Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION

2012

MARKING SCHEMES

MATHEMATICS ORDINARY LEVEL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION

2012

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

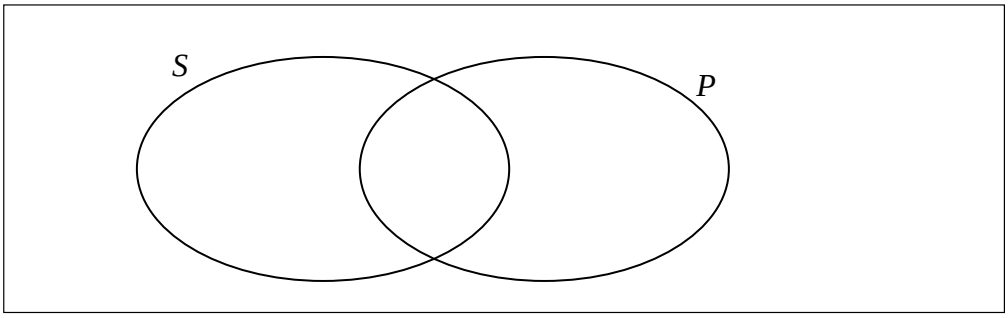
QUESTION 1

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

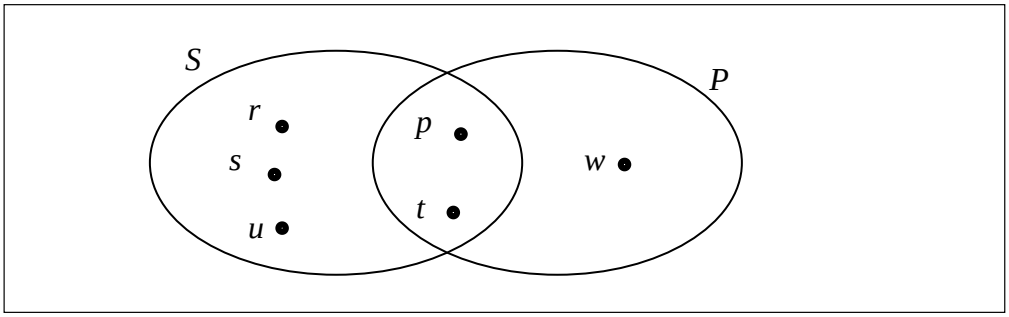
(a) **10 marks** **Att 3**

1. **(a)** $S = \{p, r, s, t, u\}$ $P = \{p, t, w\}$

Fill the elements of *S* and *P* into the following diagram.



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



Slips (-1)
S1 Each element incorrectly filled into diagram
S2 Each element omitted from diagram but see W1
S3 Each unlisted element used but see W1 (some relevant element must be present to use S3)

Misreading (-1)
M1 Interchanging *S* and *P* totally

Attempts (3 marks)
A1 Totally incorrect filling of the Venn diagram using given elements
A2 Correct number of dots in each set without labels

Worthless (0)
W1 No filling in of the Venn diagram or use of unlisted elements only but see S3

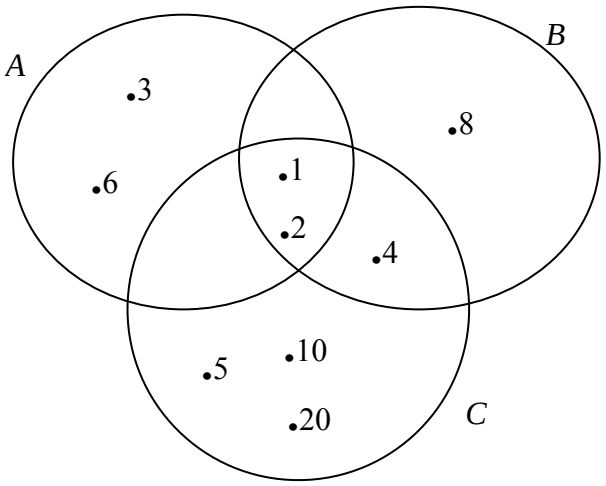
(b) **20 marks (5,5,5,5)** **Att 2,2,2,2**

(b)

$A = \{1, 2, 3, 6\}$ is the set of the divisors of 6.

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

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



List the elements of:

(i) $B \cup C$

(ii) $A \setminus (B \cup C)$

(iii) $B \cap C$

(iv) the common divisors of 6, 8 and 20.

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

$B \cup C = \{1,2,4,5,8,10,20\}$

Blunders (-3)

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

Misreading (-1)

M1 $B \cap C = \{1, 2, 4\}$

Attempts (2 marks)

A1 3or 6 appear in the answer

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

$A \setminus (B \cup C) = \{3,6\}$

Blunders (-3)

B1 Any incorrect set of the elements of A, B and C

Misreading (-1)

M1 $(A \setminus B) \cup C = \{3,5, 6,10 ,20,1,2,4 \}$

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

$B \cap C = \{1, 2, 4\}$

Blunders (-3)

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

Misreading (-1)

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

Attempts (2 marks)

A1 1, 2 or 4 appear in the answer

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

the common divisors of 6, 8 and 20 = { 1, 2 }

Slips (-1)

S1 Each missing or incorrect element to a max of 3

Attempts (2 marks)

A1 Any correct divisors of 6,8 or 20 appears, but see S1

A2 Ans. 120

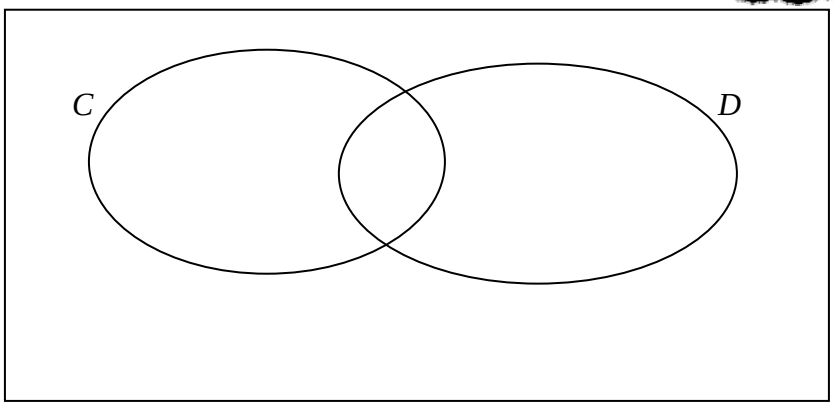
Worthless (0)

W1 Elements listed that are not divisors of 6, 8 or 20

(c) **20 (10,5,5) Marks** **Att 3,2,2**

(c) In a survey, 60 households were asked if they had a cat (C) or a dog (D).
20 said they had a cat.
25 said they had a dog.
12 said they had both a cat and a dog.

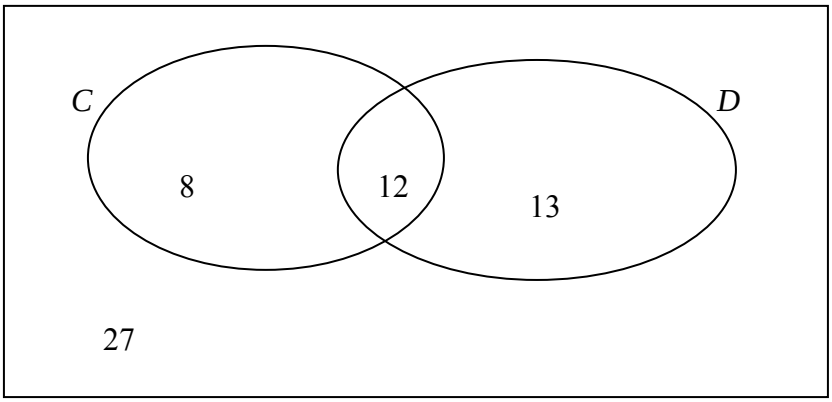
(i) Represent this information in the Venn diagram below.



(ii) How many households had only a cat or a dog?

(iii) What percentage of households had neither a cat nor a dog?

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



Blunders (-3)

B1 Each incorrect or omitted entry (unless consistent error) in Venn diagram subject to S1 below.

Slips (-1)

S1 Numerical errors where work is clearly shown

Misreading (-1)

M1 Interchanges cats and dogs

Attempts (3 marks)

A1 Any one correct/relevant entry

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

$8 + 13 = 21$

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

*Accept candidates work from previous part c (i).

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

S2 Fails to add their correct relevant 2 figures

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

$\frac{27}{60} \times 100 = 45\%$

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

*Accept candidates work from previous parts (c) (i), (c) (ii).

Blunders (-3)

B1 No work shown

B2 Mishandles the percentage

B3 Any incorrect use of the given numbers or numbers from the previous work [Subject to Second *above]

B4 Fails to find the percentage

Misreading (-1)

M1 $\frac{33}{60} \times 100$ or similar and continues

Slips (-1)

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

Attempts (2 marks)

A1 Any one correct/relevant step

A2 100 appears

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

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

(a) 3 packets of soup cost €3·51.
What would be the cost of 5 packets of the same soup?

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

1costs $\frac{3.51}{3}$ = 1.17 Or 3:5 Or 3:5 = 3.51 : x

5 cost 1.17 × 5 =5.85 $\frac{3.51}{3}$ = 1.17 $\frac{3}{5} = \frac{3.51}{x}$

Ans 5.85 1.17 × 5 = 5.85 $3x = 3.51 \times 5 = 17.55$

$x = \frac{17.55}{3} = 5.85$

*Correct answer without work 7marks

*Special Case $\frac{3}{5} \times 3.51 = 2.106$ 7 marks

*Stops at 1.17 or $\frac{3.51}{3}$ 4marks (no use of 5, B(-3) and B4 or B5)

*Stops at 3.51 × 5 (=17.55) 4 marks (no use of 3 and possible slips)

Blunders (-3)

B1 Divisor ≠ 3but see above
B2 incorrect multiplier
B3 5:3 = 3.5 : x and continues
B4 Error in decimal point (apply once)
B5 Fails to finish

Slips (-1)

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

Attempts (3 marks)

A1 Indicates $\frac{5}{3}$ or 3:5 or 3.51: x only and stops
A2 1.17 or 17.55 or $\frac{117}{100}$ or $\frac{1755}{100}$ (only) appear with no work shown
A3 $\frac{1}{3}$ only appears
A4 (3.51×3) or (3.51÷5) and stops
A5 3.51 is multiplied or divided by any wrong number correctly

Worthless (0)

W1 Incorrect answer without work but see A1 and A2
W2 3.51 + 3 = 6.54 or similar, and stops

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

(b) **(i)** By rounding each of these numbers to the nearest whole number, estimate the value of $\dfrac{24 \cdot 231}{15 \cdot 6 - 3 \cdot 78}$.

.

$\dfrac{24 \cdot 231}{15 \cdot 6 - 3 \cdot 78}$ is approximately equal to:

$$\frac{\square}{\square - \square} = \frac{\square}{\square} = \square$$

(ii) Using a calculator, or otherwise, find the exact value of $\dfrac{24 \cdot 231}{15 \cdot 6 - 3 \cdot 78}$.

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

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

$\dfrac{24 \cdot 231}{15 \cdot 6 - 3 \cdot 78}$ is approximately equal to:

$$\frac{24}{16 - 4} = \frac{24}{12} = 2$$

$*\ \dfrac{24}{16-4}$ and stops or $\dfrac{24}{16-4} = \dfrac{24}{12}$ $\Rightarrow$ 7 marks

*No penalty if the intermediate step between approximations and final answer not shown i.e. $\dfrac{24}{12}$ not shown. $\Rightarrow$ 10 marks.

*Special Case: $\dfrac{24 \cdot 231}{15 \cdot 6 - 3 \cdot 78} = 2.05$ in this part $\rightarrow$ 3 marks.

Blunders (-3)

B1 Correct answer without work✍
B2 Error(s) in rounding off to the nearest whole number (once only if consistent)
B3 Decimal error in calculation of approximate value
B4 An arithmetical operation other than indicated.
B5 $\frac{24}{16} - 4 = -2.5$ or $(24 \div 4 - 16) = -10$ (breaking order) or similar and continues

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

Worthless (0)

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

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

$$\frac{24 \cdot 231}{15 \cdot 6 - 3 \cdot 78} = \frac{24 \cdot 231}{11 \cdot 82} = 2 \cdot 05$$

Blunders (-3)

B1 Decimal error or early rounding off
B2 Fails to finish
B3 Treats as $(24.231 \div 15.6) - 3.78 = -2.226730769\ldots$
B4 Treats as: $(24.231 \div 3.78) - 15.6 = -9.18968254\ldots$
B5 Treats as: $24.231 \div (15.6 + 3.78) = 1.250309598\ldots$
B6 Treats as:. $24.231 \div (15.6 \times 3.78) = 0.410917785\ldots$

Slips (-1)

S1 Numerical errors to a max of 3

Attempts (2 marks)

A1 Any correct relevant step and stops.
A2 Any of the following (see above): -2.226730765…, 9.18968254…, 1.250309598…, 0.410917785… or $\frac{24.231}{15.6} = 1.553269231$ or $\frac{24.231}{3.78} = 6.41031746$ (minimum 4 decimal places) **<u>with or without work</u>**

Worthless (0)

W1 Wrong answer without work but see A2

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

$2{\cdot}05 - 2{\cdot}00 = 0{\cdot}05$ or $\frac{41}{20} - 2 = \frac{1}{20}$

*Allow candidate's figures

Blunders (-3)

B1 Fails to finish

B2 Decimal error (once only if consistent)

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

Slips (-1)

S1 Numerical errors to a max of -3

Attempts (2 marks)

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

Worthless (0)

W1 Incorrect answer without work

(c)` **20 (5,5,5,5) marks** **Att 2,2,2,2**

(c) **(i)** ✍ Using a calculator, or otherwise, multiply $450\,000 \times 7{\cdot}8$.

Then express your answer in the form $a \times 10^n$, where $1 \leq a < 10$ and $n \in \mathbb{N}$.

(ii) Write $\frac{a^7}{a^3}$ in the form a^n, where $n \in \mathbb{N}$.

Hence or otherwise evaluate $\frac{11^7}{11^3}$.

(iii) ✍ It takes three workers four days to build a wall.

How long would it take two workers to build the same wall?

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

✍

$450\,000 \times 7{\cdot}8 = 3\,510\,000 = 3{\cdot}51 \times 10^6$

* 3.51 or 3.51×10^6 (without work) → 4 marks

Blunders (-3)

B1 Decimal error

B2 An arithmetic operation other than that indicated e.g. $450000 \div 7.8 = 57692.30789$

Slips (-1)

S1 Numerical errors to a max of -3

S2 Rounds off to 3×10^6

S3 Incorrect format, where $a \leq 1$ *or* $a \geq 10$ and $n \notin Z$

S4 Finds 3 510 000 and stops

Attempts (2 marks)

A1 Any relevant step and stops

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

$$\frac{a^7}{a^3} = a^{7-3} = a^4 \qquad \text{or} \qquad \frac{a\times a\times a\times a\times a\times a\times a}{a\times a\times a} = \frac{a^7}{a^3} = a^4$$

***** $a\times a\times a\times a$ and stops 4marks
***** a^{7-3} and stops 4marks

Blunders (-3)
B1 Each error in calculation involving indices
B2 Each incorrect number of *a*'s in the extended form
B3 Each incorrect elimination of the *a*'s in extended form

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

Attempts (2 marks)
A1 Some correct manipulation of indices
A2 4 only written down

Worthless (0)
W1 Writes *a* only or incorrect answer with no work shown other than A2

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

$$\frac{11^7}{11^3} = 11^4 = 14641$$

*****Accept candidate's answer from above unless it oversimplifies the question

Blunders (-3)
B1 Each error in calculation involving indices
B2 Each incorrect number of 11's in the extended form
B3 Fails to finish
B4 Each incorrect elimination of the 11's in extended form

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

Attempts (2 marks)
A1 Some correct manipulation of indices
A2 $11^2 = 121$ or similar and stops
A3 Candidate transfers their answers from above

Worthless (0)
W1 Incorrect answer with no work shown

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

1 man takes 3×4 days $= 12$days

2 men take $\frac{12}{2} = 6$ days ✍

* Special case: $\frac{4\times2}{3} = \frac{8}{3}$ →2 marks

* Stops at $\frac{4}{2}(=2)$ →2 marks

Blunders (-3)

B1 Incorrect answer without work

B1 Divisor ≠ 2 and continues

B2 Incorrect multiplier (≠3) or fails to multiply, or fails to multiply but see 1st *

Slips (-1)

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

Attempts (2 marks)

A1 Mentions one man or man days

A2 12 or 2 only appear (no work shown)

A3 4×2 or $\frac{4}{3}$ and stops

A4 4 is multiplied or divided by any wrong number, correctly

Worthless(0)

W1 Incorrect answer without work but see A2 above

W2 3 + 4 = 7 or similar

W3 hours only with no mention of 3 or 4 or (96 on its own)

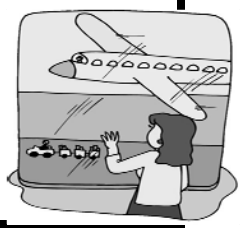
QUESTION 3

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

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

3. **(a)** The cost of a holiday came to €2400.
This was made up of the cost of travel, accommodation and spending money.
$\frac{3}{5}$ of the cost was for travel and accommodation.

How much spending money was there?



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

$\frac{3}{5} \times 2400 = 1440$ $2400 - 1440 =$ **€960**	$\frac{3}{5}$ travel + acc => $\frac{2}{5}$ spend. $\frac{2}{5} \times 2400 =$ **€960**	$\frac{3}{5} = 60\% => \frac{2}{5} = 40\%$ $2400 \times \frac{40}{100} =$ **€960**

* No penalty for omitting € symbol

Blunders (-3)

B1 Correct answer without work

B2 $2400 \div \frac{3}{5}$ (method 1)

B3 $2400 \div \frac{2}{5}$ (method 2)

B4 Calculates the travel and accommodation and stops (method 1)

B5 Operation other than subtraction in final step or omits final step. (method 1)

B6 Finds 60% 0f 2400 and stops (same as B5)

Slips (-1)

S1 Numerical errors (to max -3)

Attempts (3 marks)

A1 Any attempt at getting $\frac{3}{5}$ of 2400 or $\frac{2}{5}$ of 2400

A2 Writes down $\frac{2}{5}$ or 40%

(b) **20 (10,10) Marks** **Att (3,3)**

(b) **(i)** Amanda borrows €1000.
She agrees to pay it back at €90 per month for a year.

How much interest will she pay?

(ii) A computer is ordered online. It is advertised for €550 plus VAT at 23%.
There's a delivery charge of €7·50.

What is the total cost to be paid?

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

Amanda borrows €1000.
She agrees to pay it back at €90 per month for a year.
How much interest will she pay?

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

90×12 = 1080
Int: 1080 – 1000 = €**80**

* No penalty for omitting € symbol

Blunders (-3)
B1 Correct answer without work
B2 90× 12=1080 and stops
B3 90÷ 12 = 7.5 and continues correctly
B4 Multiplies 90 by some whole number other than 12 and continues
B5 Fails to finish
Slips (-1)
S1 Numerical errors (to max -3)

Attempts (3 marks)
A1 Oversimplification
A2 Multiplies 90 by some number other than 12 and stops

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

23 % = $\frac{23}{100}$ VAT = $\frac{23}{100} \times 550$ = 126.50 **Total Cost** = 550 + 126.50 + 7.50 = €684	100% = €550 1% = $\frac{\mathbf{550}}{\mathbf{100}}$ 123% = $\frac{550}{100} \times 123$ = 5.50 × 123 = 676.50 **Total Cost** = €676.50 + 7 .50 = €684	550 × 1.23 = €676.50 **Total Cost** = €676.50 + 7.50 = €684

* No penalty for omitting € symbol

Blunders (-3)

B1 Correct answer without work
B2 Decimal error
B3 Inverts as $\frac{100}{23}$ *or* $\frac{100\cdot}{123}$ and continues (giving answers 2391.30 or 447.51)
B4 Mishandles 23 % eg 550×23 *or* $550 \div 23$ Note: (550 must be used}
B5 550 taken as 123% and finds his 100% and continues
B6 No addition of VAT (as per candidates work) to the bill
B7 No addition of the delivery charge
B8 Subtraction of VAT (as per candidates work) from the bill
B9 No addition of 550

Slips (-1)

S1 Numerical errors to a max of -3

Misreadings (-1)

M1 Reads as 32% or €500

Attempts (3 marks)

A1 $\frac{23}{100}$ and stops or $\frac{\mathbf{550}}{\mathbf{100}}$ and stops
A2 100% = 550 and stops
A3 $100 \times \frac{23}{550}$ and stops or $\frac{\mathbf{550}}{\mathbf{23}}$ and stops
A4 $550 \div 23$ % and stops
A5 €550 + 7.50 and stops

Worthless (0)

W1 Incorrect answer without work
W2 550 + 23 = €573 and stops or continues

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

(i) A work of art is priced at €6600. After VAT is added it costs €7491.

Calculate the amount of VAT and the rate of VAT.

(ii) Ronan was given a bicycle which was in need of repair.
For the repairs, he spent €60 on spare parts and €12 on paint.
When it was repaired he sold it for €95.
Calculate the profit he made as a percentage of his costs.

Give the percentage to the nearest whole number.

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

A work of art is priced at €6600. After VAT is added it costs €7491.
Calculate the amount of VAT and the rate of VAT.

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

7491 – 6600 = 891 = VAT

$\frac{891}{6600} \times 100 = 13.5\%$

* No penalty for omitting € symbol
*7991 – 6600 = 891 = 13.5% → 10 marks
*Stops after €891 → 4 marks ($\frac{891}{6600}$ and stops still only 4 marks)

Blunders (-3)

B1 Correct answer without work.
B2 Decimal error eg 1.35%
B3 Inverts as $\frac{6600}{891}$ and continues (to get 740.74 %)
B4 7461 + , $\times$ *or* $\div$ by 6600 and continues correctly
B5 Mishandles the finding of the rate of vat
B6 $\frac{891}{7491} \times 100$ to get 11.89% = 12%
B7 Rounds off to 14% without showing 13.5%
B8 Fails to finish

Slips (-1)

S1 Numerical errors (apart from decimal errors) max of -3

Attempts (3marks)

A1 Some use of 100
A2 Some attempt at subtraction

(c) (ii) **10 marks** **Att3**

Ronan was given a bicycle which was in need of repair.
For the repairs, he spent €60 on spare parts and €12 on paint.
When it was repaired he sold it for €95.
Calculate the profit he made as a percentage of his costs.
Give the percentage to the nearest whole number.

(c) (ii) **10 marks** **Att3**

60 + 12 = 72 95 – 72 = €23 Profit $\frac{23}{72} \times 100 = 31.944$ = 32 %	60 + 12 = 72 $\frac{95}{72} \times 100 = 131.944\%$ (132% accept) 131.944 – 100 = 31.944 = 32%

* No penalty for omitting € symbol
*Answer €23 → 4 marks

* $\frac{23}{72} \times 100$ and stops → 6 marks

Blunders (-3)
B1 Correct answer without work
B2 Adds €95 to €72 and continues
B3 Calculates profit as percentage of selling price. ie. $\frac{23}{95} \times 100 = 24.21\% = 24\%$
B4 Divisor not equal to 72
B5 Mishandles the calculation of profit as a percentage
B6 Fails to multiply by 100

Slips (-1)
S1 Numerical errors to a max of -3
S2 Fails to round off to the nearest whole number

Attempts (3 marks)
A1 Some indication of subtraction
A2 Some use of 100
A3 60 +12 (= 72)

Worthless (0 marks)
W1 Incorrect answer without work = 0 marks.

QUESTION 4

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

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

(a) If $a = 4$ and $b = 5$, find the value of:

✍ **(i)** $2a + b$

✍ **(ii)** $ab - 3$

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

(i) $2a + b = 2(4) + 5 = 8 + 5 = 13$

*8 +5(only) → **9 marks**

*<u>One substitution</u> coupled with an <u>implied substitution</u> leading to correct answer
e.g. = $2a$ +5 = 13 ⇒ 10 marks.

Blunders (-3)

B1 Correct answer without work ✍
B2 Leaves 2(4) in the answer
B3 Breaks order i.e. 2(4+5) = 18
B4 Treats 2(4) as 6 or 24

Slips (-1)

S1 Numerical errors to a max of 3
S2 Values of a and b interchanged.

Misreadings (-1)

M1 Incorrect numerical substitution for either a or b, but not both, and continues (See W1) or $a + 2b$ calculated out

Attempts (3 marks)

A1 Incomplete substitution and stops e g $2a + 5$

Worthless (0)

W1 Incorrect substitution for both a and b

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

(ii) $ab - 3 = 4 \times 5 - 3 = 20 - 3 = 17$

*20 – 3 (only) → 4 marks

*<u>One substitution</u> coupled with an <u>implied substitution</u> leading to correct answer
e g $4b - 3 = 17$ or $5a - 3 = 17 \Rightarrow$ 5 marks

Blunders (-3)

B1 Correct answer without work ✍

B2 Leaves 4(5) in the answer

B3 Breaks order i.e. 4(5-3) = 8

B4 Treats 4(5) as 9 or 45

Slips (-1)

S1 Numerical errors to a max of -3

Misreadings (-1)

M1 Incorrect numerical substitution for either *a* or *b*, but not both, and continues (See W1)

Attempts (2 marks)

A1 Incomplete substitution and stops e g $4b$ -3

Worthless (0)

W1 Incorrect substitution for both *a* and *b*.

(b) **15 (5,5,5) Marks** **Att 2,2,2**

(b) $f(x) = 2x - 1$.

(i) Draw a graph of $f(x)$ in the domain $-1 \le x \le 1,\ x \in \mathbb{R}$.

(ii) Use your graph to estimate the value of x when $f(x) = 0$.

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

$f(x) = 2x - 1$
$f(-1) = 2(-1) - 1 = -2 - 1 = -3$ (-1,-3)
$f(0) = 2(0) - 1 = 0 - 1 = -1$ (0,-1)
$f(1) = 2(1) - 1 = 2 - 1 = 1$ (1,1)

OR
$f(x) = 2x - 1$
$f(-1) = 2(-1) - 1 =$ **-3** (-1,-3)
$f(0) = 2(0) - 1 =$ **-1** (0,-1)
$f(1) = 2(1) - 1 =$ **1** (1,1)

OR

x		**-1**	**0**	**1**
$+2x$		-2	0	+2
-1		-1	-1	-1
$f(x)$		**-3**	**-1**	**1**

* Error(s) in each row/column calculation attracts a **maximum** deduction of 3marks
* 2 points correct (full marks) _ (need not be in domain)

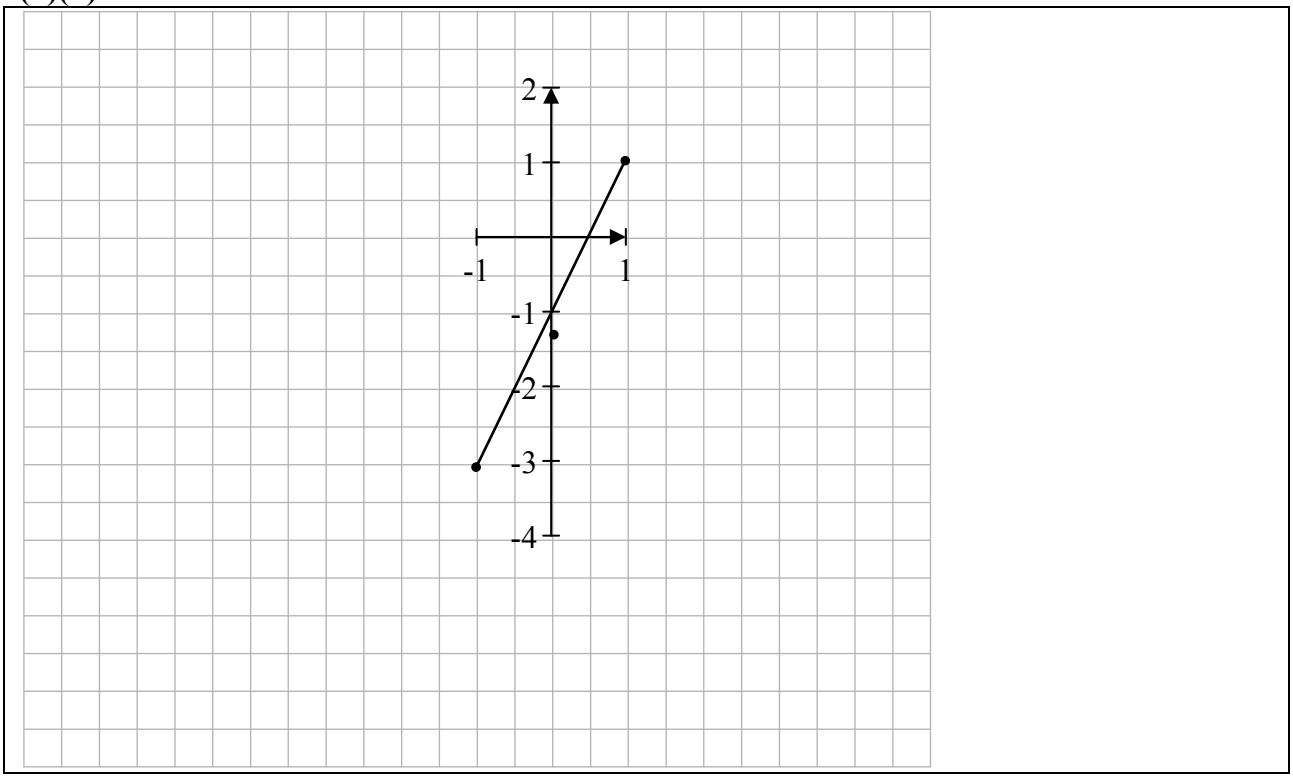
Blunders (-3)
B1 "$+2x$" taken as "2" all the way. [In the row headed "$+2x$" by candidate]
B2 "-1" calculated as "$-x$" all the way. [In the row headed "-1" by candidate]
B3 Adds in top row when evaluating $f(x)$ in Box
B4 Omits "-1" row
B5 Omits "$+2x$" row
B6 Takes $2x$ as $2 + x$ and applies it in his calculations
B7 Each incorrect image without work i.e. calculation through the function method

Slips (-1)
S1 Numerical errors to a max of -3 in any row / column

Misreadings (-1)
M1 Misreads -1 as +1 and places +1 in the table or function.
M2 Misreads "$+2x$" as "$-2x$" and places "$-2x$" in the table or function

Attempts (2 marks)
A1 Any effort at calculating point(s)
A2 Only one point calculated and stops

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



* Answers need not be written in table. .
*Accept candidate's value from (i) but see B1 and S4 (see S2)
*Tolerance ± 0.5 (± 1Box on grid)
*Correct graph but no table **award full marks i.e. (5 + 5)**
*Only **<u>one</u>** correct point **<u>graphed correctly</u>** but no table ⇒ **Att <u>2</u> + Att <u>2</u>**
*Accept reversed co-ordinates if
(i) if axes not labelled or (ii) if axes are reversed to compensate (see B1 below)

Blunders (-3)
B1 Full domain not covered
B2 Scale error (once)
B3 Reversed co-ordinates plotted against non-reversed axes (once only) {See 6th * above}

Slips (-1)
S1 All points not joined or joined in incorrect order
S2 Each incorrectly plotted point
S3 Each point { 2 points needed } from table not graphed [See 2nd * above]
S4 Not a straight line if not already penalised in b(i) or b(ii) but see 2nd *

<u>Attempts (2 marks)</u>
A1 Graduated axes (need not be labelled)
A2 Some effort to plot a point { See 2nd * above}
A3 Random straight line with or without axes
A4 One correct point, with /without work

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

Answer to be written here: $\underline{x = \mathbf{0{\cdot}5}}$ when $f(x) = 0$

* Allow candidate's figures

Blunders (-3)

B1 Fails to finish but draws some relevant line

Slips (-1)

S1 Numerical errors to a max of -3

S2 Correct answer indicated and/or written on graph only

Attempts (2 marks)

A1 Some correct indication on graph

A2 Attempts at algebraic evaluation or calculator

A3 Finds answer -1 i.e. find $x = 0$ (where crosses y-axis)

Worthless (0)

W1 Wrong answer without work

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

(c) **(i)** Conor spent € y on a book.
He then spent € $(4y + 6)$ on a football jersey.
In total, he spent €61.
Write an equation in y to represent this information.

(ii) Solve your equation from **(i)** to find the value of y.

(iii) Solve the equation: $x^2 - 5x - 14 = 0$.

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

$y + 4y + 6 = 61$
$5y + 6 = 61$

Blunders (-3)

B1 Incorrect expression for the cost of a book and football jersey other than misreading below

Slips (-1)

S1 No 61 included in answer

Misreadings (-1)

M1 Answer given as $y + 4y - 6 = 61$ or similar

Attempts (2 marks)

A1 Any effort at forming an expression (y included)

Worthless (0)

W1 Cost of book given as a constant

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

$5y + 6 = 61$
$5y + 6 - 6 = 61 - 6$
$5y = 55$
$y = 11$

* Accept candidates answer from previous work.

Blunders(-3)
B1 Correct answer without work
B2 Error in forming equation
B3 Distribution error
B4 Transposition error
B5 Stops at $5y = 55$ or fails to solve equation
B6 Error in collecting like term

Misreadings (-1)
M1 Transfers information in (i) incorrectly if not oversimplied

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 Any effort at solving their equation
A4 Successful **Trial and Error**

Worthless (0 marks)
W1 Incorrect answer with no work

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

$x^2 - 5x - 14 = 0$
$x^2 - 7x + 2x - 14 = 0$
$x(x - 7) + 2(x - 7) = 0$
$(x + 2)(x - 7) = 0$
$(x + 2) = 0$ or $(x - 7) = 0$

$x = -2$ *or* $x = 7$

$x^2 - 5x - 14 = 0$

x $+2$
x -7

$(x + 2) = 0$ or $(x - 7) = 0$

$x = -2$ or $x = 7$

$$\frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-14)}}{2(1)}$$

$$\frac{5 \pm \sqrt{25 + 56}}{2} = \frac{5 \pm 9}{2}$$

$$\frac{-4}{2} = -2 \quad and \quad \frac{14}{2} = 7$$

* **2** correct solutions by **Trial and Error** **10 MARKS**
* 1 correct solution by Trial and Error 3 MARKS (Attempt)

Blunders (-3) ***Factor Method***

B1 Correct answers without work ✍

B2 Incorrect two term linear factors of x^2-5x -14 formed from correct (but inapplicable) factors of x^2 and/or ±14,e.g. (x+14)(x-1)

B3 No roots given, or two incorrect roots (once only)

B4 Incorrect factors of x^2 and/or ±14

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

B6 $x(x-7) + 2(x-7)$ 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 marks)

W1 $x^2 - 5x = 14$ 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 $\frac{5\pm9}{2}$

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 5

Part (a)	**10 marks**	**Att 3**
Part (b)	**20 (5,5.10) marks**	**Att (2,2,3)**
Part (c)	**20 (10, 10) marks**	**Att (3,3)**

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

(a) Simplify fully $2(x + 1) + 5(2x + 3)$.

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

$2(x + 1) + 5(2x + 3) = 2x + 2 + 10x + 15$
$= 12x + 17$

* Stops after correct removal of brackets 7 Marks
* Gathering of terms at most one blunder

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. $5(5x) = 25x$

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

(i) Factorise $5xy + 3y$.

(ii) Factorise $ax + 2ay + 3x + 6y$.

(iii) Solve for x and y: $2x + 5y = 19$

$3x - y = 3$

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

$5xy + 3y = y(5x + 3)$

Blunders (-3)
B1 Removes factor incorrectly

Attempts (2 marks)
A1 Indication of common factor e g underlines *y*'s and stops

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

$ax + 2ay + 3x + 6y = a(x + 2y) + 3(x + 2y)$ or $x(a+3) + 2y(a + 3)$
$= (a + 3)(x + 2y)$ $= (a+3)(x+ 2y)$

*Accept also (with or without brackets) for 5 marks any of the following
(a+3) and *(x+2y)* [The word **and** is written down.]
(a+3) or *(x+2y)* [The word **or** is written down.]
(a+3), (x+2y) [A comma is used]

Blunders (-3)
B1 Correct answer without work
B2 Stops after first line of correct factorization e.g. $a(x + 2y) + 3(x + 2y)$ or equivalent i,e. $x(a + 3) + 2y(a + 3)$
B3 Error(s) in factorising any pair of terms
B4 Correct first line of factorisation but ends as *(a+3).2xy* or equivalent

Slips (-1)
S1 *(a+3)* $\pm$ *(x+2y)*

Attempts (2 marks)
A1 Pairing off, or indication of common factors and stops
A2 Correctly factorises any pair and stops

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

$2x + 5y = 19$ $3x - y = 3$ X**5**	OR $6x + 15y = 57$ $-6x + 2y = -6$	Or $3x - 3 = y$ $2x + 5(3x - 3) = 19$
$2x + 5y = 19$ $\underline{15x - 5y = 15}$ $17x = 34$	$17y = 51$ $y = 3$	$2x + 15x - 15 = 19$ $17x = 19 + 15$
$x = 2$	$2x + 15 = 19$	$17x = 34$
$2(2) + 5y = 19$ $4 + 5y = 19$	$2x = 4$ $x = 2$	$x = 2$
$5y = 15$ $\boldsymbol{y = 3}$		$4 + 5y = 19$ **$y = 3$**

*Apply only **one** blunder deduction (B2 or B3) to any error(s) in establishing the first equation; in terms of x only or the first equation in terms of y only
*Finding the second variable is subject to a maximum deduction of -3

Blunders (-3)
B1 Correct answers without work **(stated or substituted)**
B2 Error or errors in establishing the first equation in terms of x only ($17x = 34$) or the first equation in terms of y only ($17y = 51$) through elimination by cancellation **(but see S1)**
B3 Error or errors in establishing the first equation in terms of x only ($17x = 34$) or the first equation in terms of y only ($17y = 51$) 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 his correct 2nd variable
A4 One correct answer without work (stated and substituted)

Worthless (0 marks)
W1 Incorrect values for x or y substituted into the equations

(c) **20 Marks (10,10)** **Att 3,3**

(i) Write as a single fraction

$$\frac{x}{2}+\frac{3x}{8}.$$

(ii) Solve the equation $3(2x-7)-5(x-1)=0.$

Verify your answer.

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

$$\frac{x}{2}+\frac{3x}{8}=\frac{4x}{8}+\frac{3x}{8}=\frac{7x}{8}$$

* $\frac{\mathbf{4x+3x}}{\mathbf{8}}$ or $\frac{\mathbf{8x+6x}}{\mathbf{16}}$ or $\frac{\mathbf{12x+9x}}{\mathbf{24}}$ etc **→ 7 marks**

* $\frac{4x}{8}+\frac{3x}{8}$ and stops **→4 Marks**

* $\frac{x}{2}+\frac{3x}{8} = \frac{4x}{10}$ **→0 Marks**

Blunders (-3)

B1 Correct answer without work

B2 Incorrect common denominator and continues

B3 Incorrect numerator from candidate's denominator $\frac{8(x)+2(3x)}{8}$

B4 Omitted or incorrect denominator

Slips (-1)

S1 Numerical errors to a max of -3

Attempts (3 marks)

A1 Any correct step.

A2 Any correct common denominator found

Worthless (0 marks)

W1 $(\frac{x}{2})(\frac{3x}{8})$ and stops

W2 Incorrect answer, with no work

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

Solve ✍

$3(2x - 7) - 5(x - 1) = 0$
$6x - 21 - 5x + 5 = 0$
$x - 16 = 0$
$x = 16$

Verify
$3(2x - 7) - 5(x - 1)$
$3(2(16) - 7) - 5(16 - 1$
$3(32 - 7) - 5(15)$
$3(25) - 75 = 0$

*Stops after correct removal of brackets 4 Marks
*If changes -5 to +5 at the start: blunder (-3)
*States x=16 (no work) and verifies correctly 7 Marks
*States x=16 (no work) with no verification 4 Marks
*Verifies correctly x=16 (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

Slips (-1)
S1 Numerical errors to a max of -3
S2 Incorrect or no conclusion from their work

Misreadings (-1)
M1 $3(2x+7)$ or similar and continues but see 2nd* 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. $3(14x) = 42x$
W2 Invented answer verified but see * above
W3 Incorrect answer with no work

QUESTION 6

Part (a)	**10(5,5) marks**	**Att 2,2**
Part (b)	**30 (15,15) marks**	**Att (5,5)**
Part (c)	**10 (5,5) marks**	**Att (2,2)**

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

6. **(a)** $P = \{(1, a), (2, a), (3, b), (4, c)\}$.
Write out the domain and range of P.

Domain =

Range =

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

Domain = {1, 2, 3,4}

Slips (-1)
S1 Each incorrect element omitted / included other than the misreading below.

Misreadings (-1)
M1 Correct range $\{a,b,c\}$ or $\{a,a,b,c\}$ given.

Worthless (0)
W1 No element of the domain appears.

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

Range = $\{a,b,c\}$

*Accept $\{a,a,b,c\}$ for full marks.

Slips (-1)
S1 Each incorrect element omitted / included other then the misreading below

Misreadings (-1)
M1 Correct domain {1, 2, 3, 4} given

Worthless (0)
W1 No element of the range appears.

Part (b) **30(15, 15) marks** **Att (5, 5)**

Draw the graph of the function

$$f : x \to 5 + 2x - x^2$$

in the domain $-2 \le x \le 4$, where $x \in R$.

Table **15marks** **Att 5**

$f(x) = 5 + 2x - x^2$

$f(-2) = 5 + 2(-2) - (-2)^2 = 5 - 4 - 4 = -3 \Rightarrow (-2,-3)$
$f(-1) = 5 + 2(-1) - (-1)^2 = 5 - 2 - 1 = 2 \Rightarrow (-1,2)$
$f(0) = 5 + 2(0) - (0)^2 = 5 + 0 - 0 = 5 \Rightarrow (0, 5)$
$f(1) = 5 + 2(1) - (1)^2 = 5 + 2 - 1 = 6 \Rightarrow (1 , 6)$
$f(2) = 5 + 2(2) - (2)^2 = 5 + 4 - 4 = 5 \Rightarrow (2 , 5)$
$f(3) = 5 + 2(3) - (3)^2 = 5 + 6 - 9 = 2 \Rightarrow (3 , 2)$
$f(4) = 5 + 2(4) - (4)^2 = 5 + 8 - 16 = -3 \Rightarrow (4 , -3).$

OR

A

$f(-2)$	=	5	$+2(-2)$	$-(-2)^2$	=	**-3**
$f(-1)$	=	5	$+2(-1)$	$-(-1)^2$	=	**2**
$f(0)$	=	5	$+2(0)$	$-(0)^2$	=	**5**
$f(1)$	=	5	$+2(1)$	$-(1)^2$	=	**6**
$f(2)$	=	5	$+2(2)$	$-(2)^2$	=	**5**
$f(3)$	=	5	$+2(3)$	$-(3)^2$	=	**2**
$f(4)$	=	5	$+2(4)$	$-(4)^2$	=	**-3**

B

x	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**
5	5	5	5	5	5	5	5
$+2x$	-4	-2	0	+2	+4	+6	+8
$-x^2$	-4	-1	0	-1	-4	-9	-16
$f(x)$	**-3**	**2**	**5**	**6**	**5**	**2**	**-3**

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

Blunders (-3)

B1 Correct answer, without work i.e. 7 correct couples only and no graph
B2 "$+2x$" taken as "2" all the way. [In the row headed "$+2x$" by candidate]
B3 "5" calculated as "$5x$" all the way. [In the row headed "5" by candidate]
B4 Adds in top row when evaluating $f(x)$ in ***B.***
B5 Omits "5" row
B6 Omits "$+2x$" row
B7 Omits a value in the domain (each time).
B8 Each incorrect image without work i.e. calculation through the function method (***A***)
B9 Misreads "$-x^2$" as "$+x^2$" and places "$+x^2$" in the table or function.

Slips (-1)

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

Misreadings (-1)

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

M2 Misreads "5" as "-5" and places "-5" in the table or function.

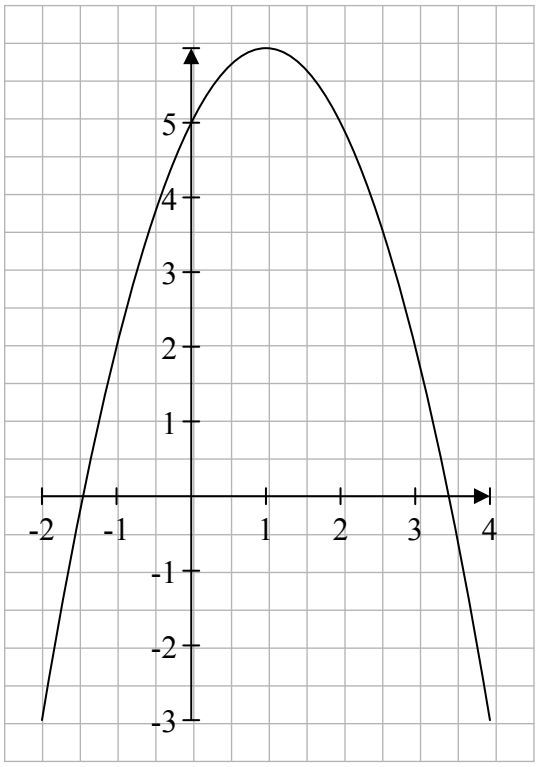
Attempts (5 marks)

A1 Omits "$-x^2$" row from table or treats "$-x^2$" as $\pm x$ or $\pm 2x$.

A2 Any effort at calculating point(s).

A3 Only one point calculated and stops.

Graph **15 marks** **Att 5**



* Only **<u>one</u>** correct point **<u>graphed correctly</u>** $\Rightarrow$ Att <u>5</u> + Att <u>5</u>

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

* Accept reversed co-ordinates if
(i) if axes not labelled or (ii) if axes are reversed to compensate (see B1 below)

Blunders (-3)

B1 Reversed co-ordinates plotted against non-reversed axes (once only) {See 3rd * 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 (7 points needed) from table not graphed [See 2nd * above]

Attempts (5 marks)

A1 Graduated axes (need not be labelled)

A2 Some effort to plot a point { See 1st * above}

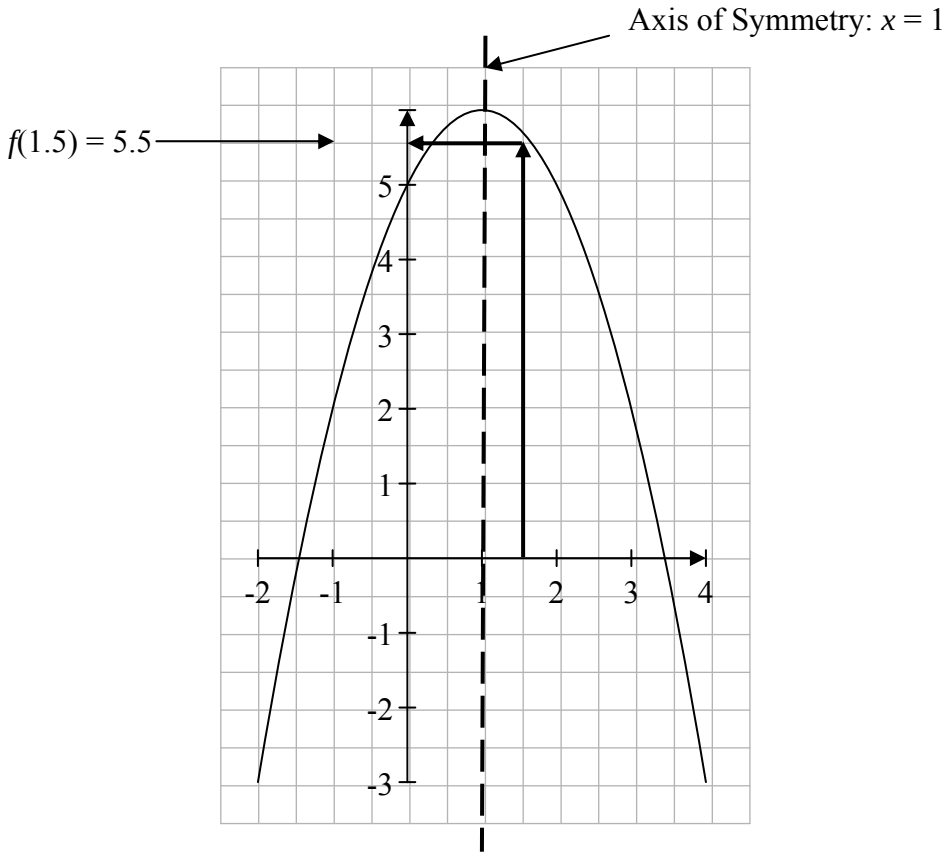
Part (c) **10 (5, 5) marks** **Att 2, 2**

(c) **(i)** Draw the axis of symmetry of the graph you have drawn in **6(b)**.

(ii) Use your graph to estimate the value of $5 + 2x - x^2$ when $x = 1 \cdot 5$.

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

(c) **(i)** Draw the axis of symmetry of the graph you have drawn in **6(b)**.



* Accept any vertical line (parallel to candidate's *y*-axis) within tolerance of ± 0.25.

Blunders (-3)

B1 Any vertical line (parallel to the candidate's *y*-axis) outside of the tolerance.

B2 Marks $x = 1$ on the *x*-axis and stops.

B3 States $x = 1$ but no line is indicated on the graph.

Attempts (2 marks)

A1 Any attempt at axial symmetry of $f(x)$.

A2 *y*-axis indicated as the axis of symmetry (See B1).

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

(c) **(ii)** Use your graph to estimate the value of $5 + 2x - x^2$ when $x = 1.5$

Work to be shown on the graph and answer to be written here.

5.75

*Correct answer (clearly consistent with candidate's graph) inside the tolerance without graphical indication $\Rightarrow$ 2 marks.

Blunders (-3)

B1 Correct answer without work
B2 Answer on the diagram but outside of tolerance (± 0.25)
B3 Fails to write down the answer, when indicated correctly on graph

Slips (-1)

S1 Correct answer indicated and/or written on graph only

Attempts (2 marks)

A1 Attempts at algebraic evaluation or calculator
A2 Marks 1.5 in any way on either axis and stops

Worthless (0)

W1 Answer outside of tolerance without graphical indication.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION

2012

MARKING SCHEME

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.

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

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

1. **(a)** Add 250 grams to 950 grams and give your answer in kilograms.

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

250 + 950 = 1200g = 1·2 kg

Blunders (-3)

B1 Correct answer without work ✍
B2 Incorrect conversion or no conversion
B3 Incorrect mathematical operation and continues correctly e.g. multiplies instead of adds
B4 Decimal error

Slips (-1)

S1 Numerical slips to a maximum of -3
S2 1200 g = 1kg 200g

Attempts (3 marks)

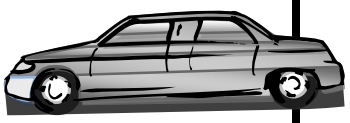
A1 Some correct relevant step with work
A2 Converts one or both to kilograms and stops e.g. 0.25 kg
A3 States 1,000 g. = 1 kg and stops
A4 Some correct effort at conversion and stops e.g. $\frac{250}{1000}$
A5 1200 without work and stops
A6 250 + 950 and stops

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies

(b) **20(10 ,5 ,5) Marks** **Att(3,2,2)**

(i) Áine started a car journey in Dublin at 10:20 and arrived in Rosslare at 12:50.
How long did it take Áine to reach Rosslare?
Give your answer in hours and minutes.



(ii) The distance from Dublin to Rosslare is 150 km.
What was her average speed for the journey? Give your answer in km/h.

(iii) On the return journey from Rosslare to Dublin Áine's average speed was 75 km/h.
How long did the return journey take?

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

12:50 – 10:20 2 hours 30 minutes or 2: 30

* Do not penalise the same error twice in part (b)
* Accept correct answer without work

Blunders (-3)
B1 Incorrect mathematical operation with work and continues
B2 Incorrect conversion

Slips (-1)
S1 Numerical slips to a maximum of -3
S2 Gives answer as 150 minutes or as 2.5 hours

Attempts (3 marks)
A1 Any correct relevant step
A2 Subtracts hours or minutes only
A3 2.3 without work

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

2 hours 30 minutes = 2·5 hours

Speed = Distance /Time

$$\text{Speed} = \frac{150}{2 \cdot 5} = 60\,\text{km/h}$$

* Accept candidates' answer from part (b)(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 2 hours 30 minutes as 2.3 hours
B5 Leaves answer as $\frac{150}{2.5}$

Slips (-1)

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

Attempts (2 marks)

A1 Any correct relevant step
A2 Correct formula and stops
A3 2 hours 30 minutes = 2.5 hours or 1 hour = 60 minutes and stops

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

Time = Distance /Speed

$$\text{Time} = \frac{150}{75} = 2 \text{ hours}$$

* Formula need not be written down
* Accept ratio method

Blunders (-3)

B1 Correct answer without work ✍
B2 Incorrect relevant formula
B3 $\frac{150}{75}$ and stops
B4 Decimal error

Slips (-1)

S1 Numerical slips to a maximum of -3

Attempts (2 marks)

A1 Any correct relevant step
A2 150 + 75 or 150 – 75 or 150 × 75 and stops or continues
A3 Correct formula and stops

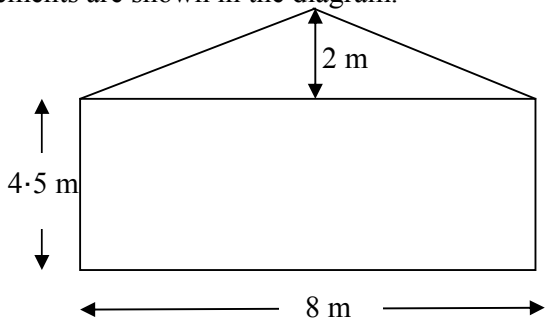
Worthless (0)

W1 Incorrect answer without work

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

(c) The end wall of a house consists of a lower rectangular section and a top triangular section.

The measurements are shown in the diagram.



(i) Find, in m^2, the area of the lower rectangular section.

(ii) Find, in m^2, the area of the top triangular section.

(iii) Dara intends to paint the wall.
He finds out that 5 litres of paint will cover 32 m^2.
How many litres of paint will he need to cover the wall with two coats of paint?

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

Area $= lb$
$= 8 \times 4{\cdot}5 = 36\ m^2$

Blunders (-3)
B1 Correct answer without work ✍
B2 Incorrect mathematical operation with work and continues successfully
B3 Incorrect formula
B4 Decimal error
B5 Incorrect substitution

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

Misreadings (-1)
M1 Gets area of top triangular section (if not attempted in part (ii))

Attempts (2 marks)
A1 4.5 + 8 or 4.5 – 8 or 4.5 ÷ 8 or 8 – 4.5 and stops
A2 Some work with 4.5 and / or 8
A3 Gets perimeter of rectangle
A4 Correct relevant formula and stops
A5 Any correct step

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

Area = $\frac{1}{2}bh = \frac{1}{2}(8)(2) = 8\,\text{m}^2$

Blunders (-3)
B1 Correct answer without work ✍
B2 Incorrect substitution and continues correctly e.g. $\mathbf{\frac{1}{2}} \times 4.5 \times 8 = 18$
B3 Incorrect relevant formula and continues e.g. $2 \times 8 = 16$
B4 Mathematical error

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

Misreadings (-1)
M1 Gets area of bottom rectangular section (if not attempted in part (i))

Attempts (2 marks)
A1 Any correct relevant step
A2 2 + 8 or 2 – 8 or 2 ÷ 8 or 8 – 2 and stops
A3 Some work with 2 and/or 8
A4 Gets perimeter of triangle
A5 Correct relevant formula and stops
A6 States base = 8 or perpendicular height = 2 and stops

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

Total area = 36 + 8 = 44 m^2

Litres paint required **for 2 coats** = $\frac{44}{32} \times 2 \times 5 = 13 \cdot 75$

* Candidates may offer other correct versions

* Accept candidates' answers in previous parts

Blunders (-3)

B1 Correct answer without work ✍

B2 Only gets litres of paint required for one coat (6.875)

B3 $\frac{44}{32} \times 2 \times 5$ or $\frac{88}{32} \times 5$ and stops

B4 Incorrect mathematical operation but continues successfully

B5 Does not multiply by 5

B6 Does not divide by 32

B7 Gets volumes of paint needed for both components but does not add them together

Slips (-1)

S1 Numerical slips up to a maximum of -3

Attempts (3marks)

A1 Any correct relevant step

A2 36 + 8 (= 44) and stops

A3 States area of wall is area of triangle + area of rectangle and stops

A4 Gets volume of paint needed for one component and stops

Worthless (0)

W1 Incorrect answer without work

QUESTION 2

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

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

2. **(a)** The length of the side of a square tile is 15 cm.

✍ Find, in cm^2, the area of 6 of these tiles.

15 cm

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

Area square = l^2

Area six squares = $6 \times l^2$

$= 6 \times (15)^2$

$= 6 \times 225$

$= 1350 \text{ cm}^2$

Blunders (-3)

B1 Correct answer without work ✍

B2 Finds the area of one tile only

B3 Incorrect relevant formula

B4 Incorrect mathematical operation with work and continues successfully

Slips (-1)

S1 Numerical slips to a maximum of -3

Attempts (3marks)

A1 Any correct relevant step

A2 Area = l^2 or similar and stops

A3 Gets perimeter of one tile

A4 Attempt of multiplication by 6

A5 6×15 (= 90) and stops

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies

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

(b) A trundle wheel has a diameter of 20 cm.

(i) Find, in cm, the radius of the wheel.

(ii) Taking π as 3·142 calculate, in cm, the circumference of the trundle wheel.

(iii) Máire used the trundle wheel to measure the length of a school corridor.
The trundle wheel made 24 complete turns.
What was the length of the corridor?
Give your answer in metres, correct to the nearest metre.

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

Radius (r) = 20 /2 = 10 cm

* Accept correct answer without work

Blunders (-3)

B1 Multiplies by 2 instead of dividing by 2

Attempts (2 marks)

A1 States radius = ½ (diameter) and stops

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

Circumference (l) = $2\pi r = 2 \times 3{\cdot}142 \times 10 = 62{\cdot}84$ cm

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

Blunders (-3)

B1 Correct answer without work ✍
B2 Mathematical error
B3 Incorrect relevant formula and continues e.g. πr^2 or πr
B4 Incorrect mathematical operation and continues successfully
B5 Decimal error
B6 $\pi \neq 3.142$ or answer in terms of π

Slips (-1)

S1 Numerical slips to a maximum of -3

Attempts (2 marks)

A1 Any correct relevant step
A2 Correct formula and stops
A3 Product of two relevant numbers and stops

Worthless (0 marks)

W1 Incorrect answer without work unless attempt mark applies

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

Corridor = $24 \times 62{\cdot}84$ cm = $1508{\cdot}16$ cm
= $15{\cdot}0816$ m
= 15 m

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

Blunders (-3)

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

Slips (-1)

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

Attempts (3 marks)

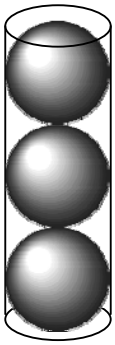
A1 Any correct relevant step
A2 Writes 24×62.84 and stops
A3 Converts 62.84 to metres and stops
A4 Writes 100 cm. = 1 m and stops

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

(c) A sphere has a radius of 2·4 cm.

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

(ii) Three of these spheres fit exactly into a cylindrical container.



Find, in cm^3, the volume of the container.
Take π as 3·142.
Give your answer correct to one decimal place.

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

$$\text{Volume} = \frac{4}{3}\pi r^3$$
$$= -(3.142)(2.4)^3$$
$$= -(3.142)(13.824)$$
$$= 57{\cdot}913 \text{ cm}^3$$
$$\text{Volume} = 58 \text{ cm}^3$$

Blunders (-3)

B1 Correct answer without work ✍
B2 Incorrect relevant sphere formula, e.g. $4\pi r^2$ or πr^3 and continues
B3 Incorrect substitution, e.g. $r \neq 2.4$
B4 Mathematical error, e.g. $(2.4)^3 = 7.2$
B5 $\pi \neq 3.142$ 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 Any correct relevant step
A2 Gives volume as $\frac{4}{3}\pi r^3$ and stops
A3 π dropped in calculations
A4 Product of two relevant numbers ($\frac{4}{3}$, 3.142 or 2.4) and stops
A5 Some correct substitution into incorrect relevant sphere formula i.e. $4\pi r^2$ or $\frac{2}{3}\pi r^3$

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

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

Cylinder $r = 2{\cdot}4$
$h = 2{\cdot}4 \times 6 = 14{\cdot}4$ cm

Volume $= \pi r^2 h$
$= 3{\cdot}142 \times (2{\cdot}4)^2 \times 14{\cdot}4$
$= 3.142 \times 5.76 \times 14.4$
$= 260{\cdot}61$
$= 260{\cdot}6$

* Accept candidates' value of r from part (c)(i)
* If candidates' value of π penalised in part (c)(i), do not penalise the same value of π here

Blunders (-3)
B1 Correct answer without work ✍
B2 $\pi \neq 3.142$ (see second asterisk above)
B3 $r \neq 2.4$ (see first asterisk above)
B4 $h \neq 14.4$
B5 Incorrect relevant cylinder formula, e.g. $2\pi rh$, and continues
B6 Mathematical error, e.g. $(2.4)^2 = 4.8$, and continues

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

Attempts (3marks)
A1 Any correct relevant step
A2 Gives volume as $\pi r^2 h$ and stops
A3 π dropped in calculations
A4 Product of two relevant numbers (3.142 , 2.4 or 14.4) and stops
A5 Some correct substitution into incorrect relevant formula i.e. $2\pi rh$
A6 $h = 2.4 \times 6$ ($= 14.4$) and stops

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

QUESTION 3

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

(a) 10 marks Att 3

3. (a) Find the mode of the following numbers:

2, 3, 5, 7, 3, 7, 2, 9, 7.

(a) 10 marks Att 3

Mode = 7

* Accept correct answer without work

Blunders (-3)

B1 Gives 3 as the mode with explanation e.g. because 7 occurs three times

B2 Finds mean (5) or median (5) of given numbers with work

Slips (-1)

S1 Numerical slips up to a maximum of -3

Attempts (3marks)

A1 Any correct step

A2 Writes " mode means most " or similar and stops

A3 Writes 2 + 3 + 5 + 7 + 3 + 7 + 2 + 9 + 7 whether added or not

A4 Writes 3 or 9 and stops

A5 Rearranges the numbers in order and stops

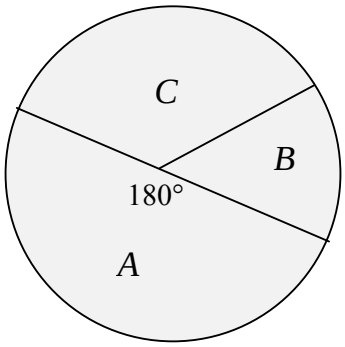
Worthless (0)

W1 Incorrect answer without work unless attempt mark applies

W2 Copies order of numbers in question

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

(b) A group of teenagers was asked which of *A*, *B*, or *C* was their favourite sport.
The results are shown in the pie chart below.



(i) 24 of the teenagers said *A* was their favourite.
How many were in the group?

(ii) 18 gave *C* as their favourite.
What is the measure of the angle in the sector *C*?

(iii) What percentage of the total gave *B* as their favourite?

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

$A = 180^o = 24$ students or Total $= 360^o = 2 \times 180^o$
$= \text{Half}$
Total $= 24 \times 2 = 48$

Blunders (-3)
B1 Correct answer without work ✍
B2 Angle representing *A* not 180°
B3 Angle in circle not 360°
B4 Divides by 2 instead of multiplying
B5 Incorrect mathematical operation and continues successfully

Attempts (3 marks)

A1 Any correct relevant step

A2 States angles *A* , *B* and *C* add up to 360 °

A3 States the angle representing *A* is a half circle and stops

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

C= $\frac{18}{48} \times 360^\circ = 135^\circ$

* Accept candidates' answer from part (b)(i) * Accept ratio method

Blunders (-3)

B1 Correct answer without work ✍

B2 Inverts fraction

B3 Incorrect numerator in fraction

B4 Incorrect denominator in fraction

B5 Angle in circle ≠ 360˚

Slips(-1)

S1 Numerical slips up to a maximum of -3

Attempts (2 marks)

A1 Any correct relevant step

A2 $\frac{\mathbf{18}}{\mathbf{48}}$ and stops

A3 Any relevant statement

Worthless (0)

W1 130˚ without work

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

B Angle = 360 –(180 +135) = 45°

or

Students in *B* = 48 –(24+18) = 6

%*B* $\frac{45}{360} \times 100 = 12 \cdot 5\%$ or $\frac{6}{48} \times 100 = 12 \cdot 5\%$

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

Blunders (-3)

B1 Correct answer without work ✍

B2 Leaves answers in fraction form

B3 Decimal error

B4 Adds instead of subtracts in both methods

B5 Angle in circle ≠ 360°

B6 Does not form fraction

Slips (-1)

S1 Numerical slips up to a maximum of -3

Attempts (2 marks)

A1 Any correct relevant step

A2 360 – (180 + 135) and stops or 48 – (24 + 18) and stops

A3 180 + 135 and stops or 24 + 18 and stops

A4 Any relevant statement

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

The number of newspapers sold in a shop from Monday to Saturday of one week is given in the table below:

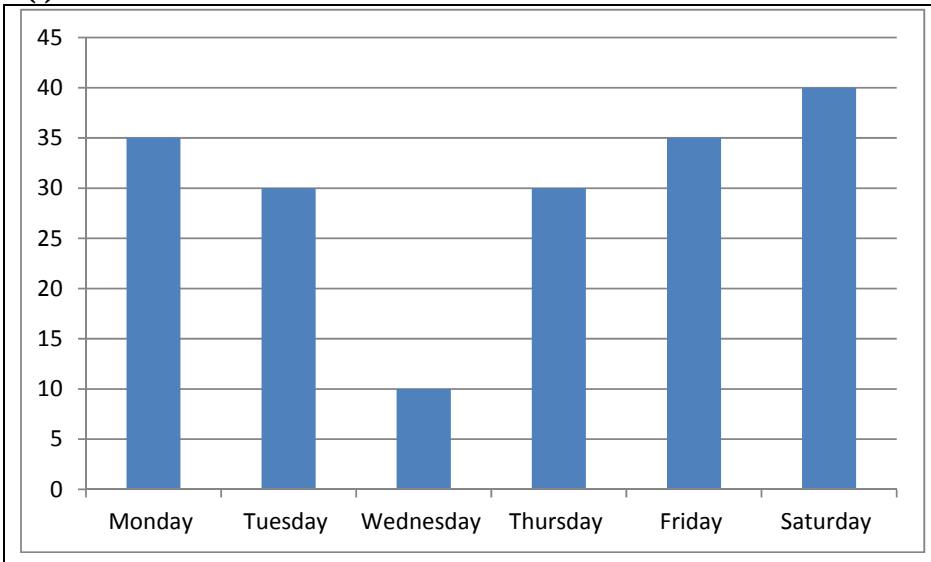
Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Number of papers	35	30	10	30	35	40

(i) Draw a bar chart of the data. Put the days on the horizontal axis.

(ii) Find the mean number of newspapers sold per day.

(iii) The following week the mean was 38.
How many extra papers were sold that week?

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



* Accept correct graph with no labels
* Accept bars of unequal widths or bars joined as a histogram
* Accept lines as bars

Blunders (-3)
B1 Puts the days on the vertical axis
B2 Axis with number of papers not graduated uniformly
B3 Draws a trend graph or pie chart

Slips (-1)
S1 Each incorrect bar or bar omitted

Attempts (3 marks)
A1 Graduated axis or axes only

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

Mean = $\frac{35+30+10+30+35+40}{6} = \frac{180}{6} = 30$

Blunders (-3)
B1 Correct answer without work ✍
B2 Denominator not 6
B3 Inverted fraction
B4 Incorrect mathematical operation in numerator
B5 $\frac{180}{6}$ and stops
B6 Mathematical error

Slips (-1)
S1 Numerical slips to a maximum of -3
S2 Each value omitted in numerator up to a maximum of- 3

Attempts (2 marks)
A1 Some correct step with work and stops, e.g. 35 + 30 + 10 + 30 + 35 + 40 and stops
A2 Mean = $\frac{\Sigma fx}{\Sigma f}$ and stops
A3 A relevant addition and stops
A4 6 and stops

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

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

Number sold in 2nd week was 38×6 = 228
Extra that week = 228 – 180 = 48

or Extra per day = 38 - 30 =8
Extra for week = 8 ×6 = 48

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

Blunders (-3)
B1 Correct answer without work ✍
B2 228 – 180 and stops or 38-30 = 8 and stops
B3 Incorrect mathematical operation
B4 Number of days not 6

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

Attempts (2marks)
A1 Any correct relevant step
A2 38 × 6 and stops or 38 – 30 and stops

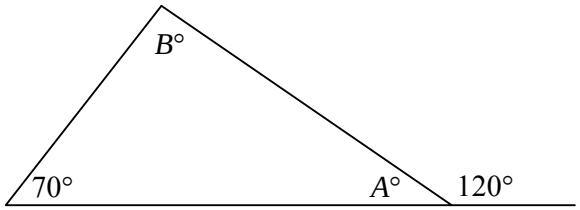
Worthless (0)
W1 Incorrect answer without work unless attempt mark applies

QUESTION 4

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

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

4. **(a)**



Find the values of the angles *A* and *B* in the diagram above.

A = *B* =

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

A = 180º-120º= 60º

B= 120º- 70º = 50º
or *B*= 180º - (*A* + 70º) = 180º - (60º + 70º) = 180º - 130º= 50º

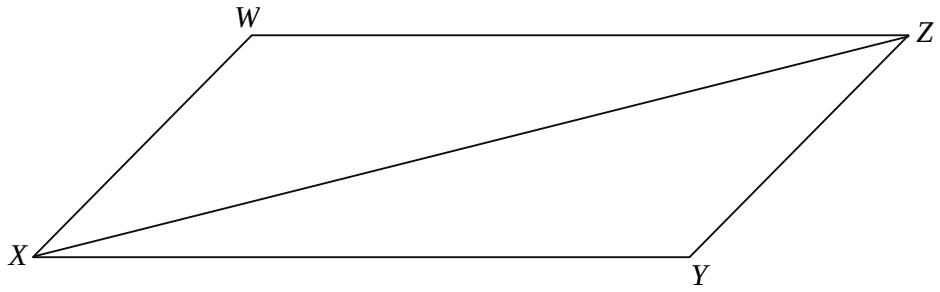
* Accept correct answer without work for full marks for A and B
* Accept candidates' value of *A* in finding *B*
* Accept candidates' value of *B* in determining *A*
* Candidate may give answers in the diagram. Allow for full marks if correct

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

Attempts (2 marks)
A1 States straight line angle = 180˚ and stops (for *A*)
A2 A + 120˚ = 180˚ and stops (for *A*)
A3 States exterior angle is equal to the two interior opposite angles (for *B*)
A4 B + 70˚ + 60˚ = 180˚ and stops (for *B*)
A5 A + B + 70˚ = 180˚ (allow once for an attempt if no other attempt mark secured)

Worthless (0)
W1 Incorrect answer(s) without work

(b) **(i)** *XYZW* is a parallelogram.



Using the properties of a parallelogram:

Name another line segment equal in measure to [*XW*]

Answer:

Name another line segment equal in measure to [*WZ*]

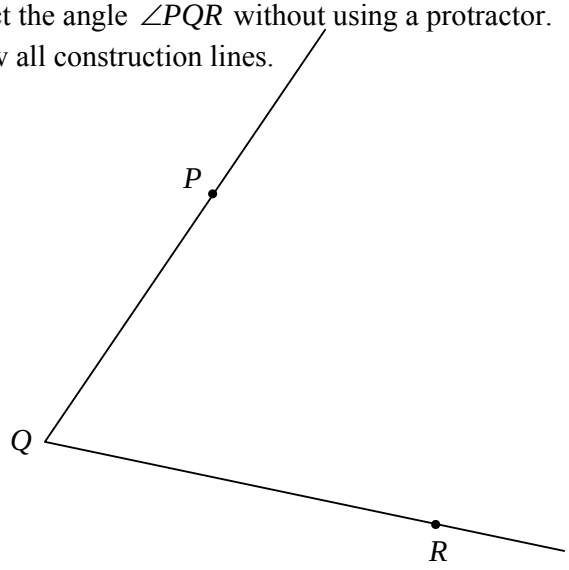
Answer:

Name another angle equal in measure to $\angle XWZ$

Answer:

(ii) The area of the triangle *XWZ* is 52 cm^2.
What is the area of the parallelogram *XYZW*?

(iii) Bisect the angle $\angle PQR$ without using a protractor.
Show all construction lines.



(b)(i) **15 (5,5,5) marks** **Att (2,2,2)**

Name another line segment equal in measure to [*XW*]

Answer: *YZ*

Name another line segment equal in measure to [*WZ*]

Answer: *XY*

Name another angle equal in measure to $\angle XWZ$

Answer: $\angle XYZ$

*Check diagram for work
*Accept correct answer without work

Blunders(-3)
B1 Gives answer as < XZY or < YXZ (for third part)

Slips(-1)
S1 Indicates answer in diagram

Attempts(2 marks)
A1 States opposite sides of a parallelogram are equal in length
A2 States opposite angles in a parallelogram are equal in measure (for third part)

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

Area *XYZW* = $52 \times 2 = 104$ cm^2

* Accept correct answer without work

Blunders(-3)
B1 Incorrect relevant formula and continues e.g. 2 × base × perpendicular height
B2 Mathematical error

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

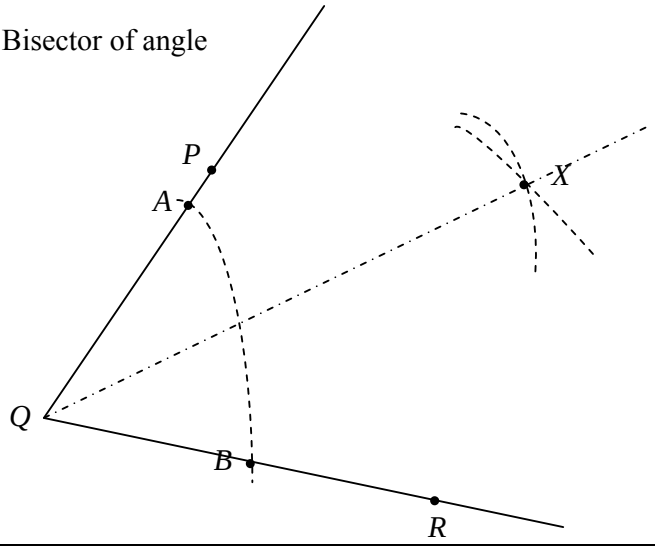
Attempts (2 marks)
A1 Gives correct formula and stops
A2 Some correct substitution into incorrect relevant formula and stops
A3 States area of parallelogram is twice area of triangle and stops

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

Step 1 Draw arc centre at Q cutting QP at A and cutting QR at B

Step 2 Draw arc centre at A – Draw arc centre at B Let X be point of intersection

Step 3 Join QX Bisector of angle



Blunders (-3)

B1 Bisector not drawn

B2 Each construction arc not shown

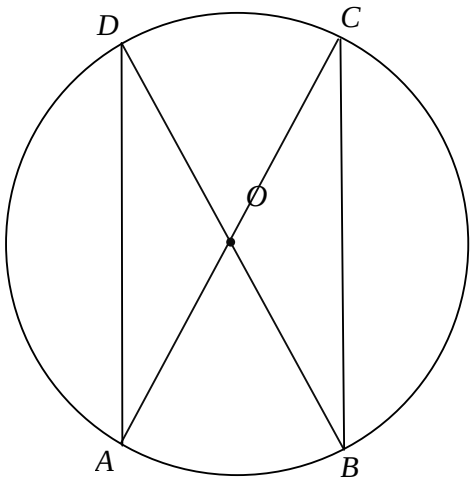
Attempts (2 marks)

A1 Draws arc AB and stops

A2 Draws arc but centre not at Q

Part (c) **15 (5,5,5) marks** **Att (2,2,2)**

O is the centre of the circle in the diagram.
AC and *BD* are diameters of the circle.



(i) Is the triangle *AOD* isosceles?
Explain your answer.

(ii) What is the image of the triangle *AOD* under the central symmetry in the point *O*?

(iii) If $|\angle OCB| = 35^\circ$, find $|\angle COB|$.

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

Yes
$|OD| = |OA|$ Radii of circle

* Check diagram for work

Blunders (-3)
B1 Correct answer without work
B2 | OA| = |OD| and stops

Slips (-1)
S1 If both distances marked on diagram assuming " Yes " is written down

Attempts (2 marks)
A1 States Yes and stops or gives incorrect reason

Worthless (0)
W1 Incorrect answer without work

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

$AOD \rightarrow COB$

*****Check diagram for work

* States D→B , O→O and A→C and stops . Accept for full marks

Blunders (-3)

B1 States | OA | = | OC | and | OD | = | OB | and stops

Attempts (2 marks)

A1 States a triangle is mapped onto a triangle by central symmetry

A2 A → C or O → O or D → B and stops

A3 | OA | = | OC | or | OD | = | OB | and stops

A4 Three letter answer given with one or two letters correct

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

$$\angle COB = 180^\circ - 2(35)^\circ$$
$$= 180^\circ - 70^\circ$$
$$= 110^\circ$$

*****Check diagram for work

Blunders (-3)

B1 Correct answer without work ✍

B2 $|< OBC | \neq 35^\circ$

B3 $2 \times 35^\circ = 70^\circ$ and stops

B4 70° subtracted from an angle $\neq 180^\circ$

Slips (-1)

Numerical slips to a maximum of -3

Attempts (2 marks)

A1 $| < OBC | = 35^\circ$ and stops

A2 $| < COB | = 180^\circ - (| < OCB | + | < OBC |)$ and stops

A3 States that the three angles in a triangle sum to 180° and stops

A4 | < OCB | = | < OBC | stated or marked in diagram

Worthless (0)

W1 Incorrect answer without work

QUESTION 5

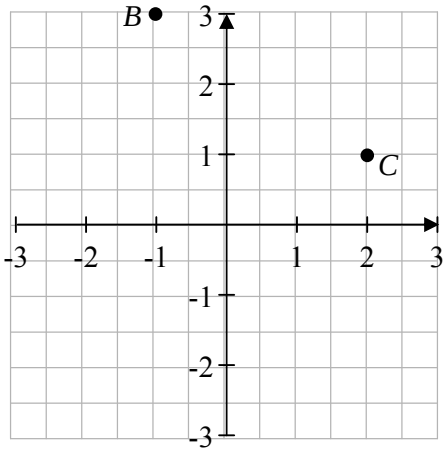
Part (a)	**10(5,5) marks**	**Att (2,2)**
Part (b)	**20 (10,5,5) marks**	**Att (3,2,2)**
Part (c)	**20 (10,10) marks**	**Att (3,3)**

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

5. **(a)** Write down the coordinates of the points *B* and *C*.

$B = (\quad , \quad)$

$C = (\quad , \quad)$



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

$B = (\quad -1 \ , \ 3 \quad)$

$C = (\ 2 \quad , \ 1 \quad)$

* Accept without brackets for full marks , e.g. -1 , 3 and 2 , 1
* Accept $x = -1$ and $y = 3$ and $x = 2$ and $y = 1$ for full marks

Blunders (-3)
B1 Incorrect order of ordinates for *B* and / or *C*(penalise once)
B2 Incorrect *x* ordinate , if not sign error , subject to B1
B3 Incorrect *y* ordinate , if not sign error , subject to B1
B4 $x = -1$ and stops or $y = 3$ and stops (for B) or $x = 2$ and stops or $y = 1$ and stops (for C)

Slips (-1)
S1 Sign error in *x* ordinate
S2 Sign error in *y* ordinate

Misreadings (-1)
M1 *B* = (2 , 1) and *C* = (-1 , 3)

Attempts (2 marks)
A1 Draws a line through $x = 2$ or $y = 1$ (for *C*)
A2 Draws a line through $x = -1$ or $y = 3$ (for *B*)

Notes
For *B* : (1 , 3) is S1 , (-1 , -3) is S2 , (1 , -3) is S1 and S2
For *C* : (-2 , 1) is S1 , (2 , -1) is S2 , (-2 , -1) is S1 and S2

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

(b) R is the point $(-1, 2)$ and S is the point $(5, 6)$.
Find each of the following:

(i) the midpoint of $[RS]$

(ii) the slope of RS

(iii) the length of $[RS]$

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

$$\text{Midpoint} = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{-1+5}{2}, \frac{2+6}{2}\right) = \left(\frac{4}{2}, \frac{8}{2}\right) or (2,4)$$

* 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. (7 , -4) and continues
B6 Mathematical error

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

Slips (-1)
S1 Numerical slips up to a maximum of -3
S2 Error in one sign in formula and continues
S3 One incorrect substitution or sign e.g. $(\frac{-1+5}{2}, \frac{2-6}{2})$ and continues
S4 Takes (-1 , 2) as midpoint and finds extremity e.g. (5 , 6) → (-1 , 2) → (-7 , -2) or
Takes (5 , 6) as midpoint and finds extremity e.g. (-1 , 2) → (5 , 6) → (11 , 10)

Attempts(3 marks)
A1 Any correct relevant step
A2 Some correct substitution
A3 Some correct substitution into an incorrect relevant formula
A4 Correct midpoint on diagram and not named (if named B1 applies)
A5 Point R and/or S plotted reasonably well for this part
A6 Labels R and/or S with (x_1 , y_1) and stops
A7 Correct relevant formula and stops

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

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

Slope (m) $= \frac{y_2 - y_1}{x_2 - x_1} = \frac{6-2}{5-(-1)} = \frac{4}{6} or \frac{2}{3}$

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

Blunders (-3)
B1 Correct answer without work ✍
B2 Incorrect formula e.g. error in both signs, 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. (3 , 5) 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 and continues e.g. $\frac{6-2}{5-1}$ when substituting

Attempts (2marks)
A1 Any correct relevant step
A2 Some correct substitution
A3 Some correct substitution into an incorrect relevant formula
A4 Tan A = $\frac{opposite}{adjacent}$ or $\frac{rise}{run}$ or m = $\frac{vertical}{horizontal}$ and stops
A5 Some correct substitution into formula with $x_2 - x_1$ and / or $y_2 - y_1$ and stops
A6 Labels *R* and / or *S* with (x_1 , y_1) and stops
A7 Plots a diagram with *R* and *S* drawn reasonably well and the line *RS* drawn
A8 Correct relevant formula and stops

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

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

$= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(5-(-1))^2 + (6-2)^2} = \sqrt{4^2 + 6^2} = \sqrt{16+36} = \sqrt{52}$

* Accept correct use of Pythagoras

Blunders (-3)
B1 Correct answer without work ✍
B2 Incorrect 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
B7 No square root sign included with substitution and continues to get 52
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 sign when substituting
S4 If square root is included with substitution and omitted in answer of 52

Attempts (2 marks)
A1 Any correct relevant step
A2 Some correct substitution
A3 Some substitution into incorrect relevant formula
A4 States Pythagoras' Theorem and stops
A5 Labels *R* and / or *S* with (x_1 , y_1) and stops

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

(c) **20 (10.10) marks** **Att 3,3**

(c) The line l contains the point (2, 3). The slope of l is –1.

(i) Find the equation of the line l.

✍

(ii) By letting $y = 0$, find the co-ordinates of the point where the line l meets the x-axis.

✍

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

$y - y_1 = m(x - x_1)$
$y - 3 = -1(x-2)$

* $3 - y = -1(2 - x)$ or similar merits full marks

Blunders (-3)
B1 Correct answer without work ✍
B2 Incorrect formula and continues
B3 Switches x and y i.e. $y - 2 = -1 (x - 3)$
B4 Mathematical error
B5 $y = -1\, x + c$ and stops
B6 Uses a point other than (2 , 3)
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 (3 marks)
A1 Any correct relevant step
A2 Some correct step with work
A3 Writes $m = -1$ and stops
A4 States $y = mx \pm c$ and stops
A5 Gives correct formula and stops
A6 Labels point with (x_1 , y_1) and stops

Worthless(0)
W1 Use of wrong formula
Note : If an error is made while attempting to simplifying this equation , penalise in part (ii)

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

$y - 3 = -1 (x - 2)$	or	$y - 3 = -1 (x - 2)$
$0 - 3 = -1 (x - 2)$		$y - 3 = -x + 2$
$-3 = -x + 2$		$y + x = 3 + 2$
$x = 3 + 2$		$y + x = 5$
$x = 5$		$0 + x = 5$
		$x = 5$
Point = (5 , 0)		

* Accept answer given as $x = 5$ with work shown for full marks

Blunders (-3)
B1 Correct answer without work ✍
B2 Substitutes $x = 0$ and continues
B3 Mathematical error
B4 Incorrect substitution and continues
B5 Transposition error

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

Attempts (3 marks)
A1 Any correct relevant step
A2 Writes answer as $(x, 0)$ without work, where x is an arbitrary number, subject to B1
A3 Substitutes $x = 0$ into equation and stops

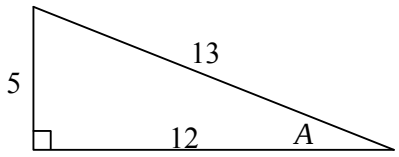
Worthless (0)
W1 Incorrect answer without work unless attempt mark applies

QUESTION 6

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

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

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



(i) Write, as a fraction, the value of sin *A*.

sin *A* =

(ii) Write, as a fraction, the value of tan *A*.

tan *A* =

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

$\sin A = \frac{5}{13}$

* Accept correct answer without work for full marks

* Accept $\sin \frac{\mathbf{5}}{\mathbf{13}}$ for full marks

Blunders (-3)

B1 Incorrect ratio i.e. $\frac{\mathbf{5}}{\mathbf{12}}$ or $\frac{\mathbf{12}}{\mathbf{13}}$

B2 Inverted ratio i.e. $\frac{\mathbf{13}}{\mathbf{5}}$

Slips(-1)

S1 sin A not as a fraction (0.3846)

Attempts (2 marks)

A1 Any correct trigonometric ratio written down

A2 Gives answer as 22.62˚ (evaluates A)

A3 Gives answer as 0.0067 ($\sin \frac{\mathbf{5}}{\mathbf{13}}$)

A4 One or more sides labelled correctly in diagram

Worthless (0)

W1 Incorrect answer without work unless attempt mark secured

W2 Answer given as $\frac{13}{12}$ or $\frac{12}{5}$

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

tan $A = \frac{5}{12}$

* Accept correct answer without work for full marks
* Accept tan $\frac{5}{12}$ for full marks
* Accept candidates answer for part (i)

Blunders (-3)

B1 Incorrect ratio i.e. $\frac{5}{13}$ or $\frac{12}{13}$

B2 Inverted ratio i.e. $\frac{12}{5}$

Slips (-1)

S1 Answer not in fraction form = 0.4166

Attempts (2marks)

A1 Any correct trigonometric ratio written down in answer box

A2 Gives answer as 22.61˚ or rounded off to 23 ˚

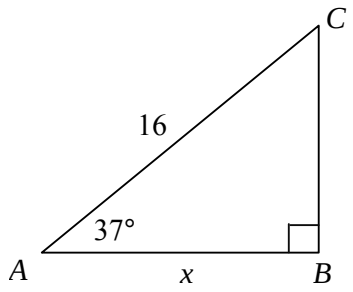
A3 Gives answer of 0.0072 i.e. tan $\frac{5}{12}$

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies

(b) **20 (10,5,5) Marks** **Att(3,2,2)**

In the right-angled triangle *ABC*,
$|AC| = 16$, $|\angle CAB| = 37°$ and $|AB| = x$.



Use your calculator to find cos 37°.
Give your answer correct to one decimal place.

Cos 37° =

From the diagram write cos 37° as a fraction.

cos 37° = $\frac{\square}{\square}$

(iii) Using the answers from parts **(i)** and **(ii)**, or otherwise, find the value of *x*.

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

cos 37° = 0·79863551
= 0.8

* Accept correct answer without work
* Accept cos0.8 for full marks

Blunders (-3)
B1 Finds sin 37° (0.6018) or tan 37° (0.7535)
B2 Uses rad (0.7654) or grad (0.8358) mode in calculator

Slips(-1)
S1 Failure to round off or rounds off incorrectly

Attempts (3 marks)
A1 Any correct trigonometric ratio in answer box
A2 cos 37° = $\frac{|AB|}{|AC|}$ and stops (for this part)
A3 Gets cos |< ACB| correctly (0.6018)
A4 Gets |<ACB| = 53° and stops

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

$\text{Cos } 37^\circ = \frac{x}{16}$ or $\frac{|AB|}{|AC|}$ or $\frac{x}{|AC|}$ or $\frac{|AB|}{16}$

* Accept correct answer without work

Blunders (-3)

B1 Inverted ratio, i.e. $\frac{\mathbf{16}}{\boldsymbol{x}}$

Attempts (2 marks)

A1 Any correct trigonometric ratio

A2 Answer of $\frac{|\boldsymbol{CB}|}{\boldsymbol{x}}$ or $\frac{|\boldsymbol{CB}|}{\mathbf{16}}$

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

$\frac{x}{16} = 0 \cdot 8$

$x = 0{\cdot}8 \times 16 = 12{\cdot}8$

* 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

Attempts (2marks)

A1 States Pythagoras Theorem

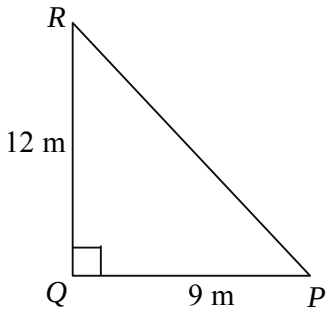
A2 States Sine Rule

Worthless(0)

W1 Measures value of *x* from diagram

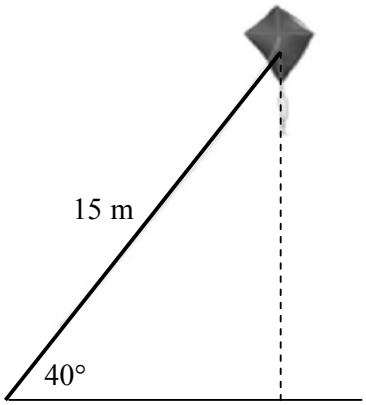
(c) **20 (15, 5) marks** **Att 5,2**

(c) **(i)** In the right-angled triangle PQR
$|QR| = 12$ m, $|PQ| = 9$ m and $|\angle PQR| = 90°$.
Find $|\angle QPR|$, correct to the nearest degree.



(ii) A kite on a string makes an angle of 40° to the horizontal ground.
The length of the string is 15 m.

How high above the ground is the kite?
Give your answer to the nearest metre.



(c)(i) **15 marks** **Att 5**

$$\tan \angle QPR = \frac{|QR|}{|QP|} = \frac{12}{9} = 1.3333$$

$$\tan^{-1}(1\cdot 3333) = 53\cdot 130^{o}$$

$$\angle QPR = 53^{\circ}$$

Blunders (-3)

B1 Correct answer without work ✍

B2 Incorrect trigonometric ratio i.e. $\frac{|QP|}{|QR|} = \frac{9}{12}$

B3 Decimal error

B4 Mathematical error

B5 Error in manipulation of equation

B6 Uses rad (0.9272) or grad (59.03) mode in calculator

Misreading(-1)

M1 Finds | < QRP | correctly

Slips(-1)
S1 Numerical slips to a maximum of -3
S2 Fails to round off or rounds off incorrectly

Attempts (3 marks)
A1 Some correct step with work and stops e.g. Sine Rule stated or use of Pythagoras
A2 Any correct trigonometric ratio written down
A3 Identifies angle correctly in diagram

(ii) 5 marks Att 2

$$\frac{h}{15} = \sin(40)^\circ$$
Sin 40º= 0·6428
h= 0·6428×15= 9·642
h =10

* If incorrect mode used in (c)(i) do not penalise again

Blunders (-3)
B1 Correct answer without work ✍
B2 Gets cos 40˚ (0.7660) or tan 40˚ (0.8390)
B3 Inverts fraction
B4 Uses rad (0.7451) or grad (0.5877)
B5 Error in transposition
B6 Mathematical error
B7 Decimal error

Slips (-1)
S1 Numerical slips up to a maximum of -3
S2 Failure to round off or incorrect rounding off

Attempts (3marks)
A1 Any correct relevant step
A2 Any correct trigonometric ratio
A3 Identifies side correctly in diagram
A4 States the hypotenuse = 15 and stops

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