



Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION

2009

MARKING SCHEME

**MATHEMATICS
ORDINARY LEVEL
PAPER 1**

GENERAL GUIDELINES FOR EXAMINERS

- 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.
- 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.
- Worthless work is awarded zero marks. Some examples of such work are listed in the scheme and they are labelled as W1, W2,...etc.
- The phrase "hit or miss" means that partial marks are not awarded – the candidate receives all of the relevant marks or none.
- The phrase "and stops" means that no more work is shown by the candidate.
- 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.
- The sample solutions for each question are not intended to be exhaustive lists – there may be other correct solutions.
- Unless otherwise indicated in the scheme, accept the best of two or more attempts – even when attempts have been cancelled.
- The *same* error in the *same* section of a question is penalised *once* only.
- Particular cases, verifications and answers derived from diagrams (unless requested) qualify for attempt marks at most.
- A serious blunder, omission or misreading results in the attempt mark at most.
- Do not penalise the use of a comma for a decimal point, e.g. €5.50 may be written as €5,50.

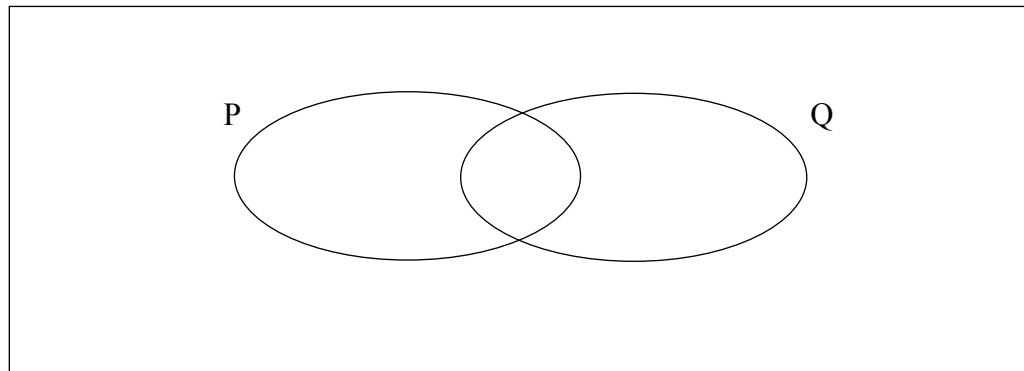
QUESTION 1

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

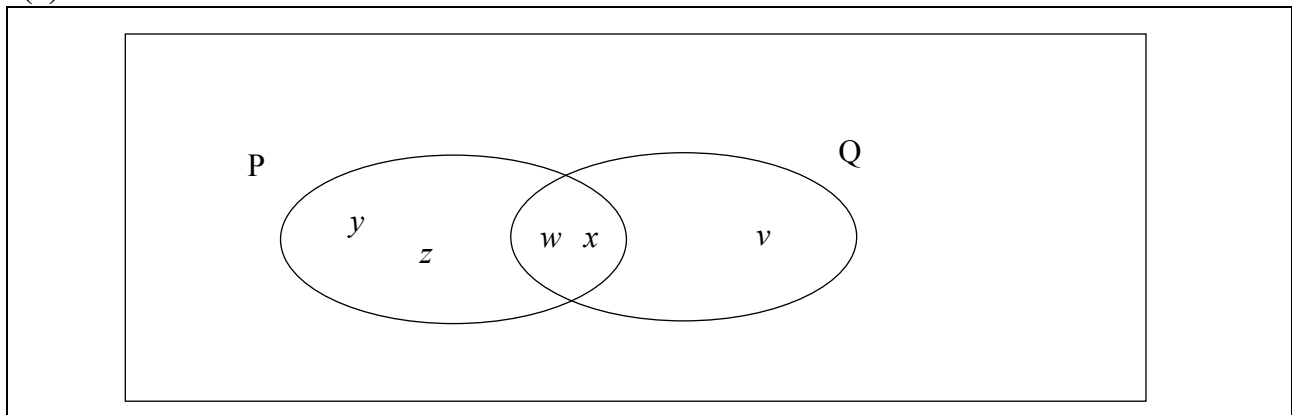
Part (a) **10 marks** **Att 3**

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

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

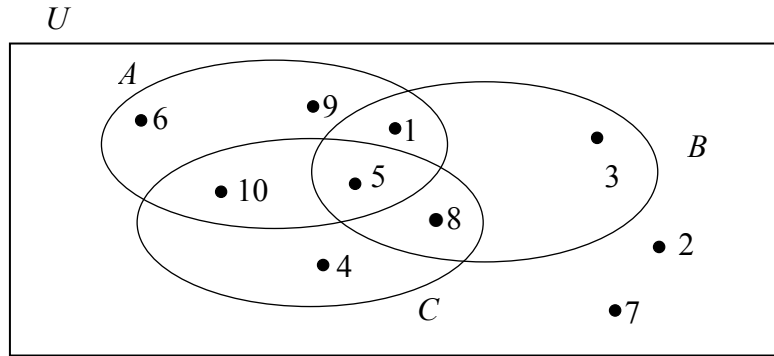
(b)

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?

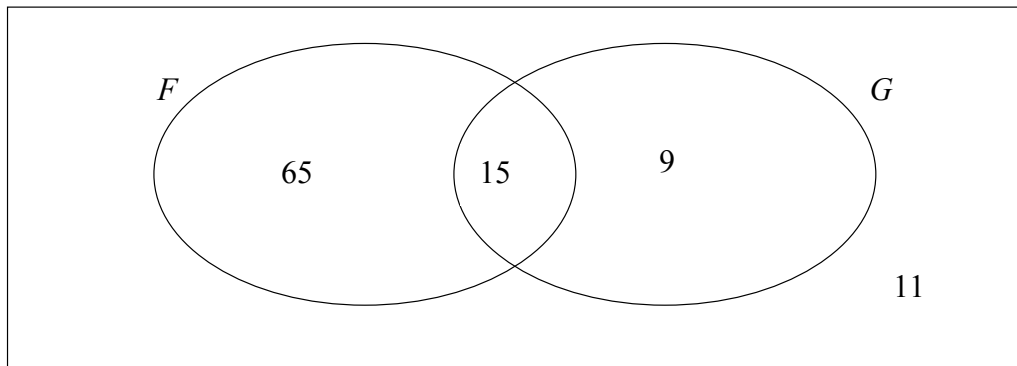
(iii) How many students did not study German?

(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

$$\begin{aligned} \text{(ii)} \quad & 2x(x-3) + 1(x-3) \\ & \Rightarrow 2x^2 - 6x + x - 3 \\ & \Rightarrow 2x^2 - 5x - 3 \end{aligned}$$

or

$$\begin{aligned} & x(2x+1) - 3(2x+1) \\ & \Rightarrow 2x^2 + x - 6x - 3 \\ & \Rightarrow 2x^2 - 5x - 3 \end{aligned}$$

* $2x^2 + x - 6x - 3 \Rightarrow 7$ 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

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

- * 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

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

- * 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

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

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

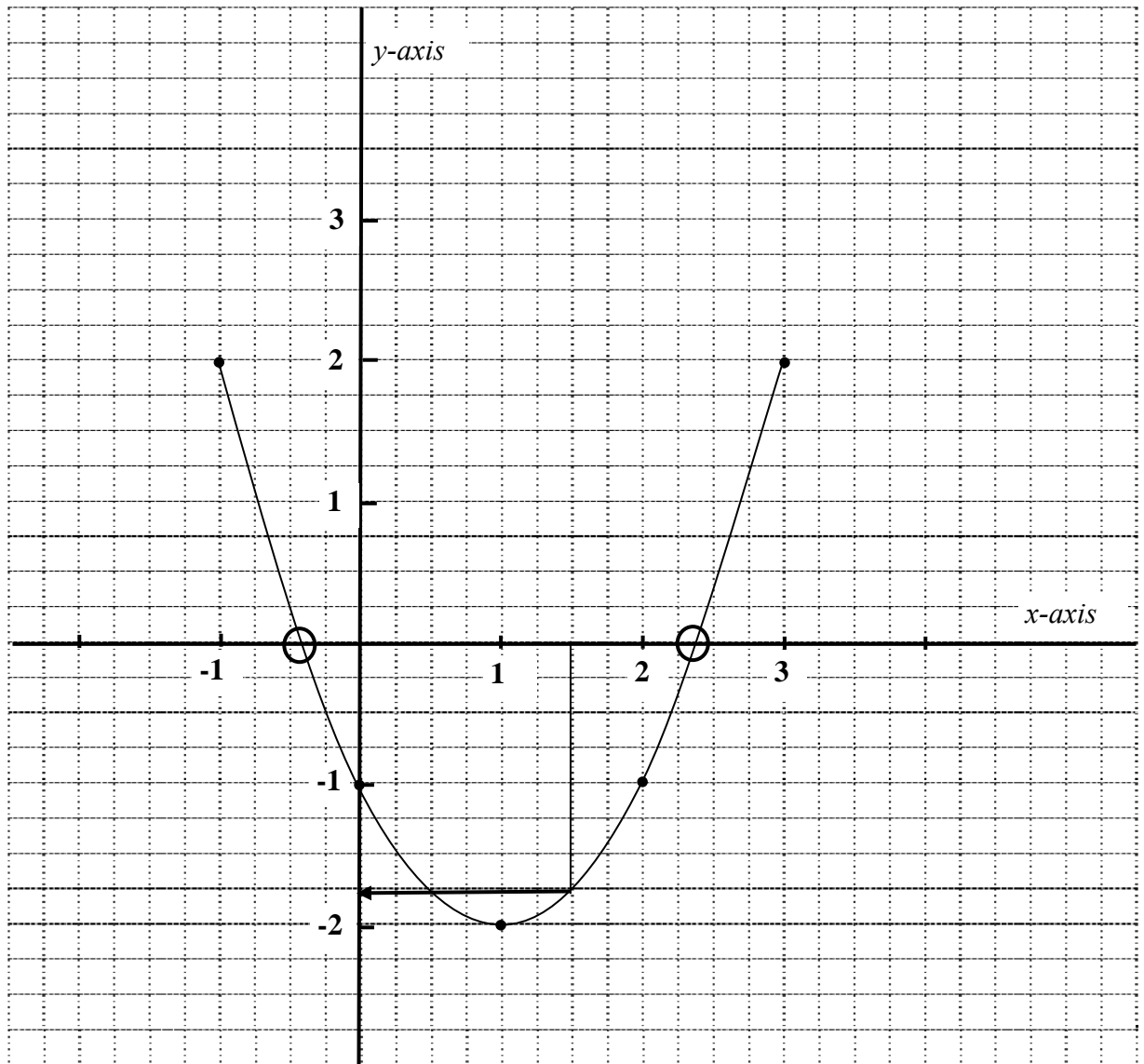
*Misreadings (-1)*M1 Misreads “ x^2 ” as “ $-x^2$ ” and places “ $-x^2$ ” in the table or function.M2 Misreads “ $-2x$ ” as “ $2x$ ” and places “ $2x$ ” in the table or function.

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



Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION

2009

MARKING SCHEME

**MATHEMATICS
ORDINARY LEVEL
PAPER 2**

MARKING SCHEME
JUNIOR CERTIFICATE EXAMINATION 2009
MATHEMATICS - ORDINARY LEVEL - PAPER 2

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


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

Subtract 430 m from 6780 m and give your answer in km.

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


$$\begin{aligned} & 6780 - 430 \\ & = 6350\text{m} \\ & = \frac{6350}{1000} \\ & = 6.35\text{km} \end{aligned}$$

Blunders (-3)

- B1 Correct answer without work 
- B2 Incorrect conversion or no conversion
- B3 Incorrect mathematical operation with work and continues correctly e.g. adds instead of subtracts.
- B4 Decimal error
- B5 $6780 - 430 = 6350 = 6 \text{ km } 350 \text{ m}$ and stops.

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Leaves answer as $\frac{6350}{1000}$

Attempts (3 marks)

- A1 Some correct step with work.
- A2 Converts one or both to kilometres correctly and stops e.g. 6.78 km
- A3 States $1000\text{m} = 1\text{km}$ and stops.
- A4 Some correct effort at conversion and stops e.g. $\frac{430}{1000}$.
- A5 6350 or 6km 350 m without work and stops
- A6 $6780 - 430$ and stops.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

Part (b)

25 marks (10, 5, 10)

Att 3, 2, 3

Tara went by car from Dublin to Wexford, a journey of 150 kilometres.
Tara took 2 hours and 30 minutes to complete the journey.

(b)(i)

10 marks

Att 3

Tara left Dublin at 10:15. At what time did she arrive in Wexford?

(b)(i)

10 marks

Att 3

$$\begin{aligned} \text{✍} \quad 10:15 + 2:30 \\ = 12:45 \end{aligned}$$

* Do not penalise the same error twice in part (b)

Blunders (-3)

- B1 Correct answer without work ✍
- B2 Incorrect mathematical operation with work and continues.
- B3 Error in converting hours / minutes or no conversion.
- B4 Leaves answer as 10:15 + 2:30

Slips (-1)

- S1 Numerical slips to a maximum of -3

Attempts (3 marks)

- A1 Some correct step with work
- A2 States 1 hour = 60 minutes and stops.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

(b)(ii)

5 marks

Att 2

Calculate the average speed, in km/h, for Tara's journey.

(b)(ii)


5 marks

Att 2

$$\begin{array}{lcl} \text{✍} \quad 2\text{h } 30\text{m} = 2.5\text{h} & & 2\text{h } 30\text{m} = 150\text{ mins} \\ \text{Average Speed} = \frac{D}{T} & \text{OR} & \text{Average Speed} = \frac{D}{T} \\ = \frac{150}{2.5} & & = \frac{150}{150} \times 60 \\ = 60\text{ km/h} & & = 60\text{ km/h} \end{array}$$

* Accept ratio method.

Blunders (-3)

- B1 Correct answer without work 
- B2 Incorrect relevant formula.
- B3 Error in converting hours / minutes or no conversion (unless penalised in part (i)).
- B4 No division.
- B5 Decimal error

Slips (-1)

- S1 Numerical slips to a maximum of -3

Attempts (2 marks)

- A1 Some correct step with work e.g. 2 hours 30 minutes = 2.5 hours
- A2 States 1 hour = 60 minutes and stops.
- A3 Correct formula and stops.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

(b)(iii)

10 marks


Att 3

Tara's car emitted 19 500 grammes of carbon dioxide gas in travelling from Dublin to Wexford.
How many grammes of carbon dioxide did Tara's car emit for every kilometre travelled?


(b)(iii)

10 marks

Att 3


$$\frac{19500}{150}$$
$$= 130g$$

Blunders (-3)

- B1 Correct answer without work 
- B2 Incorrect mathematical operation with work and continues.
- B3 Leaves answer as $\frac{19500}{150}$
- B4 Inverts fraction and continues.

Slips (-1)

- S1 Numerical slips to a maximum of -3

Attempts (3 marks)

- A1 Some correct step with work
- A2 States 150 kilometres travelled.
- A3 Incorrect divisor e.g. $\frac{19500}{60}$, complete or incomplete.

Worthless (0)

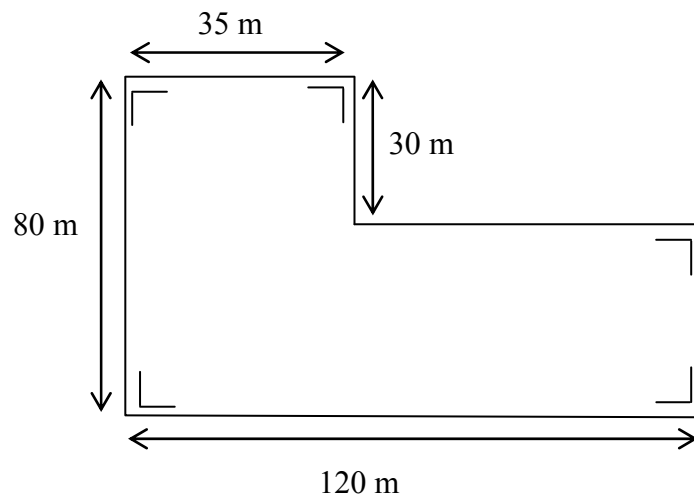
- W1 Incorrect answer without work unless attempt mark applies.

Part (c)

15 marks (5, 5, 5)

Att (2, 2, 2)

(c) A field has shape and measurements as shown in the diagram.



(c)(i)

5 marks

Att 2

Find, in metres, the length of the perimeter of the field.

(c)(i)

5 marks

Att 2

✍ $80 - 30 = 50; \quad 120 - 35 = 85$

$$P = 80 + 120 + 50 + 85 + 30 + 35 \\ = 400 \text{ m}$$

OR

$$2(80 + 120) \\ = 400 \text{ m}$$

*Do not penalise the same error twice in part (c)

Blunders (-3)

- B1 Correct answer without work ✍
- B2 Incorrect mathematical operation with work..
- B3 Each measurement omitted or incorrect.

Slips (-1)

- S1 Numerical slips to a maximum of -3.
- S2 Leaves answer as $80 + 120 + 50 + 85 + 30 + 35$

Attempts (2 marks)

- A1 Some correct step with work and stops.
- A2 Finds 50 and / or 85 and stops.
- A3 Adds two of the given numbers correctly.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

(c)(ii)

5 marks


Att 2

Find, in m^2 , the area of the field.

(c)(ii)


5 marks

Att 2

			
Small rectangle = $35 \times 30 = 1050$		$80 \times 120 = 9600$	$35 \times 80 = 2800$
Big rectangle = $50 \times 120 = 6000$	OR	$30 \times 85 = 2550$	OR $85 \times 50 = 4250$
Total Area = $1050 + 6000$		$9600 - 2550$	$2800 + 4250$
$= 7050 \text{ m}^2$		$= 7050 \text{ m}^2$	$= 7050 \text{ m}^2$

* Accept candidates dimensions from part (i)

Blunders (-3)

- B1 Correct answer without work 
B2 Incorrect mathematical operation and continues.

Slips (-1)

- S1 Numerical slips to a maximum of -3.
S2 Leaves answer as $1050 + 6000$ or $2800 + 4250$

Attempts (2 marks)

- A1 Some correct step with work.
A2 Product of two relevant numbers and stops.
A3 Gets 1050 and/or 6000 with or without work and stops.
A4 Gets 9600 and/or 2550 with or without work and stops.
A5 Gets 2800 and / or 4250 with or without work and stops.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

(c)(iii)

5 marks

Att 2

Tim bought the field at a cost of €41 000 per hectare.
How much did Tim pay for the field?
[1 hectare = 10 000 m²]

(c)(iii)

5 marks

Att 2

$$\begin{aligned} \text{✍} \quad 7050 \text{ m}^2 &= \frac{7050}{10000} \text{ ha} \\ &= .705 \end{aligned}$$

$$\begin{aligned} \text{cost} &= .705 \times 41000 \\ &= \text{€}28\,905 \end{aligned}$$

* Accept candidates answer from part (ii).

Blunders (-3)

- B1 Correct answer without work ✍
- B2 Incorrect mathematical operation and continues.
- B3 Decimal error.
- B4 Fails to convert to hectares or converts incorrectly.

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Early round off.

Attempts (2 marks)

- A1 Some correct step with work.
- A2 Gets 0.705 and stops.
- A3 Writes 7050 and stops.

Worthless (0)

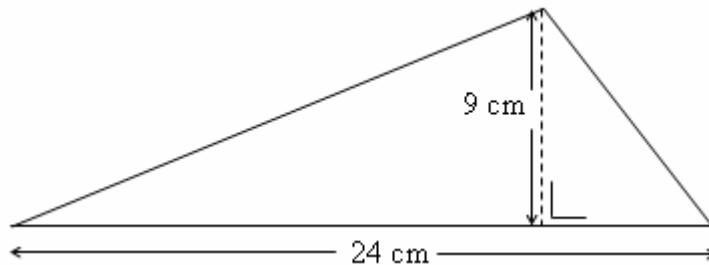
- W1 Incorrect answer without work unless attempt mark applies.

QUESTION 2

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

Part (a) 10 marks Att 3

A triangle has measurements as shown in the diagram.



Find, in cm^2 , the area of the triangle

(a) 10 marks Att 3



$$\begin{aligned}\text{Area} &= \frac{1}{2} \text{ base} \cdot \text{height} \\ &= \frac{1}{2} \times 24 \times 9 \\ &= 108 \text{ cm}^2\end{aligned}$$

Blunders (-3)

- B1 Correct answer without work
- B2 Incorrect substitution and continues correctly
- B3 Mathematical error
- B4 Incorrect relevant formula and continues e.g. $24 \times 9 = 216$

Slips (-1)

- S1 Numerical slips to a maximum of -3

Attempts (3 marks)

- A1 Some correct step with work and stops
- A2 $\text{Area} = \frac{1}{2} \text{ base} \cdot \text{height}$ or similar and stops.
- A3 Writes $\frac{1}{2} \times 24$ or $\frac{1}{2} \times 9$ and stops.
- A4 Writes $24 + 9 = 33$.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

Part (b)

25(10,10,5) marks

Att 3, 3, 2

A bicycle wheel has a diameter of 60 cm.

(b)(i)

10 marks

Att 3

Calculate, in cm, the radius of the bicycle wheel.

(b)(i)

10 marks

Att 3



$$\begin{aligned}\text{Radius} &= \frac{1}{2} \times 60 \\ &= 30 \text{ cm}\end{aligned}$$

Blunders (-3)

B1 Correct answer without work

B2 Incorrect mathematical operation and continues.

Slips (-1)

S1 Numerical slips to a maximum of -3

Attempts (3 marks)

A1 Some correct step with work and stops.

A2 Writes Radius = $\frac{1}{2}$ of diameter and stops.

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

(b)(ii)

10 marks

Att 3

Taking π as 3.142 calculate, in cm, the circumference of the bicycle wheel.

(b)(ii)

10 marks

Att 3



$$\begin{aligned}\text{Circumference} &= 2\pi r \\ &= 2 \times 3.142 \times 30 \\ &= 188.52 \text{ cm}\end{aligned}$$

* Accept candidates answer from part (i).

Blunders (-3)

B1 Correct answer without work

B2 Mathematical error

B3 Incorrect relevant formula and continues e.g πr^2 or πr

B4 Incorrect mathematical operation and continues

B5 Decimal error.

B6 $\pi \neq 3.142$ or answer in terms of π

Slips (-1)

S1 Numerical slips to a maximum of -3

Attempts (3 marks)

A1 Some correct step with work and stops.

A2 Correct formula and stops.

A3 Product of two relevant numbers and stops.

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

(b)(iii)

5 marks

Att 2

How far does the bicycle travel when the wheel makes 340 complete turns?
Give your answer to the nearest metre.

(b)(iii)

5 marks

Att 2

$$\begin{aligned} \text{✍} \quad \text{Distance Travelled} &= 188.52 \times 340 \\ &= 64096.8 \text{ cm} \\ &= \frac{64096.8}{100} \\ &= 640.968 \text{ m} \\ &= 641 \text{ m} \end{aligned}$$

* Accept candidates answer from part (ii).

Blunders (-3)

- B1 Correct answer without work ✍
- B2 Incorrect mathematical operation and continues .
- B3 Decimal error
- B4 Fails to convert to metres.

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Early round off
- S3 Fails to round off to nearest metre.

Attempts (2 marks)

- A1 Some correct step with work and stops.
- A2 Writes 340×188.52 and stops.
- A3 Converts 188.52 to metres and stops.
- A4 Writes $100\text{cm} = 1\text{m}$ and stops

Worthless (0)

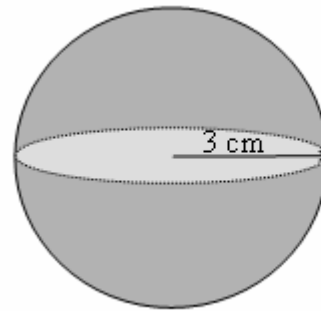
- W1 Incorrect answer without work unless attempt mark applies.

Part (c)

15(5,10) marks

Att 2, 3

A solid metal sphere has a radius 3 cm



(c)(i)

5 marks

Att 2

Taking π as 3.142 find, in cm^3 , the volume of the solid metal sphere.

(c)(i)

5 marks


Att 2



$$\begin{aligned}\text{Volume} &= \frac{4}{3}\pi r^3 \\ &= \frac{4}{3} \times 3.142 \times 3^3 \\ &= \frac{4}{3} \times 3.142 \times 27 \\ &= 113.112 \text{ cm}^3\end{aligned}$$

*Accept $\frac{4}{3}\pi r^3$ for volume of sphere.

Blunders (-3)

- B1 Correct answer without work 
- B2 Incorrect substitution and continues.
- B3 Mathematical error e.g. $3^3 = 9$
- B4 Incorrect relevant formula and continues e.g. multiples of πr^3 or πr^2 .
- B5 Decimal error.
- B6 $\pi \neq 3.142$ or answer in terms of π

Slips (-1)

- S1 Numerical slips to a maximum of -3

Attempts (2 marks)

- A1 Some correct step with work and stops e.g. correct formula
- A2 π omitted with or without work.
- A3 Product of two relevant numbers and stops e.g. $3.142 \times 3 = 9.426$

Worthless (0)

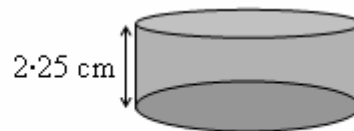
- W1 Incorrect answer without work unless attempt mark applies.

(c)(ii)

10 marks

Att 3


The solid metal sphere was melted down and a quarter of the metal was recast to form a cylinder of height 2.25 cm. Taking π as 3.142 calculate, in cm, the radius of this cylinder.



(c)


10 marks

Att 3

	$\frac{1}{4} \times 113.112$	=	28.278
	$\pi r^2 h$	=	28.278
	$3.142 r^2 \times 2.25$	=	28.278
	r^2	=	$\frac{28.278}{3.142 \times 2.25}$
	r^2	=	4
	r	=	2 cm or $\sqrt{4}$

* Accept candidates answer from part (i)

Blunders (-3)

- B1 Correct answer without work 
- B2 Incorrect mathematical operation and continues e.g $4 \times 113.112 = 452.448$
- B3 Incorrect substitution and continues.
- B4 Incorrect relevant formula and continues.
- B5 Decimal error.
- B6 $\pi \neq 3.142$
- B7 Incorrect or no square root.

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Early round off.

Attempts (3 marks)

- A1 Some correct step with work and stops
- A2 Writes 113.112 or candidates answer from part (i).
- A3 Correct formula and stops.
- A4 Writes 28.278 or $\frac{1}{4} \times$ the candidates answer from part (i) with or without work.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

QUESTION 3

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

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

Find the mean of the numbers 0.2, 4.6, 8.3, 10.2 and 11.7

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

$0.2 + 4.6 + 8.3 + 10.2 + 11.7 = 35$

$$\frac{0.2 + 4.6 + 8.3 + 10.2 + 11.7}{5}$$

$$= \frac{35}{5}$$

Mean = 7

Blunders (-3)

- B1 Correct answer without work
- B2 Multiplies instead of adds.
- B3 Decimal error.
- B4 Incorrect divisor.
- B5 Omits a value each time.
- B6 Inverted fraction.

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 $\frac{35}{5}$ and stops.

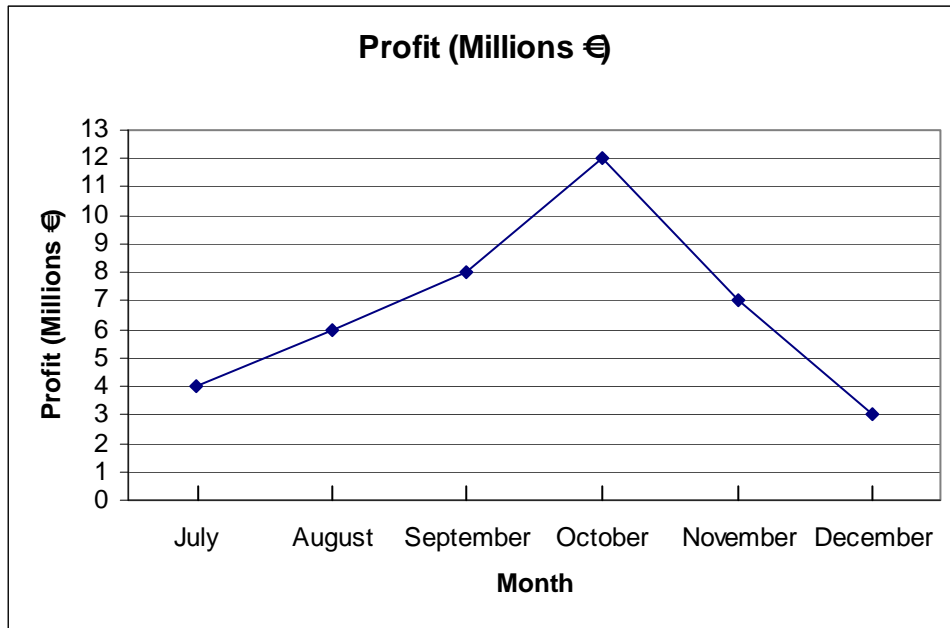
Attempts (3 marks)

- A1 Some correct step and stops.
- A2 Writes $0.2 + 4.6 + 8.3 + 10.2 + 11.7$ and stops
- A3 Partial addition with work and stops.
- A4 Idea of mean indicated e.g. $\frac{\sum x}{n}$ or a verbal description.
- A5 States median is 8.3 and stops
- A6 35 or 5 without work.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

The trend graph shows the profit, in millions of euro, made by a company during the last six months of last year



Use the trend graph to answer the following questions

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

In which month did the company make the lowest profit?

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

December

* Accept correct answer without work.

Attempts (3 marks)

A1 Writes July, August, September, October or November.

A2 Writes 3 as the answer.

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

What was the total profit, in millions of euro, made by the company in the given six months?



$$4 + 6 + 8 + 12 + 7 + 3$$

$$= 40 \text{ or } \text{€}40 \text{ million}$$

Blunders (-3)

B1 Correct answer without work

B2 Incorrect mathematical operation.

Slips (-1)

S1 Numerical slips to a maximum of -3

S2 Omits an entry or includes an incorrect entry in the addition (each time).

Attempts (2 marks)

A1 Some correct step and stops.

A2 Writes one of the relevant figures and stops.

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

(b)(iii)

5 marks

Att 2

What percentage of the overall profit was made in July?

(b)(iii)

5 marks

Att 2



July = 4

$\frac{4}{40}$

$\Rightarrow \frac{4}{40} \times 100$

= 10%

* Accept candidates answer in part (ii)

Blunders (-3)

B1 Correct answer without work

B2 Omits the 100 or divides by the 100

B3 Leaves answer as $\frac{4}{40} \times 100$

B4 Inverts the fraction.

Misreading (-1)

M1 Takes a correct profit for another month and continues.

Slips (-1)

S1 Numerical slips to a maximum of -3.

Attempts (2 marks)

A1 Some correct step with work and stops e.g. indicates the 100.

A2 Writes 4, 6, 8, 12, 7, 3, 0r 40 and stops.

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

Part (c)

20(5,10,5) marks

Att 2, 3, 2

The highest temperatures, in degrees Centigrade, of each of the days in June, 2006, were:

18°C 18°C 20°C 19°C 20°C 19°C
19°C 18°C 18°C 19°C 18°C 21°C
20°C 22°C 20°C 22°C 21°C 20°C
18°C 19°C 19°C 20°C 22°C 19°C
18°C 18°C 19°C 18°C 22°C 21°C

(c)(i)

5 marks

Att 2

Complete the following frequency table:

Temperature °C	18	19	20	21	22
Number of Days					

(c)(i)

5 marks

Att 2

Temperature °C	18	19	20	21	22
Number of Days	9	8	6	3	4

- * Accept correct answer with no work shown
- * Hit or miss; 1 mark per correct entry.

Attempts (2 marks)

A1 One correct entry only

Worthless (0)

W1 Table in question reproduced merits zero marks.

(c)(ii)

10 marks

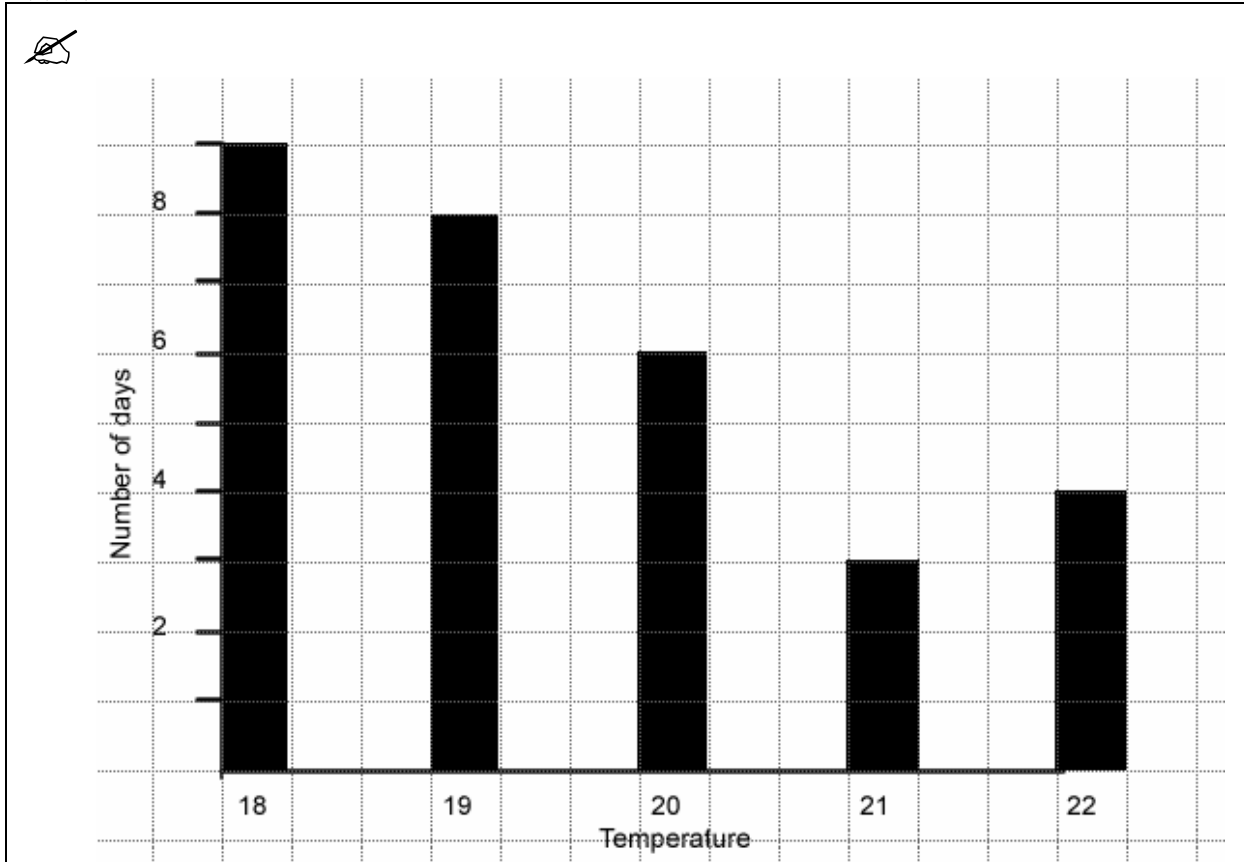
Att 3

Draw a bar chart of the data

(c)(ii)

10 marks

Att 3



- * Accept correct graph with no labels.
- * Accept horizontal or vertical bar chart
- * Accept bars of unequal widths or bars joined as a histogram
- * Accept lines as bars

Blunders (-3)

- B1 Axis with number of days not graduated uniformly.
- B2 Reverse variable and frequency when drawn.
- B3 Draws a trend graph or pie chart.

Slips (-1)

- S1 Each incorrect bar or bar omitted to a max of -3.

Attempts (3 marks)

- A1 Graduated axis or axes only.

Calculate the mean daily temperature for the month of June, 2006



$$\begin{aligned}
 \text{Mean} &= \frac{\sum fx}{\sum f} \\
 &= \frac{(18 \times 9) + (19 \times 8) + (20 \times 6) + (21 \times 3) + (22 \times 4)}{9 + 8 + 6 + 3 + 4} \\
 &= \frac{162 + 152 + 120 + 63 + 88}{30} \\
 &= \frac{585}{30} \\
 &= 19.5
 \end{aligned}$$

Blunders (-3)

- B1 Correct answer without work
- B2 Incorrect mathematical operation in numerator or denominator.
- B3 Incorrect denominator or no denominator e.g. $\frac{585}{10}$
- B4 Inverted fraction.
- B5 Frequencies omitted in numerator
- B6 Omits 2 or more values in numerator.

Slips (-1)

- S1 Numerical slips to a maximum of -3.
- S2 $\frac{585}{30}$ and stops.
- S3 Omits one value in numerator with work.

Attempts (2 marks)

- A1 Some correct step with work and stops e.g. $9 + 8 + 6 + 3 + 4$ and/or 30.
- A2 Mean = $\frac{\sum fx}{\sum f}$ and stops.
- A3 A relevant multiplication and stops.
- A4 Average of the frequencies e.g. $\frac{9 + 8 + 6 + 3 + 4}{5} = \frac{30}{5}$
- A5 $\frac{18 + 19 + 20 + 21 + 22}{5} = \frac{100}{5}$.
- A6 585 or 30 without work.
- A7 Indicates addition of any numbers from data in part (i) e.g. $18 + 18$

Worthless (0)

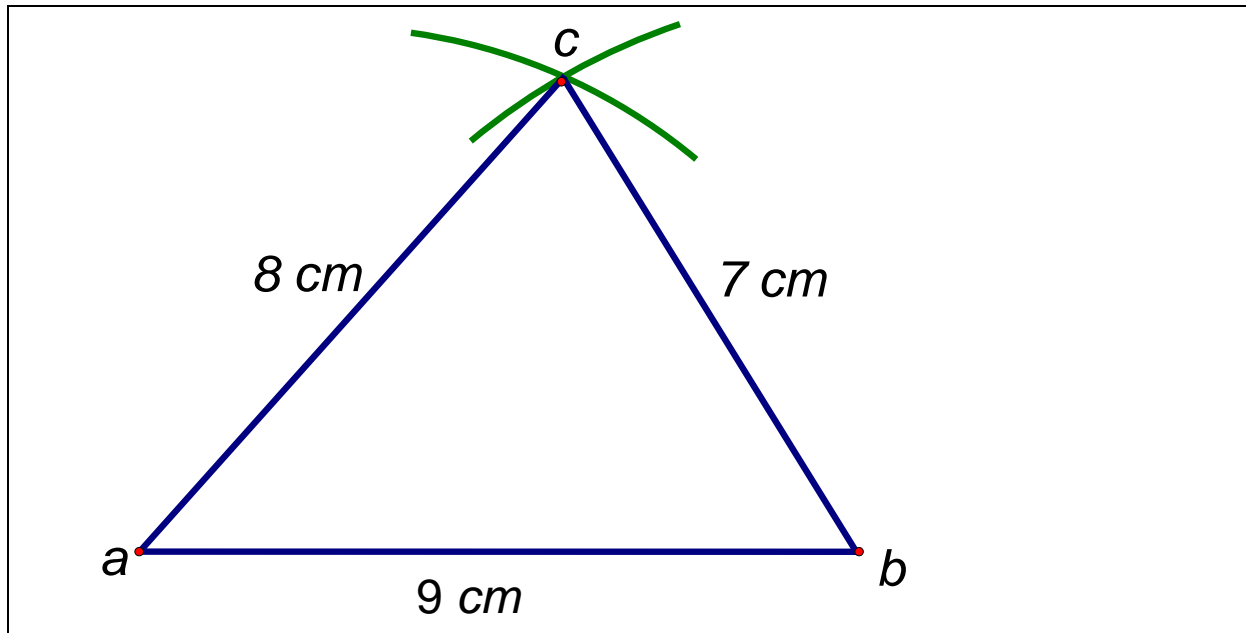
- W1 Incorrect answer without work unless attempt mark applies.

QUESTION 4

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**

Construct a triangle abc with $|ab| = 9 \text{ cm}$, $|ac| = 8 \text{ cm}$ and $|bc| = 7 \text{ cm}$.
Label your diagram clearly



- * Accept base other than $[ab]$
- * Tolerance of $\pm 2 \text{ mm}$ on each side.
- *Examiners must measure candidates work.

Blunders (-3)

- B1 Incorrect length of first two sides drawn each time.
- B2 Failure to complete the triangle.

Slips (-1)

- S1 No labels or incorrect labels on the diagram.
- S2 Units other than centimetres

Attempts (3 marks)

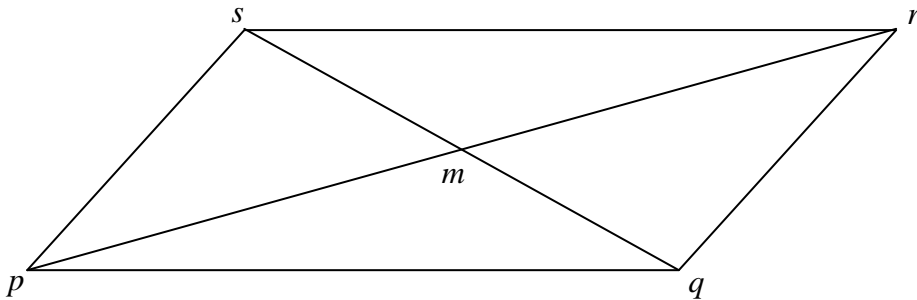
- A1 Pilot diagram drawn
- A2 Draws a line segment of the correct length, labelled or unlabelled.
- A3 Draws a labelled line segment $[ab]$ or $[ac]$ or $[bc]$ of any length.

Part (b)

15(5, 5, 5) marks

Att 2, 2, 2

$pqrs$ is a parallelogram.
The diagonals $[sq]$ and $[pr]$ intersect at m



(b)(i)

5 marks

Att 2

The Δpqr has area 18 cm^2

Write down the area of the parallelogram $pqrs$

Give a reason for your answer

(b)(i)

5 marks

Att 2

Area of the parallelogram $pqrs = 36 \text{ cm}^2$

Reason: Diagonal bisects area of parallelogram

* Accept correct answer without work

Blunders (-3)

B1 Area = $n \times 18, n \neq 2$ e.g. $4 \times 18 = 72$ or $\frac{1}{2} \times 18 = 9$

Slips (-1)

S1 Numerical slips to a maximum of -3.

S2 Correct answer without a reason or with an incorrect reason.

Attempts (2 marks)

A1 Reason only given

A2 Correct area formula for triangle or parallelogram.

A3 States opposite sides / angles of a parallelogram are equal in measure.

Worthless (0)

W1 Incorrect answer without work unless attempt mark or B1 applies.

W2 Diagram reproduced without modification.

(b)(ii)

5 marks

Att 2

Given that $|pr| = 10.6$ cm, find $|mr|$.

Give a reason for your answer.

(b)(ii)

5 marks

Att 2

$$|mr| = \frac{10.6}{2} = 5.3 \text{ cm}$$

Reason: Diagonals of a parallelogram bisect each other.

* Accept correct answer marked / indicated on a diagram

* Accept correct answer without work

Blunders (-3)

B1 $|mr| = \frac{10.6}{n}, n \neq 2$

B2 Incorrect Mathematical operation

Slips (-1)

S1 Numerical slips to a maximum of -3.

S2 Correct answer without a reason or with an incorrect reason

Attempts (2 marks)

A1 Reason only

A2 Any mention of congruence.

A3 Writes $|pm| = |mr|$ and stops.

A4 Writes $|mr| = \frac{1}{2}|pr|$

Worthless (0)

W1 Incorrect answer without work unless attempt mark or B1 applies.

W2 Diagram reproduced without modification.

(b)(iii)

5 marks

Att 2

Complete the following reasons for the fact that the triangles Δsmp and Δqmr are congruent

Reasons:	<input type="text"/>		<input type="text"/>
	<input type="text"/>	=	<input type="text"/>
	<input type="text"/>	=	<input type="text"/>
	<input type="text"/>	=	<input type="text"/>

Reasons:	In Δsmp		In Δqmr
	$ sm $	=	$ mq $
	$ pm $	=	$ mr $
	$ sp $	=	$ rq $

*Accept correct answer marked or indicated on a diagram

*Accept other correct reasons

Blunders (-3)

B1 Each step omitted

Attempts (2 marks)

A1 Some correct step with work and stops .

A2 States same shape or SSS or ASA or SAS.

A3 States triangles fold onto each other.

A4 Clearly indicates the two required triangle in the answer box for this part.

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

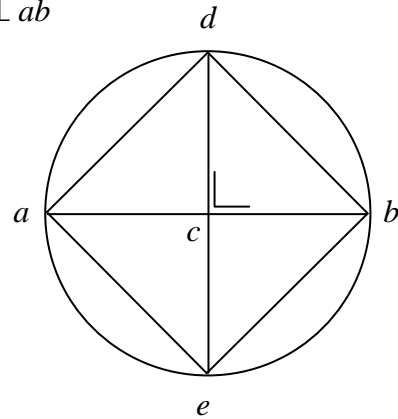
W2 Diagram reproduced without modification.

Part (c)

25 (5,10,10)marks

Att 2, 3, 3

$[ab]$ and $[de]$ are diameters of a circle with centre c . $de \perp ab$



(c)(i)

5 marks

Att 2

Name the image of the Δdbc under S_c , the central symmetry in the point c

(c)(i)

5 marks

Att 2

Δace

* Accept Δace with points in any order.

* Accept $d \rightarrow e$, $b \rightarrow a$ and $c \rightarrow c$.

* Accept diagram with correct indication / shading.

Blunders (-3)

B1 Each point whose image is not found (or incorrectly found).

Attempts (2 marks)

A1 Some correct step with work and stops.

A2 Shows some knowledge of central symmetry and stops.

A3 States that the image is a triangle.

A4 Finds the image of one or two points correctly e.g. $d \rightarrow e$ or $bc \rightarrow ac$

A5 If a , c or e appears in any group of letters.

Worthless (0)

W1 Diagram reproduced without modification.

(c)(ii)

10 marks

Att 3

Write down $|\angle cdb|$. Give a reason for your answer.

(c)(ii)

10 marks

Att 3

$$|\angle cdb| = 45^\circ$$

Reason: $\triangle cdb$ isosceles or $|cb| = |cd|$
or $|\angle cdb| = |\angle cbd|$

*Accept correct answer without work.

* Accept correct answer marked or indicated on a diagram.

Blunders (-3)

B1 Sum of angles in a triangle $\neq 180^\circ$

B2 Transposition error.

B3 Takes an arbitrary angle for $|\angle cbd|$ and continues.

Slips (-1)

S1 Numerical slips to a maximum of -3.

S2 Correct answer without a reason or with an incorrect reason.

Attempts (3 marks)

A1 Some correct step with work and stops.

A2 Writes down $|\angle dcb| = 90^\circ$.

A3 Writes down $\triangle cbd$ is isosceles.

A4 Writes down $|cb| = |cd|$ and / or $|\angle cdb| = |\angle cbd|$

A5 Reason only given.

A6 States “*sum of the three angles in a triangle = 180*” or similar and stops.

A7 $180 - 90 = 90$ and stops.

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies

W2 Diagram reproduced without modification.

(c)(iii)

10 marks

Att 3

Given that $|ab| = 10$ cm, use the Theorem of Pythagoras to find $|db|$

(c)(iii)

10 marks

Att 3

$$|ab| = 10 \Rightarrow |cb| \text{ and } |cd| = 5$$

$$|cb|^2 + |cd|^2 = |db|^2 \quad \text{or} \quad |ab|^2 = |ad|^2 + |db|^2$$

$$5^2 + 5^2 = |db|^2 \quad 100 = |db|^2 + |db|^2$$

$$50 = |db|^2 \quad 50 = |db|^2$$

$$7.07 \text{ or } \sqrt{50} = |db| \quad 7.07 \text{ or } \sqrt{50} = |db|$$

* Accept correct answer without work

Blunders (-3)

B1 Mathematical error $5^2 = 10$

B2 Incorrect Theorem of Pythagoras.

B3 Error in manipulation of equation.

B4 Takes an arbitrary figure for $|ad|$ or similar and continues.

B5 Takes $|cb|$ or $|cd|$ as 10

Slips (-1)

S1 Numerical slips to a maximum of -3.

S2 Fails to write $\sqrt{50}$ and gives answer as 7.

Attempts (3 marks)

A1 Some correct step with work and stops.

A2 States Theorem of Pythagoras.

A3 States $|cb| = 5$ and stops.

A4 5^2 or 10^2 and stops.

Worthless (0)

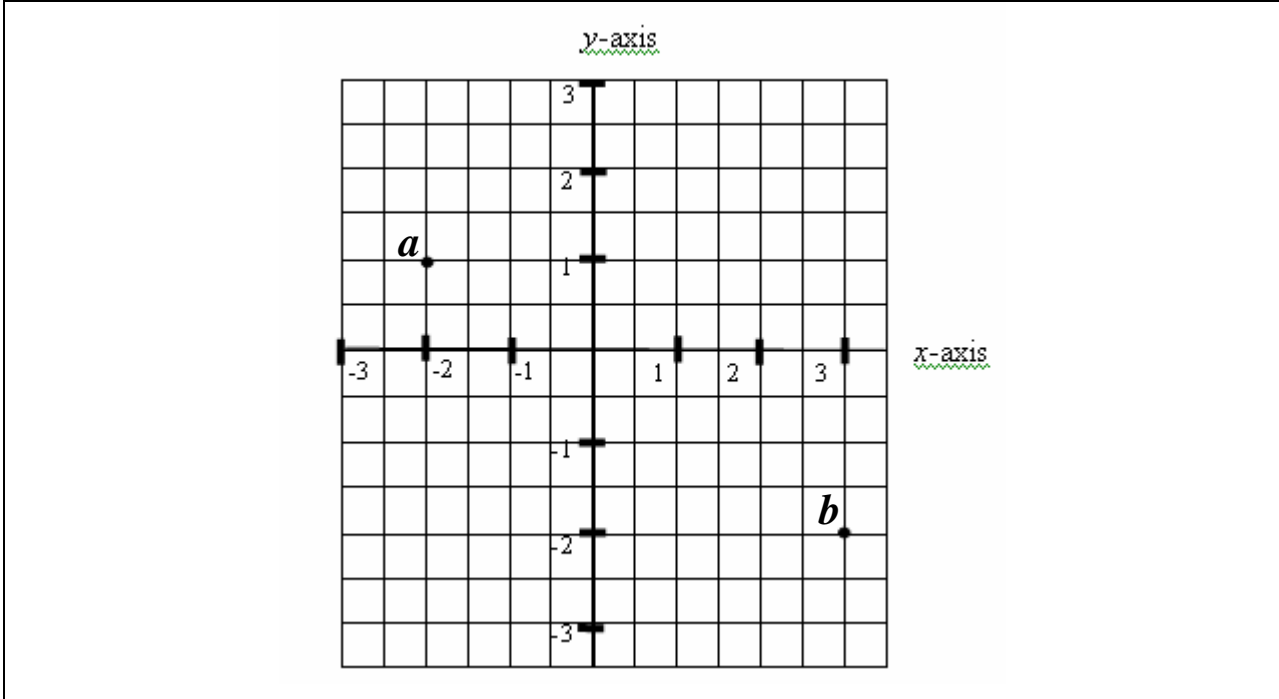
W1 Incorrect answer without work unless attempt mark applies

QUESTION 5

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

a is the point $(-2, 1)$
 b is the point $(3, -2)$
 Plot the points a and b .

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



* Accept correct answer without work.

Blunders (-3)

- B1 Correctly plots and labels one point.
- B2 Plots incorrect order of both couples – penalise once

Misreading (-1 marks)

- M1 Each sign incorrect

Slips (-1)

- S1 Fails to label points (each time)

Attempts (3 marks)

- A1 Some correct step and stops e.g. Writes $x = -2$ and / or $y = 1$ for point a or similar.
- A2 Plots $(-2,0)$ and / or $(0,1)$ for point a or similar.
- A3 Picks a random point and plots it correctly

Worthless (0)

- W1 Random point selected and plotted incorrectly.
- W2 Diagram reproduced without modification.

Part (b)

25 (10, 10, 5)marks

Att 3, 3, 2

p is the point (5, 3) and q is the point (-3, 1). Find each of the following

(b)(i)

10 marks

Att 3

the slope of pq

(b)(i)

10 marks

Att 3



$$\left(\frac{3-1}{5-(-3)} \right) = \frac{2}{8} \text{ or } \frac{1}{4} \text{ or } 0.25 \quad \text{OR} \quad \left(\frac{1-3}{-3-5} \right) = \frac{-2}{-8} \text{ or } \frac{1}{4} \text{ or } 0.25$$

* Accept candidates midpoint as a point for finding the slope.

* Accept correct trigonometric method i.e. $\tan \theta = \frac{1}{4}$.

Blunders (-3)

B1 Correct answer without work .

B2 Incorrect slope formula e.g. $\frac{x_2 - x_1}{y_2 - y_1}$ or $\frac{y_2 + y_1}{x_2 + x_1}$ or $\frac{y_2 - y_1}{x_1 - x_2}$ or $\frac{x_1 - y_1}{x_2 - y_2}$ or $\frac{\text{horizontal}}{\text{vertical}}$
or $\tan \theta = \frac{\text{adjacent}}{\text{opposite}}$ and continues.

B3 Incorrectly treats couples as (x_1, x_2) and (y_1, y_2)

B4 Mathematical error e.g. sign rules.

B5 Uses one of the given points and some arbitrary point e.g. (5,3) and (0,0) and continues.

B6 Error in more than one sign when substituting.

Misreading (-1)

M1 Use of points in part (a)

Slips (-1)

S1 Numerical slips to a maximum of -3.

S2 Error in one sign in slope formula e.g. $\frac{y_2 - y_1}{x_2 + x_1}$.

S3 One incorrect substitution or sign for substituting.

Attempts (3 marks)

A1 Some correct step with work and stops.

A2 $\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$ or $m = \frac{\text{vertical}}{\text{horizontal}}$ and stops.

A3 Some correct substitution into formula with $x_2 - x_1$ and / or $y_2 - y_1$

A4 Points p and / or q plotted reasonably well for this part.

A5 Identifies (x_1, y_1) and / or (x_2, y_2) in this part.

Worthless (0)


W1 Use wrong formula e.g. midpoint formula.

W2 States given formula only.

(b) (ii)

10 marks

Att 3

 (ii) the midpoint of $[pq]$

(b) (ii)

10 marks

Att 3

$$\begin{aligned} & \left(\frac{5-3}{2}, \frac{3+1}{2} \right) \\ &= \left(\frac{2}{2}, \frac{4}{2} \right) \\ &= (1,2) \end{aligned}$$

* Accept translation method.

* No penalty on brackets.

Blunders (-3)

B1 Correct answer without work 

B2 Incorrect formula e.g. error in both signs $\left(\frac{x_1 - x_2}{2}, \frac{y_1 - y_2}{2} \right)$ or $\left(\frac{x_1 + y_1}{2}, \frac{x_2 + y_2}{2} \right)$ or $\left(\frac{x_1 + x_2}{2} + \frac{y_1 + y_2}{2} \right)$ or omits the divisor 2 and continues.

B3 Incorrectly treats couples as (x_1, x_2) and (y_1, y_2) if not already penalised.

B4 Two or more signs incorrect in substitution and continues.

B5 Reversal of coordinates i.e. (2,1) with work.

B6 One ordinate only worked out correctly.

B7 Uses one of the given points and some arbitrary point e.g. (5,3) and (0,0) and continues.

B8 Mathematical error e.g. sign rules

Slips (-1)

S1 Numerical slips to a maximum of -3.

S2 Error in one sign in midpoint formula and continues.

S3 One incorrect substitution or sign when substituting e.g. $\left(\frac{5-3}{2}, \frac{3-1}{2} \right)$ and continues

S4 Takes (5,3) as midpoint and finds extremity e.g. $(-3,1) \rightarrow (5,3) \rightarrow (13,5)$ or takes $(-3,1)$ as midpoint and finds extremity e.g. $(5,3) \rightarrow (-3,1) \rightarrow (-11,-1)$

Attempts (3 marks)

A1 Some correct substitution

A2 Correct midpoint indicated on graph and not named (if named B1 applies)

A3 Point p and / or q plotted reasonably well for this part.

A4 Identifies (x_1, y_1) and/or (x_2, y_2) (for this part).

Worthless (0)


W1 Use wrong formula e.g. slope or distance formula.

W2 Writes midpoint formula and stops.

(b) (iii)

5 marks

Att 2

 (iii) the length of $[pq]$

(b) (iii)


5 marks

Att 2

$ pq $	=	$\sqrt{(5 - -3)^2 + (3 - 1)^2}$	$ pq $	=	$\sqrt{(-3 - 5)^2 + (1 - 3)^2}$
	=	$\sqrt{(8)^2 + (2)^2}$		=	$\sqrt{(-8)^2 + (-2)^2}$
	=	$\sqrt{(64 + 4)}$		=	$\sqrt{(64 + 4)}$
	=	$\sqrt{68}$ or 8.24		=	$\sqrt{68}$ or 8.24

* Accept correct use of Pythagoras.

Blunders (-3)

- B1 Correct answer without work. 
- B2 Incorrect formula e.g. $\sqrt{(x_2 - x_1)^2 - (y_2 - y_1)^2}$ or $\sqrt{(x_2 + x_1)^2 + (y_2 + y_1)^2}$ or omits square root sign or squares and continues.
- B3 Incorrectly treats couples as (x_1, x_2) and (y_1, y_2) if not already penalised.
- B4 Mathematical error e.g. $8^2 = 16$
- B5 Two or more signs in substitution.
- B6 No square root included with substitution and continues correctly to get 68.

Slips (-1)

- S1 Numerical slips to a maximum of -3.
- S2 Error in one sign in $(x_2 - x_1)$ or $(y_2 - y_1)$ in formula.
- S3 One incorrect substitution or sign when substituting.
- S4 If the square root sign is included with the substitution and omitted in the answer of 68.

Attempts (2 marks)

- A1 Some correct step with work.
- A2 Some correct substitution into a formula with $x_2 - x_1$ and/or $y_2 - y_1$
- A3 States theorem of Pythagoras and stops.
- A4 Point p and or q plotted reasonably well (for this part)
- A5 Identifies (x_1, y_1) and/or (x_2, y_2) (for this part).

Worthless (0 marks)

- W1 Use of wrong formula e.g. midpoint formula.
- W2 Incorrect answer without work unless attempt mark applies .

(c) (i)

10 marks

Att 3

The line K contains the point $(-1, 6)$
 K has a slope of 2.
 Find the equation of K .

(c) (i)

10 marks

Att 3




$$y - y_1 = m(x - x_1)$$

$$y - 6 = 2(x - -1)$$

* $6 - y = 2(-1 - x)$ or similar merits full marks.

Blunders (-3)

- B1 Correct answer without work. 
- B2 Incorrect formula e.g. $y + y_1 = m(x + x_1)$ or $(x - x_1) = m(y - y_1)$ and continues.
- B3 Switches x and y e.g. $y - -1 = 2(x - 6)$
- B4 Mathematical error.
- B5 $y = 2(x + c)$ and stops
- B6 Uses a point other than $(-1, 6)$ e.g. $(0, 0)$.
- B7 $m \neq 2$

Slips (-1)

- S1 Numerical slips to a maximum of -3.
- S2 Error in one sign in formula.
- S3 One incorrect substitution or sign when substituting.

Attempts (3 marks)

- A1 Some correct step with work.
- A2 Writes $m = 2$ and stops.
- A3 States $y = mx \pm c$ and stops

Worthless (0 marks)

- W1 Use of wrong formula
- W2 States given formula only.

Note: If an error is made while attempting to simplify this equation, penalise in part (ii)

(c) (ii)

5 marks

Att 2

By letting $x = 0$, find the coordinates of s , the point of intersection of the line K and the y -axis.

(c) (ii)

5 marks

Att 2



$$y-6 = 2(x+1)$$

$$y-6 = 2(1)$$

$$y-6 = 2$$

$$y = 2+6$$

$$y = 8$$

$$s = (0,8)$$

* Accept candidates answer from part (i)

* Accept answer given as $y = 8$ with work shown for full marks.

Blunders (-3)

B1 Correct answer without work.

B2 Substitutes $y = 0$ and continues.

B3 Mathematical error.

B4 Incorrect substitution and continues.

B5 Transposition error

Slips (-1)

S1 Numerical slips to a maximum of -3.

Attempts (2 marks)

A1 Some correct step with work and stops.

A2 Substitutes $y = 0$ and stops.

A3 Writes $y - 6 = 2(x + 1)$ and stops.

A4 Writes answer as $(0,y)$ without work where y is an arbitrary number subject to B1.

Worthless (0)

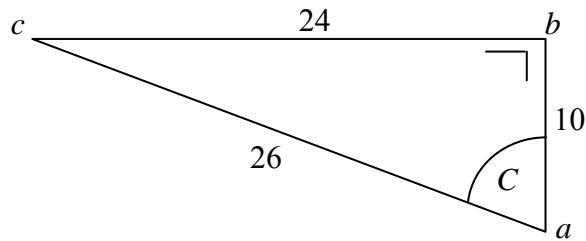
W1 Incorrect answer with no work unless attempt mark applies.

QUESTION 6

Part (a)	15(10,5) marks	Att 3,2
Part (b)	20(5,10,5) marks	Att 2,3,2
Part (c)	15(5,10) marks	Att 2,3

Part (a) **15(10,5) marks** **Att 3, 2**

The right-angled triangle abc has measurements as shown.



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

Write down the length of the side opposite to the angle C

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

Length of the side opposite to the angle $C = 24$

- * Correct answer with no work merits full marks.
- * Indicates 24 only in diagram, accept for 10 marks.

Blunders (-3 marks)

B1 Gives answer as $[bc]$.

Attempts (3 marks)

- A1 Any mention of a correct trigonometric ratio.
- A2 Gives answer as 26 or 10.

Worthless (0)

- W1 Incorrect answer with no work unless attempt mark applies.
- W2 Gives more than one answer.
- W3 Answer measured from examination paper.

(a) (ii)

5 marks

Att 2

Write down the value of $\tan C$, as a fraction

(a) (ii)

5 marks

Att 2

$$\tan C = \frac{24}{10}$$

- * Correct answer with no work merits full marks.
- * Accept consistent error from part (i)
- * Accept $\tan \frac{24}{10}$ for full marks.

Blunders (-3)

- B1 Inverted or incorrect ratio e.g. $\tan C = \frac{10}{24}$ or $\frac{24}{26}$ or $\frac{10}{26}$
- B2 Gets $\tan \angle acb$ (check is not consistent error from (i)).

Slips (-1)

- S1 Answer = 2.4 (answer not a fraction)

Attempts (2 marks)

- A1 Any correct trigonometric ratio written down in answer box.
- A2 Only gives answer = 67.38° or rounded to 67° for this part.
- A3 Only gives answer = 0.0419 i.e. $\tan \frac{24}{10}$

Worthless (0)

- W1 Incorrect answer with no work unless attempt mark applies.
- W2 Answer given as $\frac{26}{24}$ or $\frac{26}{10}$.

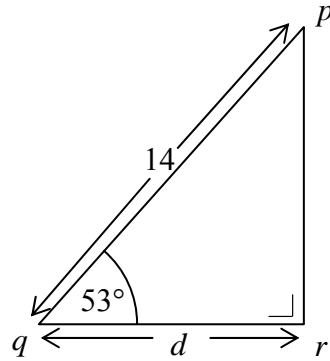
Part (b)

20 (5, 10, 5)marks

Att 2, 3, 2

6(b) In the right-angled triangle pqr ,
 $|pq| = 14$ and $|\angle pqr| = 53^\circ$.

Let $|qr| = d$.



(b) (i)

5 marks

Att 2

Using the diagram write down the value of $\cos 53^\circ$, as a fraction

(b) (i)

5 marks

Att 2

$$\frac{d}{14}$$

* Correct answer with no work merits full marks.

* Accept $\cos \frac{d}{14}$ for full marks

Blunders (-3)

B1 Inverts the answer

B2 Gives the answer as 0.6018

B3 Correct sin or tan ratio given.

Attempts (2 marks)

A1 Writes $\frac{qr}{pq}$

A2 Any correct trigonometric ratio written down.

Worthless (0)

W1 Incorrect answer with no work unless attempt mark applies.

(b) (ii)

10 marks

Att 3

Using your calculator, or otherwise, write down the value of $\cos 53^\circ$ correct to one decimal place.

(b) (ii)

10 marks

Att 3

$$\cos 53^\circ = 0.6018 = 0.6$$

- * Correct answer with no work merits full marks.
- * Accept $\cos 0.6$ for full marks.

Blunders (-3)

B1 Writes $\cos 37 = 0.7986$ as the answer.

B2 Finds $\sin 53$ or $\tan 53$ and continues.

B3 $\cos 53 = \frac{d}{14}$ and stops or $\frac{d}{14}$ on it's own.

B4 Uses Radian or Grad mode on the calculator.

	RAD	GRAD
Cos 53	-0.9182	0.6730

Slips (-1 marks)

S1 Failure to round off or rounds off incorrectly.

Attempts (3 marks)

A1 Writes $\cos 53 = \frac{qr}{pq}$ or $\frac{qr}{pq}$ and stops.

A2 Any correct trigonometric ratio written down.

A3 $\sin 37 = 0.549$ $\tan 37 = 0.6568$ \rightarrow Grad mode

or

$\sin 37 = -0.6435$ $\tan 37 = -0.8407$ \rightarrow Rad mode.

Worthless (0)

W1 Incorrect answer with no work unless attempt mark applies.

W2 0.549 or similar on its own (must be in format given in A3 to merit marks)

(b) (iii)

5 marks

Att 2

Hence find d , the value of $|qr|$

(b) (iii)

5 marks

Att 2



$$\begin{aligned}\frac{d}{14} &= 0.6 \Rightarrow \\ d &= 14 \times 0.6 \\ &= 8.4\end{aligned}$$

* Accept candidates answers from parts (i) and (ii).

Blunders (-3)

B1 Correct answer without work.

B2 Error in forming equation e.g. $\frac{14}{d} = 0.6$ and continues

B3 Error in manipulation of equation.

B4 Writes $\frac{d}{14} = 0.7986$ or 0.8 and continues i.e. $\cos 37$

	RAD	GRAD
Cos 53	-0.9182	0.6730

B5 Uses Radian or Grad mode on calculator unless already penalised in part (ii).

Slips (-1 marks)

S1 Numerical slips to a maximum of -3.

Attempts (2 marks)

A1 Any correct step with work and stops e.g. $\frac{x}{14}$ or $\frac{14}{x}$

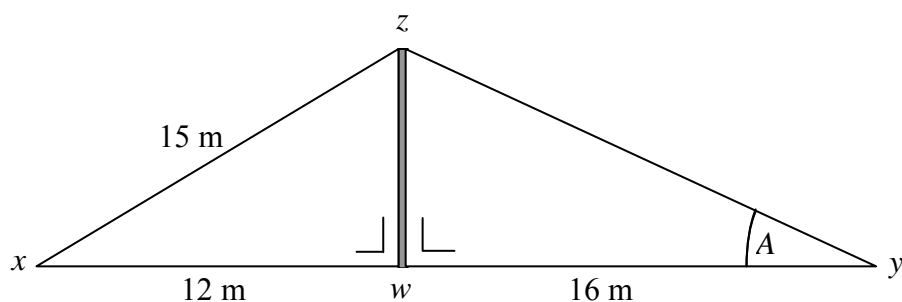
A2 Correct scale diagram.

A3 $\cos 53$ or 0.6 or any trigonometric ratio.

Worthless (0)

W1 Incorrect answer with no work unless attempt mark applies.

W2 Answer = 3.5cm (measured from examination paper)



$[zw]$ is a vertical television aerial mast

$[zx]$ and $[zy]$ are supporting cables.

$|zx| = 15$ m, $|xw| = 12$ m and $|wy| = 16$ m

(c) (i)

5 marks

Att 2

(i) In Δxwz , use the Theorem of Pythagoras, to find $|zw|$
the height of the television aerial mast.

(c) (i)

5 marks

Att 2



$$(12)^2 + |wz|^2 = (15)^2$$

$$144 + |wz|^2 = 225$$

$$|wz|^2 = 225 - 144$$

$$= 81$$

$$|wz| = 9 \text{ or } \sqrt{81}$$

* Accept $|wz|$ found correctly using a correct trigonometric ratio method for full marks.

Blunders (-3)

- B1 Correct answer without work
- B2 Incorrect theorem of Pythagoras and continues.
- B3 Mathematical error e.g. $12^2 = 24$
- B4 Error in manipulation of equation.
- B5 Stops at $|wz|^2 = 81$

Slips (-1 marks)

- S1 Numerical slips to a maximum of -3.

Attempts (2 marks)

- A1 Some correct step with work and stops e.g. 12^2 or writes 90° for $\angle W$ on diagram.
- A2 States theorem of Pythagoras and stops.
- A3 Correct Sin, Cos or Tan ratio written down and stops.
- A4 Labels correctly the hypotenuse e.g. $h=15$.

Worthless (0)

- W1 Incorrect answer with no work unless attempt mark applies e.g. 144.
- W2 $15 - 12 = 3$ or $15 + 12 = 27$.
- W3 Answer = 2.8cm (measured from examination paper)

(c) (ii)

10 marks

Att 3



Hence find the measure of the angle marked A in the diagram correct to the nearest degree

(c) (ii)

10 marks

Att 3

$$\begin{aligned}\tan A &= \frac{9}{16} \\ &= 0.5625 \\ A &= 29.357^\circ \\ A &= 29^\circ\end{aligned}$$

* Accept candidates answer from part (i).

Blunders (-3)

- B1 Correct answer without work
- B2 Incorrect trigonometric ratio.
- B3 Decimal error.
- B4 Mathematical error.
- B5 Uses radian or grad mode on calculator.
- B6 Error in manipulation of equation.

Misreading (-1 marks)

- M1 Finds $|\angle yzw|$ correctly.

Slips (-1 marks)

- S1 Numerical slips to a maximum of -3.
- S2 Fails to round off or rounds off incorrectly.
- S3 Obvious slip in reading tables or calculator.

Attempts (3 marks)

- A1 Some correct step with work and stops e.g. Sine rule stated.
- A2 Any correct trigonometric ratio written down.
- A3 Correct scale diagram.
- A4 States 180 with or without work.

Worthless (0)

- W1 Incorrect answer with no work unless attempt mark applies.

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 marks \times 5% = 9.9 \Rightarrow bonus = 9 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