Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2014

Marking Scheme

Mathematics
(Project Maths – Phase 3)

Foundation Level

Note to teachers and students on the use of published marking schemes

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

Future Marking Schemes

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

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Model Solutions

Note: The model solutions for each question are not intended to be exhaustive – there may be other correct solutions. Any Examiner unsure of the validity of the approach adopted by a particular candidate to a particular question should contact his / her Advising Examiner.

Instructions

There are 15 questions on this examination paper. Answer **all** questions.

Questions do not necessarily carry equal marks. To help you manage your time during this examination, a maximum time for each question is suggested. If you remain within these times you should have about 10 minutes left to review your work.

Write your answers in the spaces provided in this booklet. You may lose marks if you do not do so. There is space for extra work at the back of the booklet. You may also ask the superintendent for more paper. Label any extra work clearly with the question number and part.

The superintendent will give you a copy of the *Formulae and Tables* booklet. You must return it at the end of the examination. You are not allowed to bring your own copy into the examination.

You will lose marks if all necessary work is not clearly shown.

Answers should include the appropriate units of measurement, where relevant.

Answers should be given in simplest form, where relevant.

Write the make and model of your calculator(s) here:

Question 1   **30 Marks**

(a) $3 + 8 =$ 11

(b) $67 \times 8 =$ 536

(c) $25{\cdot}8 - 13{\cdot}2 =$ 12·6

(d) $12{\cdot}6 \div 3 =$ 4·2

(e)   On the number line below, mark in the following decimal numbers:

$$0{\cdot}1, \quad 0{\cdot}9, \quad 1{\cdot}6.$$
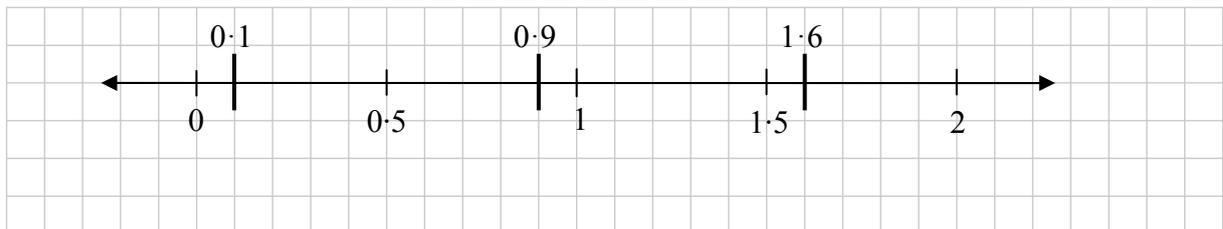
(f)   Shade in $\dfrac{3}{4}$ of the strip shown below.

Question 2 20 Marks

Barry went to the cinema last weekend.

(a) The film Barry saw started at 19:20 and finished at 21:38.
How long was the film? Give your answer in hours and minutes.

> 21:38
> − 19:20
> = 2:18 = 2 hours and 18 minutes

(b) Before the film, Barry bought a bag of sweets, a small popcorn, and a regular drink.

Part of the price list at the cinema is shown below.

Item	Price
Small Popcorn	€2·75
Medium Popcorn	€3·50
Large Popcorn	€4·25
Bag of Sweets	€2·90
Regular Drink	€2·20
Large Drink	€3·05

Complete the table on the right to find out
how much Barry paid in total for these.

| Item	Cost
One Bag of Sweets	€2·90
One Small Popcorn	€2·75
One Regular Drink	€2·20
Total	€7·85

(c) Barry went to the cinema with €20. His cinema ticket cost him €5·50.
How much change did Barry have after buying the cinema ticket, sweets, popcorn, and drink?

> Total cost: €5·50 + €7·85 = €13·35
>
> Change: €20 − €13·35 = €6·65

Question 3   **20 Marks**

Seventeen people were asked if they liked milk chocolate (Milk) or dark chocolate (Dark).

The results are shown in the Venn diagram below.
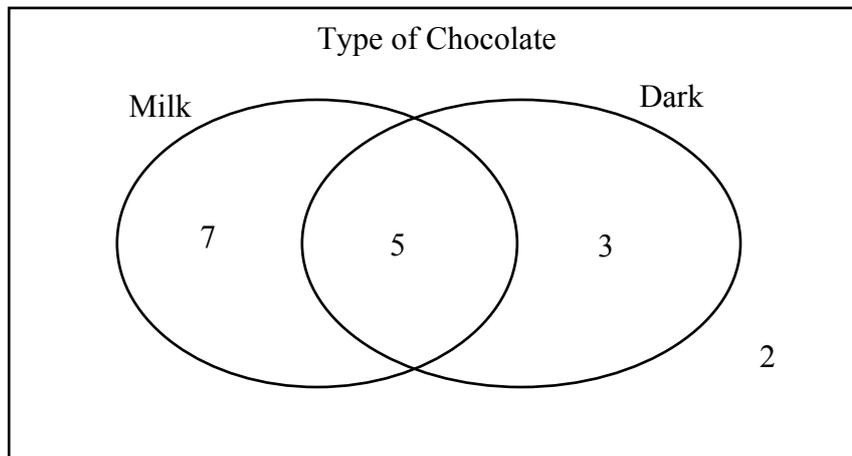
(i) How many people liked both types of chocolate?

5

(ii) How many people did not like either type of chocolate?

2

(iii) How many people liked one type of chocolate only?

7 + 3 = 10

(iv) One person is picked at random from the group.

What is the probability that this person liked both types of chocolate?

$\dfrac{5}{17}$

Question 4   **25 Marks**

Jackie and her family went to Edinburgh for a week on their holidays.

(a)   They hired a car for the week.

The cost of hiring the car for 7 days was €78 per day, plus VAT at 15%.

Find the total cost of hiring the car for the week.

7 days @ €78 per day	€546
VAT @ 15%	€ 81·90
Total Cost	€627·90

(b)   Jackie wanted to buy a new MP3 player.
She had two different memory sizes to pick from.
She had four different colours to pick from.

These are shown in the tables below.

Memory Size
16 GB
32 GB

Colour
White
Black
Pink
Blue

Complete the table below to show all of the eight possible MP3 players that Jackie could buy.

	Memory Size	Colour
1	**16 GB**	**White**
2	**16 GB**	**Black**
3	16 GB	Pink
4	16 GB	Blue
5	32 GB	White
6	32 GB	Black
7	32 GB	Pink
8	32 GB	Blue

(c) Jackie decided to buy a blue MP3 player with a memory size of 32GB. The price was £140.

The exchange rate was £1 = €1·17. Find the cost of the MP3 player, in euro (€).
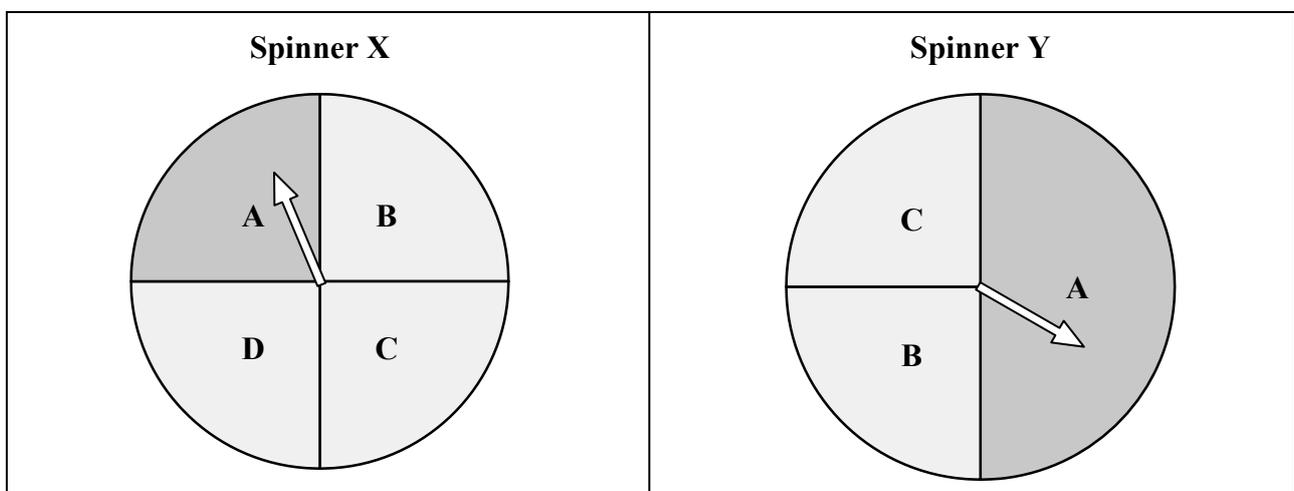
140 × 1·17 = €163·80

Question 5 10 Marks

Áine and Mark are playing a board game with a spinner.

They can play using either **Spinner X** or **Spinner Y**, as shown.

To win the game, they must spin the arrow and have it stop on the sector marked **A**.

(a) Which spinner should Áine choose in order to have the best chance of winning?
Explain your answer.

Spinner Áine should use: **Y**

Explanation: **A** is bigger in **Y** than in **X**, *or equivalent.*

(b) Mark plays the game 12 times using **Spinner Y**.

Out of his 12 games, how many should he expect to win?

12 × 0·5 = 6

Answer: 6 *or* Around 6.
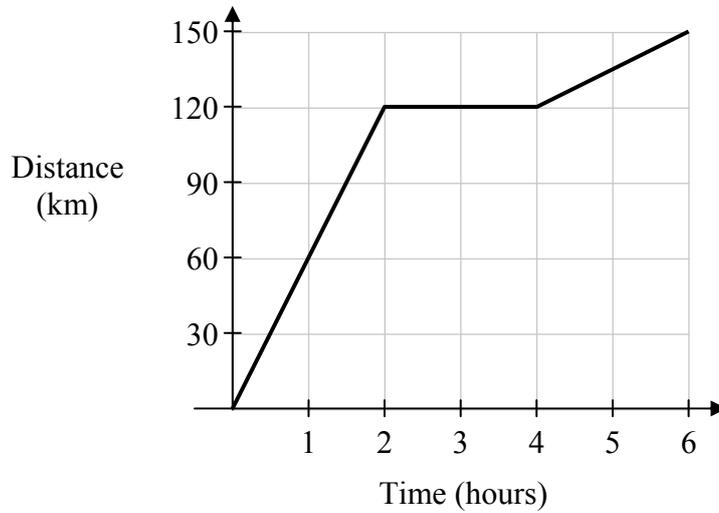
Question 6   **10 Marks**

The diagram below shows the distance travelled by a car on a certain journey.

One of the stories below matches the graph. Put a tick (✓) in the box matching the correct story.

(Note: Only **one** story matches the graph.)

Story	Tick one story
A car travels 120 km in 2 hours. It stops for 2 hours. It then travels another 150 km in 2 hours.	
A car travels 120 km in 1 hour. It stops for 1 hour. It then travels another 30 km in 1 hour.	
A car travels 120 km in 2 hours. It stops for 2 hours. It then travels another 30 km in 2 hours.	✓

Question 7   **35 Marks**

During a PE class, the number of push-ups completed by twelve students was recorded.
The results are as follows.

32	28	68	22	17	12
39	33	16	25	15	28

(i) Fill in the stem-and-leaf plot to show the number of push-ups completed by the students.

1	2	5	6	7
2	2	5	8	8
3	2	3	9	
4				
5				
6	8			

Key: $1|2 = 12$ push-ups

(ii) What was the **least** number of push-ups completed by a student?

> 12 push-ups

(iii) Find the **range** of the data.

> 68 – 12 = 56 push-ups

(iv) Calculate the **mean** number of push-ups completed.

> $$\frac{12+15+16+17+22+25+28+28+32+33+39+68}{12} = \frac{335}{12} \ \text{or} \ 27\frac{11}{12} \ \text{or} \ 27\cdot916... \ \text{push-ups.}$$

(v) One student does a lot of physical training. Write down the number of push-ups completed by this student. Give a reason for your answer.

> Number of push-ups: 68
>
> Reason: It is a lot more than the others, *or equivalent*

Question 8 20 Marks

Kate needed a taxi to take her from her house to the airport. HI-HO taxis was the cheapest.

HI-HO taxis had a flat charge of €3, and a further charge of €2 for each km travelled.

(i) Complete the following table to show the cost of the taxi.

Number of km travelled	Cost (€)
0	**3**
1	**5**
2	7
3	9
4	11
5	13
6	15
7	17
8	19
9	21

(ii) Kate travelled a distance of 7 km in the taxi. How much was she charged for this trip?

€17

(iii) When Kate arrived at the airport she paid the taxi driver with a €20 note.
She told the taxi driver to "keep the change".

How much change did the taxi driver keep?

€20 – €17 = €3

Question 9   **20 Marks**

(i)   Construct the triangle ABC, where:

$$|AB| = 9 \text{ cm}$$

$$|BC| = 5 \text{ cm}$$

$$|\angle ABC| = 60°.$$
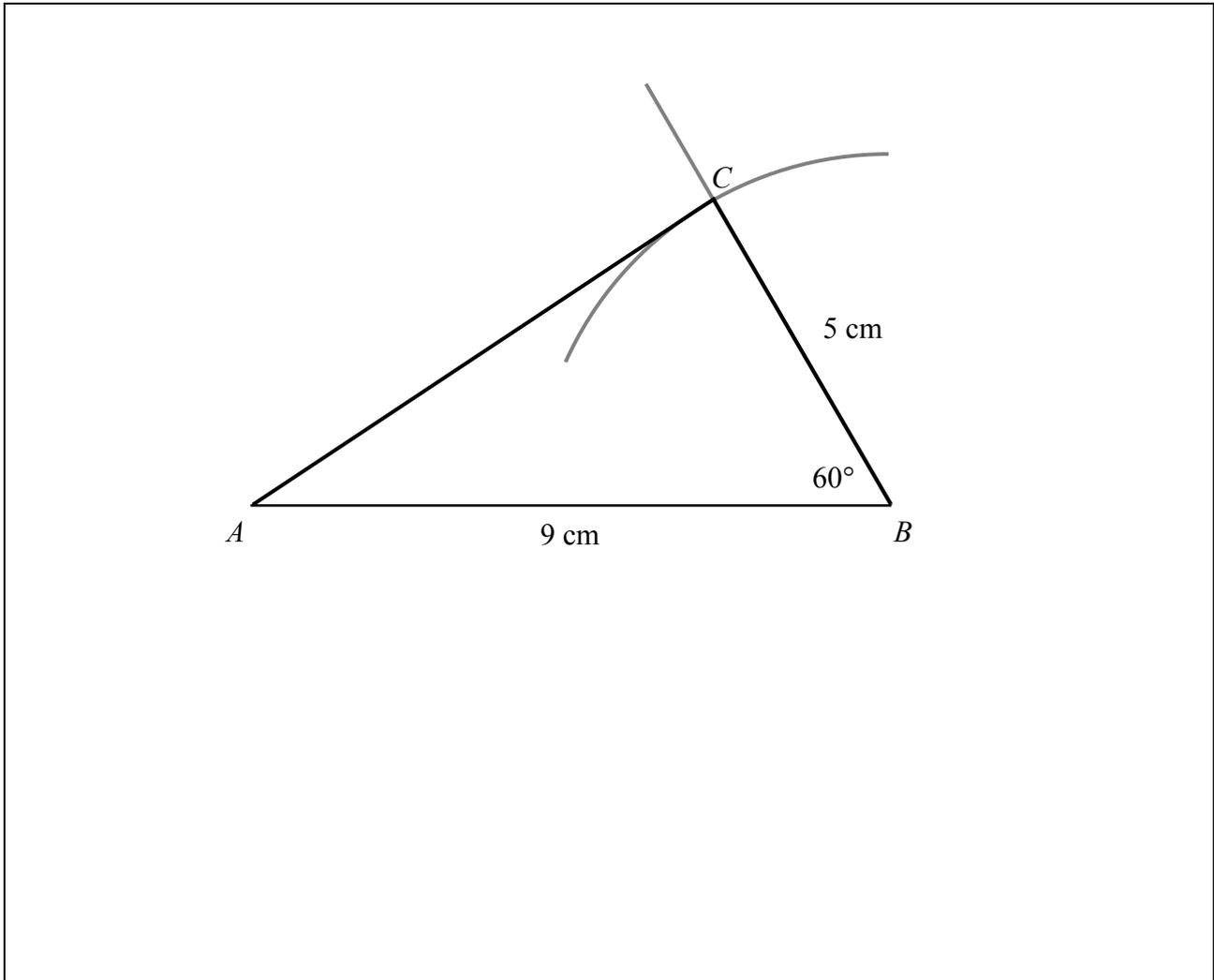
(ii)   Measure $|AC|$. $|AC| =$ 7·8 cm

(iii)   What type of triangle have you constructed in **(i)** above?
             Put a tick (✓) in the correct box below.

         Equilateral   Isosceles   Scalene

             ☐   ☐   ☑

Question 10   **20 Marks**
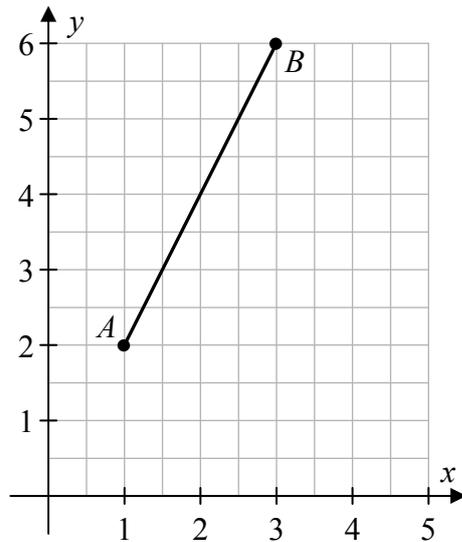
The points A and B are shown on the co-ordinate diagram below.

$A = (\ 1 \ , \ 2 \ )$

$B = (\ 3 \ , \ 6 \ )$

(i)   Write down the co-ordinates of A and B.

(ii)   Join A to B using a ruler.

(iii)   Find the slope of the line AB.

$$\frac{6-2}{3-1} = \frac{4}{2} = 2 \quad or \quad \frac{\text{Rise}}{\text{Run}} = \frac{4}{2} = 2$$

Question 11   **20 Marks**

(a)   Evaluate $4x + 6y$, when $x = 3$ and $y = 5$.

$$4(3) + 6(5) = 12 + 30 = 42$$

(b)   Solve $3x + 2 = 17$.

$$3x + 2 = 17$$
$$3x = 15$$
$$x = 5$$

Question 12   **10 Marks**

(a)   Simplify $2(3x - 4y + 6)$.

$$2(3x - 4y + 6) = 6x - 8y + 12$$

(b)   Factorise $3x^2 + 4x$.

$$3x^2 + 4x = x(3x+4)$$

Question 13   **10 Marks**

The diagram below shows a right-angled triangle with sides of length 3 cm, 4 cm, and 5 cm.
The angle P is marked.
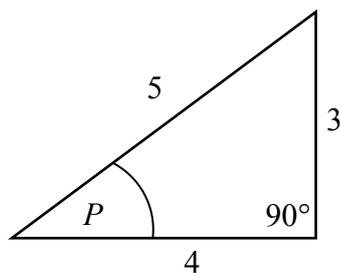
(i)   What is the length of the **hypotenuse**?   Hypotenuse =   5

(ii)   What is the length of the side **adjacent** to the angle P?   Adjacent =   4

(iii) Write down $\cos P$ as a fraction. $\cos P = \dfrac{4}{5}$

Question 14   **25 Marks**

(a)   Find the value of x and the value of y in the following diagram.
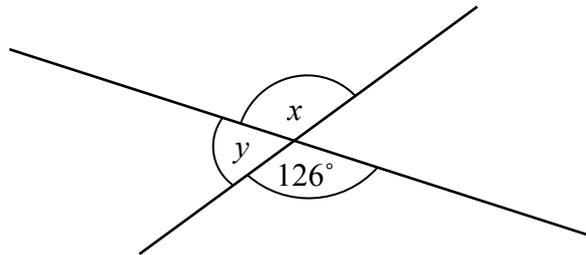
$x = 126°$ $y = 180 - 126 = 54°$

(b)   **(i)**   Draw the image of the shaded rectangle below, under axial symmetry in the line k.

(ii)   Find the **perimeter** of the shaded rectangle in **(b)(i)**.
Give your answer in centimetres.

Perimeter $= 3 + 2 + 3 + 2 = 10$ cm

Jamal throws a cricket ball straight up in the air.
The table below shows the height of the ball, to the nearest metre, over the first 2 seconds.

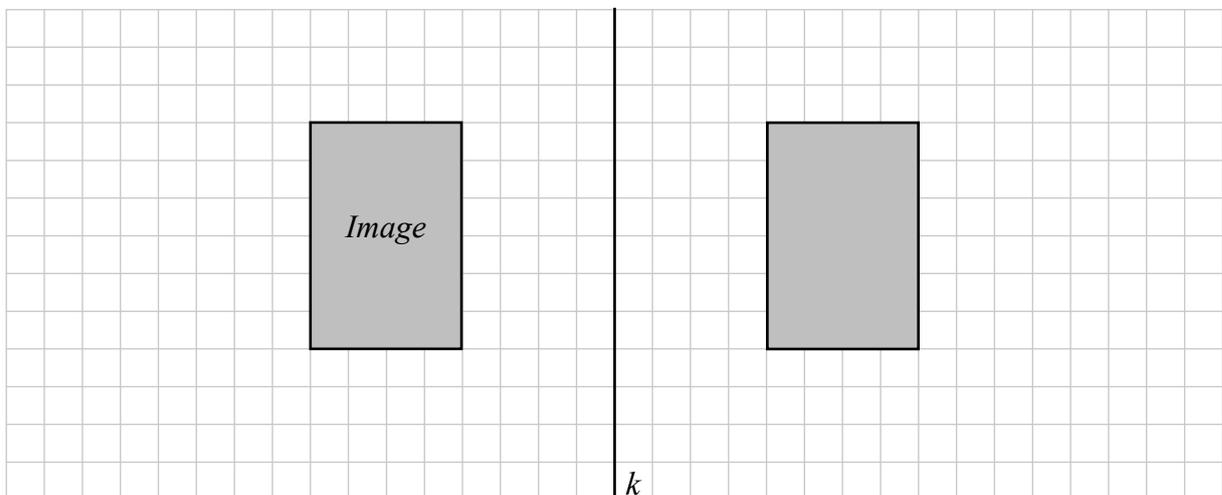| Time (seconds)	Height (metres)
0·0	1
0·5	10
1·0	16
1·5	20
2·0	21

(i) Draw a graph to show the height of the ball over the first 2 seconds.
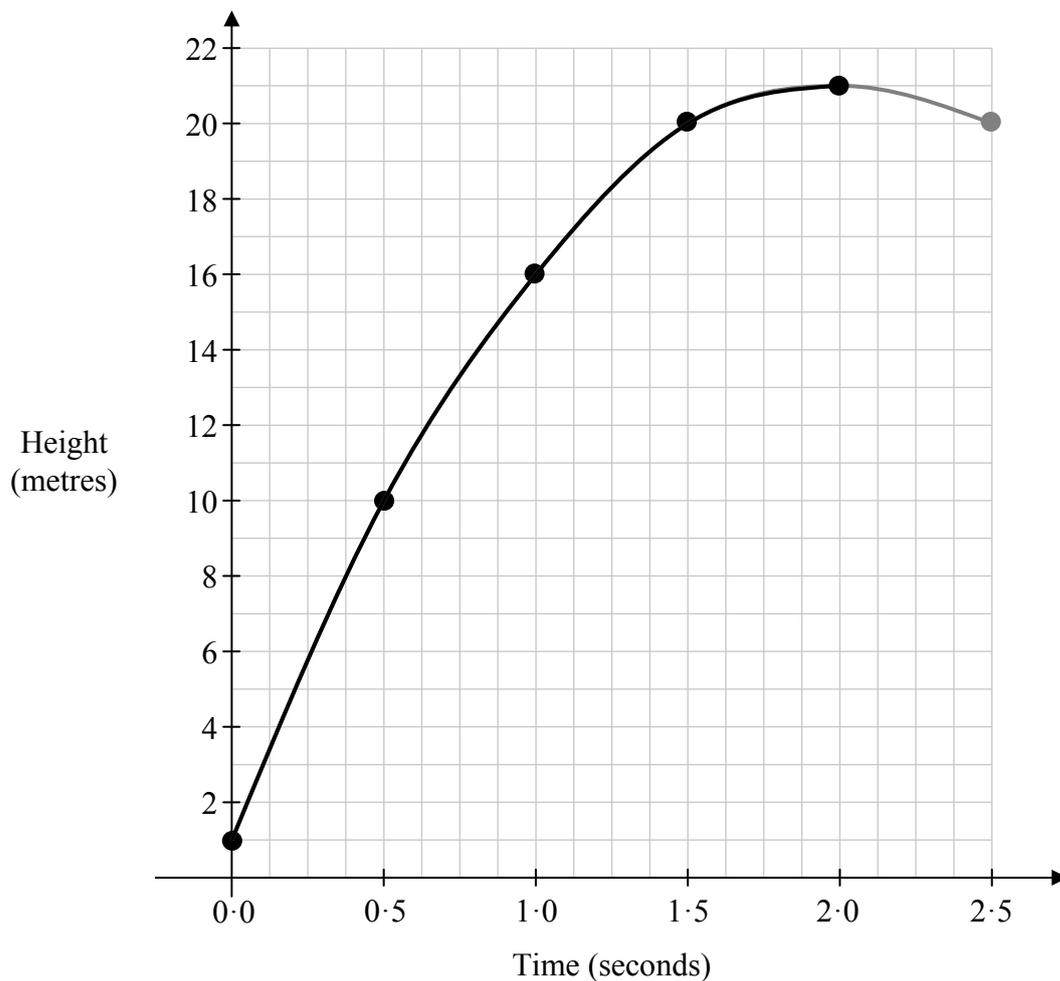
(ii) After exactly 2 seconds, the ball is at its highest point.
What height do you expect the ball to be at after 2·5 seconds?

Height after 2·5 seconds = 20 m   *See diagram*

Structure of the marking scheme

Candidate responses are marked according to different scales, depending on the types of response anticipated. Scales labelled A divide candidate responses into two categories (correct and incorrect), scales labelled B divide responses into three categories (correct, partially correct, and incorrect), and so on. The scales and the marks that they generate are summarised in this table:

Scale label	A	B	C	D
No of categories	2	3	4	5
5-mark scale	0, 5	0, 2, 5	0, 2, 3, 5	
10-mark scale		0, 5, 10	0, 4, 7, 10	
20-mark scale				0, 5, 10, 15, 20

A general descriptor of each point on each scale is given below. More specific directions in relation to interpreting the scales in the context of each question are given in the scheme, where necessary.

Marking scales – level descriptors

A-scales (two categories)
- incorrect response (no credit)
- correct response (full credit)

B-scales (three categories)
- response of no substantial merit (no credit)
- partially correct response (partial credit)
- correct response (full credit)

C-scales (four categories)
- response of no substantial merit (no credit)
- response with some merit (low partial credit)
- almost correct response (high partial credit)
- correct response (full credit)

D-scales (five categories)
- response of no substantial merit (no credit)
- response with some merit (low partial credit)
- response about half-right (middle partial credit)
- almost correct response (high partial credit)
- correct response (full credit)

In certain cases, typically involving incorrect rounding, omission of units, a misreading that does not oversimplify the work or, an arithmetical error that does not oversimplify the work, a mark that is one mark below the full-credit mark may be awarded. Thus, for example, in Scale 10C, 9 marks may be awarded.

Unless otherwise specified, accept correct answer with or without work.

Accept a candidate's work in one part of a question for use in subsequent parts of the question, unless this oversimplifies the work involved.

Summary of mark allocations and scales to be applied

Question 1 (30)

(a)	5B
(b)	5B
(c)	5B
(d)	5B
(e)	5C
(f)	5B

Question 2 (20)

(a)	10C
(b)	5C
(c)	5B

Question 3 (20)

(i)	5A
(ii)	5A
(iii)	5B
(iv)	5B

Question 4 (25)

(a)	10C
(b)	10C
(c)	5B

Question 5 (10)

(a)	5B
(b)	5B

Question 6 (10)

	10B

Question 7 (35)

(i)	10C
(ii)	5B
(iii)	5B
(iv)	10C
(v)	5B

Question 8 (20)

(i)	10C
(ii)	5B
(iii)	5B

Question 9 (20)

(i)	10C
(ii)	5B
(iii)	5B

Question 10 (20)

(i)	10C
(ii)	5B
(iii)	5B

Question 11 (20)

(a)	10C
(b)	10C

Question 12 (10)

(a)	5C
(b)	5B

Question 13 (10)

(i) & (ii)	5B
(iii)	5B

Question 14 (25)

(a)	10C
(b)(i)	10B
(b)(ii)	5B

Question 15 (25)

(i)	20D
(ii)	5B

Detailed marking notes

Question 1

(a)	Scale 5B (0, 2, 5)	
	Partial credit:	Uses incorrect operator.
(b)	Scale 5B (0, 2, 5)	
	Partial credit:	Uses incorrect operator.
(c)	Scale 5B (0, 2, 5)	
	Partial credit:	Uses incorrect operator, or reverses subtraction.
(d)	Scale 5B (0, 2, 5)	
	Partial credit:	Uses incorrect operator, or reverses division.
(e)	Scale 5C (0, 2, 3, 5)	***Tolerance***: $\pm 0 \cdot 5$cm (1 box).
	High partial credit:	2 correct entries.
	Low partial credit:	1 correct entry.
(f)	Scale 5B (0, 2, 5)	***Tolerance***: $\pm 0 \cdot 5$cm.
	Full credit –1:	Shades in ¼.
	Partial credit:	Shading outside of tolerance.

Question 2

(a)	Scale 10C (0, 4, 7, 10)	
	High partial credit:	Hours or minutes correct.
	Low partial credit:	Some work of merit.
(b)	Scale 5C (0, 2, 3, 5)	
	High partial credit:	3 correct entries.
	Low partial credit:	1 correct entry.
(c)	Scale 5B (0, 2, 5)	
	Partial credit:	13·35 or 12·15 or 14·50 or 17·10 or 17·25 or 17·80.

Question 3

(i)	Scale 5A (0, 5)	
(ii)	Scale 5A (0, 5)	
(iii)	Scale 5B (0, 2, 5)	
	Partial credit:	7 or 3.
(iv)	Scale 5B (0, 2, 5)	
	Partial credit:	⅓ or 5 or 15 or 17.

Question 4

(a)	Scale 10C (0, 4, 7, 10)	
	High partial credit:	Correct VAT or 546+11·70 = 557·70 or 78+11·70 = 89·70.
	Low partial credit:	Some work of merit.
(b)	Scale 10C (0, 4, 7, 10)	
	High partial credit:	4 correct pairs.
	Low partial credit:	1 correct entry.
(c)	Scale 5B (0, 2, 5)	
	Partial credit:	140 ÷ 1·17 or 14000/17 or 119·658119.

Question 5

(a)	Scale 5B (0, 2, 5)	
	Partial credit:	Correct spinner with no valid reason.
(b)	Scale 5B (0, 2, 5)	
	Full credit:	Accept ½ or 50%.
	Partial credit:	¼ × 12 = 3 or ⅓ × 12 = 4.

Question 6

	Scale 10B (0, 5, 10)	
	Partial credit:	1 element of the story correct.

Question 7

(i)	Scale 10C (0, 4, 7, 10)	
	High partial credit:	8 correct entries.
	Low partial credit:	1 correct entry.
(ii)	Scale 5B (0, 2, 5)	
	Partial credit:	A single digit from graph in (i).
(iii)	Scale 5B (0, 2, 5)	
	Full credit −1:	From 12 to 68 or similar.
	Partial credit:	12 or 68.
(iv)	Scale 10C (0, 4, 7, 10)	
	High partial credit:	Omits 12 or multiplies by 12.
	Low partial credit:	Some work of merit [including the mode (28) or the median (26·5)].
(v)	Scale 5B (0, 2, 5)	
	Partial credit:	Number given without a valid reason.

Question 8

(i)	Scale 10C (0, 4, 7,10)	
	High partial credit:	5 correct entries.
	Low partial credit:	Some work of merit.
(ii)	Scale 5B (0, 2, 5)	
	Partial credit:	Some work of merit.
(iii)	Scale 5B (0, 2, 5)	
	Partial credit:	Some work of merit.

Question 9

(i)	Scale 10C (0, 4, 7, 10)	***Tolerance***: ± 0·5cm and ± 5°.
	Full credit:	Accept [BC] without construction arc.
	Full credit –1:	Angle BAC = 60°.
	High partial credit:	Triangle with 1 measurement outside tolerance.
	Low partial credit:	Triangle with 2 measurements outside tolerance.
(ii)	Scale 5B (0, 2, 5)	***Tolerance***: ± 0·5cm.
	Full credit:	Accept measurement of $|AC|$ from candidate's construction.
	Partial credit:	Measurement outside tolerance.
(iii)	Scale 5B (0, 2, 5)	
	Full credit:	If answer is given as equilateral or isosceles, check candidate's work to see if it is consistent with answer given.
	Full credit –1:	Incorrect or no units.
	Partial credit:	Some work of merit.

Question 10

(i)	Scale 10C (0, 4, 7, 10)	
	High partial credit:	One correct point or two correct points reversed.
	Low partial credit:	Some work of merit.
(ii)	Scale 5B (0, 2, 5)	
	Partial credit:	Some work of merit.
(iii)	Scale 5B (0, 2, 5)	
	Partial credit:	Some substitution into correct formula.
		Rise or run mentioned.
		4 or 8 or 2,4 or 4,2.

Question 11

(a)	Scale 10C (0, 4, 7, 10)	
	High partial credit:	Correct substitution and stops.
	Low partial credit:	Some substitution or 18 or 90 or 108.
(b)	Scale 10C (0, 4, 7, 10)	
	Full credit:	3(5) + 2 = 17.
	Full credit –1:	Answer left as 15/3.
	High partial credit:	3x = 15 and stops.
	Low partial credit:	Unsuccessful trial and error.

Question 12

(a)	Scale 5C (0, 2, 3, 5)	
	High partial credit:	2 correct terms.
	Low partial credit:	Some work of merit.
(b)	Scale 5B (0, 2, 5)	
	Partial credit:	Some work of merit.

Question 13

(i) & (ii)	Scale 5B (0, 2, 5)	
	Partial credit:	A side from the triangle used.
(iii)	Scale 5B (0, 2, 5)	
	Full credit:	Ratio can be taken from the diagram or from (i) and (ii).
	Partial credit:	Incorrect ratio using a side from the triangle.

Question 14

(a)	Scale 10C (0, 4, 7, 10)	
	High partial credit:	x or y correct, or $x + y = 180$.
	Low partial credit:	Some work of merit.
(b) (i)	Scale 10B (0, 5, 10)	**Tolerance**: ± 0.5 cm (one box).
	Full credit:	Shading not needed for full credit.
	Partial credit:	Incorrect transformation.
(b) (ii)	Scale 5B (0, 2, 5)	
	Full credit –1:	20.
	Partial credit:	2 or 3 or 4 or 6 or 24.

Question 15

(i)	Scale 20D (0, 5, 10, 15, 20)	***Tolerance***: $\pm 0{\cdot}5$ cm (one box)
	High partial credit:	4 correct points, joined; or
		5 correct points plotted but not joined / joined incorrectly.
	Mid partial credit:	3 correct points.
	Low partial credit:	1 correct point.
(ii)	Scale 5B (0, 2, 5)	
	Full credit:	Accept: $19 \leq$ Answer < 21, or answer from graph, if extended (tolerance as in (i)).
		Note: Candidates do not need to extend the graph.
	Partial credit:	Height outside of tolerance

Bonus marks for answering through Irish

Bonus marks are applied separately to each paper, as follows:

If the mark achieved is 225 or less, the bonus is 5% of the mark obtained, rounded **down**.
For instance, 198 marks $\times$ 5% = 9·9 $\Rightarrow$ bonus = 9 marks.

If the mark achieved is above 225, the following table applies:

Bunmharc (Mark achieved)	Marc Bónais (Bonus mark)	Bunmharc (Mark achieved)	Marc Bónais (Bonus mark)
226	11	261 – 266	5
227 – 233	10	267 – 273	4
234 – 240	9	274 – 280	3
241 – 246	8	281 – 286	2
247 – 253	7	287 – 293	1
254 – 260	6	294 – 300	0