1)

- S1 Numerical errors where work is clearly shown, to a max of 3
- S2 Fails to finish

Attempts (2 marks)

- A1 Any one correct relevant sum where work is clearly shown

Worthless

- W1 Incorrect answer with no work shown

(c)(iii)

5 marks

Att 2

c(iii)	$65 + 11 = 76$ or $100-24$
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- * Any correct answer written here in the space provided takes precedence over an incorrect Venn diagram (Subject to M1)
- * Accept candidate's work from previous part c(i)

Blunders (-3)

- B1 Any incorrect use of the given numbers or the numbers from an incorrect Venn diagram (Subject to S1)

Slips (-1)

- S1 Numerical errors, where work is clearly shown to a max of 3
- S2 Fails to finish.

Misreadings (-1)

- M1 German read as French (Ans. = 20).

Attempts (2 marks)

- A1 Mention of 65 or 11 or candidate's work from c(i)

Worthless

- W1 Incorrect answer with no work shown

QUESTION 2

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

Part (a)	10 marks	Att 3
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(a) 9 metres of cloth cost €13.95. Find the cost of 20 metres of the same cloth.

(a)	10 marks	Att 3
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Method (1)	Method (2)	Method (3)	Method (4)
$9m = 13.95$	$9:20$	$9:20 = 13.95:x$	$\frac{13.95}{9} \times 20$
$1m = \frac{13.95}{9} = 1.55$	$\frac{13.95}{9} = 1.55$	$\frac{9}{20} = \frac{13.95}{x}$	1.55×20
$20m = 1.55 \times 20 = 31$	$1.55 \times 20 = 31$	$9x = 13.95 \times 20 = 279$	31
		$x = \frac{279}{9} = 31$	

* Correct answer without work \Rightarrow 7 marks

* **Special Case** $\frac{9}{20} \times 13.95 = 6.2775 \Rightarrow$ 7 marks

* Stops at 1.55 or $\frac{13.95}{9} [=1.55] \Rightarrow$ 4 marks (no use of 20(-3) and B4 or B5)

* Stops at $13.95 \times 20 [= 279] \Rightarrow$ 4 marks (no use of 9 and possible slips)

* Incorrect answer without work \Rightarrow 0 marks except 279, 155 or equivalent $\left(\frac{31}{20}\right)$

Blunders (-3)

B1 Divisor $\neq 9$ and continues but see 2nd *

B2 Incorrect multiplier i.e. $\neq 20$ and continues but see 2nd *

B3 $20 : 9 = 13.95 : x$ and continues

B4 Error in decimal point (once only)

B5 Fails to finish

Slips (-1)

S1 Numerical errors where work is clearly shown to a max of 3

Attempts (3 marks)

A1 Indicates $\frac{20}{9}$ or $9 : 20$ or $13.95 : x$, only, and stops

A2 279 or 1.55 or $\left(\frac{21}{20}\right)$, **only**, appears

A3 $\frac{1}{9}$ only appears

A4 13.95×9 or $13.95 \div 20$ and stops or continues

A5 13.95 is multiplied or divided by any wrong number correctly

Worthless

W1 $13.95 + 9 = 22.95$ or similar

Part (b)

20(5,10,5) marks

Att 2,3,2

- (i) Simplify $\frac{a^9 \times a^3}{a^6 \times a^2}$, giving your answer in the form a^n , where $n \in \mathbb{N}$.
- (ii) By rounding each of these numbers to the nearest whole number, estimate the value of $\frac{18 \cdot 207}{3 \cdot 7 + 2 \cdot 08}$.
- (iii) Using a calculator, or otherwise, find the exact value of $\frac{18 \cdot 207}{3 \cdot 7 + 2 \cdot 08}$.



(b)(i)

5 marks

Att 2

(i) $\frac{a^9 \times a^3}{a^6 \times a^2} = \frac{a^{12}}{a^8} = a^4$ or $\frac{a^9 \times a^3}{a^6 \times a^2} = a^3 \times a = a^4$

or $\frac{a^9 \times a^3}{a^6 \times a^2} = \frac{a \ a \ a \ a \ a \ a \ a \ a \ a \ a \ a \ a}{a \ a \ a \ a \ a \ a \ a} = a^4$

- * $\frac{a^{12}}{a^8}$ and stops \Rightarrow 2 marks
- * a^{12} and stops \Rightarrow 2 marks
- * Correct answer without work \Rightarrow 2 marks
- * $a^3 \times a$ and stops \Rightarrow 2 marks
- * $a \times a \times a \times a$ as answer \Rightarrow 2 marks

Blunders (-3)

- B1 Correct answer, without work
- B2 Each error in calculation involving indices
- B3 Each incorrect number of a's in the extended form
- B4 Each incorrect elimination of a's in the extended form

Slips (-1)

S1 $\frac{a^{12}}{a^8} = 4$ or $\frac{1}{a^{-4}}$ as final answer

Attempts (2 marks)

- A1 Some correct manipulation of indices

Worthless

- W1 Incorrect answer with no work shown

(b)(ii)

10 marks

Att 3

$\frac{\boxed{18}}{\boxed{4} + \boxed{2}} = \frac{\boxed{18}}{\boxed{6}} = \boxed{3}$

* $\frac{18}{4+2}$ and stops \Rightarrow 4 marks.

* No penalty if the intermediate step between approximations and correct final answer is not shown i.e. $\frac{18}{6}$ not shown

* Special Case: $\frac{18.207}{3.7+2.08} = 3.15$ or $\left(\frac{63}{20}\right)$ – presented in this part \Rightarrow Attempt 3 marks.

* $\frac{18}{6}$ and stops \Rightarrow 7 marks.

Blunders (-3)

B1 Error(s) in rounding off to the nearest whole number (once only)

B2 Decimal error in calculation of final value

B3 An arithmetic operation other than indicated

B4 Error(s) in the manipulation of the denominator

B5 Incorrect cancellation

Slips (-1)

S1 Numerical errors to a max of 3

Attempts (3 marks)

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

A2 Ans. 3 with no preceding rounding off

Worthless (0)

W1 Incorrect answer without work

(b)(iii)

5 marks

Att 2

$\frac{18.207}{5.78} = 3.15 \text{ or } \left(\frac{63}{20}\right)$

* **Any of the following:** 7.00081081 13.6741762 2.365774428 11.23888889
 10.23528649 or 12.45336538 **merit 2 marks (with or without work)**

Blunders (-3)

B1 Decimal error

B2 Fails to finish

Slips (-1)

S1 Numerical errors to a max of 3

S2 Any rounding off.

Attempts (2 marks)

A1 Any correct relevant calculation and stops.

e.g. $\frac{18.207}{3.7} = 4.9208$ or similar

Worthless (0)

W1 Incorrect answer without work but see *

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

- 2(c) (i)** Using a calculator, or otherwise, write $\frac{1}{8}$ and $\frac{13}{80}$ as decimals.

Hence or otherwise, put the following numbers in order, starting with the smallest and finishing with the largest:

$$\frac{1}{8}, \frac{13}{80}, 0.1525.$$

- (ii)** Using a calculator, or otherwise, find the exact value of $(3 \cdot 61)^{\frac{1}{2}}$.

- (iii)** Using a calculator, or otherwise, evaluate

$$\sqrt{94 \cdot 09} \times (2 \cdot 75)^2 - \frac{1}{0 \cdot 3125}.$$

Give your answer correct to two decimal places.

* Note: $\frac{1}{8} = 0.125$. or $\frac{13}{80} = 0.1625$. merits 4 marks.

(c)(i)**10marks****Att 3**

$$\frac{1}{8} = 0.125$$

$$\frac{13}{80} = 0.1625$$

$$\frac{1}{8}$$

0.1525

$$\frac{13}{80}$$

* Accept: 0.125, 0.1525, 0.1625, merits **10** marks.

* Note: $\frac{1}{8} = 0.125$ or $\frac{13}{80} = 0.1625$ merits **4** marks

Blunders (-3)

B1 Fails to write a fraction as a decimal (each time)

B2 Writes fraction as incorrect decimal (each time)

B3 Decimal error (once only if consistent)

B4 Inverts fraction and continues. (each time)

B5 Incorrect order or fails to order.

Attempts (3 marks)

A1 $0.1525 = \frac{1525}{10000}$ and stops

A2 Attempt at ordering

Worthless(0)

W1 Nothing correct

(c)(ii)

5 marks

Att 2

$$1.9 \text{ or } \left(\frac{19}{10}\right)$$

Blunders (-3)

- B1 Squares
- B2 Decimal error

Attempts (2 marks)

- A1 mentions square root or power

Worthless(0)

- W1 Dividing by 2 or multiplying by 2

(c)(iii)

5 marks

Att 2

$$9.7 \times 7.5625 - 3.2 = 70.15625 = 70.16$$

- * answer 70.15625 \Rightarrow 2 marks
- * answer 70.15625 = 70.16 \Rightarrow 5 marks
- * $\left[\frac{2245}{32}\right]$ as final answer \Rightarrow 0 marks but = 70.15625 \Rightarrow 4 marks
- * Ans 70.15 (no work shown) \Rightarrow 2 marks

Blunders (-3)

- B1 Correct answer, without work ✍
- B2 Decimal error
- B3 Inverts fraction
- B4 Incorrect operator

Slips (-1)

- S1 Numerical errors to a max of 3
- S2 Fails to give answer to 2 dec. places
- S3 Each premature rounding off, that effects final answer,(to a maximum of 3marks)

Attempts (2 marks)

- A1 Any relevant step. e.g. Partial long division or similar

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) Aideen owns 6000 shares in a certain company.
She sells two-thirds of her shares.
How many shares does she now own in the company?

(a) **10 marks** **Att3**



$$6000 \div 3 = 2000$$

or

Number of shares sold: $6000 \times \frac{2}{3} = 4000$

Shares now owned: $6000 - 4000 = 2000$

Blunders (-3)

- B1 Correct answer without work
- B2 $6000 \div \frac{2}{3}$
- B3 Calculates the number of shares sold and stops
- B4 Operation other than subtraction in final step

Slips (-1)

- S1 Numerical errors (to max -3)
- S2 Early rounding off

Attempts (3 marks)

- A1 Any attempt at getting $\frac{2}{3}$ of 6000
- A2 Writes down $\frac{1}{3}$ or $\frac{6000}{2} = 3000$

Part (b)

20(10,10) marks

Att 3,3

- (i) Brian's gross annual pay is €26 000. His annual tax credit is €2800. He pays income tax at the rate of 20%. What is his annual take-home pay?
- (ii) A dealer buys a car for €17 500. He sells the car for €23 800. Calculate his profit as a percentage of the cost price.

(b)(i)

10 marks

Att 3

- (i) Brian's gross annual pay is €26 000. His annual tax credit is €2800. He pays income tax at the rate of 20%. What is his annual take-home pay?

(b)(i)

10 marks

Att 3

Gross Pay	€26 000
Tax @ 20%	5200
Tax Credit	€2800
Tax Due	2400
Take-home Pay	23600

 $\frac{26000 \times 20}{100} = 5200$ $5200 - 2800 = 2400$ $26000 - 2400 = 23600$

* Finds Tax Due 2400 and stops \Rightarrow 7 marks (at least 2 out of 3 boxes filled in)

Blunders (-3)

- B1 Correct answer, without work.
B2 Mishandles 20% of 26,000. {Must use 26,000}
B3 Decimal error
B4 Misuse of Tax Credit
B5 Incorrect use of Tax Amount e.g. 26000 + 5200
B6 Fails to finish. {B4 may apply}

Slips (-1)

- S1 Numerical errors to a max of 3

Attempts (3 marks)

- A1 Some use of 100 in attempt to find percentage e.g. 20% = 20/100 and stops.

Worthless (0)

- W1 Incorrect answer without work

(b) (ii)

10 marks

Att 3

(b) (ii) A dealer buys a car for €17 500. He sells the car for €23 800.
Calculate his profit as a percentage of the cost price.



(b)(ii)

10 marks

Att 3

 $23800 - 17500 = 6300$ $\frac{6300}{17500} \times 100 = 36\%$
or Method 2: $\frac{23800}{17500} \times 100 = 136 \Rightarrow 136 - 100 = 36\%$

* Answer 6300 \Rightarrow 4 marks

* $\frac{6300}{100} \times 17500 = 1102500 \Rightarrow$ 7 marks

Blunders (-3)

B1 Correct answer without work

B2 Adds €17 500 to €23 800.

B3 Calculates profit as percentage of selling price.

B4 Divisor not equal to 17500

B5 Mishandles the calculation of profit as a percentage e.g. $\frac{6300}{100} \times 17500$

B6 Incorrect cancellation(s)

B7 Fails to multiply by 100

B8 Fails to finish

Slips (-1)

S1 Numerical errors to a max of 3

Attempts (3 marks)

A1 Some indication of subtraction

A2 Some use of 100

Part (c)**20(10,10) marks****Att 3,3**

3(c) (i) €20 000 is invested at 5.2% per annum.
What is the amount of the investment at the end of one year?

(ii) €5000 is withdrawn from this amount at the beginning of the second year.
The interest rate for the second year is 6.25% per annum.
What is the amount of the investment at the end of that year?

(c)(i)**10 marks****Att3**

$\frac{20000 \times 5.2}{100} = 1040$ $20000 + 1040 = \text{€}21040$ <i>or</i> $20000 \times 1.052 = 21040$		
<i>or</i> $1\% = \frac{20000}{100}$ $5.2\% = \frac{20000}{100} \times 5.2$ Interest = 1040 Amount = 20000 + 1040 Amount = 21040	<i>or</i> $I = \frac{P \times R}{100}$ $I = \frac{20000}{100} \times 5.2$ Interest = 1040 Amount = 20000 + 1040 Amount = €21040	<i>or</i> Amount = 20000 × 1.052 Amount = €21040

- * € 1040 (without work) and stops ⇒ 4 marks.
- * Writes down 20000 + 5.2% = 21040 ⇒ 10 marks
- * Writes down 20000 × 5.2% = 1040 and stops ⇒ 7 marks.
- * Writes down 20000 × 5.2% and stops, or 20000 + 5.2% and stops ⇒ 4 marks.

Blunders (-3)

- B1 Correct answer without work ✍
- B2 Mishandles 5.2%. e.g. $\frac{20000}{5.2} \times 100$ Note: {20000 must be used}.
- B3 Decimal error (once only)
- B4 Stops at interest i.e. fails to calculate amount.
- B5 Subtracts to calculate amount.
- B6 1.052 treated as 1.52.

Slips (-1)

- S1 Numerical errors to a max of 3

Misreadings (-1)

- M1 Reads as €2000

Attempts (3 marks)

A1 Correct formula with or without substitution and stops

A2 Some use of 100 in attempt to find percentage e.g. $5.2\% = \frac{5.2}{100}$ or $1 \cdot 052$ and stops.

Worthless (0)

W1 Incorrect answer without work

W2 $20000 + 5.2 = 20005.2$ and stops or continues.

(c)(ii)

10 marks

Att3

$21040 - 5000 = 16040$	$\frac{16040 \times 6.25}{100} = 1002.5$	
$16040 + 1002.5 = \text{€}17042.5$ [or $16040 \times 1.0625 = 17042.5$]		

* Accept candidates answer from (i)

* € 16040 (without work) and stops \Rightarrow 4 marks.

* Writes down $16040 + 6.25\% = 17042.5 \Rightarrow$ 10 marks

* Writes down $16040 \times 6.25\% = 1002.5$ and stops \Rightarrow 7 marks.

* Writes down $16040 \times 6.25\%$ and stops, or $16040 + 6.25\%$ and stops \Rightarrow 4 marks.

* Uses $5000(-3)(-3)$. Uses $20000(-3)$

Blunders (-3)

B1 Correct answer without work 

B2 Fails to subtract 5000

B3 Mishandles 6.25%

B4 Decimal error (once only).

B5 Stops at interest i.e. fails to calculate amount.

B6 Subtracts to calculate amount.

B7 Incorrect Principal

Slips (-1)

S1 Numerical errors to a max of 3

Misreadings (-1)

M1 Reads as €500 or similar.

Attempts (3 marks)

A1 Correct formula with or without substitution and stops

A2 Some use of 100 in attempt to find percentage and stops.

A3 $21040 - 5000 = 16040$ and stops

Worthless (0)

W1 Incorrect answer without work

W2 $21040 + 6.25$ and stops or continues

QUESTION 4

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

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

(a) If $a = 5$, find the value of



(i) $4a + 1$



(ii) $a^2 - 3a + 6$

(a)(i) **5 marks** **Att2**

(i) $4(5) + 1 = 21$

* $20 + 1 \Rightarrow 4$ marks

Blunders (-3)

- B1 Correct answer, without work
- B2 Leaves $4(5)$, in the answer
- B3 Incorrect substitution and continues
- B4 Breaks order i.e. $4(5 + 1) = 4.6 = 24$
- B5 Treats $4(5)$ as 9 or 45

Slips (-1)

- S1 Numerical errors to a max of 3
- S2 Treats as $4a - 1$

Attempts (2 marks)

- A1 Any number substituted for a and stops e.g. $4(8)$.
- A2 Writes 5 in this part
- A3 Any correct step.

Worthless (0)

- W1 Incorrect answer with no work.

(a)(ii)

5 marks

Att2

(ii)	$(5)^2 - 3(5) + 6 = 16$	or	$25 - 15 + 6 = 10 + 6 = 16$
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* $31 - 15$ or $10 + 6 \Rightarrow 4$ marks

Blunders (-3)

- B1 Correct answer without work
- B2 Leaves 5^2 or $-3(5)$ in the answer
- B3 Incorrect substitution and continues.
- B4 Breaks order e.g. $-3(5+6)$.
- B5 Treats $-3(5)$ as 2 or -35 .
- B6 Fails to finish but see * above

Slips (-1)

- S1 Numerical errors to a max of 3
- S2 Treats as $a^2 - 3a - 6$

Attempts (2 marks)

- A1 Any substitution for either a^2 or $-3a$ and stops e.g. (8) etc.
- A2 writes 5 in this part.
- A2 Any correct step.

Worthless (0 marks)

- W1 Incorrect answer, with no work.

Part (b)

20(10,10) marks

Att 3,3

4(b) (i) Solve the equation $5x - 10 = 3(x + 2)$.

(ii) Multiply $(x - 3)$ by $(2x + 1)$.
Write your answer in its simplest form.

(b)(i)

10 marks

Att 3

(i) $5x - 10 = 3x + 6 \Rightarrow 5x - 3x = 6 + 10 \Rightarrow 2x = 16 \Rightarrow x = 8$

Blunders (-3)

- B1 Correct answer without work ($x = 8$ stated or substituted).
- B2 Error in distributive law and continues, e.g. $5x - 10 = 3x + 2$.
- B3 Errors in transposition (each time)
- B4 Stops at $2x = 16$ or similar.

Slips (-1)

- S1 Numerical errors to a max of 3
- S2 Leaves as $\frac{16}{2}$ or similar.

Attempts (3 marks)

- A1 Any substitution for values of x other than $x = 8$.
- A2 Any correct step.
- A3 Combines "x's" to numbers and continues with any correct step e.g. $5x - 10 = -5x$.

Worthless (0 marks)

- W1 Combines "x's" to numbers and stops.
- W2 Incorrect answer, with no work

(b)(ii)

10 marks

Att3

(ii)	$2x(x-3) + 1(x-3)$ $\Rightarrow 2x^2 - 6x + x - 3$ $\Rightarrow 2x^2 - 5x - 3$	or	$x(2x+1) - 3(2x+1)$ $\Rightarrow 2x^2 + x - 6x - 3$ $\Rightarrow 2x^2 - 5x - 3$
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* $2x^2 + x - 6x - 3 \Rightarrow 7$ marks

Blunders (-3)

- B1 Correct answer without work
- B2 Error(s) in distribution.(each time)
- B3 Fails to group or groups incorrectly

Slip (-1)

- S1 Numerical errors to a max of 3.

Attempts (3 marks)

- A1 Any correct multiplication e.g. $2x^2$ etc.
- A2 Any correct grouping of terms.
- A3 Any correct step.
- A4 Substitutes a value of "x" and continues correctly.
- A5 Treats as $(x-3)\pm(2x+1)$ to give $3x-2$ or $-x-4$
- A6 Combines "x's" to numbers and continues with correct step e.g. $x-3 = -3x$ or $2x+1 = 3.x$

Worthless (0 marks)

- W1 Combines "x's" to numbers and stops.
- W2 No distribution but A2 or A5 may apply to subsequent work e.g. gathering of terms.

- (i) The cost of a cinema ticket is € t for an adult and €5 for a child.
The cost of tickets for 2 adults and 3 children is €33.

Write down an equation in t to represent this information.

- (ii) Solve the equation you formed in part (i) above, for t .

- (iii) Solve for x and for y :

$$5x - 4y = 16$$

$$2x + 3y = 11$$

(c)(i)

5 marks

Att2

$$2t + 3(5) = 33$$

or

$$2t + 15 = 33$$

Blunders (-3)

B1 Each incorrect term in equation

*Misreading (-1)*M1 Substitutes x (or similar) for t *Attempt (2 marks)*

A1 Any attempt at forming an equation **but** numbers written on their own (except **15** or **33**) are **worthless**

(c)(ii)

5marks

Att 2

$$2t + 15 = 33 \quad \Rightarrow 2t = 18 \Rightarrow t = 9$$

* Accept candidates' equation from previous work.

*Blunders (-3)*B1 Correct answer without work ($t = 9$ stated or substituted).

B2 Errors in transposition

B3 Stops at $2t = 18$ or similar*Slip (-1)*

S1 Numerical errors to a max of 3

S2 Leaves as $\frac{18}{2}$ or similar.*Attempts (2 marks)*

A1 Answer from part c(i) written down and stops

A2 Any correct step e.g. $3.5 = 15$ *Worthless (0 marks)*

W1 Incorrect answer, with no work

(c)(iii)

10 marks

Att 3

	I	II
$5x - 4y = 16$	$5x - 4y = 16$	$4y = 5x - 16$
$\underline{2x + 3y = 11}$	$\underline{2x + 3y = 11}$	$y = \frac{5x - 16}{4}$
$15x - 12y = 48$	$10x - 8y = 32$	$2x + 3\left(\frac{5x - 16}{4}\right) = 11$
$\underline{8x + 12y = 44}$	$\underline{-10x - 15y = -55}$	$8x + 15x - 48 = 44$
$23x = 92$	$-23y = -23$	$23x = 92$
$x = \frac{92}{23} = 4$	$y = \frac{-23}{-23} = 1$	$x = 4$
$\Rightarrow y = 1$	$\Rightarrow x = 4$	$\Rightarrow y = 1$

- * Apply only **one** blunder deduction (B2 or B3) 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 of (3).

Blunders (-3)

- B1 Correct answers without work(**stated or substituted**)
- B2 Error or errors in establishing the first equation in terms of x only ($23x = 92$) or the first equation in terms of y only ($-23y = -23$) through elimination by cancellation (**but see S1**)
- B3 Errors in transposition when finding the first variable.
- B4 Errors in transposition when finding the second variable
- B5 Incorrect substitution when finding second variable
- B6 Finds one variable only

Slips (-1)

- S1 Numerical errors to a max of 3

Attempt (3 marks)

- A1 Attempt at transposition and stops
- A2 Multiplies either equation by some number and stops
- A3 Incorrect value of x or y substituted correctly to find his correct 2nd variable

Worthless (0 marks)

- W1 Incorrect values for x or y substituted into the equations

QUESTION 5

Part (a)	10 marks	Att 3
Part (b)	15(5,5,5) marks	Att 2,2,2
Part (c)	25(5,10,10) marks	Att 2,3,3

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

(a) Write in its simplest form $3(x + 2) + 4(3x + 1)$.

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

 $3x + 6 + 12x + 4 = 15x + 10$

* Stops after correct removal of brackets \Rightarrow 7marks

* Ignore excess work $5(3x + 2)$

Blunders (-3)

- B1 Correct answer without work 
- B2 Error(s) in distribution (each time)
- B3 Combining unlike terms

Attempts (3 marks)

- A1 Any correct multiplication
- B4 Fails to group like terms

Slips (-1)

- S1 Numerical errors to a max of 3

Misreadings (-1)

- M1 $3(x + 2) \times 4(3x + 1)$ and continues

Worthless (0)

- W1 combining unlike terms, before attempting multiplication and stops

5(b) Factorise

(i)	$5cd + 7d$
-----	------------

(ii)	$ax + 3ay + 4x + 12y$
------	-----------------------

(iii)	$x^2 - 49$
-------	------------

(b)(i)

5 marks

Att 2

$d(5c + 7)$

Blunders (-3)

B1 Removes factor incorrectly.

*Attempts (2 marks)*A1 Indication of common factor e.g. underline *ds* and stops.

(b) (ii)

5marks

Att 2

	$ax + 3ay + 4x + 12y$	or	$ax + 4x + 3ay + 12y$
	$a(x + 3y) + 4(x + 3y)$		$x(a + 4) + 3y(a + 4)$
	$(a + 4)(x + 3y)$		$(x + 3y)(a + 4)$

* Accept also (with or without brackets) for 5 marks any of the following

 $(a + 4)$ and $(x + 3y)$ [The word **and** is written down.] $(a + 4)$ or $(x + 3y)$ [The word **or** is written down.] $(a + 4)$, $(x + 3y)$ [A comma is used]*Blunders (-3)*

B1 Correct answer without work

B2 Stops after first line of correct factorisation e.g. $a(x + 3y) + 4(x + 3y)$ or equivalent.

B3 Error(s) in factorising any pair of terms (each time)

B4 Incorrect common factor and continues. e.g. $x(a + 4) + y(3a + 12)$ (B2 will apply)B5 Correct first line of factorisation but ends as $(x + 3y)4a$.*Slips (-1)*S1 $(x + 3y) \pm (a + 4)$ *Attempts (2 marks)*

A1 Pairing off, or indication of common factors and stops.

A2 Correctly factorises any pair and stops.

(b) (iii)

5 marks

Att 2

$$x^2 - 49$$

$$x^2 - 7^2$$

$$(x - 7)(x + 7)$$

- * Accept also (with or without brackets) for 5 marks any of the following
($x - 7$) and ($x + 7$) [The word **and** is written down.]
($x - 7$) or ($x + 7$) [The word **or** is written down.]
($x - 7$), ($x + 7$) [A comma is used]
- * Quadratic equation formula method is subject to slips and blunders.
- * ($x - \sqrt{49}$)($x + \sqrt{49}$) merits 5 marks

Blunders (-3)

- B1 Incorrect two term linear factors of $x^2 - 49$ formed from correct (but inapplicable) factors of x^2 and ± 49 .e.g. ($x - 49$)($x + 1$)
- B2 Incorrect factors of 49
- B3 Incorrect factors of x^2
- B4 ($7 - x$)($7 + x$).
- B5 ($x - 49$)($x + 49$).
- B6 Answer left as roots. ($x = \pm 7$)

Slips (-1)

- S1 ($x - 7$) \pm ($x + 7$)

Attempts (2 marks)

- A1 Correct factors of x^2 only
- A2 Correct factors of ± 49 only
- A3 $\pm x$ or ± 7 appears.
- A4 $x^2 - 49 = x \times x - 7 \times 7$
- A5 Mention of the difference of two squares .e.g. $x^2 - 49^2$
- A6 Correct quadratic equation formula quoted and stops.
- A7 $\sqrt{49}$

Worthless (0 marks)

- W1 Combines x s to “numbers” and continues or stops.

Part (c)**25(5,10,10) marks****Att 2,3,3**

(i) Express $\frac{5x+1}{3} - \frac{x+6}{5}$ as a single fraction.

Give your answer in its simplest form.

(ii) Verify your answer to part (i) by substituting $x = 4$ into $\frac{5x+1}{3} - \frac{x+6}{5}$

and into your answer to part (i).

(iii) Solve the equation $x^2 - 4x - 21 = 0$.

(c)(i)**5 marks****Att2**

$$(i) \quad \frac{5(5x+1) - 3(x+6)}{15} = \frac{25x+5 - 3x-18}{15} = \frac{22x-13}{15}$$

* $\frac{5x+1}{3} - \frac{x+6}{5} = \frac{4x+7}{-2}$ Zero marks

Blunders (-3)

B1 Correct answer, without work ✍

B2 Error(s) in distribution e.g. $5(5x+1) = 5x+1$.

B3 Mathematical error e.g. $5-18=13$, $-3(6)=18$

B4 Incorrect common denominator and continues

B5 Incorrect numerator, from candidate's denominator e.g. $\frac{3(5x+1) - 5(x+6)}{15}$.

B6 No simplification of numerator

B7 Omitting denominator

Slips (-1)

S1 Drops denominator

S2 Numerical errors to a max of 3

S3 Answer not in simplest form. e.g. $\frac{44x-26}{30}$.

Attempts (2 marks)

A1 15 only or a multiple of 15 only appears.

A2 Any correct step.

Worthless (0)

W1 $\left(\frac{5x+1}{3}\right)\left(\frac{x+6}{5}\right)$ and stops.

Part(c) (ii)

10 marks

Att 3

$\frac{5(4)+1}{3} - \frac{4+6}{5}$		$\frac{22x-14}{15}$
$= \frac{20+1}{3} - \frac{10}{5}$		$= \frac{22(4)-13}{15}$
$= \frac{21}{3} - \frac{10}{5}$	and	$= \frac{88-13}{15}$
$= 7 - 2$		$= \frac{75}{15}$
$= 5$		$= 5$

- * Accept candidates answer from previous section [May result in inequality].
- * Accept usage of a value other than 4 for verification.

Blunders (-3)

- B1 Correct answer, without work ✍
- B2 Substitutes into **one** expression only (B4 will also apply)
- B3 Manipulation to force equality
- B4 Conclusion missing

Slips (-1)

- S1 Numerical errors to a max of 3

Attempts (3 marks)

- A1 Writes answer from previous part in this section
- A2 Substitutes a value into one expression and stops

(c) (iii)

10 marks

Att 3

$x^2 - 4x - 21 = 0$ $x^2 - 7x + 3x - 21 = 0$ $x(x - 7) + 3(x - 7) = 0$ $(x + 3)(x - 7) = 0$ $\Rightarrow x = -3 \text{ and } x = 7$	$\begin{array}{ccc} x & & +3 \\ & \diagdown & / \\ & & \\ & / & \diagdown \\ x & & -7 \end{array}$ $\Rightarrow (x + 3)(x - 7) = 0$ $\Rightarrow x = 7 \text{ and } x = -3$	$\frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-21)}}{2(1)}$ $\frac{4 \pm \sqrt{16 + 84}}{2} = \frac{4 \pm 10}{2}$ $\frac{14}{2} = 7 \text{ and } \frac{-6}{2} = -3$ $\Rightarrow x = 7 \text{ and } x = -3$
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Factor Method

Blunders (-3)

- B1 Correct answers without work ✍
- B2 Incorrect two term linear factors of $x^2 - 4x - 21$ formed from correct (but inapplicable) factors of x^2 and/or ± 21 . e.g. $(x+21)(x-1)$
- B3 No roots given.(each time)
- B4 Incorrect factors of x^2 and/or ± 21 .
- B5 Correct cross method but factors not shown and stops [Note: B3 applies also].
- B6 $x(x-7) + 3(x-7)$ or similar and stops [Note: B3 applies also].
- B7 Error in transposition (each time)

Slips (-1)

- S1 Numerical errors, to a max of 3

Attempts (3 marks)

- A1 Some effort at factorisation
- A2 One correct answer without work

Worthless (0 marks)

- W1 $x^2 - 4x = 21$, or similar, and stops.
- W2 Trial and error
- W3 Oversimplification, resulting in a linear equation

Formula Method

Blunders (-3)

- B1 Correct answers without work. ✍
- B2 Error in a, b, c substitution (apply once only)
- B3 Sign error in substituted formula (apply once only)
- B4 Error in square root or square root ignored.

B5 Stops at $\frac{4 \pm 10}{2}$

B6 Incorrect quadratic formula and continues.

Slips (-1)

S1 Numerical errors to a max of 3

S2 Roots left in the form $\frac{p}{q}$

Attempts (3 marks)

A1 Correct formulas and stops

A2 One correct substitution and stops

QUESTION 6

Part (a)	10(5,5) marks	Att 2,2
Part (b)	25(10,15) marks	Att 3,5
Part (c)	15(10,5) marks	Att 3,2

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

- (a) $f(x) = 4x - 5$. Find:
(i) $f(3)$
(ii) $f(-2)$

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



$$f(3) = 4(3) - 5 = 12 - 5 = 7$$

* Answer 12-5 \Leftrightarrow 4 marks

Blunders (-3)

- B1 Correct answer no work.
- B2 Leaves 4(3) in the answer
- B3 Mathematical error e.g. treats 4(3) as 43.
- B4 Breaks order i.e. $[4(3-5)=4(-2)=-8]$.

Slips (-1)

- S1 Numerical errors to a max of 3
- S2 Leaves x in the answer e.g. $7x$

Misreadings (-1)

- M1 Correct substitution of any number other than 3 and continues.

Attempts (2 marks)

- A1 Substitutes for x and stops e.g. 4(3)
- A2 Treats as an equation and continues or stops $4x - 5 = 3$
- A3 Combines " x 's to "numbers" and continues. e.g. $4x - 5 = -x = -(3)$

Worthless (0)

- W1 Combines " x 's to "numbers" and stops.
- W2 Ignores x giving $4 - 5 = -1$
- W3 $3[f(x)] = 12x - 15$
- W4 Replaces coefficient i.e. $4x \rightarrow 3x$
- W5 Incorrect answer, without work

(a) (ii)

5 marks

Att 2



$$f(-2) = 4(-2) - 5 = -8 - 5 = -13$$

* Answer $-8-5 \Leftrightarrow$ 4 marks (stops or continues)

* $-8x - 5x = 13x \Rightarrow$ 4marks but $-8x - 5x = 13 \Rightarrow$ 5marks (rectified error)

Blunders (-3)

B1 Correct answer no work

B2 Leaves $4(-2)$ in the answer

B3 Mathematical error e.g. treats $4(-2)$ as ± 42 .

B4 Breaks order i.e. $[4(-2-5) = 4(-7) = -28]$.

Slips (-1)

S1 Numerical errors to a max of 3

S2 Leaves x in the answer e.g. $-13x$

A3 Combines "x's" to "numbers" and continues. e.g. $4x - 5 = -x = -(-2) = 2$

A4 Substitutes positive value for x and **continues** correctly

Misreadings (-1)

M1 Correct substitution of any negative number other than -2 and continues

Attempts (2 marks)

A1 Substitutes for x and stops e.g. $4(-2)$

A2 Treats as an equation and continues or stops $4x - 5 = -2$

Worthless (0)

W1 Combines "x's" to "numbers" and stops

W2 Ignores x giving $4 - 5 = -1$

W3 $-2[f(x)] = -8x \pm 10$

W4 Replaces coefficient i.e. $4x \rightarrow -2x$

W5 Incorrect answer, without work

(b) Draw the graph of the function

$$f: x \rightarrow x^2 - 2x - 1$$

in the domain $-1 \leq x \leq 3$, where $x \in \mathbf{R}$.

Table

10marks

Att 3

$f(-1)$	=	$(-1)^2$	$-2(-1)$	-1	=	2
$f(0)$	=	$(0)^2$	$-2(0)$	-1	=	-1
$f(1)$	=	$(1)^2$	$-2(1)$	-1	=	-2
$f(2)$	=	$(2)^2$	$-2(2)$	-1	=	-1
$f(3)$	=	$(3)^2$	$-2(3)$	-1	=	2

x	-1	0	1	2	3
x^2	1	0	1	4	9
$-2x$	2	0	-2	-4	-6
-1	-1	-1	-1	-1	-1
$f(x)$	2	-1	-2	-1	2

* Error(s) in each row /column calculation attracts a maximum deduction of 3 marks*Blunders (-3)*

B1 Correct answer, without work i.e. 5 correct couples only and no graph

B2 “ $-2x$ ” taken as “2” all the way. [In row headed “ $-2x$ ” by candidate]B3 “-1” calculated as “ $-x$ ” all the way. [In row headed “-1” by candidate]B4 Adds in top row when evaluating $f(x)$.

B5 Omits “-1” row

B6 Omits “ $-2x$ ” row

B7 Omits a value in the domain (each time).

B8 Each incorrect image without work i.e. calculation through the function method

Slips (-1)

S1 Numerical errors to a max of 3 in any row / column

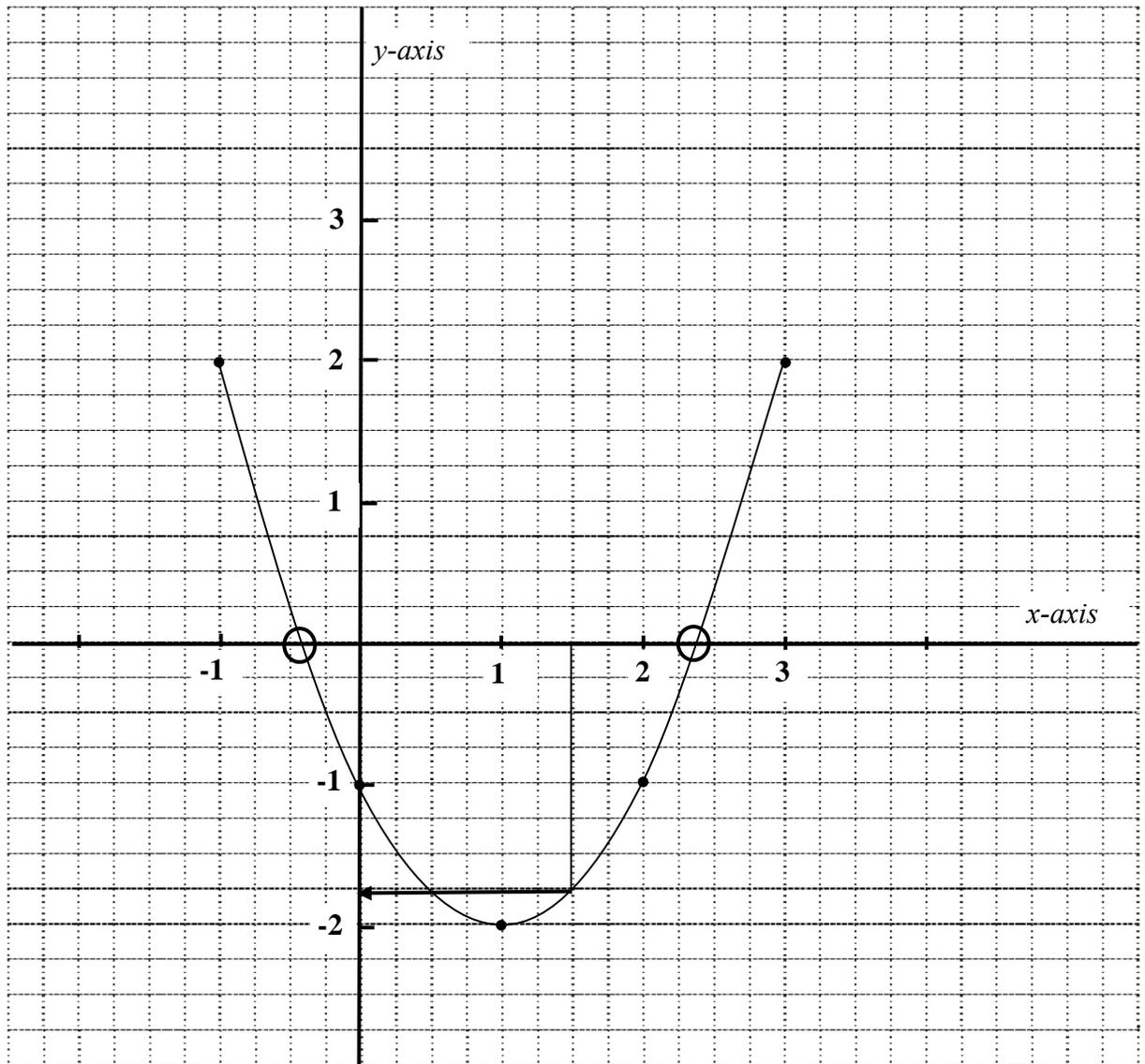
*Misreadings (-1)*M1 Misreads “ x^2 ” as “ $-x^2$ ” and places “ $-x^2$ ” in the table or function.M2 Misreads “ $-2x$ ” as “ $2x$ ” and places “ $2x$ ” in the table or function.

M3 Misreads “-1” as “1” and places “1” in the table or function

*Attempts (3 marks)*A1 Omits “ x^2 ” row from table or treats “ x^2 ” as $\pm x$ or $\pm 2x$.

A2 Any effort at calculating point(s).

A3 Only one point calculated and stops.



* Accept candidate's values from previous work. (**5 co-ordinates needed**) but see S2

* Only **one** correct point **graphed correctly** \Rightarrow Att 3 + Att 5

* **Correct graph but no table** \Rightarrow full marks i.e. **(10+15)** marks.

* Accept reversed co-ordinates if

(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 4th * above}.

B2 Scale error (once only).

B3 Points not joined or joined in incorrect order (once only).

Slips (-1)

S1 Each point of candidate graphed incorrectly. {Tolerance ± 0.25 }

S2 Each point (**5 points needed**) from table not graphed [See 2nd * above].

Attempts (5 marks)

A1 Graduated axes (need not be labelled)

A2 Some effort to plot a point {See 2nd * above}

Part (c)

15(10,5) marks

Att 3,2

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

- (i) the values of x for which $x^2 - 2x - 1 = 0$
- (ii) the value of $f(x)$ when $x = 1.5$.

(c) (i)

10 marks

Att 3



$$x = 2.4 \text{ and } x = -0.4$$

work to be shown on graph for correct answer

- * Accept candidate's values from previous work.
- * 2 indications on graph and 2 values written down (blunder each time)

Blunders (-3)

B1 Answers beyond tolerance. {Tolerance ± 0.25 }

Misreading (-1)

M1 Answers not presented in designated box (but elsewhere)

Attempts (3marks)

A1 One point of intersection indicated only or one value of x written down

A2 Algebraic evaluation ($x = 1 \pm \sqrt{2}$)

Worthless (0)

W1 Answers outside of tolerance without graphical indication

W2 $f(0)$ gives -1 as answer.

(c) (ii)

5 marks

Att 2



$$f(x) = -1.75$$

work to be shown on graph for correct answer

* Accept candidate's values from previous work.

Blunders (-3)

B1 Answer beyond tolerance. {Tolerance ± 0.25 }.

B2 Correct answers no work

B3 Sign error

Misreading (-1)

M1 Answers not presented in designated box (but elsewhere)

Attempts (2 marks)

A1 Point indicated only.

A2 Algebraic evaluation or correct calculator calculation.

A3 Testing x value for $y = 1.5$

Worthless(0)

W1 Answers outside of tolerance without graphical indication.

BONUS MARKS FOR ANSWERING THROUGH IRISH

Bonus marks are applied separately to each paper as follows:

If the mark achieved is 225 or less, the bonus is 5% of the mark obtained, rounded *down*.
(e.g. $198 \text{ marks} \times 5\% = 9.9 \Rightarrow \text{bonus} = 9 \text{ marks.}$)

If the mark awarded is above 225, the following table applies:

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