



Coimisiún na Scrúduithe Stáit State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION 2006 MATHEMATICS - ORDINARY LEVEL - PAPER 2 MARKING SCHEME

GENERAL GUIDELINES FOR EXAMINERS

- Penalties of three types are applied to candidates' work as follows:
 - Blunders - mathematical errors/omissions (-3)
 - Slips- numerical errors (-1)
 - Misreadings (provided task is not oversimplified) (-1).Frequently occurring errors to which these penalties must be applied are listed in the scheme. They are labelled: B1, B2, B3,..., S1, S2,..., M1, M2,... etc. These lists are not exhaustive.
- When awarding attempt marks, e.g. Att(3), note that
 - any *correct, relevant* step in a part of a question merits at least the attempt mark for that part
 - if deductions result in a mark which is lower than the attempt mark, then the attempt mark must be awarded
 - a mark between zero and the attempt mark is never awarded.
- Worthless work is awarded zero marks. Some examples of such work are listed in the scheme and they are labelled as W1, W2,... etc.
- The phrase "hit or miss" means that partial marks are not awarded – the candidate receives all of the relevant marks or none.
- The phrase "and stops" means that no more work is shown by the candidate.
- Special notes relating to the marking of a particular part of a question are indicated by an asterisk. These notes immediately follow the box containing the relevant solution.
- The sample solutions for each question are not intended to be exhaustive lists – there may be other correct solutions.
- Unless otherwise indicated in the scheme, accept the best of two or more attempts – even when attempts have been cancelled.
- The *same* error in the *same* section of a question is penalised *once* only.
- Particular cases, verifications and answers derived from diagrams (unless requested) qualify for attempt marks at most.
- A serious blunder, omission or misreading results in the attempt mark at most.
- Do not penalise the use of a comma for a decimal point, e.g. €5.50 may be written as €5,50.

QUESTION 1

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

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

Multiply 375 m by 4.
Give your answer in kilometres (km).


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



$$375 \text{ m by } 4 = 1500 \text{ m}$$

$$= 1.5 \text{ km}$$

Blunders (-3)

- B1 Correct answer without work (.
- B2 Incorrect conversion or no conversion.
- B3 Incorrect mathematical operation with work and continues
- B4 Decimal error

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Leaves as $\frac{1500}{1000}$

Attempts (3 marks)

- A1 Converts to kilometres and stops e.g. 0.375 km
- A2 States 1000 m = 1 km and stops
- A3 Some correct effort at conversion
- A4 1500 without work and stops
- A5 375×4 and stops.

Worthless (0)

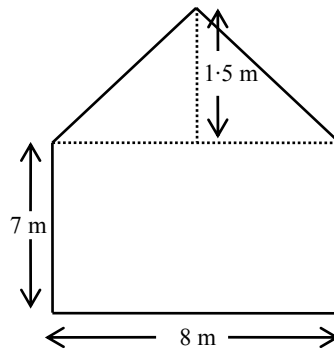
- W1 Incorrect answer without work unless attempt mark applies.

Part (b)

20 marks (10, 5, 5)

Att 7 (3, 2, 2)

The gable-end of a house has measurements as shown in the diagram



Part (b) (i)

10 Marks

Att 3

(i) Find, in m^2 , the area of the bottom rectangular section of the gable-end.

(b) (i)

10 Marks

Att 3

\sphericalangle Area of the bottom rectangular section of the gable-end = $7 \times 8 = 56 \text{ m}^2$

Blunders (-3)

- B1 Correct answer without work (\sphericalangle).
- B2 Incorrect relevant formula e.g. $\frac{1}{2}(7 \times 8) = 28$.
- B3 $7^2 \times 8^2 = 3136$
- B4 Each incorrect substitution and continues.

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 7×8 and stops.

Attempts (3 marks)

- A1 Find perimeter of part or whole correctly or incorrectly with work shown
- A2 Correct formula for area and stops e.g. area = $L \times W$
- A3 Any relevant work e.g. understands the meaning of area

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

Part (b) (ii)

5 Marks

Att 2

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

(b) (ii)

5 Marks

Att 2

~~✍~~

Area of the top triangular section of the gable-end = $\frac{1}{2} \times 8 \times 1.5 = 6 \text{ m}^2$

Blunders (-3)

B1 Correct answer without work (~~✍~~).

B2 Incorrect relevant formula e.g. $8 \times 1.5 = 12$.

B3 Incorrect substitution / dimension and continues correctly e.g. Area = $\frac{1}{2}(7 \times 8)$ or Area = $\frac{1}{2}(1.5)(1.5)$ each time.

B4 Decimal error

B5 Mathematical error.

Slips (-1)

S1 Numerical slips to a maximum of -3

Attempts (2 marks)

A1 Some correct step with work and stops

A2 Product of any 2 dimensions with work shown

A3 Area = $\frac{1}{2} \times \text{base} \times \text{height}$ or similar and stops

A4 Some work involving multiplication by $\frac{1}{2}$

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

Part (b) (iii)

5 Marks

Att 2

✍ The cost of 5 litres of paint is €23.
5 litres of this paint will cover an area of 31m^2 .
Find the cost of painting the gable-end with this paint.

(b) (iii)

5 Marks

Att 2

✍ Area of gable end = $56 + 6 = 62\text{ m}^2$
Volume of paint required = $\frac{62}{31} \times 5 = 10\text{ l}$
Cost = $\text{€}23 \times 2 = \text{€}46$

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

Blunders (-3)

- B1 Correct answer without work (✍).
- B2 Incorrect mathematical operation e.g. subtracts the areas
- B3 Multiplies 62×23 and continues.
- B4 $5 \times 23 \times 2$

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 23×2 and stops.

Attempts (2 marks)

- A1 Writes $56 + 6$ or 62 and stops (be mindful of second *).
- A2 Some correct step with work and stops.
- A3 Finds cost of 1 litre and / or area covered by 1 litre and stops.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

Part (c)

20 marks (5, 10, 5)

Att 7 (2, 3, 2)

Peter travelled 50 km to a football match and he returned home by the same route when the match was over.
Peter travelled to the match at an average speed of 60 km/h.
How many minutes did the journey to the match take?

Part (c) (i)

5 Marks

Att 2

$\frac{50}{60} \times 60 = 50$ minutes

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

Blunders (-3)

- B1 Correct answer without work ($\frac{50}{60}$).
- B2 Error in converting hours to minutes or no conversion.
- B3 Incorrect relevant formula and continues.
- B4 Mathematical error.

Misreadings (-1)

- M1 Uses 100km for journey to match with work.

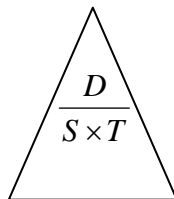
Slips (-1)

- S1 Numerical slips to a maximum of -3

Attempts (2 marks)

- A1 Converts hours to minutes and stops e.g. 1 hour = 60 minutes.
- A2 Correct formula only and stops.
- A3 Any relevant work e.g. 1 km in 1 minute and stops.

- A4 States  or similar version.



Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

Part (c) (ii)

10 Marks

Att 3

(ii) Peter arrived at the match at 17:35.
At what time did he leave from home to travel to the match?

(ii)

10 Marks

Att 3

$\not\leftarrow$ $17:35 - 0:50 = 16:95 - 0:50 = 16:45$

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

Blunders (-3)

- B1 Correct answer without work ($\not\leftarrow$).
- B2 Error in converting hours / minutes or no conversion, unless B2 applied in part (i)
- B3 Adds instead of subtracts with work
- B4 Correctly subtracts an arbitrary time from 17:35 with work.

Slips (-1)

- S1 Numerical slips to a maximum of -3

Attempts (3 marks)

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

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

Part (c) (iii)

5 Marks

Att 2

(iii) Peter took 75 minutes to travel home from the match.
Calculate the average speed, in km/h, for this journey.

(c) (iii)

5 Marks


Att 2



$$\text{Average speed} = \frac{50}{1.25} = 40 \text{ km/hr} \quad \text{or} \quad \frac{50}{75} \times 60 = 40 \text{ km/hr}$$

* Do not penalise same error twice in section (c).

Blunders (-3)

- B1 Correct answer without work ().
- B2 Incorrect or no conversion of minutes to hours if applicable if not already penalised in parts (i) or (ii).
- B3 No division
- B4 Mathematical error.
- B5 Incorrect relevant formula.

Slips (-1)

- S1 Numerical slips to a maximum of -3

Misreadings (-1)

- M1 Takes journey as 100km and continues correctly.

Attempts (2 marks)

- A1 Converts minutes / hours and stops
- A2 Correct formula and stops.
- A3 Any relevant work

Worthless (0)

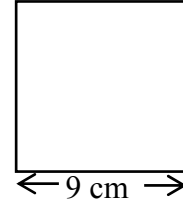
- W1 Incorrect answer without work unless attempt mark applies.

QUESTION 2

Part (a)	10 marks	Att 3
Part (b)	20 marks	Att 6
Part (c)	20 marks	Att 7

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

- (a) The length of each side of a square tile is 9 cm.
What area, in cm^2 , will 12 of these tiles cover?




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



$$\begin{aligned}\text{Area of one tile} &= 9 \times 9 = 81 \text{ cm}^2 \\ \text{Area covered by 12 tiles} &= 81 \times 12 = 972 \text{ cm}^2\end{aligned}$$

Blunders (-3)

- B1 Correct answer without work ()
- B2 Incorrect relevant formula e.g correct surface area and continues
- B3 Incorrect substitution or omission or extra each time
- B4 Mathematical error e.g. $9^2 = 18$ and continues
- B5 Correctly finds the perimeter and continues.

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 81×12 and stops.

Attempts (3 marks)

- A1 Some correct step with work and stops.
- A2 Correct formula and stops.
- A3 Writes 9×9 or 9×12 and stops

Worthless (0)

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

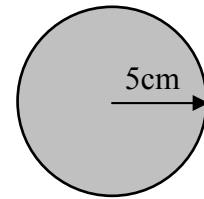
Part (b) (i)

10 marks

Att 3

(b) (i) A circular disc has a radius of 5 cm.

Taking π as $3 \cdot 14$, find, in cm^2 , the area of the disc.



(b) (i)

10 marks

Att 3

~~✍~~

$$\begin{aligned}\text{Area of disc} &= \pi r^2 \\ &= 3 \cdot 14 \times 5 \times 5 \\ &= 78.5 \text{ cm}^2\end{aligned}$$

Blunders (-3)

- B1 Correct answer without work (~~✍~~).
- B2 Incorrect relevant formula and continues e.g. $2\pi r$ or a multiple of πr^2 .
- B3 Mathematical error e.g. $5^2 = 10$ and continues.
- B4 Incorrect substitution and continues.
- B5 $\pi \neq 3.14$ or answer in terms of π
- B6 Decimal error.

Slips (-1)

- S1 Numerical slips to a maximum of -3

Attempts (3 marks)

- A1 Some correct step with work and stops.
- A2 Product of two relevant numbers and stops.
- A3 Writes 5^2 and stops

Worthless (0)

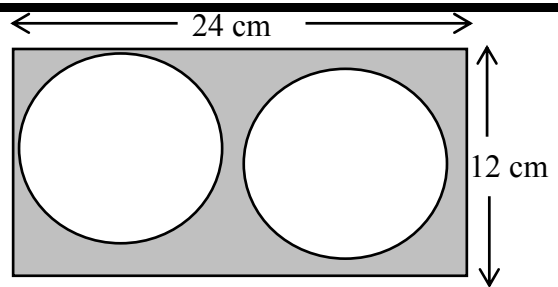
- W1 Incorrect answer without work unless attempt mark applies.

Part (b) (ii)

10 marks

Att 3

- (ii) A rectangular piece of cardboard has measurements as shown. Two circular pieces, each of radius length 5 cm, are cut out of this rectangular piece of cardboard as shown.



Find, in cm^2 , the area of the remaining piece of cardboard.

(b) (ii)

10 marks

Att 3

~~✍~~

$$\text{Area of rectangular piece} = 24 \times 12 = 288$$

$$\text{Area of 2 discs} = 78.5 \times 2 = 157$$

$$\text{Area of the remaining piece} = 288 - 157 = 131 \text{ cm}^2$$

* Accept candidates answer from part (i)

Blunders (-3)

- B1 Correct answer without work (~~✍~~).
- B2 Incorrect relevant formula e.g. $L \times L$ and continues
- B3 Incorrect mathematical operation
- B4 Decimal error.
- B5 Uses one disc only.

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 $288 - 157$ and stops.

Attempts (3 marks)

- A1 Some correct step with work and stops.
- A2 Correct formula for area of rectangle and stops.

Worthless (0)

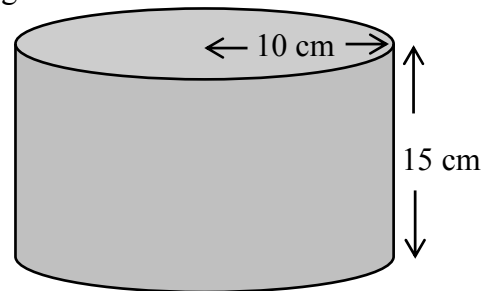
- W1 Incorrect answer without work unless attempt mark applies.

Part (c)

20 marks (10, 5, 5)

Att 7 (3, 2, 2)

(c) A solid metal cylinder has radius 10 cm and height 15 cm



Part (c) (i)

10 Marks

Att 3

(i) Taking π as $3 \cdot 14$, find, in cm^3 , the volume of the solid metal cylinder.

(c) (i)

10 Marks

Att 3

~~✍~~

$$\begin{aligned} V &= \pi r^2 h \\ &= 3.14 \times 10 \times 10 \times 15 \\ &= 4710 \text{ cm}^3 \end{aligned}$$

Blunders (-3)

- B1 Correct answer without work (~~✍~~).
- B2 Incorrect relevant formula for a cylinder e.g Surface area $2\pi rh$ or an incorrect multiple of $\pi r^2 h$ or πr^2 with work.
- B3 Incorrect substitution each time and continues.
- B4 Mathematical error e.g. $10^2 = 20$.
- B5 $\pi \neq 3 \cdot 14$ or answer in terms of π
- B6 Decimal error

Slips (-1)

- S1 Numerical slips to a maximum of -3

Attempts (3 marks)

- A1 A correct substitution and stops e.g. $3 \cdot 14 \times 10^2 \times h$.
- A2 Any relevant work.
- A3 π omitted with or without work.

Worthless (0)

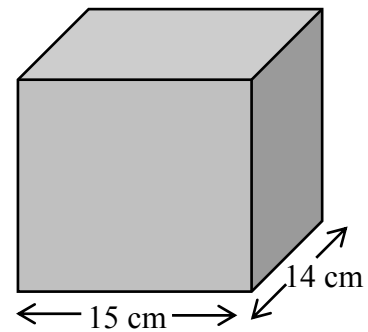
- W1 Incorrect answer without work unless attempt mark applies.

Part (c) (ii)

5 Marks

Att 2

- (ii) The cylinder was melted down and half of the metal was recast as a rectangular solid. This rectangular solid has length 15 cm and width 14 cm. Calculate, in cm, its height, correct to one decimal place.



(c) (ii)

5 Marks

Att 2

$$\begin{aligned} \cancel{\text{e}} \quad 0.5 \times 4710 &= 2355 \\ \frac{2355}{(15 \times 14)} &= 11.2 \end{aligned}$$

* Accept candidates answer from part (i).

Blunders (-3)

- B1 Correct answer without work ($\cancel{\text{e}}$).
- B2 Failure to divide volume of metal by 2.
- B3 Decimal error.
- B4 Incorrect formula for volume of a rectangular solid.
- B5 Mathematical error.

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Incorrect round off or no round off

Attempts (2 marks)

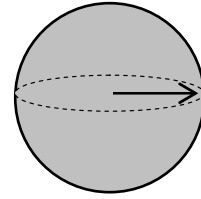
- A1 Correct formula for volume of rectangular solid and stops.
- A2 Some correct substitution and stops.
- A3 15×14 or 210 or 2355 or candidates answer from part (i) and stops.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

Part (c) (iii)**5 Marks****Att 2**

- (iii) The other half of the metal was recast as a sphere.
 This sphere had a surface area of $272 \cdot 57\pi \text{ cm}^2$.
 Find, in cm, the radius of the sphere, correct to two decimal places.

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

$$\begin{aligned} \cancel{\neq} \quad 4 \times \pi \times r^2 &= 272 \cdot 57\pi \\ 4 \times r^2 &= 272 \cdot 57 \\ r^2 &= 68 \cdot 14 \\ r &= 8 \cdot 254 \quad \text{or} \quad \sqrt{68 \cdot 14} \\ r &= 8 \cdot 25 \end{aligned}$$

Blunders (-3)

- B1 Correct answer without work ($\cancel{\neq}$).
- B2 Incorrect relevant formula e.g. multiples of πr^3 or πr^2 with work.
- B3 Decimal error.
- B4 Incorrect substitution and continues.
- B5 Mathematical error e.g. $r^2 = 68 \cdot 14$, $r = 34 \cdot 07$

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Incorrect round off or no round off.

Attempts (2 marks)

- A1 Some correct step with work.
- A2 Effort at trial and error.
- A3 Writes $\frac{4710}{2}$ and / or 2355 and stops.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

QUESTION 3

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

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

(a) Find the mean of the numbers: 3.2, 4.4, 4.6, and 7.8.

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

~~✗~~
$$\frac{3.2 + 4.4 + 4.6 + 7.8}{4} = 5$$

Blunders (-3)

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

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 $\frac{20}{4}$ and stops.

Attempts (3 marks)

- A1 Addition of data only.
- A2 Partial addition with work and stops.
- A3 Idea of mean indicated e.g. $\frac{\sum x}{n}$ or verbal description.
- A4 States “median is 4.5” and stops.
- A5 20 or 4 without work.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

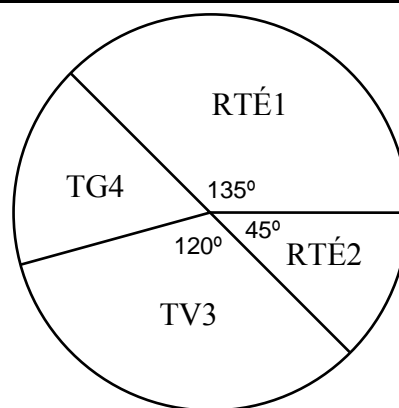
Part (b)

20 marks (10, 5, 5)

Att 7 (3, 2, 2)

(b) A group of students were surveyed to find their favourite channel from four given TV channels.

The pie chart represents the results of the survey.



Part (b) (i)

10 marks

Att 3

(i) What is the measure of the angle for TG4?

(b) (i)

10 marks

Att 3

$\not\approx$ $360^\circ - (120^\circ + 45^\circ + 135^\circ) = 60^\circ$

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

Blunders (-3)

- B1 Correct answer without work ($\not\approx$).
- B2 Angle at centre of circle $\neq 360^\circ$
- B3 No subtraction.
- B4 Straight line angle $\neq 180^\circ$.

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 Each angle omitted to a maximum of -3
- S3 Indicates subtraction i.e. $360^\circ - 300^\circ$ and stops

Attempts (3 marks)

- A1 Some Addition.
- A2 States “straight angle = 180° ” or similar and stops.
- A3 States “angle centre of circle = 360° ” or similar and stops.
- A4 Writes 135° , 45° or 120° and stops.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

Part (b) (ii)

5 marks

Att 2

(ii) 12 students replied that RTÉ2 was their favourite channel.
How many students were surveyed?

(b) (ii)

5 marks

Att 2

$$\begin{array}{l} 45^\circ = 12 \\ \text{✍} \quad 1^\circ = \frac{12}{45} \quad \underline{OR} \quad 45^\circ = \frac{1}{8} \text{ of } 360^\circ \\ 360^\circ = \frac{12}{45} \times 360 = 96 \quad 12 \times 8 = 96 \end{array}$$

Blunders (-3)

- B1 Correct answer without work (✍).
- B2 Incorrect ratio method.
- B3 Mathematical error.

Misreading (-1)

- M1 Reads RTÉ1 for RTÉ2 and continues

Slips (-1)

- S1 Numerical slips to a maximum of -3
- S2 12×8 and stops.

Attempts (2 marks)

- A1 Some relevant step.
- A2 Writes 45° or 360° and / or $\frac{1}{8}$ and stops.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark applies.

Part (b) (iii)

5 marks

Att 2

(iii)

How many gave TV3 as their reply?

(b) (iii)

5 marks

Att 2

$\frac{120}{360} \times 96 = 32$

$$\frac{120}{360} \times 96 = 32$$

* Accept candidates answer from part (ii).

Blunders (-3)

B1 Correct answer without work ($\frac{120}{360}$).

B2 Incorrect ratio method.

B3 Mathematical error.

Slips (-1)

S1 Numerical slips to a maximum of -3

Attempts (2 marks)

A1 Some relevant step.

A2 Any relevant angle e.g. 120° , 360° , 45° .

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

Part (c)**20 marks (10, 5, 5)****Att 7 (3, 2, 2)****(c)** The marks gained in a test by 20 students were

40	30	20	50	40
30	20	40	30	10
50	40	30	10	30
50	20	30	40	20

Part (c) (i)**10 Marks****Att 3****(i)** Complete the following frequency table:

Marks	10	20	30	40	50
Number of students					

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

Marks	10	20	30	40	50
Number of students	2	4	6	5	3

* Accept correct answer with no work shown.

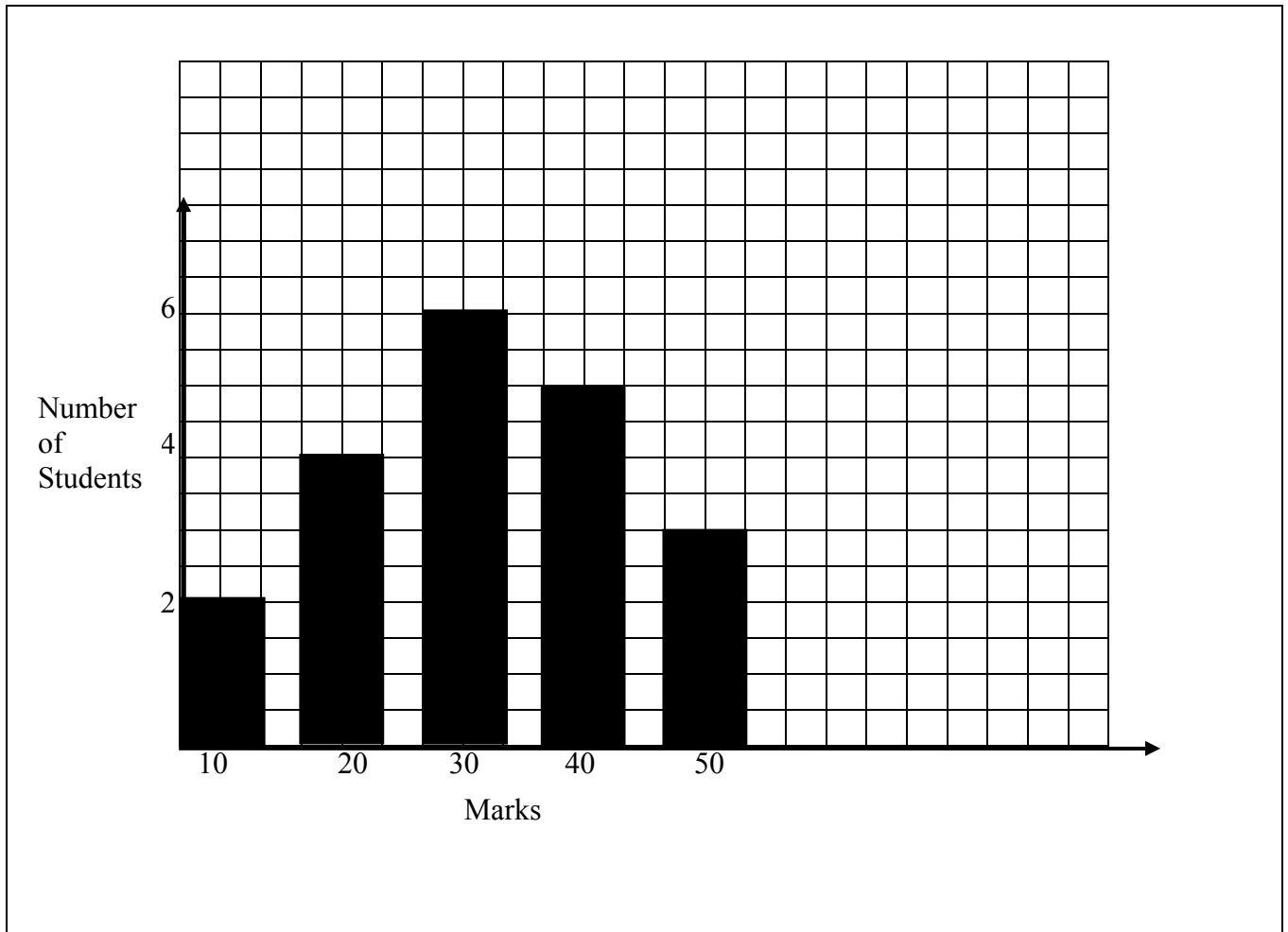
Attempts (3 marks)

A1 One correct entry only.

Worthless (0)

W1 Table in question reproduced merits zero marks.

(ii) Draw a bar chart of the data.



- * Accept horizontal or vertical bar chart.
- * Accept bars of unequal widths.
- * Accept “ lines ” as bars.
- * Labelling not required

Blunders (-3)

- B1 Axis with student numbers not graduated uniformly.
- B2 Reverses variable and frequency when drawn.
- B3 Draws a trend graph or pie chart.

Slips (-1)

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

Attempts (2 marks)

- A1 Graduates axis or axes only

(iii) Calculate the mean mark.

(c) (iii)

5 Marks

Att 2

$$\begin{aligned}
 \text{Mean} &= \frac{\sum fx}{\sum f} \\
 &= \frac{(2 \times 10) + (4 \times 20) + (6 \times 30) + (5 \times 40) + (3 \times 50)}{2 + 4 + 6 + 5 + 3} \\
 &= \frac{20 + 80 + 180 + 200 + 150}{20} \\
 &= \frac{630}{20} \\
 &= 31.5
 \end{aligned}$$

* Accept candidates values from table.

Blunders (-3)

B1 Correct answer without work (\neq).

B2 Multiplies instead of adds in denominator

B3 Adds instead of multiplies in numerator.

B4 Incorrect denominator or no denominator e.g. $\frac{630}{5}$

B5 Inverted fraction

B6 Frequencies omitted in numerator e.g. $\frac{10 + 20 + 30 + 40 + 50}{20} = \frac{150}{20}$

B7 Omits 2 or more values in numerator.

Slips (-1)

S1 Numerical slips to a maximum of -3

S2 Omits one value in numerator with work.

S3 $\frac{630}{20}$ and stops.

Attempts (2 marks)

A1 Some relevant step e.g. $\sum f$.

A2 Mean = $\frac{\sum fx}{\sum f}$ and stops

A3 A relevant multiplication and stops.

A4 Average of frequencies $\frac{2 + 4 + 6 + 5 + 3}{5} = \frac{20}{5} = 4$

A5 $\frac{10 + 20 + 30 + 40 + 50}{5} = \frac{150}{5} = 30$

A6 630 or 20 without work.

Worthless (0)

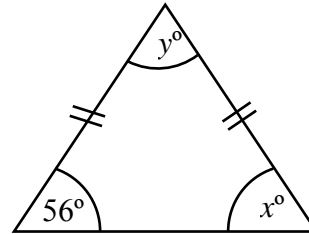
W1 Incorrect answer without work unless attempt mark applies.

QUESTION 4

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

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

Find the value of x and the value of y in the diagram.



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

$x = 56^\circ$	$y = 68^\circ$
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- * Accept correct answer marked / indicated on a diagram.
- * Accept correct answers and no work.

Blunders (-3)

- B1 States $y = 56^\circ$ and continues to get $x = 68^\circ$
- B2 Mathematical error.
- B3 Uses incorrect isosceles triangle e.g. $56^\circ/62^\circ/62^\circ$ without work.
- B4 Sum of angles in triangle $\neq 180^\circ$.
- B5 Finds one correct value only.

Slips (-1)

- S1 Numerical slips to a maximum of -3

Attempts (3 marks)

- A1 States "straight line angle = 180° " or similar.
- A2 States "angle sum of triangle = 180° " or similar.
- A3 Any mention of isosceles triangle
- A4 Uses arbitrary value for x or y and continues.

Worthless (0)

- W1 Incorrect answer without work unless attempt mark or B1 or B3 applies e.g. $x = 124^\circ$, $y = 124^\circ$ merits zero marks.

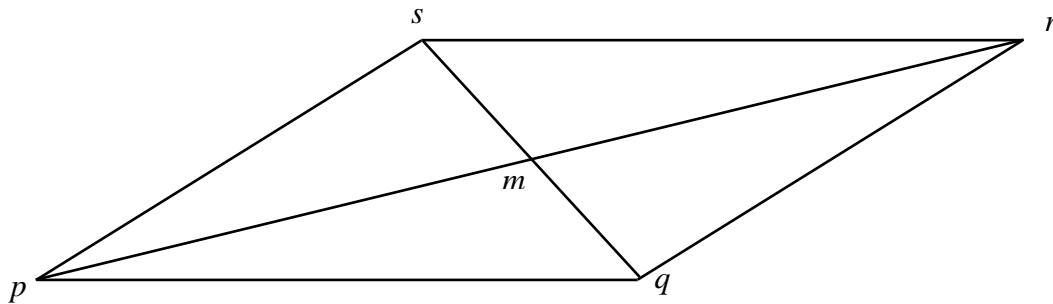
Part (b)

20 marks (10, 5, 5)

Att 7 (3, 2, 2)

(b) $pqrs$ is a parallelogram.

The diagonals $[sq]$ and $[pr]$ intersect at m .



Part (b) (i)

10 marks

Att 3

(i) The Δpsq has area 12 cm^2 .

Write down the area of the parallelogram $pqrs$ and give a reason for your answer.

(b) (i)

10 marks

Att 3

(i) Area of parallelogram $pqrs = 24 \text{ cm}^2$

Reason: Diagonal bisects area

* Accept correct answer and no work.

Blunders (-3)

B1 Area = $n \times 12$, $n \neq 2$, e.g. $4 \times 12 = 48$ or $\frac{1}{2} \times 12 = 6$

Slips (-1)

S1 Numerical slips to a maximum of -3

S2 Correct answer with no reason or incorrect reason.

Attempts (3 marks)

A1 Reason only.

A2 Correct area formula for triangle or parallelogram.

A3 Opposite sides / angles of a parallelogram equal in measure

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

Part (b) (ii)

5 marks

Att 2

(ii) Given that $|sq| = 4.1$ cm, find $|mq|$ and give a reason for your answer.

(b) (ii)

5 marks

Att 2

(ii) $|mq| = 2.05$

Reason: Diagonals bisect each other

* Accept correct answer marked / indicated on a diagram.

* Accept correct answer and no work.

Blunders (-3)

B1 $|mq| = n \times 4.1, n \neq \frac{1}{2}$

Slips (-1)

S1 Correct answer with no reason or incorrect reason.

Attempts (2 marks)

A1 Reason only.

A2 Any mention of congruence.

A3 Writes $|sm| = |mq|$ and stops.

A4 Writes $|mq| = \frac{1}{2}|sq|$ and stops.

Worthless (0)

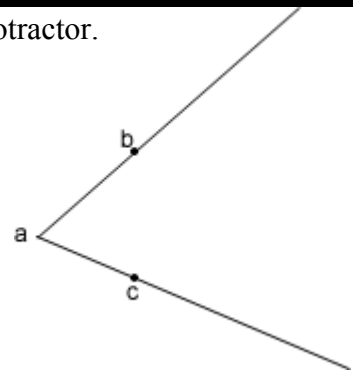
W1 Incorrect answer without work unless attempt mark applies.

Part (b) (iii)

5 marks

Att 2

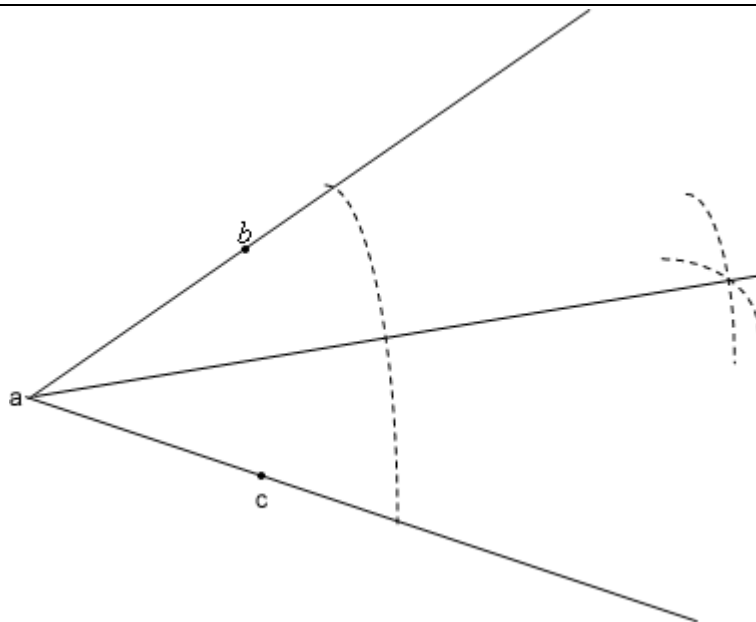
(iii) Bisect the given angle $\angle bac$ without using a protractor.
Show all construction lines.



(b) (iii)

5 marks

Att 2



* Accept for 5 marks any correct method of bisection provided all necessary construction lines are drawn.

Misreading (-1)

M1 Bisects incorrect angle and shows relevant construction lines.

Attempts (2 marks)

A1 Some attempt at drawing a circle and or an arc, or joins b to c.

A2 Marks or writes $|ab| = |ac|$.

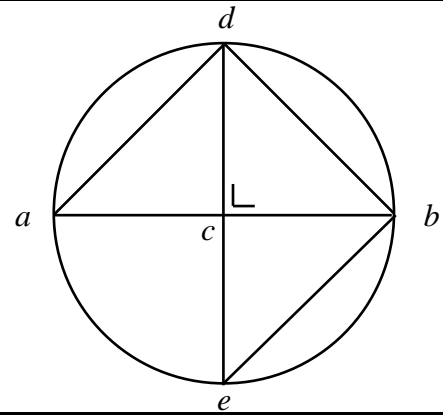
A3 Line bisecting angle at a correctly shown, with no construction lines.

Part (c)

20 marks (10, 5, 5)

Att 7 (3, 2, 2)

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



Part (c) (i)

10 Marks

Att 3

- (i) Write down $|\angle cad|$.

(c) (i)

10 Marks

Att 3

- (i) $|\angle cad| = 45^\circ$

- * Accept correct answer with no work.
- * Accept correct answer marked / indicated on a diagram.

Blunders (-3)

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

Slips (-1)

- S1 Numerical slips to a maximum of -3.

Attempts (3 marks)

- A1 Writes down or indicates two equal sides.
- A2 Writes down or indicates two equal angles.
- A3 Write down or indicate $|\angle dca| = 90^\circ$.
- A4 Clearly indicates $|\angle cad|$ on the diagram.
- A5 States “straight line angle = 180° ” or similar and stops.
- A6 States “angle sum in a triangle = 180° ” or similar and stops.

Worthless (0)

- W1 Incorrect answer with no work e.g. $|\angle cad| = 90^\circ$.
- W2 Diagram reproduced without modification.

Part (c) (ii)

5 Marks

Att 2

(i) Show that Δacd and Δbce are congruent.

(c) (ii)

5 Marks

Att 2

Reasons: $ ac = cb $	<i>or</i>	$ \angle dac = \angle ceb $
$ \angle acd = \angle ecb $		$ ac = cb $
$ dc = ce $		$ \angle cda = \angle cbe $

* Accept correct answer marked / indicated on a diagram.

Blunders (-3)

B1 Each step omitted

Attempts (2 marks)

A1 One step correct.

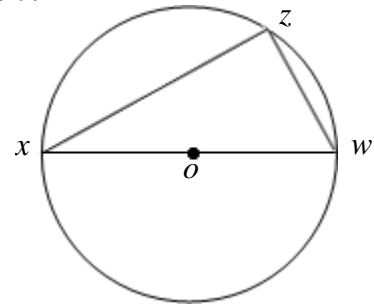
A2 States same shape or ASA, SAS.

A3 States triangles fold onto each other.

A4 Clearly indicates the two required triangles.

Part (c) (iii)**5 Marks****Att 2****(iii)**

$[xw]$ is a diameter of a circle with centre o .
 z is a point on the circle.



Given $|ow| = 5$ cm, $|wz| = 6$ cm, use the Theorem of Pythagoras to find $|xz|$.

(c) (iii)**5 Marks****Att 2**~~✍~~

$$|xw|^2 = |zw|^2 + |xz|^2$$

$$(10)^2 = (6)^2 + |xz|^2$$

$$100 = 36 + |xz|^2$$

$$64 = |xz|^2$$

$$\sqrt{64} \text{ or } 8 = |xz|$$

Blunders (-3)

- B1 Correct answer without work (~~✍~~).
- B2 Incorrect theorem of Pythagoras.
- B3 Mathematical error e.g. $6^2 = 12$.
- B4 Takes an arbitrary figure or 5 for $|xw|$ and continues.
- B5 Error in manipulation of equation.

Slips (-1)

- S1 Numerical slips to a maximum of -3.

Attempts (2 marks)

- A1 A correct step.
- A2 States theorem of Pythagoras.
- A3 States $|xw| = 10$ and stops
- A4 Marks $|wz| = 6$ and / or $|ow| = 5$ on the diagram and stops.
- A5 5^2 and / or 6^2 and / or 10^2 and stops.

Worthless (0)

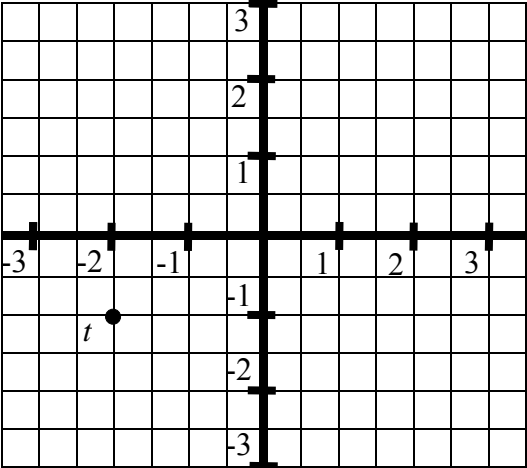
- W1 Incorrect answer without work unless attempt mark applies.
- W2 $5 + 6 = 11$.
- W3 36 without work.

QUESTION 5

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

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

(a) Write down the coordinates of the point t .



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

(a)	$t = (-2, -1)$	
------------	----------------	--

- * No penalty on brackets e.g. -2,-1.
- * Accept $x = -2$ and $y = -1$ written separately for full marks

Blunders (-3)

- B1 Incorrect order in couple (-1, -2).
- B2 Incorrect x ordinate if not sign error subject to B1
- B3 Incorrect y ordinate if not a sign error subject to B1.
- B4 $x = -2$ and stops or $y = -1$ and stops.

Slips (-1)

- S1 Sign error x ordinate.
- S2 Sign error y ordinate.

Attempts (3 marks)

- A1 Draws line or segment through -2 and / or -1.

Worthless (0)

- W1 -1 on its own with no work.
- W2 -2 on its own with no work.

Notes

- | | | |
|-----------|--------------|--------------|
| (-2,2):B3 | (2,1):S1,S2 | (1,-2):B2,B3 |
| (-2,0):B3 | (2,0):S1,B3 | (-1,2):B2,B3 |
| (2,-1):S1 | (-1,2):B2,B3 | (4,4):B2,B3 |

Part (b)

25 marks (10, 10, 5)

Att 8 (3, 3, 2)

(b) p is the point (3, 5) and q is the point (1, -7). Find each of the following:

Part (b) (i)

10 marks

Att 3

~~✗~~

(i) the midpoint of $[pq]$

(b) (i)

10 marks

Att 3

$$\begin{aligned} \del \left(\frac{3+1}{2}, \frac{5-7}{2} \right) \\ = \left(\frac{4}{2}, \frac{-2}{2} \right) \\ = (2, -1) \end{aligned}$$

- * Accept translation method.
- * No penalty on brackets.

Blunders (-3)

B1 Correct answer without work (~~✗~~).

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

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

B4 Two or more signs incorrect in substitution.

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

B6 One ordinate only worked out correctly.

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

Slips (-1)

S1 Numerical errors to a maximum of -3.

S2 Error in one sign in midpoint formula and continues.

S3 One incorrect substitution or sign when substituting e.g. $\left(\frac{-1+3}{2}, \frac{-7+5}{2} \right)$ and continues

S4 Takes (3,5) as midpoint and finds extremity e.g. $(1,-7) \rightarrow (3,5) \rightarrow (5,17)$ or takes (1,-7) as midpoint and finds extremity e.g. $(3,5) \rightarrow (1,-7) \rightarrow (-1,-19)$

Attempts (3 marks)

A1 Some correct substitution

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

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

A4 Labels p and / or q with (x_1, y_1) and stops.

Worthless (0)

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

W2 Writes midpoint formula and stops.

(ii) ✍

the slope of pq

(b) (ii)

10 marks

Att 3

(ii) ✍

$$\left(\frac{-7-5}{1-3} \right)$$

$$= 6 \text{ or } \frac{12}{2} \text{ or } \frac{-12}{-2}$$

* Accept correct trigonometric method i.e. $\tan \theta = \frac{12}{2}$.

Blunders (-3)

B1 Correct answer without work (✍).

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

B3 Incorrectly treats couples as (x_1, x_2) and (y_1, y_2) if not already penalised e.g. $\frac{3-5}{1+7}$ or
 $\frac{5-3}{-7-1}$

B4 Mathematical error e.g. sign rules.

B5 Gets the slope of op or oq correctly

B6 Error in more than one sign when substituting.

Slips (-1)

S1 Numerical errors to a maximum of -3.

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

S3 One incorrect substitution or sign when substituting.

Attempts (3 marks)

A1 $\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$ or $m = \frac{\text{vertical}}{\text{horizontal}}$ and stops.

A2 Some correct substitution into formula with $x_2 - x_1$ and / or $y_2 - y_1$ A3 Points p and / or q plotted reasonably well for this part.A4 Identifies (x_1, y_1) and / or (x_2, y_2) in this part.*Worthless (0)*

W1 Use wrong formula e.g. midpoint formula.

W2 States given formula only.

Part (b) (iii)

5 marks

Att 2

(iii) ~~the~~ the equation of the line pq .

(b) (iii)

5 marks

Att 2

(iii) $(y - 5) = 6(x - 3)$

* Accept candidates slope from previous section.

Blunders (-3)

- B1 Correct answer without work (~~work~~).
- B2 Incorrect formula e.g. $y + y_1 = m(x + x_1)$ or $(x - x_1) = m(y - y_1)$
- B3 Switches x and y e.g. $y - 3 = 6(x - 5)$
- B4 Mathematical error.
- B5 $y = 6(x + c)$ and stops
- B6 Uses a point other than $(3,5)$ and $(1,-7)$ e.g. $(0,0)$.
- B7 $m \neq 6$

Slips (-1)

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

Attempts (2 marks)

- A1 Writes $m = 6$ and stops.
- A2 States $y = mx \pm c$ and stops
- A3 $-7 - 5 = 6(1 - 3)$, substitutes both points.

Note

$5 - y_1 = 6(3 - x_1)$ merits full marks.

Part (c) (i)

10 Marks

Att 3

- (c) (i) L is the line $7x - 2y + 14 = 0$.
 L cuts the x -axis at a , $(-2, 0)$ and the y -axis at b .
By letting $x = 0$, find the coordinates of b .

(c) (i)

10 Marks

Att 3

$x = 0$
 $7(0) - 2y + 14 = 0$
 $-2y = -14$
 $y = 7$

 $(0, 7)$

* Accept answer given as $y = 7$ with work shown

Blunders (-3)

- B1 Correct answer without work ($\cancel{\text{e}}$).
- B2 Substitutes $y = 0$ and continues.
- B3 Mathematical error.
- B4 Incorrect substitution and continues.

Slips (-1)

- S1 Numerical slips to a maximum of -3.
- S2 $7(0) = 7$
- S3 Stops at $\frac{14}{2}$ or $\frac{-14}{-2}$ with work.

Attempts (3 marks)

- A1 Substitutes $x = 0$ and stops.
- A2 Any correct manipulation of equation and stops e.g. $7x - 2y = -14$.
- A3 Substitutes $(-2, 0)$ into given equation.

Worthless (0)

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

Part (c) (ii)

5 Marks

Att 2

(ii) Find the image of the point a , under S_y , the axial symmetry in the y -axis.
--

(c) (ii)

5 Marks

Att 2

(ii) (2,0)

* Accept correct answer without work.

Blunders (-3)

B1 Writes answer as (0,2).

Attempts (2 marks)

A1 Draws x and y axes.

A2 Effort at finding image graphically.

Worthless (0)

W1 Incorrect answer with no work unless attempt mark applies.

W2 Substitutes $y = 0$ into equation and finds $x = -2$

QUESTION 6

Part (a)	15 marks	Att 5
Part (b)	20 marks	Att 6
Part (c)	15 marks	Att 5

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

<p>(a) The right-angled triangle abc has measurements as shown.</p>	
--	--

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

<p>(i) Write down the length of the side opposite the angle A.</p>
--

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

<p>(i) Length of the side opposite the angle A = 24</p>

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

Blunders (-3 marks)

B1 Writes down the length of the hypotenuse e.g. 25

Misreadings (-1)

M1 Treats angle A as the angle at point a giving 7 as the answer.

Attempts (3 marks)

- A1 Any mention of a correct trigonometric ratio.
- A2 Writes $[ab]$ or $[ba]$ or $[bc]$ or $[cb]$.

Worthless (0)

- W1 Incorrect answer with no work unless attempt mark applies.
- W2 Gives more than one answer.

Part (a) (ii)

5 Marks

Att 2

(ii)	Write down the value of $\tan A$, as a fraction.
------	---

(a)(ii)

5 Marks

Att 2

(ii)	$\frac{24}{7}$
------	----------------

- * Correct answer with no work merits full marks.
- * Accept consistent error from part (i)
- * Accept $\tan \frac{24}{7}$ for full marks.

Blunders (-3)

B1 Incorrect or inverted ratio e.g. $\tan A = \frac{7}{24}$.

B2 Gets \tan of angle *bac* (check is not consistent error from (i)).

Misreadings (-1)

M1 If a(i) not attempted and $\frac{7}{24}$ given as the answer.

Slips (-1)

S1 Answer = 3.4285 (answer not a fraction)

Attempts (2 marks)

A1 Any correct trigonometric ratio written down in answer box.

A2 Only gives answer = 73° or rounded to 74° or 16° for this part.

A3 Only gives answer = 0.0599113 i.e. $\tan \frac{24}{7}$

Worthless (0)

W1 Incorrect answer with no work unless attempt mark applies.

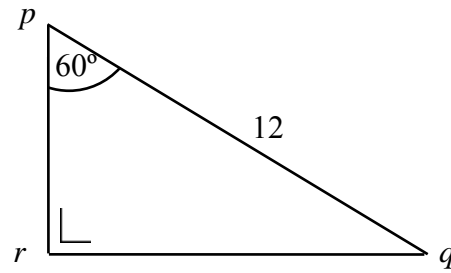
Part (b)

20 marks (10, 10)

Att 6 (3, 3)

(b) In the right-angled triangle pqr ,

$$|pq| = 12 \text{ and } |\angle qpr| = 60^\circ.$$



Part (b) (i)

10 marks

Att 3

(i) Write down the value of $\cos 60^\circ$.

b) (i)

10 marks

Att 3

(i) 0.5

* Correct answer with no work merits full marks.

* Accept $\cos \frac{1}{2}$ for full marks.

Blunders (-3)

B1 Gives $\cos 30^\circ = \frac{\sqrt{3}}{2}$ or 0.866 as the answer.

B2 Finds $\tan 60$ or $\sin 60$ and continues.

B3 $\cos 60 = \frac{pr}{12}$, or $\frac{pr}{12}$ on its own and stops.

B4 Uses radian or grad mode on calculator.

	RAD	GRAD
Cos 60	-0.952	0.5877

Attempts (3 marks)

A1 Writes $\cos 60 = \frac{pr}{pq}$, or $\frac{pr}{pq}$ on its own and stops.

A2 Gives $\angle pqr = 30^\circ$ and stops.

A3 Any correct trigonometric ratio written down.

A4 Correctly marks hypotenuse or opposite or adjacent on diagram and stops – first part of question.

A5 Some correct step.

Worthless (0)

W1 Incorrect answer with no work unless attempt mark or B4 applies.

Part (b) (ii)

10 marks

Att 3

(ii)

Calculate $|pr|$.

Part (b) (ii)

10 marks

Att 3

$$\cancel{\cos} \cos 60 = \frac{|pr|}{12} \quad \text{or} \quad 0.5 = \frac{|pr|}{12}$$

$$12 \cos 60 = |pr| \quad \text{or} \quad 12 \times 0.5 = |pr|$$

$$6 = |pr|$$

* Accept candidates answer from part (i).

Blunders (-3)

B1 Correct answer without work ($\cancel{\cos}$).

B2 Error in forming equation e.g. $\frac{12}{x} = 0.5$ and continues.

B3 Error in transposing equation.

Slips (-1 marks)

S1 Numerical slips to a maximum of -3.

Attempts (3 marks)

A1 Correct scale diagram.

A2 Any correct step e.g. $\frac{x}{12}$ and stops.

A3 Cos 60 or 0.5 or any correct trigonometric ratio.

Worthless (0)

W1 Incorrect answer with no work unless attempt mark applies.

W2 Answer = 3 cm (measured from examination paper).

Part (c)

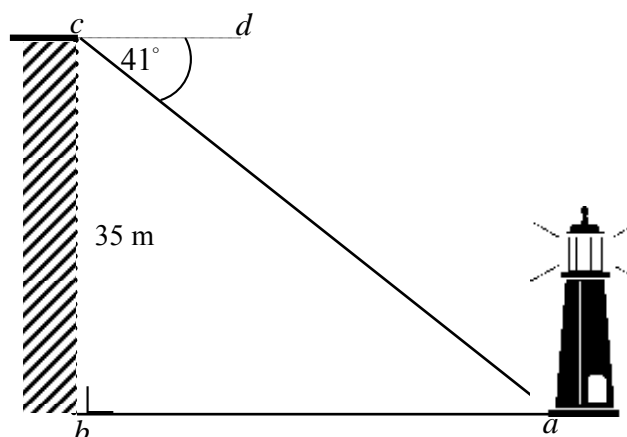
15 marks (10, 5)

Att 5 (3, 2)

- (c) Claire is at the point c on the top of a cliff.
The point b is at the base of the cliff.
The height of the cliff is 35 m, as shown in diagram.
She wishes to find $|ba|$, the distance from the base of the cliff to the base of the lighthouse.

She measured $\angle dca$ and found it to be 41° .

cd is parallel to ba .



Part (c) (i)

10 Marks

Att 3

(i)

Find $|\angle bac|$.

(c) (i)

10 Marks

Att 3

(i)

41°

* Correct answer with no work merits full marks.

Blunders (-3)

- B1 Gives answer as 49° with work.
- B2 3 angles of triangle $\neq 180^\circ$.
- B3 Mathematical error.

Slips (-1 marks)


- S1 Numerical slips to a maximum of -3.

Attempts (3 marks)

- A1 “3 angles of a triangle = 180° ” and stops.
- A2 Finds $\angle acb = 49^\circ$ and stops
- A3 Writes or indicates $\angle dcb = 90^\circ$.
- A4 Any relevant step.
- A5 Correct trigonometric ratio and stops.

Worthless (0)


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

-  (ii) Find, to the nearest metre, $|ba|$, the distance from the base of the cliff to the base of the lighthouse

(c) (ii)

5 Marks

Att 2


$$\tan 41 = \frac{35}{|ba|}$$


$$|ba| \tan 41 = 35$$

$$|ba| = \frac{35}{\tan 41}$$

$$|ba| = 40 \text{ m}$$

* Accept candidates answer from part (i).

Blunders (-3)

- B1 Correct answer without work ().
 B2 Incorrect trigonometric ratio.
 B3 Decimal error.
 B4 Mathematical error.
 B5 Uses radian or grad mode on calculator.
 B6 Incorrect transposition.

	RAD	GRAD
Tan 49	-3.1729	0.9690
Tan 41	0.1606	0.7508

Slips (-1 marks)

- S1 Numerical slips to a maximum of -3.
 S2 Fails to round off or rounds off incorrectly.
 S3 Obvious slip in reading tables or calculator.
 S4 Calculates $|ac|$ correctly.

Attempts (2 marks)

- A1 Any correct trigonometric ratio written down.
 A2 Some use of sin/cos/tan.
 A3 Finds the third angle of the triangle and stops – must be in the answer box.
 A4 correct scale diagram.
 A5 Any relevant step.

Worthless (0)

- W1 Incorrect answer with no work unless attempt mark applies.
 W2 $|ba|=6$ cm, measured off examination paper.