Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE 2008

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.

QUESTION 1

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

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

Add 430 cm to 179 cm and give your answer in metres.

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

✍ $430 + 179 = 609cm$

$\frac{609}{100}$

$6 \cdot 09\, m$

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

Blunders (-3)

B1 Correct answer without work ✍

B2 Incorrect conversion or no conversion

B3 Incorrect mathematical operation with work and continues correctly e.g. multiplies instead of adds.

B4 Decimal error

B5 $430 + 179 = 609$ = 6 m 9 cm and stops

Slips (-1)

S1 Numerical slips to a maximum of -3

S2 Leaves answer as $\frac{609}{100}$

Attempts (3 marks)

A1 Some correct step with work.

A2 Converts one or both to metres correctly and stops e.g. 4·30m

A3 States 100cm = 1m and stops.

A4 Some correct effort at conversion and stops e.g. $\frac{430}{100}$.

A5 609 without work and stops

A6 $430 + 179$ and stops.

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

Part (b) **25(10, 10, 5) marks** **Att 8(3, 3, 2)**

A bus leaves Sligo at 11:45 and arrives in Derry at 14:15.

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

How long does the bus journey take?
Give your answer in hours and minutes.

$14:15 - 11:45$ or $13:75 - 11:45$
$= 2:30$ $= 2:30$

* Accept answer in twelve hour clock format.
* Do not penalise the same error twice in part (b)

Blunders (-3)

B1 Correct answer without work
B2 Incorrect mathematical operation with work and continues.
B3 Error in converting hours to minutes or no conversion.
B4 Incorrectly converts to a twelve hour format and continues.

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

Attempts (3 marks)
A1 Some correct step with work
A2 States 1 hour = 60 minutes and stops.
A3 Writes $11:45 - 14:15 = 3:30$

Worthless (0)
W1 Incorrect answer without work unless attempt mark applies e.g. $3:10$

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

The bus travels a distance of 135 km.

Calculate the average speed, in km/h, for the journey from Sligo to Derry

2 hours 30 minutes = 2·5 hours

$$\text{Average Speed} = \frac{D}{T}$$

$$= \frac{135}{2{\cdot}5}$$

$$= 54$$

* Accept candidates answer in part (i)
* Accept ratio method.

Blunders (-3)

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

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

Attempts (3 marks)
A1 Some correct step with work e.g. 2 hours 30 minutes = 2·5 hours
A2 States 1 hour = 60 minutes and stops.
A3 Correct formula and stops.

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

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

The bus uses 1 litre of diesel for every 4·5 km travelled.
On a particular day, diesel cost 115·9 cent per litre.
Find the cost of the diesel used by the bus on that day
for the journey from Sligo to Derry.
Give your answer correct to the nearest euro.

$$\text{No. of litres required} = \frac{135}{4{\cdot}5} = 30$$

$$\text{Cost} = 30 \times 115{\cdot}9$$
$$= 3477 \text{ or } 34{\cdot}77$$
$$= €35$$

Blunders (-3)

B1 Correct answer without work 
B2 Incorrect mathematical operation with work and continues.
B3 Decimal error.
B4 Mathematical Error

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 e.g. $\frac{135}{4 \cdot 5}$ and stops.
A2 Answer given as 30 with or without work and stops.
A3 Writes $135 \times 115 \cdot 9$ or $4 \cdot 5 \times 115 \cdot 9$ and stops.

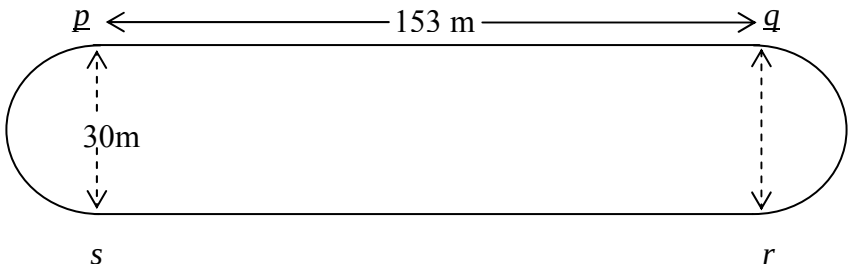
Worthless (0)
W1 Incorrect answer without work unless attempt mark applies.

Part (c) **15 (5, 5, 5) marks** **Att 6(2, 2, 2)**

An athletics track has two equal parallel sides [*pq*] and [*sr*]

and two equal semi-circular ends with diameters [*ps*] and [*qr*].

$|pq| = |sr| = 153$ metres, and $|ps| = |qr| = 30$ metres.



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

Taking π as $3{\cdot}14$, calculate the length of one of the semi-circular ends,

correct to the nearest metre.

Length = πr

= 3.14×15

= $47{\cdot}1$

= 47m

Blunders (-3)

B1 Correct answer without work

B2 Incorrect mathematical operation with work and continues.

B3 Incorrect relevant formula e.g. $2\pi r$. or πr^2

B4 Incorrect substitution and continues e.g $r = 30$.

B5 $\pi \neq 3{\cdot}14$ or answer given in terms of π

B6 Decimal Error

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 r =15 and stops or 15 without work.

A3 Correct formula or $2\pi r$ and stops.

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

W2 Incorrect formula without work.

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

Calculate the total length of one lap of the track,
correct to the nearest metre.

Length = $153 + 153 + 47 + 47$
= 400 m

* Accept candidates answer from part (i)

Blunders (-3)

B1 Correct answer without work
B2 Incorrect mathematical operation and continues.
B3 Omits one or more lengths.

Slips (-1)
S1 Numerical slips to a maximum of -3.
S2 Fails to add.

Attempts (2 marks)
A1 Some correct step with work e.g. $153 + 153$ and stops
A2 Writes 47 and/or 94 and stops
A3 Recognises 153 as part of the answer e.g. $153 + ...$ and stops or 153 on its own.

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

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

Noirín ran a 5000 metre race on the above track in 15 minutes.
Calculate, in seconds, the average time it took Noirín to complete one lap of the track during that race.

✍

1 metre in $\frac{15}{5000}$ 400 metres in $\frac{15}{5000}\times 400$ = 1·2 minutes = 72 seconds.	$\frac{5000}{400}$ = 12·5 $\frac{15}{12.5}\times 60$ = 72 seconds

* Accept candidates answers from part (ii).

Blunders (-3)

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

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

Attempts (2 marks)
A1 Some correct step with work.
A2 States 1minute = 60 seconds.
A3 Writes $\frac{15}{5000}$ and stops.

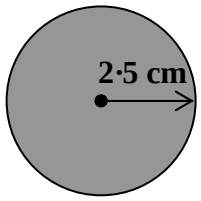
Worthless (0)
W1 Incorrect answer without work unless attempt mark applies.

QUESTION 2

Part (a)	**10 marks**	**Att 3**
Part (b)	**20(15,5) marks**	**Att 7(5,2)**
Part (c)	**20(10,5,5) marks**	**Att 7(3,2,2)**

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

A disc has a radius of 2·5 cm.



Taking π as 3·14, calculate, in cm^2, the area of the disc

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

Area of disc $= \pi r^2$

$= 3 \cdot 14 \times 2 \cdot 5 \times 2 \cdot 5$

$= 19 \cdot 625 \text{ cm}^2$

Blunders (-3)

B1 Correct answer without work

B2 Incorrect substitution and continues correctly

B3 Mathematical error e.g. $(2 \cdot 5)^2 = 5$

B4 Incorrect relevant formula and continues e.g. $2\pi r$ or a multiple of πr^2

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 Some correct step with work and stops e.g. πr^2

A2 $3 \cdot 14 \times 2 \cdot 5$ with or without answer of 7·85.

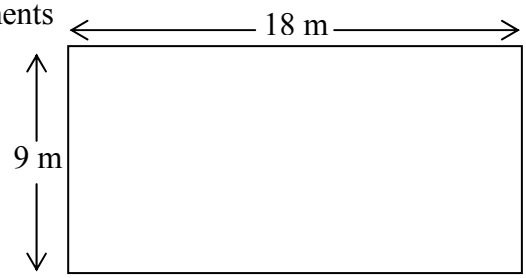
A3 Writes $(2 \cdot 5\ )^2$ and stops.

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

Part (b) **20 marks (15, 5)** **Att 7 (5, 2)**

A rectangular garden has measurements as shown.



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

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

Area = 18×9 = $162\,m^2$

Blunders (-3)

B1 Correct answer without work
B2 Incorrect substitution or omission or extra, each time and continues.
B3 Incorrect mathematical operation and continues.
B4 Incorrect relevant formula and continues.
B5 Correctly finds the perimeter and continues.

Slips (-1)

S1 Numerical slips to a maximum of -3
S2 Leaves answer as 18×9

Attempts (5 marks)

A1 Some correct step with work and stops.
A2 Correct formula e.g. $L \times B$ and stops.

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.
W2 Use of formula involving π
W3 $L \times L$ and stops.

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

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The garden is to be covered completely with square concrete slabs each of side 50 cm . Find the number of slabs required to cover the garden

Area of one slab	=	$0\cdot5\times0\cdot5$	=	$0\cdot25\,m^2$	or	36×18
Area of garden			=	$162\,m^2$		$=648$
Number of slabs	=	$\frac{162}{0\cdot25}$	=	648.		

* Accept candidates answer from part (i).

Blunders (-3)

B1 Correct answer without work

B2 Mathematical error

B3 Incorrect relevant formula and continues

B4 Incorrect mathematical operation and continues e.g. $162\times0\cdot25=40\cdot5$

B5 Decimal error.

Slips (-1)

S1 Numerical slips to a maximum of -3

Attempts (2 marks)

A1 Some correct step with work and stops.

A2 Correct formula for area of square or rectangle and stops.

A3 Converts 50cm to metres correctly and stops.

A4 Writes 162 or candidates answer from part (i) and stops.

A5 Writes 36 and / or 18 and stops.

A6 Writes $\frac{162\times100}{50}$ with or without answer

A7 Writes $\frac{162}{0\cdot5}$ with or without answer.

Worthless (0)

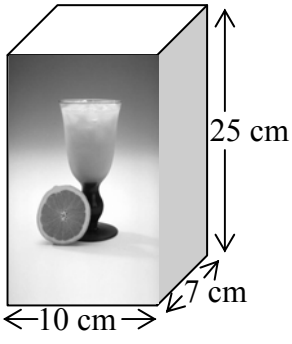
W1 Incorrect answer without work unless attempt mark applies.

W2 Use of formula involving π

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

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

A rectangular carton full of orange juice measures 10 cm by 7 cm by 25 cm.
Find, in cm^3, the volume of orange juice in the carton



Volume = $10 \times 7 \times 25$

= $1750\ cm^3$

Blunders (-3)

B1 Correct answer without work
B2 Incorrect substitution or omission or extra, each time and continues.
B3 Mathematical error
B4 Incorrect relevant formula and continues e.g. surface area and continues.
B5 Leaves answer as $10 \times 7 \times 25$

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

Attempts (3 marks)
A1 Some correct step with work and stops.
A2 Correct formula for volume of rectangular solid and stops.
A3 Writes $10 + 7 + 25 = 42$

Worthless (0)
W1 Incorrect answer without work unless attempt mark applies.
W2 Use of formula involving π
W3 Writes $10 + 7 + 25$ and stops.
W4 Writes 42 without work

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

The orange juice fills 14 cylindrical glasses exactly.
Find, in cm^3, the volume of each glass

$$\text{Volume of glass} = \frac{1750}{14}$$
$$= 125\ cm^3$$

* Accept candidates answer from part (i)

Blunders (-3)

B1 Correct answer without work

B2 Incorrect mathematical operation and continues e.g 1750×14

Slips (-1)

S1 Numerical slips to a maximum of -3

S2 $\frac{1750}{14}$ and stops.

Attempts (2 marks)

A1 Some correct step with work and stops

A2 Writes 1750 and stops.

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

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

The radius of each glass is 2·4 cm. Taking π as 3·14,.
calculate the height of each glass, correct to the nearest cm.

$$\begin{aligned} \pi r^2 h &= 125 \\ (3{\cdot}14)(2{\cdot}4)(2{\cdot}4)(h) &= 125 \\ h &= \frac{125}{(3\cdot14)(2\cdot4)(2\cdot4)} \\ &= 6{\cdot}91 \\ &= 7 \text{ cm} \end{aligned}$$

* Accept candidates answer from part (ii)

Blunders (-3)

B1 Correct answer without work

B2 Incorrect relevant cylinder formula with work e.g. $2\pi r h$.

B3 Incorrect substitution.

B4 Mathematical error

B5 Transposition error

B6 $\pi \neq 3\cdot14$ or answer given in terms of π

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 and stops.

A2 A correct substitution and stops.

A3 Use of the answer from part (ii) e.g. $\frac{125}{2\cdot4}$

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

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

Find the mode of the numbers: 11, 6, 8, 6, 11, 4, 6, 3, 8.

Mode = 6

***** Accept correct answer without work.

Blunders (-3)

B1 Gives 3 as the mode with explanation e.g. "because 6 occurs 3 times"
B2 Finds mean of the given numbers e.g. 7

Attempts (3 marks)

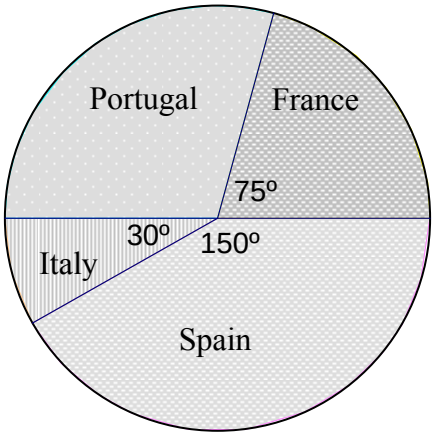
A1 Some correct step and stops.
A2 Writes, "mode means most".
A3 Writes 11 + 6 + 8 + 6 + 11 + 4 + 6 + 3 + 8 and / or 63 and stops.
A4 Writes 9 or 3 or 63 and stops.
A5 Rearranges the numbers in order and stops.

Worthless (0)

W1 Incorrect answer without work unless attempt mark or B2 applies.
W2 Just a list of numbers e.g. 6, 1, 5..

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

A group of people was surveyed to find which country was their preferred holiday destination+ The pie chart represents the result of that survey



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

What is the measure of the angle for Portugal?

$75 + 150 + 30 = 255$ or $180 - 75$
$360 - 255$ 105
105

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

Blunders (-3)

B1 Correct answer without work
B2 Angle at centre of circle $\neq 360°$
B3 Straight line angle $\neq 180°$
B4 Each angle omitted.

Slips (-1)
S1 Numerical slips to a maximum of -3
S2 Writes $360 - 255$ or $180 - 75$ and stops

Attempts (3 marks)
A1 Some correct step with work and stops e.g. $75 + 30 = 105$
A2 States "Straight line = 180° " or similar and stops
A3 States "Angle at centre of circle = 360° " or similar and stops.
A4 Writes 255 and stops.

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

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

10 people replied that Italy was their favourite holiday destination
How many people were surveyed?

$30° = 10$

$1° = \frac{10}{30}$

$360° = \frac{10}{30} \times 360$

$= 120$

or

$30° = \frac{1}{12}$ of 360

$12 \times 10 = 120$

Blunders (-3)

B1 Correct answer without work

B2 Incorrect ratio

B3 Mathematical error

B4 Decimal error.

Slips (-1)

S1 Numerical slips to a maximum of -3

S2 12×10 and stops

Attempts (2 marks)

A1 Some relevant step with work

A2 Writes $30°$ or $360°$ and / or $\frac{1}{12}$ or $\frac{1}{3}$ and stops

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

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

How many gave Spain as their reply?

✍	$\frac{150}{360}\times 120$	**or**	$30°$	=	10
			$150°$	=	10×5
	= 50			=	50

* Accept candidates answer in part (ii)

Blunders (-3)

B1 Correct answer without work ✍
B2 Incorrect ratio
B3 Mathematical error.
B4 Decimal error.

Slips (-1)
S1 Numerical slips to a maximum of -3.
S2 Writes 10×5 and stops.
S3 Early round off.

Misreading (-1)
M1 Gives correct answer for France or Portugal with work e.g. 25 or 35.

Attempts (2 marks)
A1 Some correct step with work and stops
A2 Writes 150, 360 or 120 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)**

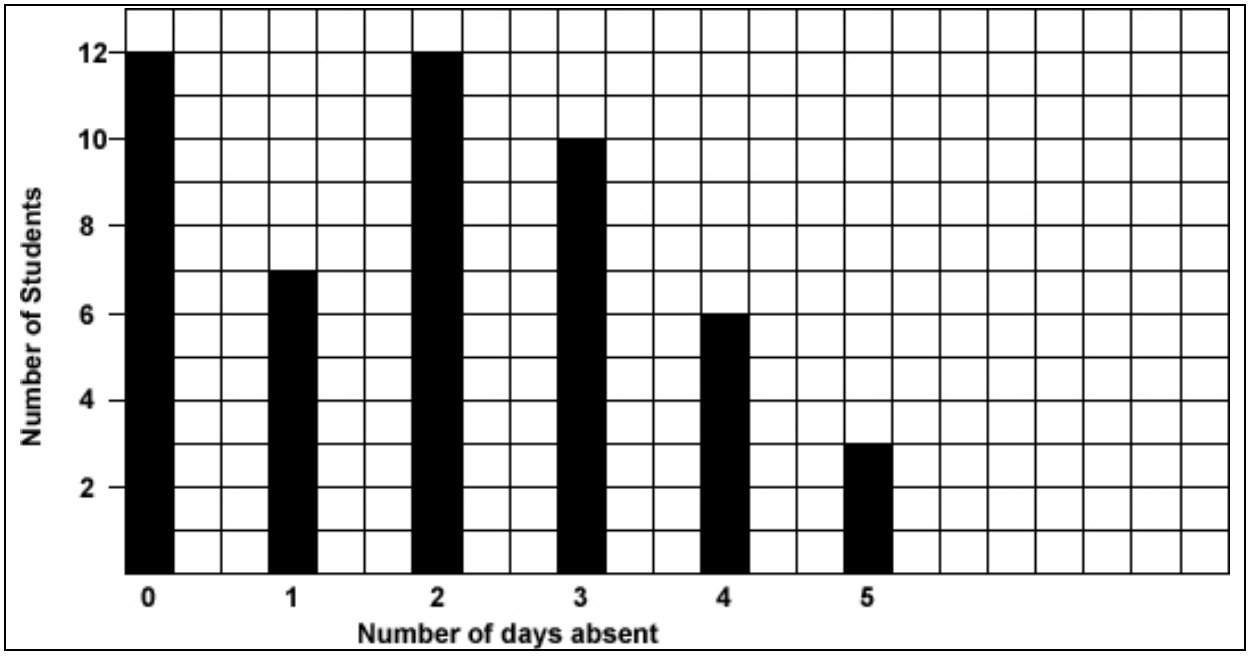
At the end of a month 50 students wrote down the number of days they were absent from school during that particular month.

The results are shown in the following table:

Number of days absent	0	1	2	3	4	5
Number of students	12	7	12	10	6	3

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

Draw a bar chart of the data.



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

Blunders (-3)
B1 Axis with student numbers not graduated uniformly.
B2 Reverse variable and frequency when drawn.
B3 Draws a trend graph or pie chart.

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

Attempts (3 marks)
A1 Graduated axis or axes only.

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

Find the mean number of days absent per student.

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$= \frac{(0\times 12)+(1\times 7)+(2\times 12)+(3\times 10)+(4\times 6)+(5\times 3)}{12+7+12+10+6+3}$$

$$= \frac{0+7+24+30+24+15}{50}$$

$$= \frac{100}{50}$$

$$= 2$$

Blunders (-3)

B1 Correct answer without work

B2 Incorrect mathematical operation in numerator or denominator.

B3 Incorrect denominator or no denominator e.g. $\frac{100}{12}$

B4 Inverted fraction.

B5 Frequencies omitted in numerator

B6 Omits 2 or more values in numerator.

Slips (-1)

S1 Numerical slips to a maximum of -3.

S2 $\frac{100}{50}$ and stops.

S3 Omits one value in numerator with work.

Attempts (2 marks)

A1 Some correct step with work and stops e.g. $12 + 7 + 12 + 10 + 6 + 3$ and/or 50.

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

A3 A relevant multiplication and stops.

A4 Average of the frequencies e.g. $\frac{12 + 7 + 12 + 10 + 6 + 3}{6} = \frac{50}{6}$

A5 $\frac{0 + 1 + 2 + 3 + 4 + 5}{6} = \frac{15}{6}$.

A6 100 or 50 without work.

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

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

Find the percentage of students who were absent for three or more days.

Number of students absent = $10 + 6 + 3 = 19$

Percentage = $\frac{19}{50} \times 100$

= $38\ \%$

Blunders (-3)

B1 Correct answer without work

B2 Incorrect mathematical operation.

B3 Omits the 100 or divides by the 100.

B4 Omits an entry or inserts an incorrect entry in the addition

B5 Leave answer as $\frac{19}{50} \times 100$

B6 Decimal error

Slips (-1)

S1 Numerical slips to a maximum of -3.

S2 Writes 19×2 and stops.

Attempts (2 marks)

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

A2 Writes any of the following numbers; 10, 6, 3, 19, 50, 100.

Worthless (0)

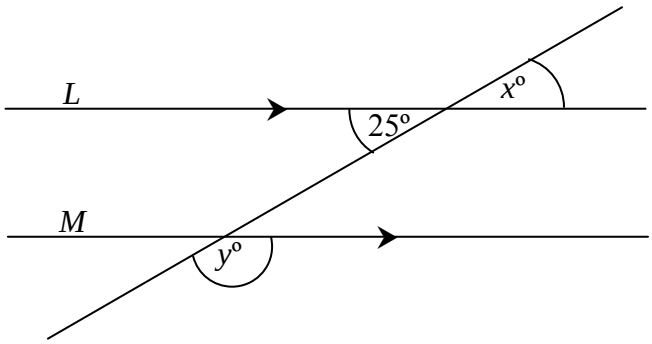
W1 Incorrect answer without work unless attempt mark applies.

QUESTION 4

Part (a)	**10 marks**	**Att 3**
Part (b)	**25 (10,5,5,5) marks**	**Att 9(3,2,2,2)**
Part (c)	**15 (5,5,5) marks**	**Att 6(2,2,2)**

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

L and *M* are parallel lines.
Find the value of *x* and the value of *y* in the diagram



$x = 25°$ $y = 180 - 25$
$155°$

* Accept correct answer marked / indicated on a diagram
* Accept correct answer without work

Blunders (-3)
B1 Straight line angle $\neq 180°$
B2 Finds one value only
B3 Writes $x = 155°$ and $y = 25°$

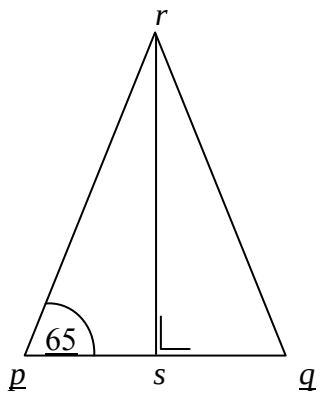
Slips (-1)
S1 Numerical slips to a maximum of -3.
.

Attempts (3 marks)
A1 Some correct step and stops e.g. 180º.
A2 States "Straight line angle = 180º" or similar and stops.
A3 States "Vertically opposite angles are equal" or similar and stops.
A4 Uses an arbitrary value for *x* or *y* with relevant work.
A5 $y = 25º$.
A6 $x = 155º$.

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

Part (b) **25 marks (10, 5, 5, 5)** **Att 9 (3, 2, 2, 2)**

pqr is an isosceles triangle with $|rp| = |rq|$, $rs \perp pq$ and $|\angle rpq| = 65°$



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

Find $|\angle pqr|$ and give a reason for your answer

$|\angle pqr| = 65°$

Reason: Base angles in an isosceles triangle are equal

* Accept correct answer marked / indicated on a diagram
* Accept correct answer without work

Blunders (-3)

B1 States $|\angle prq| = 65°$ and continues to get $|\angle pqr| = 50°$

B2 Sum of angles in a triangle $\neq 180°$

B3 Correct answer without a reason or with an incorrect reason.

Attempts (3 marks)

A1 Some correct step with work and stops e.g. Finds $|\angle prs| = 25°$

A2 Indicates clearly $\angle pqr$ on the diagram

A3 Marks $|rp| = |rq|$ on the diagram.

A4 Correct reason only given.

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

W2 Diagram reproduced without modification.

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

Find $|\angle prq|$.

$|\angle prq| = 180 - 65 - 65 = 50°$ **or** $\angle prq = 2\angle prs = 2(90 - 65) = 2(25) = 50°$

* Accept correct answer marked / indicated on a diagram
* Accept correct answer without work
*Accept candidates answer from part (i)

Blunders (-3)
B1 Sum of angles in a triangle $\neq 180°$
B2 Mathematical error.

Attempts (2 marks)
A1 Some correct step and stops e.g. 180º or 25º or 90º or 130º.
A2 States "Sum of angles in a triangle = 180º" or similar.
A3 Clearly indicates $\angle prq$ on a diagram drawn in answer box.

Worthless (0)
W1 Incorrect answer without work unless attempt mark applies.
W2 Diagram reproduced without modification.

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

Given that $|pq| = 5{\cdot}8$ cm and $|rs| = 6{\cdot}2$ cm,
find the area of the $\Delta\, pqr$ in cm^2.

Area	=	$\frac{1}{2}(base)(height)$
	=	$\frac{1}{2}(5\cdot 8)(6\cdot 2)$
	=	$\frac{1}{2}(35\cdot 96)$
	=	$17{\cdot}98\ cm^2$

Blunders (-3)

B1 Correct answer without work

B2 Incorrect relevant formula and continues e.g. $\frac{1}{2}$ omitted

B3 Incorrect mathematical operation

B4 Decimal error.

Slips (-1)

S1 Numerical slips to a maximum of -3.

Attempts (2 marks)

A1 Some correct step with work and stops .

A2 Correct formula for area of triangle and stops.

A3 Writes 5.8×6.2 and stops.

A4 Indicates on diagram $|pq| = 5\cdot 8$ and/or $|rs| = 6\cdot 2$ in this answer box.

Worthless (0)

W1 Incorrect answer without work unless attempt mark applies.

W2 Diagram reproduced without modification.

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

Show that $\Delta\, prs$ and $\Delta\, qrs$ are congruent.

✍	$\lvert rp\rvert = \lvert rq\rvert$	or $\lvert\angle rpq\rvert = \lvert\angle rqp\rvert$	or $\lvert rp\rvert = \lvert rq\rvert$
	$\lvert rs\rvert = \lvert rs\rvert$ common side.	$\lvert rp\rvert = \lvert rq\rvert$	$\lvert\angle prs\rvert = \lvert\angle qrs\rvert$
	$\lvert\angle rsp\rvert = \lvert\angle rsq\rvert$	$\lvert\angle prs\rvert = \lvert\angle qrs\rvert$	$\lvert rs\rvert = \lvert rs\rvert$

* Accept correct answer marked or indicated on a diagram.

Blunders (-3)

B1 Each step omitted.

Attempts (2 marks)

A1 Some correct step with work and stops.
A2 States same shape or SSS or ASA or SAS or RHS.
A3 States triangles fold onto each other.
A4 Clearly indicates the two required triangles in the answer box for this part.

Worthless (0)

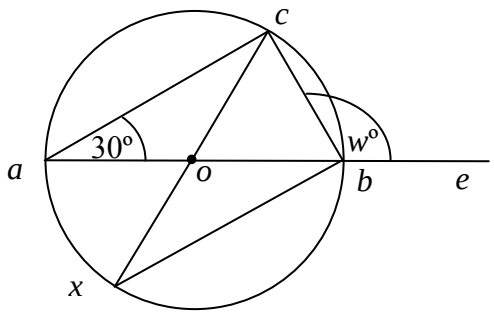
W1 Diagram reproduced without modification.

Part (c) **15 marks (5, 5, 5)** **Att 8 (2, 2, 2)**

a, b, c and x are points on a circle with centre o.

as shown. $|\angle bac| = 30°$, $|\angle cbe| = w°$.

.



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

Name the image of $\Delta\, aoc$ under S_o, the central symmetry in o.

$\Delta\, box$

* Accept $\Delta\, box$ with points in any order.

* Accept $a \to b$, $o \to o$ and $c \to x$.

* Accept diagram with correct indication / shading.

Blunders (-3)

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

Attempts (2 marks)

A1 Some correct step with work and stops.

A2 Shows some knowledge of central symmetry and stops.

A3 States that the image is a triangle.

A4 Finds the image of one or two points correctly e.g. $o \to o$ or $ao \to ox$

A5 If b, o or x appears in any group of letters.

Worthless (0)

W1 Diagram reproduced without modification.

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

Find the value of w.

$30 + 90 + \lvert\angle abc\rvert$	=	180º
$\lvert\angle abc\rvert$	=	180-120
$\lvert\angle abc\rvert$	=	60º
180	=	$60 + w$
120	=	w

Blunders (-3)

B1 Correct answer without work

B2 Straight line angle $\neq 180°$.

B3 Transposition error.

B4 Error in finding $\lvert\angle abc\rvert$

B5 Sum of angles in triangle $\neq 180°$

Slips (-1)

S1 Numerical slips to a maximum of -3.

S2 $180 - 60$ and stops.

Attempts (2 marks)

A1 Some correct step with work and stops.

A2 Writes down or indicates that $\lvert\angle acb\rvert = 90°$.

A3 States "angles in a straight line = 180º" or similar and stops.

A4 States "sum of 3 angles in a triangle $= 180°$" or similar and stops.

A5 Writes $30 + 90$ and stops.

A6 $180 - 30$ or $180 - 90$ or 180 and stops.

Worthless (0)

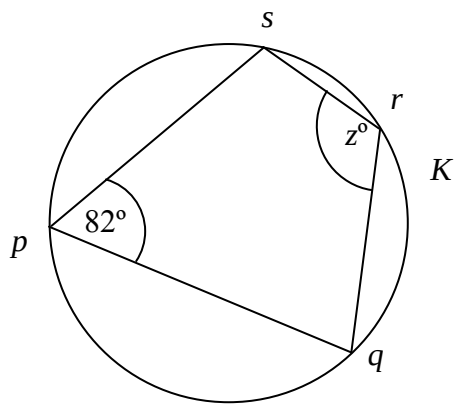
W1 Incorrect answer without work unless attempt mark applies

W2 Diagram reproduced without modification.

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

pqrs is a cyclic quadrilateral of the circle *K*

$|\angle spq| = 82^o$ and $|\angle srq| = z^o$.



Find the value of *z*.

$z =$ 180 - 82 = 98º

* Accept correct answer marked / indicated on a diagram
* Accept correct answer without work

Blunders (-3)
B1 Opposite angles $\neq 180°$

Slips (-1)
S1 Numerical slips to a maximum of -3.
S2 Writes $180 - 82$ and stops.

Attempts (2 marks)
A1 Some correct step with work and stops.
A2 States "opposite angles of cyclic quadrilateral = 180º" or similar and stops.
A3 Writes 180° or 360º or 164º and stops.

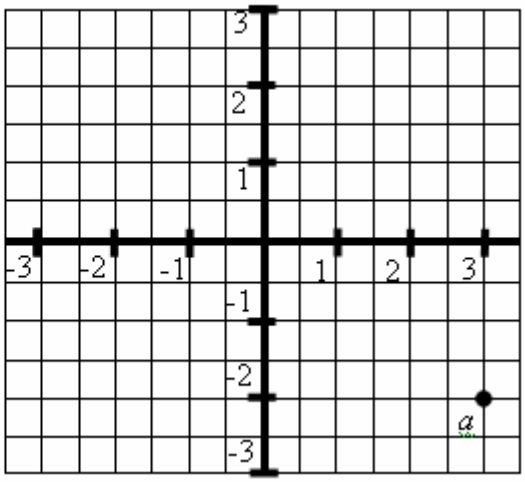
Worthless (0)
W1 Incorrect answer without work unless attempt mark applies
W2 Diagram reproduced without modification.

QUESTION 5

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

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

Write down the coordinates of the point *a*.



b.

a = (3,-2)

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

Blunders (-3)
B1 Incorrect order in couple (-2,3) .
B2 Incorrect x ordinate, if not sign error, subject to B1.
B3 Incorrect y ordinate, if not sign error, subject to B1.
B4 x = 3 and stops or y = -2 and stops

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

Attempts (3 marks)
A1 Draws a line through 3 and / or -2

Worthless (0)
W1 3 on its own with no work
W2 -2 on its own with no work

Notes:

(3,4): B3	(-3,2): S1,S2	(2,3): B2,B3
(3,0): B3	(0,2): S1,B2	(-2,-3): B2,B3
(3,2): S2	(4,4): B2,B3	(-2,3): B1

Part (b) **25 marks (10, 10, 5)** **Att 8 (3, 3, 2)**

p is the point (1, 2) and *q* is the point (5, -8). Find each of the following:

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

the midpoint of $[pq]$

$$(\frac{1+5}{2}, \frac{2-8}{2})$$
$$= (\frac{6}{2}, \frac{-6}{2})$$
$$= (3,-3)$$

* Accept translation method.
* No penalty on brackets.

Blunders (-3)

B1 Correct answer without work

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

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

B4 Two or more signs incorrect in substitution and continues.

B5 Reversal of coordinates i.e. (-3, 3) with work.

B6 One ordinate only worked out correctly.

B7 Uses one of the given points and some arbitrary point e.g. (1, 2) and (0,0) and continues.

B8 Mathematical error e.g. Sign rules

Slips (-1)

S1 Numerical slips to a maximum of -3.

S2 Error in one sign in midpoint formula and continues.

S3 One incorrect substitution or sign when substituting e.g. $\left(\frac{1+5}{2}, \frac{2+8}{2}\right)$ and continues

S4 Takes (1,2) as midpoint and finds extremity e.g. $(5,-8) \rightarrow (1,2) \rightarrow (-3,12)$ or takes (5,-8) as midpoint and finds extremity e.g. $(1,2) \rightarrow (5,-8) \rightarrow (9,-18)$

Attempts (3 marks)

A1 Some correct substitution

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

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

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

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

Worthless (0)

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

W2 Writes midpoint formula and stops.

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

✍ **(ii)** the slope of *pq*

✍ $\left(\frac{2+8}{1-5}\right) = \frac{10}{-4}$ or $\frac{-5}{2}$ or -2·5 **OR** $\left(\frac{-8-2}{5-1}\right) = \frac{-10}{4}$ or $\frac{-5}{2}$ or -2·5

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

* Accept correct trigonometric method i.e. $\tan\theta = \frac{-5}{2}$.

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 $\frac{horizontal}{vertical}$ or $\tan\theta = \frac{adjacent}{opposite}$ and continues.

B3 Incorrectly treats couples as (x_1, x_2) and (y_1, y_2) if not already penalised e.g. $\frac{5+8}{1-2}$ or $\frac{1-2}{5+8}$

B4 Mathematical error e.g. sign rules.

B5 Uses one of the given point and some arbitrary point e.g. (1, 2) and (0,0) and continues.

B6 Error in more than one sign when substituting.

Slips (-1)

S1 Numerical slips to a maximum of -3.

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

S3 One incorrect substitution or sign for substituting.

Attempts (3 marks)

A1 Some correct step with work and stops.

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

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

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

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

Worthless (0)

W1 Use wrong formula e.g. midpoint formula.

W2 States given formula only.

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

(iii) the length of $[pq]$

$\lvert pq\rvert$	=	$\sqrt{(1-5)^2+(2+8)^2}$	$\lvert pq\rvert$	=	$\sqrt{(5-1)^2+(-8-2)^2}$
	=	$\sqrt{(-4)^2+(10)^2}$		=	$\sqrt{(4)^2+(-10)^2}$
	=	$\sqrt{(16+100)}$		=	$\sqrt{(16+100)}$
	=	$\sqrt{116}$ or 10·77		=	$\sqrt{116}$ or 10·77

* Accept correct use of Pythagoras.

Blunders (-3)

B1 Correct answer without work.

B2 Incorrect formula e.g. $\sqrt{(x_2-x_1)^2-(y_2-y_1)^2}$ or $\sqrt{(x_2+x_1)^2+(y_2+y_1)^2}$ or omits square root sign or squares and continues.

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

B4 Mathematical error e.g. $4^2 = 8$

B5 Two or more signs in substitution.

Slips (-1)

S1 Numerical slips to a maximum of -3.

S2 Error in one sign in $(x_2 - x_1)$ or $(y_2 - y_1)$ in formula.

S3 One incorrect substitution or sign when substituting.

Attempts (2 marks)

A1 Some correct step with work.

A2 Some correct substitution into a formula with $x_2 - x_1$ and/or $y_2 - y_1$

A3 States theorem of Pythagoras and stops.

A4 Point *p* and or *q* plotted reasonably well (for this part)

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

Worthless (0 marks)

W1 Use of wrong formula e.g. midpoint formula.

W2 Incorrect answer without work unless attempt mark applies.

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

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

The line L contains the point (2, 1)
L has a slope of 3.
Find the equation of L.

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

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

Blunders (-3)

B1 Correct answer without work.
B2 Incorrect formula e.g. $y + y_1 = m(x + x_1)$ or $(x - x_1) = m(y - y_1)$ and continues.
B3 Switches x and y e.g. $y - 2 = 3(x - 1)$
B4 Mathematical error.
B5 $y = 3(x + c)$ and stops
B6 Uses a point other than (2, 1) e.g. (0,0).
B7 $m \neq 3$

Slips (-1)
S1 Numerical slips to a maximum of -3.
S2 Error in one sign in formula.
S3 One incorrect substitution or sign when substituting.

Attempts (3 marks)
A1 Some correct step with work.
A2 Writes $m = 3$ and stops.
A3 States $y = mx \pm c$ and stops
.

Worthless (0 marks)
W1 Use of wrong formula
W2 States given formula only.

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

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

By letting $y = 0$, find the coordinates of *p,* the point of intersection of the line *L* and the *x*-axis.

$$\begin{aligned} y\text{-}1 &= 3(x\text{-}2) \\ 0\text{-}1 &= 3x\text{-}6 \\ 5 &= 3x \\ \frac{5}{3} &= x \end{aligned}$$

$p = (\frac{5}{3},0)$ or $(1\frac{2}{3},0)$

* Accept candidates answer from part (i)

* Accept answer given as $x = \frac{5}{3}$ 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 (2 marks)

A1 Some correct step with work and stops.

A2 Substitutes $y = 0$ and stops.

A3 Writes $y - 1 = 3(x - 2)$ and stops.

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

Worthless (0)

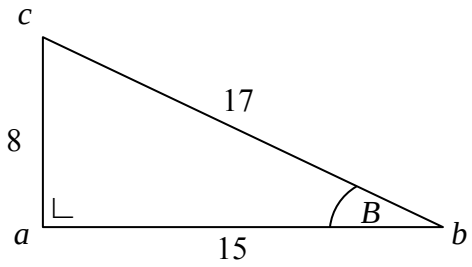
W1 Incorrect answer with no work unless attempt mark applies.

QUESTION 6

Part (a)	**15 (10,5) marks**	**Att 5(3,2)**
Part (b)	**20 (10,5,5) marks**	**Att 7(3,2,2)**
Part (c)	**15 (10,5) marks**	**Att 5(3,2)**

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

The right-angled triangle *abc* has measurements as shown.



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

Write down the length of the hypotenuse of the Δabc.

Length of the hypotenuse of the $\Delta abc = 17$

* Correct answer with no work merits full marks.
* Indicates 17 only in diagram, or "h" or "hypotenuse", accept for 10 marks.

Blunders (-3 marks)
B1 Gives answer as [*bc*].

Attempts (3 marks)
A1 Any mention of a correct trigonometric ratio.
A2 Gives answer as 8 or 15.

Worthless (0)
W1 Incorrect answer with no work unless attempt mark applies.
W2 Gives more than one answer.
W3 Answer measured from examination paper.

Part (a) (ii) **5 Marks** **Att 2**

Write down the value of sin B, as a fraction.

$\sin B = \frac{8}{17}$

* Correct answer with no work merits full marks.
* Accept consistent error from part (i)
* Accept $\sin\frac{8}{17}$ for full marks.

Blunders (-3)

B1 Incorrect or inverted ratio e.g. $\sin B = \frac{17}{8}$.

B2 Gets $\sin \angle acb$ (check is not consistent error from (i)).

Slips (-1)

S1 Answer = 0.47 (answer not a fraction)

Attempts (2 marks)

A1 Any correct trigonometric ratio written down in answer box.

A2 Only gives answer = $28 \cdot 07°$ or rounded to $28°$ for this part.

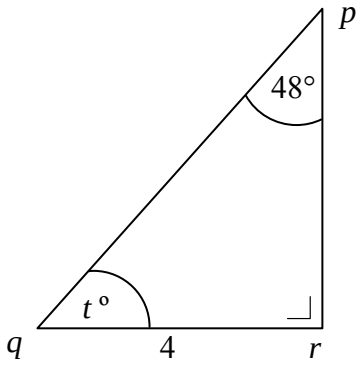
A3 Only gives answer = 0·0082 i.e. $\sin\frac{8}{17}$

Worthless (0)

W1 Incorrect answer with no work unless attempt mark applies.

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

6(b) In the right-angled triangle pqr,
$|qr| = 4$, $|\angle qpr| = 48°$ and $|\angle pqr| = t°$.



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

(i) Find the value of t.

$t = 180 - 90 - 48 = 42°$

* Correct answer with no work merits full marks.

Blunders (-3)

B1 Three angles of a triangle $\neq 180°$

B2 Fails to subtract one of the angles e.g. $180 - 48 = 132°$

B3 Mathematical error.

Slips (-1)

S1 Numerical slips to a maximum of -3.

Attempts (3 marks)

A1 Some correct step and stops e.g. 132 or 90 or 180.

A2 Writes "3 angles in a triangle add up to 180" and stops.

A3 Writes $|\angle prq| = 90°$ or correctly writes the $90°$ angle on the diagram and stops.

A4 Any correct trigonometric ratio written down.

Worthless (0)

W1 Incorrect answer with no work unless attempt mark applies.

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

Using your calculator, or otherwise, write down the value of tan $\angle pqr$ correct to one decimal place .

tan $\angle pqr$ = $\tan 42 = 0 \cdot 9$

* Correct answer with no work merits full marks.
* Accept candidates answer from part (i).
* Accept tan 0.9 for full marks.

Blunders (-3)

B1 Writes $\tan 48 = 1.1$ or 1.11 as the answer.

B2 Finds $\sin 42$ or $\cos 42$ and continues.

B3 $\tan 42 = \frac{pr}{4}$ and stops or $\frac{pr}{4}$ on it's own.

B4 Uses Radian or Grad mode on the calculator.

	RAD	GRAD
Tan 42	2·29	0·77

Slips (-1 marks)

S1 Failure to round off or rounds off incorrectly.

Attempts (2 marks)

A1 Writes $\tan 42 = \frac{pr}{qr}$ or $\frac{pr}{qr}$ or Tan 42 and stops.

A2 Any correct trigonometric ratio written down.

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

A4 $\cos 48 = 0 \cdot 72$ $\sin 48 = 0 \cdot 68$ → Grad mode

<u>or</u>

$\cos 48 = -0 \cdot 64$ $\sin 48 = -0 \cdot 76$ → Rad mode.

Worthless (0)

W1 Incorrect answer with no work unless attempt mark applies.

W2 0·72 or similar on its own (must be in format given in A4 to merit marks)

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

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

$\tan 42$	=	$\frac{pr}{4}$	**or**	$0 \cdot 9$	=	$\frac{pr}{4}$
$4 \tan 42$	=	pr		$4(0{\cdot}9)$	=	pr
$4(0{\cdot}9)$	=	pr		$3{\cdot}6$	=	pr
$3{\cdot}6$	=	pr				

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

Blunders (-3)

B1 Correct answer without work.

B2 Error in forming equation e.g. $\frac{4}{pr} = 1 \cdot 11$ and continues

B3 Error in manipulation of equation.

B4 Writes $\frac{pr}{4} = 1 \cdot 11$ and continues i.e. $\tan 48$

	RAD	GRAD
Tan 42	2·29	0·77

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

Slips (-1 marks)

S1 Numerical slips to a maximum of -3.

S2 Failure to round off or rounds off incorrectly.

Attempts (2 marks)

A1 Any correct step with work and stops e.g. $\frac{x}{4}$ or $\frac{4}{x}$

A2 Correct scale diagram.

A3 $\tan 42$ or 0·9 or any trigonometric ratio.

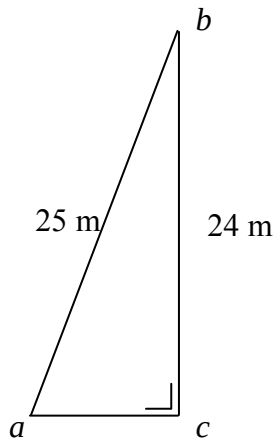
Worthless (0)

W1 Incorrect answer with no work unless attempt mark applies.

W2 Answer = 4·2cm (measured from examination paper)

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

In the Δabc, $|\angle bca| = 90º$, $|ab| = 25$ m and $|bc| = 24$ m.



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

(**i**) Find, in metres, $|ac|$.

$$|ab|^2 = |ac|^2 + |bc|^2$$
$$|25|^2 = |ac|^2 + |24|^2$$
$$625 = |ac|^2 + 576$$
$$49 = |ac|^2$$
$$\sqrt{49} \text{ or } 7 = |ac|$$

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

Blunders (-3)

B1 Correct answer without work
B2 Incorrect theorem of Pythagoras and continues.
B3 Mathematical error e.g. $24^2 = 48$
B4 Error in manipulation of equation.
B5 Stops at $|ac|^2 = 49$

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

Attempts (3 marks)
A1 Some correct step with work and stops e.g. 25^2 or writes 90º for $\angle C$ on diagram.
A2 States theorem of Pythagoras and stops.
A3 Correct Sin, Cos or Tan ratio written down and stops.
A4 Labels correctly the hypotenuse e.g. $h = 25$.

Worthless (0)
W1 Incorrect answer with no work unless attempt mark applies e.g. 625.
W2 $25 - 24 = 1$ or $25 + 24 = 49$.
W3 Answer = 2.4cm (measured from examination paper)

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

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

$\sin \angle bac = \frac{24}{25}$ $\angle bac = 73 \cdot 73°$ or $73°44'$ $\angle bac = 74°$	$\cos \angle bac = \frac{7}{25}$ $\angle bac = 73 \cdot 73°$ or $73°44'$ $\angle bac = 74°$

* Accept candidates answer from part (i).

Blunders (-3)

B1 Correct answer without work

B2 Incorrect trigonometric ratio.
B3 Decimal error.
B4 Mathematical error.
B5 Uses radian or grad mode on calculator.
B6 Error in manipulation of equation.

Misreading (-1 marks)

M1 Finds $|\angle abc|$ correctly.

Slips (-1 marks)

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

Attempts (2 marks)

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

Worthless (0)

W1 Incorrect answer with no work unless attempt mark applies.