Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION

2011

MARKING SCHEMES

MATHEMATICS ORDINARY LEVEL

Coimisiún na Scrúduithe Stáit
State Examination Commission

Scrúdu
an Teastais Shóisearaigh

JUNIOR CERTIFICATE EXAMINATION

2011

MARKING SCHEME

MATHEMATICS ORDINARY LEVEL PAPER 1

GENERAL GUIDELINES FOR EXAMINERS

1. Penalties of three types are applied to candidates' work as follows:
   - Blunders - mathematical errors/omissions (-3)
   - Slips- numerical errors (-1)
   - Misreadings (provided task is not oversimplified) (-1).

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

2. When awarding attempt marks, e.g. Att(3), note that
   - any *correct, relevant* step in a part of a question merits at least the attempt mark for that part
   - if deductions result in a mark which is lower than the attempt mark, then the attempt mark must be awarded
   - a mark between zero and the attempt mark is never awarded.

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

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

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

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

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

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

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

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

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

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

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 × 5% = 9.9 ⇒ 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

QUESTION 1

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

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

(a) $S = \{w, x, y, z\}$

(i) Write down a subset of S that has one element.

(ii) Write down a subset of S that has three elements.

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

$\{w\}$ or $\{x\}$ or $\{y\}$ or $\{z\}$

* No penalty for the omission of brackets.

* No penalty for use of Venn Diagram to show subsets.

Blunders (-3)

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

Misreadings (-1)

M1 Subset of S with two or three elements. e.g. $S = \{w, x\}$.

Attempts (3 marks)

A1 Draws a single bracket & stops.

A2 { } Null set or set itself

Worthless(0)

W1 No relevant element listed without brackets but see A1 above

(a) (ii) **5 marks** **Att2**

$\{w,x, y\}$ or $\{w, x, z\}$ or $\{w ,y, z\}$ or $\{x, y,z\}$

* No penalty for omission of brackets.

* No penalty for use of Venn Diagram to show subsets.

Blunders (-3)

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

Misreadings (-1)

M1 Correct subsets of S with one or two elements e.g. $S = \{w,x\}$.etc

Attempts (2)

A1 Draws a single bracket & stops.

A2 { } Null set or set itself

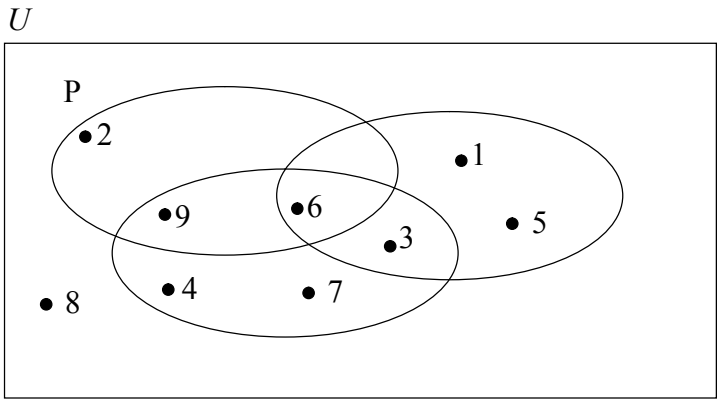
Worthless(0)

W1 No relevant element listed without brackets but see A1 above

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

U is the universal set.

$P = \{2, 6, 9\}$
$Q = \{1, 3, 5, 6\}$
$R = \{3, 4, 6, 7, 9\}$



List the elements of:

(i) $R \setminus Q$
(ii) P', the complement of set P
(iii) $Q \cup (P \cap R)$
(iv) $(Q \cap R) \setminus P$

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

$R \setminus Q = \{4,7,9\}$

Blunders (-3)
B1 Any incorrect set of elements of Q and R other than the misreading below.

Misreadings (-1)
M1 $Q \setminus R = \{1,5\}$
Attempts (2 marks)
A1 4 or 7 or 9 appear in the answer.
A2 $P \cap (Q / R) = \{\ \}$
Worthless(0)
W1 {8}

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

P', the complement of set $P = \{1,3,4,5,7,8\}$

Blunders (-3)
B1 Any incorrect set of the elements of P and Q and R other than the misreading below
Misreadings (-1)
M1 $P \cup Q \cup R$ giving { 1,2,3,4,5,6,7,9 } (all needed)
M2 $R' = \{2,1,5,8\}$
M3 Q' giving {2,4,7,8,9 }
M4 {2,6,9}
Attempts (2 marks)
A1 At least one correct entry appears in the answer

(iii) **5 marks** **Att 2**

$Q \cup (P \cap R) = \{1,3,5,6,9\}$

Blunders (-3)

B1 Any incorrect set of elements of Q, P or R other than the misreadings below.

Misreadings (-1)

M1 $Q \setminus (P \cap R) = \{1,5,3\}$.

M2 $Q \cap (P \cap R) = \{6\}$

M3 $Q \cup (P \cup R) = \{1,2,3,4,5,6,7,9\}$

M4 $Q \cap (P \cup R) = \{3,6\}$

Attempts (2 marks)

A1 1,3,5,6, or 9 appear in the answer. but see Misreadings above

Worthless(0)

W1 Answer {8}.

(iv) **5 marks** **Att2**

$(Q \cap R) \setminus P = \{3\}$

Blunders (-3)

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

B2 (Q ∩ R) = {6,3} and stops

Misreadings (-1)

M1 $Q \setminus (R \cap P) = \{1,3,5\}$.

M2 $Q \setminus (R \cup P) = \{1,5\}$

M3 $Q \cup (R / P) = \{1,3,4,5,7\}$

Attempts (2 marks)

A1 6 or 3 appear in the answer.

Worthless(0)

W1 Answer {8}.

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

(i) List all the divisors of 18 and 24.

(ii) Write down the highest common factor of 18 and 24.

(iii) {5, 7, 9, 11, 13, 15} is the set of odd numbers between 4 and 16.
Which of these numbers are <u>not</u> prime numbers?
Give a reason for your answer.

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

Divisors of 18: = 1, 2 ,3, 6, 9, 18

Divisors of 24: = 1,2, 3, 4, 6, 8, 12, 24

Slips (-1)

S1 Each missing or incorrect element to a max of −3

Attempts (2 marks)

A1 Any one correct element identified

Worthless(0)

W1 Elements listed that are not divisors of 18 or 24

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

Highest common factor = 6

*Accept candidate's answer from c(i)

Blunders (-3)
B1 A common factor that is not the highest
Slips (-1)
S1 Answer written as 2×3

Misreadings (-1)
M1 Writes down LCM = 72

Attempts (2 marks)
A1 Any common factor listed

Worthless(0)
W1 Incorrect answer without work but see M1 or **** above***

(iii) **5 marks** **Att 2**

Not prime numbers: 9 and 15

Reason: " Each has more than 2 factors"

Blunders (-3)
B1 Each incorrect or omitted entry

Slips (-1)
S1 No or incorrect reason given

Misreadings (-1)
M1 Gives prime numbers only

Attempts (2 marks)
A1 Any one relevant entry between 4 and 16 inclusive
A2 Correct reason as to why numbers are not primes

Worthless(0)
W1 Incorrect answer with no work shown

QUESTION 2

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

(a) 10 marks Att 3

€52 is divided between Fiona and Orla in the ratio 9:4.
How much does each receive?

(a) 10 marks Att 3

9+4= 13 **OR** 9+4 =13 **OR** $9x : 4x$ $13x = 52$

52 ÷13 = 4 $\frac{1}{13} = 4$ $x = 4$

9×4 =36

4×4 =16 $\frac{9}{13} = 36$ $4x=16$

$\frac{4}{13} = 16$

Fiona: 36 Orla: 16 **or** 52–36 =16 $9x = 36$

* Correct answer without work ⇒ 7 marks

* Incorrect answer without work ⇒ 0 marks, except for answers given in A4 below

* $\frac{52}{4} = 13$ and $\frac{52}{9} = 5.777\ldots / 5.78$ or 5.8 merits 4 marks

Blunders (-3)

B1 Divisor ≠ 13 and continues
B2 Incorrect multiplier or fails to multiply (each time)
B3 Adds instead of subtracts i.e. 36 + 52 = 98
B4 Fails to find second amount
B6 Error in transposition

Slips (-1)

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

Attempts (3 marks)

A1 Divisor ≠ 13 e.g, $\frac{52}{9}$ and/ or $\frac{52}{4}$ and stops
A2 Indicates 13 parts or 9 parts or 4 parts or $\frac{9}{13}$ or $\frac{4}{13}$ and stops
A3 Indicates multiplication of 52by 9 and/or 4 **and stops**
A4 Both answers added together equal 52 (no work shown)
A5 Finds 9% of 52 (4.68) and 4% of 52 (2.08)
A6 One correct answer without work

Worthless(0)

W1 52 +9 = 61 or similar
W2 Incorrect answer without work. (subject to A4)

(b) **10,5,5 marks** **Att 3,2,2**

(i) By rounding each of these numbers to the nearest whole number, estimate the value of $\frac{14\cdot18-4\cdot086}{1\cdot96}$.

(ii) Using a calculator, or otherwise, find the exact value of $\frac{14\cdot18-4\cdot086}{1\cdot96}$

(iii) Find the difference between the exact value in **(ii)** and the estimated value in **(i)**.

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

$$\frac{14\cdot18-4\cdot086}{1\cdot96}\approx\frac{14-4}{2}=\frac{10}{2}=5$$

* $\frac{14-4}{2}$ and stops $\Rightarrow$ 7 marks.

* $\frac{14-4}{2}=\frac{10}{2}$ and stops $\Rightarrow$ 7 marks.*(-3)*

* No penalty if the intermediate step between approximations and correct final answer is not shown i.e. $\frac{10}{2}$ not shown

* Special Case: $\frac{14.18-4.085}{1.96}$ = 5.15 in this part $\Rightarrow$ Attempt 3 marks. (or $\frac{103}{20}$ or $5\frac{3}{20}$)

Blunders (-3)

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

B2 Decimal error in calculation of final value

B3 An arithmetic operation other than indicated e.g. 14 – (4 ÷ 2) = 7 (breaking order)

B4 Error(s) in the manipulation of the denominator e.g. $\frac{14}{2}$ or $\frac{4}{2}$

B5 Incorrect cancellation

Slips (-1)

S1 Numerical errors to a max of −3

Attempts (3 marks)

A1 Only one approximation made to the given numbers and stops

A2 Ans. 5 with no preceding rounding off

Worthless (0)

W1 Incorrect answer without work but note **Special Case *** above

(ii) **5 marks** **Att2**

$$\frac{14\cdot18-4\cdot086}{1\cdot96}=\frac{10\cdot094}{1\cdot96}=5\cdot15$$

Blunders (-3)

B1 Decimal error or early rounding off

B2 Leaves as $\frac{\mathbf{10.094}}{\mathbf{1.96}}$

B3 Treats as 14.18 – 4.086/1.96 = **12.09530612**

B4 Treats as $\frac{14.18+4.086}{1.96}$ = **9.319387753**

B5 Treats as $\frac{14.18}{1.96}$ – 4.086 = **3.148603878**

Slips (-1)

S1 Numerical errors to a max of −3

Attempts (2 marks)

A1 Any correct relevant calculation and stops.

A2 Any of the following; (see above)

12.09530612, 9.319387753 or 3.148603878

merits 2 marks (minimum 4 decimal places) (with or without work)

Worthless (0)

W1 Incorrect answer without work but see A2

(iii) **5 marks** **Att2**

$5\cdot15-5=0\cdot15$

* Allow candidate's previous answers

Blunders (-3)

B1 Correct answer without work

B2 Decimal error (once only if consistent)

B3 Finds the sum of b(i) and (ii)

Attempts (2 marks)

A1 Any relevant step i.e. transfers answers from b(i) and/or b(ii)

Worthless (0)

W1 Incorrect answer without work

(c) **5,5,5,5 marks** **Att 2,2,2,2**

(i) Write $(a^3)^2$ in the form a^n, $n \in \mathbb{N}$

(ii) Using your answer from **(i)** or otherwise evaluate $(5^3)^2$.

Before going on holidays to the USA Seán changed €500 into dollars.

The exchange rate was €1 = US$1·22.

(iii) How many dollars did Seán get?

(iv) When Seán came home he changed US$50 back into euro (€).
The exchange rate was the same.
How much, in euro, did Seán receive?
Give your answer to the nearest cent.

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

$(a^3)^2 = a^{3\times2} = a^6$ or $(a^3)^2 = a^3\times a^3 = a^6$
or $a\times a\times a\times a\times a\times a = a^6$

* $a\times a\times a\times a\times a\times a$ and stops 4 marks
* $a^{3\times2}$ and stops 4 marks
* 6 only written down 2 marks

Blunders (-3)
B1 $a^3 = a\times a\times a$ and stops
B2 each error in calculation involving indices e.g. $(a^3)^2 = a^5$
B3 Each incorrect number of a's in the extended form
Slips (-1)
S1 Numerical errors to a max of −3
Attempts (2 marks)
A1 $(a^3)^2 = a^{3+2}$ and stops
A2 Some correct manipulation of indices
Worthless (0)
W1 Writes a only

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

✍
$(5^3)^2 = 5^6 = 15625$ or $5^3 = 125$ $125^2 = 15625$

* Accept candidate's answer fom c(i) unless it oversimplifies the question
Blunders (-3)
B1 Correct answer, without work ✍
B2 Each error in calculation involving indices
B3 Each incorrect number of 5's in the extended form
B4 Fails to finish
Slips (-1)
S1 Numerical errors to a max of −3
Attempts (2 marks)
A1 Some correct manipulation of indices
A2 $5^2 = 25$ and stops
A3 $5^3 = 125$ and stops
A4 Candidate transfers answer from c(i)
Worthless(0)
W1 Incorrect answer with no work shown

(iii) **5 marks** **Att 2**

✍ €500 × 1·22 = $610

* No penalty for omission of € or $ signs

Blunders (-3)

B1 Correct answer, without work ✍

B2 Incorrect operator i.e. divides by 1.22 correctly : 409.836

B3 Decimal error

B4 Fails to finish i.e. €500 × 1· 22 and stops

Slips (-1)

S1 Numerical errors to a max of −3

Attempts (2 marks)

A1 Some correct manipulation of 500 and/ or 1.22

Worthless(0)

W1 Incorrect answer with no work shown

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

$$\frac{50}{1\cdot 22} = 40\cdot 9836 = 40\cdot 98$$

Blunders (-3)

B1 Correct answer, without work ✍

B2 Multiplies by 1.22 `i.e. 50 × 1.22 = 61

B3 Incorrect ratio i.e. $\frac{1.22}{50}$ or $\frac{122}{5000}$

B4 Decimal error

B5 Fails to finish i.e. leaves answer as $\frac{50}{1.22}$

Slips (-1)

S1 Numerical errors to a max of −3

S2 Fails to round off or rounds off incorrectly

Attempts (2 marks)

A1 Some manipulation of 50 and/ or 1.22

A2 If answer is 41 or 40.9 with no work shown but see W1

Worthless(0)

W1 Incorrect answer with no work shown but see A2

QUESTION 3

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

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

Three books were bought. They cost €8·75, €9·50 and €10·55 respectively.
If a €50 note was used to pay for the books, how much change was given?

Part (a) **15 marks** **Att 5**

€8.75 + €9.50 + €10.55 = €28.80 €50.00 - €28.80 = €21.20 Change = €21.20	€50.00 – (€8.75 + €9.50 + €10.55) or 50.00 – €8.75 - €9.50 - €10.50 = €21.20 Change = €21.20

*Accept 2120 or 21.2.
*No penalty for the omission of the € sign
*Final subtraction step subject to maximum deduction of −3.

Blunders (-3)
B1 Correct answer without work ⟶ **12 marks**
B2 Fails to find the change.
B3 Operation other than addition when finding the total cost.
B4 Operation other than subtraction when finding the change.
B5 Each missing addition.
B6 Decimal error eg. €2.12 (Note 1st * above).

Slips (−1)
S1 Numerical errors to a max of 3

Attempts (3 marks)
A1 Any attempt at addition or subtraction of the given numbers and stops

Worthless (0)
W1 Incorrect answer without work is 0 marks.
W2 Multiplication or division of the given numbers.

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

(i) A washing machine costs €320 plus VAT at 21·0%.
Calculate the total cost of the washing machine after the VAT is added.

(ii) A popular breakfast cereal comes in two sizes of packet,
Regular (360 g) and *Large* (900 g).
A standard portion of cereal is 30 g.
How many portions are there in each size of packet?

(iii) A *Regular* box costs €0·96 and a *Large* box costs €2·25.
Using the number of portions per box, or otherwise,
find which size is better value?

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

100% = 320 1% = $\frac{320}{100}$ 121% = $\frac{320}{100}$ x 121 = 3.2 x 121 Total Bill = €387.20	21% = $\frac{21}{100}$ × 320 VAT = $\frac{21}{100}$ × 320 = 67.2 Total Bill = 320 + 67.2 Total Bill = €387.20	320 x 1.21 Total Bill = € 387.20

* 320 + 21% = 387.20 ⟶ 5 marks.
* 320 x 21% = 67.2 and stops ⟶ 2 marks.
* 320 + 21% and stops *or* 320 × 21% and stops ⟶ 2 marks.
* €67.20 without work and stops merits 2 marks.

Blunders (-3)
B1 Correct answer without work
B2 Decimal error.
B3 Inverts as $\frac{100}{121}$ or $\frac{100}{21}$ and continues (giving answers 264.46 or 1523.81).
B4 Mishandles 121% or 21% eg. 320 × 121 or 320 ÷ 121 or similar. (Note: 320 must be used)
B5 320 taken as 121% or 21%.
B6 No addition of VAT (as per candidates work).
B7 Subtraction of VAT (as per candidates work).

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

Attempts (3 marks)
A1 $\frac{121}{100}$ or $\frac{21}{100}$ or $\frac{320}{100}$ and stops.
A2 100% = 320 and stops.
A3 100 × $\frac{121}{320}$ and stops.
A4 $\frac{320}{121}$ or similar and stops.

Worthless (0)
W1 Incorrect answer without work
W2 320 + 21 = 341 and stops or continues.

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

Regular: **Number of portions** = 360/30 =**12**

✍

Large: **Number of portions** = 900/30 = **30**

Blunders (-3)

B1 Correct answers without work ✍
B2 Multiplication instead of division when finding the number of portions (once only)
B3 Finds only one answer
B4 Decimal error

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

Attempts (2 marks)
A1 Any attempt at division and stops
A2 30 + 30 + …or any correct step

Worthless (0)
W1 Incorrect answer without work

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

Method 1 Regular: 96 ÷ 12 = 8c per portion Large: 225 ÷ 30 = 7.5c per portion *Large* box is better value.	Method 2 Regular: 360g = 96cent Large: 900g = 225 c 1g = 96/360 1g = 225/900 1g = 0.267cent 1g = 0.25cent *Large* box is better value.
Method 3 Regular: 96cent = 360g Large: 225cent = 900g 1 cent = 360/96 1 cent = 900/225 1 cent = 3.75g 1 cent = 4g *Large* box is better value	Method 4 Regular: 10 boxes = 3600g = 10 x 0.96 = 9.60 Large: 4 boxes = 3600g = 4 x 2.25 = 9.00 *Large* box is better value.

* Candidate must indicate in some way that the Large box is better value. See S2.
* Accept candidate's previous answer

Blunders (-3)
B1 Operation other than division in unitary methods 1, 2, and 3
B2 Operation other than multiplication in common denominator method 4
B3 Finds unit cost or weight for one size box only
B4 Decimal error

Slips (-1)
S1 Numerical errors to a max of −3
S2 Fails to highlight or indicate *Large* box as better value

Misreading (-1)
M1 Transposes costs or weight for each box (eg. *Regular* box costs €2.25 or similar) and continues.

Attempt (2 marks)
A1 States *Larger* box without any relevant supporting work.
A2 Some attempt at division or multiplication using either €0.96 or €2.25.
A3 Some attempt at division using 12 or 30 or 360 or 900
A4 12 and 30 **or** 360 and 900 both multiplied as alternative in method 4

Worthless (0)
W1 Incorrect answer without work
W2 Adds given figures

(c) **5,5,5,5 marks** **Att 2,2,2,2**

Geraldine's annual wage is €40 000.
She pays income tax at the rate of 20% on the first €33 000 of her wage and income tax at the rate of 41% on the remainder of her wage.
Geraldine has an annual tax credit of €3500.

(i) Calculate the tax on the first €33 000 of her wage, at the rate of 20%.
(ii) How much of Geraldine's wage is taxed at the rate of 41%?
(iii) Calculate the amount of tax payable at the rate of 41%.
(iv) Calculate the tax due.

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

100% = 33000 1% = 330 20% = 6600 Tax = €6600	Tax = $\frac{33000}{100} \times 20$ Tax = €6600	Tax = 33000 × 0.2 Tax = €6600	20% = $\frac{1}{5}$ 33000 ÷ 5 Tax = €6600

* No penalty for omitting € symbol

Blunders (-3)
B1 Correct answer without work.
B2 Mishandles 20% eg. 33000 × 20 = 660000 or 33000 ÷ 20 = 1650
B3 Uses € 40000 instead of €33000
B4 Decimal error.

Slips (-1)
S1 Numerical error to a max of −3.

Attempts (2 marks)
A1 Some use of 100 in attempt to find percentage eg. 20% = $\frac{20}{100}$ or 0.2 or $\frac{1}{5}$ and stops

A2 Writes 33000 × 20 and stops

Worthless (0)
W1 Incorrect answer without work
W2 33000 + 20 and stops or continues

3(c) (ii) How much of Geraldine's wage is taxed at the rate of 41%?

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

€40000 – €33000 = €7000 taxed at 41%

* No penalty for omitting € symbol

Blunders (-3)

B1 Correct answer without work.

B2 Operation other than subtraction used with €40000 or €33000

B3 €6600 or 3500 is used in a subtraction with €40000 or €33000.

.

Slips (-1)

S1 Numerical error to a max of −3.

Attempts (2 marks)

A1 Some subtraction involving €40000 or €33000.

Worthless (0)

W1 Incorrect answer without work.

(c) (iii) **5 marks** **Att 2**

100% = 7000 1% = 70 41% = 2870 Tax = €2870	Tax = $\frac{7000}{100} \times 41$ Tax = €2870	Tax = 7000 × 0.41 Tax = €2870

* No penalty for omitting € symbol

*Accept use of candidate's answer from (ii) above.

Blunders (-3)

B1 Correct answer without work.

B2 Mishandles 41% eg. 7000 ÷ 41 = 170.73 or similar. Note: (No penalty if already penalised in (c) (i).... consistent error.)

B3 Does not use €7000 but see 2nd * above.

B4 Decimal error.

Slips (-1)

S1 Numerical error to a max of –3.

Attempts (2 marks)

A1 Some correct use of 100 in attempt to find percentage eg. 41% = $\frac{41}{100}$ or 0.41 and stop

A2 Some correct use of €7000

A3 Uses €40000 or €33000 instead of €7000.

Worthless (0)

W1 Incorrect answer without work

W2 7000 + 41 = 7041 and stops or continues

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

€6,600 + €2870 = €9470 €9470 - €3500 = €5970

Total Tax	€9470
Tax Credit	€3500
Tax Due	€5970

* No penalty for omitting € symbol
* Accept use of candidate's answer from (i) and (iii) above.
* If all 3 boxes are correctly filled in award full marks

Blunders (-3)

B1 Correct answer without work.

B2 Subtracts to find gross tax. e.g. 6600 – 2870 = 3730.

B3 Misuse or no use of Tax Credit

B4 Decimal error

B5 Total tax incorrectly calculated

Slips (-1)

S1 Numerical error to a max of –3.

Attempts (2 marks)

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

Worthless (0)

W1 Incorrect answer without work.

QUESTION 4

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

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

If $a = 4$, find the value of:

(i) $3a + 5$

(ii) $3a^2 - 20$

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

(i) $3a + 5$ $3(4) + 5 = 12 + 5 = 17$

* 12 +5➔ 9 marks

Blunders (-3)

B1 Correct answer, without work ✍

B2 Leaves 3(4) in the answer

B3 Incorrect substitution and continues

B4 Breaks order i.e. 3(4+5) = 3(9) = 27

B5 Treats 3(4) as 7 or 34

Slips (-1)

S1 Numerical errors to a max of 3

S2 Treats as $3a - 5$

S3 Fails to finish

Misreadings (-1)

M1 Uses $5a + 3$

Attempts (2 marks)

A1 Any number substituted for a and stops e.g. 3(6)

A2 Any correct step

A 3 Treats as $15a = 15(4) = 60$ or $8a = 8(4) = 32$

Worthless (0)

W1 Incorrect answer with no work

(a)(ii) **5 marks** **Att2**

✍	$3a^2 - 20$	$3(4)^2 - 20 = 3(16) - 20 = 48 - 20 = 28$

* 48 -20 ➔ 4 marks

Blunders (-3)

B1 Correct answer without work ✍
B2 Leaves 42 in the answer
B3 Incorrect substitution and continues
B4 Breaks order e.g. $3(16 - 20) = 3(-4) = -12$.
B5 Treats $3(16)$ as $3 + 16$
B6 Incorrect squaring eg. $4^2 = 8$
B7 Treats as $a^2 - 20$ i.e omits the 3

Slips (-1)

S1 Numerical errors to a max of −3
S2 Fails to finish but see * above

Misreadings (-1)

M1 Treats as $3a^2 + 20$

Attempts (2 marks)

A1 Any substitution for a^2 and stops
A3 Any correct step

Worthless (0)

W1 Incorrect answer, with no work

(b) **5,10 marks** **Att 2,3**

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

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

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

✍

$$\frac{x}{3}+\frac{5x}{6}=\frac{2x+5x}{6}=\frac{7x}{6}$$

* $\frac{x}{3}+\frac{5x}{6}=\frac{6x}{9}$ 0 Marks, but allow $\frac{7x}{6}$ **or** $\frac{2x+5x}{6}$ **or** $\frac{4x+10x}{12}$ **or** $\frac{6x+15x}{18}$ **etc** for **full marks**

* $\frac{2x+5x}{6}$ 5Marks

* $\frac{2x}{6}+\frac{5x}{6}$ and stops 5 Marks

Blunders (-3)

B1 Correct answer without work ✍

B2 Incorrect common denominator and continues

B3 Incorrect numerator from candidate's denominator $\frac{1(x)+2(5x)}{6}$

B4 Omitting denominator

Slips (-1)

S1 Drops denominator

S2 Numerical errors to a max of 3

Attempts (2 marks)

A1 Any correct step.

A2 Any correct common denominator found

Worthless (0)

W1 $(\frac{x}{3})(\frac{5x}{6})$ and stops

W2 Incorrect answer, with no work

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

✍

$(2x - 5)(3x - 4) = 2x(3x - 4) - 5(3x - 4) = 6x^2 - 8x - 15x + 20 = 6x^2 - 23x + 20$

* If $6x^2 - 8x - 15x + 20$ is correct (minimum 7 MARKS)

Blunders (-3)

B1 Correct answer without work✍
B2 Error in distribution each time
B3 Errors in multiplication of powers
B4 Errors in collecting like terms
B5 Mathematical (sign) errors eg $-5 \times -4 = -20$
B6 $(2x - 5)$ written as $(2x + 5)$ and continues *and/or* $(3x - 4)$ written as $(3x + 4)$ --- oversimplifies

Slips (-1)

S1 Numerical errors to a max of −3

Misreadings (-1)

M1 $(5x - 2)(4x - 3)$ etc and continues

Attempts (3 marks)

A1 One term correctly multiplied and stops e.g. $6x^2$
A2 $2x(3x - 4)$ or $-5(3x - 4)$ and stops
A3 $2x(3x - 4) - 5(3x - 4)$ and stops

Worthless (0)

W1 Incorrect answer with no work

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

(i) The cost of a DVD is €x. The cost of a CD is €3 less.
What is the cost of a CD in terms of x?

(ii) The total cost of 3 DVDs and 2 CDs is €54.

Write an equation in x to represent this information.
Solve your equation to find the cost of a DVD.

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

CD : $x - 3$

* Algebraic work required to earn marks

Blunders (-3)
B1 Incorrect expression for the cost of a CD other than misreading below

Misreadings (-1)
M1 Answer given as $\mathbf{3 + x}$ *or* $\mathbf{3 - x}$

Attempts (2 marks)

Worthless (0)
W1 Cost of CD given as a constant or x.

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

Equation : $3x + 2(x - 3) = 54$

$3x + 2x - 6 = 54$

$5x = 60$

$x = 12$

Cost of a DVD = 12

* Accept candidates answer from previous work.
B1 Error in forming equation.
B2 Distribution error
B3 Transposition error
B4 Stops at $5x = 60$ or fails to solve equation
B5 Error in collecting like terms

Misreading (-1)
M1 $2x + 3(x - 3) = 54$ or similar

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

Attempts (2 marks)
A1 Answer from part c (i) written down and stops.
A2 Any effort at forming an expression.
A3 Writes $x = 12$
A4 Any effort at solving their equation
A5 Successful **Trial and Error**

Worthless (0)
W1 Incorrect answer with no work.

(iii) **10 marks** **Att 3**

Solve for x and y:

$x + 3y = 12$

$3x + 2y = 11$

(iii) **10 marks** **Att 3**

$5x + 3y = 12$ **(× –2) OR** $5x + 3y = 12$ **(× 3)** OR $x = \frac{12-3y}{5}$

$3x + 2y = 11$ **(×3)** $3x+2y = 11$ **(× –5)** $\mathbf{3}(\frac{12-3y}{5}) + 2y = 11$

$-10x - 6y = -24$ $15x + 9y = 36$ $36 - 9y + 10y = 55$

$9x + 6y = 33$ $-15x - 10y = -55$ $y = 55 - 36$

$-x = 9$ $-y = -19$

$x = -9$ $y = 19$ $y = 19$

$5(-9) + 3y = 12$ $5x + 3(19) = 12$ $x = \frac{12-3(19)}{5}$

$-45 + 3y = 12$ $5x + 57 = 12$

$3y = 57$ $5x = 12 - 57$ $x = \frac{12-57}{5}$

$y = 19$ $5x = -45$ $x = \frac{12-57}{5}$ $x = -9$

$x = -9$ $x = -9$

* Apply only <u>one</u> 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 ($-x = 9$) or the first equation in terms of y only ($-y = -19$) through elimination by cancellation **(but see S1)**

B3 Error or errors in establishing the first equation in terms of x only ($x = -9$) or the first equation in terms of y only ($-y = -19$) through elimination by substitution **(but see S1)**

B4 Errors in transposition when finding the first variable

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

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 candidate's correct 2nd variable

Worthless (0)

W1 Incorrect values for x or y substituted into the equations

QUESTION 5

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

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

(a) Write in its simplest form $2(x + 5) + 7(2x + 3)$.

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

$2(x + 5) + 7(2x + 3) = 2x + 10 + 14x + 21 = \mathbf{16x + 31}$

*Stops after correct removal of brackets 7 Marks

Blunders (-3)

B1 Correct answer without work ✍
B2 Error(s) in distribution (each time)
B3 Combining unlike terms after removal of brackets and continues
B4 Fails to group like terms
B5 Fails to finish

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

Misreadings (-1)
M1 $2(x + 2)$ and continues.

Attempts (3 marks)
A1 Any one term correctly multiplied
A2 Combines unlike terms at the start and finishes correctly

Worthless (0)
W1 Combining unlike terms before attempting multiplication and stops e.g. $2(5x) = 10x$

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

Factorise:

(i) $4xy - 8y$

(ii) ✍ $xy - xz + 3y - 3z$

(iii) $x^2 + 7x + 12$

(iv) $x^2 - 64$

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

$$4xy - 8y = 4y(x - 2)$$

* $y(4x–8)$ or $2y(2x–4)$ or $2(2xy –4y)$ or $4(xy – 2y)$ merit **4 Marks**

Blunders (-3)

B1 Removes factor incorrectly

Attempts (2 marks)

A1 Indication of common factor e.g. underlines *y*'s and stops

A2 Lists factors of 4 and factors of 8

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

✍ $xy - xz + 3y - 3z = x(y - z) + 3(y - z)$ or $y(x + 3) - z(x + 3)$
$= (y - z)(x + 3)$ $= (y - z)(x + 3)$

* Accept also (with or without brackets) for 5 marks any of the following
($y–z$) and (x+3) [The word and is written down.]
($y–z$) or (x+3) [The word or is written down.]
($y–z$), (x+3) [A comma is used]

Blunders (-3)

B1 Correct answer without work ✍

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

B3 Error(s) in factorising any pair of terms

B4 Correct first line of factorisation but ends as (x+3).$–yz$ or equivalent

Slips (-1)

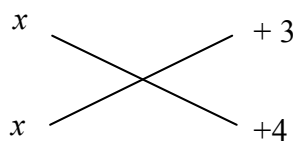
S1 $(y–z) \pm (x+3)$

Attempts (2 marks)

A1 Pairing off, or indication of common factors and stops

A2 Correctly factorises any pair and stops

(iii) **5 marks** **Att 2**

$x^2 + 7x + 12$ $x^2 + 4x + 3x + 12$ $x(x + 4) + 3(x + 2)$ $(x + 3)(x + 4)$	 $(x + 3)(x + 4)$	$\frac{-7 \pm \sqrt{(7)^2 - 4(1)(12)}}{2(1)}$ $\frac{-7 \pm \sqrt{49 - 48}}{2} = \frac{-7 \pm 1}{2}$ $\frac{-6}{2} = -3$ *and* $\frac{-8}{2} = -4$ $(x + 3)(x + 4)$

Factor Method

Blunders (-3)

B1 Incorrect two term linear factors of $x^2+7x+12$ formed from correct (but inapplicable) factors of x^2 and/or ±12. e.g. $(x+12)(x-1)$

B2 Incorrect factors of x^2 and/or ±12

B3 Correct cross method but factors not shown and stops

B4 $x(x+3)+4(x+3)$or similar and stops

Slips (-1)

S1 Numerical errors to a max of 3

Attempts (2 marks)

A1 Some effort at factorization e.g. $(x\quad)(\quad)$ or the cross with at least one "x" written in

A2 States one correct factor without work

Worthless (0 marks)

W1 $x^2 + 7x = 12$ or similar and stops

W2 Incorrect Trial and error

W3 Oversimplification, resulting in a linear equation

W4 Combines x with numbers and continues or stops

Formula Method

Blunders (-3)

B1 Error in a,b,c substitution (apply once only)

B2 Sign error in substituted formula (apply once only)

B3 Error in square root or square root ignored

B4 Stops at $\frac{-7 \pm 1}{2}$

B5 Incorrect quadratic formula and continues

B6 No factors from roots or incorrect factors

Slips (-1)

S1 Numerical errors to a max of −3

S3 One factor only

Attempts (2 marks)

A1 Correct formula and stops

Worthless (0 marks)

W1 Combines x with numbers and continues or stops

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

$x^2 - 64 = x^2 - (8)^2 = (x+8)(x-8)$

* Accept also (with or without brackets) for 5 marks any of the following $x + 8$ and $(x-8)$
[The word and is written down.]
$(x+8)$ or $(x-8)$ [The word or is written down.]
$(x+8)$, $(x-8)$ [A comma is used]
* Quadratic equation formula method is subject to slips and blunders.
* $(x-\sqrt{64})(x+\sqrt{64})$ merits 5 marks
* $x \pm 8$ merits 4 marks

Blunders (-3)
B1 Incorrect two term linear factors of x^2-64 formed from correct (but inapplicable) factors of x^2 and 64 e.g $(x-64)(x+1)$
B2 Incorrect factors of -64
B3 Incorrect factors of x^2
B4 $(8-x)(8+x)$.
B5 $(x-64)(x+64)$
B6 Answer left as roots. $(x = \pm 8)$

Slips (-1)
S1 $x-8(x+8)$

Attempts (2 marks)
A1 Some effort at factorization e.g. $(x \quad)(\quad)$ or the cross with at least one "x" written in
A2 $\pm x$ *or* ± 8 appears
A3 $x^2 - 64 = x.x - 8.8$ only
A4 Mention of the difference of two squares .e.g. $x^2 - 64^2$
A5 Correct quadratic equation formula quoted and stops
A6 $\sqrt{64}$

Worthless (0)
W1 Combines ***x***s to "numbers" and continues or stops

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

(i) Solve the equation $5(3x + 1) – 2(5x + 35) = 0$.
Verify your answer.

(ii) Solve $x^2 + 3x – 10 = 0$.

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

$5(3x + 1) – 2(5x + 35) = 0$
$15x + 5 – 10x – 70 = 0$
$5x – 65 = 0$
$5x = 65$
$x = 13$

Verify

$5(3x + 1) – 2(5x + 35)$ $\quad x = 13$
$5(3(13) + 1) – 2(5(13) + 35)$
$5(39 + 1) – 2(65 + 35)$
$5(40) – 2(100)$
$200 – 200 = 0$

* If changes −2 to +2 at the start: Blunder(−3)
* States x =13 (no work) and verifies correctly 7 Marks
* States x =13 (no work) with no verification 4 Marks
* Verifies correctly x = 13 (not stated) Att 3

Blunders (-3)
B1 Correct answer without work ✍
B2 Error(s) in distribution (each time)
B3 Combining unlike terms (each time) and continues
B4 Fails to group like terms
B5 Error(s) in transposition (each time)
B6 Fails to finish
B7 Fails to verify or verifies incorrectly

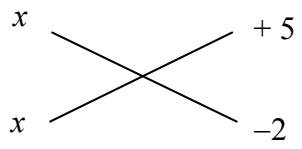
Slips (-1)
S1 Numerical errors to a max of –3

Misreadings (-1)
M1 $5(3x−1)$ or similar and continues but see * above

Attempts (3 marks)
A1 Any one term correctly multiplied
A2 Any correct step

Worthless (0)
W1 combining unlike terms before attempting multiplication and stops e.g. $5(4x) = 20x$
W2 Invented answer verified but see * above
W3 Incorrect answer with no work

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

$x^2 + 3x - 10 = 0$ $x^2 + 5x - 2x - 10 = 0$ $x(x + 5) - 2x - 10 = 0$ $x(x + 5) - 2(x + 5) = 0$ $(x + 5)(x - 2) = 0$ $(x + 5) = 0$ or $(x - 2) = 0$	$(x + 5)(x - 2) = 0$ $(x + 5) = 0$ or $(x - 2) = 0$  	$\frac{-(3) \pm \sqrt{(3)^2 - 4(1)(-10)}}{2(1)}$ $\frac{-3 \pm \sqrt{9 + 40}}{2} = \frac{-3 \pm 7}{2}$ $\frac{-10}{2} = -5$ *and* $\frac{4}{2} = 2$
$x = -5$ *or* $x = 2$	x = -5 or x = 2	

* **2** correct solutions by **Trial and Error** **10** Marks

* **1** correct solution by **Trial and Error** **3** Marks (Attempt)

Factor Method

Blunders (-3)

B1 Correct answers without work ✍

B2 Incorrect two term linear factors of $x^2+3x-10$ formed from correct (but inapplicable) factors of x^2 and/or ±10,e.g. $(x + 10)(x - 1)$

B3 No roots given. (once only)

B4 Incorrect factors of x^2 and/or ±10

B5 Correct cross method but factors not shown and stops [Note: B3 applies also].

B6 $x(x+5)-2(x+5)$ or similar and stops [Note: B3 applies also].

B7 Error(s) in transposition

Slips (-1)

S1 Numerical errors to a max of –3

S2 One root only from factors

Attempts (3 marks)

A1 Some effort at factorization e.g. (*x*)( ) or the cross with at least one "*x*" written in

A2 States one correct root without work

Worthless (0)

W1 $x^2 + 3x = 10$ or similar and stops

W2 Incorrect Trial and error

W3 Oversimplification, resulting in a linear equation

Formula Method

Blunders (-3)

B1 Error in *a,b,c* substitution (apply once only)

B2 Sign error in substituted formula (apply once only)

B3 Error in square root or square root ignored

B4 Stops at $\frac{-3 \pm 7}{2}$

B5 Incorrect quadratic formula and continues

Slips (-1)

S1 Numerical errors to a max of −3

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

S3 One root only

Attempts (3 marks)

A1 Correct formula and stops

A2 One correct substitution and stops

QUESTION 6

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

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

(a) $f(x) = 2x - 7$. Find:

(i) $f(4)$

(ii) $f(-3)$

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

(i) $f(x) = 2x - 7$

$f(4) = 2(4) - 7 = 8 - 7 = 1$

Blunders (-3)

B1 Correct answer without work. ✍

B2 Mathematical error. e.g. $(2)(4) = 24$,

B3 Leaves 2(4) in the answer.

B4 Combines "$x's$" to "numbers" and continues e.g. $2x - 7 = -5x = -5(4) = -20$.

B5 Mathematical error e.g $8 - 7 = -1$.

B6 Breaks order i.e. $2(4 - 7) = 2(-3) = -6$.

Slips (-1)

S1 Numerical errors to a max of −3.

S2 Leaves x in the answer e.g. $1x$

Misreadings (-1)

M1 Correctly substitutes in any number other than 4 and continues.

Attempts (2marks)

A1 Treats as equation and continues or stops. . i.e $2x - 7 = 4$.

A2 Substitutes for "x" and stops. i.e. 2(4).

Worthless (0)

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

W2 Ignores x giving $2 - 7 = -5$.

W3 $4[f(x)] = 8x - 28$.

W4 Replaces coefficient i.e. $2x \to 4x$.

W5 Incorrect answer without work.

(a) (ii)	**10 marks**	**Att3**
(a) (ii)	$f(-3) = 2(-3) - 7 = -6 - 7 = -13$	

Blunders (-3)

B1 Correct answer without work. ✍ [Do not penalise if already penalised in part (a) (i) or work is shown in part (a) (i).]

B2 Mathematical error. i.e. −6 – 7 = 13

B3 Leaves 2(−3) in the answer.

B4 Combines "*x*'s" to "numbers" and continues e.g. $2x - 7 = -5x = -5(-3) = 15$.

B5 Breaks order i.e. 2(–3 –7) = 2(–10) = –20

Slips (-1)

S1 Numerical errors to a max of –3.

S2 Leaves *x* in the answer e.g. −13 *x*

Misreadings (-1)

M1 Substitutes in any negative number other than −3 and continues.

Attempts (3marks)

A1 Treats as equation and continues or stops. i.e. $2x - 7 = -3$.

A2 Substitutes in any positive number

A3 Substitutes for *x* and stops. i.e. 2(−3).

Worthless (0)

W1 Ignores *x* giving 2 –7 = −5

W2 $-3f(x) = -6x + 21$

W3 Combines "*x*'s" to "numbers" and stops.

W4 Replaces coefficient i.e. $2x \rightarrow -3x$.

W5 Incorrect answer without work.

(b) **10 (Table), 10 (Graph) marks** **Att 3,3**

Draw the graph of the function

$$g : x \to 2x^2 - 4x + 1$$

in the domain $-1 \le x \le 3$, where $x \in \mathbb{R}$.

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

$g : x \to 2x^2 - 4x + 1$

$g(x) = 2x^2 - 4x + 1$
$g(-1) = 2(-1)^2 - 4(-1) + 1 = 2 + 4 + 1 = 7$ **(–1,7)**
$g(0) = 2(0)^2 - 4(0) + 1 = 0 + 0 + 1 = 1$ **(0, 1)**
$g(1) = 2(1)^2 - 4(1) + 1 = 2 - 4 + 1 = -1$ **(1, – 1)**
$g(2) = 2(2)^2 - 4(2) + 1 = 8 - 8 + 1 = 1$ **(2, 1)**
$g(3) = 2(3)^2 - 4(3) + 1 = 18 - 12 + 1 = 1$ **(3, 7)**

Table **10 marks** **Att 3**

A

$f(-1)$	=	$2(-1)^2$	-4(-1)	+1	=	**7**
$f(0)$	=	$2(0)^2$	-4(0)	+1	=	**1**
$f(1)$	=	$2(1)^2$	-4(1)	+1	=	**-1**
$f(2)$	=	$2(2)^2$	-4(2)	+1	=	**1**
$f(3)$	=	$2(3)^2$	-4(3)	+1	=	**7**

B

x	**-1**	**0**	**1**	**2**	**3**
$2x^2$	2	0	2	8	18
$-4x$	+ 4	- 0	- 4	- 8	- 12
+1	+1	+1	+1	+1	+1
$f(x)$	**7**	**1**	**-1**	**1**	**7**

* **Error(s) in each row/column** calculation attracts a **<u>maximum</u>** deduction of **3marks**

<u>Blunders (-3)</u>

B1 Correct answer, without work i.e. 5 correct couples only and no graph
B2 Takes "$2x^2$" as "x^2" and places "x^2" in the table or function.
B3 Errors in evaluating "$2x^2$", e.g. $2(-1)^2 = (-2)^2 = 4$, once only if consistent.
B4 "$-4x$" taken as "–4" all the way [In the row headed "$-4x$" by candidate]
B5 "+1" calculated as "$+1x$" all the way. [In the row headed "+1" by candidate]
B6 Adds in top row when evaluating $f(x)$ in table method (***B).***
B7 Omits "+1" row
B8 Omits "$-4x$" row
B9 Omits a value in the domain (each time).
B10 Each incorrect image, without work, or, calculation through the function method (***A***).

Slips (-1)

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

S2 Fails to find a value **of Range** each time in table to a max of 3

Misreadings (-1)

M1 Misreads "$-4x$" as "$+4x$" and places "$+4x$" in the table or function.

M2 Misreads "+1" as "–1" and places "–1" in the table or function.

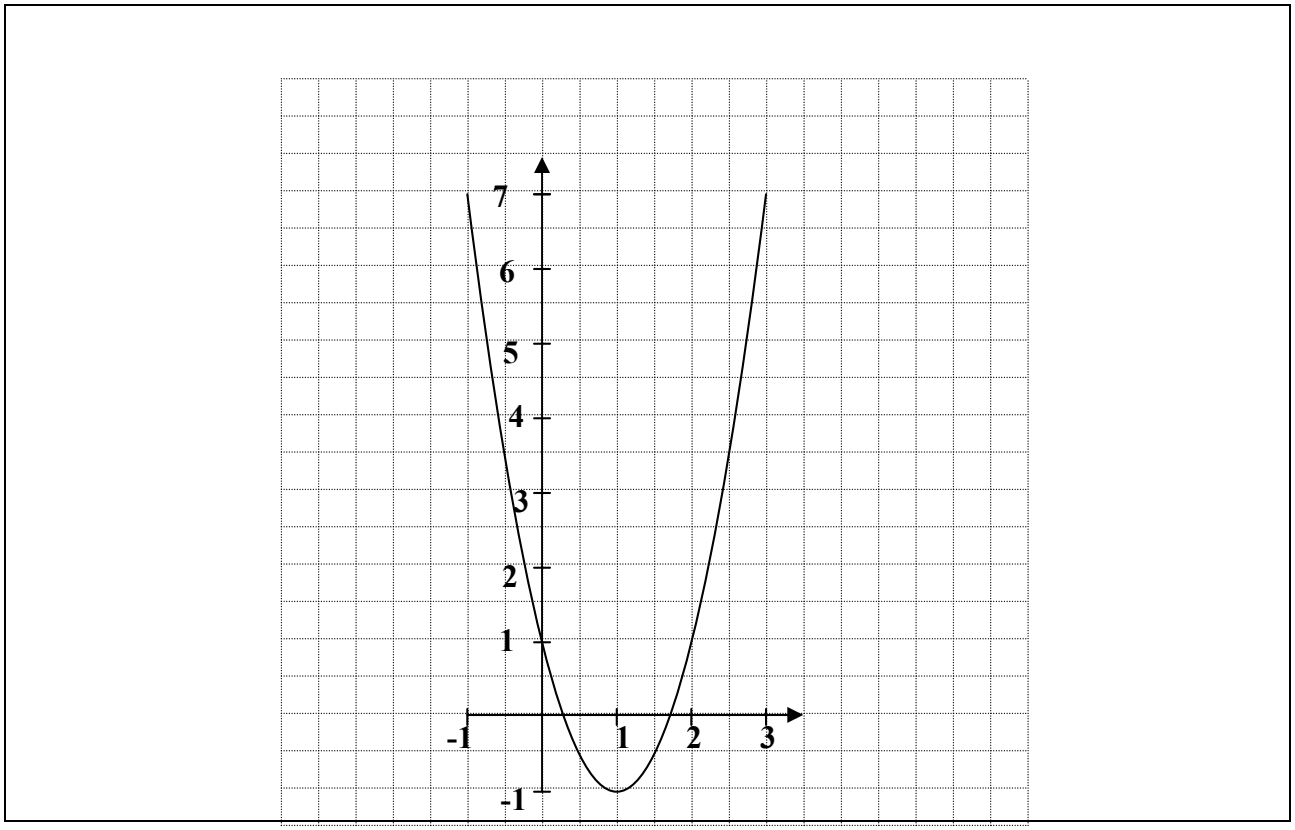
Attempts (3marks)

A1 Omits "$2x^2$" row or treats "$2x^2$" as $\pm 2x$ **or** $\pm x$, (i.e. evaluates a linear function)

A2 Any effort at calculating point(s) in the **Domain**

A3 Only one point calculated and stops.

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



* Accept candidates values from previous work (**5 co-ordinates needed**) but see S2

* Only **<u>one</u>** correct point **<u>graphed correctly</u>** $\Rightarrow$ **Att <u>3</u> + Att 3**

* Correct graph but **no table** $\Rightarrow$ full marks i.e. **(10 + 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 { **5 points needed** } from table not graphed [See **2nd *** above]

Attempts (3 marks)

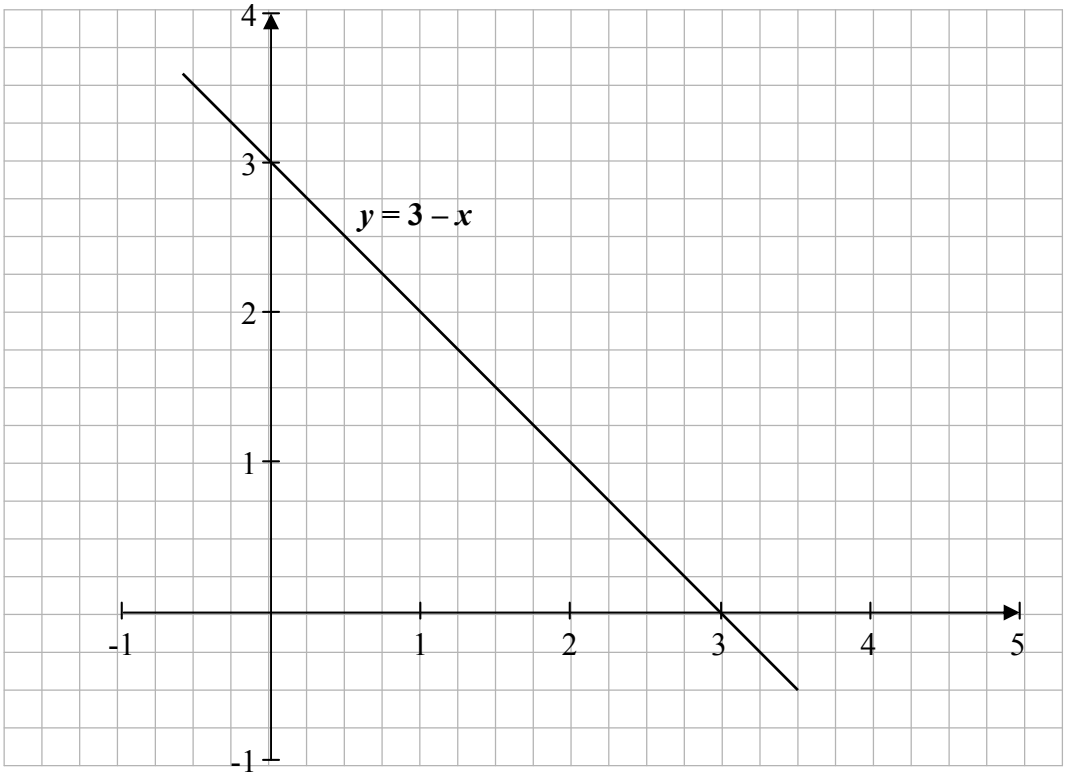
A1 Graduated axes (need not be labelled)
A2 Some effort at plotting a point { See **2nd *** above}

(c) **5,5,5 marks** **Att 2,2,2**

(c) **(i)** Given that $y = x - 1$, complete the table below.

x	1	2	3	4
y				

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.



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

Answer to be written here.

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

(i) Given that $y = x - 1$, complete the table below.

x	1	2	3	4
y	0	1	2	3

*** Accept candidate's values without work**

Slips (-1)
S1 Each 'y' value omitted or incorrect.

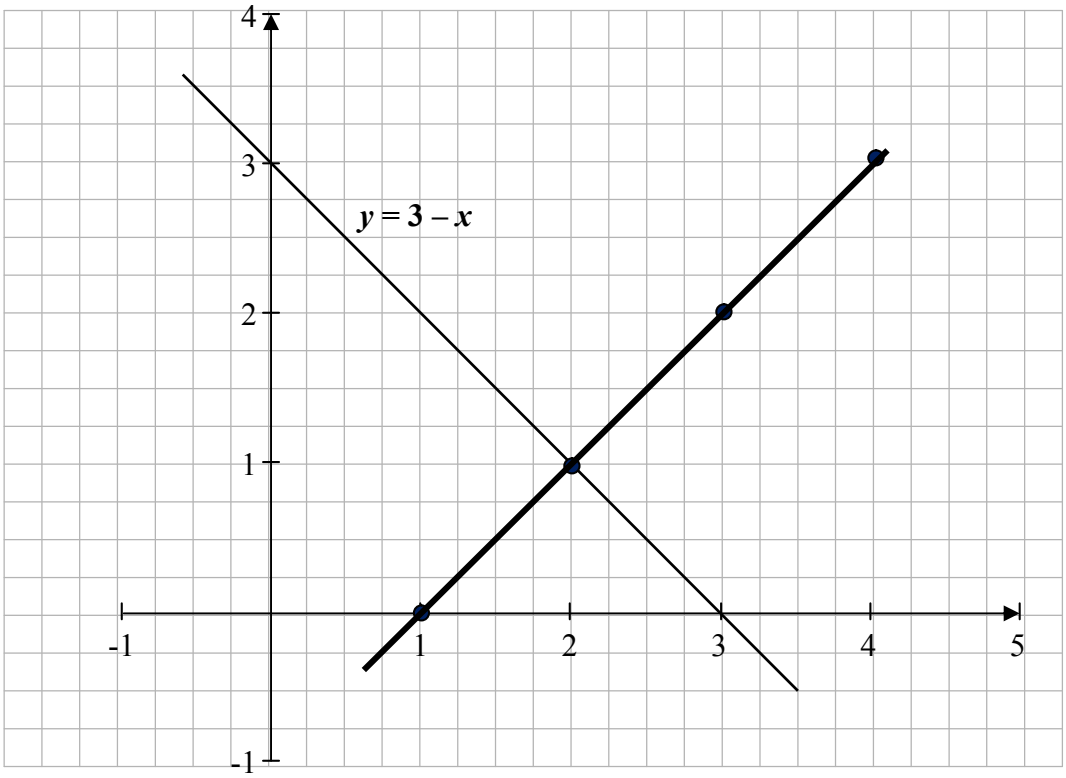
Misreadings (-1)
M1 Treats $y = x - 1$ as $y = x + 1$. (consistent error)

Attempts (2) marks)
A1 Any one correct 'y' value.
A2 Any effort at calculating points.
A3 Treats as $y = -x$ and continues

Worthless (0)
W1 Copies x values into y row.
W2 All 'y' values incorrect with no work shown but (See M1 and A3 above)

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

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.



*** Accept candidates values from previous work**

Blunders (-3)
B1 Reversed co-ordinates 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.

Attempts (2 marks)
A1 Any one correct point plotted.
A2 Any incorrect straight line drawn

Worthless (0)
W1 No correct point plotted. {See B1 above}.

(iii)	**5 marks**	**Att 2**
(2,1)		

*** Accept correct answer based on candidate's graph from c(ii), otherwise, attempt marks at most.**

Blunders (-3)

B1 Answer beyond tolerance (± 0.25).

B2 Answer given with co-ordinates reversed, i.e. (y, x).

Slips (-1)

S1 Correct answer written on graph but not presented in the answer box.

Attempts (2 marks)

A1 Algebraic evaluation. (fully correct)

A2 Point of intersection clearly indicated correctly on graph, but not written down.

Worthless (0)

W1 Answer outside of tolerance without graphical indication.

W2 Incorrect answer from candidate's graph.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION

2011

MARKING SCHEME

MATHEMATICS ORDINARY LEVEL PAPER 2

QUESTION 1

(a)	**10 marks**	**Att 3**
(b)	**20 (5,10,5) marks**	**Att2,3,2**
(c)	**20 (5,10,5) marks**	**Att 2,3,2**

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

1. (a) Multiply 320 grams by 5 and give your answer in kilograms.

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

320 ×5 = 1600 g	or	320/1000 = 0·32 kg
1600 /1000 =1·6 kg		0·32 kg × 5 = 1·6 kg

Blunders (-3)

B1 Correct answer without work
B2 Does not divide by 1,000
B3 Decimal error
B4 Incorrect mathematical operation with work and continues correctly, e.g. divides instead of multiplying
B5 Incorrect conversion or no conversion

Slips (-1)

S1 Numerical slips to a maximum of -3
S2 1,600 g = 1 kg 600 g

Misreadings(-1)

M1 Multiplies 320 by any number other than 5 or multiplies any number by 5

Attempts (3 marks)

A1 Some correct step with work e.g. 1,000 g = 1 kg and stops
A2 $\frac{320}{5}$ or 320 – 5 or 320 + 5 and stops

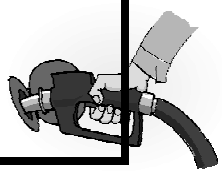
Part (b) **5,10,5 marks** **Att 2,3,2**

(b) John travelled by car from Tralee to Galway.
He left Tralee at 09:45 and arrived in Galway at 12:57.

(i) How long did it take John to travel from Tralee to Galway?
Give your answer in hours and minutes.

(ii) The distance from Tralee to Galway is 200 km.
Calculate John's average speed, in km/h.

(iii) John had estimated it cost 22 cent per km to drive his car.
How much did it cost him to drive his car from Tralee to Galway?



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

12:57− 09:45 = 3:12 or 3 hours 12 minutes

* 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

Slips (-1)
S1 Numerical slips to a maximum of -3
S2 Gives answer as 192 minutes or 3.2 hours

Attempts (2 marks)
A1 Subtracts hours or minutes only
A2 3.12 without work

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

Speed = Distance /Time

Distance =200 km Time (3 hours 12 minutes) = 3·2 hours

$$\text{Speed} = \frac{200}{3 \cdot 2} = 62 \cdot 5 \text{ km/h}$$

* Accept **c**andidates' answer from part (i)
* Accept ratio method

Blunders (-3)

B1 Correct answer without work
B2 Incorrect relevant formula
B3 Decimal error
B4 Error in converting minutes to hours e.g. treats 3 hours 12 minutes as 3.12 hours
B5 Leaves answer as $\frac{200}{3.2}$, i.e. no division

Slips (-1)

S1 Numerical slips to a maximum of -3
S2 Gives answer in km/min or m/hour

Attempts (3 marks)

A1 Correct formula and stops
A2 3 hours 12 minutes = 3.2 hours or 1 hour = 60 minutes and stops

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

200 × 22c = 4400c or €44

Blunders (-3)

B1 Correct answer without work
B2 Incorrect mathematical operation with work
B3 Decimal error

Slips (-1)

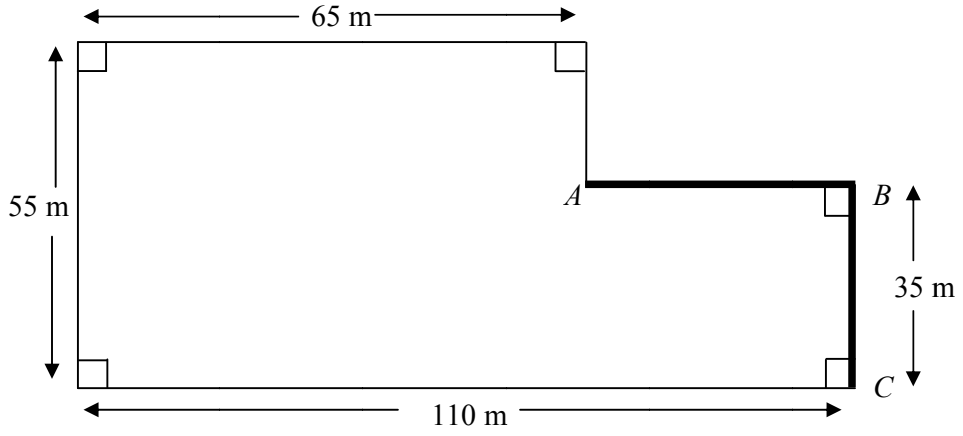
S1 Numerical slips to a maximum of -3

Attempts (2 marks)

A1 Multiplication using 200 or 22

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

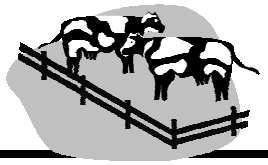
(c) The shape and measurements of a field are shown in the diagram below.



(i) Find the length $|AB|$.

(ii) Find the length of the perimeter of the field.

(iii) The sections $[AB]$ and $[BC]$ are stone walls.
A farmer wishes to put fencing around the rest of the field.
The fencing costs €62·50 per 5 metres.
Find the cost of the fencing.



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

$$|AB| = 110 - 65 = 45$$

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

Blunders (-3)
B1 Correct answer without work or correct answer given in diagram

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

Attempts (2 marks)
A1 Gets other unknown side correctly (20 m)

Worthless (0)
W1 Incorrect answer without work

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

Perimeter = 2×110m + 2× 55 m = 220 + 110 = 330 m

or

P = 55 +65+ 45 + 20 + 35 +110 = 330 m

* Accept candidates' answer from part (i)

Blunders (-3)

B1 Correct answer without work
B2 Incorrect mathematical operation with work
B3 Each measurement omitted or incorrect
B4 Stops at 220 + 110 or 55 + 65 + 45 +20 + 35 +110

Slips (-1)

S1 Numerical slips to a maximum of -3

Attempts (3 marks)

A1 Some correct step with work and stops
A2 Finds unknown side (20 m)
A3 Adds two of the given numbers
A4 Gets area of field or part of

(c) (iii) **5 marks** **Att 2**

Length Fencing = 330 − (35 +45) = 330 -80 = 250 m

Cost fencing = 250/5 × 62·50 =50 × 62·50 = €3125

* Accept candidates' answer to parts (i) and (ii)

Blunders (-3)

B1 Correct answer without work
B2 Includes wall / walls in cost calculation
B3 Each measurement omitted or incorrect, if not already penalised
B4 Decimal error
B5 Incorrect mathematical operation with work
B6 Does not divide by 5

Slips (-1)

S1 Numerical slips to a maximum of -3

Attempts (2 marks)

A1 Adds 35 + 45 and stops
A2 Multiplies by € 62.50
A3 € 62.50 ÷ 5 and stops
A4 Calcuates 250 m. correctly and stops

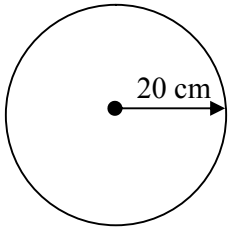
QUESTION 2

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

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

(a) A circular disc has a radius of 20 cm.

Taking π as 3·142 find, in cm^2, the area of the disc.



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

Area = $\pi r^2 = 3{\cdot}142(20)^2 = 3{\cdot}142(400) = 1256{\cdot}8\ cm^2$

Blunders (-3)

B1 Correct answer without work
B2 Incorrect substitution and continues correctly
B3 Decimal error
B4 Mathematical error e.g. $20^2 = 40$
B5 Incorrect relevant formula and continues i.e. $2\pi r$
B6 $\pi \neq 3.142$ or answer in terms of π

Slips (-1)

S1 Numerical slips to a maximum of -3

Attempts (3 marks)

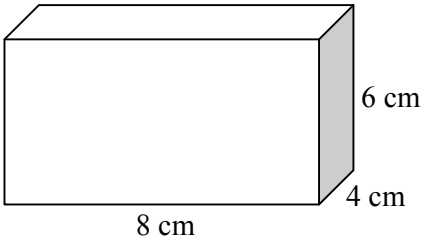
A1 Some correct step with work and stops e.g. $\pi (20)^2$ and stops
A2 3.142×20 with or without answer of 62.84
A3 Writes $(20)^2$ and stops
A4 Correct relevant formula and stops
A5 Some correct substitution

Worthless(0)

W1 Incorrect answer without work unless attempt mark applies

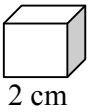
Part (b) **20 (10,5,5) marks** **Att 3,2,2**

(b) A solid rectangular block of wood has length 8 cm, width 4 cm and height 6 cm.



(i) Find, in cm^3, the volume of the block of wood.

(ii) Find, in cm^3, the volume of a cube of side 2 cm.



(iii) How many solid cubes, each of side 2 cm, can be made from the block of wood in **(i)**?

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

Volume = $l \times w \times h = 8 \times 4 \times 6 = 192$ cm^3

Blunders (-3)
B1 Correct answer without work
B2 Incorrect mathematical operation and continues
B3 Each incorrect dimension
B4 Incorrect relevant formula and continues i.e. surface area
B5 Leaves answer as $8 \times 4 \times 6$

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

Attempts (3 marks)
A1 Some correct step with work and stops e.g. 8×6 or 8×4 or 4×6 and stops
A2 Correct formula for volume of rectangular solid and stops

Worthless (0)
W1 Incorrect answer without work
W2 Use of formula involving π

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

Volume cube = $l^3 = 2^3 = 2\times2\times2 = 8\ cm^3$

Blunders (-3)
B1 Correct answer without work
B2 Incorrect mathematical operation and continues
B3 Incorrect substitution
B4 Incorrect relevant formula and continues i.e. surface area
B5 Leaves answer as $2 \times 2 \times 2$ or 2^3
B6 $2^3 = 6$

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

Attempts (2 marks)
A1 Some correct step with work and stops e.g. 2×2
A2 Correct formula for volume of cube and stops
A3 $2 \times 3 = 6$ and stops

Worthless (0)
W1 Incorrect answer without work
W2 Use of formula involving π

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

Number of cubes = $4\times2\times3 = 24$ or $\frac{192}{8} = 24$

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

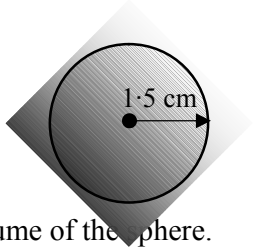
Blunders (-3)
B1 Correct answer without work
B2 Incorrect mathematical operation and continues
B3 $4 \times 2 \times 3$ and stops
B4 $\frac{192}{8}$ and stops
B5 $\frac{8}{192}$ and continues

Slips (-1)
S1 Numerical slips up to a maximum of -3
Attempts (2 marks)
A1 4×2 or 2×3 or 4×3 and stops
A2 $\frac{8}{192}$ and stops
A3 If answer from b(i) and/or b(ii) appears in this part

Worthless(0)
W1 Incorrect answer without work

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

(c) A solid metal sphere has radius length 1·5 cm.



(i) Taking π as 3·142 find, in cm^3, the volume of the sphere.
Give your answer correct to two decimal places.

(ii) 100 of these spheres were melted down and recast as a cylinder.
The cylinder had a diameter of 10 cm.
Find, to the nearest cm, the height of the cylinder.

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

$$\text{Volume} = \frac{4}{3}\pi r^3 \quad = \frac{4}{3}(3{\cdot}142)(1{\cdot}5)^3 = \frac{4}{3}(3.142)(3.375) = 14{\cdot}139 = 14{\cdot}14 \text{ cm}^3$$

Blunders (-3)
B1 Correct answer without work
B2 Incorrect relevant sphere formula i.e. $4\pi r^2$
B3 Incorrect substitution e.g. radius ≠ 1.5
B4 Mathematical error e.g. $(1.5)^3 = 4.5$
B5 π ≠ 3.142 or answer in terms of π

Slips (-1)
S1 Numerical slips to a maximum of -3
S2 Incorrect rounding off or no rounding off

Attempts (3 marks)
A1 Gives volume as $\frac{4}{3}\pi r^3$ and stops
A2 π dropped in calculations with or without work
A3 Product of two relevant numbers ($\frac{4}{3}$, 3.142 or 1.5)
A4 Some correct substitution

Worthless (0)
W1 Incorrect answer without work

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

Volume 100 spheres = 14·14 (100) = 1414

Volume cylinder = 1414

$3{\cdot}142\ (5)^2 h = 1414$

$$h = \frac{1414}{25 \times 3{\cdot}142} = \quad 18{\cdot}00127$$

$h = 18$

* Accept candidates' answer from part (i)

* Allow values of π of 3.142 , 3.14 , 3.1 , $\frac{22}{7}$ or calculator value of $\boldsymbol{\pi}$

Blunders (-3)

B1 Correct answer without work
B2 Incorrect substitution and continues e.g. r = 10
B3 Decimal error
B4 Incorrect mathematical operation and continues
B5 Incorrect relevant formula and continues e.g. 2 π r h
B6 Mathematical error e.g. $5^2 = 10$
B7 Does not multiply by 100

Slips (-1)

S1 Numerical slips to a maximum of -3
S2 Early rounding off that affects answer e.g. 25 × 3 = 75
S3 Answer not to nearest cm. or incorrect cm. given

Attempts (3 marks)

A1 Some correct step with work and stops
A2 Candidates' answer for (i) appears in this part with or without work
A3 Correct formula and stops
A4 Some correct substitution

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies

QUESTION 3

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

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

(a) Find the mean of the numbers:

4·1, 5·9, 10·2, 7·3, 13·5

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

$$\text{Mean} = \frac{4\cdot1+5\cdot9+10\cdot2+7\cdot3+13\cdot5}{5} = \frac{41}{5} = 8\cdot2$$

Blunders (-3)

B1 Correct answer without work
B2 Multiplies instead of adds
B3 Decimal error
B4 Incorrect divisor
B5 Omits a value each time in numerator
B6 Inverted fraction
B7 $\frac{41}{5}$ and stops

Slips (-1)

S1 Numerical slips to a maximum of -3

Attempts (3 marks)

A1 Some correct step and stops
A2 Writes 4.1 + 5.9 + 10.2 +7.3 + 13.5 and stops
A3 Partial addition with work and stops
A4 States median is 7.3 and stops
A5 41 and/or 5 without work
A6 Idea of mean indicated e.g. $\frac{\Sigma x}{n}$ or a verbal description

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies

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

The table shows the number of hours Mary spent watching television from Monday to Friday during a mid-term break.

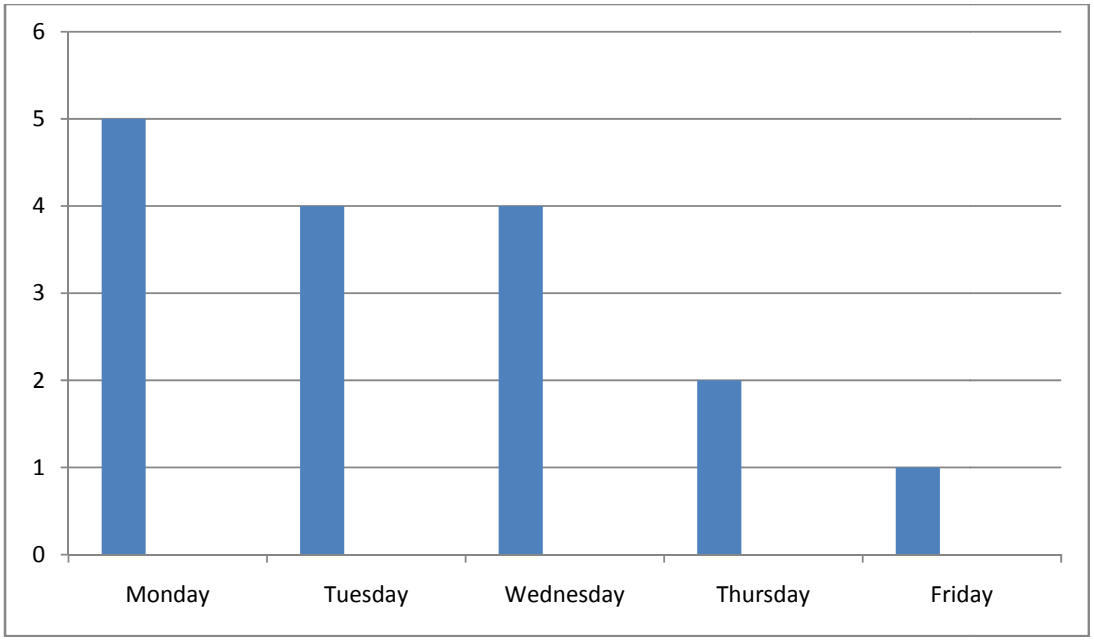
Day of the week	Monday	Tuesday	Wednesday	Thursday	Friday
Number of hours	5	4	4	2	1

(i) Draw a bar chart of the data.

(ii) On which day of the week did Mary spend most time watching television?

(iii) Write the number of hours Mary spent watching television on Thursday as a fraction of the total number of hours she spent watching television from Monday to Friday.

(b) (i) **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 hours not graduated uniformly
B2 Draws a trend graph or pie chart

Slips (-1)
S1 Each incorrect bar or bar omitted to a maximum of -3

Attempts (3 marks)
A1 Graduated axis or axes only

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

Monday

* Accept answer based on candidates' bar chart

Misreading (-1)
M1 Friday (day in which she watched the least)

Attempts (2 marks)
A1 Any other day

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

$5 + 4 + 4 + 2 + 1 = 16$ $\frac{2}{16}$ or $\frac{1}{8}$

Blunders (-3)
B1 Correct answer without work
B2 Incorrect mathematical operation with work
B3 Omits an entry or inserts an incorrect entry in the addition
B4 Numerator $\neq 2$
B5 $5 + 4 + 4 + 2 + 1 = 16$ and stops
B6 Inverted fraction

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

Misreading (-1)
M1 Gives answer of $12\frac{1}{2}$ % or 0.125 with work

Attempts (2 marks)
A1 Attempt at adding two or more of the numbers

Worthless (0)
W1 Incorrect answer without work

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

The number of days that each of 20 pupils was absent from school during a six week period is listed below:

1	2	0	1	2
0	4	4	5	1
2	1	2	1	0
4	0	5	3	1

(i) Complete the following frequency table.

Number of days absent	0	1	2	3	4	5
Number of pupils						

(ii) Calculate the mean number of days absent per pupil.
Give your answer correct to the nearest number of days.

(iii) What percentage of the pupils was absent for 3 days or more?

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

Number of days absent	0	1	2	3	4	5
Number of pupils	**4**	**6**	**4**	**1**	**3**	**2**

***** Accept correct answer with no work shown

Slips (-1)
S1 Each incorrect entry to a maximum of -3

Attempts (2 marks)
A1 One correct entry only

Worthless (0)
W1 Table in question reproduced

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

$$\text{Mean} = \frac{0\times4+1\times6+2\times4+3\times1+4\times3+5\times2}{20}$$

$$= \frac{0+6+8+3+12+10}{20}$$

$$= \frac{39}{20} = 1{\cdot}95 \qquad 2 \text{ days}$$

***** Accept candidates' table from part (i)

Blunders (-3)

B1 Correct answer without work
B2 Incorrect mathematical operation with work
B3 Incorrect denominator
B4 Inverted fraction
B5 Frequencies omitted in numerator
B6 Omits two or more values in numerator
B7 $\frac{39}{20}$ and stops

Slips (-1)

S1 Numerical slips to a maximum of -3
S2 1.95 and stops
S3 Incorrect rounding off
S4 Omits one value in numerator with work

Attempts (3 marks)

A1 Some correct step with work and stops e.g. a relevant multiplication
A2 States mean = $\frac{\Sigma f x}{\Sigma f}$ and stops
A3 Average of the frequencies i.e. $\frac{4+6+4+1+3+2}{6} = \frac{10}{3}$
A4 $\frac{0+1+2+3+4+5}{6} = \frac{5}{2}$
A5 39 with or without work

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies

(c) (iii) **5 marks** **Att 2**

3 days or more = 1+3+2 = 6 pupils

$\frac{6}{20} \times 100\ \% = 30\ \%$

Blunders (-3)

B1 Correct answer without work
B2 Incorrect mathematical operation with work
B3 Decimal error
B4 Omits the 100 or divides by the 100
B5 Leaves answer as $\frac{\mathbf{6}}{\mathbf{20}} \times 100$
B6 Omits an entry or includes an incorrect entry in the addition

Slips (-1)

S1 Numerical slips to a maximum of -3
S2 Writes 6 × 5 and stops with work shown

Misreadings(-1)

M1 Gets 3 days or less (75 %)

Attempts (2 marks)

A1 Some correct step with work and stops e.g. indicates the 100
A2 Writes any of the following numbers and stops : 1,3,2,6,20,100

Worthless (0)

W1 Incorrect answer without work shown unless attempt mark applies

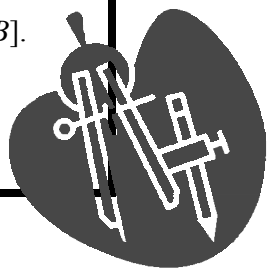
QUESTION 4

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

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

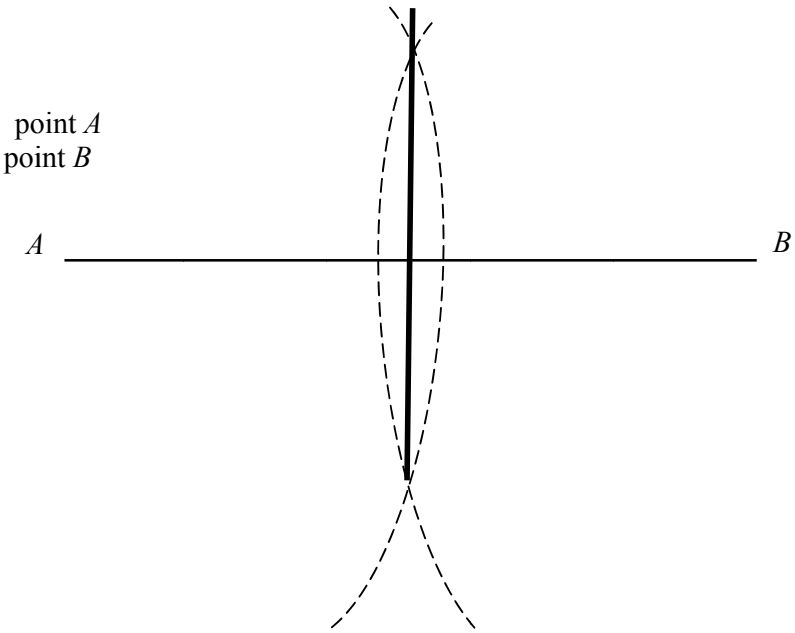
(a) Using only a compass and straight edge, construct the perpendicular bisector of [*AB*].
Show all construction work.

A _____ *B*



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

Arc, centre point *A*
Arc, centre point *B*
Join



* Allow a tolerance of ± 1 mm in distance measurement and of ± 2° in angle measurement

Blunders (-3)

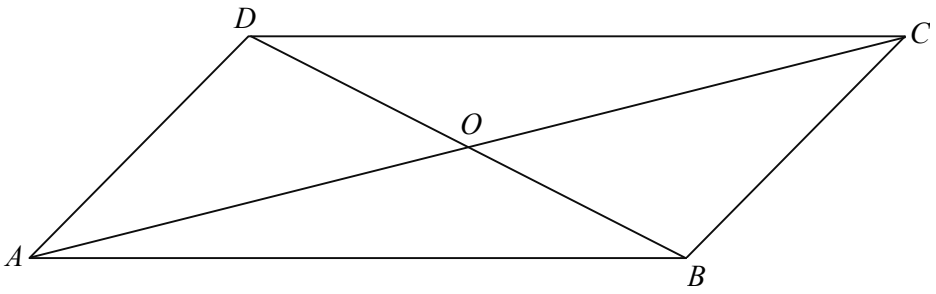
B1 Arcs drawn correctly but bisector not drawn or drawn incorrectly
B2 Perpendicular bisector drawn but arcs not shown (check measurements and perpendicularity)
B3 Distance or angle measurement outside tolerance (each time)

Attempts (3 marks)

A1 One arc drawn from *A* or *B* or two arcs drawn that do not intersect from *A* and *B*
A2 Any correct statement referring to the perpendicular bisector
A3 Does not use compass in drawing arcs or straight edge in drawing bisector
A4 Midpoint of line found correctly (by measurement) and stops

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

(b) *ABCD* is a parallelogram.
The diagonals [*AC*] and [*BD*] intersect at the point *O*.



(i) Find the image of [*AD*] by the translation $\overrightarrow{DC}$.

(ii) Name the angle equal in measure to $\angle DAO$.

(iii) Complete the following reasons for the fact that the triangles
$\Delta\ AOD$ and $\Delta\ BOC$ are congruent.

In $\Delta\ AOD$		In $\Delta\ BOC$
	=	
	=	
	=	

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

$[AD] \rightarrow [BC]$

* Correct answer could be highlighted in diagram
* Accept [$\boldsymbol{CB}$] for full marks if no work shown (see A4 below)

Slips (-1)
S1 States A→ B and D → C and stops

Attempts (2 marks)
A1 States A → B or D → C and stops
A2 States that the opposite sides of a parallelogram are equal and stops
A3 Any correct statement about a translation
A4 Gets [$\boldsymbol{CB}$] using central symmetry in O with work shown
A5 One letter correct

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

< DAO = < OCB or < ACB

* Correct answer could be highlighted in diagram
* Accept correct answer without work

Blunders (-3)
B1 Gives < C or < COB or < OBC as answer

Misreading (-1)
M1 Takes angle as < BAO

Slips (-1)
S1 States A → C and D → B and O → O and stops

Attempts (2 marks)
A1 States alternate angles are equal and stops
A2 States < ADO = < OBC and / or < AOD = < COB and stops

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

In Δ *AOD*		In Δ *BOC*
AD	=	*BC*
$\lvert\angle DAO\rvert$	=	$\lvert\angle OCB\rvert$
AO	=	*OC*

Accept any other correct version of ASA , SSS , or SAS

* Accept correct answer without work
* Accept correct answer marked or indicated in a reproduced diagram

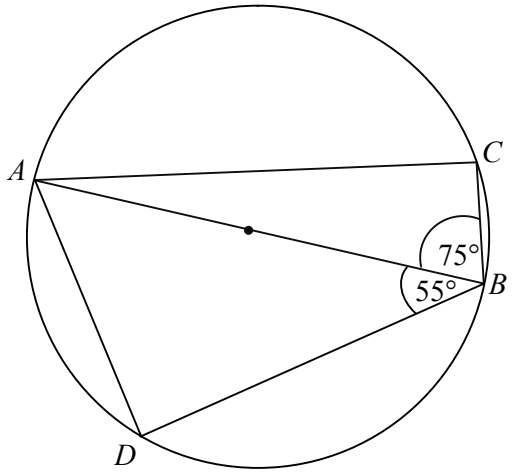
Blunders (-3)
B1 Each step incorrect or omitted

Attempts (3 marks)
A1 States same shape or SSS or ASA or SAS

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

[AB] is a diameter of a circle.

C is a point on the circle and $|\angle ABC| = 75°$.



(i) Write down $|\angle ACB|$ and give a reason for your answer.

(ii) Calculate $|\angle BAC|$.

D is another point on the circle and $|\angle ABD| = 55°$.

(iii) Find $|\angle DAC|$.

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

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

Reason: Angle in a semi-circle

* Correct angle may be written in diagram
* Accept right- angled symbol in diagram for full marks
* Accept correct answer without work

Misreading (-1)
M1 Gives answer as 15° (| < BAC |)

Slips(-1)
S1 Gives no reason or incorrect reason

Attempts (2 marks)
A1 Correct reason but no angle given or an incorrect angle given

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

$|\angle BAC| = 180° - (90° + 75°) = 180° - 165° = 15°$

***** Accept candidates' answer from (i)

Blunders (-3)
B1 Correct answer without work
B2 Incorrect mathematical operation
B3 180° - 90° = 90° or 180° - 75° = 105° or 90° + 75° = 165° and stops

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

Misreading (-1)
M1 Finds $|\angle BAD| = 35°$

Attempts (2 marks)
A1 States that the sum of the angles in a triangle = 180° and stops
A2 Writes 90° + 75° and stops

Worthless(0)
W1 Incorrect answer without work unless attempt mark applies

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

$$|\angle DAC| = 180° - (55° + 75°) = 180° - 130° = 50°$$

or

$$|\angle DAC| = |\angle DAB| + |\angle CAB|$$
$$= 35° + 15°$$
$$= 50°$$

* Accept $|\angle CAB|$ from part (i)

Blunders (-3)
B1 Correct answer without work
B2 Incorrect mathematical operation with work
B3 180° - 130° and stops or 35° + 15° and stops
B4 $|\angle DAB| \neq 35°$ with work shown

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

Attempts (3 marks)
A1 55° + 75° and stops
A2 States $|\angle BDA| = 90°$ and stops or states $|\angle BAD| = 35°$ and stops
A3 States opposite angles in a cyclic quadrilateral add up to 180° and stops
A4 States the sum of the angles in a triangle = 180° and stops
A5 Mentions 360° and stops

Worthless(0)
W1 Incorrect answer without work unless attempt mark applies

QUESTION 5

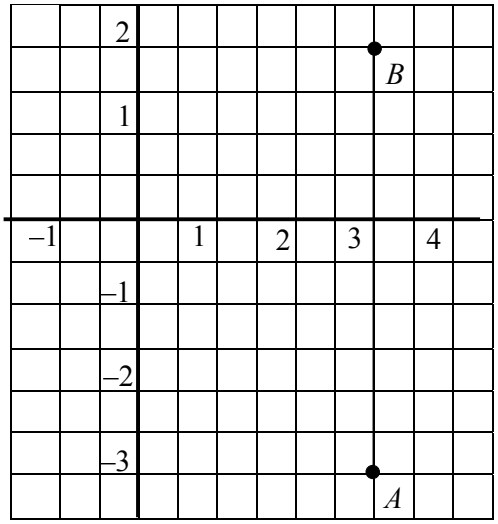
(a)	**10 marks**	**Att 3**
(b)	**20 (10,5,5) marks**	**Att 3,2,2**
(c)	**20 (5,5,10) marks**	**Att 2,2,3**

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

A is the point $(3, -3)$.

B is the point $(3, 2)$.

Find $|AB|$, the length of $[AB]$.



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

$|AB| = 5$ (By inspection)

or By formula

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(3-3)^2 + (-3-2)^2} = \sqrt{(0)^2 + (-5)^2} = \sqrt{25} or 5$$

* Accept correct answer without work
* Accept -5 for full marks
* Answer may be stated in diagram

Blunders (-3)

B1 Incorrect relevant formula and continues
B2 Incorrectly treats couples as (x1,x2) and (y1,y2) and continues
B3 Two or more signs incorrect in substitution with work
B4 Uses one of the given points and some arbitrary point e.g. (1,2) and continues
B5 Mathematical error
B6 No square root sign included with substitution and continues correctly to get 25

Slips (-1)

S1 Numerical slips to a maximum of -3
S2 Error in one sign in formula inside brackets and continues
S3 One incorrect substitution or incorrect sign when substituting
S4 If square root sign is included originally but omitted in answer of 25

Attempts (3 marks)

A1 Some correct substitution
A2 Some correct substitution into an incorrect relevant formula
A3 Labels A and / or B with (x_1 , y_1) and stops
A4 Correct relevant formula and stops
A5 10 without work

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies

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

(b) Q is the point (4, 3) and S is the point (2, – 5).
Find each of the following:
(i) the midpoint of [QS]
(ii) the slope of QS
(iii) the equation of the line QS

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

Midpoint $= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{4+2}{2}, \frac{3+-5}{2}\right) = \left(\frac{6}{2}, \frac{-2}{2}\right)$ or $(3,-1)$

* Accept translation method
* No penalty on brackets

Blunders (-3)
B1 Correct answer without work
B2 Incorrect relevant formula 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 with work
B5 Uses one of the given points and some arbitrary point e.g. (1,2) and continues
B6 Uses two arbitrary points and continues
B7 Mathematical error

Misreading (-1)
M1 Uses both points in part (a)

Slips (-1)
S1 Numerical slips to a maximum of -3
S2 Error in one sign in formula and continues
S3 One incorrect substitution or incorrect sign e.g. ($\frac{\mathbf{4-2}}{\mathbf{2}}, \frac{\mathbf{3+-5}}{\mathbf{2}}$) when substituting
S4 Takes Q as midpoint and finds extremity i.e. (2,-5) → (4,3) → (6,11) or takes S as midpoint and finds extremity i.e. (4,3)→ (2,-5) → (0,-13)

Attempts (3 marks)
A1 Some correct substitution
A2 Some correct substitution into an incorrect relevant formula
A3 Labels Q and / or S with (x_1 , y_1) and stops
A4 Correct midpoint on diagram and not named (if named B1 applies)
A5 Plots Q and/or S reasonably well (for this part)
A6 Correct relevant formula and stops

Worthless (0)
W1 Incorrect answer without work unless attempt mark applies

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

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5-3}{2-4} = \frac{-8}{-2} \text{ or } 4$$

* Accept candidates' midpoint from (i) as a point for finding the slope
* Accept correct trigonometric method

Blunders(-3)

B1 Correct answer without work
B2 Incorrect relevant formula 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 with work
B5 Uses one of the given points and some arbitrary point e.g. (1,2) and continues
B6 Mathematical error
Note Do not apply B3 here if already penalised in previous part

Slips (-1)

S1 Numerical slips to a maximum of -3
S2 Error in one sign in formula and continues
S3 One incorrect substitution or incorrect sign e.g. $\frac{5-3}{2-4}$ when substituting

Attempts (2 marks)

A1 Some correct substitution
A2 Some correct substitution into an incorrect relevant formula
A3 Labels Q and / or S with (x_1 , y_1) and stops
A4 Plots Q and S on a diagram drawn reasonably well (for this part)
A5 Tan A = $\frac{opposite}{adjacent}$ or $\frac{rise}{run}$ or m = $\frac{vertical}{horizontal}$ and stops
A6 Correct relevant formula and stops

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies

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

Equation Line : $y - y_1 = m(x - x_1)$

$y - 3 = 4(x - 4)$

$y - 3 = 4x - 16$

$4x - y = 13$

* Accept $3 - y = 4(4 - x)$ or similar for full marks

Blunders (-3)

B1 Correct answer without work
B2 Incorrect relevant formula and continues
B3 m value not consistent with previous part or leaves slope as m i.e. $y - 3 = m(x - 4)$
B4 Two or more signs incorrect in substitution with work
B5 (x_1, y_1) used not Q or S
B6 Mathematical error
B7 Switches x and y i.e. $y - 4 = 4(x - 3)$

Slips (-1)

S1 Numerical slips to a maximum of -3
S2 Error in one sign in formula and continues
S3 One incorrect substitution or incorrect sign e.g. $y + 3 = 4(x - 4)$ when substituting

Attempts (2 marks)

A1 Some correct substitution
A2 Some correct substitution into an incorrect relevant formula
A3 Labels Q and / or S with (x_1, y_1) and stops
A4 Point Q and/ or S plotted reasonably well (for this part)
A5 Writes $m = 4$ and stops
A6 Correct relevant formula and stops

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies

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

(i) l is the line $3x + 2y - 12 = 0$.
Verify that the point (4, 0) is on the line l.

(ii) l cuts the y-axis at the point T.
By letting $x = 0$ find the co-ordinates of the point T.

(iii) Hence draw the line l on the grid below.

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

$3x + 2y - 12 = 0$

$3(4) + 2(0) - 12 = 12 - 12 = 0$ True

***** Candidate needs to get $12 - 12 = 0$ for full marks (the "True" is not required)

Blunders (-3)

B1 Incorrect substitution and continues e.g. switches x and y

B2 Mathematical error

B3 $3(4) + 2(0) - 12 = 0$ and stops

Slips (-1)

S1 Numerical slips to a maximum of -3

Attempts (2 marks)

A1 Substitutes one correct value and stops

A2 Identifies $x = 4$ and/or $y = 0$ and stops

A3 Plots (4,0)

A4 Any correct transposition of equation and stops e.g. $3x + 2y = 12$ and stops

A5 States "Yes it is" and stops

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

$3x + 2y - 12 = 0$

$3(0) + 2y - 12 = 0$

$2y = 12$

$y = 6$

$T = (0,6)$

***** Accept answer given as $y = 6$ 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

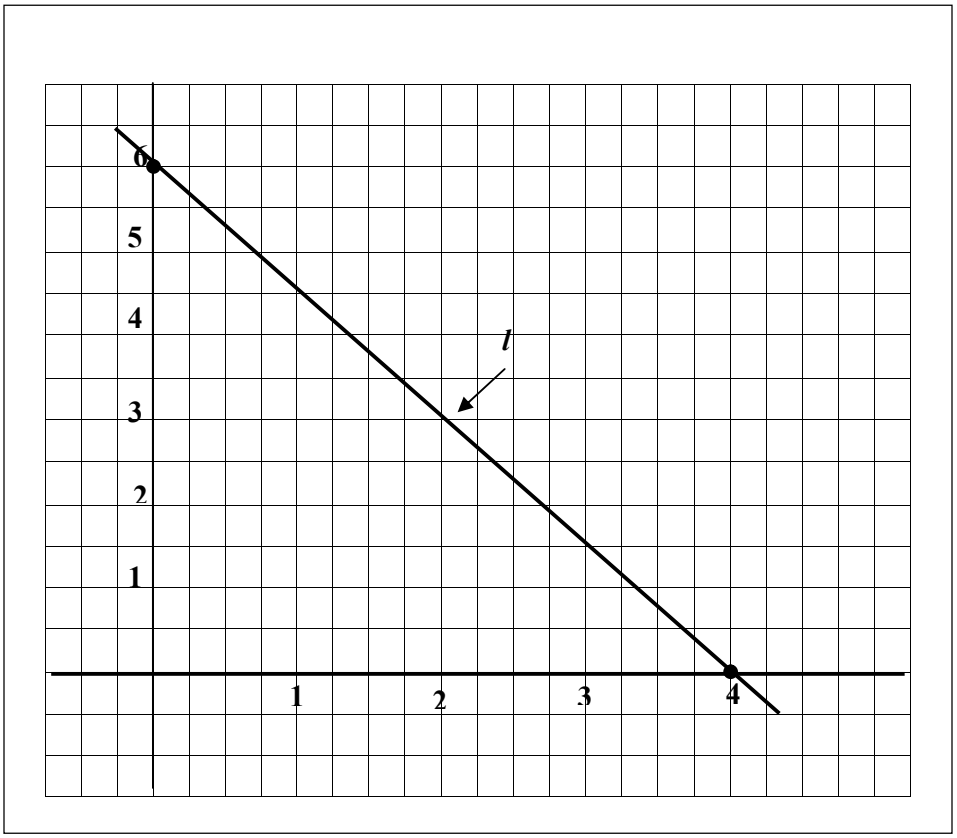
Attempts (2 marks)

A1 Substitutes y = 0 and stops
A2 Writes answer as $(0,y)$ without work , where y is an arbitrary number, subject to B1
A3 Substitutes $x = 0$ into equation and stops

Worthless (0)

W1 Incorrect answer without work , unless attempt mark applies

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



***** Accept candidates' answer from part (ii)

Blunders (-3)
B1 Each point plotted incorrectly or omitted
B2 *x* and *y* values of one/both point(s) switched
B3 Line not drawn

Slips (-1)
S1 Switches *X* and *Y* axes

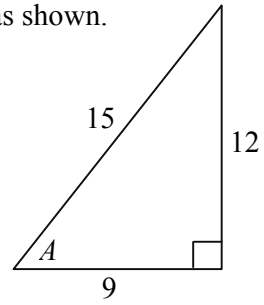
Attempts (3 marks)
A1 Scaled axis/axes drawn

QUESTION 6

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

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

6. **(a)** The right-angled triangle in the diagram has measurements as shown.



(i) Write down the length of the side opposite the angle A.

(ii) Write down, as a fraction, the value of sin A

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

Length of the side opposite the angle $A = 12$

* Correct answer without work merits full marks

* Indicates 12 only in diagram, accept for full marks

Attempts (2 marks)

A1 Gives answer as 9 or 15

A2 Any mention of a correct trigonometric ratio

Worthless(0)

W1 Gives more than one answer

W2 Answer measured from examination paper (3.7 cm.)

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

$\sin A = \frac{12}{15}$ or $\frac{4}{5}$

* Accept correct answer without work
* Accept candidate's opposite from part (i)
* Accept sin $\frac{\mathbf{12}}{\mathbf{15}}$ for full marks

Blunders (-3)

B1 Incorrect ratio e.g. $\frac{9}{15}$ or $\frac{9}{12}$

B2 Inverted ratio i.e. $\frac{15}{12}$

Slips (-1)

S1 sinA not as a fraction (0.8)

Attempts (2 marks)

A1 Any correct trigonometric ratio

A2 Gives answer as 53.13° (evaluates A)

A3 Gives answer as 0.013 (sin $\frac{\mathbf{12}}{\mathbf{15}}$)

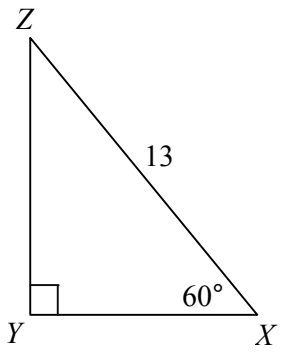
Worthless(0)

W1 Incorrect answer without work unless attempt mark applies

W2 Answer given as $\frac{\mathbf{12}}{\mathbf{9}}$ or $\frac{\mathbf{15}}{\mathbf{9}}$

Part (b) **20 (10,5,5) marks** **Att3,2,2**

In the right-angled triangle XYZ,
$|XZ| = 13$ and $|\angle YXZ| = 60^\circ$.



(i) Using your calculator, write down the value of cos 60°.

(ii) Using the diagram, complete the following

$$\cos 60^\circ = \frac{|XY|}{\square}$$

(iii) Hence calculate $|XY|$

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

$\cos 60^\circ = 0{\cdot}5$ or $\frac{1}{2}$

* Accept correct answer without work
* Accept cos 0.5 for full marks

Blunders (-3)

B1 Finds sin 60° (0.8660) or tan 60° (1.732)

B2 Uses rad or grad mode in calculator (rad = - 0.9524 , grad = 0.5877)

Attempts (3 marks)

A1 Any correct trigonometric ratio

A2 $\cos 60^\circ = \frac{XY}{ZX}$ and stops (for this part)

A3 Gets $\cos |< YZX|$ correctly

A4 Gets $|< YZX| = 30^\circ$ and stops

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

$$\cos 60^\circ = \frac{|XY|}{\square} = \frac{|XY|}{13} \qquad \text{or} \qquad \frac{|XY|}{|ZX|}$$

Blunders (-3)
B1 $\cos 60° = \frac{|XY|}{|ZY|}$ and stops

Attempts (2 marks)
A1 Any correct trigonometric ratio

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

$$\frac{|XY|}{13} = 0 \cdot 5$$
$$|XY| = 0 \cdot 5 \times 13 = 6 \cdot 5$$

***** Accept candidates' answers from previous parts

Blunders (-3)
B1 Correct answer without work
B2 Transposition error
B3 Decimal error
B4 Incorrect mathematical operation with work

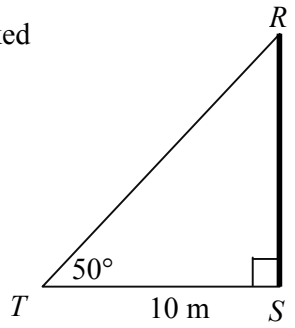
Slips (-1)
S1 Numerical slips to a maximum of -3
S2 Uses Sine Rule to get answer

Attempts (2 marks)
A1 Any correct trigonometric ratio
A2 Uses Pythagoras' Theorem
A3 States Sine Rule

Worthless (0)
W1 Measures $|XY|$ from diagram (3.2 cm)

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

(c) As part of an activity lesson a group of students was asked to measure the height of the mast [RS].
The mast, [RS], is supported by the cable [RT].



The students measured the distance from S to T and they also measured the angle $\angle STR$.
They found $|ST| = 10$ m and $|\angle STR| = 50°$.

(i) Find the height of the mast $|RS|$.
Give your answer correct to the nearest metre

(ii) Using the theorem of Pythagoras, or otherwise, find the length of the supporting cable, $|RT|$.
Give your answer correct to the nearest metre.

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

$$\frac{|RS|}{10} = \tan 50^\circ$$

$$\frac{|RS|}{10} = 1\cdot 1917$$

$$|RS| = 11\cdot 917$$

$$|RS| = 12$$

Blunders (-3)
B1 Correct answer without work
B2 Mathematical error
B3 Decimal error
B4 Incorrect Trigonometric ratio
B5 Transposition error
B6 Uses rad or grad mode in calculator (rad = -2.719 , grad = 10)

Slips (-1)
S1 Numerical slips to a maximum of -3
S2 Fails to round off or rounds off incorrectly
S3 Early rounding off that affects answer

Misreading (-1)
M1 Finds $|RT|$ correctly

Attempts (3 marks)
A1 Any correct trigonometric ratio
A2 tan 50° = 1.1917 and stops
A3 Gets $|< TRS|$ = 40° and stops
A4 States Pythagoras' Theorem
A5 States 180° with/without work

Worthless (0)
W1 Measures $|RS|$ from diagram (3.5 cm.)

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

$$|RT|^2 = (10)^2 + (12)^2$$
$$|RT|^2 = 100 + 144$$
$$|RT|^2 = 244$$
$$|RT| = \sqrt{244}$$
$$|RT| = 15 \cdot 62$$
$$|RT| = 16$$

* Accept candidates' answer from part (i)
* Accept Sine Rule method
* Accept trigonometric ratio method

Blunders (-3)

B1 Correct answer without work
B2 Incorrect theorem of Pythagoras and continues
B3 Mathematical error
B4 Incorrect use of Sine Rule
B5 Calculator in rad or grad mode, if not already penalised in (i)
B6 Stops at $|RT| = \sqrt{\mathbf{244}}$ or $|RT|^2 = 244$

Slips (-1)

S1 Numerical slips up to a maximum of -3
S2 Failure to round off or no rounding off
S3 Early rounding off that affects answer

Attempts (3 marks)

A1 Some correct step with work and stops e.g. 10^2
A2 States theorem of Pythagoras and stops
A3 Any correct trigonometric ratio written down and stops
A4 States Sine Rule

Worthless(0)

W1 Measures $|RT|$ from diagram (4.8 cm.)