Coimisiún na Scrúduithe Stáit
State Examinations Commission

MARKING SCHEME

JUNIOR CERTIFICATE EXAMINATION 2004

MATHEMATICS – ORDINARY LEVEL – PAPER 2 (300 marks)

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 as B1, B2, B3,......, S1, S2, S3,...., M1, M2, etc. Note that these lists are not exhaustive.

2. When awarding attempt marks, e.g. Att(3), it is essential to 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 *same* error in the *same* section of a question is penalised *once* only.

5. Particular cases, verifications and answers derived from diagrams (unless requested) qualify for attempt marks only.

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

7. Special notes relating to the marking of a particular part of a question or question with ✍ symbol are indicated by an asterisk ∗ under solution box.

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 swimming pool is 50 m in length. Mary swims 25 lengths of the pool.
What distance, in kilometres, does Mary swim?

✍   Distance = 50 x 25

   = 1250 m

   $= \dfrac{1250}{1000}$ km

   = 1.25 km

∗   Correct answer without work merits 7 marks

Blunders (-3)
B1   Divides instead of multiplies
B2   Incorrect conversion m $\rightarrow$ km or no conversion

Slips (-1)
S1   Numerical slips to a maximum of -3
S2   Leaves as $\dfrac{1250}{1000}$ km

Attempts (3 marks)
A1   Converts units and stops

Worthless (0)
W1   Incorrect answer without work unless attempt mark applies (answer relevant to scheme)
W2   Adds or subtracts both numbers and stops

Notes: $\dfrac{50}{25} = 2$ merits 4 marks (B1 + B2) but $\dfrac{50}{25}$ and stops merits attempt mark

   $\dfrac{25}{50} = \dfrac{1}{2}$ merits 4 marks (B1 + B2) but $\dfrac{25}{50}$ and stops merits attempt mark

A garden is made up of a rectangular lawn that is surrounded by a path.
The garden is 16 m long and 10 m wide. The path is 2 m wide.
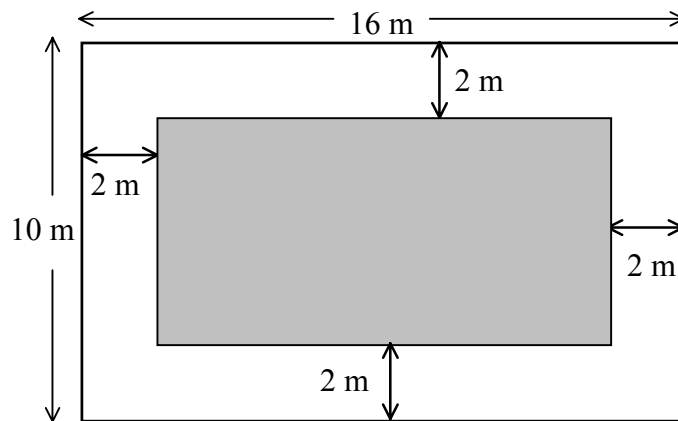
Part (b)(i)   **10 marks**   **Att 3**

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

Area = l x b
= 16 x 10
= 160 m^2

     ∗   Correct answer without work merits 7 marks
     ∗   Answers must be in relevant boxes

Blunders (-3)
B1   Incorrect relevant formula
B2   Incorrect substitution each time
B3   Mathematical error

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

Attempts (3 marks)
A1   Correct formula and stops
A2   Some correct step and stops

A3   Area = l + b and continues i.e 16 + 10 or $\dfrac{16}{10} = 1.6$ or $\dfrac{10}{16} = 0.625$

A4   Finds area of a relevant section
A5   Indicates some multiplication of relevant numbers

Worthless (0)
W1   Incorrect answer without work unless attempt mark applies (answer relevant to scheme)
W2 $\dfrac{16}{10}$ or $\dfrac{10}{16}$ and stops

Notes: 16 x 2 = 32 or 10 x 2 = 20 merit 7 marks (B2)

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

$16 - 2(2) = 12$
$10 - 2(2) = 6$
Area $= l \times b$
$= 12 \times 6$
$= 72$ m^2

* Correct answer without work merits 2 marks

Blunders (-3)
B1   Incorrect relevant formula
B2   Incorrect substitution each time
B3   Mathematical error
B4   Incorrect calculation of dimension

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

Attempts (2 marks)
A1   Correct formula and stops
A2   Some correct step and stops
A3   Area $= l + b$ and continues i.e $12 + 6$
A4   Finds area of a relevant section
A5   Indicates some multiplication of relevant numbers

Worthless (0)
W1   Incorrect answer without work unless attempt mark applies (answer relevant to scheme)
W2 $\dfrac{16}{2} = 8$

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

✎   160, 72
    Area = 160 - 72
        = 88 m^2

*   Correct answer without work merits 2 marks
*   Accept answers from previous parts

Blunders (-3)
B1   Incorrect relevant formula
B2   Incorrect substitution each time
B3   Mathematical error
B4   Adds instead of subtracts

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

Attempts (2 marks)
A1   Correct formula and stops
A2   Some correct step and stops
A3   Area = l + b and continues i.e 16 + 2
A4   Finds area of a relevant section
A5   Indicates some multiplication of relevant numbers
A6   Indicates subtraction

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

Part (c)   **20 marks**   **Att 7**

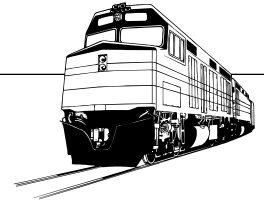On Monday a train left Galway at 13:05 and arrived in Dublin at 15:35.

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

How many hours and minutes did it take the train
to travel from Galway to Dublin?

✑   Time = 15:35 - 13:05
                = 2:30
               or 2 hrs 30 min.

∗   Correct answer without work merits 7 marks

Blunders (-3)
B1   Adds instead of subtracts
B2   Error in converting hr/min

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

Misreadings (-1)
M1   Misreading of time without oversimplication

Attempts (3 marks)
A1   Converts hr/min and stops
A2   Correctly subtracts arbitrary time/s

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

> The distance travelled by the train was 240 km.
> Calculate the average speed, in km/hr, for the journey from Galway
> to Dublin.

✍

$$2 \text{ hrs } 30 \text{ min} = 2.5 \text{ hrs}$$

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

$$= \frac{240}{2.5}$$

$$= 96 \text{ km/hr}$$

*   Correct answer without work merits 2 marks
*   Accept candidate's answer from part (i)
*   Accept ratio method

Blunders (-3)
B1   Incorrect formula
B2   Error in converting hr/min or no conversion, unless B2 applied in part (i)
B3   No division
B4   Mathematical error
B5   Incorrect substitution each time

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

Attempts (2 marks)
A1   Correct formula and stops
A2   Some correct step and stops
A3   States 1 hr = 60 mins and stops

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

> On Tuesday, the train left Galway at 13:05 and travelled to Dublin.
> The average speed for this journey of 240 km was 100 km/hr.
> At what time did the train arrive in Dublin?

✍   Time for journey $= \dfrac{D}{S}$

$$= \dfrac{240}{100}$$

$$= 2.4 \text{ hrs}$$

$$= 2\text{hrs } 24\text{mins}$$

Arrival time $= 13:05 + 2:24$

$$= 15:29$$

*   Correct answer without work merits 2 marks
*   Accept ratio method

Blunders (-3)
B1   Incorrect formula
B2   Error in converting hr/min or no conversion, unless B2 applied in part (i) or (ii)
B3   No division
B4   Mathematical error
B5   Uses answer from part (i)

Slips (-1)
S1   Numerical slips to a maximum of -3
S2   Leaves as 13:05 + 2:24

Attempts (2 marks)
A1   Correct formula and stops
A2   Some correct step and stops
A3   States 1 hr = 60 mins and stops

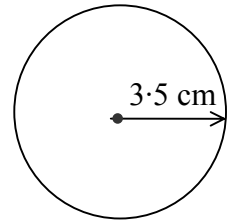*Worthless (0)*
W1   Incorrect answer without work unless attempt mark applies (answer relevant to scheme)

QUESTION 2

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

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

A circle has a radius of 3·5 cm.

3·5 cm

Taking π as $\dfrac{22}{7}$, calculate the length of the circumference of the circle

✍   Length = 2πr

$= 2 \times \dfrac{22}{7} \times 3.5$

$= 22$ cm

∗   Correct answer without work merits 7 marks

Blunders (-3)
B1   Incorrect relevant formula
B2   Incorrect substitution
B3   Mathematical errors e.g. fraction
B4 $\pi \neq \dfrac{22}{7}$

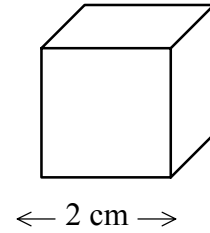*Slips (-1)*
S1   Numerical slips to a maximum of -3

Attempts (3 marks)
A1   Correct formula and stops
A2   Some correct step and stops

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

A cube has side of length 2 cm.

$\longleftarrow$ 2 cm $\longrightarrow$

Find the volume of this cube in cm^3.

✍   Volume of cube = l x l x l
                        = 2 x 2 x 2
                        = 8 cm^3

∗   Correct answer without work merits 2 marks.

Blunders (-3)
B1   Incorrect relevant formula
B2   Incorrect substitution
B3   Mathematical error

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

Attempts (2 marks)
A1   Correct formula and stops
A2   Some correct step and stops
A3   Volume = l + b + h and continues i.e. 2 + 2 + 2 = 6
A4   Some multiplication

Worthless (0)
W1   Incorrect answer without work unless attempt mark applies (answer relevant to scheme)
W2   Answer = 6 without work shown

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

> A rectangular block is built using 18 of these cubes.
> Find the volume of the rectangular block in cm^3.

✎   Volume of block = 18 x 8   or   6 x 6 x 4
                            = 144 cm^3 = 144 cm^3

∗   Accept correct answer without work for 7 marks.
∗   Accept candidate's answer from part (i)

Blunders (-3)
B1   Volume = n x 18, n ≠ ans.(i)
B1   Divides instead of multiples

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

Attempts (3 marks)
A1   Ans.(i) ± 18
A2   Writes down answer from (i) and stops

Worthless (0)
W1   Incorrect answer without work e.g. 26 or 10

> This rectangular block is 6 cm long, 6 cm wide and 4 cm high.
> Find its surface area in cm^2.

✎   Area = 2(l x b + l x h + b x h)
                    = 2(6 x 6 + 6 x 4 + 6 x 4)
                    = 2(36 + 24 + 24)
                    = 2(84)
                    = 168 cm^2

∗   Correct answer without work merits 2 marks

Blunders (-3)
B1   Incorrect relevant formula
B2   Incorrect substitution each time
B3   Mathematical error
B4   Omits area of more than one section

Slips (-1)
S1   Numerical slips to a maximum of -3
S2   Omits area of one section only

Attempts (2 marks)
A1   Correct formula and stops
A2   Some correct step and stops
A3   Area = l + b and continues i.e 6 + 6
A4   Finds area of a relevant section and stops
A5   Some multiplication
A6   Finds volume of block e.g. 6 x 6 x 4 =.144 m^3

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

Part (c)   **20 marks**   **Att 6**

A solid sphere made of lead has radius 6 cm.

6 cm

Part (c)(i)   **10 marks**   **Att 3**
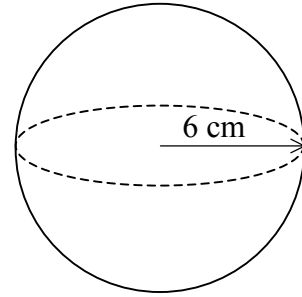
Find the volume of the sphere in terms of π.

$$\text{Volume of sphere} = \frac{4}{3}\,\pi\,r^3$$
$$= \frac{4}{3}\,\pi\,(6)^3$$
$$= \frac{4}{3}\,\pi\,(216)$$
$$= 288\pi$$

*   Correct answer without work merits 7 marks

Blunders (-3)
B1   Incorrect relevant sphere formula
B2   Incorrect substitution
B3   Mathematical error

Slips (-1)
S1   Numerical slips to a maximum of -3
S2   Answer not in terms of π

Attempts (3 marks)
A1   Correct formula and stops
A2   Some correct step and stops
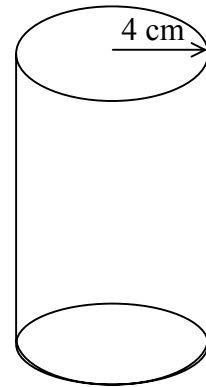A3   Finds surface area

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

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

This sphere is melted down and all the lead is used to make a lead cylinder with radius 4 cm
Find the height of the lead cylinder.

4 cm

✎   Volume $= \pi r^2 h$ or   Volume $= 288\pi$ or $\pi r^2 h = 288\pi$

$$\pi \times (4)^2 \times h = 288\pi$$
$$16 h = 288$$
$$h = 18 \text{ cm}$$

* Correct answer without work merits 7 marks
* Accept candidate's answer from part (i)

Blunders (-3)
B1   Incorrect relevant cylinder formula
B2   Incorrect substitution
B3   Mathematical error
B4   Error in manipulation of equation
B5   Value of $\pi \neq \dfrac{22}{7}$ or 3.14 or calculator π

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

Attempts (3 marks)
A1   Correct formula and stops
A2   Some correct step and stops

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

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

Find the mode of the numbers**:** 10, 8, 12, 5, 10, 12, 10, 18.

Mode = 10

Blunders (-3)
B1   Writes mode as 10 and 12

Attempts (3 marks)
A1   Writes 85
A2   Writes 10.625
A3   Writes 8
A4   Writes 12
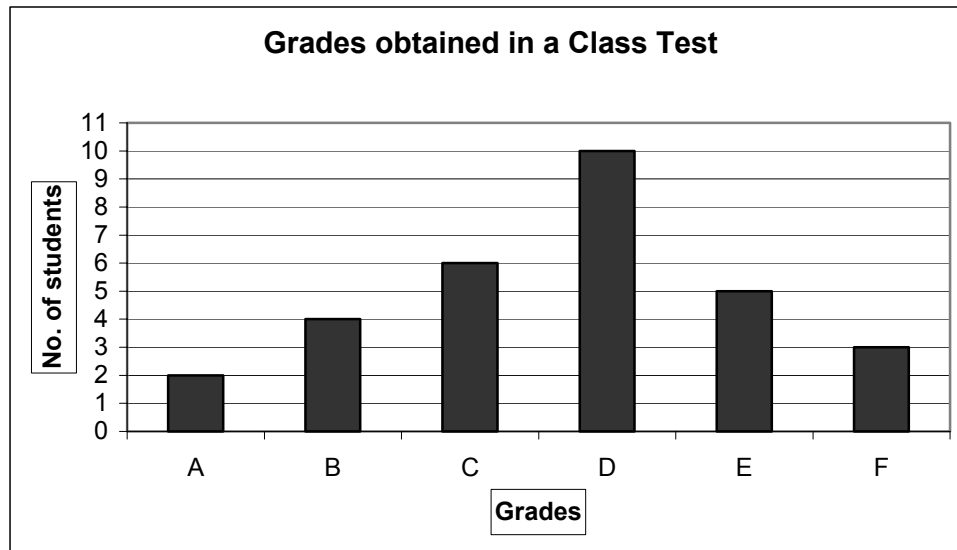A5   Rearranges numbers in order

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

Part (b)   **20 marks**   **Att 7**

> All students in a certain class sat a test. The grades that they obtained in the test are shown in the following bar chart.

Grades obtained in a Class Test

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

> How many students were in the class?

     ✎   2, 4, 6, 10, 5, 3
              $2 + 4 + 6 + 10 + 5 + 3$
        $= 30$

∗   Correct answer without work merits 7 marks

Blunders (-3)
B1   Omits or includes more than one entry/incorrect entry in addition
B2   Multiplies numbers instead of adds

Slips (-1)
S1   Numerical errors to a maximum of -3
S2   Omits or includes one entry/incorrect entry in addition

Attempts (3 marks)
A1   Some addition
A2   Writes down one correct entry

Worthless (0)
W1   Incorrect answer without work unless attempt mark applies (answer relevant to scheme)
W2   Answer = 11

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

How many students achieved a grade lower than a grade D?

✎   5, 3
           5 + 3
       = 8

∗   Correct answer without work merits 5 marks. Special case.
∗   Accept candidate's values from previous part

Blunders (-3)
B1   Omits or includes more than one entry/incorrect entry in addition
B2   Multiplies numbers instead of adds

Slips (-1)
S1   Numerical errors to a maximum of -3
S2   Omits or includes one entry/incorrect entry in addition
S3   Uses one extra entry

Attempts (2 marks)
A1   Any correct step

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

Express the number of students, who achieved a grade A or a grade B, as a percentage of the total number of students in the class.

✍ $2 + 4 = 6$

$\dfrac{6}{30}$ x $100 = 20\%$

∗   Correct answer without work merits 2 marks
∗   Accept candidate's values from part (i)

Blunders (-3)
B1   Omits or includes more than one entry/incorrect entry in addition
B2   Multiplies numbers instead of adds
B3   Omits the 100 or divides by 100
B4   Multiplies by $\dfrac{30}{100}$

Slips (-1)
S1   Numerical errors to a maximum of -3
S2   Omits or includes one entry/incorrect entry in addition

Attempts (2 marks)
A1   Any correct step e.g. indicates x 100

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

Part (c)   **20 marks**   **Att 7**

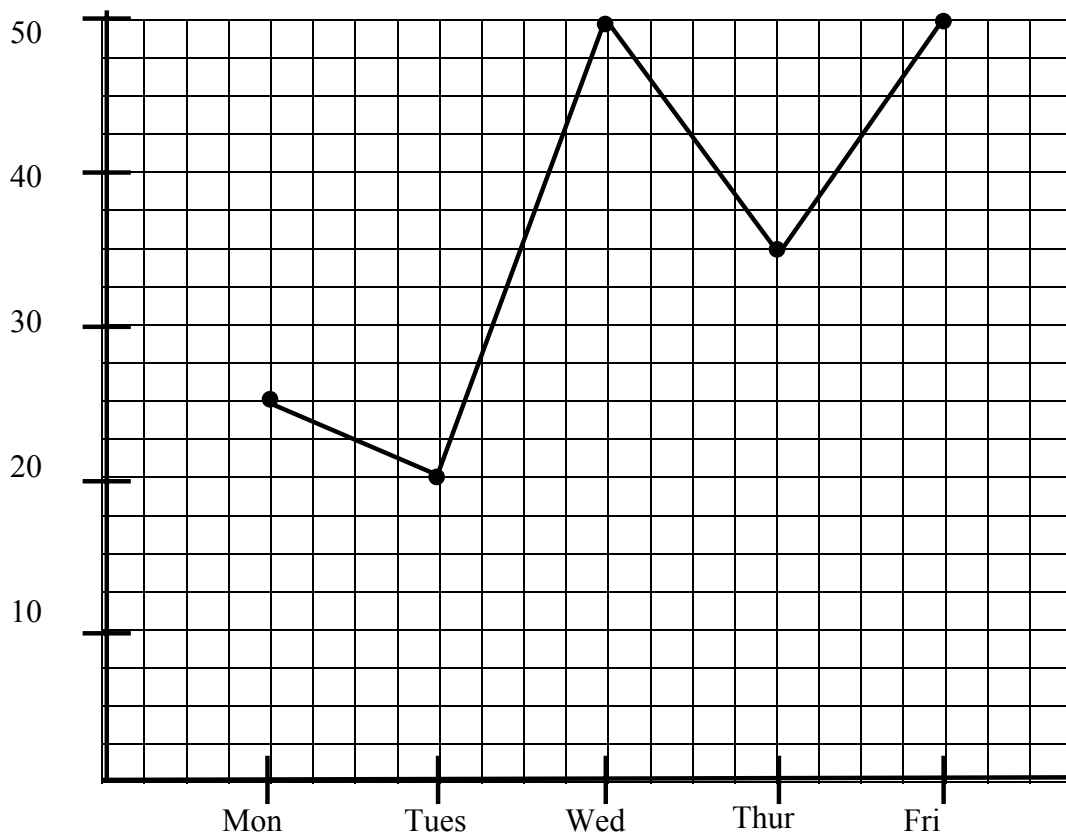> The table shows the number of compact discs sold per day in a shop from Monday to Friday of a particular week.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
No. of compact discs sold	25	20	50	35	50

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

> Draw a trend graph of the data, putting days on the horizontal axis

*   Be lenient with plotting of points

Blunders (-3)
B1   Axes not graduated uniformly (once)
B2   Points not joined or joined in incorrect order
B3   Reorders days axis

Slips (-1)
S1   Each incorrect plot or point omitted
S2   Axes reversed
S3   Draws bar or pie chart

Attempts (3 marks)
A1   Graduated axis or axes only or x and y axes only
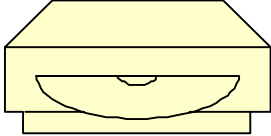
Part (c)(ii)   **5 marks**   **Att 2**

> Calculate the mean number of compact discs sold per day from Monday to Friday.

$$\text{Average} = \frac{\Sigma x}{n}$$

$$= \frac{25 + 20 + 50 + 35 + 50}{5}$$

$$= \frac{180}{5} \text{ or } 36$$

*   Correct answer without work merits 2 marks.

Blunders (-3)
B1   Multiplies instead of adds in numerator
B2   Incorrect divisor (divisor of 1 must be shown)
B3   Omits or includes more than one entry/incorrect entry in addition
B4   Inverted fraction

Slips (-1)
S1   Numerical errors to a maximum of -3
S2   Omits or includes one entry/incorrect entry in addition

Attempts (2 marks)
A1   Writes 180 only and stops
A2   Partial addition and stops e.g. numerator = 180
A3   Idea of mean indicated e.g. $\dfrac{\Sigma x}{n}$
A4   "Median is 35" and stops
A5   Mode = 50 and stops

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

Notes   Writes $\dfrac{5}{180} = 36$ merits 2 marks (B4)

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

> The shop was also open on the Saturday of that particular week. The mean number of compact discs sold per day from Monday to Saturday was as 40.
> Calculate the number of compact discs sold on that Saturday.

✍   Total number of dics $= 40 \times 6 = 240$ or $\dfrac{25 + 20 + 50 + 35 + 50 + x}{6} = 40$

$$\dfrac{180 + x}{6} = 40$$
$$180 + x = 240$$

Number of discs (Saturday) $= 240 - 180$ $x = 240 - 180$
                           $= 60$ $x = 60$

∗   Correct answer without work merits 2 marks.

Blunders (-3)
B1   Multiplies instead of adds in numerator
B2   Incorrect divisor (divisor of 1 must be shown)
B3   Omits or includes more than one entry/incorrect entry in addition
B4   Inverted fraction
B5   Error in manipulation of equation
B6   Total = n x 40 and n ≠ 6
B7   Adds instead of subtracts

Slips (-1)
S1   Numerical errors to a maximum of -3
S2   Omits or includes one entry/incorrect entry in addition

Attempts (2 marks)
A1   Writes 25 + 20 + 50 + 35 + 50 + x only and stops
A2   Partial addition and stops
A3   Idea of mean indicated e.g. $\dfrac{\sum x}{n}$
A4   Indicates subtraction

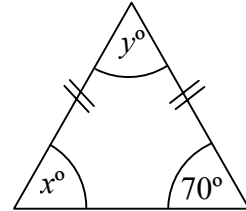*Worthless (0)*
W1   Incorrect answer without work unless attempt mark applies (answer relevant to scheme)
W2   4 only

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

Part (a)	10 marks	Att 3

Calculate the value of x and the value of y in the diagram

$x = 70°$.

$y = 180^0 - (70^0 + 70^0)$

$\quad = 180^0 - 140^0$

$\quad = 40^0$

*   Accept correct answer marked/indicated on a diagram
*   Accept correct answers and no work

Blunders (-3)

B1   States $y = 70^0$ and continues
B2   Uses incorrect isosceles triangle
B3   Sum of angles in $\Delta \neq 180^o$
B4   Mathematical error

Slips (-1)

S1   Numerical errors to a maximum of -3

Attempts (3 marks)

A1   States "straight line angle $= 180^o$" or similar
A2   States "angle sum of $\Delta = 180^o$" or similar
A3   Any mention of isosceles Δ
A4   Uses arbitrary value for x or y and continues

Worthless (0)

W1   Incorrect answer without work unless attempt mark applies (answer relevant to scheme)
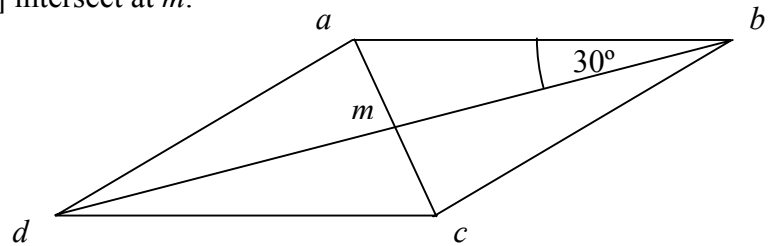
Part (b)   **20 marks**   **Att 8**

abcd is a parallelogram.

The diagonals [ac] and [bd] intersect at m.

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

The parallelogram abcd has area 36 cm^2.

Write down the area of $\triangle adc$ and give a reason for your answer.

Area of $\triangle adc = $ 18 cm^2.

Reason: A diagonal bisects the area of a parallelogram.

*   Accept correct answer and no work

Blunders (-3)
B1   Area = n x 36, n ≠ 1/2

Slips (-1)
S1   Correct answer with no reason or incorrect reason
S2   Numerical errors to a maximum of -3

Attempts (2 marks)
A1   Reason only
A2   Correct area formula for triangle or parallelogram
A3   Opposites sides/angles of a parallelogram equal in measure

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

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

Given that $|\angle abd| = 30°$, find $|\angle bdc|$ and give a reason for your answer.

$|\angle bdc| = 30°$.

Reason: Alternate angles.

*   Accept correct answer marked/indicated on a diagram
*   Accept correct answer and no work

Blunders (-3)
B1   Names two other angles equal in measure

Slips (-1)
S1   Correct answer with no reason or incorrect reason
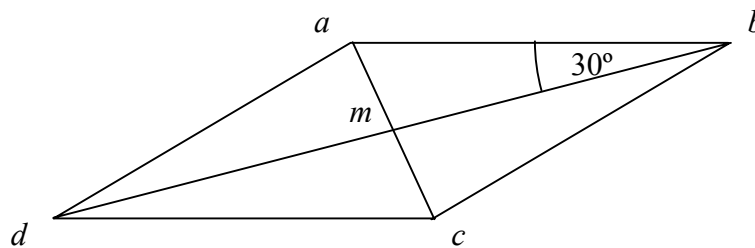
Attempts (2 marks)
A1   Reason only
A2   Opposite angles in parallelogram equal in measure
A3   Any mention of congruence

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

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

Given that $|am| = 2 \cdot 25$ cm, find $|ac|$ and give a reason for your answer.

$|ac| = 4 \cdot 5$ cm.

Reason: Diagonals of a parallelogram bisect each other.

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*   Accept correct answer marked/indicated on a diagram
*   Accept correct answer and no work

Blunders (-3)
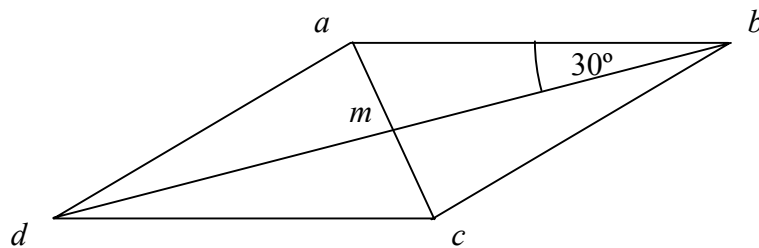B1 |ac| = n x 2.25, n ≠ 2

Slips (-1)
S1   Correct answer with no reason or incorrect reason
S2   Numerical errors to a maximum of -3

Attempts (2 marks)
A1   Reason only
A2   Mentions midpoint
A3   Any mention of congruence

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

Show that $\triangle amb$ and $\triangle dmc$ are congruent.

$\|mb\| = \|md\|$	or	$\|ab\| = \|dc\|$	or	$\|\angle amb\| = \|\angle cmd\|$
$\|\angle abm\| = \|\angle mdc\|$		$\|am\| = \|mc\|$		$\|mb\| = \|md\|$
$\|ab\| = \|dc\|$		$\|mb\| = \|md\|$		$\|\angle abm\| = \|\angle mdc\|$
$\therefore$ SAS		$\therefore$ SSS		$\therefore$ ASA

∗   Accept correct answer marked/indicated on a diagram

Blunders (-3)
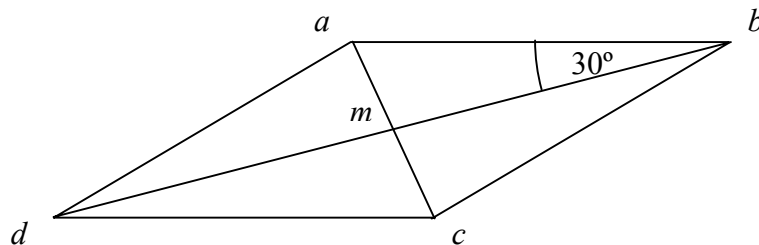B1   Each step omitted

Attempts (2 marks)
A1   One correct step
A2   States same shape or all sides the same

Worthless (0)
W1   Incorrect answer without work unless attempt mark applies (answer relevant to scheme)
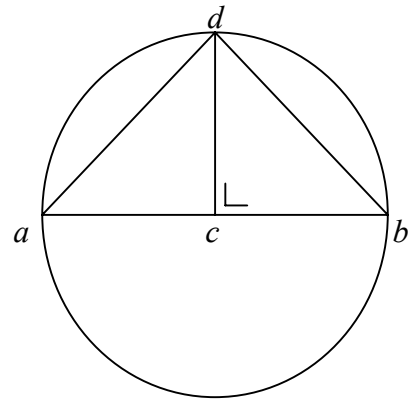
Part (c)   **20 marks**   **Att 8**

[ab] is a diameter of a circle with centre c.

d is a point on the circle.

$dc \perp ab$.

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

Name the image of the Δdcb

under S_{dc}, the axial symmetry in the line dc.

Image $= \Delta dca$.

∗   Accept Δdca with points in any order
∗   Accept d→d, c→c, b→a
∗   Accept diagram with correct indication/shading

Blunders (-3)
B1   Each point whose image is not found or incorrectly found but note B2, B3
B2   Correct image of Δdcb under some other axial symmetry (even on extended diagram)
B3   Correct image of some other Δ under S_{dc}

Attempts (2 marks)
A1   Shows some knowledge of axial symmetry and stops
A2   A axial symmetry not related to diagram or question
A3   Correct axial symmetry or translation on some other Δ
A4   States that image is a Δ

Worthless (0)
W1   Diagram reproduced without modification

> Given that $\left|\angle dac\right| = 45°$, write down two other angles equal in measure
>
> to $\angle dac$.

$\angle adc, \angle bdc$ or $\angle dbc$.

∗   Accept angle marked/indicated on diagram

Blunders (-3)
B1   Names one other angle equal in measure
B2   Names two other angles equal in measure but not equal to $|\angle dac|$
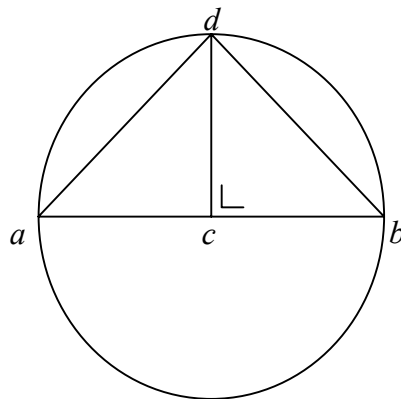
Slips (-1)
S1   Numerical errors to a maximum of - 3

Attempts (2 marks)
A1   States "straight line angle = 180º" or similar
A2   States "angle sum of Δ = 180º" or similar
A3   Any mention of isosceles Δ

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

$|\angle adb| = 90°$.

Reason: Angle in a semi-circle or $180° - 45° - 45° = 90°$.

An angle subtended by a diameter at the circumference is a right angle

∗   Accept right angle marked/indicated on diagram

Blunders (-3)
B1   Sum of angles in $\Delta \neq 180°$

Slips (-1)
S1   Correct answer without reason or incorrect reason

Attempts (2 marks)
A1   States "Angle at centre = twice angle at circle standing on same arc" or similar and stops
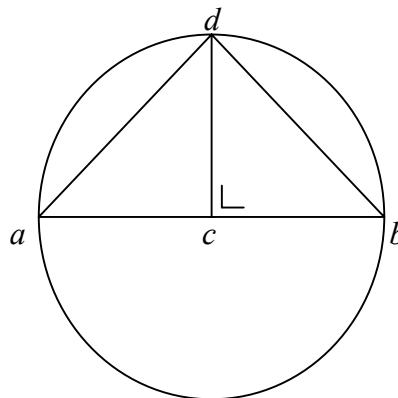A2   States "Straight line angle = 180°" or similar and stops
A3   States "Angle sum in Δ = 180°" or similar
A4   Writes $|\angle bcd|$ or $|\angle acd|$

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

Given that $|ad| = |db| = 2$, show that $|ab| = \sqrt{8}$.

✎
$$|ab|^2 = (2)^2 + (2)^2$$
$$= 4 + 4$$
$$= 8$$
$$|ab| = \sqrt{8}$$

Blunders (-3)
B1   Incorrect Pythagoras Theorem
B2   Mathematical error
B3   Error in manipulation of equation

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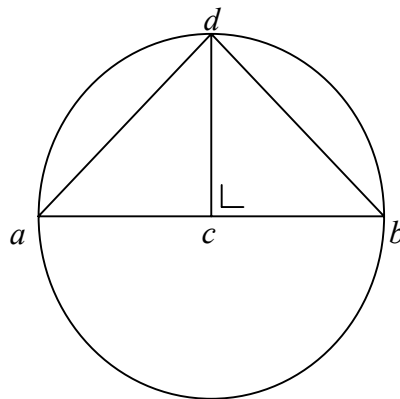S1   Numerical errors to a maximum of -3

Attempts (2 marks)
A1   A correct step
A2   States Pythagoras Theorem

Worthless (0)
W1   Incorrect answer without work unless attempt mark applies (answer relevant to scheme)
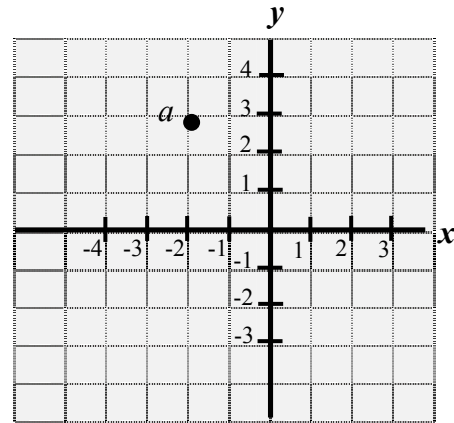W2   2 + 2 = 4 or 2 + 2 + 2 + 2 = 8
W3   √8 = 2.82

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

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

.

Write down the co-ordinates of the point a

$a = (-2, 3)$

* No penalty on brackets e.g. –2,3

* Accept x = -2 and y = 3 written separately for full marks

Blunders (-3)

B1 Incorrect order in couple, (3,-2)

B2 Incorrect x ordinate if not sign error, subject to B1

B3 Incorrect y ordinate if not sign error, subject to B1

B4 x = -2 and stops or y = 3 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 3

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

> p is the point (1, 3) and q is the point (3, 5). Find each of the following:
>
> the midpoint of [pq]

✎   the midpoint of $[pq] = \left(\dfrac{1+3}{2} \ , \ \dfrac{3+5}{2} \right)$ or $= \left(\dfrac{3+1}{2} \ , \ \dfrac{5+3}{2} \right)$

                       $= \left(\dfrac{4}{2}, \dfrac{8}{2} \right)$ or (2, 4) $= \left(\dfrac{4}{2}, \dfrac{8}{2} \right)$ or (2, 4)

   ∗   Correct answer without work merits 7 marks
   ∗   Accept translation method
   ∗   No penalty on brackets e.g. 2, 4 is acceptable

Blunders (-3)

B1   Incorrect formula e.g. error in both signs $\left(\dfrac{x_1 - x_2}{2}, \dfrac{y_1 - y_2}{2} \right)$ or $\left(\dfrac{x_1 + y_1}{2}, \dfrac{x_2 + y_2}{2} \right)$

         or omits divisor 2
B2   Incorrectly treats couples as (x_1, x_2) and (y_1, y_2) if not already penalised
B3   Mathematical error e.g. sign rules or incorrect cancellation
B4   Two or more signs incorrect in substitution
B5   Reversal of coordinates i.e. (4,2)
B6   One coordinate only worked out
B7   Uses one of the points given and some arbitary point e.g. (1,3) and (0,0)

Slips (-1)
S1   Numerical errors to a maximum of –3
S2   Error in one sign in midpoint formula

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

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

Attempts (3 marks)
A1   Some correct substitution
A2   Correct midpoint indicated on graph and not named
A3   Point p and/or q plotted reasonably well for this part

Worthless (0)
W1   Uses wrong formula e.g. slope or distance formula

Notes: Answer $= \left(\dfrac{4}{2} + \dfrac{8}{2} \right)$ with work shown merits 9 marks: (S2)

the slope of [*pq*]

✍   the slope of *pq*   or $= \dfrac{vertical}{horizontal}$

$= \dfrac{5-3}{3-1}$ or $= \dfrac{3-5}{1-3}$ or vertical = 2   horizontal = 2

$= \dfrac{2}{2}$ or 1 $= \dfrac{-2}{-2}$ or 1 $= \dfrac{2}{2}$ or 1

*   Correct answer without work merits 2 marks

*   Accept correct trigonometric method (i.e. Tan θ $= \dfrac{2}{2}$ or 1)

Blunders (-3)

B1   Incorrect slope formula e.g. $\dfrac{x_2 - x_1}{y_2 - y_1}$ or $\dfrac{y_2 + y_1}{x_2 + x_1}$ or $\dfrac{y_2 - y_1}{x_1 - x_2}$ or $\dfrac{horizontal}{vertical}$

or Tan θ $= \dfrac{adjacent}{opposite}$ and continues

B2   Incorrectly treats couples as (x_1, x_2) and (y_1, y_2) e.g. $\dfrac{3-1}{5-3}$

B3   Mathematical error e.g. sign rules or $\dfrac{5}{3} \pm \dfrac{3}{1}$

B4x2   Uses $\dfrac{x_1 - y_1}{x_2 - y_2}$ and continues

B5   Gets the slope of op or oq correctly

B6   Error in more than one sign when substituting e.g. $\dfrac{5+3}{3+1}$ or $\dfrac{3+5}{1+3}$

Slips(-1)

S1   Numerical errors to a maximum of –3

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

S3   One incorrect substitution or sign when substituting e.g. $\dfrac{5+3}{3-1}$

Attempts (2 marks)

A1   Tan θ $= \dfrac{opposite}{adjacent}$ or $m = \dfrac{vertical}{horizontal}$ and stops

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

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

Worthless (0)

W1   Uses wrong formula e.g. midpoint formula
W2   Correct formula only

the equation of the line *pq*

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

Blunders (-3)
B1   Incorrect formula e.g. $y + y_1 = m(x + x_1)$ or $x - x_1 = m(y - y_1)$
B2   Switches x and y e.g. $y - 1 = 1(x - 3)$
B3   Mathematical error e.g. sign rules
B4 $y = x + c$ and stops
B5   Uses a point other than (1, 3) or (3, 5) e.g. (0,0)
B6 $m \neq 1$

Slips (-1)
S1   Numerical errors to a maximum of -3
S2   Error in one sign in formula
S3   One incorrect sign in substitution

Attempts (2 marks)
A1   Writes $m = 1$ and stops
A2   States $y = mx \pm c$ and stops

Notes: $3 - y_1 = 1(1 - x_1)$ merits full marks
          Say $7 - 3 = 1(5 - 1)$ merits attempt mark

L is the line $3x - 2y - 12 = 0$. L cuts the x- axis at the point c.
Find the co-ordinates of the point c.

✍ $y = 0$ $\Rightarrow$ $3x - 2(0) - 12 = 0$
                                            $3x - 12 = 0$
                                                $3x = 12$
                                                    $x = 4$

∗   Correct answer without work merits 7 marks
∗   Accept answer given as x = 4 with work shown

Blunders (-3)
B1   Substitutes x = 0 and continues
B2   Mathematical error e.g. sign rules
B3   Error in manipulation of equation

Slips (-1)
S1   Numerical errors to a maximum of –3
S2   2(0) = 2

Attempts (3 marks)
A1   Substitutes y = 0 and stops
A2   Writes y = 0 and stops
A3   Any correct manipulation of equation

Worthless (0)
W1   Incorrect answer and no work shown

The point $(k, 6)$ is on the line $3x - 2y - 12 = 0$.

Find the value of k.

✍ $x = k, y = 6$ $\Rightarrow$ $3(k) - 2(6) - 12 = 0$

                                          $3k - 12 - 12 = 0$

                                          $3k - 24 = 0$

                                                $3k = 24$

                                                  $k = 8$

∗   Correct answer without work merits 7 marks
∗   Accept answer given as x = 8 with work shown

Blunders (-3)
B1   Substitutes x = 6 and y = k $\Rightarrow$ k = 3
B2   Mathematical error e.g. sign rules
B3   Error in manipulation of equation

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

Attempts (3 marks)
A1   Substitutes one value and stops
A2   Draws a line y = 6 or states x = k and/or y = 6 and stops
A3   Some statement similar to "substituting in will satisfy the equation"
A4   Use of arbitrary value e.g. x = 0 or y = 0 with some correct work
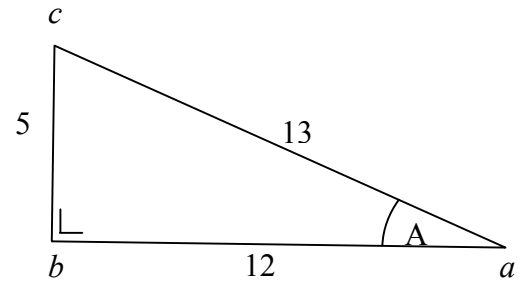A5   Any correct manipulation of equation and stops e.g. 3x – 2y = 12

Worthless (0)
W1   Incorrect answer and no work shown

QUESTION 6

Part (a)	10 marks	Att 4
Part (b)	20 marks	Att 6
Part (c)	20 marks	Att 6

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

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

Write down the length of the side opposite the angle A.

Length of the side opposite the angle A = 5.

Blunders (-3)
B1   Writes one of other sides

Attempts (2 marks)
A1   Writes [bc] or [cb]

A2   Labels opposite or o correctly on diagram

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

$$\text{Sin A} = \frac{5}{13}.$$

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

Blunders (-3)

B1   Incorrect or inverted ratio e.g. $\sin A = \frac{13}{5}$

B2   Gets sin of top angle

Slips (-1)

S1   Gives answer in decimal form (0.3846)

Attempts (2 marks)

A1   Any correct trigonometric ratio written down
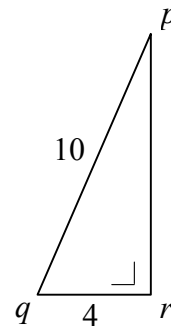A2   Gives answer = 22.6^o exactly or rounded to 23°
A3   Gives answer = 0.0067
A4   States relevant geometry e.g. 180°
A5   Answer = 0.4067

In the right-angled triangle *pqr*,

$|pq| = 10$ and $|qr| = 4$.

> Find the value of $\cos \angle pqr$.

✍ $\cos \angle pqr = \dfrac{4}{10}$ or 0.4

---

*   Accept $\cos \dfrac{4}{10}$ for full marks

Blunders (-3)

B1   Incorrect or inverted ratio e.g. $\cos \angle pqr = \dfrac{10}{4}$

B2   Gets cos of top angle

Attempts (3 marks)
A1   Any correct trigonometric ratio written down
A2   Gives answer $= 66.42^0$ exactly or rounded to 66^0
A3   Gives answer $= 0.99997$
A4   States relevant geometry e.g. 180°
A5   Answer $= 0.3746$ or 0.3584
A6   Reads cos (angle) correctly

Hence find the measure of ∠*pqr*, correct to the nearest degree.

✎ $|\angle pqr| = 66 \cdot 42° = 66°.$

∗   Correct answer without work merits 10 marks. Special case.
∗   Accept candidate's answer from part (i) unless W4 applies

Blunders (-3)
B1   Incorrect trigonometric ratios but note W3 below
B2   No decimal point or misplaced decimal point
B3   Incorrectly uses radian or grad mode
B4   Incorrect manipulation of fraction
B5   Error in handling minutes → degrees if top angle found first

Slips (-1)
S1   Numerical errors to a maximum of –3
S2   Fails to round off or rounds off incorrectly
S3   Obvious slip in reading tables or calculator

Attempts (3 marks)
A1   Any correct trigonometric ratio written down
A2   States theorem of Pythagoras or uses it to find length of third side and stops
A3   Correctly rounds off arbitrary answer from part (i)

Worthless (0)
W1   Incorrect answer without work unless attempt mark applies (answer relevant to scheme)
W2   Diagram reproduced with no modifications
W3   Angle measured with protractor
W4   Value of Sin or Cos > 1

An aeroplane, leaves the ground at an angle of 20° to the runway.
Its speed is 28 m/sec.

20º

Take-off point
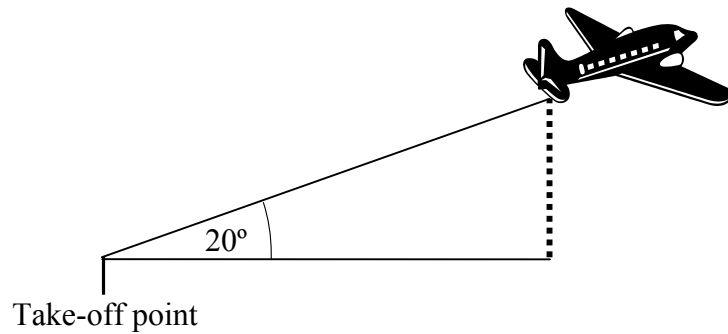
Part (c)(i)   **10marks**   **Att 3**

How far does the aeroplane travel in the first 30 seconds?

✍   Distance (30sec) = Speed x Time
                        $= 28 \times 30$
                        = 840 m

∗   Correct answer without work merits 7 marks

Blunders (-3)
B1   Distance = n x 28, n ≠ 30 or n x 30, n ≠ 28
B2   Divides instead of multiplies

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

Worthless (0)
W1   Incorrect answer without work unless attempt mark applies (answer relevant to scheme)
W2   Diagram reproduced with no modifications
W3   Adds or subtracts numbers

What is its height above the ground after the first 30 seconds?
Write your answer to the nearest metre.

✍   Height $\dfrac{h}{840} = \sin 20°$

$\dfrac{h}{840} = 0.3420201$

$h = 287.29692$

$h \approx 287m$

*   Correct answer without work merits 7 marks

Blunders (-3)
B1   Incorrect trigonometric ratios
B2   No decimal point or misplaced decimal point
B3   Incorrectly uses radian or grad mode
B4   Mathematical error
B5   Error in manipulation of equation

Slips (-1)
S1   Numerical errors to a maximum of –3
S2   Fails to round off or rounds off incorrectly
S3   Obvious slip in reading tables or calculator

Attempts (3 marks)
A1   Any correct trigonometric ratio written down
A2   Some use of Sin/Cos/Tan
A3   States relevant geometry e.g. 180^0 or Pythagoras
A4   Answer written down from (i)

Worthless (0)
W1   Incorrect answer without work unless attempt mark applies (answer relevant to scheme)
W2   Diagram reproduced with no modifications