



**Coimisiún na Scrúduithe Stáit**  
**State Examinations Commission**

**Junior Certificate 2012**

**Marking Scheme**

**Project Maths (Phase 2)**

**Ordinary Level**



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## **Introduction**

The Ordinary Level Mathematics examination for candidates in the 24 initial schools for *ProjectMaths* shared a common question on Paper 1 with the examination for all other candidates. The marking scheme used for the common question was identical for the two groups. This document contains the complete marking scheme for both papers for the candidates in the 24 schools.

Readers should note that, as with all marking schemes used in the state examinations, the detail required in any answer is determined by the context and the manner in which the question is asked, and by the number of marks assigned to the question or part. Requirements and mark allocations may vary from year to year.



## Question 2

- (a) Cathy works in a bakery and earns €8.65 per hour. She works 40 hours a week. Find Cathy's gross pay for the week.

$$\begin{aligned} & \text{€}8.65 \times 40 \\ & = \text{€}346.00 \end{aligned}$$

- (b) Cathy has to pay income tax at a rate of 20%. Find Cathy's gross tax.

$$\begin{aligned} & \text{€}346 \times 20\% \\ & = \text{€}69.20 \end{aligned}$$

- (c) She has a tax credit of €20 per week. Find Cathy's net tax.

$$\begin{aligned} & \text{€}69.20 - \text{€}20 \\ & = \text{€}49.20 \end{aligned}$$

- (d) How much per week is she left with?

$$\begin{aligned} & \text{€}346.00 - \text{€}49.20 \\ & = \text{€}296.80 \end{aligned}$$

- (e) Cathy had €1650 saved in the credit union at the beginning of a year. The credit union paid 4.5% interest on her money. Find the interest earned in that year.

$$\begin{aligned} & \text{€}1650 \times 0.045 \\ & = \text{€}74.25 \end{aligned}$$

- (f) Cathy wants to use this interest to pay an electricity bill. Electricity costs 20 cent per unit. She used 250 units. The bill also has a standing charge of €30. Calculate the electricity bill.

$250 \times 0.20 = \text{€}50$
$\text{€}50 + \text{€}30 = \text{€}80$

- (g) Does Cathy have enough money from the interest to pay the electricity bill? Explain your answer.

Answer:	<b>No</b>
Reason:	<b>She only has €74.25 and would need €5.75 more to pay the bill.</b>

### Question 3

The table below shows the values when 2 is raised to certain powers.

(a) Complete the table.

Power of 2	Expanded power of 2	Answer
$2^1$	2	2
$2^2$	$2 \times 2$	4
$2^3$	$2 \times 2 \times 2$	8
$2^4$	$2 \times 2 \times 2 \times 2$	16
$2^5$	$2 \times 2 \times 2 \times 2 \times 2$	32
$2^6$	$2 \times 2 \times 2 \times 2 \times 2 \times 2$	64
$2^7$	$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$	128
$2^8$	$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$	256
$2^9$	$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$	512

Maria wins a prize in a lottery and is given two options.

Option A: €1000 cash today

€1000

or

Option B: Take €2 today, €4 tomorrow, €8 the next day, and doubling every day for 9 days.

$$\boxed{\text{€}2} + \boxed{\text{€}4} + \boxed{\text{€}8} + \boxed{\text{€}} + \dots$$





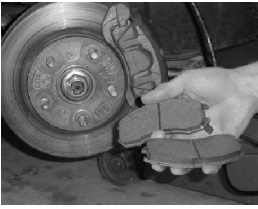

(b) Which option should Maria choose if she wants to get the most prize money. Explain your answer.

Option:	<b>B</b>
Reason:	<b>With Option B she would get €1022. €22 extra</b>



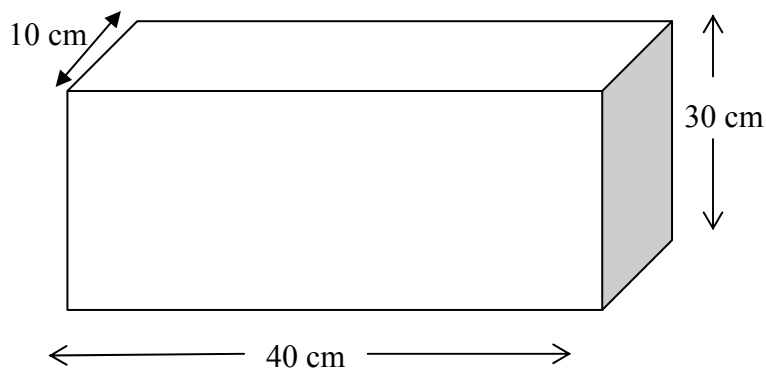
#### Question 4

John takes his car to a garage for a service and receives an itemised bill.  
Find the total cost of servicing the car.

Itemised bill for service	Cost
 5 litres of oil at €4.20 per litre	<b>€21</b>
 2 windscreen wiper blades at €4.50 per blade	<b>€9.00</b>
 2 brake shoes at €28 each	<b>€56.00</b>
 2 hours of labour at €60 per hour	<b>€120</b>
Sub-total (before VAT added)	<b>€206</b>
VAT @ 13.5%	<b>€27.81</b>
Total bill	<b>€233.81</b>

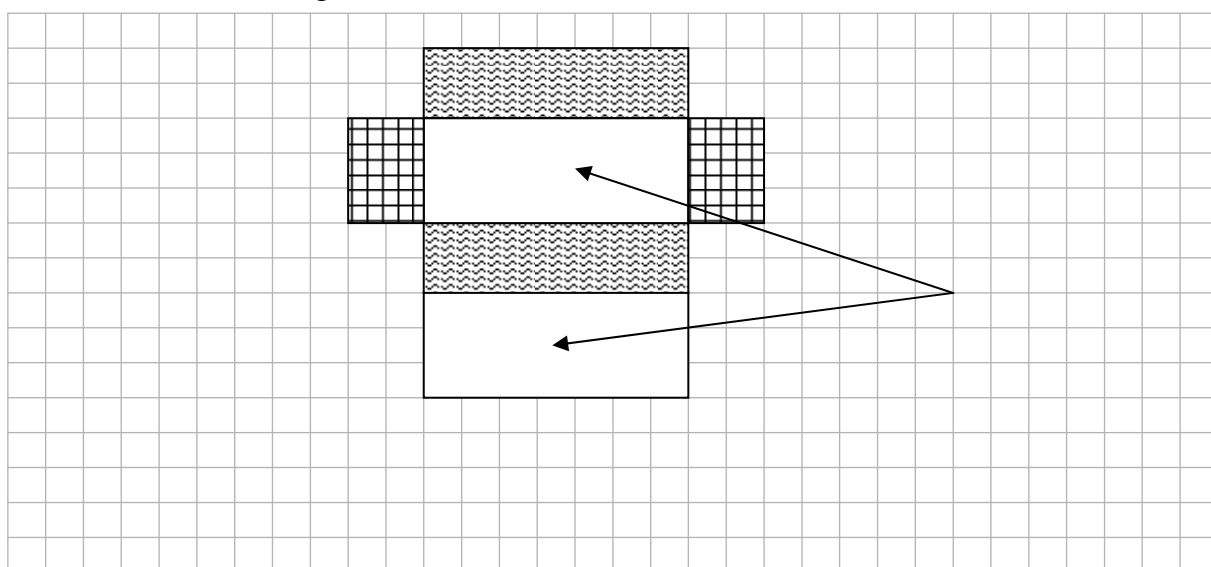
**Question 5**

Ciaran is wrapping a present in a rectangular box.



(a) How many faces has the rectangular box? 6

(b) Draw a net of the rectangular box here, to a suitable scale.



(c) Indicate on your diagram in (b) one pair of faces that are equal in area.

(d) Find the surface area of the box.

$$\begin{aligned} & 2(40 \times 30 + 40 \times 10 + 30 \times 10) \\ & = 2(1200 + 400 + 300) \\ & = 2(1900) \\ & = 3800 \text{ cm}^2 \end{aligned}$$

**Question 6**

The universal set,  $U = \{ 1, 2, 3, 4, 5, 7, 10, 11, 13, 17, 19, 20 \}$ .

$A$  is the set of prime numbers between 1 and 20.  $B$  is the set of factors of 20.

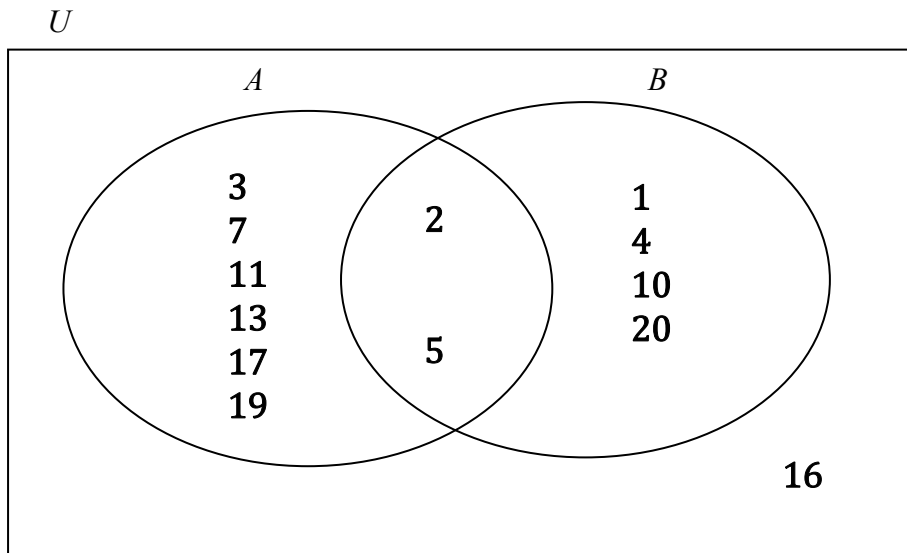
- (a) List the elements of the set  $A$ .

$$A = \{ 2, 3, 5, 7, 11, 13, 17, 19 \}$$

- (b) List the elements of the set  $B$ .

$$B = \{ 1, 2, 4, 5, 10, 20 \}$$

- (c) Fill in the Venn diagram below placing all elements of  $U$  in the correct regions.



- (d) List the elements of  $A \cap B$ .

$$A \cap B = \{ 2, 5 \}$$

- (e) Complete the sentence below.

If an element is in the region  $A \cap B$ , it has two properties: it is a prime number and it is a factor of 20.

- (f) The number 16 is added to the universal set. Place 16 in the correct region in the Venn diagram in part (c) and explain why you placed it there.

Reason:	It is in $U$ but is not prime and is not a factor of 20

**Question 7**

(a) Write the following numbers correct to the nearest ten.

121

195

504

**120**

**200**

**500**

(b) Write the following numbers correct to 3 decimal places.

105.5555

2.173

0.0264

**105.556**

**2.173**

**0.026**

(c) Write the following numbers correct to two significant figures.

2 920

159

0.0336

**2900**

**160**

**0.034**

(d) Karen went to a shop to buy five magazines. She had €10 to spend. She made an estimate of the total cost by correcting the price of each magazine to the next highest euro. The magazines cost €1.95, €1.99, €3.59, €1.40 and 99 cent. Work out her estimate.

$\begin{aligned} & \text{€}2 + \text{€}2 + \text{€}4 + \text{€}2 + \text{€}1 \\ & = \text{€}11 \end{aligned}$
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(e) Based on the estimate, would she think she had enough money?

**No**

(f) Work out the exact cost of the magazines.

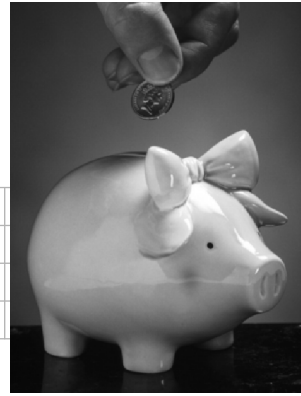
$\begin{aligned} & \text{€}1.95 + \text{€}1.99 + \text{€}3.59 + \text{€}1.40 + \text{€}0.99 \\ & = \text{€}9.92 \end{aligned}$
--

(g) Suggest what you think is a better method for estimating the total cost of the magazines. Give a reason for your answer.

Method:	Reason:
<b>Round to the nearest whole number.</b>	<b>This should give a more accurate estimate because some will round up and some will round down.</b>

### Question 8

Kevin has saved €20. He gets €7 a week for doing jobs at home. He spends €2 on sweets every week and saves the rest in a piggybank.



- (a) How much money has he saved at the end of week 1?

		<b>€5</b>		
--	--	-----------	--	--

- (b) Complete the table to show how his savings grow in the first five weeks.

	Week 1	Week 2	Week 3	Week 4	Week 5
€20	<b>€25</b>	€30	<b>€35</b>	<b>€40</b>	<b>€45</b>

- (c) Write down a formula (in words) to represent the amount he has saved at the end of each week.

	<b>€5(week number) + €20</b> or <b>5n + 20</b>	
--	--	--

- (d) Kevin would like to buy a mobile phone costing €100. Use your formula to find out how many weeks he needs to save, to have enough money to buy the phone.

	$5n + 20 = 100$ $5n = 100 - 20$ $5n = 80$ $n = \frac{80}{5}$ $n = 16$	
--	---	--

- (e) Kevin stops buying the sweets after 5 weeks. How much can he save each week after that?

	<b>€7</b>	
--	-----------	--

- (f) Kevin thinks he can buy his phone 3 weeks sooner with the extra savings. Do you agree with Kevin? Explain your answer.

Answer:	<b>Yes</b>
Reason:	<b>After 13 weeks, he will have saved €101.</b>

### Question 9

- (a) Find the values of the following expressions if  $a = 4$  and  $b = -1$ .

(i)  $2a + 3b - 2$ .

$$\begin{aligned} & 2(4) + 3(-1) - 2 \\ = & 8 - 3 - 2 \\ = & 3 \end{aligned}$$

(ii)  $a^2 + b^2 + 4$

$$\begin{aligned} & (4)^2 + (-1)^2 + 4 \\ = & 16 + 1 + 4 \\ = & 21 \end{aligned}$$

(iii)  $\frac{a+2b}{2} =$

$$\frac{4+2(-1)}{2} = \frac{4-2}{2} = \frac{2}{2} = 1$$

- (b) Multiply  $x + 4$  by  $x - 6$ .

$(x + 4)(x - 6) =$

$$\begin{aligned} & x(x - 6) + 4(x - 6) \quad \text{or} \quad \begin{array}{r} x \\ -6 \end{array} \begin{array}{|c|c|} \hline x^2 & +4x \\ \hline -6x & -24 \\ \hline \end{array} \\ = & x^2 - 6x + 4x - 24 \\ = & x^2 - 2x - 24 \end{aligned}$$

**Question 10**

**(Suggested maximum time: 5 minutes)**

- (a) There are four terms given below. Three of them have a common factor other than 1.

$3xy$        $6ay$        $11ax$        $9y$

Underline these three terms and write down the highest common factor of the three terms.

$3y$

- (b) Factorise each of the following:

(i)  $4x + 8y - 12z$

$= 4( x + 2y - 3z )$

(ii)  $ab - 2a + 3b - 6$

$= a( b - 2 ) + 3( b - 2 )$   
 $= ( a + 3 )( b - 2 )$

(iii)  $x^2 + 5x + 6$

$( x + 3 )( x + 2 )$

(iv)  $b^2 - 16$

$( b - 4 )( b + 4 )$

### Question 11

(a) Jane sets Molly a word problem. "If I multiply a number by seven and add four, the result is the same as multiplying the number by three and taking eight." Molly starts by writing  $7x + 4 =$ . Finish Molly's equation and solve it to find the number.

$7x + 4 = 3x - 8$	$7x + 4 = 3x - 8$
	$7x - 3x = -8 - 4$
	$4x = -12$
	$x = \frac{-12}{4}$
	$x = -3$

(b) Solve the equation  $x^2 - 3x - 10 = 0$ .

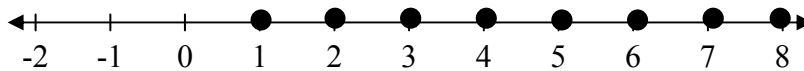
$(x - 5)(x + 2) = 0$
$x = 5$ or $x = -2$

### Question 12

(a) Solve the inequality.  
 $3x - 5 \geq -2, x \in \mathbb{N}$

$3x \geq -2 + 5$
$3x \geq 3$
$x \geq \frac{3}{3}$
$x \geq 1$

(b) Mark the solution on the number line given below.





(c) John and Gemma played a new computer game called *Benga*. John scored two bengas minus three penalties. His total score was seven points. He made the equation  $2x - 3y = 7$  to represent his score. Gemma scored five bengas minus five penalties for twenty points.

(i) Make an equation to represent Gemma's score.

$$5x - 5y = 20$$

(ii) Use simultaneous equations to find the number of points for a benga and the number of points for a penalty.

$$\begin{array}{r}
 2x - 3y = 7 \\
 \underline{5x - 5y = 20} \\
 -10x + 15y = -35 \\
 \underline{10x - 10y = 40} \\
 5y = 5 \\
 y = \frac{5}{5} \\
 y = 1 \\
 x = 5
 \end{array}$$

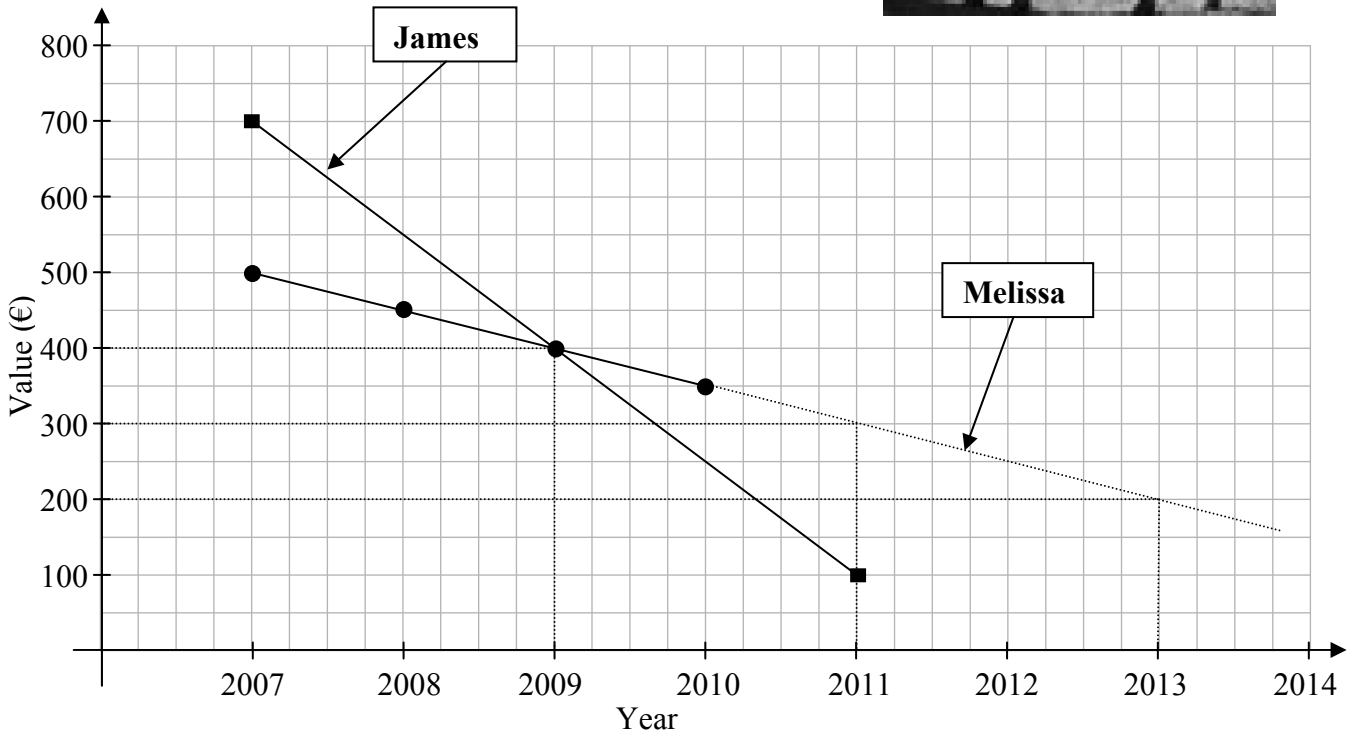
(iii) Verify your solutions in both equations.

$$\begin{array}{r}
 2(5) - 3(1) = 7 \\
 10 - 3 = 7 \\
 7 = 7
 \end{array}
 \qquad
 \begin{array}{r}
 5(5) - 5(1) = 20 \\
 25 - 5 = 20 \\
 20 = 20
 \end{array}$$

**Question 13**

(Suggested maximum time: 10 minutes)

Melissa bought a horse in 2007 for €500. She took the horse to the sales each year for three years to have it valued but did not sell. She recorded the values on the graph below.



(a) Use a line to join the points on the graph.

(b) If the pattern continued, what was the horse worth in 2011? **€300**

(c) How much does the horse lose in value each year?

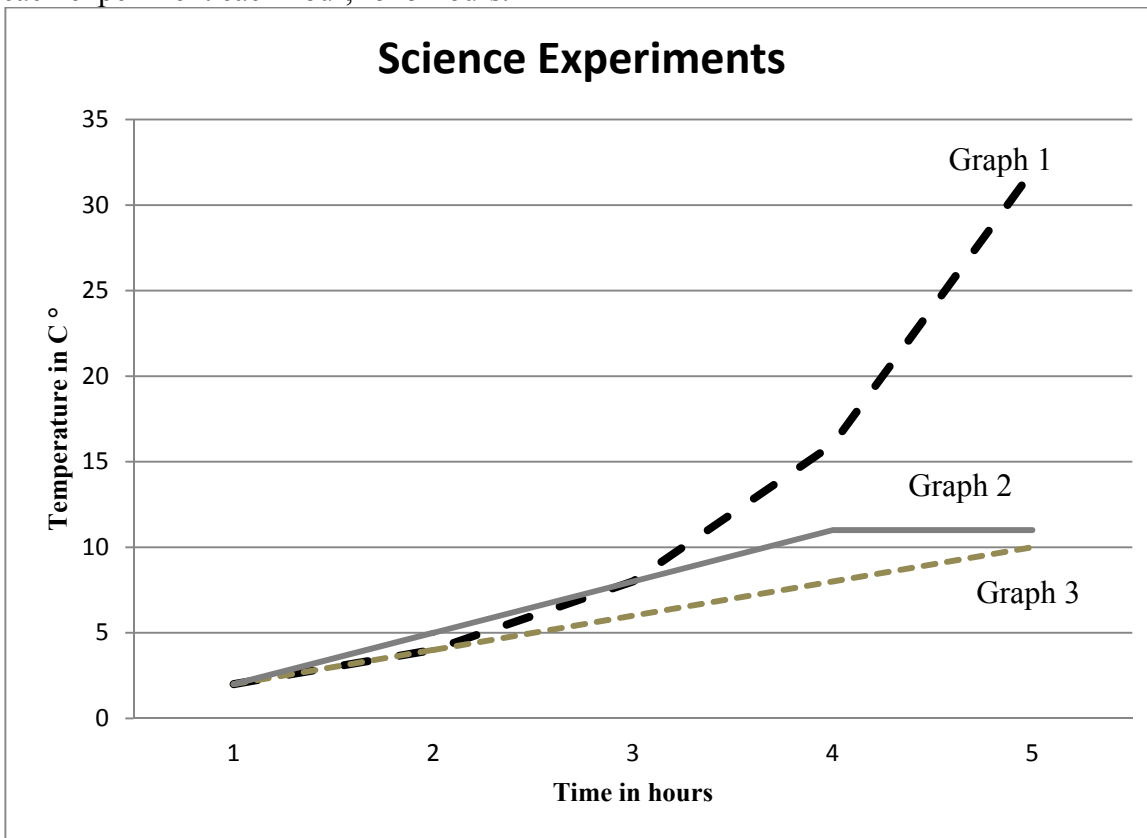
€50
-----

(d) Melissa will sell the horse when it reaches a value of €200. If the pattern continues, in what year will she sell the horse? **2013**



### Question 14

Three experiments on temperature are done in the science lab. Pupils record and plot the temperature of each experiment each hour, for 5 hours.



In experiment A, the temperature doubles every hour.

In experiment B, the temperature increases by 2° every hour.

In experiment C, the temperature increases by 3° each hour for three hours and then remains constant.

Identify each experiment by its number.

Experiment	Graph number
A	1
B	3
C	2

## 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
2 mark scale	0, 2	0, 1, 2		
5 mark scale	0, 5	0, 3, 5	0, 3, 4, 5	
10 mark scale	0, 10	0, 6, 10	0, 5, 8, 10	0, 5, 7, 8, 10
15 mark scale		0, 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 (four categories)**

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

In certain cases, typically involving incorrect rounding or omission of units, a mark that is one mark below the full-credit mark may also be awarded. Such cases are flagged with an asterisk. Thus, for example, *scale 10C\** indicates that 9 marks may be awarded.

## Summary of mark allocations and scales to be applied.

<b>Question 1(5)</b>		<b>Question 2(31)</b>		<b>Question 3(15)</b>	
(a)&(b)&(c)	5C	(a)	5A	(a)&(b)	15C
		(b)	5C		
		(c)	2B		
		(d)	2B		
		(e)	2B		
		(f)	10B		
		(g)	5B		
<b>Question 4(25)</b>		<b>Question 5(14)</b>		<b>Question 6(24)</b>	
(Oil)	2A	(a)	5A	(a)	2B
(Blades)	2A	(b)	2B	(b)	5B
(Brakes)	2A	(c)	5B	(c)	5B
(Labour)	2A	(d)	2B	(d)	5A
(Sub-total)	2A			(e)	2B
(VAT)	10A			(f)	5B
(Total)	5A				
<b>Question 7(30)</b>		<b>Question 8(24)</b>		<b>Question 9(27)</b>	
(a)&(b)&(c)	5C	(a)	5A	(a)(i)	5C
(d)	5C	(b)	5C	(a)(ii)	5C
(e)	5A	(c)	2B	(a)(iii)	5C
(f)	10B	(d)	5B	(b)	2B
(g)	5B	(e)	5A		
		(f)	2B		
<b>Question 10(10)</b>		<b>Question 11(4)</b>		<b>Question 12(7)</b>	
(a)&(b)	10D	(a)	2B	(a)&(b)	2B
		(b)	2B	(c)(i,ii,iii)	5C
<b>Question 13(29)</b>		<b>Question 14(5)</b>		<b>Question 15(50)</b>	
(a)	2A	5C		(a)	10
(b)	5A			(b)	30
(c)	5A			(c)	10
(d)	5A				
(e)	5A				
(f)	5B				
(g)	2B				

## QUESTION 1

**(a) and (b) and (c) Scale 5C**

*Full Credit:* (a) and (b) and (c) correct.

*High partial credit:* Any 2 from (a)/(b)/(c) correct.

*Low partial credit:* Any 1 from (a)/(b)/(c) correct.

## QUESTION 2

### (a) Scale 5C

*High partial credit:* 40(€8·65).

*Low partial credit:* Use of €8·65 or 40.

### (b) Scale 5C

*High partial credit:* €346(0·20) or similar.

*Low partial credit:* Use of candidates answer to part (a) or 20%.

### (c) Scale 2B

*Partial credit:* Any use of candidates answer to part (b) or €20.

### (d) Scale 2B

*Partial credit:* Use of candidates answers to part (a) or part (c).

### (e) Scale 2B

*Partial credit:* Use of €1650 or 4·5%.

### (f) Scale 10B

*Partial credit:* Use of 250 or 20 or €30.

### (g) Scale 5B

*Partial credit:* Correct answer or correct reason.  
Correct answer but unsound reason.  
Incorrect answer but gives a valid reason



### QUESTION 3

**(a) and (b) Scale 15C**

Accept  $2^4$  expanded as  $2 \times 2 \times 2 \times 2$  or  $2^3 \times 2$  or  $2^2 \times 2^2$ .

*Full Credit:*            **(a) and (b)** correct.  
Note: **(b)** Correct option and correct reason.

*High partial credit:* Correct table.

*Low partial credit:* 1 correct entry from table.

### QUESTION 4

Itemised items

Oil:            Scale 2A

Blades:        Scale 2A

Brakes:        Scale 2A

Labour:        Scale 2A

Sub-total:     Scale 2A

VAT:            Scale 10A

Total bill:     Scale 5A

## QUESTION 5

(a) Scale 5A

(b) Scale 2B

*Partial credit:* An effort at drawing a net with at least 4 faces.  
An effort to modify box to show hidden faces.

(c) Scale 5B

*Partial credit:* Indicates any 2 unequal faces on the net.

(d) Scale 2B\*

*Partial credit:* 300 or 400 or 1200 .  
Correct substitution into  $L \times B$ .  
Volume calculated correctly (12000).  
Perimeter calculated correctly (320).

## QUESTION 6

### (a) Scale 2B

*Full credit:* 8 correct elements (no excess).

*Partial credit:* 2 correct elements.

### (b) Scale 5B

*Full credit:* 6 correct elements (no excess).

*Partial credit:* 2 correct elements.

### (c) Scale 5B

Do not penalise candidate for incorrect set notation.

*Partial credit:* 2 correct entries on Venn diagram.

### (d) Scale 5A

### (e) Scale 2B

*Full credit:* Valid explanation.

*Partial credit:* Mention of “Factor” or 20 or “middle”.

### (f) Scale 5B

Do not penalise candidate for incorrect set notation.

*Full credit:* 16 placed in correct region and valid reason.

*Partial credit:* 16 placed in correct region or valid reason.  
16 placed in correct region but unsound reason.  
(A  $\cup$  B) written down.

## QUESTION 7

**(a) and (b) and (c) Scale 5C**

*High partial credit:* 5 correct roundings.

*Low partial credit:* 1 correct rounding.

**(d) Scale 5C**

*High partial credit:* 4 correct roundings.

*Low partial credit:* 1 correct rounding.

Exact cost correctly calculated (€9.92).

**(e) Scale 5A**

Credit is dependent on answer in part **(d)**.

**(f) Scale 10B**

*Partial credit:* Evidence of addition.

**(g) Scale 5B**

*Partial credit:* Correct method or correct reason.  
Correct method but unsound reason.  
Incorrect method but gives a valid reason.

## QUESTION 8

### (a) Scale 5A

Accept €25 or €5.

### (b) Scale 5C

*High partial credit:* 3 correct entries.

*Low partial credit:* 1 correct entry.

### (c) Scale 2B

*Full credit:*  $y = 5n + 20$ .  
 $5n + 20$  only.

*Partial credit:* €5 or €20.

### (d) Scale 5B

*Full credit:* Correct answer using formula/counting method.

*Partial credit:* An effort to use formula.  
Counting method without conclusion (must go beyond week 5).  
Trial and error with work.

### (e) Scale 5A

### (f) Scale 2B

*Partial credit:* Correct answer or correct reason.  
Correct answer but unsound reason.  
Incorrect answer but gives a valid reason.  
An effort to use formula/counting method using week 5 as the starting point.

## QUESTION 9

### (a)(i) Scale 5C

*High partial credit:*  $8 - 3 - 2$ .

a and b mixed-up but finished correctly ( $-2 + 12 - 2 = 8$ ).

*Low partial credit:* A correct substitution.

### (a)(ii) Scale 5C

*High partial credit:*  $16 + 1 + 4$ .

a and b mixed-up but finished correctly ( $1 + 16 + 4 = 21$ ).

*Low partial credit:* A correct substitution.

### (a)(iii) Scale 15C

*High partial credit:*  $\frac{4-2}{2}$ .

a and b mixed-up but finished correctly ( $\frac{7}{2}$ ).

*Low partial credit:* A correct substitution.

### (b) Scale 2B

*Full credit:*  $x^2 + 4x - 6x - 24$ .

*Partial credit:* A correct multiplication of terms.  
An effort to distribute the brackets.  
An effort to set-up the area model.

## QUESTION 10

**(a) and (b)      Scale 10D**

Accept only 11ax highlighted/crossed out and 3y, for part (a).

*Full Credit:*      **(a) and (b)(i) and (b)(ii) and (b)(iii) and (b)(iv)** correct.

*High partial credit:* Any 3 from **(a)/(b)(i)/(b)(ii)/(b)(iii)/(b)(iv)** correct.

*Partial credit:*      Any 1 from **(a)/(b)(i)/(b)(ii)/(b)(iii)/(b)(iv)** correct.

*Low partial credit:* Correct 3 terms highlighted. (part a)  
HCF only (3y). (part a)

A correct effort at factorising. (part b)

A correct effort at substitution into quadratic formula. (part b)

## QUESTION 11

**(a)      Scale 2B**

*Partial credit:*       $3x - 8$ .  
Correct answer, not from equation, without work.  
 $3(7x + 4) - 8$ .

**(b)      Scale 2B**

*Full credit:*      Correct roots by trial and error provided both are verified.

*Partial credit:*      Factors of  $x^2$  or 10.  
A correct substitution into quadratic formula.  
An effort to obtain a root by trial and error with work.

## QUESTION 12

**(a) and (b)      Scale 2B**

*Full Credit:*      **(a) and (b)** correct.

*Partial credit:*      A correct transposing.  
A correct point indicated on the number line.  
Correct testing of inequality for 1 value.

**(c)(i) and (c)(ii) and (c)(iii)      Scale 5C**

*Full Credit:*      **(c)(i) and (c)(ii) and (c)(iii)** correct.

*High partial credit:* Any 2 from **(c)(i)/(c)(ii)/(c)(iii)** correct.

*Low partial credit:* Any 1 from **(c)(i)/(c)(ii)/(c)(iii)** correct.



### QUESTION 13

(a) Scale 2A

(b) Scale 5A

Accept answer in the range [ 275 – 325 ].

(c) Scale 5A

(d) Scale 5A

(e) Scale 5A

(f) Scale 5B

*Partial credit:* Correct year or value.

(g) Scale 2B

*Partial credit:* Correct line identified and no explanation.  
Negative slope mentioned only.

### QUESTION 14

**Scale 5C**

*Full credit:* 3 correct matches.

*High partial credit:* 2 correct matches.

*Low partial credit:* 1 correct match.

**QUESTION 15**  
**MARKING SCHEME**  
**JUNIOR CERTIFICATE EXAMINATION 2012**  
**PROJECT MATHS (PHASE 2) - ORDINARY LEVEL- PAPER 1**

GENERAL GUIDELINES FOR EXAMINERS

1. Penalties of three types are applied to candidates' work as follows:
  - Blunders - mathematical errors/omissions (-3)
  - Slips- numerical errors (-1)
  - Misreadings (provided task is not oversimplified) (-1).

Frequently occurring errors to which these penalties must be applied are listed in the scheme. They are labelled: B1, B2, B3,..., S1, S2,..., M1, M2,...etc. These lists are not exhaustive.

2. When awarding attempt marks, e.g. Att(3), note that
  - any *correct, relevant* step in a part of a question merits at least the attempt mark for that part
  - if deductions result in a mark which is lower than the attempt mark, then the attempt mark must be awarded
  - a mark between zero and the attempt mark is never awarded.
3. Worthless work is awarded zero marks. Some examples of such work are listed in the scheme and they are labelled as W1, W2,...etc.
4. The phrase "hit or miss" means that partial marks are not awarded – the candidate receives all of the relevant marks or none.
5. The phrase "**and stops**" means that no more work is shown by the candidate.
6. Special notes relating to the marking of a particular part of a question are indicated by an asterisk. These notes immediately follow the box containing the relevant solution.
7. The sample solutions for each question are not intended to be exhaustive lists – there may be other correct solutions.
8. Unless otherwise indicated in the scheme, accept the best of two or more attempts – even when attempts have been cancelled.
9. The **same error** in the **same section** of a question is penalised **once** only.
10. Particular cases, verifications and answers derived from diagrams (unless requested) qualify for attempt marks at most.
11. A serious blunder, omission or misreading results in the attempt mark at most.
12. Do not penalise the use of a comma for a decimal point, e.g. €5·50 may be written as €5,50.

QUESTION 15

<b>Part (a)</b>	<b>10(5,5) marks</b>	<b>Att 2,2</b>
<b>Part (b)</b>	<b>30 (15,15 ) marks</b>	<b>Att (5,5)</b>
<b>Part (c)</b>	<b>10 (5,5) marks</b>	<b>Att (2,2)</b>

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

6. (a)  $P = \{(1, a), (2, a), (3, b), (4, c)\}$ .  
Write out the domain and range of  $P$ .

Domain =  Range =
-------------------------

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

Domain = {1, 2, 3, 4}
-----------------------

Slips (-1)

S1 Each incorrect element omitted / included other than the misreading below.

Misreadings (-1)

M1 Correct range  $\{a, b, c\}$  or  $\{a, a, b, c\}$  given.

Worthless (0)

W1 No element of the domain appears.

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

Range = {a, b, c}
-------------------

\*Accept  $\{a, a, b, c\}$  for full marks.

Slips (-1)

S1 Each incorrect element omitted / included other than the misreading below.

Misreadings (-1)

M1 Correct domain  $\{1, 2, 3, 4\}$  given.

Worthless (0)

W1 No element of the range appears.

**Part (b)** **30(15, 15) marks** **Att 10(5, 5)**

Draw the graph of the function $f : x \rightarrow 5 + 2x - x^2$ in the domain $-2 \leq x \leq 4$ , where $x \in R$ .
---

$$f(x) = 5 + 2x - x^2$$

$$f(-2) = 5 + 2(-2) - (-2)^2 = 5 - 4 - 4 = -3 \Rightarrow (-2, -3)$$

$$f(-1) = 5 + 2(-1) - (-1)^2 = 5 - 2 - 1 = 2 \Rightarrow (-1, 2)$$

$$f(0) = 5 + 2(0) - (0)^2 = 5 + 0 - 0 = 5 \Rightarrow (0, 5)$$

$$f(1) = 5 + 2(1) - (1)^2 = 5 + 2 - 1 = 6 \Rightarrow (1, 6)$$

$$f(2) = 5 + 2(2) - (2)^2 = 5 + 4 - 4 = 5 \Rightarrow (2, 5)$$

$$f(3) = 5 + 2(3) - (3)^2 = 5 + 6 - 9 = 2 \Rightarrow (3, 2)$$

$$f(4) = 5 + 2(4) - (4)^2 = 5 + 8 - 16 = -3 \Rightarrow (4, -3).$$

OR

<i>A</i>	$f(-2)$	=	5	+2(-2)	-(-2) <sup>2</sup>	=	<b>-3</b>
	$f(-1)$	=	5	+2(-1)	-(-1) <sup>2</sup>	=	<b>2</b>
	$f(0)$	=	5	+2(0)	-(0) <sup>2</sup>	=	<b>5</b>
	$f(1)$	=	5	+2(1)	-(1) <sup>2</sup>	=	<b>6</b>
	$f(2)$	=	5	+2(2)	-(2) <sup>2</sup>	=	<b>5</b>
	$f(3)$	=	5	+2(3)	-(3) <sup>2</sup>	=	<b>2</b>
	$f(4)$	=	5	+2(4)	-(4) <sup>2</sup>	=	<b>-3</b>

*B*

<i>x</i>	<b>-2</b>	<b>-1</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
5	5	5	5	5	5	5	5
+2 <i>x</i>	-4	-2	0	+2	+4	+6	+8
- <i>x</i> <sup>2</sup>	-4	-1	0	-1	-4	-9	-16
<i>f(x)</i>	<b>-3</b>	<b>2</b>	<b>5</b>	<b>6</b>	<b>5</b>	<b>2</b>	<b>-3</b>

\* Error(s) in each row/column calculation attracts a **maximum** deduction of 3marks

Blunders (-3)

- B1 Correct answer, without work i.e. 5 correct couples only and no graph  
 B2 "+2*x*" taken as "2" all the way. [In the row headed "+2*x*" by candidate]  
 B3 "5" calculated as "5*x*" all the way. [In the row headed "5" by candidate]  
 B4 Adds in top row when evaluating  $f(x)$  in *B*.  
 B5 Omits "5" row  
 B6 Omits "+2*x*" row  
 B7 Omits a value in the domain (each time).  
 B8 Each incorrect image without work i.e. calculation through the function method (*A*).  
 B9 Misreads " $-x^2$ " as " $+x^2$ " and places " $+x^2$ " in the table or function.

Slips (-1)

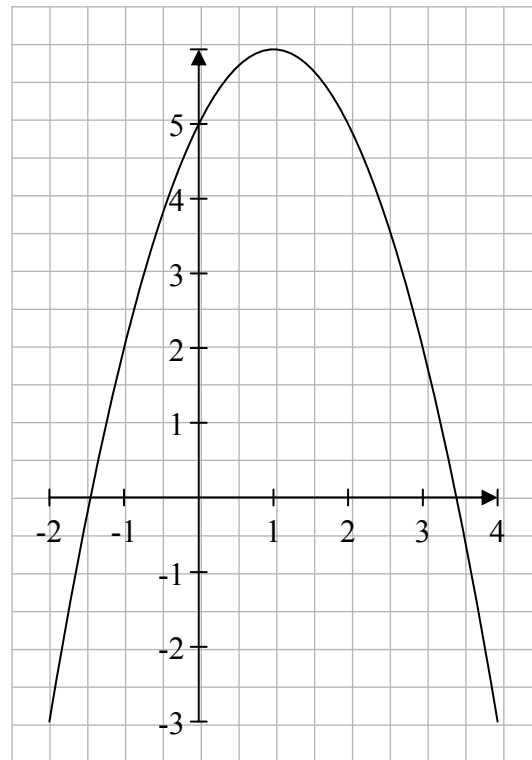
S1 Numerical errors to a max of 3 in any row / column

Misreadings (-1)

- M1 Misreads "+2*x*" as "-2*x*" and places "-2*x*" in the table or function.  
 M2 Misreads "5" as "-5" and places "-5" in the table or function.

Attempts (5 marks)

- A1 Omits " $-x^2$ " row from table or treats " $-x^2$ " as  $\pm x$  or  $\pm 2x$ .  
 A2 Any effort at calculating point(s).  
 A3 Only one point calculated and stops.



- \* Only **one** correct point **graphed correctly**  $\Rightarrow$  Att 5 + Att 5
- \* Correct graph but no table  $\Rightarrow$  full marks i.e. (15 + 15) marks.
- \* Accept reversed co-ordinates if
  - (i) if axes not labelled or
  - (ii) if axes are reversed to compensate (see B1 below)

Blunders (-3)

- B1 Reversed co-ordinates plotted against non-reversed axes (once only) {See 3rd \* above}.
- B2 Scale error (once only)
- B3 Points not joined or joined in incorrect order (once only).

Slips (-1)

- S1 Each point of candidate graphed incorrectly. {Tolerance  $\pm 0.25$ }
- S2 Each point { 7 points needed } from table not graphed [ See 2<sup>nd</sup> \* above ]

Attempts (5 marks)

- A1 Graduated axes (need not be labelled)
- A2 Some effort to plot a point { See 1st \* above}

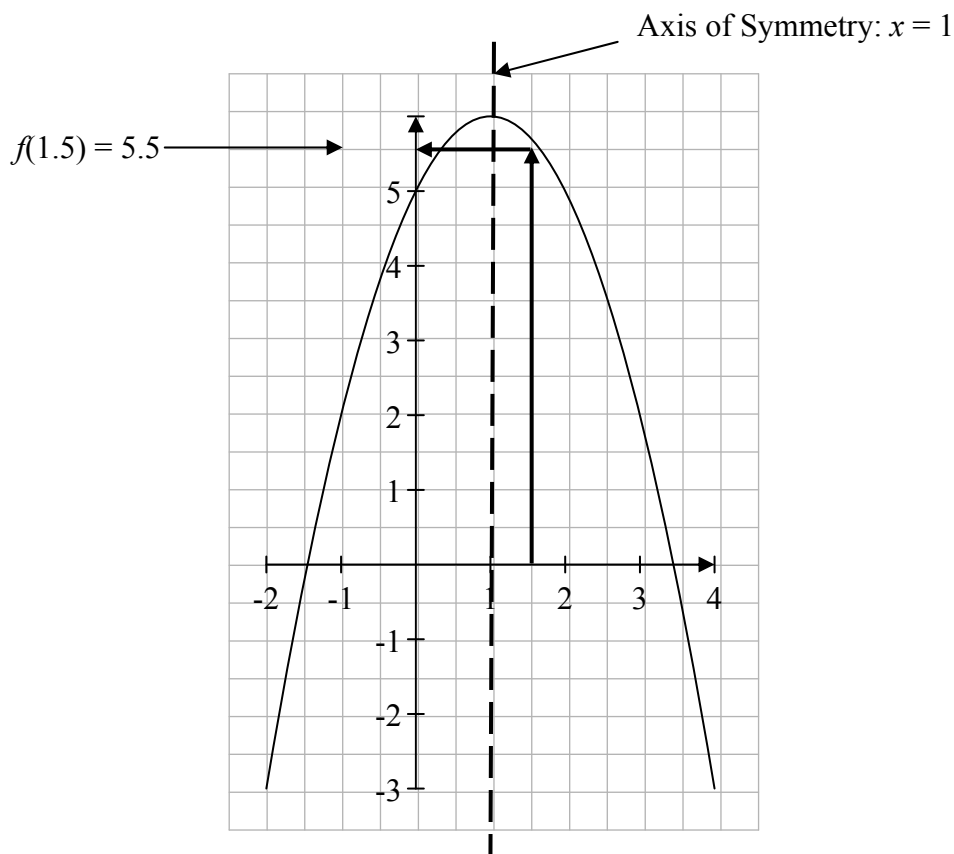
**Part (c)**

**10 (5, 5) marks**

**Att 2, 2**

- (c) (i) Draw the axis of symmetry of the graph you have drawn in **6(b)**.
- (ii) Use your graph to estimate the value of  $5 + 2x - x^2$  when  $x = 1.5$ .

- (c) (i) Draw the axis of symmetry of the graph you have drawn in **6(b)**.



\* Accept any vertical line (parallel to candidate's y-axis) within tolerance of  $\pm 0.25$ .

Blunders (-3)

- B1 Any vertical line (parallel to the candidate's y-axis) outside of the tolerance.
- B2 Marks  $x = 1$  on the x-axis and stops.
- B3 States  $x = 1$  but no line is indicated on the graph.

Attempts (2 marks)

- A1 Any attempt at axial symmetry of  $f(x)$ .
- A2 y-axis indicated as the axis of symmetry (See B1).

**Part (c) (ii)**

**5 marks**

**Att 2**

**(c) (ii)** Use your graph to estimate the value of  $5 + 2x - x^2$  when  $x = 1.5$

Work to be shown on the graph and answer to be written here.

**5.5**

\* Correct answer (clearly consistent with candidate's graph) inside the tolerance without graphical indication  $\Rightarrow$  2 marks.

Blunders (-3)

- B1 Correct answer without work.
- B2 Answer on the diagram but outside of tolerance ( $\pm 0.25$ ).
- B3 Fails to write down the answer, when indicated correctly on graph.

Slips (-1)

- S1 Correct answer indicated and/or written on graph only

Attempts (2 marks)

- A1 Attempts at algebraic evaluation or calculator.
- A2 Marks 1.5 in any way on either axis and stops.

Worthless (0)

- W1 Answer outside of tolerance without graphical indication.

*Coimisiún na Scrúduithe Stáit  
State Examination Commission*

*Scrúdu  
an Teastais Shóisearaigh*



**JUNIOR CERTIFICATE  
EXAMINATION  
MARKING SCHEME  
MATHEMATICS  
(PROJECT MATHS – PHASE 2)  
PAPER 2  
ORDINARY LEVEL**

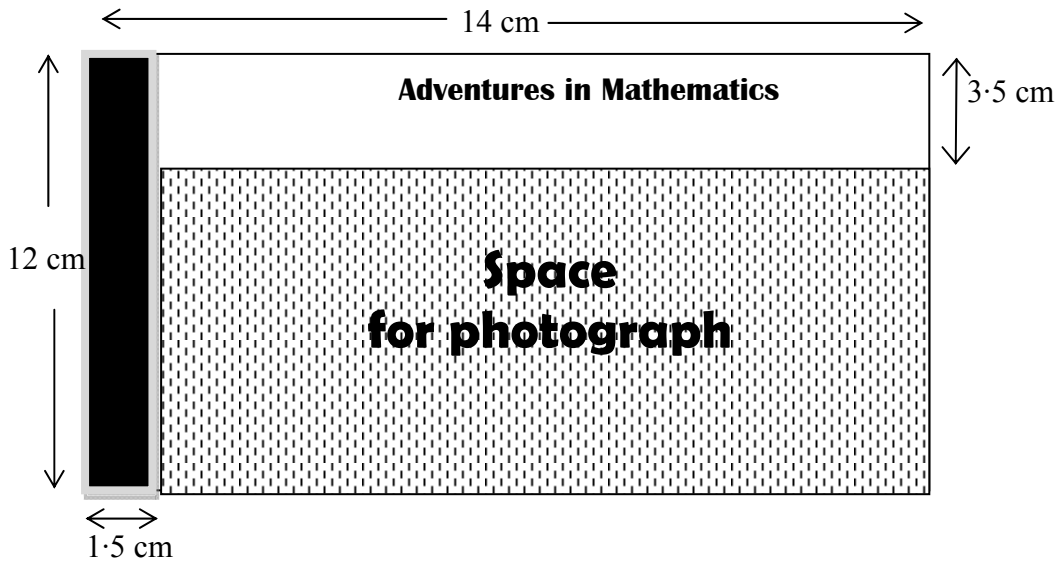


**Coimisiún na Scrúduithe Stáit**  
*State Examinations Commission*



### Question 1

A designer is making a DVD cover as shown below (diagram not to scale). He has left a space for a photograph. Find the area of the space for the photograph.



$$14 - 1.5 = 12.5$$

$$12 - 3.5 = 8.5$$

$$12.5 \times 8.5$$

$$= 106.25 \text{ cm}^2$$

or

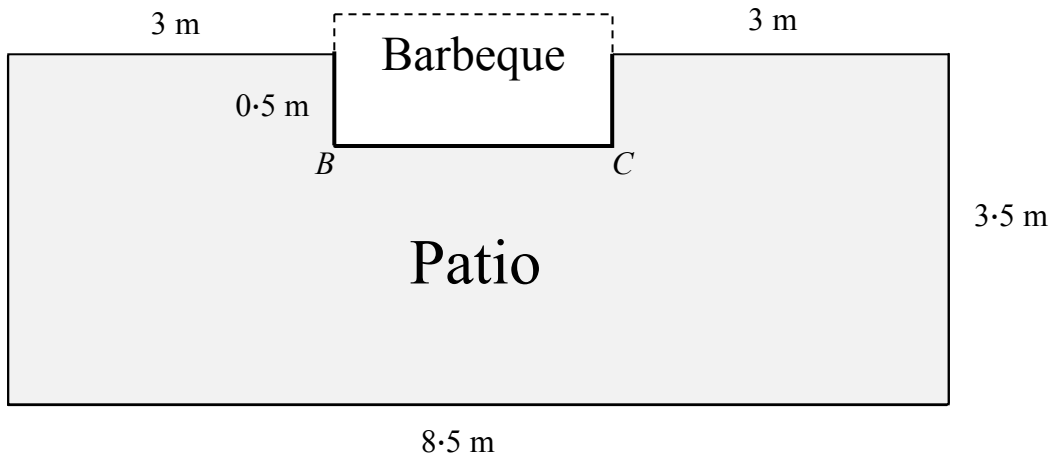
$$12 \times 14 - [12.5 \times 3.5 + 12 \times 1.5]$$

$$= 168 - [43.75 + 18]$$

$$= 106.25 \text{ cm}^2$$

### Question 2

A gardener wants to build a patio in her garden and a space for a barbeque. Below is a plan of the patio and barbeque she wants to build.



- (a) Find the length of  $[BC]$ .

$$\begin{aligned} 8.5 - 3 - 3 \\ = 2.5 \text{ m} \end{aligned}$$

- (b) Find the perimeter of the patio.

$$\begin{aligned} 3 + 0.5 + 2.5 + 0.5 + 3 + 3.5 + 8.5 + 3.5 \\ = 25 \text{ m} \end{aligned}$$

- (c) The owner wants to cover the patio with slabs. Find the area to be covered.

$$\begin{aligned} 8.5 \times 3.5 - 2.5 \times 0.5 \\ = 29.75 - 1.25 \\ = 28.5 \text{ m}^2 \end{aligned}$$

- (d) The slabs are squares of side 0.5 m. Find the number of slabs required.

$$\begin{aligned} 0.5 \times 0.5 \\ = 0.25 \\ \hline 28.5 \\ 0.25 \\ \hline = 114 \end{aligned}$$

- (e) She has €500 to spend on slabs. The slabs cost €4.50 each. Does she have enough money to cover the entire patio? Explain your answer.

Answer:	<b>No.</b>
Explanation:	<b>She would need €513 to get all the slabs.</b>

**Question 3**

**(suggested maximum time: 10 minutes)**

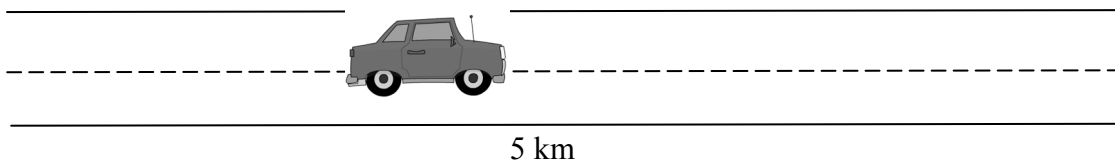
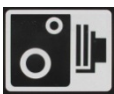
- (a) Caoimhe travelled by car from Athlone to Sligo. She left Athlone at 8:45 a.m. and arrived in Sligo at 10:30 a.m. How long did it take Caoimhe to travel from Athlone to Sligo? Give your answer in hours and minutes.

<b>1 hour and 45 minutes</b>
------------------------------

- (b) The distance from Athlone to Sligo is 112 km. Find Caoimhe's average speed, in km per hour.

$\frac{112}{1 \text{ hr } 45 \text{ mins}} = \frac{112}{1.75} = 64 \text{ km/hr}$
---

- (c) Caoimhe travels a certain 5 km stretch of road in 4 minutes at a constant speed. Find how far she travels in one minute, on this stretch.



$\frac{5 \text{ km}}{4 \text{ mins}} = 1.25 \text{ km/min}$
---

- (d) Find her speed for this stretch of road in km/h.

$$1.25 \times 60 \\ = 75 \text{ km/h}$$

- (e) The speed limit for this stretch of road is 80 km/h. From your answer in part (d) above, was Caoimhe driving over the speed limit? Give a reason for your answer.

Answer:

**No**

Reason:

**75 km/h is within the speed limit.**



#### Question 4

- (a) Let  $A$  be the set of months of the year. List the elements of  $A$ .

**{Jan, Feb, March, April, May, June, July, August, Sept, Oct, Nov, Dec}**

- (b) What is the probability that a month chosen at random from set  $A$  begins with the letter J?

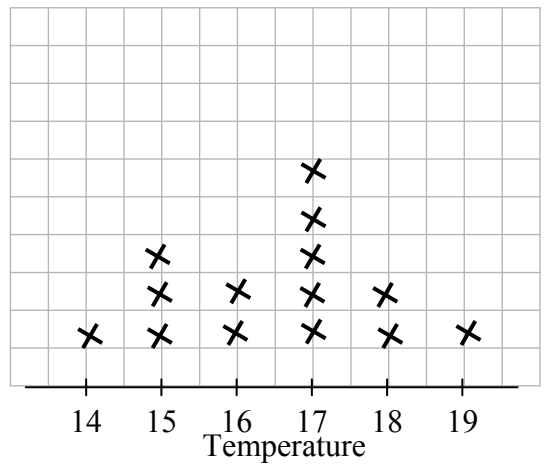
$$P(J) = \frac{1}{4}$$

**Question 5**

Karen went on holidays for two weeks in August 2011. Below is a record of the daily temperatures for the two weeks in August 2011.

Day	Temperature
Monday 15 <sup>th</sup>	17°
Tuesday 16 <sup>th</sup>	18°
Wednesday 17 <sup>th</sup>	16°
Thursday 18 <sup>th</sup>	17°
Friday 19 <sup>th</sup>	16°
Saturday 20 <sup>th</sup>	18°
Sunday 21 <sup>st</sup>	17°
Monday 22 <sup>nd</sup>	19°
Tuesday 23 <sup>rd</sup>	17°
Wednesday 24 <sup>th</sup>	15°
Thursday 25 <sup>th</sup>	15°
Friday 26 <sup>th</sup>	15°
Saturday 27 <sup>th</sup>	14°
Sunday 28 <sup>th</sup>	17°

- (a) What was the temperature on Thursday 18<sup>th</sup> of August? 17°
- (b) Use a line plot to show the number of times each temperature was recorded.



- (c) What is the range of the data? 5

- (d) What is the mode of the data? 17°
- (e) Karen says that “on average it was warmer during the first week than the second week of my holiday”. Do you agree with Karen? Explain your answer.

Answer:	<b>Yes.</b>
Explanation:	<b>The average for the first week was 17 degrees but the average for the second week was only 16 degrees.</b>

### Question 6

There are 22 players on the Irish rugby squad for a game. Their heights (in centimetres) are given below.

180, 188, 185, 180, 183, 177, 180, 183, 198, 191, 191,  
185, 185, 180, 185, 196, 180, 188, 180, 183, 191, 193

- (a) What is the height of the tallest player? 198 cm
- (b) How many of the players are over 184 cm in height? 12
- (c) What percentage of the players are below 181 cm in height? Give your answer correct to the nearest whole number.

$$\frac{7}{22} \times \frac{100}{1} = 31.8181..... = 32 \%$$

The arm spans (in centimetres) of the same players in the same order are given below.

180, 184, 188, 178, 182, 176, 180, 185, 201, 190, 189,  
185, 186, 182, 182, 196, 181, 189, 178, 184, 190, 193

- (d) Find the median arm span.

176,178,178,180,180,181,182,182,182,184, <del>184</del> ,185,185,186,188,189,189,190,190,193,196,201
--

$\frac{184+185}{2} = 184.5 \text{ cm.}$
---

- (e) Complete the table below to show the height and arm span of the tallest and shortest player in the squad.

Player	Height	Armspan
Tallest (cm)	198	201
Shortest (cm)	177	176

- (f) Write the ratio of height to arm span for (i) the tallest player and (ii) the shortest player in part (e).

Tallest:	<b>198:201</b>	Shortest:	<b>177:176</b>
----------	----------------	-----------	----------------

- (g) Write each ratio in (f) above as a decimal. Give your answer correct to two decimal places.

Tallest:	<b>0.99</b>	Shortest:	<b>1.01</b>
----------	-------------	-----------	-------------

- (h) The coach is 170 cm tall. What would you expect his arm span to be? Give a reason for your answer.

Answer:	<b>170 cm.</b>
Reason:	<b>The ratio is almost 1:1</b>

### Question 7

In a survey, 1500 people were asked which national radio station they normally listen to. The results of the survey are given in the table below.

	RTE1	Today FM	Newstalk	Lyric FM	2FM	No national station
Frequency	375	195	120	45	165	600
Relative frequency (as a fraction)	$\frac{375}{1500}$	$\frac{195}{1500}$	$\frac{120}{1500}$	$\frac{45}{1500}$	$\frac{165}{1500}$	$\frac{600}{1500}$
Relative frequency (as a decimal)	0.25	0.13	0.08	0.03	0.11	0.4

- (a) How many of the people surveyed do not listen to a national radio station?

$$375 + 195 + 120 + 45 + 165 = 900$$

$$1500 - 900 = 600$$

- (b) Complete the table above.

- (c) Find the sum of the relative frequencies written as fractions.

$$\frac{375}{1500} + \frac{195}{1500} + \frac{120}{1500} + \frac{45}{1500} + \frac{165}{1500} + \frac{600}{1500} = \frac{1500}{1500} = 1$$

- (d) Find the sum of the relative frequencies written as decimals.

$$0.25 + 0.13 + 0.08 + 0.11 + 0.40 = 1.00$$

- (e) Jackie wrote the relative frequencies as percentages. She found their sum to be 80%. Do you think her calculations are correct? Give a reason for your answer.

Answer: **No.**

Reason: **They should add up to 1.**



- (f) Denis looked at the data and said “I can find out how many people in the survey normally listen to local radio”. Do you agree or disagree with Denis? Explain your answer.

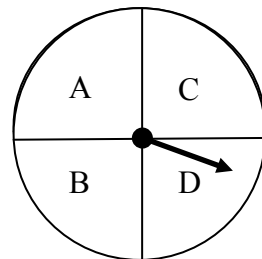
Answer:	<b>No.</b>
Explanation:	<b>Some people may not listen to any radio at all.</b>

**Question 8**

Jack rolls a fair die and spins a fair spinner as shown.



Die



Spinner

- (a) Complete the table below showing all possible outcomes.

		Spinner			
		A	B	C	D
Die	1	(1,A)	(1,B)	(1,C)	(1,D)
	2	(2,A)	(2,B)	(2,C)	(2,D)
	3	(3,A)	(3,B)	(3,C)	(3,D)
	4	(4,A)	(4,B)	(4,C)	(4,D)
	5	(5,A)	(5,B)	(5,C)	(5,D)
	6	(6,A)	(6,B)	(6,C)	(6,D)

- (b) How many possible outcomes are there?

<b>24</b>
-----------

- (c) How many outcomes consist of an odd number and B?

<b>3</b>
----------

- (d) What is the probability that an outcome will contain an even number?

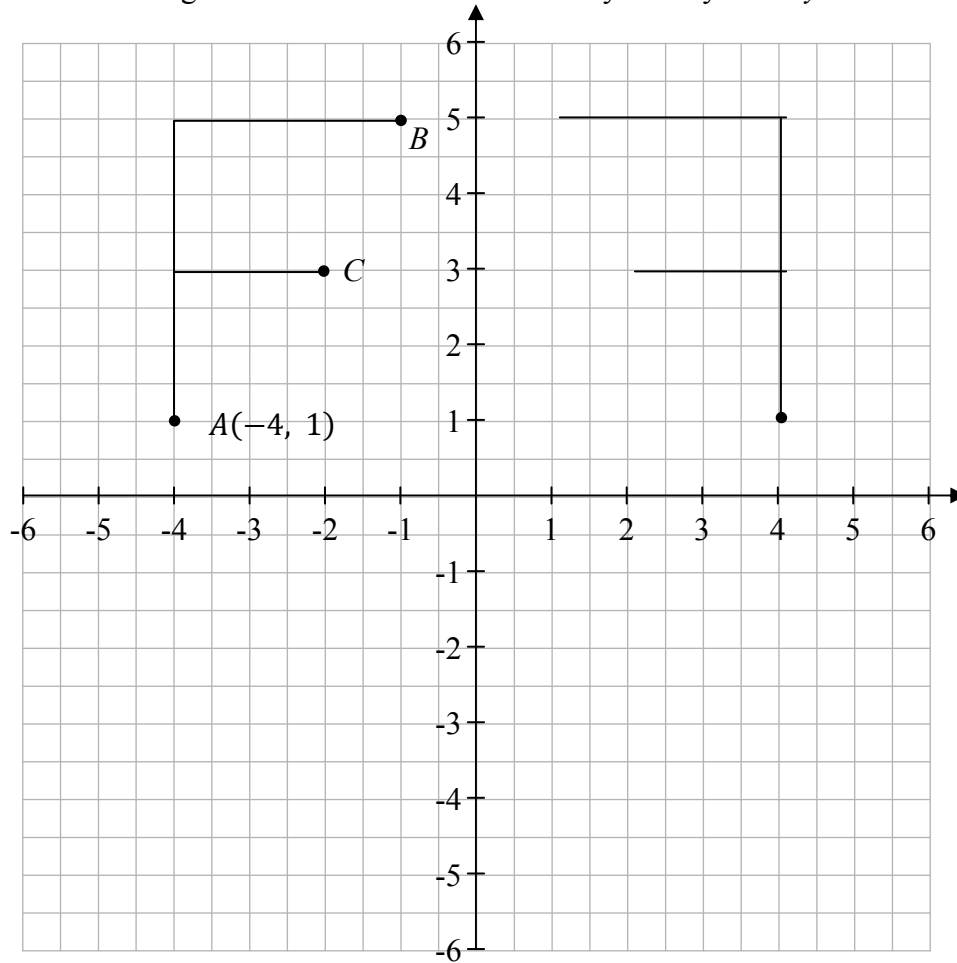
<b>1</b>
<b>2</b>



**Question 10**

The diagram below shows the letter F on the co-ordinate plane.

- (a) Draw in the image of the letter F under an axial symmetry in the  $y$ -axis.



- (b) Write down the coordinates of the points  $B$  and  $C$ .

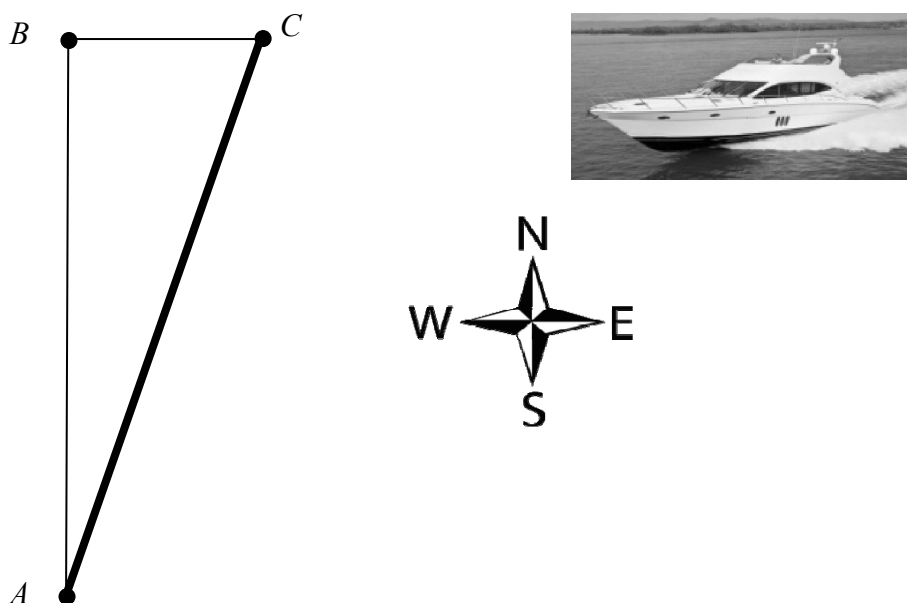
$$B( -1 , 5 ) \quad c( -2 , 3 )$$

- (c)  $A$ ,  $B$  and  $C$  are mapped onto  $A'$ ,  $B'$  and  $C'$  under the transformation above. Write down the co-ordinates of  $A'$ ,  $B'$  and  $C'$ .

$$A'( 4 , 1 ) \quad B'( 1 , 5 ) \quad c'( 2 , 3 )$$

### Question 11

A boat travels due north from  $A$  for 30 minutes at 20 km/h. It reaches  $B$  and then travels due east for 24 minutes at 10 km/h. It is then at  $C$ .



- (a) How many kilometers has the boat travelled?

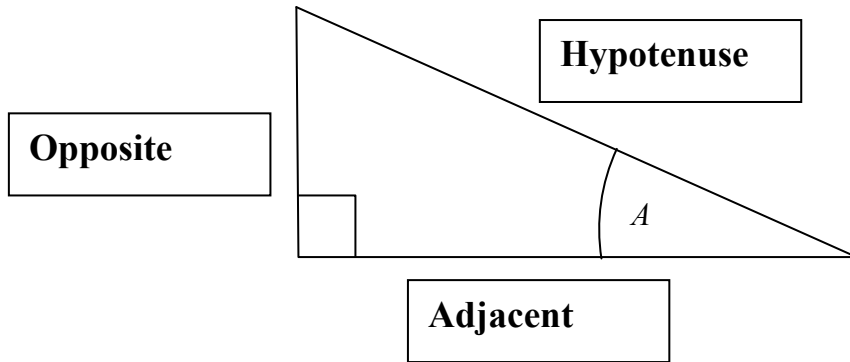
	<p>20 km/h for <math>\frac{1}{2}</math> hour = 10 km</p> <p>10 km/h for <math>\frac{2}{5}</math> hours = 4 km</p> <p><b>Total = 14 km</b></p>
--	---

- (b) On the diagram, draw a line segment that shows the shortest distance from  $C$  back to  $A$ .
- (c) Use Pythagoras' theorem to calculate the shortest distance from  $C$  to  $A$ .  
Give your answer correct to the nearest metre.

	<p><math>x^2 = 10^2 + 4^2</math></p> <p><math>x^2 = 100 + 16</math></p> <p><math>x^2 = 116</math></p> <p><math>x = \sqrt{116}</math></p> <p><math>x = 10.77</math></p> <p><b><math>x = 11</math> Km</b></p>
--	---

**Question 12**

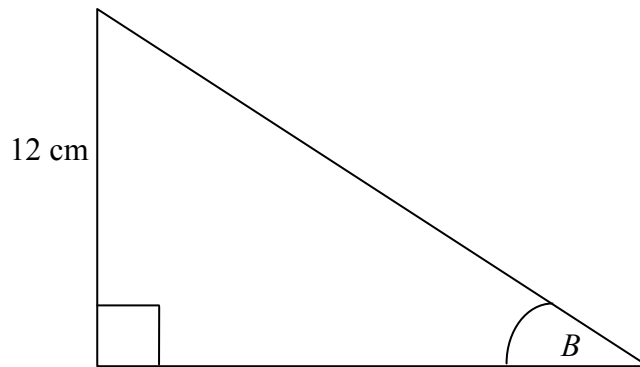
(a) The diagram below shows the angle  $A$  in a right-angled triangle. Indicate which side is adjacent and which is opposite in relation to the angle  $A$ , and which side is the hypotenuse.



(b) Fill in the appropriate ratios in the table below.

Trigonometric Ratio	Ratio
<b>Sin</b>	$\frac{\textit{opposite}}{\textit{hypotenuse}}$
$\text{Cos } A$	$\frac{\textit{adjacent}}{\textit{hypotenuse}}$
<b>tan</b>	$\frac{\textit{opposite}}{\textit{adjacent}}$

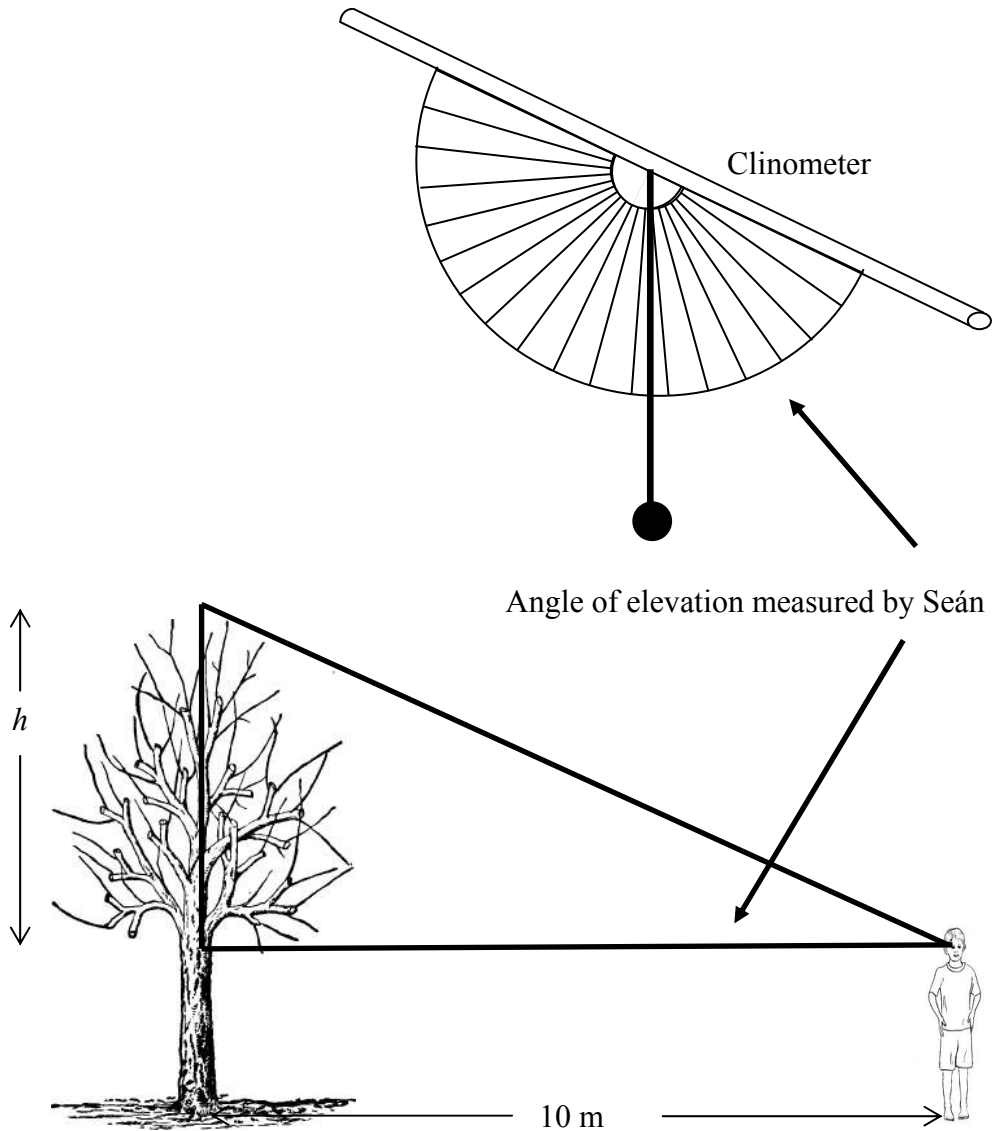
(c) In the right angled triangle below  $B = 35^\circ$  and the opposite side is 12 cm. Find the length of the hypotenuse correct to the nearest centimetre.



$\sin 35^\circ = \frac{\text{Opp}}{\text{Hyp}}$ $0.5736 = \frac{12}{x}$ $x = \frac{12}{0.5736}$ $x = 20.9205$ $x = 21 \text{ cm}$
---

**Question 13**

Seán makes a clinometer using a protractor, a straw, a piece of thread and a piece of plasticine (used as a weight). He stands 10 m from a tree and uses his clinometer to measure the angle of elevation to the top of the tree as shown. Seán is 1.75 m in height.



- (a) Find the angle of elevation by reading the clinometer above. 65°

- (b) Calculate the height  $h$  as shown in the diagram. Give your answer correct to two decimal places.

$$\begin{aligned}\tan 65^\circ &= \frac{\text{Opp}}{\text{Adj}} \\ 2.1445 &= \frac{h}{10} \\ h &= 10(2.1445) \\ h &= 21.445 \\ h &= 21.45 \text{ m}\end{aligned}$$

- (c) Find the total height of the tree.

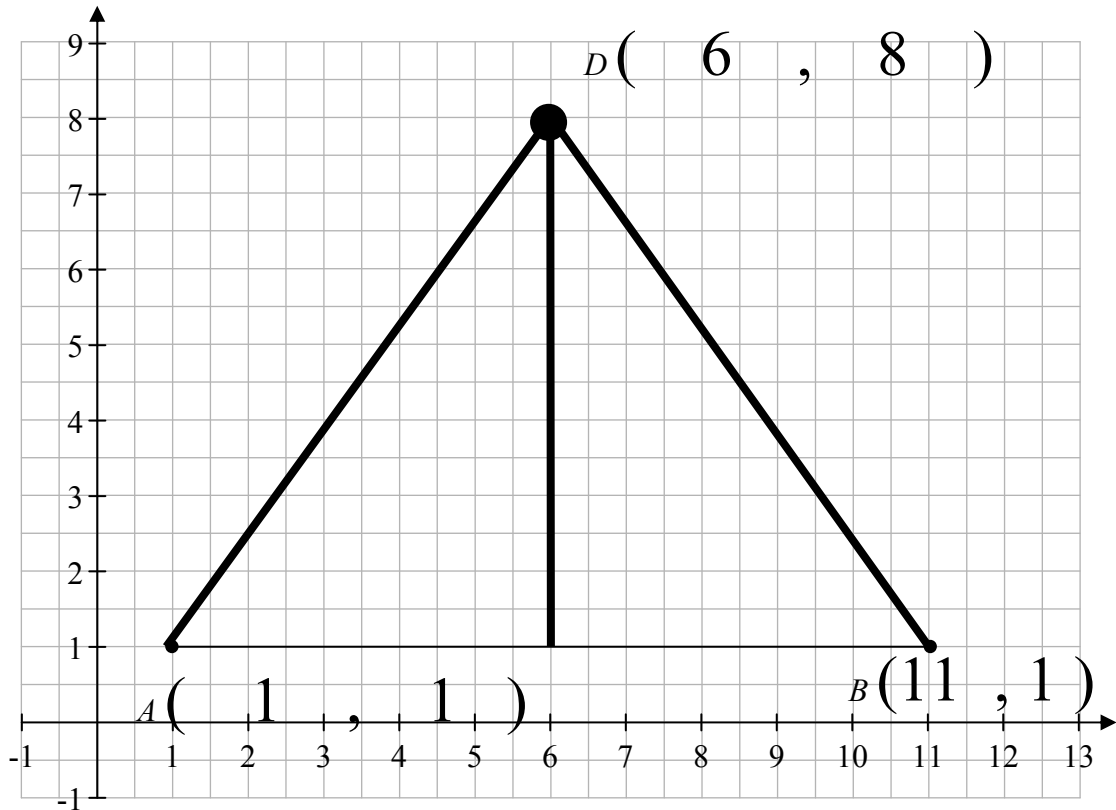
$$\begin{aligned}21.45 + 1.75 \\ = 23.2 \text{ m}\end{aligned}$$

- (d) Another student uses the same method as Seán and finds the height of the tree to be 23.1 m. Seán did not get this answer. Give one possible reason why the answers might be different.

**He could have used  $64^\circ$ .**

**Question 14**

- (a) Write down the coordinates of point  $A$  and point  $B$  on the diagram.



- (b) Mark in the point  $D(6, 8)$  on the diagram.
- (c) Find the co-ordinates of  $C$ , the midpoint of  $[AB]$ .

$$\left( \frac{1+11}{2}, \frac{1+1}{2} \right) = (6, 1)$$

- (d) Join  $A$  to  $D$ . Join  $B$  to  $D$ . Join  $C$  to  $D$ .
- (e) Use the distance formula to find  $|AD|$  and  $|BD|$ .

$\begin{aligned} &\sqrt{(6-1)^2 + (8-1)^2} \\ &\sqrt{25+49} \\ &\sqrt{74} \end{aligned}$	$\begin{aligned} &\sqrt{(6-11)^2 + (8-1)^2} \\ &\sqrt{25+49} \\ &\sqrt{74} \end{aligned}$
--	---



(f) What type of triangle is  $ABD$ ? Give a reason for your answer.

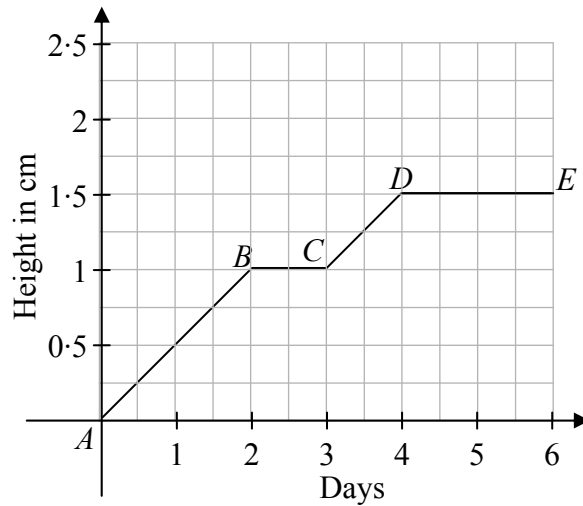
Type:	<b>Isosceles.</b>
Reason:	<b>Two sides are the same from (e) above.</b>

(g) State whether the triangles  $ACD$  and  $BCD$  are congruent. Give a reason for your answer.

Answer:	<b>Yes, they are congruent.</b>
Reason:	<b>AC = BC</b> <b>AD = BD</b> <b>CD = CD</b>  <b><math>\therefore</math> S S S</b>

**Question 15**

The height of a watercress seedling over six days is shown in the diagram below.



- (a) The plant grows steadily between *A* and *B*. It does not grow during two periods. Identify these two periods from the graph.

Period 1:	<b>B to C</b>
Period 2:	<b>D to E</b>

- (b) Find the slope of *AB* =


$$\frac{\text{Rise}}{\text{Run}} = \frac{1}{2} (= 0.5)$$

- (c) Find the slope of *CD* =


$$\frac{\text{Rise}}{\text{Run}} = \frac{0.5}{1} (= 0.5)$$

- (d) Janet says that the seedling grows at the same rate in the two growing periods. Do you agree with Janet? Give a reason for your answer.

Answer:	<b>Yes.</b>
Reason:	<b>The slopes of the lines are the same.</b>

- (e) Describe the growth of the seedling over the six days.

<b>The seedling grows steadily for two days.</b>
<b>It then stops for a day.</b>
<b>Then it grows for a day.</b>
<b>Then stops growing for two more days.</b>

## 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
2 mark scale	0, 2	0, 1, 2		
5 mark scale	0, 5	0, 3, 5	0, 3, 4, 5	
10 mark scale	0, 10	0, 6, 10	0, 5, 8, 10	0, 5, 7, 8, 10
15 mark scale		0, 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 (four categories)

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

In certain cases, typically involving incorrect rounding or omission of units, a mark that is one mark below the full-credit mark may also be awarded. Such cases are flagged with an asterisk. Thus, for example, *scale 10C\** indicates that 9 marks may be awarded.

## Summary of mark allocations and scales to be applied.

### Question 1(15)

15C\*

### Question 2(27)

- (a) 10B\*
- (b) 5B\*
- (c) 5B\*
- (d) 2B
- (e) 5B

### Question 3(25)

- (a)&(b) 5C
- (c) 5B\*
- (d) 10B\*
- (e) 5B

### Question 4(10)

(a)&(b) 10C

### Question 5(20)

- (a) 5A
- (b) 5B
- (c)&(d) 5C
- (e) 5B

### Question 6(24)

- (a) 5B\*
- (b) 5B
- (c)&(d) 5C\*
- (e) 5C
- (f)&(g) 2B\*
- (h) 2B

### Question 7(32)

- (a) 5B
- (b) 5B
- (c) 2B
- (d) 10B
- (e) 5B
- (f) 5B

### Question 8(20)

- (a) 5C
- (b) 5B
- (c) 5B
- (d) 5B

### Question 9(25)

- (a) 10C
- (b) 15C

### Question 10(5)

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

### Question 11(10)

- (a) 5B
- (b)&(c) 5C

### Question 12(10)

- (a) 5B
- (b)&(c) 5C\*

### Question 13(20)

- (a) 10A
- (b)&(c) 5C\*
- (d) 5B

### Question 14(27)

- (a) 5B
- (b) 5A
- (c) 2B
- (d) 5B
- (e) 5C\*
- (f)&(g) 5C

### Question 15(30)

- (a) 15B
- (b)&(c) 5C
- (d) 5B
- (e) 5B

## QUESTION 1

### (a) Scale 15C\*

*High partial credit:*  $8.5(12.5)$   
 $12(14) - [12(1.5) + 12.5(3.5)]$

*Low partial credit:*  $12 - 3.5$  or  $14 - 1.5$   
 $12 \times 14(168)$  or  $12 \times 1.5(18)$  or  $12.5 \times 3.5(43.75)$

## QUESTION 2

Note: \* is applied only once in this question.

### (a) Scale 10B\*

*Partial credit:* A relevant addition or subtraction (e.g. 6).

### (b) Scale 5B\*

*Partial credit:* Identifies 2 relevant sides.  
Area calculated correctly (29.75).

### (c) Scale 5B\*

*Partial credit:* Correct answer without work.  
A relevant area found (e.g. 29.75, 10.5, 7.5, 1.5 or 25.5).

### (d) Scale 2B

*Partial credit:* An effort at division by 0.25 or 0.5  
Use of candidates part (c) or 0.5.

### (e) Scale 5B

*Partial credit:* Correct answer or valid explanation.  
Correct answer but unsound explanation  
Incorrect answer but gives a valid explanation.  
€513 or €13.

### QUESTION 3

Note: \* is applied only once in this question.

**(a) and (b)**      **Scale 5C\***

*Full Credit:*      **(a) and (b)** correct.

*High partial credit:* **(a) or (b)** correct.

*Low partial credit:* 1:85 or 2:25 or 2:15. (part **a**)

Use of 112 or 1hr 45min. (part **b**)

1hr 45min = 1.75 hrs. (part **b**)

Correct formula or S/D/T triangle drawn. (part **b**)

**(c)**      **Scale 5B\***

*Partial credit:*       $\frac{5}{4}$  or 5(4).

**(d)**      **Scale 10B\***

*Partial credit:*      1.25(60).  
Writes 1.25 or 60.

**(e)**      **Scale 5B**

Note: Credit is dependent on answer to part **(d)**.

*Partial credit:*      Correct answer or valid explanation.  
Correct answer but unsound explanation  
Incorrect answer but gives a valid explanation.  
Yes or no, correct, based on answer to part **(d)**, with no reason.

#### QUESTION 4

**(a) and (b)          Scale 10C**

Do not penalise candidate for incorrect set notation.  
Accept any appropriate abbreviation for a month.

*High partial credit:* 12 correct months identified.  
Correct probability, simplified/unsimplified.

*Low partial credit:* Correct numerator or denominator.  
1 month identified.  
 $\frac{12}{3}$ .

#### QUESTION 5

**(a)    Scale 5A**

**(b)    Scale 5B**

Tolerance:  $\pm 1$  Box  
Accept a plot with  $\bullet/x$  used.

*Partial credit:*          1 correct entry.  
A correct frequency.  
Bar chart.

**(c) and (d)          Scale 5C**

*Full Credit:*          (c) and (d) correct.

*High partial credit:* (c) or (d) correct.

*Low partial credit:* 14 or 19. (part c)  
5. (part d)

**(e)    Scale 5B**

*Partial credit:*          Correct answer or valid explanation.  
Correct answer but unsound explanation.  
Incorrect answer but gives a valid explanation.  
An effort to get average.



## QUESTION 6

Note: \* is applied only once in this question.

**(a) Scale 5B\***

*Partial credit:* A height from data.

**(b) Scale 5B**

*Partial credit:* A number in the range [1 – 11].

**(c) and (d) Scale 5C\***

*Full Credit:* (c) and (d) correct.

*High partial credit:* (c) or (d) correct.

*Low partial credit:* 7 or 22. (part c)

An effort to rank the numbers. (part d)

$\frac{189+185}{2}$ . (part d)

Mean calculated correctly (185·409). (part d)

Mode (182). (part d)

**(e) Scale 5C**

*High partial credit:* 3 correct entries.

*Low partial credit:* 1 correct entry.

**(f) and (g) Scale 2B\***

*Partial credit:* A correct numerator or denominator.  
A correct decimal.

**(h) Scale 2B**

*Partial credit:* Correct answer or valid explanation.  
Correct answer but unsound explanation  
Incorrect answer but gives a valid explanation.

## QUESTION 7

### (a) Scale 5B

*Partial credit:* An effort at addition.  
1500 – 375 or similar.  
900.

### (b) Scale 5C

*High partial credit:* 6 correct entries.

*Low partial credit:* 1 correct entry.

### (c) Scale 2B

*Partial credit:* 1 fraction from table.

### (d) Scale 10B

*Partial credit:* 1 decimal from table.

### (e) Scale 5B

*Partial credit:* Correct answer or valid reason.  
Correct answer but unsound reason.  
Incorrect answer but gives a valid reason.

### (f) Scale 5B

*Partial credit:* Correct answer or valid explanation.  
Correct answer but unsound explanation.  
Incorrect answer but gives a valid explanation.

## QUESTION 8

### (a) Scale 5C

Accept fully correct Tree diagram.

*High partial credit:* 12 correct entries.

*Low partial credit:* 1 correct entry.

### (b) Scale 5B

*Partial credit:* 22 (ignores 1A and 6D).  
6 × 4.

### (c) Scale 5B

*Partial credit:* 1 correct outcome identified.  
15.

### (d) Scale 5B

*Partial credit:* Correct numerator or denominator (allow 22).  
1 correct outcome identified.

## QUESTION 9

### (a) Scale 10C

*High partial credit:* 3 correct entries.

*Low partial credit:* 1 correct entry.

### (b) Scale 15C

*High partial credit:* 3 correct entries.

*Low partial credit:* 1 correct entry.

## QUESTION 10

Tolerance:  $\pm 1$  box.

Note:

Correct image does not require A', B' and C' to be specified on the diagram

If image is from any of the following:

Axial Symmetry in the  $x$ -axis or Central symmetry in the origin or a Translation

then the candidate must specify A', B' and C' on the diagram for any credit in A', B' and C'.

### (a) and (b) and (c) Scale 5C

*Full Credit:* Image (a) and 5 points (b and c) correct.

*High partial credit:* Image (a) or 5 points (b and c) correct.

*Low partial credit:* Image of 1 vertex correct. (part a)  
Axial Symmetry not in the  $x$ -axis. (part a)  
Central symmetry not in the origin. (part a)  
An image that is not the same size as the object. (part a)

1 point correct. (part b and c)

## QUESTION 11

### (a) Scale 5B

*Partial credit:* 10 km or 4 km.  
Some substitution into  $D = S \times T$   
(e.g.  $30 \times 20$  or  $0.30 \times 20$  or  $24 \times 10$  or  $0.24 \times 10$ )

### (b) and (c) Scale 5C\*

Accept correct trigonometric ratio method.

*High partial credit:* Line drawn correctly.  
 $\sqrt{116}$  or 10.77

*Low partial credit:*  $10^2$  or  $4^2$ .  
A correct substitution into Sin/Cos/Tan.

## QUESTION 12

### (a) Scale 5C

Accept appropriate abbreviations for the sides (e.g. Opposite  $\equiv$  Opp  $\equiv$  O).

*High partial credit:* 2 correct entries.

*Low partial credit:* 1 correct entry.

### (b) and (c) Scale 5C\*

Accept Sin for Sin A or similar.

*Full Credit:* (b) and (c) correct.

*High partial credit:* (b) or (c) correct.

*Low partial credit:* 1 correct entry. (part b)

$\frac{12}{x}$ . (part c)

Sin  $35^\circ$  or Cos  $55^\circ$ . (part c)

Hypotenuse correctly identified on diagram. (part c)

### QUESTION 13

**(a) Scale 10A**

Accept angle  $60^\circ - 70^\circ$ .

Accept angle  $20^\circ - 30^\circ$ .

**(b) and (c) Scale 5C\***

*Full Credit:* **(b) and (c)** correct.

*High partial credit:* **(b) or (c)** correct.

*Low partial credit:*  $\frac{h}{10}$ . (part **b**)

Tan  $65^\circ$  (Tan  $25^\circ$ ). (part **b**)

Sides identified on diagram (e.g. O/H/A). (part **b**)

Use of candidates height from part (b) or 1.75. (part **c**)

**(d) Scale 5B**

*Partial credit:* Incomplete/unsatisfactory reason but with some element of reasoning.

### QUESTION 14

**(a) Scale 5B** Tolerance:  $\pm 1$  box

*Partial credit:* A or B correct.

**(b) Scale 5A** Tolerance:  $\pm 1$  box

**(c) Scale 2B** Tolerance:  $\pm 1$  box

Accept accurate construction methods.

*Partial credit:* A substitution into a correct midpoint formula.  
A correct construction line/arc.

**(d) Scale 5B**

Tolerance:  $\pm 1$  box

*Partial credit:* 1 correct line drawn.

**(e) Scale 5C\***

Accept correct use of Pythagoras theorem.

*Full credit:*  $|AD|$  and  $|BD|$  calculated correctly using correct formula.

*High partial credit:*  $|AD|$  or  $|BD|$  calculated correctly using correct formula.

*Low partial credit:* A correct substitution into the distance formula or Pythagoras.  
 $|AD|$  and  $|BD|$  measured correctly ( $\approx 8.6$  cm).

**(f) and (g) Scale 5C**

Accept congruency correctly disproved, for part **(g)** based on work in previous parts.

*Full credit:* **(f)** and **(g)** correct.

*High partial credit:* **(f)** or **(g)** correct.

*Low partial credit:* Correct type or valid reason. (part **f**)  
Correct type but unsound reason. (part **f**)  
Incorrect type but gives a valid reason. (part **f**)  
  
Correct answer or valid reason. (part **g**)  
Correct answer but unsound reason. (part **g**)  
Incorrect answer but gives a valid reason. (part **g**)

## QUESTION 15

### (a) Scale 15B

B to C can also be identified as (i) from day 2 to day 3 or (ii) at a height of 1cm.  
Similarly for D to E.

*Partial credit:* 1 period correct.

### (b) and (c) Scale 5C

Accept  $\frac{0.5}{1}$  for part (c).

*High partial credit:* 1 correct slope.

*Low partial credit:* 1 correct co-ordinate (A or B or C or D).  
 $\frac{\text{Rise}}{\text{Run}}$  formula written down.  
A correct substitution into slope formula.

### (d) Scale 5B

*Partial credit:* Correct answer or valid reason.  
Correct answer but unsound reason.  
Incorrect answer but gives a valid reason.

### (e) Scale 5B

*Full credit:* Valid description based on specific comments  
for each of the 4 periods.

*Partial credit:* Incomplete/unsatisfactory description but with some  
element of reasoning using the information given.