Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2014

Marking Scheme

Mathematics
(Project Maths – Phase 2)

Ordinary 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 – Paper 1

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.

Question 15 carries a total of 50 marks.

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   **20 Marks**

(a)   The digits 6, 2, 9, and 5 are written on four cards as shown:

| 6 | | 2 | | 9 | | 5 |

The cards can be rearranged to make different four-digit numbers, for example:

| 9 | | 6 | | 5 | | 2 | $= 9652$.

Rearrange the cards to give:

(i)   an odd number

> 5629 *or similar. (Any number using the 4 digits and ending in 9 or 5.)*

(ii)   the smallest possible number.

> 2569

(b)   Insert operators to make each calculation below correct.
Use the operators $+$, $-$, and $\times$.

> *Example*:   3 ☐ 2 ☐ 5 = 13
>
> *Answer*:   3 $+$ 2 $\times$ 5 = 13

(i)   3 $-$ 2 $+$ 5 = 6

(ii)   3 $\times$ 2 $-$ 5 = 1

Question 2   **20 Marks**

(a)   **(i)**   Michael buys five items in a shop.
He estimates the total cost of his purchases by rounding each item to the nearest euro, and then adding the estimates.

Complete the table to show Michael's calculations.

Item	Actual Cost	Estimate (nearest euro)
Magazine	€2·80	3
Milk	€1·79	2
Banana	34 cent	0
Bread	€1·23	1
Biscuits	79 cent	1
Total	€6·95	7

    (ii)   Find the difference between the actual total cost and Michael's estimate of the total cost.

€7 − 6·95 = €0·05, *or* 5 cent.

(b)   The numbers in the table below were rounded using different methods.
Complete the table.

Number	Rounded number	Rounded to…
851·7	852	the nearest whole number
0·0026	0·003	three decimal places
798·798	798·8	one decimal place
12·342, *or similar* (incl. 12·34)	12·34	two decimal places

Question 3   **20 Marks**

(a) Last month, Ciara spent $\frac{1}{5}$ of her pocket money on snacks and spent $\frac{1}{2}$ of her pocket money on phone credit. She put the remainder of her pocket money into her credit union account.

    (i) What fraction of her pocket money did she spend?

$^1/_5 + {}^1/_2 = {}^2/_{10} + {}^5/_{10} = {}^7/_{10}$

    (ii) The amount she put into her credit union account was €12.
        How much pocket money did Ciara receive for the month?

$^3/_{10} = €12$

$^1/_{10} = €4$

$^{10}/_{10} = €40$

(b) There are 45 sweets in a box.
The sweets are to be divided between three children in the ratio of their ages.
The children are aged 2, 3, and 4 years old.

How many sweets will each child get?

$2 + 3 + 4 = 9$ parts.
$45 \div 9 = 5$ sweets per part.

$2 \times 5 = 10$ sweets
$3 \times 5 = 15$ sweets
$4 \times 5 = 20$ sweets

Question 4 **20 Marks**

The table below shows the values when 3 is raised to certain powers.

(i) Complete the table.

Power of 3	Expanded power of 3	Answer
3^1	3	3
3^2	3×3	9
3^3	$3 \times 3 \times 3$	27
3^4	$3 \times 3 \times 3 \times 3$	81
3^5	$3 \times 3 \times 3 \times 3 \times 3$	243

(ii) 3^8 is 6561.

Explain how you could use this to find the value of 3^9 without using a calculator.

Multiply 6561 by 3   *or* $3^8 \times 3^1 = 3^9$ *or equivalent.*

Question 5   **15 Marks**

(a) John was asked to give an example of a set.
He said: "The set of good websites."

Explain why this is **not** a set.

> You can't say for sure if some websites are good or not, *or equivalent.*
>
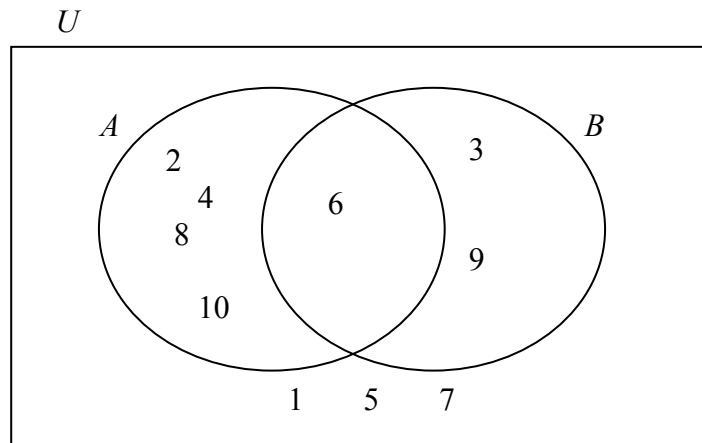> *Explanation should include the idea that this is **not well-defined**.*

(b) The sets *U*, *A*, and *B* are defined as follows:

$U = \{1, \ 2, \ 3, \ 4, \ 5, \ 6, \ 7, \ 8, \ 9, \ 10\}$

A is the set of multiples of 2, from 1 to 10 inclusive

B is the set of multiples of 3, from 1 to 10 inclusive.

(i) Use these sets to fill in the Venn diagram.

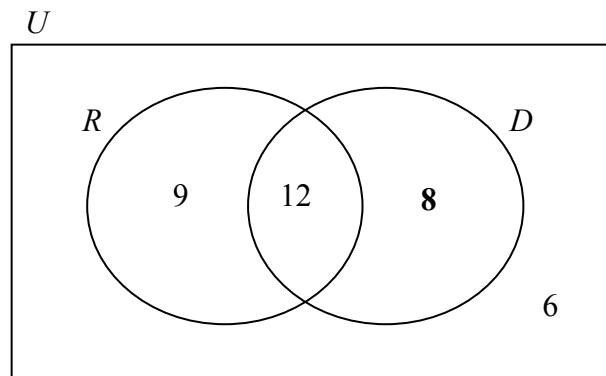**(ii)** Using your Venn diagram, find the smallest number that is both a multiple of 2
and a multiple of 3 (the least common multiple).

> 6

Question 6   **25 Marks**

As part of a survey, 35 students were asked if they like Rihanna (*R*) or One Direction (*D*).
Some of the results are shown in the Venn diagram below.

(i)   Complete the Venn diagram.
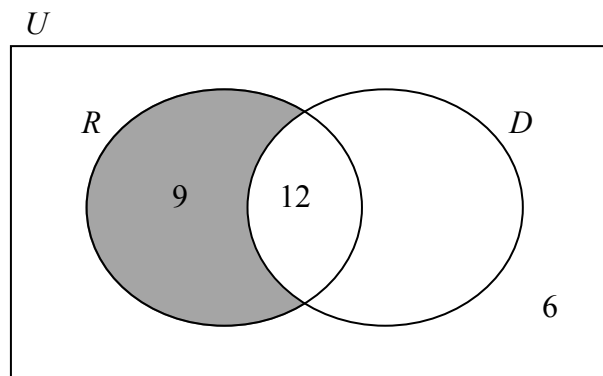
> 9 + 12 + 6 = 27
>
> 35 − 27 = 8
>
> *See diagram.*

(ii)   How many pupils liked One Direction?

> 12 + 8 = 20

(iii)   Shade the region of the Venn diagram which represents $R \setminus D$.

(iv)   Describe in your own words what this shaded region represents.

> The students who liked Rihanna but not One Direction, *or equivalent*.

Question 7   **10 Marks**

VAT in Ireland is charged at different rates on different items. For instance:

    Children's shoes have a VAT rate of 0%
    Bulls have a VAT rate of 4·8%
    Newspapers have a VAT rate of 9%.

(a)   A pair of children's shoes costs €20 **before** VAT is added.
       Write down the cost of the shoes **after** VAT is added.

€20

(b)   A bull is sold for €1600 **before** VAT is added.
       Find the cost of the bull **after** VAT is added.
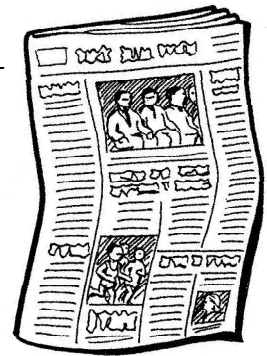
4·8% of €1600 = €76·80
€1600 + €76·80 = €1676·80

(c)   A newspaper costs €2·18 **after** VAT is added.
       Find the cost of the newspaper **before** VAT is added.

109% = €2·18
1% = €0·02
100% = €2

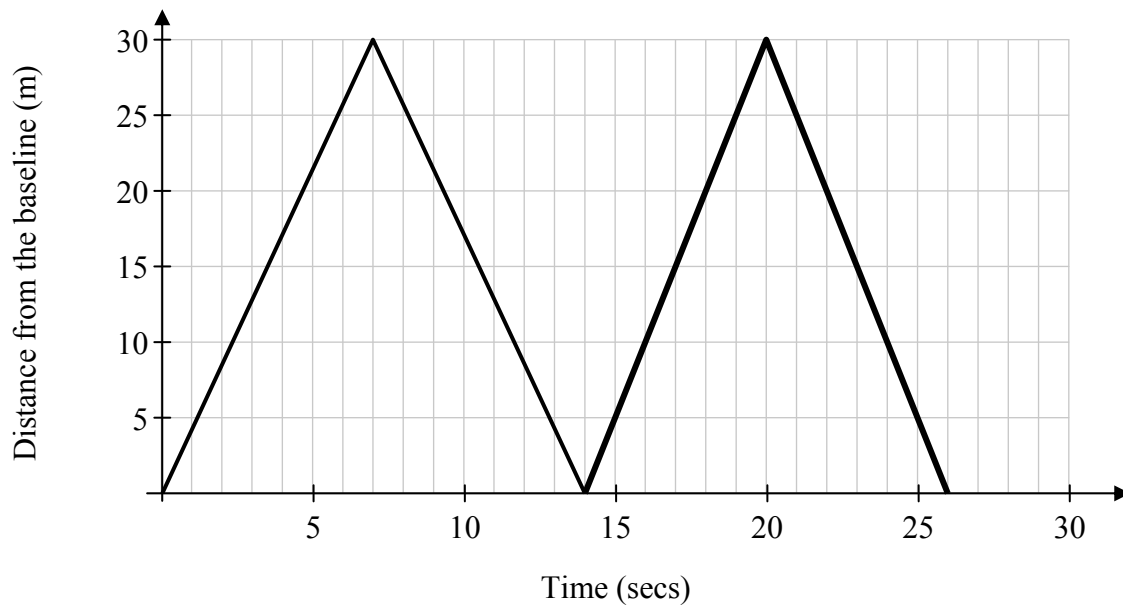**Question 8**   20 Marks

The students in a PE class are doing a fitness test.

Each student runs from the *baseline* of the gym to the *halfway line* of the gym, and back again.
This is called a *lap*. They run a number of laps in the fitness test.

The graph below shows Miriam's distance from the baseline for her first lap.

(i)   From the graph, how long did it take Miriam to complete her first lap?

14 seconds

(ii) From the graph, how far is the *baseline* of the gym from the *halfway line* of the gym?

30 m

(iii) For her second lap, Miriam increases her average speed to 5 metres per second.
On the diagram, continue the graph to show her distance from the baseline over the course
of this lap.

See diagram. (No working out required – *for each second you go out on the vertical* *axis, you go up/down 5 metres.)*	*Or*: $$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$ $$= \frac{30}{5}$$ $$= 6 \text{ seconds}$$ for half lap, total time 12 seconds *See diagram.*

Question 9   **15 Marks**

(i)   Fill in the first difference and the second difference for the following patterns.
Some of Pattern 1 has been completed for you.

Pattern 1:   2   4   9   17   28

First difference:
(*Change*)   2   **5**   8   11

Second difference:
(*Change of change*)   3   3   **3**

Pattern 2:   −1   2   5   8   11

First difference:
(*Change*)   3   3   3   3

Second difference:
(*Change of change*)   0   0   0

(ii)   State whether each pattern is **linear** or **quadratic**. Give a reason for each answer.

Pattern 1:   Quadratic
Reason: First difference changes, second difference is constant, *or equivalent*
Pattern 2:   Linear
Reason: First difference is constant, *or equivalent*

Question 10   **30 Marks**

(a)   Factorise fully each of the following expressions.

     (i) $5x + 10$

> $5 (x + 2)$

     (ii) $rc - sc + 2rd - 2sd$

> $(c + 2d) (r - s)$

     (iii) $x^2 - 16$

> $(x + 4)(x - 4)$

(b)   **(i)**   Factorise $x^2 - 5x + 6$.

> $(x - 3)(x - 2)$

     (ii)   Using your answer from **(b)(i)**, or otherwise, solve the equation $x^2 - 5x + 6 = 0$.

> $(x - 3)(x - 2) = 0$
>
> $x = 3 \quad x = 2$

     (iii)   Verify **one** of your answers from **(b)(ii)**.

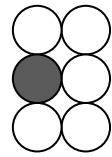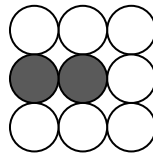| *Either*:	*Or*:
$3^2 - 5(3) + 6 = 0$	$2^2 - 5(2) + 6 = 0$
$9 - 15 + 6 = 0$	$4 - 10 + 6 = 0$
$0 = 0$	$0 = 0$

Question 11 15 Marks

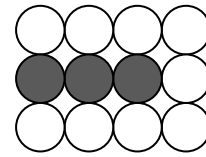The first three stages of a pattern are shown below.
Each stage is made up of a certain number of shaded discs and a certain number of white discs.

1st Stage   2nd Stage   3rd Stage

(i) Shade in the appropriate discs below to show the 4th stage of the pattern.
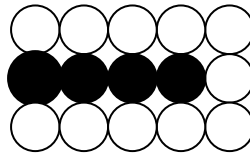
(ii) Complete the table below to show how the pattern continues.

Number of Shaded Discs	Number of White Discs
1	5
2	7
3	9
4	11
5	13
6	15

(iii) In a particular stage of the pattern, there are 21 white discs.
How many shaded discs are there in this stage of the pattern?

9

(iv) Write down the relation between the number of shaded discs and the number of white discs in each stage of the pattern. State clearly the meaning of any letters you use.

There are 2 extra white discs for each extra shaded disc. There is 1 shaded disc and 5 white discs at the start.	*Or*: Shaded discs $= n$ White discs $= 3 + 2n$

Question 12   **15 Marks**

(a) $\mathbb{Z}$ is the set of integers. Explain what an integer is.

> Integers are all the whole numbers;
>
> *or*:   An integer is an element of {....−3, −2, −1, 0, 1, 2, 3 ...};   *or equivalent.*

(b)   (i)   Solve the inequality $-7+2x\leq1$, where $x\in\mathbb{Z}$.

> $2x \leq 1 + 7$
>
> $2x \leq 8$
>
> $x \ \leq 4$

(ii)   Graph your solution to **(b)(i)** on the number line given below.
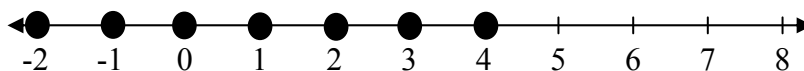
Question 13   **15 Marks**

Eva bought an Xbox for US$199·95, when she was on holidays in the United States.
The exchange rate was US$1·33 = €1.

(i)   Convert the cost of the Xbox to euro. Write your answer correct to the nearest cent.

> €199·95 ÷ 1·33 = €150·34 (to the nearest cent)

An Xbox of the same model costs €269·99 in Ireland.

(ii)   How much money did Eva save by buying the Xbox in the United States?

> €269·99 − €150·34 = €119·65

Question 14   10 Marks

The graph of the line $y = -x + 4$ is shown below.
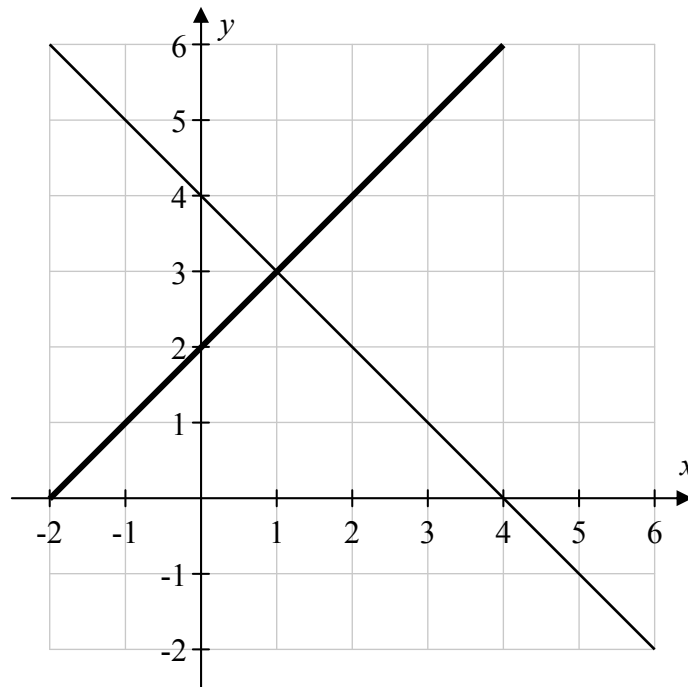
(i) Using the same axes and scales, draw the graph of the line $y = x + 2$.

> *Line cuts axes at (0,2) and (-2,0), or line cuts y-axis at 2 and has slope of 1. See diagram.*

(ii) From the graphs, state the point of intersection of the two lines.

> (1 , 3)

(iii) Verify your answer to **(ii)** using algebra.

Either simultaneous equations, e.g.:	*Or sub (1,3) into the equation of each line:*
$y \quad = \quad -x + 4$ <u>$y \quad = \quad x + 2$</u> $2y \quad = \quad 6$ $y \quad = \quad 3$ $\Rightarrow \quad x \quad = \quad 1$ $\Rightarrow \quad$ Point of intersection is (1, 3)	$y = -x + 4$ $3 = -1 + 4$ $3 = 3$ *and*: $y = x + 2$ $3 = 1 + 2$ $3 = 3$

Question 15   50 Marks

(a) $h : x \mapsto 4x - 3$, where $x \in \mathbb{R}$. Find:

$h(5) = 4(5) - 3 = 17$

$h(0) = 4(0) - 3 = -3$

(b)   **(i)**   Draw the graph of the function $f : x \mapsto x^2 - 2x - 1$ in the domain $-2 \le x \le 4$, where $x \in \mathbb{R}$.

There is room for working out on the next page.
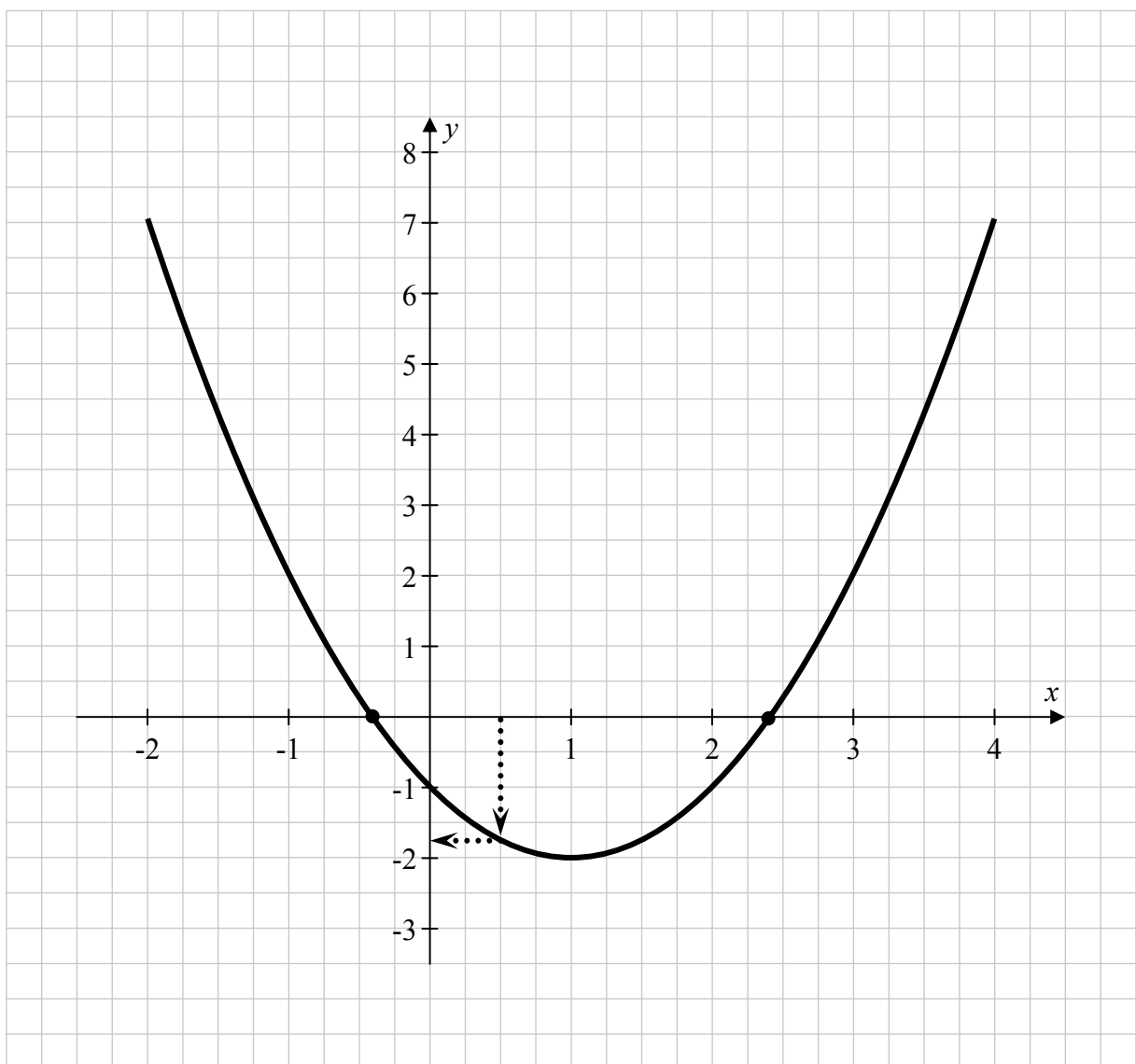
$f(-2) = 7$

$f(-1) = 2$

$f(0) = -1$

$f(1) = -2$

$f(2) = -1$

$f(3) = 2$

$f(4) = 7$

Use your graph from **(b)(i)** to answer the following questions. Show your work on the graph.

(ii)   Find the value of y when $x = 0.5$.

-1.75

See graph

(iii)   Find the values of x when $y = 0$.

-0.4 and 2.4

See graph

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:

	A	**B**	**C**	**D**
5	0, 5	0, 3, 5	0, 3, 4, 5	
10	0, 10	0, 6, 10	0, 5, 8, 10	0, 4, 7, 9, 10
15			0, 7, 13, 15	

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, 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 (20)

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

Question 2 (20)

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

Question 3 (20)

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

Question 4 (20)

(i)	10C
(ii)	10B

Question 5 (15)

(a)	5A
(b)(i)&(ii)	10C

Question 6 (25)

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

Question 7 (10)

(a)	5A
(b)&(c)	5C

Question 8 (20)

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

Question 9 (15)

(i)	10C
(ii)	5C

Question 10 (30)

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

Question 11 (15)

(i)	5A
(ii)	5C
(iii)&(iv)	5C

Question 12 (15)

(a)	5B
(b)(i)&(ii)	10D

Question 13 (15)

(i)	5C
(ii)	10B

Question 14 (10)

(i)	5C
(ii)&(iii)	5C

Question 15 (50)

(a)	15C	
(b)(i)	15C	Table
(b)(i)	15C	Graph
(b)(ii)&(iii)	5C	

Detailed marking notes

Question 1 (20)

(a)	Scale 10C (0, 5, 8, 10)	
	Low partial credit:	Use of 1 correct digit.
	High partial credit:	Either (i) or (ii) correct.
(b)(i)	Scale 5B (0, 3, 5)	
	Partial credit:	Use of given operators.
(b)(ii)	Scale 5B (0, 3, 5)	
	Partial credit:	Use of given operators.
	Full Credit –1:	$3 + 2 \div 5$.

Question 2 (20)

(a)(i)	Scale 10C (0, 5, 8, 10)	
	Low partial credit:	1 correct entry.
	High partial credit:	3 correct entries.
	Full credit:	Don't need €6·95 for full credit.
(a)(ii)	Scale 5B (0, 3, 5)	
	Partial credit:	Total(Estimate Cost) – Total(Actual), but fails to finish.
(b)	Scale 5C (0, 3, 4, 5)	
	Low partial credit:	1 correct entry.
	High partial credit:	2 correct entries.
	Full credit:	"1 significant figure" is also correct.

Question 3 (20)

(a)(i)	Scale 10C (0, 5, 8, 10)	
	Low partial credit:	Finds a common multiple between 5 and 2; *or*
		A correct conversion (e.g. 2/10 or 5/10).
	High partial credit:	Gets 2/10 **and** 5/10 (or similar).
	Full credit:	Correct answer as a fraction / percentage / decimal.
		Accept fraction if not in simplest form.
(a)(ii)	Scale 5C (0, 3, 4, 5)	
	Low partial credit:	Uses 3/10; *or* Finds 1/10 from 7/10 = €12.
	High partial credit:	Gets 1/10; *or* Starts with 7/10 = €12 and finishes correctly.
(b)	Scale 5C (0, 3, 4, 5)	
	Low partial credit:	9 parts; *or* Attempt at trial and improvement.
	High partial credit:	5 sweets per part; *or*
		Trial and improvement listed but no conclusion.

Question 4 (20)

(i)	Scale 10C (0, 5, 8, 10)	
	Low partial credit:	1 correct entry.
	High partial credit:	2 correct entries.
(ii)	Scale 10B (0, 6, 10)	
	Partial credit:	Correct expansion of 3^9.
		Note: No marks given for evaluating 3^9.

Question 5 (15)

(a)	Scale 5A (0, 5)	
	Full credit:	Accept the idea that different people will disagree over what websites are good.
(b)	Scale 10C (0, 5, 8, 10)	
	Low partial credit:	2 correctly positioned entries in Venn diagram; *or*
		Lists elements of set A or B correctly; *or* (ii) correct.
	High partial credit:	(i) correct; *or* (ii) correct and work of merit for (i) (i.e. enough to get low partial credit).

Question 6 (25)

(i)	Scale 5B (0, 3, 5) *Partial credit:* *Full credit –1:*	Uses some relevant numbers. Answer found, but not filled into Venn diagram (misreading).
(ii)	Scale 5C (0, 3, 4, 5) *Low Partial credit:* *High Partial credit:*	12 or 8. 12 + 8.
(iii)	Scale 5B (0, 3, 5) *Partial credit:*	$D \setminus R$ or $R \cap D$ shaded.
(iv)	Scale 10A (0, 10) *Full credit:*	Accept explanation of what shaded region represents, or of what $R \setminus D$ represents, if they are different.

Question 7 (10)

(a)	Scale 5A (0, 5)	
(b)&(c)	Scale 5C (0, 3, 4, 5) *Low partial credit:* *High partial credit:*	Attempts to get 4·8% or 9% of given value. (b) or (c) correct; *or* In (c), finds 9% of €2·18 and adds it to / subtracts it from €2·18.

Question 8 (20)

(i)	Scale 10B (0, 6, 10) *Partial credit:*	Answer between 0 and 13, inclusive.
(ii)	Scale 5B (0, 3, 5) *Partial credit:* *Full credit –1:*	15 m; *or* 3·5 seconds. 7 seconds (misreading).
(iii)	Scale 5C (0, 3, 4, 5) *Low partial credit:* *High partial credit:*	Some effort at continuing the graph in similar fashion to first lap; *or* Effort made to use S=D/T and S=5m/s; *or* 1st half of graph drawn correctly, but from incorrect starting point. Graph continued correctly to halfway line; *or* Graph drawn correctly, but from incorrect starting point.

Question 9 (15)

(i)	Scale 10C (0, 5, 8, 10)	
	Low partial credit:	1 correct entry.
	High partial credit:	Entries in Pattern 1 or Pattern 2 fully correct.
(ii)	Scale 5C (0, 3, 4, 5)	
	Low partial credit:	1 correct response (answer or reason for Pattern 1 or Pattern 2).
	High partial credit:	Responses fully correct for Pattern 1 or Pattern 2.

Question 10 (30)

(a)(i)	Scale 5B (0, 3, 5)	
	Partial credit:	1 correct factor.
(a)(ii)	Scale 5C (0, 3, 4, 5)	
	Low partial credit:	1 correct grouping indicated.
	High partial credit:	1 factor correctly taken out of each pair.
(a)(iii)	Scale 5B (0, 3, 5)	
	Partial credit:	Any relevant work.
(b)(i)	Scale 10C (0, 5, 8, 10)	
	Low partial credit:	A correct factorising (of x^2 or 6).
	High partial credit:	1 factor correct; *or* Correct factors, but with incorrect sign(s).
(b) (ii)&(iii)	Scale 5C (0, 3, 5)	
	Low partial credit:	Any correct step in (ii), including if got by trial and error; *or* Substitutes a solution from (ii) into (iii).
	High partial credit:	(ii) **or** (iii) correct (accept correct solutions got by trial and error in (ii), where working out for both is shown).
	Full credit:	(ii) **and** (iii) correct. (If (iii) is answered in the space for (ii), accept for *Full credit* if indication is given in (iii), e.g. "see (ii)". If no indication given, award *High partial credit*.)

Question 11 (15)

(i)	Scale 5A (0, 5)	
(ii)	Scale 5C (0, 3, 4, 5)	
	Low partial credit:	1 number correct.
	High partial credit:	3 numbers correct.
(iii) &(iv)	Scale 5C (0, 3, 4, 5)	
	Low partial credit:	1 term beyond term 6 (=15) written down in (iii), e.g. 17, 19; *or* Introduces a variable in (iv); *or* Expresses idea that there are 2 extra white discs for each extra shaded disc (or equivalent).
	High partial credit:	(iii) **or** (iv) correct; *or* Work of merit in both (iii) **and** (iv) (as listed above).
	Full credit:	(iii) **and** (iv) correct.

Question 12 (15)

(a)	Scale 5B (0, 3, 5)	
	Partial credit:	Some integers given; *or* Definition given is a subset of the integers, e.g. negative whole numbers.
	Full credit:	Need to have idea that integers are all the whole numbers. Accept "positive and negative whole numbers" (i.e. 0 omitted).
(b)	Scale 10D (0, 4, 7, 9, 10)	
	Low partial credit:	Any work of relevance.
	Mid partial credit:	Isolates x term correctly (Accept incorrect/no inequality sign).
	High partial credit:	(i) correct (accept $x = 4$); *or* (ii) correct, i.e. $x \leq 4$ graphed correctly.

Question 13 (15)

(i)	Scale 5C (0, 3, 4, 5)	
	Low partial credit:	Indicates $\times 1 \cdot 33$ or $\times 0 \cdot 33$.
	High partial credit:	Indicates $\div 1 \cdot 33$.
(ii)	Scale 10B (0, 6, 10)	
	Partial credit:	Use of €269·99 or candidate's answer to (i). *Note*: Full marks for answer given in dollars $159.14

Question 14 (10)

(i)	Scale 5C (0, 3, 4, 5)	
	Low partial credit:	1 correct point or couple indicated; *or* attempts to find *x*-intercept or *y*-intercept; *or* Any line with positive slope. Parallel line has to go through relevant point(s) to secure *Low partial credit*.
	High partial credit:	2 correct couples but no line drawn; *or* *y*-intercept or slope of line correct.
(ii) &(iii)	Scale 5C (0, 3, 4, 5)	
	Low partial credit:	Relevant work in (ii) **or** (iii). E.g. (ii): 1 correct element of couple found; *or* Co-ordinates reversed; *or* Point of intersection indicated on graph. E.g. (iii): An effort to solve simultaneous equations; *or* Substitutes an *x*- or a *y*-value into the equation of 1 line.
	High partial credit:	(ii) correct; *or* Relevant work in (ii) **and** (iii); *or* Substantial work in (iii), e.g. Solves simultaneous equations for one variable; *or* Point correctly verified by substitution in 1 line. *Note*: If parallel line drawn for (i), accept statement "no point of intersection", or equivalent, for *High partial credit* in (ii) & (iii) combined. In this case, *High partial credit* is the maximum that can be awarded, despite any work in (iii).
	Full credit:	(ii) **and** (iii) correct. (iii) can be done by simultaneous equations or by substitution.

Question 15 (50)

Note: In b(i), if the points graphed are closer to the solution than those in the table, or if no points are worked out, award the marks for the graph in both parts.

For the parts of this question involving drawing or reading from a graph, the tolerance is ±1 box.

(a)	Scale 15C (0, 7, 13, 15)	
	Low partial credit:	1 value (0 or 5) substituted in function.
	High partial credit:	Correct substitution giving 1 correct answer.
(b)(i) T	Scale 15C (0, 7, 13, 15)	
	Low partial credit:	1 correct couple / *y*-value (based on candidate's work); *or* An effort at calculating a point by substitution.
	High partial credit:	4 correct couples / *y*-values (based on candidate's work).
(b)(i) G	Scale 15C (0, 7, 13, 15)	
	Low partial credit:	1 point plotted correctly. *Note*: If points are incorrectly calculated but plotted to form a line, award *Low partial credit* at most.
	High partial credit:	4 points plotted correctly (joined or unjoined).
(b) (ii)&(iii)	Scale 5C (0, 3, 4, 5)	
	Low partial credit:	Relevant work in (ii) **or** (iii). E.g. (ii): Correct answer without indication on the graph; *or* Answer on the diagram but outside of tolerance; *or* Fails to write down the answer, when indicated correctly on graph. E.g. (iii): 1 point of intersection indicated on graph; *or* 1 value of *x* written down.
	High partial credit:	(ii) **or** (iii) correct; *or* Relevant work in (ii) **and** (iii); *or* 2 points of intersection indicated on graph for (iii).
	Full credit:	(ii) **and** (iii) correct. Accept answer(s) from graph, if within tolerance. Accept answers to (iii) without indication on graph.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate Examination 2014

Mathematics
(Project Maths – Phase 2)

Paper 2

Ordinary Level

Model Solutions – Paper 2

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 14 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.

Question 15 carries a total of 50 marks.

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   **15 Marks**

The diagram below shows two rectangular sheets of paper, with sides of length 6 cm and 8 cm.
Each sheet is cut in half along the dotted line, to form the pieces **A**, **B**, **C**, and **D**.
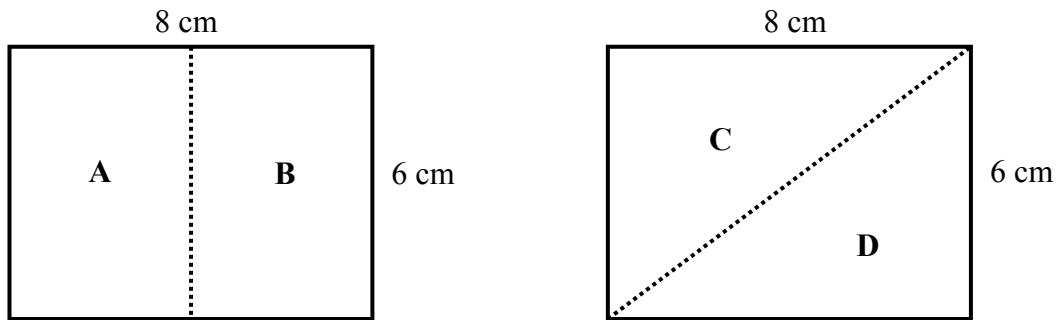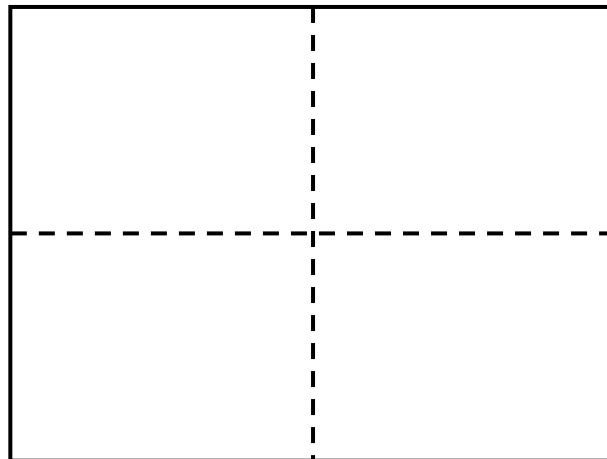
(a) Is the area of the rectangular piece **A** equal to the area of the triangular piece **D**?
Give a reason for your answer.

Answer:	Yes
Reason:	Each is half of the same rectangle
Or:	Area of A = $^1/_2 \times (8 \times 6) = 24$ cm^2 and Area of D = $^1/_2 (8 \times 6) = 24$ cm^2

(b) Draw **all** the axes of symmetry of the following rectangle.

Question 2   **10 Marks**

Students in a class were carrying out a survey on sleeping patterns of people aged between 40 years and 60 years, inclusive. The following questions were considered for the survey.

In each case, give **one reason** why the question is unsuitable, and rewrite it in a **suitable form**.

(a) Question 1: Put a tick (✓) in **one** box below to indicate your age, in years.

40 – 45	45 – 50	50 – 55	55 – 60
❏	❏	❏	❏

Explanation: Ages overlap

Suitable form: *For example*:

Put a tick (✓) in one box below to indicate your age, in years.

40 – 44	45 – 49	50 – 54	55 – 60
❏	❏	❏	❏

(b) Question 2: Normal people sleep eight hours a night. Do you sleep eight hours a night?

Explanation: Encourages people to say that they sleep eight hours a night.

Suitable form: *For example*: How many hours a night do you sleep?

Or: Do you sleep eight hours (or more) a night?

Question 3 **35 Marks**

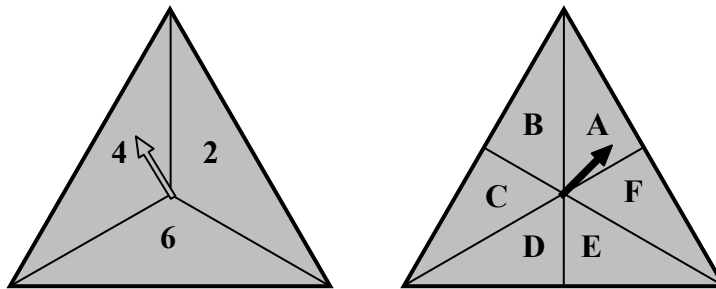A game is played using the two spinners shown below.

The first spinner has three segments labelled **2**, **4**, and **6**.
The arrow has the same chance of stopping at each number.

The second spinner has six segments labelled **A**, **B**, **C**, **D**, **E**, and **F**.
The arrow has the same chance of stopping at each letter.

Two possible outcomes are (**2**, **A**) and (**6**, **D**).

(i) List all the possible outcomes in the table below.

	A	B	C	D	E	F
2	(**2**, **A**)	(2, B)	(2, C)	(2, D)	(2,E)	(2,F)
4	(4, A)	(4, B)	(4, C)	(4, D)	(4, E)	(4,F)
6	(6, A)	(6, B)	(6, C)	(**6**, **D**)	(6, E)	(6, F)

(ii) How many outcomes contain the letter **E**?

3 outcomes

(iii) What is the probability that the outcome contains the letter **E**?

$^{3}/_{18}$ or $^{1}/_{6}$

(iv) What is the probability that the outcome contains the number **6**?

$^{6}/_{18}$ or $^{1}/_{3}$

(v) What is the probability that the outcome contains **E**, or **6**, or both?

$^{8}/_{18}$ or $^{4}/_{9}$
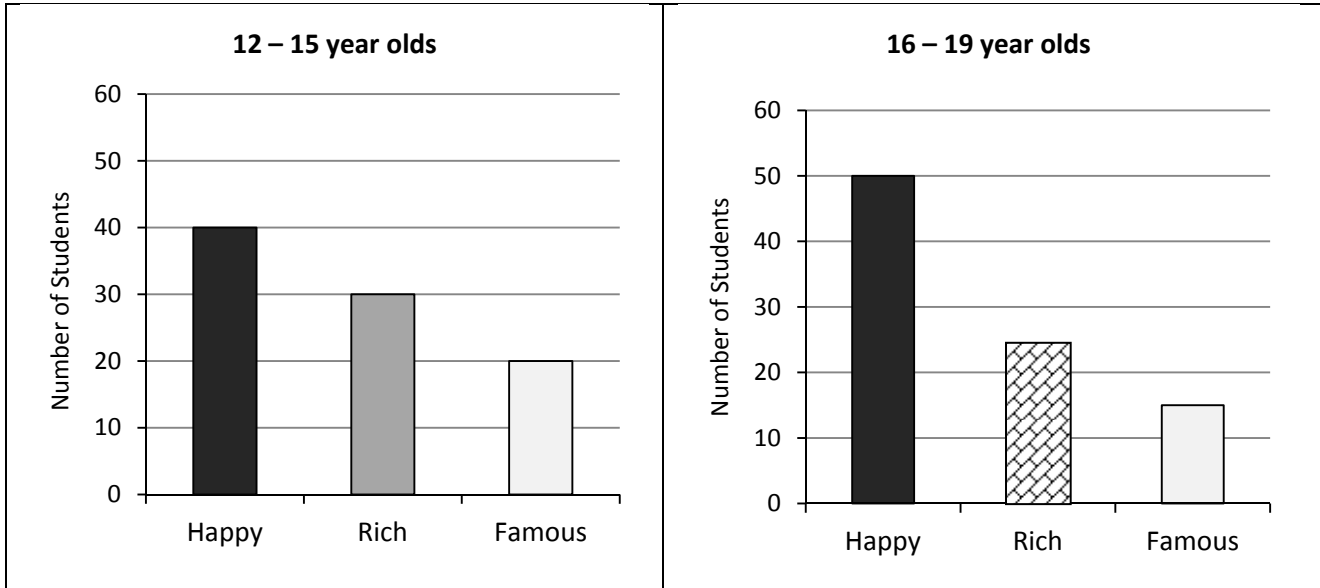
Question 4   **30 Marks**

In a survey, two groups of students were asked whether they would prefer to be **Happy**, **Rich**, or **Famous**.

The first group consisted of 12 – 15 year olds.
The second group consisted of 16 – 19 year olds.

Most of the survey results are displayed in the bar charts below.

(i)   How many 12 – 15 year olds were surveyed, in total?

> 40 + 30 + 20 = 90

(ii)   There was the same number of students in each group.

Use this information to fill in the missing bar in the graph for the 16 – 19 year olds.

> 50 + 15 = 65
>
> 90 – 65 = 25
>
> *See graph*

(iii)   What fraction in each group would prefer to be **Happy**?

12 - 15 year olds: $^{40}/_{90}$ or $^{4}/_{9}$	16 - 19 year olds: $^{50}/_{90}$ or $^{5}/_{9}$

The results from one of the groups are displayed in the pie chart below.
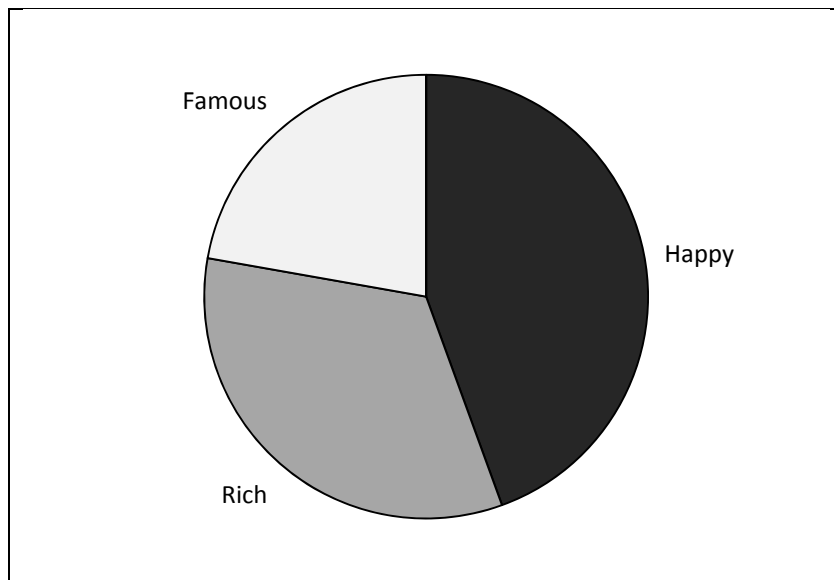
(iv) Does this pie chart represent the results of the 12 – 15 year olds, or the 16 – 19 year olds?
Give a reason for your answer.

Answer:	12 – 15 year olds
Reason:	**Happy** is less than half of pie chart, *or equivalent.*
	Or measures at least one angle, and calculates what angle should be from data on previous page.

Question 5   **50 Marks**

A class of 20 students took an on-line test.
The time, in seconds, it took each student to complete the test is shown below.

15	22	17	49	12	24	15	23	8	21
16	15	20	9	26	32	8	19	18	30

(i) Represent the data on a stem-and-leaf diagram.

0	8	8	9					
1	2	5	5	5	6	7	8	9
2	0	1	2	3	4	6		
3	0	2						
4	9							

Key: 1|6 = 16 seconds

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

> Range = 8 – 49 = 41 seconds

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

> Mode = 15 seconds

(iv) Find the **mean** of the data. Give your answer correct to the nearest second.

Mean = (8+8+9+12+15+15+15+16+17+18+19+20+21+22+23+24+26+30+32+49) / 20

= 399/20

= 19·95

=20 seconds (correct to the nearest second)

Seán had a problem with his computer and it took him longer than the other students to complete the on-line test.

(v) How long did it take Seán to complete the test?

49 seconds

(vi) The teacher said she would leave out Seán's time when she calculated the mean.

Would you expect her answer to be bigger or smaller than the mean of the whole class?

Give a reason for your answer.

Answer: Smaller

Reason: 49 is a large number; *or* (399- 49)/19 = 18·42...

Question 6   **35 Marks**

(i)   Plot the points $A(3,1)$, $B(0,4)$, and $C(-2,-1)$ on the grid below.
        Join the points to form a triangle.
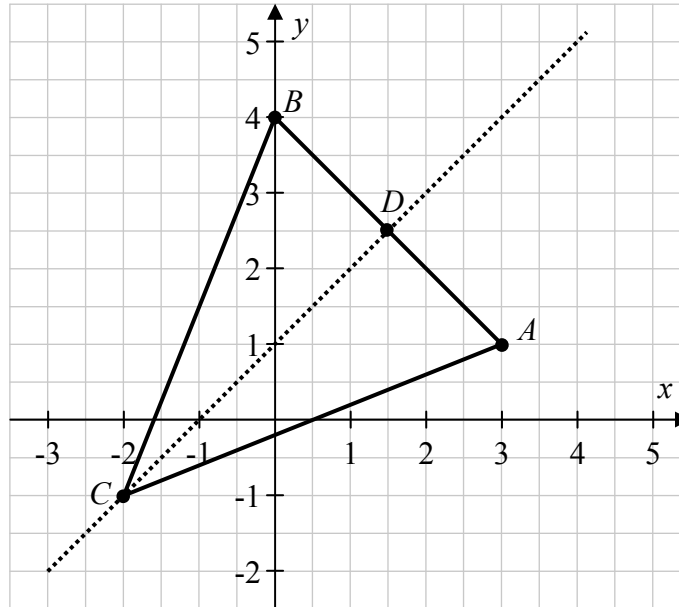
(ii)   By calculating $|AC|$ and $|BC|$, show that $|AC| = |BC|$.

$|AC| = \sqrt{2^2 + 5^2} = \sqrt{29}$	$|BC| = \sqrt{2^2 + 5^2} = \sqrt{29}$

(iii) What type of triangle is $\triangle ABC$?   Isosceles

(iv) D is the midpoint of $[AB]$. Find the co-ordinates of D.

$$D = (\,^3/_2,\ ^5/_2)\ \text{ or }\ (1\cdot 5,\, 2\cdot 5)$$

(v)   Draw the line CD on the diagram.

(vi) Show that the triangles $\triangle ADC$ and $\triangle BDC$ are congruent. Use SSS or SAS.

SSS:	SAS:
$\triangle ADC$ $\triangle BDC$	$\triangle ADC$ $\triangle BDC$
$|AC|$ $=$ $|BC|$.......from **(ii)**	$|AC|$ $=$ $|BC|$..........from **(ii)**
$|BD|$ $=$ $|DA|$ ......D is midpoint of $[AB]$	$|BD|$ $=$ $|DA|$ ....D is midpoint of $[AB]$
$|CD|$ $=$ $|CD|$ ......common	$|\angle CBD| =$ $|\angle CAD|$.... isosceles triangle

Question 7   **20 Marks**

(a) The following terms can be used to describe the probability that an event happens.

         Likely   **Certain**   **Unlikely**   **Impossible**   **50 : 50**

For each event in the table below, use one of these terms to describe the probability that it happens.

Event	Probability
When a fair coin is tossed you get a head.	50:50
If you buy a lottery ticket for next Saturday's draw, you will win the jackpot.	Unlikely
The 1st of January will be New Year's Day.	Certain

(b) Four events, **A**, **B**, **C**, and **D**, are listed below.

     A: You pick a red ball from a bag containing 3 black and 7 red balls.

     B: You get a natural number less than 7 when you roll a regular six-sided die.

     C: You pick a red card from a deck of playing cards.

   **D**:   You pick a yellow ball from a bag containing 4 red balls and 2 white balls.

Write each of the letters **A**, **B**, **C**, and **D** into the correct box on the probability scale below, to show the probability of each event.

D			C	A		B

0   0·5   1
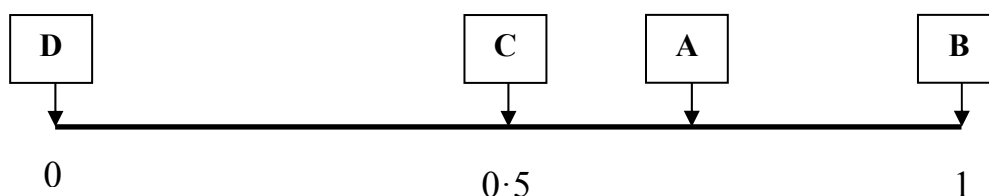
Question 8   25 Marks

On a reality TV show, contestants have to perform tasks on an island.
They are given the map of the island shown below.

Two points, *A* and *B*, are marked with **x**'s. Basecamp is also marked.
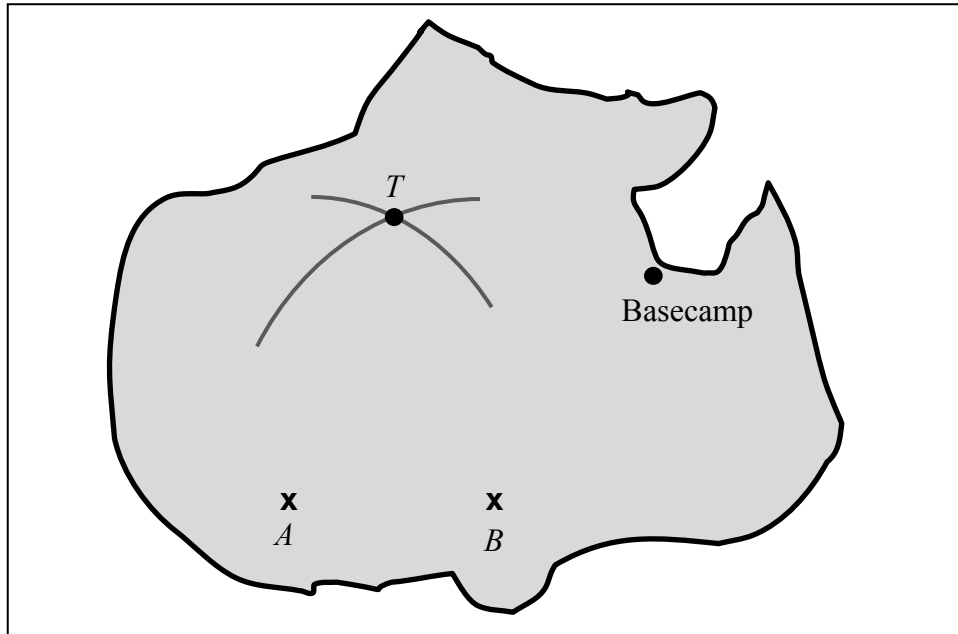
The contestants are told that treasure is buried on the island at a point *T*.
T is 20 km from *A* and 20 km from *B*.

(i)   The map is drawn to a scale of 1 cm to 5 km. **On the map**, how far is *T* from the point *A*?

> 20 ÷ 5 = 4 cm

(ii)   Using a compass, construct the point *T* on the map. Label the point *T*.

(iii)   Measure the distance from the point *T* to Basecamp on your map, and hence find the actual distance, in km, from the point *T* to Basecamp.

> On map: 3·5 cm.
>
> Actual distance = 3·5 × 5 = 17·5 km.

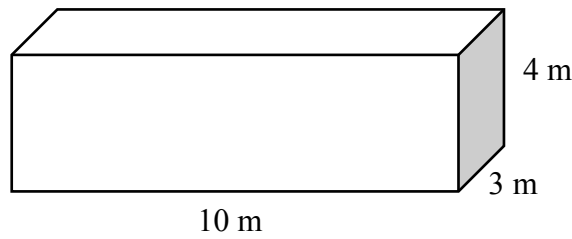**(iv)**   The contestants find the treasure at 13:00 and return to Basecamp immediately.

        If they walk at an average speed of 6 km per hour, find the time they reach Basecamp.

> Time $= \dfrac{\text{Distance}}{\text{Speed}} = \dfrac{17 \cdot 5}{6} = 2\dfrac{11}{12}$ hours, i.e. 2 hours and 55 minutes.
>
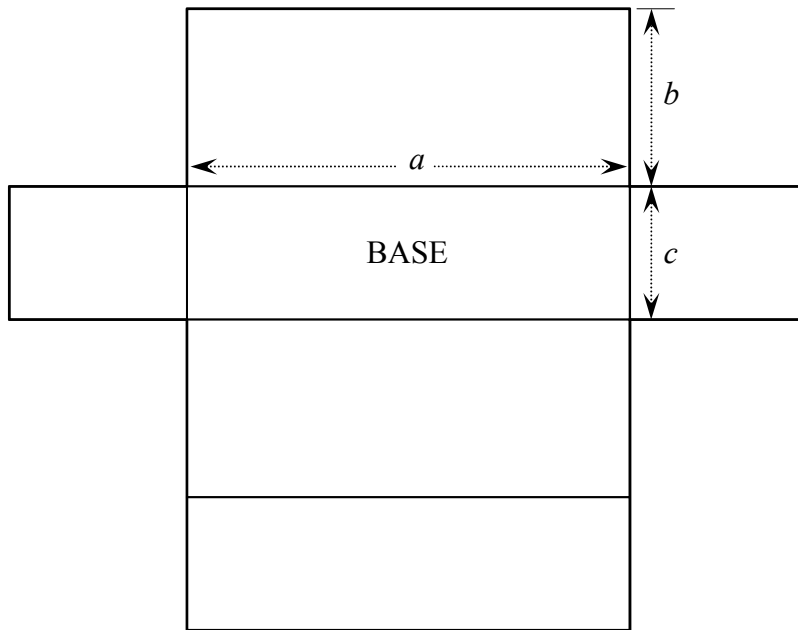> Answer: 15:55.

Question 9   **20 Marks**

A rectangular tank has a length of 10 m, a width of 3 m, and a height of 4 m, as shown.

A diagram of the net of this tank is shown below.

(i) Write down the values of a, b, and c.

$a =$ | 10 m $b =$ | 4 m $c =$ | 3 m

(ii) Find the total surface area of the tank, in m^2.

$2 \times [(10 \times 4) + (10 \times 3) + (4 \times 3)] = 164$ m^2

(iii) Find the volume of the tank, in litres. Note: 1 m$^3 \ = \ 1000$ litres.

Volume $= 10 \times 4 \times 3 = 120$ m^3

In litres $= 120 \times 1000 = 120\ 000$ litres

(iv) The tank is filled with water to a depth of 50 cm.
Find the volume of water in the tank, in litres.

Either:	*Or*:
$10 \times 0 \cdot 5 \times 3 = 15 \text{ m}^3$	50 cm is $^1/_8$ th of height, so will be $^1/_8$ th of vol.
In litres $= 15 \times 1000 = 15\,000$ litres	$^1/_8 \times 120\,000 = 15\,000$ litres.

Question 10   **15 Marks**

Ray is fitting draught excluders around the outside of one of his windows.
To do this, he needs to find the perimeter of the window.

The window is in the shape of a semicircle above a rectangle, as shown.

The diameter of the semicircle is $1 \cdot 2$ metres.
The length of the rectangle is $1 \cdot 5$ metres.

(i) What is the radius of the semicircle?

$1 \cdot 2 \div 2 = 0 \cdot 6$ m

(ii) Find the length of the semicircle.
Give your answer in metres, correct to two decimal places.

Half of $2\pi r = 0 \cdot 5 \times (\, 2 \times \pi \times 0 \cdot 6 \,)$

$= 1 \cdot 88$ m (correct to two decimal places)

1·2 m

1·5 m
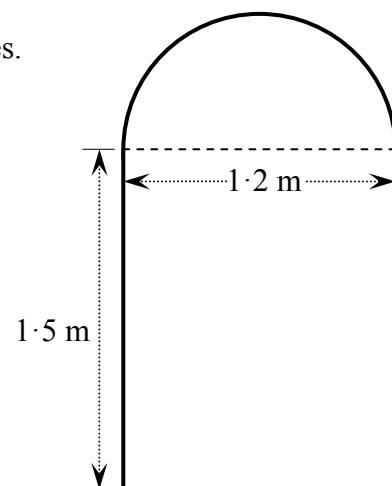
(iii) Find the perimeter of Ray's window.
Give your answer in metres, correct to two decimal places.

$1 \cdot 88 + 1 \cdot 5 + 1 \cdot 2 + 1 \cdot 5 = 6 \cdot 08$ m (correct to two decimal places)

Question 11   10 Marks

In the diagram below, the line *l* is parallel to the line *k*.
The angles *A*, *B*, *C*, *D*, *E*, *F*, *G*, and *H* are marked on the diagram.
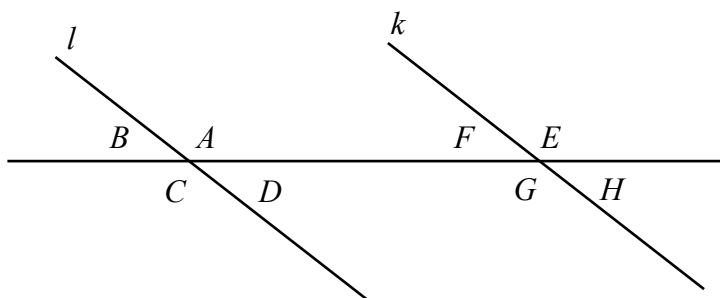
(i)   Write down a pair of angles that are **vertically opposite**.

> *B* and *D*,
>
> or   *A* and *C*,
>
> or   *F* and *H*,
>
> or   *E* and *G*.

(ii)   Write down a pair of angles that are **corresponding**.

> *B* and *F*,
>
> or   *A* and *E*,
>
> or   *C* and *G*,
>
> or   *D* and *H*.

(iii) Write down a pair of angles that are **alternate**.

> *A* and *G*,
>
> or   *D* and *F*.
>
> *Also accept the externally alternate angles:*
>
> *B* and *H*,
>
> or   *C* and *E*.

(iv)   Given $|\angle A| = 137°,$ find the measure of the angles *G* and *H*.

$|\angle G| = |\angle A| = 137°$	$|\angle H| = 180° - |\angle A| = 43°$

Question 12   **20 Marks**

The towns *A*, *B*, and *C* are shown in the diagram below.

The distance between *A* and *B* is 11 km.
The distance between *B* and *C* is 8 km.

The angle at *C* is a right angle.

Town *B*

11 km

8 km

└

X

Town *C*   Town *A*
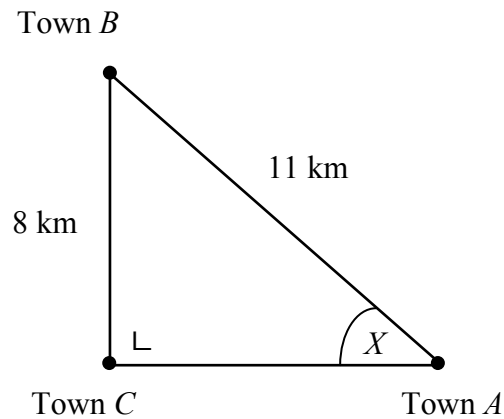
(i)   Write down the length of the **hypotenuse** of the triangle *ABC*.

Hypotenuse = 11 km

The angle *X* is marked in the diagram.

(ii)   Write down the length of the side **opposite** the angle *X*.

Opposite = 8 km

(iii) Find $\sin X$.

$\sin X = {}^8/_{11}$

(iv)   Use your answer to **(iii)** to find the size of the angle *X*.
           Give your answer correct to the nearest degree.

$X = \sin^{-1}({}^8/_{11}) = 47°$ (correct to the nearest degree)

Question 13 10 Marks

A circular table is shown in the diagram below. Aoife is trying to find the centre of the table.

She constructs the right-angled triangle *PQR* as shown, with $|QR| = 1$ m and $|\angle RQP| = 90°$.

She measures $[QP]$, and finds that $|QP| = 0 \cdot 75$ m.
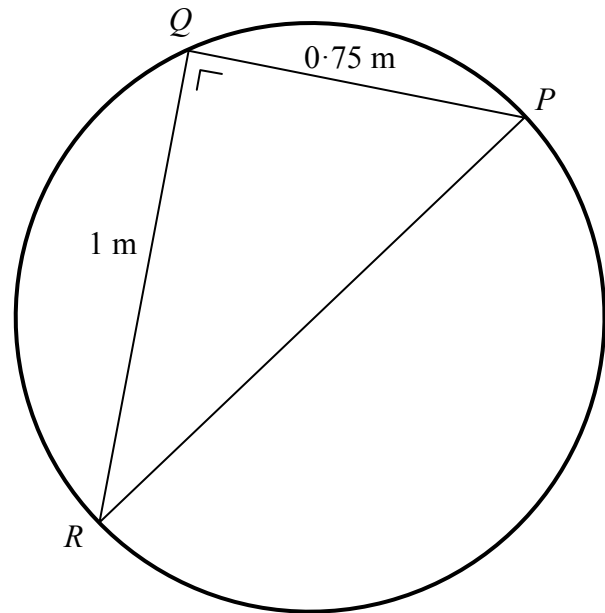
Aoife says that the centre of the circular table must be on $[PR]$.

(i) Explain why Aoife is correct.

> $|\angle PQR| = 90°$, so $[PR]$ is a diameter

(ii) Use the Theorem of Pythagoras to calculate the length $|PR|$.
Give your answer in centimetres.

Working in cm:	*Working in m*:
$\| PR \|^2 = 100^2 + 75^2 = 15\ 625$	$\| PR \|^2 = 1^2 + 0 \cdot 75^2 = 1 \cdot 5625$
$\| PR \| = \sqrt{15\ 625}\ = 125$ cm	$\| PR \| = \sqrt{1 \cdot 5625}\ = 1 \cdot 25$ m $= 125$ cm.

(iii) Find the radius of the table. Give your answer in centimetres.

> $125 \div 2 = 62 \cdot 5$ cm

Question 14 5 Marks
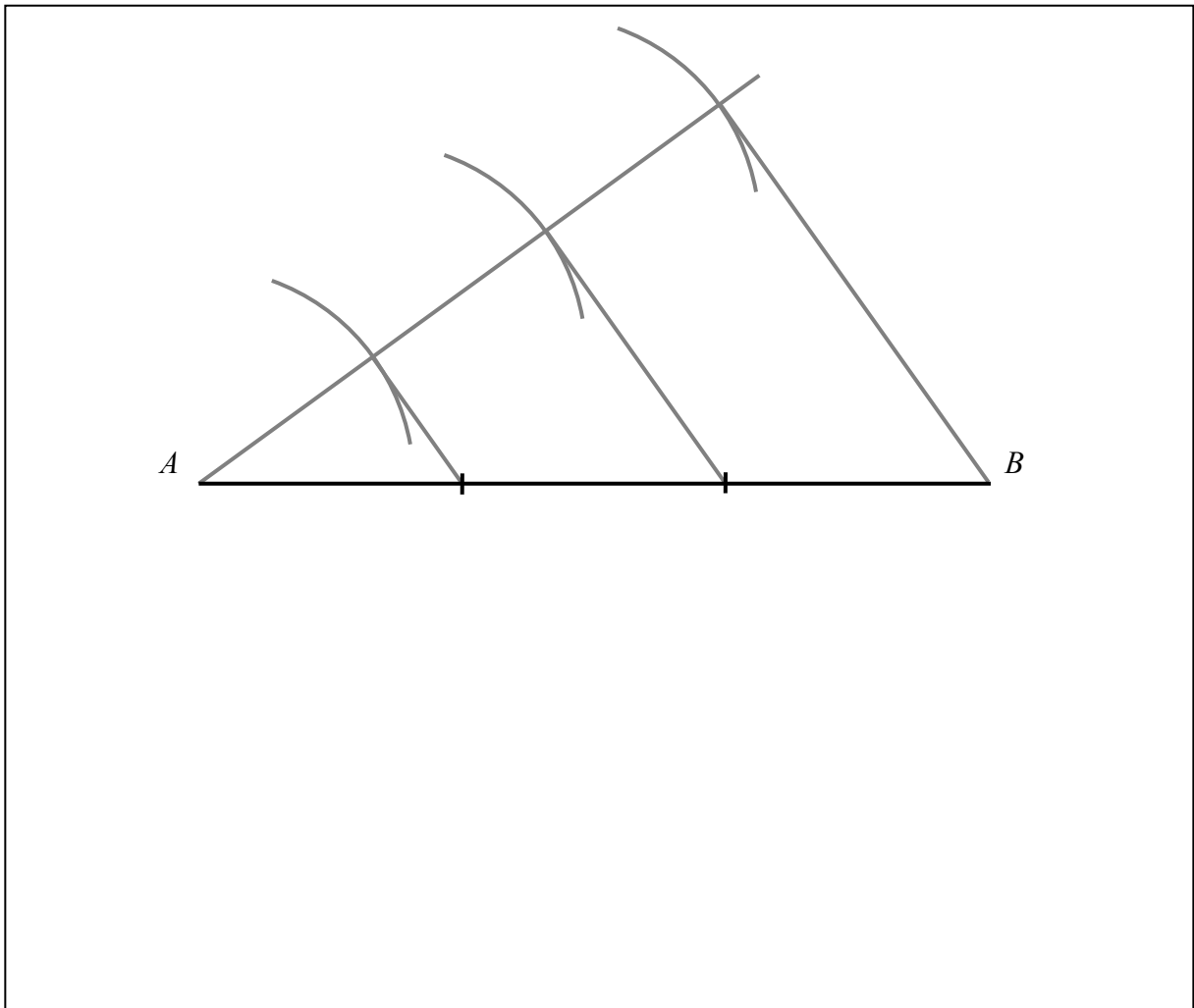
Without measuring, divide the line segment $[AB]$ below into 3 equal segments.

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:

	A	**B**	**C**
5	0, 5	0, 3, 5	0, 3, 4, 5
10		0, 6, 10	0, 4, 8, 10
15		0, 7, 15	0, 7, 13, 15

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)

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 (15)

(a)   5B

(b)   10C

Question 2 (10)

(a)   5C

(b)   5B

Question 3 (35)

(i)   15C

(ii)   5B

(iii)   5B

(iv)   5B

(v)   5B

Question 4 (30)

(i)   10C

(ii)   5B

(iii)   10C

(iv)   5C

Question 5 (50)

(i)   15C

(ii)   5C

(iii)   5A

(iv)   10C

(v)   5A

(vi)   10B

Question 6 (35)

(i)   10C

(ii)   5C

(iii)   5A

(iv)&(v)   10C

(vi)   5C

Question 7 (20)

(a)   10C

(b)   10C

Question 8 (25)

(i)   5A

(ii)   5C

(iii)   10C

(iv)   5C

Question 9 (20)

(i)   5C

(ii)   5C

(iii)   5C

(iv)   5C

Question 10 (15)

(i)   5B

(ii)   5C

(iii)   5C

Question 11 (10)

(i) & (ii) & (iii)   5C

(iv)   5B

Question 12 (20)

(i) & (ii)   15B

(iii) & (iv)   5C

Question 13 (10)

(i) & (ii)   5C

(iii)   5B

Question 14 (5)

           5C

Detailed marking notes

Question 1 (15)

(a)	Scale 5B (0, 3, 5) *Partial Credit*:	Calculates one area correctly; *or* Correct relevant formula; *or* Writes 8×3 or 8×6 or $\frac{1}{2} \times 8 \times 6$; *or* Correct answer but no reason given ; *or* States diagonal bisects the area of a rectangle; *or* States vertical line given is axis of symmetry .
(b)	Scale 10C (0, 4, 8, 10) *Low Partial Credit*:	One correct axis of symmetry.
	High Partial Credit:	Two correct axes plus extras.

Question 2 (10)

(a)	Scale 5C (0, 3, 4, 5) *Low Partial Credit*:	Correct explanation.
	High Partial Credit:	Correct explanation and suitable form with deficiencies, e.g. leaves out years, or oversimplifies e.g. no intervals; *or* Correct suitable form with no explanation.
(b)	Scale 5B (0, 3, 5) *Partial Credit*:	Correct reason given; *or* Suitable form given.
	Full Credit:	Accept any reference to "normal" being problematic for reason.

Question 3 (35)

(i)	Scale 15C (0, 7, 13, 15) *Low Partial Credit*:	At least 2 correct entries.
	High Partial Credit:	At least 14 correct entries.
	Full Credit:	Allow elements in couples in reverse order.
(ii)	Scale 5B (0, 3, 5) *Partial Credit*:	Correct outcomes indicated in table or correct outcomes listed.
(iii)	Scale 5B (0, 3, 5) *Partial Credit*:	A numerator of 3; *or* A denominator of 18.
(iv)	Scale 5B (0, 3, 5) *Partial Credit*:	A numerator of 6; *or* A denominator of 18; *or* Correct outcomes indicated in table but no probability given .
(v)	Scale 5B (0, 3, 5) *Partial Credit*:	A numerator of 8; *or* A denominator of 18; *or* $^3/_{18} + {}^6/_{18}$.

Question 4 (30)

(i)	Scale 10C (0, 4, 8, 10)	
	Low Partial Credit:	$40 + 30 = 70$ (or equivalent); *or* $40 + 30$ or $40 + 20$ or $30 + 20$; *or* Gives answer of 65 (i.e. 16 – 19 year olds).
	High Partial Credit:	$40 + 30 + 20$
(ii)	Scale 5B (0, 3, 5)	
	Partial Credit:	Gets correct number of students but does not fill in missing bar; *or* Missing bar filled in incorrectly with work shown; *or* $50 + 15 = 65$; *or* $90 - 65$; *or* $50 + 15$.
	Full Credit:	Correct bar without work.
(iii)	Scale 10C (0, 4, 8, 10)	
	Low Partial Credit:	Gets one correct fraction; *or* Denominator of 90; *or* One correct numerator.
	High Partial Credit:	Gets correct fractions for rich or famous
(iv)	Scale 5C (0, 3, 4, 5)	
	Low Partial Credit:	Correct answer but no reason given; *or* 40/90 or 30/90 or 20/90 or 50/90 or 25/90 or 15/90; *or* Use of 360°; *or* Indicates correct angle in pie chart.
	High Partial Credit:	No / incorrect answer but measures 160° and $40/90 \times 360° = 160°$ (or equivalent).

Question 5 (50)

(i)	Scale 15C (0, 7, 13, 15)	
	Low Partial Credit:	At least 5 correct entries with/without key completed.
	High Partial Credit:	At least 18 correct entries with/without key completed.
	Full Credit –1:	All entries in diagram correct but key incorrect/not completed.
	Full Credit:	Order in entries not necessary.
(ii)	Scale 5C (0, 3, 4, 5)	
	Low Partial Credit:	Recognises 8 is the minimum value, or 49 is the maximum.
	High Partial Credit:	8 – 49
(iii)	Scale 5A (0, 5)	
(iv)	Scale 10C (0, 4, 8, 10)	
	Low Partial Credit:	Denominator of 20; *or* Numerator of 399; *or* Attempt at addition of any two numbers in list; *or* Correct relevant formula.
	High Partial Credit:	399/20.

(v)	Scale 5A (0, 5)	
(vi)	Scale 10B (0, 6, 10)	
	Partial Credit:	Correct answer but no reason; *or* No / incorrect answer but calculates new mean. Accept (399 – 49)/20 = 17·5.
	Full Credit –1:	Correct answer and (399 – 49) / 20 = 17·5 (misreading).
	Full Credit:	Accept: Taking out 49 would push mean down, *or similar*.

Question 6 (35)

(i)	Scale 10C (0, 4, 8, 10)	
	Low Partial Credit:	One or two points plotted correctly; *or* Confuses *x* and *y* coordinates in points with / without triangle drawn.
	High Partial Credit:	Points plotted correctly but not joined; *or* 3 points plotted, 1 or 2 correct, and triangle drawn.
(ii)	Scale 5C (0, 3, 4, 5)	
	Low Partial Credit:	Correct distance formula (including Pythagoras's Theorem); *or* Correct substitution into slope or midpoint formula; *or* Incorrect labelling and finds 1 distance correctly.
	High Partial Credit:	1 distance calculated correctly; *or* Incorrect labelling and finds 2 distances correctly.
(iii)	Scale 5A (0, 5)	
(iv)&(v)	Scale 10C (0, 4, 8, 10)	
	Low Partial Credit:	*D* indicated on diagram correctly, but no coordinates given; *or* Line *CD* drawn correctly, but *D* not indicated on diagram; *or* Correct substitution into distance or slope formula; *or* Correct midpoint formula.
	High Partial Credit:	*D* found correctly but line not drawn; *or* *D* indicated on diagram and *CD* drawn.
(vi)	Scale 5C (0, 3, 4, 5)	
	Low Partial Credit:	1 correct statement.
	High Partial Credit:	2 correct statements.

Question 7 (20)

(a)	Scale 10C (0, 4, 8, 10)	
	Low Partial Credit:	1 correct answer.
	High Partial Credit:	2 correct answers.
(b)	Scale 10C (0, 4, 8, 10)	
	Low Partial Credit:	1 correct entry.
	High Partial Credit:	2 or 3 correct entries.

Question 8 (25)

(i)	Scale 5A (0, 5)	
(ii)	Scale 5C (0, 3, 4, 5)	
	Low Partial Credit:	Reasonable attempt at construction outside tolerance ($\pm 0 \cdot 2$ cm).
	High Partial Credit:	Construction correct but T not labelled.
(iii)	Scale 10C (0, 4, 8, 10)	
	Low Partial Credit:	Measures 3.5 correctly.
	High Partial Credit:	Distance outside tolerance ($\pm 0 \cdot 2$ cm) multiplied by scale correctly.
	Full Credit −1:	$3 \cdot 5 \times 5 \neq 17 \cdot 5$.
(iv)	Scale 5C (0, 3, 4, 5)	
	Low Partial Credit:	$17 \cdot 5 \div 6$ (or equivalent); *or* $15 \,{}^{11}/_{12}$ or $15 \cdot 916$; *or* Numerator of $17 \cdot 5$; *or* Denominator of 6; *or* Correct relevant formula, i.e. Time = Dist/Speed (or equivalent).
	High Partial Credit:	Converts to 2 hours 55 minutes (2:55).

Question 9 (20)

(i)	Scale 5C (0, 3, 4, 5)	
	Low Partial Credit:	1 value correct.
	High Partial Credit:	2 values correct.
(ii)	Scale 5C (0, 3, 4, 5)	
	No Credit:	$10 \times 4 \times 3$ merits no credit.
	Low Partial Credit:	10×4 or 10×3 or 4×3.
	High Partial Credit:	82 (i.e. does not multiply by 2).

(iii)	Scale 5C (0, 3, 4, 5)	
	Low Partial Credit:	10×4 or 10×3 or 4×3; *or* States Volume = L × B × H; *or* Multiplication by 1000.
	High Partial Credit:	Answer of 120; *or* $10 \times 4 \times 3$.
(iv)	Scale 5C (0, 3, 4, 5)	
	Low Partial Credit:	States height/volume of water is one eighth height /volume of tank; *or* 50 cm = 0·5 m.
	High Partial Credit:	Answer of 15; *or* $10 \times 0·5 \times 3$.

Question 10 (15)

(i)	Scale 5B (0, 3, 5)	
	Partial Credit:	Divides length by 2; *or* States radius is half the diameter.
(ii)	Scale 5C (0, 3, 4, 5)	
	Low Partial Credit:	Use of $r = 0·6$ m; *or* Correct relevant formula.
	High Partial Credit:	Answer of 3·77 or $2 \times \pi \times 0·6$ or $\pi \times 1·2$.
	Full Credit:	Accept $\pi = 22/7$ or 3·14 or 3·142 (or more accurate approximations of π).
(iii)	Scale 5C (0, 3, 4, 5)	
	Low Partial Credit:	Addition of 2 relevant dimensions; *or* States perimeter = 2(length) + width + semicircle.
	High Partial Credit:	Addition of 3 relevant dimensions.

Question 11 (10)

(i) –	Scale 5C (0, 3, 4, 5)	
(iii)	*Low Partial Credit*:	1 correct pair of angles.
	High Partial Credit:	2 correct pairs of angles.
(iv)	Scale 5B (0, 3, 5)	
	Partial Credit:	1 correct angle; *or* A relevant step, e.g. $|\angle A| = |\angle C|$.

Question 12 (20)

(i)&(ii)	Scale 15B (0, 7, 15)	
	Partial Credit:	1 correct; *or* Reverses values.
(iii)&(iv)	Scale 5C (0, 3, 4, 5)	
	Low Partial Credit:	Sin X = opposite/hypotenuse (or equivalent); *or* Ratio involving sides.
	High Partial Credit:	Part (iii) correct.
	Full Credit −1:	Fully correct (iii) and (iv), except that calculator is in incorrect mode.

Question 13 (10)

(i)&(ii)	Scale 5C (0, 3, 4, 5)	
	Low Partial Credit:	Any relevant work in (i) **or** (ii).
		E.g.(i): Reference to right angle or right-angled triangle; *or* States that [*PR*] is a diameter.
		E.g. (ii): States or partial use of Pythagoras's Theorem.
	High Partial Credit:	(i) correct; *or* Relevant work in (i) **and** (ii); *or* Significant work in (ii), e.g. Answer of $1 \cdot 25$ or $\sqrt{1 \cdot 5625}$, or $\mid PR \mid^2 = 15625$.
	Full Credit:	(i) **and** (ii) correct.
(iii)	Scale 5B (0, 3, 5)	
	Partial Credit:	Attempt at dividing 125 by 2; *or* States radius is half the diameter.

Question 14 (5)

	Scale 5C (0, 3, 4, 5)	
	No Credit:	No credit awarded if no construction shown.
	Low Partial Credit:	Draws ray from *A* or *B*.
	High Partial Credit:	Draws ray and three arcs of equal radii.

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 × 5% = 9·9 ⇒ 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