

MARKING SCHEME
JUNIOR CERTIFICATE EXAMINATION 2007
MATHEMATICS - ORDINARY LEVEL - PAPER 1

GENERAL GUIDELINES FOR EXAMINERS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

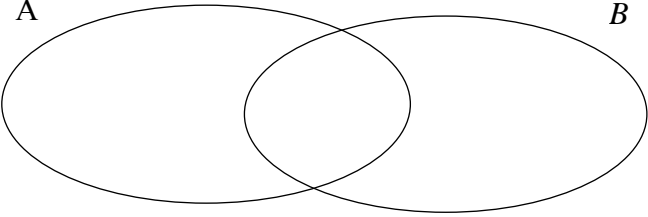
12. Do not penalise the use of a comma for a decimal point, e.g. €5.50 may be written as €5,50.

QUESTION 1

Part (a)	10(5, 5) marks	Att 4(2, 2)
Part (b)	20(5, 5, 5, 5) marks	Att 8(2, 2, 2, 2)
Part (c)	20(5, 5, 5, 5) marks	Att 8(2, 2, 2, 2)

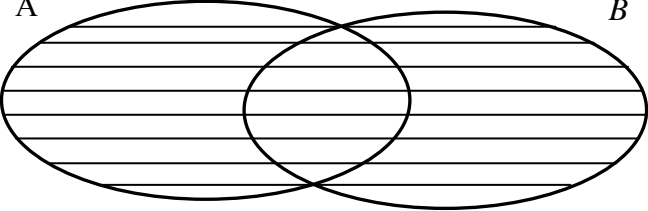
Part (a) (i) 5 marks Att 2

1(a) (i) Using the Venn diagram below, shade in the region that represents $A \cup B$.



The diagram shows two overlapping ovals, A on the left and B on the right. The intersection of A and B is the region where they overlap.

Part (a) (i) 5 marks Att 2



The diagram shows two overlapping ovals, A on the left and B on the right. The entire area covered by both ovals, including their intersection, is shaded with horizontal lines.

Blunders (-3)

B1 Any incorrect indication other than the misreading below.

Misreadings (-1)

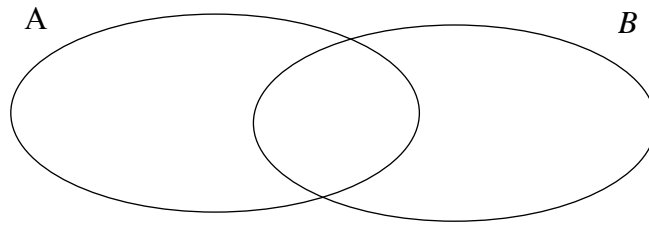
M1 $A \cap B$ indicated.

Part (a) (ii)

5 marks

Att 2

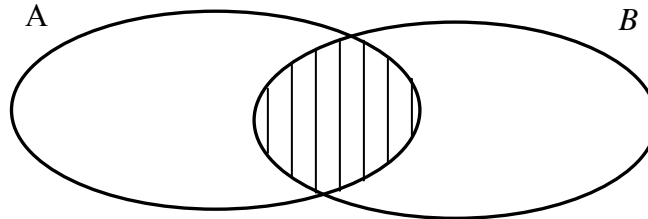
1(a) (ii) Using the Venn diagram below, shade in the region that represents $A \cap B$.



Part (a) (ii)

5 marks

Att 2



Blunders (-3)

B1 Any incorrect indication other than the misreading below.

Misreading (-1)

M1 $A \cup B$ indicated.

Part (b)

20(5, 5, 5, 5) marks

Att(2,2,2,2)

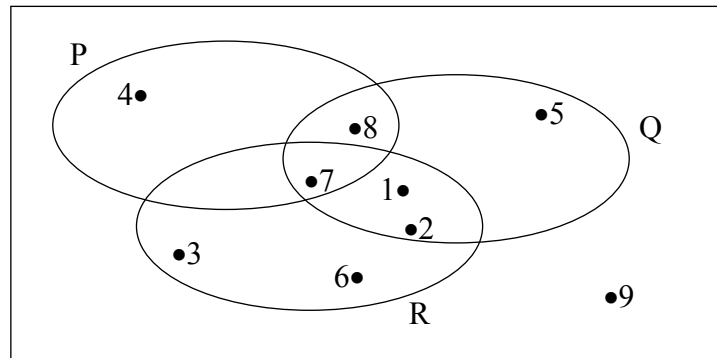
1(b)

U is the universal set

$$P = \{4, 7, 8\}$$

$$Q = \{1, 2, 5, 7, 8\}$$

$$R = \{1, 2, 3, 6, 7\}$$



Part (b) (i)

5 marks

Att 2

1(b) (i) List the elements of: $P \cup Q$.

Part (b) (i)

5 marks

Att 2

$$P \cup Q = \{1, 2, 4, 5, 7, 8\}$$

Blunders (-3)

B1 Any incorrect set of elements of P and Q other than the misreading as below.

Misreadings (-1)

M1 $P \cap Q$ giving $\{7, 8\}$.

Attempts (2 marks)

A1 3 or 6 or 9 appear in the answer.

Part (b) (ii)

5 marks

Att 2

1(b) (ii) List the elements of: $P \setminus R$.

Part (b) (ii)

5 marks

Att 2

$$P \setminus R = \{4, 8\}$$

Blunders (-3)

B1 Any incorrect set of elements of P and R other than the misreading as below.

e.g. $\{P \setminus (Q \cup R)\} = \{4\}$.

Misreadings (-1)

M1 $R \setminus P$ giving $\{1, 2, 3, 6\}$.

Attempts (2 marks)

A1 5 or 9 appear in the answer.

Part (b) (iii)

5 marks

Att 2

1(b) (iii) List the elements of: $(P \cup R) \cap Q$

Part (b) (iii)

5 marks

Att 2

$$(P \cup R) \cap Q = \{1, 2, 7, 8\}$$

Blunders (-3)

B1 Any incorrect set of elements of P and Q and R other than the misreading as below.

B2 $P \cup R = \{1, 2, 3, 4, 6, 7, 8\}$.

Misreadings (-1)

M1 $(P \cap R) \cup Q$ giving $\{1, 2, 5, 7, 8\}$.

M2 $(P \cup R) \cup Q$ giving $\{1, 2, 3, 4, 5, 6, 7, 8\}$.

M3 $(P \cap R) \cap Q$ giving $\{7\}$.

Attempts (2 marks)

A1 9 appears in the answer.

Part (b) (iv)

5 marks

Att 2

1(b) (iv) List the elements of: $(P \cup Q)'$

Part (b) (iv)

5 marks

Att 2

$$(P \cup Q)' = \{3, 6, 9\}$$

Blunders (-3)

B1 Any incorrect set of elements of P and Q other than the misreading as below.

B2 $(P \cup Q) = \{1, 2, 4, 5, 7, 8\}$ in this part.

Misreadings (-1)

M1 $(P \cap Q)'$ giving $\{1, 2, 3, 4, 5, 6, 9\}$.

M2 $P' \cup Q'$ giving $\{1, 2, 3, 4, 5, 6, 9\}$.

Attempts (2 marks)

A1 Any incorrect listing of elements other than the misreadings above.

Part (c)

20(5,5,5,5)marks

Att(2,2,2,2)

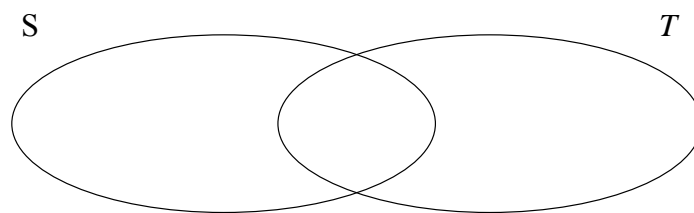
1(c) In a class, all the students study Science (*S*) or Technical Graphics (*T*).
A number of the students study both of these subjects.
22 students study Science. 12 students study Technical Graphics
8 study both subjects.

Part (c) (i)

5 marks

Att 2

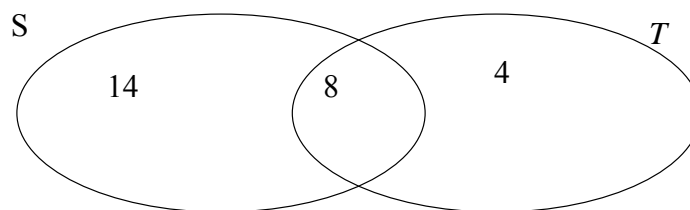
1(c) (i) Represent this information in the Venn diagram below.



Part (c) (i)

5 marks

Att 2



Blunders (-3)

B1 Incorrect Venn diagram subject to S1 below.

Slips (-1)

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

Misreadings (-1)

M1 Interchanges Technical Graphics and Science.

Attempts (2 marks)

A1 Any one correct relevant entry.

A2 Incorrect work with numbers 8, 12, and 22. (work shown)

Part(c) (ii)

5 marks

Att 2

1(c) (ii)

How many students study Science only?

Part(c) (ii)

5 marks

Att 2

14

- * A correct answer written here in the space provided takes precedence over an incorrect Venn diagram.
- * Accepts candidates work from previous part c (i).
- * If no work appears here, award **2** marks if the correct answer appears in the Venn diagram.

Blunders (-3)

B1 Any incorrect use of the given numbers or the numbers from the candidates incorrect Venn diagram. {Subject to S1}.

Slips (-1)

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

Misreadings (-1)

M1 Science read as Technical Graphics.

Attempts (2 marks)

A1 Incorrect work with numbers 8, and/or 22. (work shown)

Part(c) (iii)

5 marks

Att 2

1(c) (iii)

How many students are there in the class?

Part(c) (iii)

5 marks

Att 2

26

- * A correct answer written here in the space provided takes precedence over an incorrect Venn diagram.
- * Accepts candidates work from previous part c (i), c (ii).
Note: Answer c (ii) + 12 added correctly merits full marks.

Blunders (-3)

B1 Any incorrect use of the given numbers or numbers from the candidates incorrect Venn diagram. {Subject to 2nd * above}.

Slips (-1)

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

S2 Written as $14 + 8 + 4$.

Attempts (2 marks)

A1 Incorrect work with numbers 14, 8,4,12 or 22.

Part(c) (iv)

5 marks

Att 2

1(c) (iv)

How many students study only one of the two subjects?

Part(c) (iv)

5 marks

Att 2

18

* A correct answer written here in the space provided takes precedence over an incorrect Venn diagram.

* Accepts candidates work from previous part c (i), c (ii) and c (iii).

Note: Answer c (iii) - 8 merits full marks.

Blunders (-3)

B1 Any incorrect use of the given numbers or numbers from the candidates incorrect Venn diagram. {Subject to 2nd * above}.

Slips (-1)

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

S2 Written as $14 + 4$.

Attempts (2 marks)

A1 Incorrect work with numbers 14, 8, 4, 12, or 22.

QUESTION 2

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

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

2(a) €6650 was shared between Ciarán and Sheila in the ratio 2:5.
How much did each receive?

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

$2 \text{ parts} : 5 \text{ parts}$ $\Rightarrow \frac{6650}{7} = 950$ $\text{Ciaran} = 950 \times 2 = \text{€}1900$ $\text{Sheila} = 950 \times 5 = \text{€}4750$	$2 + 5 = 7$ $\frac{1}{7} = 950$ $\Rightarrow \frac{2}{7} = \text{€}1900 \text{ (C)}$ $\Rightarrow 6650 - 1900 = \text{€}4750 \text{ (S)}$	$2x : 5x$ $\Rightarrow 7x = 6650$ $\Rightarrow x = 950$ $\Rightarrow 2x = \text{€}1900 \text{ (C)}$ $\Rightarrow 5x = \text{€}4750 \text{ (S)}$

Blunders (-3)

- B1 Correct answer without work.
- B2 Divisor $\neq 7$ only and continues.
- B3 Incorrect multiplier or fails to multiply. (each time).
- B4 Error in transposition.
- B5 Fails to find second amount.
- B6 Adds instead of subtracts. e.g. $6650 + 1900 = 8550$.

Slips (-1)

- S1 Numerical errors to a max of 3.

Misreadings (-1)

- M1 Interchanges Ciaran and Sheila.

Attempts (3 marks)

- A1 Divisor $\neq 7$ e.g. $\frac{6650}{2}$ and/or $\frac{6650}{5}$ and stops.
- A2 Indicates 7 parts or 2 parts or 5 parts or $\frac{2}{7}$ or $\frac{5}{7}$ or $2+5=7$ and stops.
- A3 Indicates multiplication of 6500 by 2 and/or 5 and stops.
- A4 Both answers added together equal €6650. (No work shown).

Worthless (0)

- W1 Incorrect answer without work. {Subject to A4}.

Part (b) (i)

5 marks


Att 2

2(b) (i) Simplify $\frac{a^8 \times a^{10}}{a^5 \times a^7}$, giving your answer in the form, a^n where $n \in \mathbf{N}$.


Part (b) (i)

5 marks

Att 2

 $\frac{a^8 \times a^{10}}{a^5 \times a^7} = \frac{a^{18}}{a^{12}} = a^6$	$\left(\frac{a^8}{a^5}\right) \times \left(\frac{a^{10}}{a^7}\right) = a^3 \times a^3 = a^6$	$\frac{a}{a} \times \frac{a}{a} \dots \frac{a}{a} = a^6$
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Blunders (-3)

- B1 Correct answer without work. 
- B2 Error in calculation involving indices.
- B3 Error in number of a's in the extended form.
- B4 Error in elimination in the extended form.
- B5 Fails to finish.

Slips (-1)

- S1 $\frac{a^{18}}{a^{12}} = 6$
- S2 Answer left $a \times a \times a \times a \times a \times a$.

Attempts (2 marks)

- A1 Some correct manipulation of indices. e.g, $8+10$, $\frac{18}{12}$, a^3 , a^5 , or a and stops.

Worthless (0)

- W1 Incorrect answer without work.

Part (b) (ii)

10 marks


Att 3

2(b) (ii) By rounding each of these numbers to the nearest whole number, estimate the value of $\frac{24 \cdot 092}{6 \cdot 1 - 2 \cdot 93}$.

Part (b) (ii)

10 marks


Att 3

 $\frac{24 \cdot 092}{6 \cdot 1 - 2 \cdot 93}$ is approximately equal to

$$\frac{\boxed{24}}{\boxed{6} - \boxed{3}} = \frac{\boxed{24}}{\boxed{3}} = \boxed{8}$$

- * $\frac{24}{6-3}$ and stops \Rightarrow 4 marks.
- * No penalty if the intermediate step between approximations and final answer is not shown.
i.e. $\frac{24}{3}$ not shown.
- * Special Case: $\frac{24 \cdot 092}{6 \cdot 1 - 2 \cdot 93} = 7 \cdot 6$ presented in this part \Rightarrow Attempt 3 marks.

Blunders (-3)

- B1 Correct answer without work. 
- B2 Error(s) in rounding off to the nearest whole number.
- B3 Decimal error in calculation of final value.
- B4 An arithmetic operation other than indicated.
- B5 Error(s) in the manipulation of the denominator. e.g. $\frac{24}{6} - \frac{24}{3}$ or similar.

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 No rounding off applied to given numbers.

Worthless (0)

- W1 Incorrect answer without work.

Part (b) (iii)

5 marks

Att 2

2(b)(iii) Using a calculator, or otherwise, find the exact value of $\frac{24 \cdot 092}{6 \cdot 1 - 2 \cdot 93}$.

Part (b) (iii)

5 marks

Att 2

$$\frac{24 \cdot 092}{6 \cdot 1 - 2 \cdot 93} = \frac{24 \cdot 092}{3 \cdot 17} = 7 \cdot 6$$

Blunders (-3)

B1 Decimal error.

B2 Treats as $\frac{24 \cdot 092}{6 \cdot 1} - 2 \cdot 93 = 3 \cdot 949508197 - 2 \cdot 93 = 1 \cdot 019 \dots$ {B1 may occur}.

B3 Treats as $24 \cdot 092 - \frac{24 \cdot 092}{2 \cdot 93} = 24 \cdot 092 - 8 \cdot 2225 = 15 \cdot 8695 \dots$ {B1 may occur}.

B4 Treats as $\frac{24 \cdot 092}{6 \cdot 1 + 2 \cdot 93} = \frac{24 \cdot 092}{9 \cdot 03} = 2 \cdot 66799 \dots$ {B1 may occur}.

B5 Treats as $\frac{24 \cdot 092}{6 \cdot 1 \times 2 \cdot 93} = \frac{24 \cdot 092}{17 \cdot 873} = 1 \cdot 347955016 \dots$ {B1 may occur}.

B6 Treats as $24 \cdot 092 - \frac{24 \cdot 092}{3 \cdot 17} = 24 \cdot 092 - 7 \cdot 6 = 16 \cdot 492$. {B1 may occur}.

B7 Treats as $\frac{24 \cdot 092}{6 \cdot 1} - \frac{24 \cdot 092}{2 \cdot 93} = 3 \cdot 9495 - 8 \cdot 2225 \dots = -4 \cdot 2755 \dots$ {B1 may occur}.

Slips (-1)

S1 Numerical errors to a max of 3.

S2 Any rounding off.

Attempts (2 marks)

A1 Any correct relevant calculation and stops.

Worthless (0)

W1 Incorrect answer without work.

Part(c) (i)

5 marks

Att 2

2(c) (i) Using a calculator, or otherwise, find the exact value of $(2 \cdot 25)^{\frac{1}{2}}$.

Part(c) (i)

5 marks

Att 2

$$(2 \cdot 25)^{\frac{1}{2}} = \frac{3}{2} = 1.5$$

Blunders (-3)

B1 Mishandles $(2 \cdot 25)^{\frac{1}{2}}$ e.g. $(2 \cdot 25)^2 = 5 \cdot 0625$.

B2 Decimal error.

Attempts (2 marks)

A1 $\sqrt{2 \cdot 25}$ and stops.

A2 $2 \cdot 25 \times \frac{1}{2} = 1 \cdot 125$.

Worthless(0)

W1 $2 \cdot 25 \times 2$ or $2 \cdot 75$.

Part(c) (ii)

5 marks

Att 2

2(c) (ii) Using a calculator, or otherwise, multiply 54.5 by 60 and express your answer in the form $a \times 10^n$, where $1 \leq a < 10$ and $n \in \mathbf{N}$

Part(c) (ii)

5 marks

Att 2



$$54 \cdot 5 \times 60 = 3270 = 3 \cdot 27 \times 10^3$$

Blunders (-3)

B1 Correct answer without work.

B2 Decimal error.

Slips (-1)

S1 Numerical errors to a max of 3.

S2 Rounds off to, $3 \cdot 3 \times 10^3$ or $3 \cdot 0 \times 10^3$

S3 Incorrectly rounds off. e.g. $3 \cdot 2 \times 10^3$ also attracts S2.

S4 Incorrect format, where $a < 1$ or $a \geq 10$ and $n \notin \mathbf{N}$.

Attempts (2 marks)

A1 Any relevant step. e.g. Partial multiplication.

Part(c) (iii)

10 marks

Att 3

2(c) (iii) Using a calculator, or otherwise, evaluate
 $(6 \cdot 9)^2 - \sqrt{139 \cdot 8} \div 3 \cdot 55$.
Give your answer correct to two decimal places

Part(c) (iii)

10 marks

Att 3



$$\begin{aligned} &= 47 \cdot 61 - 11 \cdot 823705 \div 3 \cdot 55 \\ &= 47 \cdot 61 - 3 \cdot 330621127 \\ &= 44 \cdot 27937887 \\ &= 44 \cdot 28 \end{aligned}$$

* Correct answer (without work) incorrectly rounded off \Rightarrow 6 marks

Blunders (-3)

B1 Correct answer without work. ✍

B2 Mishandles $(6 \cdot 9)^2$.

B3 Mishandles $\sqrt{139 \cdot 8}$.

B4 Error in $11 \cdot 823705 \div 3 \cdot 55$ or candidate's equivalent from previous work.

B5 Error in $47 \cdot 61 - 3 \cdot 330621127$ or candidate's equivalent from previous work.

B6 Decimal error.

B7 Subtracts before Division $35 \cdot 786295 \div 3 \cdot 55 = 10 \cdot 08064648 = 10 \cdot 08$ {Note S2,S3 }

B8 Use of mathematical operator other than that which is indicated.

B9 Works as $47 \cdot 61 \div 3 \cdot 55 - 11 \cdot 823705 = 1 \cdot 587562606 = 1 \cdot 59$.{Note S2,S3 }

Slips (-1)

S1 Numerical errors to a max of 3.

S2 Each premature rounding off that effects the final answer to a max of 3.

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

Attempts (3 marks.)

A1 Any correct relevant step e.g. $(6 \cdot 9)^2 = 47 \cdot 61$, $\sqrt{139 \cdot 8} = 11 \cdot 823705$.

QUESTION 3

Part (a)	10 marks	Att 3
Part (b)	20(10, 10) marks	Att 6(3, 3)
Part (c)	20(10, 10) marks	Att 6(3, 3)

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

3(a) In one week Bríd sent 26 text messages on her mobile phone
 11 of these messages cost 8c each
 The rest of the text messages cost 12c each.
 Find the total cost of Bríd's texting.

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

$26 - 11 = 15$	$26 - 11 = 15$
$11 \times 8 = 88$	$8 + 8 \dots 11 \text{ Times} = 88$
$15 \times 12 = 180$	$12 + 12 \dots 15 \text{ Times} = 180.$
<i>Total Cost = 268c (€2.68)</i>	<i>Total Cost = 268c (€2.68)</i>

- * No penalty for omission of € symbol.
- * Accept 268c, (€2.68)
- * Adds $8 + 12 = 20$ and stops merits 3 marks (Oversimplification).

Blunders (-3)

- B1 Correct answer without work.
- B2 Fails to subtract 11 from 26.
- B3 Each missing product when finding each cost e.g. 11 not multiplied by 8.
- B4 Each missing item when finding total cost e.g. Expensive texts omitted.
- B5 Fails to find total cost i.e. no addition.
- B6 Operation other than addition when finding total cost.
- B7 Decimal error e.g. €26.8 (Note: 1st* above).

Slips (-1)

- S1 Numerical errors to a max of 3.

Misreadings (-1)

- M1 15 texts @ 8c and 11 texts @ 12c.

Attempts (3 marks)

- A1 Any attempt at addition /multiplication.

Worthless (0)

- W1 Incorrect answer without work.

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

- 3(b) (i) John's gross pay is €23 000. His tax credit is €3400
 He pays income tax at the rate of 20%
 Find John's take-home pay.

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

Gross Pay	€23 000
Tax @ 20%	€4600
Tax Credit	€3400
Tax-Due	€1200
Take-home Pay	€21,800
$\text{Tax} = 23,000 \times \frac{20}{100} = 4600$	
$\text{or } 23,000 \times 0.2 = 4600$	
$\text{Tax Due} = 4600 - 3400$ $= 1200$	
$\text{Take-home Pay} = 23000 - 1200$ $= €21,800$	

Blunders (-3)

- B1 Correct answer without work. ✍
 B2 Mishandles 20% of 23,000. {Must use 23 000}
 B3 Decimal error.
 B4 Misuse of Tax Credit
 B5 Incorrect use of Tax Amount.
 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. $20\% = \frac{20}{100}$ and stops.


Worthless (0)

- W1 Incorrect answer without work

Part (b) (ii)**10 marks****Att3**

3(b) (ii) VAT at 21% is added to a bill of €255
Calculate the total bill.

Part (b) (ii)**10 marks****Att3**

		
$100\% = 255$	$21\% = \frac{21}{100}$	255×1.21
$1\% = \frac{255}{100}$	$\text{VAT} = \frac{21}{100} \times 255$	$\text{Total Bill} = €308.55$
$121\% = \frac{255}{100} \times 121$	$= 53.55$	
$= 2.55 \times 121$	$\text{Total Bill} = 255 + 53.55$	
$\text{Total Bill} = €308.55$	$\text{Total Bill} = €308.55$	

* €53.55 without work and stops merits 4 marks.

Blunders (-3)

B1 Correct answer without work. 

B2 Decimal error

B3 Inverts $\frac{121}{100}$ or $\frac{21}{100}$ and continues (giving answers 210.74 or 1214.29).

B4 Mishandles 21%. e.g. 255×21 or $255 \div 21$. Note: {255 must be used}.

B5 255 taken as 121%.

B6 No addition of VAT (as per candidates work) to the bill.

B7 Subtraction of VAT (as per candidates work) from the bill.

Slips (-1)

S1 Numerical errors to a max of 3.

Misreadings (-1)

M1 Reads as €225.

Attempts (3 marks)

A1 $\frac{21}{100}$ and stops.

A2 $100\% = 255$ and stops.

A3 $\frac{255}{100}$ and stops.

A4 $100 \times \frac{21}{255}$ and stops.

A5 $\frac{255}{21}$ and stops.

A6 Use of any other %.

A7 $255 + 21\%$ and stops.

Part(c) (i)

10 marks


Att 3

3(c) (i)	€15 000 is invested at 3% per annum What is the amount of the investment at the end of the first year?
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Part(c) (i)

10 marks

Att 3

		
$1\% = \frac{15000}{100}$	$I = \frac{P \times R}{100}$	Amount = 15000×1.03
$3\% = \frac{15000}{100} \times 3$	$I = \frac{15000 \times 3}{100}$	Amount = €15 450
Interest = 450	$I = 450$	
Amount = $15000 + 450$	Amount = $15000 + 450$	
Amount = €15 450	Amount = €15 450	

* €450 (without work) and stops \Rightarrow 4 marks.

Blunders (-3)

B1 Correct answer without work. 

B2 Mishandles 3%. e.g. $\frac{15000 \times 100}{3}$ Note: {15000 must be used}.

B3 Decimal error (once only).

B4 Stops at interest i.e. fails to calculate amount.

B5 Subtracts to calculate amount.

B6 Mathematical error(s) working with $\frac{15000 \times 3}{100}$.

B7 1.03 treated as 1.3.

Slips (-1)

S1 Numerical errors to a max of 3.

Attempts (3 marks)

A1 Correct formula with or without substitution and stops.

A2 Some use of 100 in attempt to find percentage e.g. $3\% = \frac{3}{100}$ or 1.03 and stops.

A3 15000 + 3% and stops.

Worthless (0)

W1 Incorrect answer without work.

Part(c) (ii)**10 marks****Att 3**

3(c) (ii)	€1450 is withdrawn from this amount at the beginning of the second year. The interest rate for the second year is 3.5%. What is the amount of the investment at the end of that year?
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Part(c) (ii)**10 marks****Att 3**

Principal for second year = 15450 - 1450 = 14000		
$1\% = \frac{14000}{100}$	$I = \frac{P \times R}{100}$	Amount = 14000 × 1.035
$3.5\% = \frac{14000}{100} \times 3.5$	$I = \frac{14000 \times 3.5}{100}$	Amount = €14 490
Interest = 490	$I = 490$	
Amount = 14000 + 490	Amount = 14000 + 490	
Amount = €14 490	Amount = €14 490	

- * No penalty for consistent error(s) already penalised in (c) (i).
- * Accept candidates work from previous part (c) (i).
- * €490 (without work) and stops ⇒ 4 marks.
- * €14000 (without work) and stops ⇒ 3 marks.

Blunders (-3)

- B1 Correct answer without work.
- B2 Incorrect principal for second year.
- B3 Incorrect interest rate for second year.
- B4 Mishandles 3.5%. e.g. $\frac{14000 \times 100}{3.5}$ see (1st * above) Note: {14000 must be used}.
- B5 Decimal error (once only).
- B6 Stops at interest i.e. fails to calculate amount.
- B7 Subtracts to calculate amount.
- B8 Mathematical error(s) working with $\frac{14000 \times 3.5}{100}$
- B9 1.035 treated as 1.35

Slips (-1)

- S1 Numerical errors to a max of 3.

Attempts (3 marks)

- A1 Correct formula with or without substitution and stops.
- A2 Some use of 100 in attempt to find percentage e.g. $3.5\% = \frac{3.5}{100}$ or 1.035 and stops.
- A3 14000 + 3.5% and stops.

Worthless (0)

- W1 Incorrect answer without work.

QUESTION 4

Part (a)	15(10, 5) marks	Att 5(3, 2)
Part (b)	15(10, 5) marks	Att 5(3, 2)
Part (c)	20(10, 10) marks	Att 6(3, 3)

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

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

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



$$4x + 5 = 4(3) + 5 = 12 + 5 = 17$$

* $12 + 5 \Rightarrow 9$ marks.

Blunders (-3)

- B1 Correct answer without work. ✍
- B2 Leaves $4(3)$ in the answer.
- B3 Incorrect substitution and continues
- B4 Combines “x’s” to “numbers” and continues. e.g. $4x + 5 = 9x = 9(3) = 27$.
- B5 Breaks order i.e. $[4(3 + 5) = 32]$.
- B6 Treats $4(3)$ as 7 or 43 or similar.

Slips (-1)

- S1 Numerical errors to a max of 3.

Attempts (3 marks)

- A1 Substitutes for x and stops e.g. $4(3)$
- A2 Any correct step.

Worthless (0)

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

Part (a) (ii)

5 marks

Att 2

4(a) (ii) If $x = 3$, find the value of: (ii) $2x^2 - 11$

Part (a) (ii)

5 marks

Att 2



$$2x^2 - 11 = 2(3)^2 - 11 = 2(9) - 11 = 18 - 11 = 7$$

* $18 - 11 \Rightarrow 4$ marks.

Blunders (-3)

- B1 Correct answer without work. ✍
- B2 Leaves $2(9)$ in the answer.
- B3 Mishandles $(3)^2$ e.g. $(3)^2 = 6$.
- B4 Mishandles $2(3)^2$ e.g. $2(3)^2 = (6)^2$.
- B5 Mathematical error. e.g. $18 - 11 = -7$.
- B6 Incorrect substitution and continues.
- B7 Combines “x's” to “numbers” and continues. e.g. $2x^2 - 11x = -9x^2$
- B8 Breaks order i.e. $[2(9-11) = -4]$.
- B9 Treats $2(9)$ as 11 or 29 or similar.

Slips (-1)

- S1 Numerical errors to a max of 3.

Attempts (2 marks)

- A1 Substitutes for x and stops e.g. $2(3)^2$
- A2 Any correct step.

Worthless (0)

- W1 Combines “ x^2 ” to “numbers” and stops.

Part (b) (i)

10 marks


Att 3

4(b) (i)	Solve the equation	$4(5x + 6) = 84$.
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Part (b) (i)

10 marks

Att 3

$4(5x + 6) = 84$ $20x + 24 = 84$  $20x = 84 - 24$ $20x = 60$ $x = 3$	$4(5x + 6) = 84$ $5x + 6 = \frac{84}{4}$ $5x + 6 = 21$ $5x = 21 - 6$ $5x = 15$ $x = 3$
---	---

Blunders (-3)

- B1 Correct answer without work.  e.g. $x=3$ stated or substituted.
- B2 Error in distributive law and continues, e.g. $20x + 6 = 84$ (once only).
- B3 Error in transposition. (each time).
- B4 Combines "x's" to "numbers" and continues. e.g.. $20x + 24 = 44x$
- B5 Stops at $20x = 60$ or similar.

Slips (-1)

- S1 Numerical errors to a max of 3.
- S2 Leaves as $\frac{60}{20}$ or similar.

Attempts (3 marks)

- A1 Any correct step.
- A2 Particular case verified for any value of x other than 3.

Worthless (0)

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

Part (b) (ii)

5 marks

Att 2

4(b) (ii)

Write in its simplest form

$$3x^2 - 2x + 6 - x(2x - 3)$$

Part (b) (ii)

5 marks

Att 2



$$3x^2 - 2x + 6 - x(2x - 3)$$

$$3x^2 - 2x + 6 - 2x^2 + 3x$$

$$x^2 + x + 6$$

Blunders (-3)

- B1 Correct answer without work. ✍
- B2 Error(s) in distribution.
- B3 Combining unlike terms.
- B4 Fails to group or groups incorrectly.
- B5 Treats as $(3x^2 - 2x + 6 - x)(2x - 3)$ and continues.

Slips (-1)

- S1 Numerical errors to a max of 3.

Attempts (2 marks)

- A1 Any correct multiplication.e.g. $3x$
- A2 Any correct grouping of terms.
- A3 A correct step.
- A4 Substitutes a value of “ x ” and continues.

Worthless (0)

- W1 Combining unlike terms and stops.
- W2 No attempt at distribution but A2 may apply to subsequent work.

Part(c) (i)

10 marks

Att3

4(c) (i) Liam drove from Town **A** to Town **B**, a distance of x km.
He then drove from Town **B** to Town **C**, a distance of $(2x + 1)$ km.
The total distance that he drove was 56 km.
Find the value of x , correct to the nearest kilometre.

Part(c) (i)

10 marks

Att3



$$x + 2x + 1 = 56$$

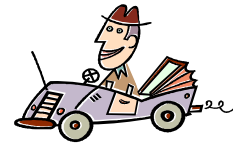
$$3x + 1 = 56$$

$$3x = 56 - 1$$

$$3x = 55$$

$$x = \frac{55}{3} \text{ or } 18.33333 \text{ or } 18\frac{1}{3}$$

$$x = 18$$



Blunders (-3)

- B1 Correct answer without work. ✍
- B2 Error(s) in forming equation for distance travelled.
- B3 Error in grouping terms. e.g. $2x + 1 = 56$ and continues.(once only).
- B4 Error in transposition.(each time).
- B5 Combines “x's”to “numbers”. e.g. $4x = 56$ and continues.
- B6 Stops at $3x = 55$ or candidate's equivalent. {S2 also applies}

Slips (-1)

- S1 Numerical errors to a max of 3.
- S2 Leaves as $\frac{55}{3}$ or 18.333 or $18\frac{1}{3}$ or candidate's equivalent.

Attempts (3 marks)

- A1 Any correct step.
- A2 Illustrates information on a diagram and stops.

Worthless (0)

- W1 Combines “x's” to “numbers” and stops.
- W2 Incorrect answer no work e.g. $x = 56$.

Part(c) (ii)

10 marks

Att3

4(c) (ii) Solve for x and for y :

$$3x + 5y = 13$$

$$x + 2y = 5$$

Part(c) (ii)

10 marks

Att3



I

II

$$3x + 5y = 13$$

$$x + 2y = 5$$

$$6x + 10y = 26$$

$$\underline{-5x - 10y = -25}$$

$$x = 1$$

$$\Rightarrow y = 2$$

or

$$3x + 5y = 13$$

$$\underline{x + 2y = 5}$$

$$3x + 5y = 13$$

$$\underline{-3x - 6y = -15}$$

$$-y = -2$$

$$y = 2$$

$$\Rightarrow x = 1$$

or

$$x = 5 - 2y$$

$$3(5 - 2y) + 5y = 13$$

$$15 - 6y + 5y = 13$$

$$-y = -2$$

$$y = 2$$

$$\Rightarrow x = 1$$

- * 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. ✍ e.g. $x=1, y=2$. stated or substituted.
- B2 Error(s) in establishing the first equation in terms of x only [$x = 1$] or the first equation in terms of y only [$-y = -2$] through elimination by cancellation.
- B3 Error(s) in establishing the first equation in terms of x only [$x = 5 - 2y$] or the first equation in terms of y only [$5y = 13 - 3x$] through elimination by substitution.
- B4 Errors in transposition in solving the first one variable equation.
- B5 Errors in transposition when finding the second variable.
- B6 Incorrect substitution when finding second variable.
- B7 Finds one variable only.

Slips (-1)

- S1 Numerical errors to a max of 3

Attempts (3 marks)

- A1 Attempt at transposition and stops.
- A2 Multiplies either equation by some number and stops.


QUESTION 5

Part (a)	10 marks	Att 3
Part (b)	20(5, 5, 5, 5) marks	Att 8(2, 2, 2, 2)
Part (c)	20(5, 5, 10) marks	Att 7(2, 2, 3)

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

5(a) Find the values of x for which $3x + 2 < 11, x \in \mathbf{N}$

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

	$3x + 2 < 11$ $3x < 11 - 2$ $3x < 9$ $x < 3$ $\{0, 1, 2\}$
---	--

Blunders (-3)

- B1 Correct answer without work. ✍
- B2 Error in transposition. (each time).
- B3 Combining unlike terms.
- B4 Mishandles the direction of inequality e.g. $3x > 9$
- B5 Treats inequality as equality and continues. {S3 may apply}
- B6 Combines “x’s” to “numbers”. e.g.. $5x < 11$ and continues.
- B7 $x < 3$ and stops.

Slips (-1)

- S1 Numerical errors to a max of 3.
- S2 $<$ taken as \leq .
- S3 No listing or incorrect listing of values. {Subject to max penalty of 3}.

Misreadings (-1)

- M1 $3x + 2 < 1$, and continues.

Attempts (3 marks)

- A1 Attempt at transposition and stops.
- A2 Particular case verified.

Part (b) (i)

5 marks

Att 2

5(b) (i) Factorise: $16xy + 11y$

Part (b) (i)

5 marks

Att 2

$y(16x + 11)$

Blunders (-3)

- B1 An incorrect factor
- B2 Removes factor incorrectly.

Attempts (2 marks)

- A1 Indication of common factor. e.g. underline y 's and stops.

Part (b) (ii)

5 marks


Att 2

5(b) (ii) Factorise: $5x + 10y + ax + 2ay$

Part (b) (ii)


5 marks

Att 2

	$5x + 10y + ax + 2ay$		$5x + 10y + ax + 2ay$
	$5(x + 2y) + a(x + 2y)$	or	$x(5 + a) + 2y(5 + a)$
	$(5 + a)(x + 2y)$		$(x + 2y)(5 + a)$

- * Accept also (with or without brackets) for 5 marks any of the following
 $(5 + a)$ and $(x + 2y)$ {The word **and** is written down.}
 $(5 + a)$ or $(x + 2y)$ {The word **or** is written down.}
 $(5 + a), (x + 2y)$ {A comma is used}

Blunders (-3)

- B1 Correct answer without work. 
- B2 Stops after first line of correct factorisation. e.g. $.5(x + 2y) + a(x + 2y)$ or equivalent.
- B3 Error(s) in factorising any pair of terms.
- B4 Incorrect common factor and continues. e.g. $2(ay + 5y) + x(a + 5)$

Slips (-1)

- S1 $(5 + a) \pm (x + 2y)$
- S2 Correct first line of factorisation but ends as $5a(x + 2y)$.

Attempts (2 marks)

- A1 Pairing off, or indication of common factors and stops.
- A2 Correctly factorises any pair and stops.

Part (b) (iii)

5 marks

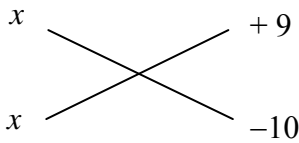
Att 2

5(b) (iii)	Factorise:	$x^2 - x - 90$
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Part (b) (iii)

5 marks

Att 2

$x^2 - x - 90$ $x^2 + 9x - 10x - 90$ $x(x + 9) - 10(x + 9)$ $(x - 10)(x + 9)$	 $\Rightarrow (x - 10)(x + 9)$	$\frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-90)}}{2(1)}$ $\frac{1 \pm \sqrt{1 + 360}}{2} = \frac{1 \pm 19}{2}$ $\frac{20}{2} = 10 \quad \frac{-18}{2} = -9$ $\Rightarrow (x - 10)(x + 9)$
--	--	---

- * Accept also (with or without brackets) for 5 marks any of the following
 $(x - 10)$ and $(x + 9)$ {The word **and** is written down.}
 $(x - 10)$ or $(x + 9)$ {The word **or** is written down.}
 $(x - 10), (x + 9)$ {A comma is used}

- B1 Incorrect two term linear factors of $x^2 - x - 90$ formed from correct (but inapplicable) factors of x^2 and -90 .e.g $(x - 45)(x + 2)$.
B2 Incorrect factors of x^2 .
B3 Incorrect factors of -90 .
B4 Correct cross method but factors not shown and stops.
B5 $x(x + 9) - 10(x + 9)$ or similar and stops.
B6 Incorrect common factor and continues.
B7 Incorrect quadratic formula and continues.
B8 Error in quadratic formula. (each time).
B9 Answer left as roots.
B10 Sign error(s) in substituted formula.
B11 Error in square root or square root ignored.

Slips (-1)

- S1 Numerical errors to a max of 3.
S2 Uses quadratic equation formula, but has wrong sign in factors.

Attempts (2 marks)

- A1 Correct quadratic equation formula quoted and stops
A2 Correct factors of either x^2 or ± 90 .
A3 Any correct step.

Worthless (0 marks)

- W1 $x^2 - x = 90$ or similar and stops.
W2 Combines "x's" to "numbers" and continues or stops.

Part (b) (iv)

5 marks

Att 2

5(b) (iv)

Factorise:

$$x^2 - 121$$

Part (b) (iv)

5 marks

Att 2

$$(x - 11)(x + 11)$$

- * Accept also (with or without brackets) for 5 marks any of the following
($x - 11$) and ($x + 11$) {The word **and** is written down.}
($x - 11$) or ($x + 11$) {The word **or** is written down.}
($x - 11$), ($x + 11$) {A comma is used}
- * Quadratic equation formula method is subject to slips and blunders.
- * ($x - \sqrt{121}$)($x + \sqrt{121}$) merits 5 marks.

Blunders (-3)

- B1 Incorrect two term linear factors of $x^2 - 121$ formed from correct (but inapplicable) factors of x^2 and -121 . e.g ($x - 121$)($x + 1$).
- B2 Incorrect factors of x^2 .
- B3 Incorrect factors of -121 .
- B4 ($11 - x$)($11 + x$).
- B5 ($x - 121$)($x + 121$).
- B6 Answer left as roots.

Slips (-1)

S1 ($x - 11$) \pm ($x + 11$)

Attempts (2 marks)

- A1 Correct factors of x^2 only.
- A2 Correct factors of ± 121 only.
- A3 x or ± 11 appears.
- A4 $x^2 - 121 = x.x - 11.11$ and stops.
- A5 Mention of the difference of two squares .e.g. $\{x^2 - (121)^2\}$
- A6 Correct quadratic equation formula quoted and stops.
- A7 $\sqrt{121}$

Worthless (0 marks)

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

Part(c) (i)

5 marks

Att2

5(c)(i) Express $\frac{2x-1}{5} + \frac{x+7}{2}$ as a single fraction.
Give your answer in its simplest form.

Part(c) (i)

5 marks

Att2



$$\begin{aligned} & \frac{2x-1}{5} + \frac{x+7}{2} \\ & \frac{2(2x-1) + 5(x+7)}{10} \\ & \frac{4x-2 + 5x+35}{10} \\ & \frac{9x+33}{10} \end{aligned}$$

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

Blunders (-3)

B1 Correct answer without work. ✍

B2 Error(s) in distribution. e.g. $2(2x-1) = 4x-1$.

B3 Mathematical error e.g. $-2+35 = -33$. $2(-1) = 2$.

B4 Incorrect common denominator and continues.

B5 Incorrect numerator from candidate's denominator e.g. $\frac{5(2x-1) + 2(x+7)}{10}$.

B6 No simplification of numerator.

B7 Omitting denominator.

Slips (-1)

S1 Drops denominator.

S2 Numerical error to a max of 3.

S3 Answer not in simplest form. e.g. $\frac{18x+66}{20}$.

Attempts (2 marks)

A1 10 only or a multiple of 10 only appears.

A2 Any correct step.

Worthless (0)

W1 $\frac{x}{5} + \frac{8x}{2}$, or $\left(\frac{2x-1}{5}\right)\left(\frac{x+7}{2}\right)$ and stops.

Part(c) (ii)

5 marks


Att2

5(c) (ii) Hence, or otherwise, solve the equation $\frac{2x-1}{5} + \frac{x+7}{2} = 6$.

Part(c) (ii)

5 marks

Att2

	$\frac{9x + 33}{10} = 6$ $9x + 33 = 60$ $9x = 60 - 33$ $9x = 27$ $x = 3$
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* Accept candidates answer from previous work.

Blunders (-3)

B1 Correct answer without work. 

B2 Error in transposition. (each time)

Slips (-1)

S1 Numerical error to a max of 3.

S2 Leaves as $\frac{27}{9}$.

Attempts (2 marks)

A1 Answer from (c) (i) written in this part or worked again in this part.

A2 Any correct step and stops.

A3 Particular case verified.

Part(c) (iii)**10 marks****Att3**5(c) (iii) Solve the equation: $x^2 + 5x - 36 = 0$.**Part(c) (iii)****10 marks****Att3**

$x^2 + 5x - 36 = 0$ $x^2 + 9x - 4x - 36 = 0$ $x(x + 9) - 4(x + 9) = 0$ $(x + 9)(x - 4) = 0$ $\Rightarrow x = -9 \quad x = 4$	 $(x + 9)(x - 4)$ $\Rightarrow x = -9$ $x = 4$	$\frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-36)}}{2(1)}$ $\frac{-5 \pm \sqrt{25 + 144}}{2} = \frac{-5 \pm \sqrt{169}}{2} = \frac{-5 \pm 13}{2}$ $\frac{8}{2} = 4 \quad \frac{-18}{2} = -9$
--	---	--

Blunders (-3)

- B1 Correct answers without work. ✍ e.g. $x = 4$, $x = -9$ stated or substituted.
- B2 Incorrect two term linear factors of $x^2 + 5x - 36$ formed from correct (but inapplicable) factors of x^2 and -36 . e.g. $(x - 12)(x + 3)$
- B3 Incorrect factors of x^2 .
- B4 Incorrect factors of -36 .
- B5 Correct cross method and factors not shown and stops. {B8 also applies}
- B6 $x(x + 9) - 4(x + 9)$ or similar and stops. {Note: B8 also applies }.
- B7 Incorrect root(s) from factors.
- B8 No roots given.
- B9 One root only
- B10 Error in quadratic formula. (each time).

Slips (-1)

- S1 Numerical errors to a max of 3.
- S2 Leaves as $\frac{p}{q}$.

Attempts (3 marks)

- A1 Correct factors of x^2 only
- A2 Correct factors of ± 36 only.
- A3 Some effort at factorisation.
- A4 Correct quadratic equation formula quoted and stops
- A5 Any correct step.

Worthless (0)

- W1 Combines unlike terms and continues or stops.

QUESTION 6

Part (a)	10(5, 5) marks	Att 4(2, 2)
Part (b)	25(15, 10) marks	Att 8(5, 3)
Part (c)	15(5, 5, 5) marks	Att 6(2, 2, 2)

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

6(a)	$P = \{(1,3) (4,6) (5,8) (7,9)\}$ Write out the domain and range of P .
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Part(a) Domain **5 marks** **Att 2**

Domain	=	$\{1, 4, 5, 7\}$
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Slips (-1)

S1 Each correct element omitted and/or each incorrect element included. {See M1}

Misreadings (-1)

M1 Correct range. i.e. $\{3,6,8,9\}$ given.

Attempts (2 marks)

A1 One element of domain.

A2 Domain $\{1 \rightarrow 7\}$

Worthless (0)

W1 No element of the domain appears. {See M1}

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

Range	=	$\{3, 6, 8, 9\}$
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Slips (-1)

S1 Each correct element omitted and/or each incorrect element included. {See M1}

Misreadings (-1)

M1 Correct domain. i.e. $\{1, 4, 5, 7\}$ given.

Attempts (2 marks)

A1 One element of range.

A2 Range $\{3 \rightarrow 9\}$

Worthless (0)

W1 No element of the range appears. {See M1}

Part (b)

25(15, 10) marks


Att 8(5, 3)

6(b) Draw the graph of the function
 $f: x \rightarrow 2 + 3x - x^2$
 in the domain $-1 \leq x \leq 4$, where $x \in \mathbf{R}$

Part (b) Table

15 marks

Att 5

							
$f(-1) = 2 + 3(-1) - (-1)^2 = -2$	x	-1	0	1	2	3	4
$f(0) = 2 + 3(0) - (0)^2 = 2$	2	2	2	2	2	2	2
$f(1) = 2 + 3(1) - (1)^2 = 4$	$+3x$	-3	0	3	6	9	12
$f(2) = 2 + 3(2) - (2)^2 = 4$	$-x^2$	-1	0	-1	-4	-9	-16
$f(3) = 2 + 3(3) - (3)^2 = 2$	$f(x)$	-2	2	4	4	2	-2
$f(4) = 2 + 3(4) - (4)^2 = -2$							

* Error(s) in each row /column attract a maximum deduction of 3.

Blunders (-3)

- B1 Treats $-x^2$ taken as x^2 and places " x^2 " in the table or function..
- B2 $-x^2$ taken as $-2x$ all the way. [In row headed $-x^2$ by candidate]
- B3 $+3x$ taken as $+3$ all the way. [In row headed $+3x$ by candidate]
- B4 2 calculated as $2x$ all the way.[In row headed 2 by candidate]
- B5 Adds in top row when evaluating $f(x)$.
- B6 Omits "2" row or omits "3 x" row.
- B7 Omits a value in the domain (each time).
- B8 Each incorrect image without work.

Slips (-1)

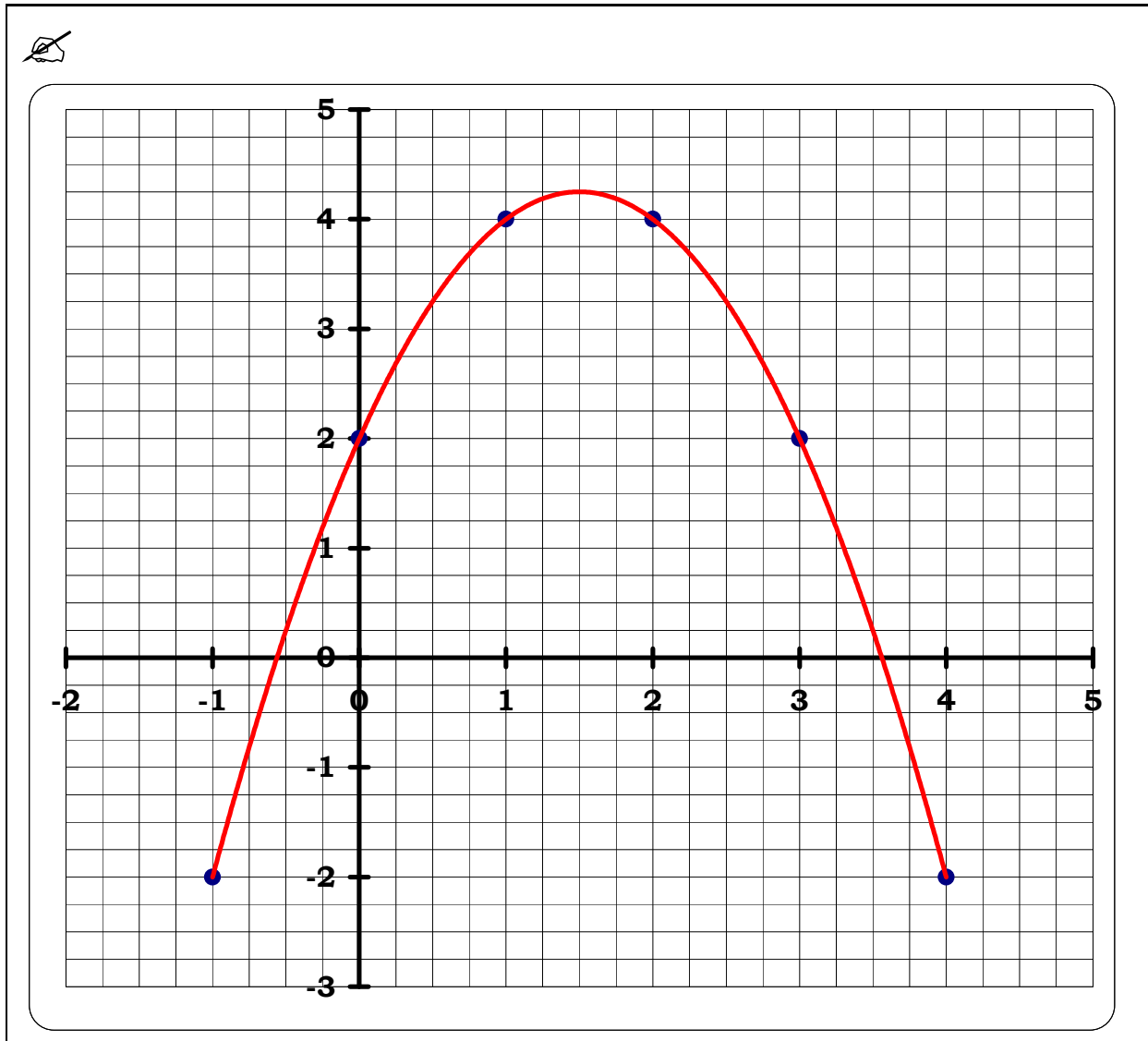
- S1 Numerical errors to a max of 3 in any row / column.

Misreadings (-1)

- M1 Misreads " $+3x$ " as " $-3x$ " and places " $-3x$ " in the table or function
- M2 Misreads "2" as "-2" and places "-2" in the table or function.

Attempts (5 marks)

- A1 Omits $-x^2$ row from table or treats $-x^2$ as $\pm x$.
- A2 Any effort at calculating point(s).
- A3 Only one point calculated and stops.



- * Accept candidate's values from previous work.
- * Only **one** correct point **graphed correctly** \Rightarrow Att 5 + Att 3
- * **Correct graph but no table** \Rightarrow full marks i.e. **(15+10)** 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 from table not graphed [See 2nd * above].

Attempts (3 marks)

- A1 Graduated axes (need not be labelled).

Part(c) (i)

5 marks

Att 2

6(c) (i) Given that $y = x + 1$, complete the table below

Part(c) (i)

5 marks

Att 2

x	0	1	2	3
y	1	2	3	4

* Accept candidate's values without work.

Slips(-1)

S1 Each y value omitted or incorrect.

Attempts(2marks)

A1 Any one correct value of y .

A2 Any effort at calculating point where work is shown.

Part(c) (ii)

5 marks

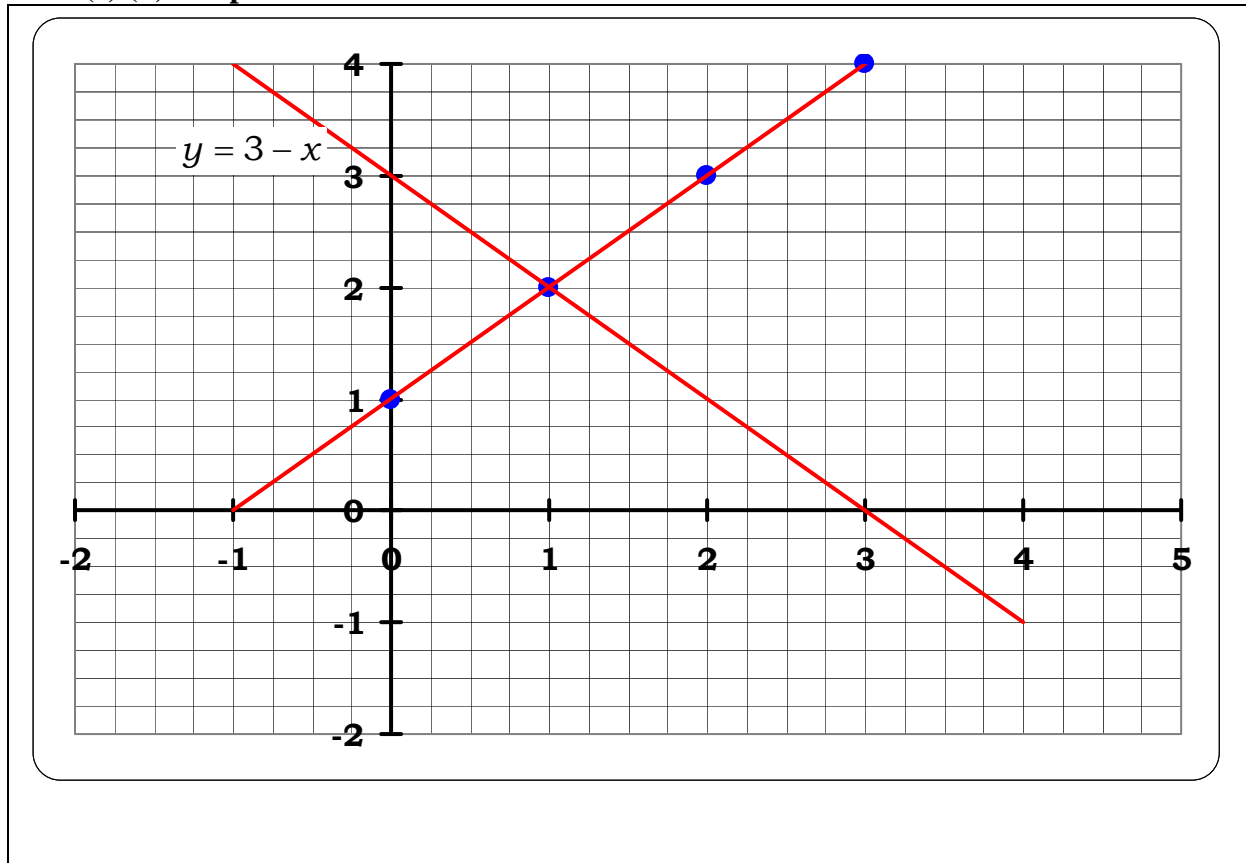
Att 2

6(c) (ii) On the grid below, the graph of the line $y = 3 - x$ is drawn.
Using your answers from (i), draw the graph of $y = x + 1$ on the same grid

Part(c) (ii) Graph

5 marks

Att 2



* Accept candidate's values from previous work.

* Only **one** point listed and **graphed correctly** \Rightarrow Att 2 + Att 2

Blunders (-3)

B1 Reversed co-ordinates (y, x) plotted.

B2 Points not joined or joined in incorrect order.

Slips (-1)

S1 Each point of candidate graphed incorrectly. {See B1}

S2 Each point from table not graphed or not contained on the candidate's graph.

Attempts (2 marks)

A1 Any straight line drawn.

Part(c)(iii) Intersection**5 marks****Att2**

6(c)(iii) Use the graphs drawn in 6 (c) (ii) to write down the coordinates of the point of intersection of the two lines $y = 3 - x$ and $y = x + 1$.

Part(c)(iii) Intersection**5 marks****Att2**

Point of intersection = (1,2)

* Accept previous graph from c (ii).

Blunders(-3)

B1 Answer not presented in designated box.

B2 Answer beyond tolerance. {Tolerance ± 0.25 }.

Attempts(2marks)

A1 Indicates correctly either x or y co-ordinate of point of intersection.

A2 Point of intersection indicated.

A3 Algebraic evaluation.

Worthless(0)

W1 Answers outside of tolerance without graphical indication.

MARKING SCHEME
JUNIOR CERTIFICATE EXAMINATION 2007
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)	20 marks	Att 7
Part (c)	20 marks	Att 8

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

One lap of a running track measures 440 m. James runs 50 laps of that track.
What distance, in kilometres, does James run?

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



$$440 \times 50 = 22,000 \text{ m}$$

$$\frac{22000}{1000}$$

$$= 22 \text{ km}$$

* Accept “,” for decimal point if used throughout the paper.

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 multiplies.
- B4 Decimal error

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Leaves answer as $\frac{22000}{1000}$

Attempts (3 marks)

- A1 Some correct step with work
- A2 Converts to kilometres correctly and stops e.g. 0.440 km
- A3 States 1000m = 1km and stops
- A4 Some correct effort at conversion e.g. $\frac{50}{1000}$.
- A5 22000 without work and stops
- A6 440×50 and stops

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

Part (b)

20 marks (10, 5, 5)

Att 7 (3, 2, 2)

Aoife books a flight from Cork to London. The plane is due to leave Cork at 18:25 and to arrive in London 1 hour and 20 minutes later.



(b)(i)

10 marks

Att 3


At what time should the plane arrive in London?



$$18 : 25 + 1 : 20 = 19 : 45$$

* Accept answer in twelve hour clock format.

Blunders (-3)

- B1 Correct answer without work 
- B2 Incorrect mathematical operation with work and continues.
- B3 Correctly adds an arbitrary time to 18 : 25 with work.
- B4 Incorrectly converts to a twelve hour format and continues.

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Leaves answer as 18 : 25 + 1 : 20

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

On the day of her flight the departure time was delayed by 25 minutes but the flight time was 6 minutes less than expected.
At what time did the plane land in London?




$$18 : 25 + 0 : 25 + 1 : 20 - 0 : 06 = 20 : 04$$

Or

$$19 : 45 + 0 : 25 - 0 : 06 = 20 : 04$$

- * Accept candidates answer in part (i)
- * Accept answer in twelve hour clock format.

Blunders (-3)

- B1 Correct answer without work 
- B2 Incorrect mathematical operation with work and continues.
- B3 Error in converting hours to minutes or no conversion (unless penalised in part (i)).

Slips (-1)

- S1 Numerical slips to a maximum of -3

Attempts (2 marks)

- A1 Some correct step with work e.g. $25 - 6 = 19$
- A2 States 1 hour = 60 minutes and stops.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

(b)(iii)

5 marks

Att 2


Aoife's fare for the flight was €48.
Excess hand baggage was charged at the rate of €3.50 per kg.
Aoife had 5.6 kg of excess hand baggage.
Find the total cost of Aoife's flight.



$$\text{Cost of hand baggage} = 5.6 \times 3.50 = €19.60$$

$$\begin{aligned} \text{Total Cost} &= 48 + 19.60 \\ &= €67.60 \end{aligned}$$

Blunders (-3)

- B1 Correct answer without work 
- B2 Incorrect mathematical operation with work and continues.
- B3 Decimal error

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Leaves as $48 + 19.60$

Attempts (2 marks)

- A1 Some correct step with work e.g. 5.6×3.5 and stops.
- A2 Answer given as €48 and stops
- A3 Answer given as 19.60 with or without work.

Worthless (0)

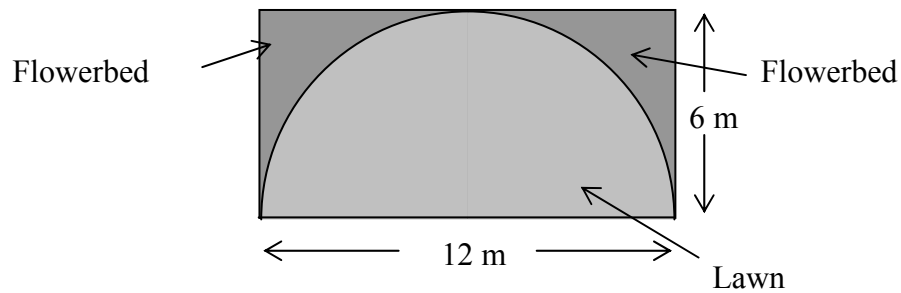
- W1 Incorrect answer without work unless attempt mark applies.

Part (c)

20 marks (5, 5, 5, 5)

Att 8 (2, 2, 2, 2)

A garden with a semicircular lawn and two flowerbeds has measurements as shown in the diagram.



(c)(i)

5 marks

Att 2

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



$$\text{Area} = 6 \times 12 = 72 \text{ m}^2$$

Blunders (-3)

- B1 Correct answer without work
- B2 Incorrect mathematical operation with work and continues
- B3 Incorrect relevant formula e.g. $\frac{1}{2}(6 \times 12) = 36$
- B4 Incorrect substitution and continues
- B5 $6^2 \times 12^2 = 5184$

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Leaves answer as 6×12

Attempts (2 marks)

- A1 Some correct step with work.
- A2 Finds perimeter of part or whole correctly or incorrectly with work shown e.g. $6 + 6 = 12$
- A3 Correct formula for area and stops e.g. $\text{Area} = L \times W$

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

Taking π as 3.14, find the area of the lawn, in m^2 .



$$\begin{aligned}
 \text{Area of lawn} &= \frac{1}{2} \times \pi r^2 \\
 &= \frac{1}{2} \times 3.14 \times 6 \times 6 \\
 &= \frac{1}{2} \times 113.04 \\
 &= 56.52 \text{ m}^2
 \end{aligned}$$

Blunders (-3)

- B1 Correct answer without work
- B2 Incorrect relevant formula and continues e.g. $2\pi r$ or πr^2
- B3 Mathematical error e.g. $6^2 = 12$ and continues.
- B4 Incorrect substitution and continues e.g. $r = 12$
- B5 $\pi \neq 3.14$ or answer given in terms of π
- B6 Decimal error

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Leaves answer as $\frac{1}{2} \times 113.04$

Attempts (2 marks)

- A1 Some correct step with work.
- A2 Product of two relevant numbers and stops
- A3 Writes 6^2 and stops
- A4 Correct formula for area of lawn and stops

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.
- W2 Incorrect formula without work

(c)(iii)

5 marks

Att 2

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



$$\begin{aligned}\text{Area of flowerbeds} &= 72 - 56 \cdot 52 \\ &= 15 \cdot 48 \text{ m}^2\end{aligned}$$

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

Blunders (-3)

- B1 Correct answer without work
- B2 Incorrect mathematical operation and continues.
- B3 Decimal error

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Leaves answer as $72 - 56 \cdot 52$

Attempts (2 marks)

- A1 Some correct step with work.
- A2 Writes 72 and / or $56 \cdot 52$ and stops.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

(c)(iv)

5 marks

Att 2

Taking π as 3.14, find the total perimeter of the semicircular lawn, in m



$$\begin{aligned} \text{Total perimeter} &= 12 + \frac{1}{2} \times 2\pi r \\ &= 12 + \frac{1}{2} \times 2 \times 3.14 \times 6 \\ &= 12 + 18.84 \\ &= 30.84 \text{ m} \end{aligned}$$

Blunders (-3)

- B1 Correct answer without work
- B2 Incorrect mathematical operation
- B3 Decimal error
- B4 Incorrect relevant formula and continues e.g. πr^2 .
- B5 $\pi \neq 3.14$ or answer given in terms of π (unless penalised in (c)(ii)).
- B6 Incorrect substitution and continues.

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Leaves answer as $12 + 18.84$.

Attempts (2 marks)

- A1 Some correct step with work.
- A2 Correct formula for perimeter of semi-circle and stops
- A3 Recognises 12 as part of the answer e.g. $12 + \dots$ and stops or writes 12 on its own.
- A4 A correct substitution and stops
- A5 π omitted with some relevant work.

Worthless (0)

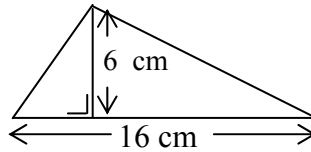
- W1 Incorrect answer without work unless attempt mark applies.

QUESTION 2

Part (a)	10 marks	Att 3
Part (b)	25 marks	Att 9
Part (c)	15 marks	Att 6

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**



$$\text{Area} = \frac{1}{2} \times 16 \times 6 = 48 \text{ cm}^2$$

Blunders (-3)

- B1 Correct answer without work
- B2 Incorrect substitution and continues correctly e.g. $\frac{1}{2} \times 6 \times 8 = 24$
- B3 Mathematical error
- B4 Incorrect relevant formula and continues e.g. $16 \times 6 = 96$

Slips (-1)

- S1 Numerical slips to a maximum of -3

Attempts (3 marks)

- A1 Some correct step with work and stops.
- A2 Product of any two dimensions with the exception of 6 and 16.
- A3 $\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$ or similar and stops.
- A4 $\frac{1}{2} \times 16$ or $\frac{1}{2} \times 6$ and stops
- A5 Writes $16 + 6 = 22$

Worthless (0)

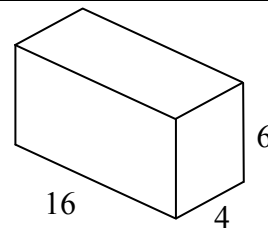
- W1 Incorrect answer without work unless attempt mark applies.

Part (b)

25 marks (15, 5, 5)

Att 9 (5, 2, 2)

A solid rectangular block of wood has length 16 cm, width 4 cm and height 6 cm.



(b)(i)

15 marks


Att 5

Find, in cm^3 , the volume of the block of wood



$$\text{Volume of block} = 16 \times 4 \times 6 = 384 \text{ cm}^3$$

Blunders (-3)

- B1 Correct answer without work 
- B2 Incorrect substitution or omission or extra, each time and continues.
- B3 Mathematical error
- B4 Incorrect relevant formula and continues e.g. surface area and continues.
- B5 Leaves answer as $16 \times 4 \times 6$

Slips (-1)

- S1 Numerical slips to a maximum of -3

Attempts (5 marks)

- A1 Some correct step with work and stops.
- A2 Correct formula for volume of rectangular solid and stops
- A3 Writes $16 + 4 + 6 = 26$

Worthless (0)

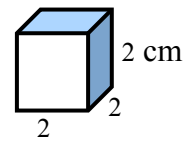
- W1 Incorrect answer without work unless attempt mark applies.
- W2 Use of formula involving π
- W3 Writes $16 + 4 + 6$ and stops

(b)(ii)

5 marks

Att 2


Cubes with sides of length 2 cm, as shown, are made from the block of wood.
Find the number of cubes that can be made from the block of wood.



$$\begin{array}{lclclcl} \text{Volume of one cube} & = & 2 \times 2 \times 2 & = & 8 \text{ cm}^3 \\ \text{Volume of block} & & & = & 384 \text{ cm}^3 \\ \text{Number of cubes} & = & \frac{384}{8} & = & 48. \end{array}$$

* Accept candidates answer from part (i).

Blunders (-3)

- B1 Correct answer without work 
- B2 Incorrect substitution or omission or extra and continues.
- B3 Mathematical error e.g. $2^3 = 6$
- B4 Incorrect relevant formula and continues
- B5 Incorrect mathematical operation e.g. 384×8

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Leaves answer as $\frac{384}{8}$

Attempts (2 marks)

- A1 Some correct step with work and stops.
- A2 Correct formula for volume of rectangular solid and stops
- A3 Some correct substitution and stops
- A4 Writes 384 or candidates answer from part (i) and stops
- A5 Writes $2 + 2 + 2 = 6$ or $2 \times 2 = 4$ and stops

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.
- W2 Use of formula involving π

(b)(iii)

5 marks


Att 2

Calculate, in cm^2 , the surface area of the block of wood.



$$\begin{aligned}\text{Surface area} &= 2 \times 16 \times 4 + 2 \times 4 \times 6 + 2 \times 16 \times 6 \\ &= 128 + 48 + 192 \\ &= 368 \text{ cm}^2\end{aligned}$$

Blunders (-3)

- B1 Correct answer without work 
- B2 Incorrect substitution or omission or extra and continues.
- B3 Mathematical error
- B4 Incorrect relevant formula and continues

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Failure to add the three areas

Attempts (2 marks)

- A1 Some correct step with work and stops e.g. 4×6
- A2 Correct formula and stops
- A3 Some correct substitution and stops
- A4 Writes $16 \times 4 \times 6$ with or without an answer
- A5 Finds surface area of the cube correctly with work

Worthless (0)

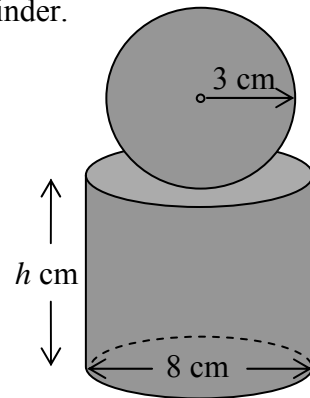
- W1 Incorrect answer without work unless attempt mark applies
- W2 Use of formula involving π

Part (c)

15 marks (5, 5, 5)

Att 6 (2, 2, 2)

A solid trophy, as shown, has a sphere mounted on top of a cylinder.
The radius of the sphere is 3 cm.



(c)(i)

5 marks

Att 2

Find the volume of the sphere in terms of π .

$$\begin{aligned}\text{Volume} &= \frac{4}{3}\pi r^3 \\ &= \frac{4}{3}\times\pi\times 3\times 3\times 3 \\ &= 36\pi\text{ cm}^3\end{aligned}$$

- * Accept $\frac{4}{3}\pi r^3$ for volume of sphere formula.
- * Correct answer with no work merits full marks.

Blunders (-3)

- B1 Incorrect substitution and continues.
- B2 Mathematical error e.g. $r^3 = 9$
- B3 Incorrect relevant formula and continues e.g. multiples of πr^3 or πr^2 with work
- B4 Decimal error

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Answer not given in terms of π

Attempts (2 marks)

- A1 Some correct step with work and stops.
- A2 Product of two relevant numbers e.g. $3\cdot 14\times 3 = 9\cdot 42$
- A3 Correct formula and stops
- A4 Some correct substitution and stops.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

(c)(ii)

5 marks

Att 2


The cylinder in the trophy has a diameter of 8 cm and its volume is four times the volume of the sphere.
Find h , the height of cylinder in the trophy.



$$\begin{aligned}\text{Volume of cylinder} &= 4 \times 36\pi \\ \pi r^2 h &= 144\pi \\ \pi \times 4 \times 4 \times h &= 144\pi \\ 16h &= 144 \\ h &= \frac{144}{16} \\ h &= 9 \text{ cm}\end{aligned}$$

* Accept candidates answer from part (i)

Blunders (-3)

- B1 Correct answer without work 
- B2 Incorrect substitution and continues.
- B3 Mathematical error
- B4 Incorrect relevant formula and continues
- B5 Decimal error

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 $\frac{144}{16}$ and stops.

Attempts (2 marks)

- A1 Some correct step with work and stops e.g. $4^2 = 16$ or $r = 4$
- A2 Writes 36π or candidates answer from part (i) and stops.
- A3 Correct formula and stops
- A4 Some correct substitution and stops.
- A5 Writes 144π or $(4 \times$ candidates answer from part (i)) with or without work.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

Find the total height of the trophy.



$$\begin{aligned} \text{Total height} &= 9 + 6 \\ &= 15 \text{ cm} \end{aligned}$$

* Accept candidates answer from part (ii)

Blunders (-3)

- B1 Correct answer without work
- B2 Incorrect mathematical operation e.g. $9 \times 6 = 54$
- B3 Uses radius instead of diameter for height of sphere

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 $9 + 6$ and stops.

Attempts (2 marks)

- A1 Some correct step with work and stops.
- A2 Writes 9 or candidates answer from part (ii) or 6 without work.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

QUESTION 3

Part (a)	5 marks	Att 2
Part (b)	25 marks	Att 8
Part (c)	20 marks	Att 7

Part (a)	5 marks	Att 2
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Find the mode of the numbers: 1, 4, 3, 4, 1, 4, 12, 4, 15, 4.

Mode = 4

* Accept correct answer without work.

Blunders (-3)

B1 Gives 5 as the mode

Attempts (2 marks)

A1 Writes "mode means most"

A2 Writes $1 + 4 + 3 + 4 + 1 + 4 + 12 + 4 + 15 + 4$ and / or 52

A3 Writes $\frac{52}{10}$ and or $5 \cdot 2$

A4 Writes 10 or 5 and stops.

A5 Rearranges the numbers in order

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

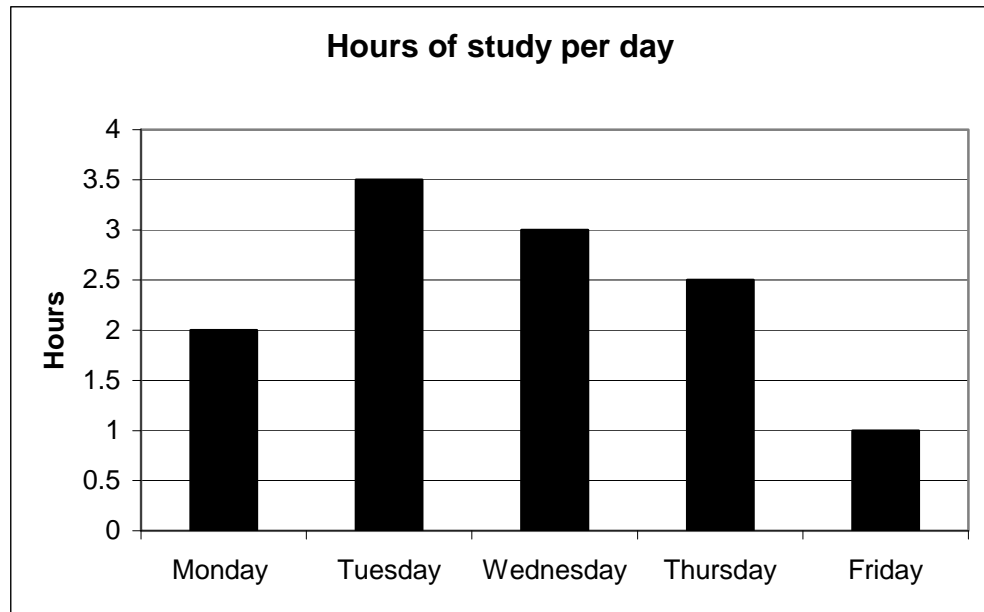
W2 Just a list of numbers e.g. 4, 7, 5

Part (b)

25 marks (10, 10, 5)

Att 8 (3, 3, 2)

The bar chart shows the number of hours that Anne spent studying from Monday to Friday of a particular school week.



(b)(i)

10 marks

Att 3

How many hours study did Anne do on the Monday of that week?

2 hours

* Accept correct answer without work.

Attempts (3 marks)

A1 Writes 3·5 or 3 or 2·5 or 1 as the answer

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

(b)(ii)

10 marks

Att 3

On what day of that week did Anne do the least study?

Friday

* Accept correct answer without work.

Attempts (3 marks)

A1 Tuesday

A2 Writes 3·5 or 1

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

(b)(iii)


5 marks

Att 2

Express the hours of study done by Anne on Wednesday as a percentage of her total hours of study for that week.

$$\begin{aligned} 2 + 3 \cdot 5 + 3 + 2 \cdot 5 + 1 &= 12 \\ \frac{3}{12} \times 100 &= 25\% \end{aligned}$$

Blunders (-3)

- B1 Correct answer without work 
- B2 Omits the 100 or divides by the 100.
- B3 Omits an entry or inserts an incorrect entry in the addition.
- B4 Multiplies hours of study instead of adding them
- B5 Leaves the answer as $\frac{3}{12} \times 100$

Misreading (-1)

- M1 Takes figure for a different day and continues e.g. $\frac{2}{12} \times 100 = 16\frac{2}{3}\%$

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 any of the following numbers, 2, 3·5, 3, 2·5, 1, 12.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

Part (c)

20 marks (10, 5, 5)

Att 7 (3, 2, 2)

The table shows the price in dollars of a barrel of crude oil for the first six months of 2006.

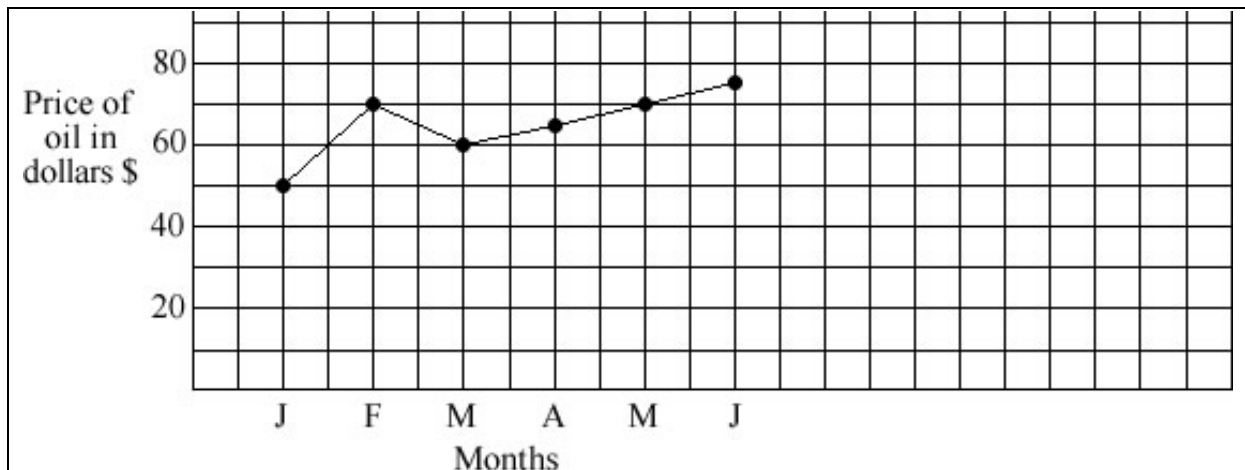
Month	January	February	March	April	May	June
Price	50	70	60	65	70	75

(c)(i)

10 marks

Att 3

Draw a trend graph of the data, putting months on the horizontal axis.



- * Accept correct graph with no labels.
- * Be lenient with the plotting of points.

Blunders (-3)

- B1 Axes not graduated uniformly (once).
- B2 Points not joined or joined in incorrect order.
- B3 Reorders months axis
- B4 Axes reversed.
- B5 Draws a bar or pie chart correctly.

Slips (-1)

- S1 Each incorrect plot or point omitted

Attempts (3 marks)

- A1 Graduated axis or axes or x and y axis only
- A2 Plots only one point.

Calculate the mean price, in dollars, of a barrel of crude oil over this six-month period.



$$\frac{50 + 70 + 60 + 65 + 70 + 75}{6} = \frac{390}{6} = 65$$

Blunders (-3)

- B1 Correct answer without work
- B2 Incorrect divisor
- B3 Inverted fraction
- B4 Multiplies instead of adding

Slips (-1)

- S1 Numerical slips to a maximum of -3.
- S2 $\frac{390}{6}$ and stops.
- S3 Omits an entry or includes an incorrect entry in the addition (each time).

Attempts (2 marks)

- A1 Some correct step with work and stops.
- A2 Addition of data only
- A3 Partial addition of data with work and stops
- A4 Idea of mean indicated e.g. $\frac{\Sigma x}{n}$ or a verbal description.
- A5 States median is 67.5 or mode is 70 and stops.
- A6 390 or 6 without work

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

The mean price of a barrel of crude oil for the first seven months of 2006 was 67 dollars.

Find the price of a barrel of such oil in July 2006.



$$\begin{aligned} 67 \times 7 &= 469 \\ 65 \times 6 &= 390 \end{aligned}$$

$$\begin{aligned} \text{Price in July} &= 469 - 390 \\ &= 79 \end{aligned}$$

or

$$\begin{aligned} 390 + x &= 469 \\ x &= 469 - 390 \\ &= 79 \end{aligned}$$

*Accept candidates answer from part (ii).

Blunders (-3)

- B1 Correct answer without work
- B2 Incorrect mathematical operation
- B3 Error in manipulation of equation

Slips (-1)

- S1 Numerical slips to a maximum of -3.
- S2 Omits an entry or includes an incorrect entry in the addition (each time).
- S3 Writes $469 - 390$ and stops.

Attempts (2 marks)

- A1 Some correct step with work and stops.
- A2 Writes $50 + 70 + 60 + 65 + 70 + 75 + x$ and stops.
- A3 Partial addition of data with work and stops
- A4 Idea of mean indicated e.g. $\frac{\sum x}{n}$ or a verbal description.
- A5 Indicates subtraction i.e. $67 - 65 = 2$

Worthless (0)

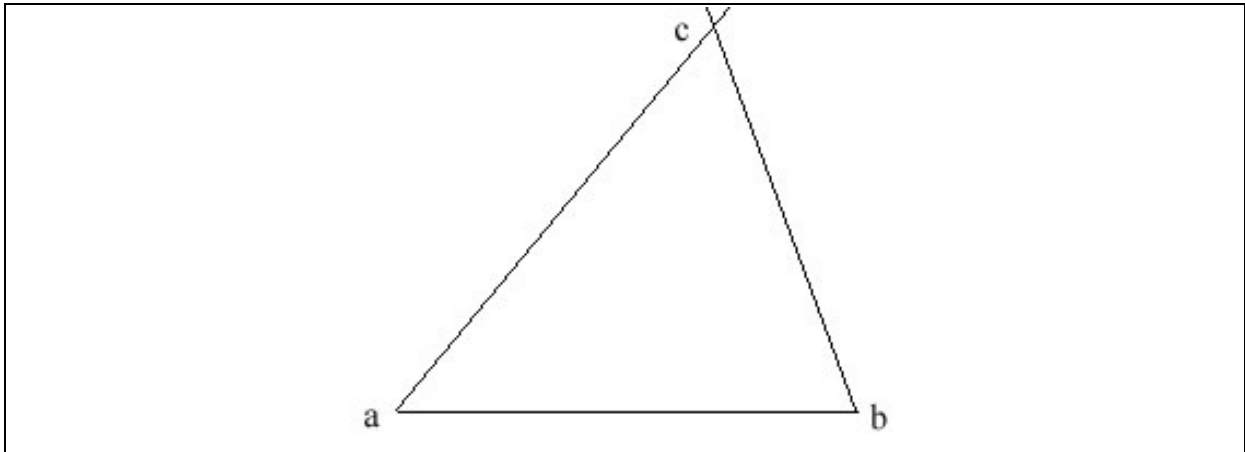
- W1 Incorrect answer without work unless attempt mark applies.

QUESTION 4

Part (a)	10 marks	Att 3
Part (b)	20 marks	Att 8
Part (c)	20 marks	Att 8

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

Construct a triangle abc with $|ab| = 6 \text{ cm}$, $|\angle bac| = 50^\circ$ and $|\angle abc| = 70^\circ$
Label your diagram clearly.



- * Accept base other than $[ab]$
- * Tolerance of $\pm 2mm$ on the side and $\pm 5^\circ$.
- * Examiners must measure candidate's work.

Blunders (-3)

- B1 Incorrect length of $[ab]$ i.e. outside tolerance
- B2 Each incorrect angle measurement i.e. outside tolerance
- B3 Failure to complete the triangle

Slips (-1)

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

Attempts (3 marks)

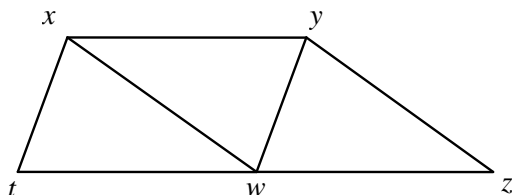
- A1 Pilot diagram drawn
- A2 Draws a line segment $[ab]$ of 6 cm in length labelled or unlabelled **or** draws a labelled line segment $[ab]$ of any length.
- A3 Unlabelled angle of 50° or 70° drawn and stops

Part (b)

20 marks (5, 5, 5, 5)

Att 8 (2, 2, 2, 2)

$xywt$ and $xyzw$ are two parallelograms as shown in the diagram.



(b)(i)

5 marks

Att 2

Name the image of the point x under the translation \vec{tw} .

Image of $x = y$

- * Accept diagram with image point indicated
- * Accept answer without work.

Misreading (-1)

M1 Image of x shown on an extended diagram under translation \vec{wt}

Attempts (2 marks)

- A1 States $tw = xy$ or $tw \parallel xy$ or indicates either on a diagram.
- A2 Shows some knowledge of the given translation and stops.

Worthless (0)

- W1 Gives answer as t or w or z or x .
- W2 Diagram reproduced without modification.

(b)(ii)

5 marks

Att 2

Name the image of $[wz]$ under the translation \overrightarrow{wx} .

Image of $[wz] = [xy]$

- * Accept line segment $[xy]$ indicated on a diagram in appropriate answer box for this part.
- * Accept the answer without work.

Blunders (-3)

B1 Line segment with either x or y correct e.g. $[xt]$

Misreading (-1)

M1 Image of $[wz]$ shown on an extended diagram under the translation \overrightarrow{xw} .

Attempts (2 marks)

A1 Image of one point only found correctly.

A2 States $wz \parallel xy$ or $|wz| = |xy|$ or indicates either on a diagram reproduced for this part.

A3 Shows some knowledge of the given translation and stops.

Worthless (0)

W1 Gives answer as $[tw]$


W2 Diagram reproduced without modification.

(b)(iii)


5 marks

Att 2

Given that the area of $\Delta xtw = 5 \text{ cm}^2$, find the area of the figure $txyz$.

 Area = $3 \times 5 = 15 \text{ cm}^2$

Blunders (-3)

- B1 Correct answer without work 
B2 Incorrect mathematical operation e.g. $5 + 3 = 8$

Slips (-1)

- S1 Numerical slips to a maximum of -3.
S2 3×5 and stops.

Attempts (2 marks)

- A1 Some correct step with work and stops
A2 States $\Delta xtw = \Delta xyw$ or similar.
A3 States the diagonal bisects the area of a parallelogram.
A4 Writes 5 in each of the triangles in the given diagram reproduced for this part and stops.
A5 Writes correct formula for area of triangle.

Worthless (0)


- W1 Incorrect answer without work unless attempt mark applies.
W2 Diagram reproduced without modification.

(b)(iv)

5 marks

Att 2

Show that Δxyw and Δywz are congruent.

	$ xy = wz $	or	$ \angle yxw = \angle yzw $	or	$ xy = wz $
	$ yw = yw $ common side.		$ xw = yz $		$ \angle yxw = \angle yzw $
	$ xw = yz $		$ \angle ywx = \angle wyz $		$ xw = yz $

* Accept correct answer marked or indicated on a diagram.

Blunders (-3)

B1 Each step omitted.

Attempts (2 marks)

A1 Some correct step.

A2 States same shape or SSS or ASA or SAS.

A3 States triangles fold onto each other.

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

Worthless (0)

W1 Diagram reproduced without modification.

Part (c)

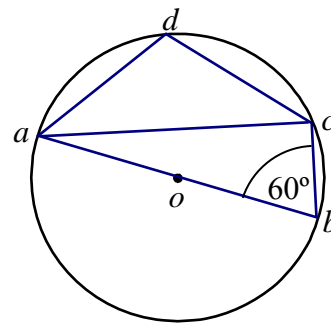
20 marks (5, 5, 5, 5)

Att 8 (2, 2, 2, 2)

$[ab]$ is the diameter of a circle with centre o .

c and d are points on the circle.

$$|\angle abc| = 60^\circ.$$



(c)(i)

5 marks

Att 2

Write down $|\angle acb|$ and give a reason for your answer.

$$|\angle acb| = 90^\circ$$

Reason: Angle in a semi circle or an angle subtended by a diameter at the circumference

* Accept right angle marked or indicated on the diagram.

Slips (-1)

S1 Correct answer without a reason or with an incorrect reason.

Attempts (2 marks)

A1 States “angle at centre is twice the angle at circle standing on same arc” or similar and stops.

A2 States “straight line angle = 180° ” or similar and stops.

A3 States “sum of three angles in triangle = 180° ” or similar.

A4 Clearly indicates $|\angle acb|$ on the diagram.

A5 Reason only given

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies e.g. $|\angle acb| = 30^\circ$

W2 Diagram reproduced without modification.

(c)(ii)

5 marks

Att 2

Write down $|\angle bac|$, and give a reason for your answer.

$$|\angle bac| = 30^\circ$$

Reason: The 3 angles in a triangle add up to 180° or $180 - 90 - 60 = 30^\circ$

* Accept candidates answer from part (i).

Blunders (-3)

- B1 Sum of the angles in a triangle $\neq 180^\circ$.
- B2 Mathematical error.
- B3 Takes an arbitrary angle for $|\angle acb|$ and continues.

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 Some correct step with work and stops.
- A2 Writes down or indicates that $|\angle acb| = 90^\circ$ for this part.
- A3 Clearly indicates $\angle bac$ on diagram drawn in the answer box.
- A4 States “sum of 3 angles in a triangle = 180° ” or similar and stops.
- A5 Writes $60 + 90$ and stops.
- A6 $180 - 60$ or $180 - 90$ and stops.
- A7 Reason only given.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies
- W2 Diagram reproduced without modification.

Write down $|\angle adc|$ and give a reason for your answer.

$$|\angle adc| = 120^\circ$$

Reason: Opposite angles of a Cyclic quadrilateral add to 180°

$$\text{or} \\ 180 - 60 = 120^\circ$$

Blunders (-3)

- B1 Use of 360° instead of 180° .
- B2 Mathematical error

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 Some correct step with work and stops.
- A2 Reason only given.
- A3 Clearly indicates $\angle adc$ on diagram reproduced in answer box.
- A4 Some reference to 180° and stops.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies
- W2 Diagram reproduced without modification.

(c)(iv)

5 marks

Att 2

Given that $|oa| = 2$ cm and $|bc| = 2$ cm, find $|ac|$.

Give your answer correct to one decimal place.



$$\begin{aligned} |ac|^2 + |cb|^2 &= |ab|^2 \\ |ac|^2 + 2^2 &= 4^2 \\ |ac|^2 + 4 &= 16 \\ |ac|^2 &= 12 \\ |ac| &= \sqrt{12} \text{ or } 3.46 = 3.5 \text{ cm} \end{aligned}$$

- * Accept candidates answers from parts (i) and (ii).
- * Accept $|ac|$ found correctly by trigonometric ratio method for full marks.

Blunders (-3)

- B1 Correct answer without work
- B2 Mathematical error e.g. $4^2 = 8$
- B3 Incorrect theorem of Pythagoras.
- B4 Takes an arbitrary figure or 2 for $|ab|$ and continues.
- B5 Error in manipulation of equation.

Slips (-1)

- S1 Numerical slips to a maximum of -3.
- S2 Fails to round off or rounds off incorrectly.

Attempts (2 marks)

- A1 Some correct step with work and stops.
- A2 States theorem of Pythagoras.
- A3 States $|ab| = 4$ or indicates this on a reproduced diagram and stops.
- A4 Marks $|bc| = 2$ and / or $|oa| = 2$ on a reproduced diagram and stops.
- A5 2^2 and / or 4^2 and stops.

Worthless (0)

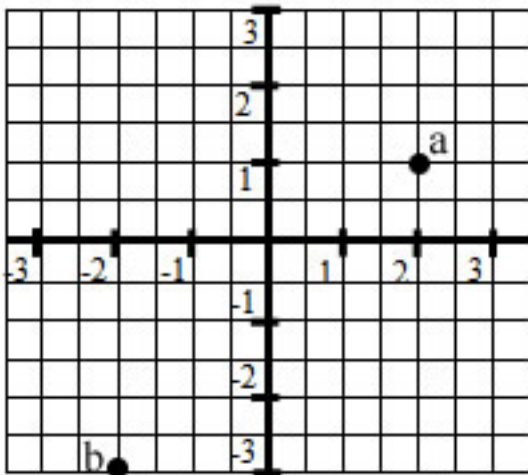
- W1 Incorrect answer without work unless attempt mark applies e.g. 4
- W2 $2 + 4 = 6$

QUESTION 5

Part (a)	10 marks	Att 3
Part (b)	25 marks	Att 8
Part (c)	15 marks	Att 5

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

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



* Accept correct answer without work.

Blunders (-3)

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

Misreadings (-1)

- M1 Plots $(-2,3)$ or $(2,-3)$ or similar.
- M2 Plots $(2,3)$ or similar. Penalise twice.

Slips (-1)

- S1 Fails to label points (each time).

Attempts (3 marks)

- A1 Some correct step and stops
- A2 Plots $(2,0)$ and / or $(0,1)$ for point a or similar.
- A3 Writes $x = 2$ and / or $y = 1$ for point a or similar.
- A4 Picks a random point and plots it correctly.

Worthless (0)

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

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

(b)(i)

10 marks


Att 3

the midpoint of $[pq]$

$$\begin{aligned} & \left(\frac{3+5}{2}, \frac{-3-1}{2} \right) \\ & = \left(\frac{8}{2}, \frac{-4}{2} \right) \\ & = (4, -2) \end{aligned}$$

- * 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) and continues.
- B4 Two or more signs incorrect in substitution and continues.
- B5 Reversal of coordinates i.e. (-2,4) with work.
- B6 One ordinate only worked out correctly.
- B7 Uses one of the given points and some arbitrary point e.g. (3,-3) and (0,0) and continues.

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. $\left(\frac{-5+3}{2}, \frac{-1-3}{2} \right)$ and continues
- S4 Take (3,-3) as midpoint and finds extremity e.g. $(5,-1) \rightarrow (3,-3) \rightarrow (1,-5)$ or takes $(5,-1)$ as midpoint and finds extremity e.g. $(3,-3) \rightarrow (5,-1) \rightarrow (7,1)$


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 Labels p and / or q with (x_1, y_1) and stops.

Worthless (0)

- W1 Use wrong formula e.g. slope or distance formula.
- W2 Writes midpoint formula and stops.

 (ii) the slope of pq

 $\left(\frac{-3+1}{3-5}\right) = \frac{-2}{-2}$ or $\frac{2}{2}$ or 1

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

* Accept correct trigonometric method i.e. $\tan \theta = \frac{2}{2}$.

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) if not already penalised e.g. $\frac{3+3}{5+1}$ or

$$\frac{-3-3}{-1-5}$$

B4 Mathematical error e.g. sign rules.

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

B6 Error in more than one sign when substituting.

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.

 (iii) the equation of the line pq .

$$(y + 3) = 1(x - 3) \text{ or } y + 1 = 1(x - 5) \text{ or } y + 2 = 1(x - 4)$$

* Accept candidates slope from part (ii) and midpoint from part (i) if used.

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. $y - 3 = 1(x + 3)$
- B4 Mathematical error.
- B5 $y = 1(x + c)$ and stops
- B6 Uses a point other than $(3, -3)$ and $(5, -1)$ or $(4, -2)$ e.g. $(0, 0)$.
- B7 $m \neq 1$

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 (2 marks)

- A1 Some correct step with work.
- A2 Writes $m = 1$ and stops.
- A3 States $y = mx \pm c$ and stops
- A4 $-1 + 3 = 1(5 - 3)$, substitutes both points.

Worthless (0 marks)

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

Note

$-3 - y_1 = 1(3 - x_1)$ or similar merits full marks.

Part (c) (i)

10 Marks

Att 3

K is the line $2x + 3y - 6 = 0$.

K cuts the y -axis at the point r .

By letting $x = 0$, find the co-ordinates of the point r .



$$2(0) + 3y - 6 = 0$$

$$3y = 6$$

$$y = \frac{6}{3}$$

$$y = 2$$

$$r = (0, 2)$$

* Accept answer given as $y = 2$ 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.

Slips (-1)

S1 Numerical slips to a maximum of -3.

S2 $2(0) = 2$

S3 Stops at $\frac{6}{3}$ with work.

Attempts (3 marks)

A1 Some correct step with work and stops.

A2 Substitutes $x = 0$ and stops.


A3 Any correct manipulation of equation and stops e.g. $2x + 3y = 6$.

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.

Find the image of the point r under S_o ,
the central symmetry in the origin, $(0, 0)$.

 $(0,2) \rightarrow (0,0) \rightarrow (0,-2)$

* Accept candidates answer from part (i)

Blunders (-3)

B1 Correct answer without work. 

B2 Writes answer as $(-2,0)$

B3 Omits second ordinate.

Slips (-1)

S1 Numerical slips to a maximum of -3.

Attempts (2 marks)

A1 Some correct step with work and stops.

A2 Writes down $(0,2)$ or candidates answer from part (i) and stops.

A3 Effort at finding graphically without naming image point.

A4 Plots $(0,2)$ and / or $(0,0)$ for this part.

A5 Effort at translation i.e. x remains unchanged, y goes down 4 or similar.

A6 Correctly finds only one ordinate.

Worthless (0)

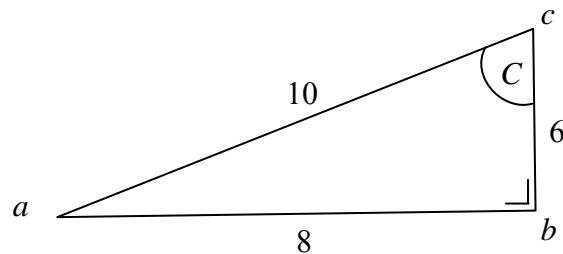
W1 Incorrect answer with no work unless attempt mark applies.

QUESTION 6

Part (a)	15 marks	Att 5
Part (b)	20 marks	Att 7
Part (c)	15 marks	Att 5

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

The right-angled triangle abc has measurements as shown.



Part (a) (i) **10 Marks** **Att 3**

Write down the length of the hypotenuse of the Δabc .

Length of the hypotenuse of the $\Delta abc = 10$

- * Correct answer with no work merits full marks.
- * Indicates 10 only in diagram, or “h” or “hypotenuse”, accept for 10 marks.

Blunders (-3)

B1 Gives answer as $[ac]$.

Attempts (3 marks)

A1 Any mention of a correct trigonometric ratio.

A2 Gives answer as 8 or 6

Worthless (0)

W1 Incorrect answer with no work unless attempt mark applies.

W2 Gives more than one answer.

W3 Answer measured from examination paper.

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

$$\cos C = \frac{6}{10} \text{ or } \frac{3}{5}$$

- * Correct answer with no work merits full marks.
- * Accept consistent error from part (i)
- * Accept $\cos \frac{6}{10}$ for full marks.

Blunders (-3)

- B1 Incorrect or inverted ratio e.g. $\cos C = \frac{10}{6}$.
- B2 Gets $\cos \angle bac$ (check is not consistent error from (i)).

Slips (-1)

- S1 Answer = 0.6 (answer not a fraction)

Attempts (2 marks)

- A1 Any correct trigonometric ratio written down in answer box.
- A2 Only gives answer = $53 \cdot 13^\circ$ or rounded to 53° for this part.
- A3 Only gives answer = 0.9999 i.e. $\cos \frac{6}{10}$

Worthless (0)

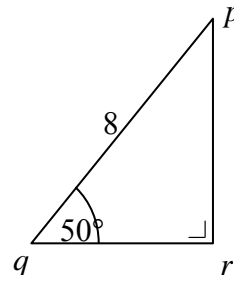
- W1 Incorrect answer with no work unless attempt mark applies.

Part (b)

20 marks (10, 5, 5)

Att 7 (3, 2, 2)

6(b) In the right-angled triangle pqr ,
 $|pq| = 8$ and $|\angle pqr| = 50^\circ$.



Part (b) (i)

10 marks

Att 3

Find $|\angle qpr|$.

$$|\angle qpr| = 180 - 90 - 50 = 40^\circ$$

* Correct answer with no work merits full marks.

Blunders (-3)

B1 Three angles of a triangle $\neq 180^\circ$

B2 Fails to subtract one of the angles e.g. $180 - 50 = 130^\circ$

B3 Mathematical error.

Slips (-1)

S1 Numerical slips to a maximum of -3.

Attempts (3 marks)

A1 Writes "3 angles in a triangle add up to 180" and stops.

A2 Writes $|\angle prq| = 90^\circ$ or correctly writes the 90° angle on the diagram and stops.

A3 Any correct trigonometric ratio written down.

A4 Clearly indicates $\angle qpr$ on the diagram

Worthless (0)

W1 Incorrect answer with no work unless attempt mark applies.

(ii) Using your calculator, or otherwise, write down the value of $\sin |\angle qpr|$ correct to two decimal places.

$$\sin |\angle qpr| = 0.64$$

- * Correct answer with no work merits full marks.
- * Accept candidates answer from part (i).
- * Accept $\sin 0.64$ for full marks.

Blunders (-3)

B1 Writes $\sin 50 = 0.77$ or 0.766 as the answer.

B2 Finds $\tan 40$ or $\cos 40$ and continues.

B3 $\sin 40 = \frac{qr}{8}$ and stops or $\frac{qr}{8}$ on it's own.

B4 Uses Radian or Grad mode on the calculator.

	RAD	GRAD
Sin 40	0.75	0.59

Slips (-1 marks)

S1 Failure to round off or rounds off incorrectly.

Attempts (2 marks)

A1 Writes $\sin 40 = \frac{qr}{qp}$ or $\frac{qr}{qp}$ and stops.

A2 Any correct trigonometric ratio written down.

A3 Correctly marks the hypotenuse or opposite or adjacent on a diagram reproduced and stops, for this part.

A4 $\cos 50 = 0.71$ $\tan 50 = 1$ \rightarrow Grad mode

or

$\cos 50 = 0.96$ $\tan 50 = -0.27$ \rightarrow Rad mode.

Worthless (0)

W1 Incorrect answer with no work unless attempt mark applies.

W2 0.71 or similar on its own (must be in format given in A4 to merit marks)

Hence, or otherwise, calculate $|qr|$ correct to one decimal place.



$$\begin{array}{lclclcl} \sin 40 & = & \frac{qr}{8} & \text{or} & 0.64 & = & \frac{qr}{8} \\ 8 \sin 40 & = & qr & & 8 \times 0.64 & = & qr \\ 5 \cdot 12 & = & qr & & 5 \cdot 12 & = & qr \\ 5 \cdot 1 & = & qr & & 5 \cdot 1 & = & qr \end{array}$$

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

Blunders (-3)

- B1 Correct answer without work.
- B2 Error in forming equation e.g. $\frac{8}{qr} = 0.64$ and continues
- B3 Error in manipulation of equation.
- B4 Writes $\frac{qr}{8} = 0.77$ and continues.
- B5 Uses Radian or Grad mode on calculator.

	RAD	GRAD
Sin 40	0.75	0.59

Slips (-1 marks)

- S1 Numerical slips to a maximum of -3.
- S2 Failure to round off or rounds off incorrectly.

Attempts (2 marks)

- A1 Any correct step with work and stops e.g. $\frac{x}{8}$ or $\frac{8}{x}$
- A2 Correct scale diagram.
- A3 $\sin 40$ or 0.64 or any trigonometric ratio.

Worthless (0)

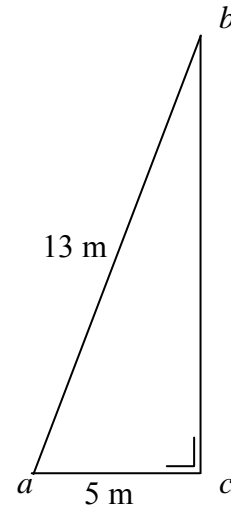
- W1 Incorrect answer with no work unless attempt mark applies.
- W2 Answer = 3.5 cm (measured from examination paper)

Part (c)

15 marks (10, 5)

Att 5 (3, 2)

In the $\triangle abc$, $|\angle bca| = 90^\circ$, $|ab| = 13$ m and $|ac| = 5$ m.



Part (c) (i)

10 Marks

Att 3

(i) Find, in metres, $|bc|$.



$$|ab|^2 = |ac|^2 + |bc|^2$$

$$|13|^2 = |5|^2 + |bc|^2$$

$$169 = 25 + |bc|^2$$

$$144 = |bc|^2$$

$$\sqrt{144} \text{ or } 12 = |bc|$$

* Accept $|bc|$ 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. $5^2 = 10$
- B4 Error in manipulation of equation.
- B5 Stops at $|bc|^2 = 144$

Slips (-1 marks)

S1 Numerical slips to a maximum of -3.

Attempts (3 marks)

- A1 Some correct step with work and stops e.g. 13^2 .
- A2 States theorem of Pythagoras and stops.
- A3 Correct Sin, Cos or Tan ratio written down and stops.

Worthless (0)

- W1 Incorrect answer with no work unless attempt mark applies e.g. 169.
- W2 $5 + 13 = 18$ or $13 - 5 = 8$.



(ii) Find $|\angle bac|$, correct to the nearest degree.



$$\sin \angle bac = \frac{12}{13}$$

$$\angle bac = 67.38^\circ \text{ or } 67^\circ 22'$$

$$\angle bac = 67^\circ$$

$$\cos \angle bac = \frac{5}{13}$$

$$\angle bac = 67.38^\circ \text{ or } 67^\circ 22'$$

$$\angle bac = 67^\circ$$

* 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 $|\angle abc|$ 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 (2 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.

Worthless (0)

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