Coimisiún na Scrúduithe Stáit
State Examination Commission

Scrúdu
an Teastais Shóisearaigh

JUNIOR CERTIFICATE EXAMINATION

2011

MARKING SCHEME

MATHEMATICS (PROJECT MATHS) ORDINARY LEVEL

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Introduction

The Ordinary Level Mathematics examination for candidates in the 24 initial schools for *Project Maths* shared a common Paper 1 and common material on Paper 2 with the examination for all other candidates. The marking scheme used for the common elements was identical for the two groups.

This document contains the complete marking scheme for both paper 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.

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.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION

2011

MARKING SCHEME

MATHEMATICS (PROJECT MATHS) ORDINARY LEVEL PAPER 1

QUESTION 1

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

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

(a) $S = \{w, x, y, z\}$

(i) Write down a subset of S that has one element.

(ii) Write down a subset of S that has three elements.

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

$\{w\}$ or $\{x\}$ or $\{y\}$ or $\{z\}$

* No penalty for the omission of brackets.

* No penalty for use of Venn Diagram to show subsets.

Blunders (-3)

B1 Any incorrect set of elements of S other than the misreading as below.

Misreadings (-1)

M1 Subset of S with two or three elements. e.g. $S = \{w, x\}$.

Attempts (3 marks)

A1 Draws a single bracket & stops.

A2 { } Null set or set itself

Worthless(0)

W1 No relevant element listed without brackets but see A1 above

(a) (ii) **5 marks** **Att2**

$\{w,x, y\}$ or $\{w, x, z\}$ or $\{w ,y, z\}$ or $\{x, y,z\}$

***** No penalty for omission of brackets.

* No penalty for use of Venn Diagram to show subsets.

Blunders (-3)

B1 Any incorrect set of elements of S other than the misreading as below.

Misreadings (-1)

M1 Correct subsets of S with one or two elements e.g. $S = \{w,x\}$.etc

Attempts (2)

A1 Draws a single bracket & stops.

A2 { } Null set or set itself

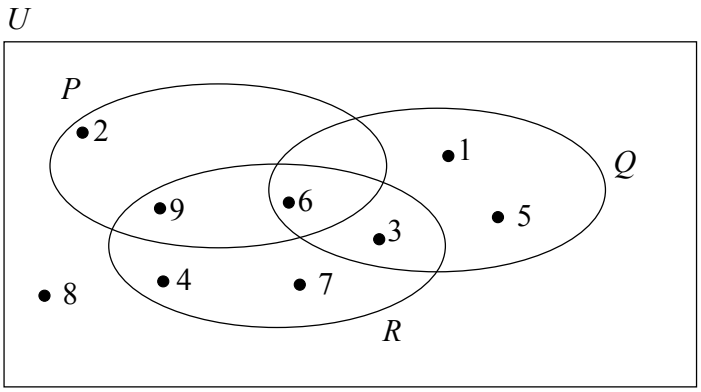
Worthless(0)

W1 No relevant element listed without brackets but see A1 above

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

U is the universal set.

$P = \{2, 6, 9\}$
$Q = \{1, 3, 5, 6\}$
$R = \{3, 4, 6, 7, 9\}$



List the elements of:

(i) $R \setminus Q$
(ii) P', the complement of set P
(iii) $Q \cup (P \cap R)$
(iv) $(Q \cap R) \setminus P$

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

$R \setminus Q = \{4,7,9\}$

Blunders (-3)
B1 Any incorrect set of elements of Q and R other than the misreading below.
Misreadings (-1)
M1 $Q \setminus R = \{1,5\}$
Attempts (2 marks)
A1 4 or 7 or 9 appear in the answer.
A2 $P \cap (Q / R) = \{\ \}$
Worthless(0)
W1 {8}

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

P', the complement of set $P = \{1,3,4,5,7,8\}$

Blunders (-3)
B1 Any incorrect set of the elements of P and Q and R other than the misreading below
Misreadings (-1)
M1 $P \cup Q \cup R$ giving {1,2,3,4,5,6,7,9} (all needed)
M2 $R' = \{2,1,5,8\}$
M3 Q' giving {2,4,7,8,9}
M4 {2,6,9}
Attempts (2 marks)
A1 At least one correct entry appears in the answer

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

$Q \cup (P \cap R) = \{1,3,5,6,9\}$

Blunders (-3)

B1 Any incorrect set of elements of Q, P or R other than the misreadings below.

Misreadings (-1)

M1 $Q \setminus (P \cap R) = \{1,5,3\}$.

M2 $Q \cap (P \cap R) = \{6\}$

M3 $Q \cup (P \cup R) = \{1,2,3,4,5,6,7,9\}$

M4 $Q \cap (P \cup R) = \{3,6\}$

Attempts (2 marks)

A1 1, 3, 5, 6, or 9 appear in the answer. but see Misreadings above

Worthless(0)

W1 Answer {8}.

(iv) **5 marks** **Att2**

$(Q \cap R) \setminus P = \{3\}$

Blunders (-3)

B1 Any incorrect set of elements of *P* and *Q* and *R* other than the misreading as below.

B2 (Q ∩ R) = {6,3} and stops

Misreadings (-1)

M1 $Q \setminus (R \cap P) = \{1,3,5\}$.

M2 $Q \setminus (R \cup P) = \{1,5\}$

M3 $Q \cup (R / P) = \{1,3,4,5,7\}$

Attempts (2 marks)

A1 6 or 3 appear in the answer.

Worthless(0)

W1 Answer {8}.

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

(i) List all the divisors of 18 and 24.
(ii) Write down the highest common factor of 18 and 24.
(iii) {5, 7, 9, 11, 13, 15} is the set of odd numbers between 4 and 16.
Which of these numbers are <u>not</u> prime numbers?
Give a reason for your answer.

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

Divisors of 18: = 1, 2 ,3, 6, 9, 18

Divisors of 24: = 1,2, 3, 4, 6, 8, 12, 24

Slips (-1)

S1 Each missing or incorrect element to a max of −3

Attempts (2 marks)

A1 Any one correct element identified

Worthless(0)

W1 Elements listed that are not divisors of 18 or 24

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

Highest common factor = 6

*Accept candidate's answer from c(i)

Blunders (-3)
B1 A common factor that is not the highest
Slips (-1)
S1 Answer written as 2×3

Misreadings (-1)
M1 Writes down LCM = 72

Attempts (2 marks)
A1 Any common factor listed

Worthless(0)
W1 Incorrect answer without work but see M1 or **** above***

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

Not prime numbers: 9 and 15

Reason: " Each has more than 2 factors"

Blunders (-3)
B1 Each incorrect or omitted entry

Slips (-1)
S1 No or incorrect reason given

Misreadings (-1)
M1 Gives prime numbers only

Attempts (2 marks)
A1 Any one relevant entry between 4 and 16 inclusive
A2 Correct reason as to why numbers are not primes

Worthless(0)
W1 Incorrect answer with no work shown

QUESTION 2

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

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

€52 is divided between Fiona and Orla in the ratio 9:4.
How much does each receive?

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

9+4= 13 **OR** 9+4 =13 **OR** $9x : 4x$ $13x = 52$

52 ÷13 = 4 $\frac{1}{13} = 4$ $x = 4$

9×4 =36

4×4 =16 $\frac{9}{13} = 36$ $4x=16$

$\frac{4}{13} = 16$

Fiona: 36 Orla: 16 **or** 52–36 =16 $9x = 36$

* Correct answer without work ⇒ 7 marks
* Incorrect answer without work ⇒ 0 marks, except for answers given in A4 below
* $\frac{52}{4} = 13$ and $\frac{52}{9} = 5.777\ldots / 5.78$ or 5.8 merits 4 marks

Blunders (-3)

B1 Divisor ≠ 13 and continues
B2 Incorrect multiplier or fails to multiply (each time)
B3 Adds instead of subtracts i.e. 36 + 52 = 98
B4 Fails to find second amount
B6 Error in transposition

Slips (-1)

S1 Numerical errors where work is clearly shown to a max of −3

Attempts (3 marks)

A1 Divisor ≠ 13 e.g, $\frac{52}{9}$ and/ or $\frac{52}{4}$ and stops
A2 Indicates 13 parts or 9 parts or 4 parts or $\frac{9}{13}$ or $\frac{4}{13}$ and stops
A3 Indicates multiplication of 52 by 9 and/or 4 **and stops**
A4 Both answers added together equal 52 (no work shown)
A5 Finds 9% of 52 (4.68) and 4% of 52 (2.08)
A6 One correct answer without work

Worthless(0)

W1 52 +9 = 61 or similar
W2 Incorrect answer without work. (subject to A4)

(b) **Marks 10,5,5** **Att 3,2,2**

(i) By rounding each of these numbers to the nearest whole number, estimate the value of $\frac{14\cdot18-4\cdot086}{1\cdot96}$.

(ii) Using a calculator, or otherwise, find the exact value of $\frac{14\cdot18-4\cdot086}{1\cdot96}$

(iii) Find the difference between the exact value in **(ii)** and the estimated value in **(i)**.

(i) **10 marks** **Att3**

$$\frac{14\cdot18-4\cdot086}{1\cdot96}\approx\frac{14-4}{2}=\frac{10}{2}=5$$

* $\frac{14-4}{2}$ and stops $\Rightarrow$ 7 marks.

* $\frac{14-4}{2}=\frac{10}{2}$ and stops $\Rightarrow$ 7 marks.*(-3)*

* No penalty if the intermediate step between approximations and correct final answer is not shown i.e. $\frac{10}{2}$ not shown

* Special Case: $\frac{14.18-4.085}{1.96}$ = 5.15 in this part $\Rightarrow$ Attempt 3 marks. Or $\frac{103}{20}$ or $5\frac{3}{20}$

Blunders (-3)

B1 Error(s) in rounding off to the nearest whole number (**once only if consistent**)

B2 Decimal error in calculation of final value

B3 An arithmetic operation other than indicated e.g. 14 – (4 ÷ 2) = 7 (breaking order)

B4 Error(s) in the manipulation of the denominator e.g. $\frac{14}{2}$ or $\frac{4}{2}$

B5 Incorrect cancellation

Slips (-1)

S1 Numerical errors to a max of −3

Attempts (3 marks)

A1 Only one approximation made to the given numbers and stops

A2 Ans. 5 with no preceding rounding off

Worthless (0)

W1 Incorrect answer without work but note **Special Case *** above

(ii) **5 marks** **Att2**

$$\frac{14\cdot18-4\cdot086}{1\cdot96}=\frac{10\cdot094}{1\cdot96}=5\cdot15$$

Blunders (-3)

B1 Decimal error or early rounding off

B2 Leaves as $\frac{\mathbf{10.094}}{\mathbf{1.96}}$

B3 Treats as $14.18-\frac{4.086}{1.96}$ = **12.09530612**

B4 Treats as $\frac{14\cdot18+4\cdot086}{1\cdot96}$ =**9.319387753**

B5 Treats as $\frac{14\cdot18}{1\cdot96}-4.086$ = **3.148603878**

Slips (-1)

S1 Numerical errors to a max of −3

Attempts (2 marks)

A1 Any correct relevant calculation and stops.

A2 Any of the following; (see above)

12.09530612, 9.319387753 or 3.148603878

merits 2 marks (minimum 4 decimal places) (with or without work)

Worthless (0)

W1 Incorrect answer without work but see A2

(iii) **5 marks** **Att2**

$5\cdot15-5=0\cdot15$

* Allow candidate's previous answers

Blunders (-3)

B1 Correct answer without work

B2 Decimal error (once only if consistent)

B3 Finds the sum of b(i) and (ii)

Attempts (2 marks)

A1 Any relevant step i,e. transfers answers from b(i) and/or b(ii)

Worthless (0)

W1 Incorrect answer without work

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

(i) Write $(a^3)^2$ in the form a^n, $n \in \mathbb{N}$

(ii) Using your answer from **(i)** or otherwise evaluate $(5^3)^2$.

Before going on holidays to the USA Seán changed €500 into dollars.

The exchange rate was €1 = US$1·22.

(iii) How many dollars did Seán get?

(iv) When Seán came home he changed US$50 back into euro (€).
The exchange rate was the same.
How much, in euro, did Seán receive?
Give your answer to the nearest cent.

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

$(a^3)^2 = a^{3\times 2} = a^6$ or $(a^3)^2 = a^3 \times a^3 = a^6$
or $a\times a\times a\times a\times a\times a = a^6$

* $a\times a\times a\times a\times a\times a$ and stops 4 marks
* $a^{3\times 2}$ and stops 4 marks
* 6 only written down 2 marks

Blunders (-3)
B1 $a^3 = a\times a\times a$ and stops
B2 Each error in calculation involving indices e.g. $(a^3)^2 = a^5$
B3 Each incorrect number of a's in the extended form
Slips (-1)
S1 Numerical errors to a max of −3
Attempts (2 marks)
A1 $(a^3)^2 = a^{3+2}$ and stops
A2 Some correct manipulation of indices
Worthless (0)
W1 Writes a only

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

✍
$(5^3)^2 = 5^6 = 15625$ or $5^3 = 125$ $125^2 = 15625$

* Accept candidate's answer fom c(i) unless it oversimplifies the question

Blunders (-3)
B1 Correct answer, without work ✍
B2 Each error in calculation involving indices
B3 Each incorrect number of 5's in the extended form
B4 Fails to finish
Slips (-1)
S1 Numerical errors to a max of −3
Attempts (2 marks)
A1 Some correct manipulation of indices
A2 $5^2 = 25$ and stops
A3 $5^3 = 125$ and stops
A4 Candidate transfers answer from c(i)
Worthless(0)
W1 Incorrect answer with no work shown

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

✍ €500 × 1·22 = $610

* No penalty for omission of € or $ signs

Blunders (-3)
B1 Correct answer, without work ✍
B2 Incorrect operator i.e. Divides by 1.22 correctly i,e, 409.836
B3 Decimal error
B4 Fails to finish i.e. €500 × 1· 22 and stops

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

Attempts (2 marks)
A1 Some correct manipulation of 500 and/ or 1.22

Worthless(0)
W1 Incorrect answer with no work shown

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

$$\frac{50}{1\cdot 22} = 40\cdot 9836 = 40\cdot 98$$

Blunders (-3)
B1 Correct answer, without work ✍
B2 Multiplies by 1.22 i.e. 50 × 1.22 = 61
B3 Incorrect ratio i.e. $\frac{1.22}{50}$ or $\frac{122}{5000}$
B4 Decimal error
B5 Fails to finish i.e. leaves answer as $\frac{50}{1.22}$

Slips (-1)
S1 Numerical errors to a max of −3
S2 Fails to round off or rounds off incorrectly

Attempts (2 marks)
A1 Some manipulation of 50 and/ or 1.22
A2 If answer is 41 or 40.9 with no work shown but see W1

Worthless(0)
W1 Incorrect answer with no work shown but see A2

QUESTION 3

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

(a) **15marks** **Att 5**

Three books were bought. They cost €8·75, €9·50 and €10·55 respectively.
If a €50 note was used to pay for the books, how much change was given?

Part (a) **15 marks** **Att 5**

€8.75 + €9.50 + €10.55 = €28.80
€50.00 - €28.80 = €21.20
Change = €21.20

€50.00 – (€8.75 + €9.50 + €10.55)
or
50.00 – €8.75 - €9.50 - €10.50 = €21.20
Change = €21.20

*****Accept 2120 or 21.2.
*No penalty for the omission of the € sign
*Final subtraction step subject to maximum deduction of 3.

Blunders (-3)
B1 Correct answer without work **12 marks**
B2 Fails to find the change.
B3 Operation other than addition when finding the total cost.
B4 Operation other than subtraction when finding the change.
B5 Each missing addition.
B6 Decimal error eg. €2.12 (Note 1st * above).

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

Attempts (5 marks)
A1 Any attempt at addition or subtraction of the given numbers and stops

Worthless (0)
W1 Incorrect answer without work.
W2 Multiplication or division of the given numbers.

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

(i) A washing machine costs €320 plus VAT at 21·0%.
Calculate the total cost of the washing machine after the VAT is added.

(ii) A popular breakfast cereal comes in two sizes of packet,
Regular (360 g) and *Large* (900 g).
A standard portion of cereal is 30 g.
How many portions are there in each size of packet?

(iii) A *Regular* box costs €0·96 and a *Large* box costs €2·25.
Using the number of portions per box, or otherwise,
find which size is better value?

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

100% = 320
1% = $\frac{320}{100}$
121% = $\frac{320}{100} \times 121$
= 3.2 × 121
Total Bill = €387.20

21% = $\frac{21}{100} \times 320$
VAT = $\frac{21}{100} \times 320$
= 67.2
Total Bill = 320 + 67.2
Total Bill = €387.20

320 × 1.21
Total Bill = € 387.20

* 320 + 21% = 387.20 5 marks.
* 320 × 21% = 67.2 and stops 2 marks.
* 320 + 21% and stops *or* 320 x 21% and stops 2 marks.
* €67.20 without work and stops merits 2 marks.

Blunders (-3)
B1 Correct answer without work
B2 Decimal error.
B3 Inverts as $\frac{100}{121}$ or $\frac{100}{21}$ and continues (giving answers 264.46 or 1523.81)
B4 Mishandles 121% or 21% eg. 320 × 121 or 320 ÷ 121 or similar. (Note: 320 must be used)
B5 320 taken as 121% or 21%.
B6 No addition of VAT (as per candidates work).
B7 Subtraction of VAT (as per candidates work).

Slips (-1)
S1 Numerical errors to a max of −3.

Attempts (2 marks)
A1 $\frac{121}{100}$ or $\frac{21}{100}$ or $\frac{320}{100}$ and stops.
A2 100% = 320 and stops.
A3 100 x $\frac{121}{320}$ and stops.
A4 $\frac{320}{121}$ or similar and stops.

Worthless (0)
W1 Incorrect answer without work
W2 320 + 21 = 341 and stops or continues.

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

Regular: **Number of portions** = 360/30 =**12**

✍

Large: **Number of portions** = 900/30 = **30**

Blunders (-3)

B1 Correct answers without work ✍
B2 Multiplication instead of division when finding the number of portions (once only)
B3 Finds only one answer
B4 Decimal error

Slips (-1)

S1 Numerical errors to a max of −3

Attempts (2 marks)

A1 Any attempt at division and stops
A2 30 + 30 + …or any correct step

Worthless (0)

W1 Incorrect answer without work

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

Method 1

Regular: 96 ÷ 12 = 8c per portion

Large: 225 ÷ 30 = 7.5c per portion

Large box is better value.

Method 2

Regular: 360g = 96cent Large: 900g = 225 c

1g = $\frac{96}{360}$ 1g = $\frac{225}{900}$

1g = 0.267cent 1g = 0.25cent

Large box is better value.

Method 3

Regular: 96cent = 360g Large: 225cent = 900g

1 cent = $\frac{360}{96}$ 1 cent = $\frac{900}{225}$

1 cent = 3.75g 1 cent = 4g

Large box is better value

Method 4

Regular: 10 boxes = 3600g = 10 x 0.96 = 9.60

Large: 4 boxes = 3600g = 4 x 2.25 = 9.00

Large box is better value.

* Candidate must indicate in some way that the Large box is better value. See S2.

* Accept candidate's previous answer

Blunders (-3)

B1 Operation other than division in unitary methods 1, 2, and 3

B2 Operation other than multiplication in common denominator method 4

B3 Finds unit cost or weight for one size box only

B4 Decimal error

Slips (-1)

S1 Numerical errors to a max of −3

S2 Fails to highlight or indicate *Large* box as better value

Misreading (-1)

M1 Transposes costs or weight for each box (eg. *Regular* box costs €2.25 or similar) and continues.

Attempt (2 marks)

A1 States *Larger* box without any relevant supporting work.

A2 Some attempt at division or multiplication using either €0.96 or €2.25.

A3 Some attempt at division using 12 or 30 or 360 or 900

A4 12 and 30 **or** 360 and 900 both multiplied as alternative in method 4

Worthless (0)

W1 Incorrect answer without work

W2 Adds given figures

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

Geraldine's annual wage is €40 000.
She pays income tax at the rate of 20% on the first €33 000 of her wage and income tax at the rate of 41% on the remainder of her wage.
Geraldine has an annual tax credit of €3500.

(i) Calculate the tax on the first €33 000 of her wage, at the rate of 20%.
(ii) How much of Geraldine's wage is taxed at the rate of 41%?
(iii) Calculate the amount of tax payable at the rate of 41%.
(iv) Calculate the tax due.

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

100% = 33000
1% = 330
20% = 6600
Tax = €6600

Tax = $\frac{33000}{100}$ x 20
Tax = €6600

Tax = 33000 x 0.2
Tax = €6600

20% = $\frac{1}{5}$
33000 ÷ 5
Tax = €6600

* No penalty for omitting € symbol

Blunders (-3)
B1 Correct answer without work.
B2 Mishandles 20% eg. 33000 x 20 = 660000 or 33000 ÷ 20 = 1650
B3 Uses € 40000 instead of €33000
B4 Decimal error.

Slips (-1)
S1 Numerical error to a max of −3.

Attempts (2 marks)
A1 Some use of 100 in attempt to find percentage eg. 20% = $\frac{20}{100}$ or 0.2 or $\frac{1}{5}$ and stops

A2 Writes 33000 × 20 and stops

Worthless (0)
W1 Incorrect answer without work
W2 33000 + 20 and stops or continues

3(c) (ii) How much of Geraldine's wage is taxed at the rate of 41%?

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

€40000 - €33000 = €7000 taxed at 41%

* No penalty for omitting € symbol

Blunders (-3)

B1 Correct answer without work.

B2 Operation other than subtraction used with €40000 or €33000

B3 €6600 or 3500 is used in a subtraction with €40000 or €33000.

Slips (-1)

S1 Numerical error to a max of −3.

Attempts (2 marks)

A1 Some subtraction involving €40000 or €33000.

Worthless (0)

W1 Incorrect answer without work.

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

100% = 7000
1% = 70
41% = 2870
Tax = €2870

Tax = $\frac{7000}{100}$ x 41
Tax = €2870

Tax = 7000 x 0.41
Tax = €2870

* No penalty for omitting € symbol
* Accept use of candidate's answer from (ii) above.

Blunders (-3)

B1 Correct answer without work.

B2 Mishandles 41% eg. 7000 ÷ 41 = 170.73 or similar. Note: (No penalty if already penalised in (c) (i).... consistent error.)

B3 Does not use €7000 but see 2nd * above.

B4 Decimal error.

Slips (-1)

S1 Numerical error to a max of −3.

Attempts (2 marks)

A1 Some correct use of 100 in attempt to find percentage eg. 41% = $\frac{41}{100}$ or 0.41 and stop

A2 Some correct use of €7000

A3 Uses €40000 or €33000 instead of €7000.

Worthless (0)

W1 Incorrect answer without work

W2 7000 + 41 = 7041 and stops or continues

(iv) **5 Marks** **Att 2**

€6,600 + €2870 = €9470 €9470 – €3500 = €5970

Total Tax	€9470
Tax Credit	€3500
Tax Due	€5970

* No penalty for omitting € symbol
* Accept use of candidate's answer from (i) and (iii) above.
* If all 3 boxes are correctly filled in give Full marks

Blunders (-3)
B1 Correct answer without work.
B2 Subtracts to find gross tax. eg. 6600 – 2870 = 3730.
B3 Misuse or no use of Tax Credit.
B4 Decimal error
B5 Total tax incorrectly calculated

Slips (-1)
S1 Numerical error to a max of −3.

Attempts (2 marks)
A1 Answer from c (i) or (iii) written in this part.

Worthless (0)
W1 Incorrect answer without work.

QUESTION 4

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

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

If $a = 4$, find the value of:

(i) $3a + 5$

(ii) $3a^2 - 20$

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

(i) $3a + 5$ $3(4) + 5 = 12 + 5 = 17$

*12 + 5→ 9 marks

Blunders (-3)

B1 Correct answer, without work ✍

B2 Leaves 3(4) in the answer

B3 Incorrect substitution and continues

B4 Breaks order i.e. . 3(4+5) = 3(9) = 27

B5 Treats 3(4) as 7 or 34

Slips (-1)

S1 Numerical errors to a max of −3

S2 Treats as $3a - 5$

S3 Fails to finish

Misreadings (-1)

M1 Uses $5a + 3$

Attempts (2 marks)

A1 Any number substituted for a and stops e.g. 3(6)

A2 Any correct step

A 3 Treats as $15a = 15(4) = 60$ or $8a = 8(4) = 32$

Worthless (0)

W1 Incorrect answer with no work

(a)(ii)	**5 marks**	**Att2**
✍	$3a^2 - 20$ $3(4)^2 - 20 = 3(16) - 20 = 48 - 20 = 28$	

*48 –20 → 4 marks

Blunders (-3)

B1 Correct answer without work ✍
B2 Leaves 42 in the answer
B3 Incorrect substitution and continues
B4 Breaks order e.g. 3(16-20) = 3(−4) = −12.
B5 Treats 3(16) as 3+16
B6 Incorrect squaring eg. 42 = 8
B7 Treats as $a^2 - 20$ i.e omits the 3

Slips (-1)

S1 Numerical errors to a max of −3
S2 Fails to finish but see * above

Misreadings (-1)

M1 Treats as $3a^2 + 20$

Attempts (2 marks)

A1 Any substitution for a^2 and stops
A3 Any correct step

Worthless (0)

W1 Incorrect answer, with no work

(b) **5, 10 marks** **Att 2,3**

(i) Write as a single fraction $\frac{x}{3}+\frac{5x}{6}$.

(ii) Multiply $(2x-5)$ by $(3x-4)$ and write your answer in its simplest form.

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

✍

$$\frac{x}{3}+\frac{5x}{6}=\frac{2x+5x}{6}=\frac{7x}{6}$$

* $\frac{x}{3}+\frac{5x}{6}=\frac{6x}{9}$ 0 Marks, but allow $\frac{7x}{6}$ **or** $\frac{2x+5x}{6}$ **or** $\frac{4x+10x}{12}$ **or** $\frac{6x+15x}{18}$ **etc** for **full marks**

* $\frac{2x+5x}{6}$ 5Marks

* $\frac{2x}{6}+\frac{5x}{6}$ and stops 5 Marks

Blunders (-3)

B1 Correct answer without work ✍

B2 Incorrect common denominator and continues

B3 Incorrect numerator from candidate's denominator $\frac{1(x)+2(5x)}{6}$

B4 Omitting denominator

Slips (-1)

S1 Drops denominator

S2 Numerical errors to a max of −3

Attempts (2 marks)

A1 Any correct step.

A2 Any correct common denominator found

Worthless (0)

W1 $(\frac{x}{3})(\frac{5x}{6})$ and stops

W2 Incorrect answer, with no work

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

✍

$(2x - 5)(3x - 4) = 2x(3x - 4) - 5(3x - 4) = 6x^2 - 8x - 15x + 20 = 6x^2 - 23x + 20$

*If $6x^2 - 8x - 15x + 20$ is correct (minimum 7 MARKS)

Blunders (-3)

B1 Correct answer without work ✍
B2 Error in distribution each time
B3 Errors in multiplication of powers
B4 Errors in collecting like terms
B5 Mathematical (sign) errors eg $-5 \times -4 = -20$
B6 $(2x - 5)$ written as $(2x + 5)$ and continues *and/or* $(3x - 4)$ written as $(3x + 4)$ --- oversimplification

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

Misreadings (-1)
M1 $(5x - 2)(4x - 3)$ etc and continues

Attempts (3 marks)
A1 One term correctly multiplied and stops e.g. $6x^2$
A2 $2x(3x - 4)$ or $-5(3x - 4)$ and stops
A3 $2x(3x - 4) - 5(3x - 4)$ and stops

Worthless (0)
W1 Incorrect answer with no work

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

(i) The cost of a DVD is €x. The cost of a CD is €3 less.
What is the cost of a CD in terms of x?

(ii) The total cost of 3 DVDs and 2 CDs is €54.

Write an equation in x to represent this information.
Solve your equation to find the cost of a DVD.

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

CD : $x - 3$

* Algebraic work required to earn marks

Blunders (-3)
B1 Incorrect expression for the cost of a CD other than misreading below

Misreadings (-1)
M1 Answer given as **$3+x$** *or* **$3-x$**

Attempts (2 marks)

Worthless (0)
W1 Cost of CD given as a constant or x.

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

✍ Equation : $3x + 2(x - 3) = 54$

$3x + 2x - 6 = 54$

$5x = 60$

$x = 12$

Cost of a DVD = 12

* Accept candidates answer from previous work.

Blunders(-3)

B1 Error in forming equation.
B2 Distribution error
B3 Transposition error
B4 Stops at $5x = 60$ or fails to solve equation
B5 Error in collecting like terms

Misreading (-1)

M1 $2x + 3(x - 3) = 54$ or similar

Slips (-1)

S1 Numerical errors to a max of −3

Attempts (2 marks)

A1 Answer from part c (i) written down and stops.
A2 Any effort at forming an expression.
A3 Writes $x = 12$
A4 Any effort at solving their equation
A5 Successful **Trial and Error**

Worthless (0)

W1 Incorrect answer with no work.

(iii) **10 marks** **Att 3**

Solve for x and y:

$x + 3y = 12$

$3x + 2y = 11$

(iii) **10 marks** **Att 3**

$5x + 3y = 12$ **(× –2)** **OR** $5x + 3y = 12$ **(× 3)**

$3x + 2y = 11$ **(×3)** $3x+2y = 11$ **(× –5)**

$-10x - 6y = -24$ $15x + 9y = 36$

$9x + 6y = 33$ $-15x - 10y = -55$

$-x = 9$ $-y = -19$

$x = -9$ $y = 19$

$5(-9) + 3y = 12$ $5x + 3(19) = 12$

$-45 + 3y = 12$ $5x + 57 = 12$

$3y = 57$ $5x = 12 - 57$

$y = 19$ $5x = -45$

$x = -9$ $x = -9$

OR $x = \frac{12-3y}{5}$

$3(\frac{12-3y}{5}) + 2y = 11$

$36 - 9y + 10y = 55$

$y = 55 - 36$

$y = 19$

$x = \frac{12-3(19)}{5}$

$x = \frac{12-57}{5}$

$x = \frac{12-57}{5}$ $x = -9$

* Apply only <u>one</u> blunder deduction (B2 or B3) to any error(s) in establishing the first equation; in terms of x only or the first equation in terms of y only.

* Finding the second variable is subject to a maximum deduction of (3).

Blunders (-3)

B1 Correct answers without work **(stated or substituted)**

B2 Error or errors in establishing the first equation in terms of x only ($-x = 9$) or the first equation in terms of y only ($-y = -19$) through elimination by cancellation **(but see S1)**

B3 Error or errors in establishing the first equation in terms of x only ($x = -9$) or the first equation in terms of y only ($-y = -19$) through elimination by substitution **(but see S1**)

B4 Errors in transposition when finding the first variable

B5 Errors in transposition when finding the second variable

B6 Incorrect substitution when finding second variable

B7 Finds one variable only

Slips (-1)

S1 Numerical errors to a max of −3

Attempt (3 marks)

A1 Attempt at transposition and stops

A2 Multiplies either equation by some number and stops

A3 Incorrect value of x or y substituted correctly to find candidate's correct 2nd variable

Worthless (0)

W1 Incorrect values for x or y substituted into the equations

QUESTION 5

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

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

(a) Write in its simplest form $2(x + 5) + 7(2x + 3)$.

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

$2(x + 5) + 7(2x + 3) = 2x + 10 + 14x + 21 = \mathbf{16x + 31}$

*Stops after correct removal of brackets 7 Marks

Blunders (-3)

B1 Correct answer without work ✍
B2 Error(s) in distribution (each time)
B3 Combining unlike terms after removal of brackets and continues
B4 Fails to group like terms
B5 Fails to finish

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

Misreadings (-1)
M1 $2(x+2)$ and continues.

Attempts (3 marks)
A1 Any one term correctly multiplied
A2 Combines unlike terms at the start and finishes correctly

Worthless (0)
W1 Combining unlike terms before attempting multiplication and stops e.g. $2(5x) = 10x$

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

Factorise:

(i) $4xy - 8y$
(ii) $xy - xz + 3y - 3z$
(iii) $x^2 + 7x + 12$
(iv) $x^2 - 64$

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

$$4xy - 8y = 4y(x - 2)$$

* $y(4x\text{-}8)$ or $2y(2x\text{-}4)$ or $2(2xy - 4y)$ or $4(xy - 2y)$ merit **4 Marks**

Blunders (-3)
B1 Removes factor incorrectly

Attempts (2 marks)
A1 Indication of common factor e,g. underlines *y*'s and stops
A2 Lists factors of 4 and factors of 8

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

✍ $xy - xz + 3y - 3z = x(y - z) + 3(y - z)$ or $y(x+3) - z(x+3)$
$= (y - z)(x + 3)$ $= (y - z)(x + 3)$

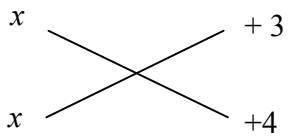
* Accept also (with or without brackets) for 5 marks any of the following
$(y-z)$ and $(x+3)$ [The word **and** is written down.]
$(y-z)$ or $(x+3)$ [The word **or** is written down.]
$(y-z)$, $(x+3)$ [A comma is used]

Blunders (-3)
B1 Correct answer without work ✍
B2 Stops after first line of correct factorisation. e.g. $x(y-z) + 3(y-z)$ or equivalent.
B3 Error(s) in factorising any pair of terms
B4 Correct first line of factorisation but ends as $(x+3).-yz$ or equivalent

Slips (-1)
S1 $(y-z) \pm (x+3)$

Attempts (2 marks)
A1 Pairing off, or indication of common factors and stops
A2 Correctly factorises any pair and stops

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

$x^2 + 7x + 12$ $x^2 + 4x + 3x + 12$ $x(x + 4) + 3(x + 2)$ $(x + 3)(x + 4)$	 $(x + 3)(x + 4)$	$\frac{-7 \pm \sqrt{(7)^2 - 4(1)(12)}}{2(1)}$ $\frac{-7 \pm \sqrt{49 - 48}}{2} = \frac{-7 \pm 1}{2}$ $\frac{-6}{2} = -3$ *and* $\frac{-8}{2} = -4$ $(x + 3)(x + 4)$

Factor Method

Blunders (-3)

B1 Incorrect two term linear factors of $x^2+7x+12$ formed from correct (but inapplicable) factors of x^2 and/or ±12. e.g. $(x+12)(x-1)$

B2 Incorrect factors of x^2 and/or ±12

B3 Correct cross method but factors not shown and stops

B4 $x(x+3)+4(x+3)$or similar and stops

Slips (-1)

S1 Numerical errors to a max of −3

Attempts (2 marks)

A1 Some effort at factorization e.g. (*x*)( ) or the cross with at least one "*x*" written in

A2 States one correct factor without work

Worthless (0 marks)

W1 $x^2 + 7x = 12$ or similar and stops

W2 Incorrect Trial and Error

W3 Oversimplification, resulting in a linear equation

W4 Combines *x* with numbers and continues or stops

Formula Method

Blunders (-3)

B1 Error in *a,b,c* substitution (apply once only)

B2 Sign error in substituted formula (apply once only)

B3 Error in square root or square root ignored

B4 Stops at $\frac{-7 \pm 1}{2}$

B5 Incorrect quadratic formula and continues

B6 No factors from roots or incorrect factors

Slips (-1)

S1 Numerical errors to a max of −3

S3 One factor only

Attempts (2 marks)

A1 Correct formula and stops

Worthless (0 marks)

W1 Combines *x* with numbers and continues or stops

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

$x^2 - 64 = x^2 - (8)^2 = (x+8)(x-8)$

* Accept also (with or without brackets) for 5 marks any of the following:
$x+8$ and $(x-8)$ [The word **and** is written down.]
$(x+8)$ or $(x-8)$ [The word **or** is written down.]
(x+8) , (x−8) [A comma is used]

* Quadratic equation formula method is subject to slips and blunders.

* $(x-\sqrt{64})(x+\sqrt{64})$ merits 5 marks

* $x \pm 8$ merits 4 marks

Blunders (-3)

B1 Incorrect two term linear factors of x^2-64 formed from correct (but inapplicable) factors of x^2 and 64. e.g $(x-64)(x+1)$

B2 Incorrect factors of -64

B3 Incorrect factors of x^2

B4 $(8-x)(8+x)$.

B5 $(x-64)(x+64)$

B6 Answer left as roots. ($x = \pm 8$)

Slips (-1)

S1 $x-8(x+8)$

Attempts (2 marks)

A1 Some effort at factorization e.g. (x)( ) or the cross with at least one "x" written in

A2 $\pm x$ *or* ± 8 appears

A3 $x^2 - 64 = x.x - 8.8$ only

A4 Mention of the difference of two squares .e.g. $x^2 - 64^2$

A5 Correct quadratic equation formula quoted and stops

A6 $\sqrt{64}$

Worthless (0)

W1 Combines ***x***s to "numbers" and continues or stops

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

(i) Solve the equation $5(3x + 1) – 2(5x + 35) = 0$.
Verify your answer.

(ii) Solve $x^2 + 3x – 10 = 0$.

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

$5(3x + 1) – 2(5x + 35) = 0$
$15x + 5 – 10x – 70 = 0$
$5x – 65 = 0$
$5x = 65$
$x = 13$

Verify

$5(3x + 1) – 2(5x + 35)$ $\quad x = 13$
$5(3(13) + 1) – 2(5(13) + 35)$
$5(39 + 1) – 2(65 + 35)$
$5(40) – 2(100)$
$200 – 200 = 0$

* If changes −2 to +2 at the start Blunder (−3)
* States x =13 (no work) and verifies correctly 7 Marks
* States x =13 (no work) with no verification 4 Marks
* Verifies correctly x = 13 (not stated) Att 3

Blunders (-3)
B1 Correct answer without work ✍
B2 Error(s) in distribution (each time)
B3 Combining unlike terms (each time) and continues
B4 Fails to group like terms
B5 Error(s) in transposition (each time)
B6 Fails to finish
B7 Fails to verify or verifies incorrectly

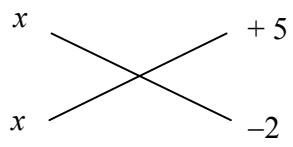
Slips (-1)
S1 Numerical errors to a max of −3

Misreadings (-1)
M1 $5(3x−1)$ or similar and continues but see * above

Attempts (3 marks)
A1 Any one term correctly multiplied
A2 Any correct step

Worthless (0)
W1 Combining unlike terms before attempting multiplication and stops e.g. $5(4x) = 20x$
W2 Invented answer verified but see * above
W3 Incorrect answer with no work

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

$x^2 + 3x - 10 = 0$ $x^2 + 5x - 2x - 10 = 0$ $x(x + 5) - 2x - 10 = 0$ $x(x + 5) - 2(x + 5) = 0$ $(x + 5)(x - 2) = 0$ $(x + 5) = 0$ or $(x - 2) = 0$	$(x + 5)(x - 2) = 0$ $(x + 5) = 0$ or $(x - 2) = 0$  	$\frac{-(3) \pm \sqrt{(3)^2 - 4(1)(-10)}}{2(1)}$ $\frac{-3 \pm \sqrt{9+40}}{2} = \frac{-3 \pm 7}{2}$ $\frac{-10}{2} = -5$ *and* $\frac{4}{2} = 2$
$x = -5$ *or* $x = 2$	x = -5 or x = 2	

* **2** correct solutions by **Trial and Error** **10** Marks

* **1** correct solution by **Trial and Error** **3** Marks (Attempt)

Factor Method

Blunders (-3)

B1 Correct answers without work ✍

B2 Incorrect two term linear factors of $x^2 + 3x - 10$ formed from correct (but inapplicable) factors of x^2 and/or ±10, e.g. $(x+10)(x-1)$

B3 No roots given. (once only)

B4 Incorrect factors of x^2 and/or ±10

B5 Correct cross method but factors not shown and stops [Note: B3 applies also].

B6 $x(x+5)-2(x+5)$ or similar and stops [Note: B3 applies also].

B7 Error(s) in transposition

Slips (-1)

S1 Numerical errors to a max of 3

S2 One root only from factors

Attempts (3 marks)

A1 Some effort at factorization e.g. (*x*)( ) or the cross with at least one "*x*" written in

A2 States one correct root without work

Worthless (0)

W1 $x^2 + 3x = 10$ or similar and stops

W2 Incorrect Trial and Error

W3 Oversimplification, resulting in a linear equation

Formula Method

Blunders (-3)

B1 Error in *a,b,c* substitution (apply once only)

B2 Sign error in substituted formula (apply once only)

B3 Error in square root or square root ignored

B4 Stops at $\frac{-3 \pm 7}{2}$

B5 Incorrect quadratic formula and continues

Slips (-1)

S1 Numerical errors to a max of 3

S2 Roots left in the form $\frac{p}{q}$

S3 One root only

Attempts (3 marks)

A1 Correct formula and stops

A2 One correct substitution and stops

QUESTION 6

Part (a)	**15(5,10) marks**	**Att 2,3**
Part (b)	**20(10,10) marks**	**Att3,3**
Part (c)	**15(5, 5, 5) marks**	**Att(2,2, 2)**

(a) **5,5 marks** **Att 2,2**

(a) $f(x) = 2x - 7$. Find:

(i) $f(4)$

(ii) $f(-3)$

(a) **5 marks** **Att2**

(i) $f(x) = 2x - 7$

$f(4) = 2(4) - 7 = 8 - 7 = 1$

Blunders (-3)

B1 Correct answer without work. ✍

B2 Mathematical error. e.g. $(2)(4) = 24$,

B3 Leaves 2(4) in the answer.

B4 Combines "x's" to "numbers" and continues e.g. $2x - 7 = -5x = -5(4) = -20$.

B5 Mathematical error e.g $8 - 7 = -1$

B6 Breaks order i.e. $2(4 - 7) = 2(-3) = -6$

Slips (-1)

S1 Numerical errors to a max of −3.

S2 Leaves x in the answer e.g. $1x$

Misreadings (-1)

M1 Correctly substitutes in any number other than 4 and continues

Attempts (2marks)

A1 Treats as equation and continues or stops i.e $2x - 7 = 4$

A2 Substitutes for "x" and stops i.e. 2(4).

Worthless (0)

W1 Combines "x's" to "numbers" and stops

W2 Ignores x giving $2 - 7 = -5$.

W3 $4[f(x)] = 8x - 28$.

W4 Replaces coefficient i.e. $2x \rightarrow 4x$

W5 Incorrect answer without work.

(a) (ii)	**10 marks**	**Att3**
(a) (ii)	$f(-3) = 2(-3) - 7 = -6 - 7 = -13$	

Blunders (-3)

B1 Correct answer without work. ✍ [Do not penalise if already penalised in part (a) (i) or work is shown in part (a) (i).]
B2 Mathematical error. i.e. –6 – 7 = 13
B3 Leaves 2(–3) in the answer.
B4 Combines "x's" to "numbers" and continues e.g $2x - 7 = -5x = -5(-3) = 15$
B5 Breaks order i.e. 2(–3–7) = 2(–10) = –20

Slips (-1)

S1 Numerical errors to a max of −3
S2 Leaves x in the answer e.g. −13 x

Misreadings (-1)

M1 Substitutes in any negative number other than −3 and continues.

Attempts (3marks)

A1 Treats as equation and continues or stops. . i.e. $2x - 7 = -3$
A2 Substitutes in any positive number
A3 Substitutes for x and stops. i.e. 2(−3)

Worthless (0)

W1 Ignores x giving 2 −7 = −5
W2 $-3f(x) = -6x + 21$
W3 Combines "x's" to "numbers" and stops.
W4 Replaces coefficient i.e. $2x \rightarrow -3x$.
W5 Incorrect answer without work.

(b) **10 (Table), 10 (Graph) marks** **Att 3,3**

Draw the graph of the function

$$g : x \to 2x^2 - 4x + 1$$

in the domain $-1 \le x \le 3$, where $x \in \mathbb{R}$.

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

$g : x \to 2x^2 - 4x + 1$

$g(x) = 2x^2 - 4x + 1$
$g(-1) = 2(-1)^2 - 4(-1) + 1 = 2 + 4 + 1 = 7$ **(–1,7)**
$g(0) = 2(0)^2 - 4(0) + 1 = 0 + 0 + 1 = 1$ **(0, 1)**
$g(1) = 2(1)^2 - 4(1) + 1 = 2 - 4 + 1 = -1$ **(1, – 1)**
$g(2) = 2(2)^2 - 4(2) + 1 = 8 - 8 + 1 = 1$ **(2, 1)**
$g(3) = 2(3)^2 - 4(3) + 1 = 18 - 12 + 1 = 1$ **(3, 7)**

Table **10 marks** **Att 3**

A

$f(-1)$	=	$2(-1)^2$	-4(-1)	+1	=	**7**
$f(0)$	=	$2(0)^2$	-4(0)	+1	=	**1**
$f(1)$	=	$2(1)^2$	-4(1)	+1	=	**-1**
$f(2)$	=	$2(2)^2$	-4(2)	+1	=	**1**
$f(3)$	=	$2(3)^2$	-4(3)	+1	=	**7**

B

x	**-1**	**0**	**1**	**2**	**3**
$2x^2$	2	0	2	8	18
$-4x$	+ 4	- 0	- 4	- 8	- 12
+1	+1	+1	+1	+1	+1
$f(x)$	**7**	**1**	**-1**	**1**	**7**

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

<u>Blunders (-3)</u>

B1 Correct answer, without work i.e. 5 correct couples only and no graph
B2 Takes "$2x^2$" as "x^2" and places "x^2" in the table or function.
B3 Errors in evaluating "$2x^2$", e.g. $2(-1)^2 = (-2)^2 = 4$, once only if consistent.
B4 "$-4x$" taken as "–4" all the way [In the row headed "$-4x$" by candidate]
B5 "+1" calculated as "$+1x$" all the way. [In the row headed "+1" by candidate]
B6 Adds in top row when evaluating $f(x)$ in table method (***B).***
B7 Omits "+1" row
B8 Omits "$-4x$" row
B9 Omits a value in the domain (each time).
B10 Each incorrect image, without work, or, calculation through the function method (***A***).

Slips (-1)

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

S2 Fails to find a value **of Range** each time in table to a max of 3

Misreadings (-1)

M1 Misreads "$-4x$" as "$+4x$" and places "$+4x$" in the table or function.

M2 Misreads "+1" as "−1" and places "−1" in the table or function.

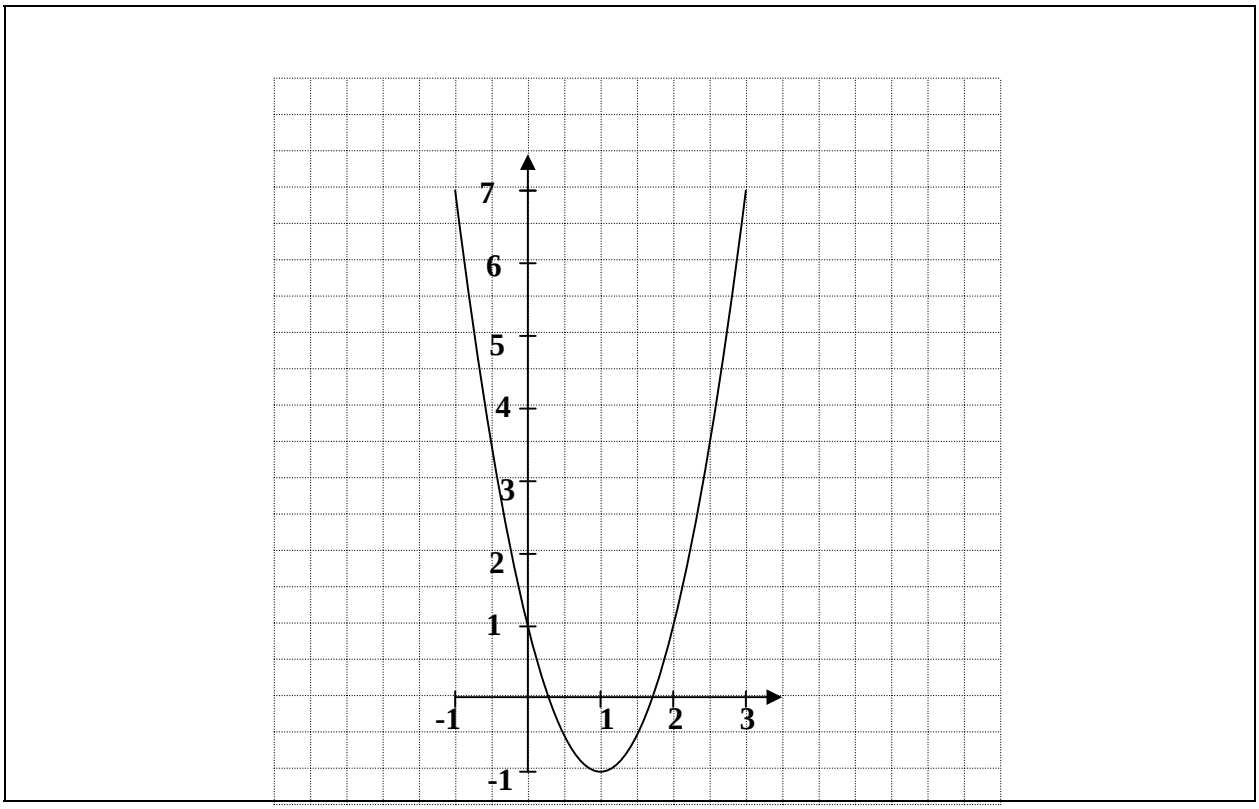
Attempts (3marks)

A1 Omits "$2x^2$" row or treats "$2x^2$" as $\pm 2x$ **or** $\pm x$, (i.e. evaluates a linear function)

A2 Any effort at calculating point(s) in the **Domain**

A3 Only one point calculated and stops.

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



* Accept candidates values from previous work (**5 co-ordinates needed**) but see S2

* Only **<u>one</u>** correct point **<u>graphed correctly</u>** $\Rightarrow$ **Att <u>3</u> + Att 3**

* Correct graph but **no table** $\Rightarrow$ full marks i.e. **(10 + 10) 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 4th * 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 ± 0.25 }

S2 Each point { **5 points needed** } from table not graphed [See **2nd *** above]

Attempts (3 marks)

A1 Graduated axes (need not be labelled)

A2 Some effort to plot a point { See **2nd *** above}

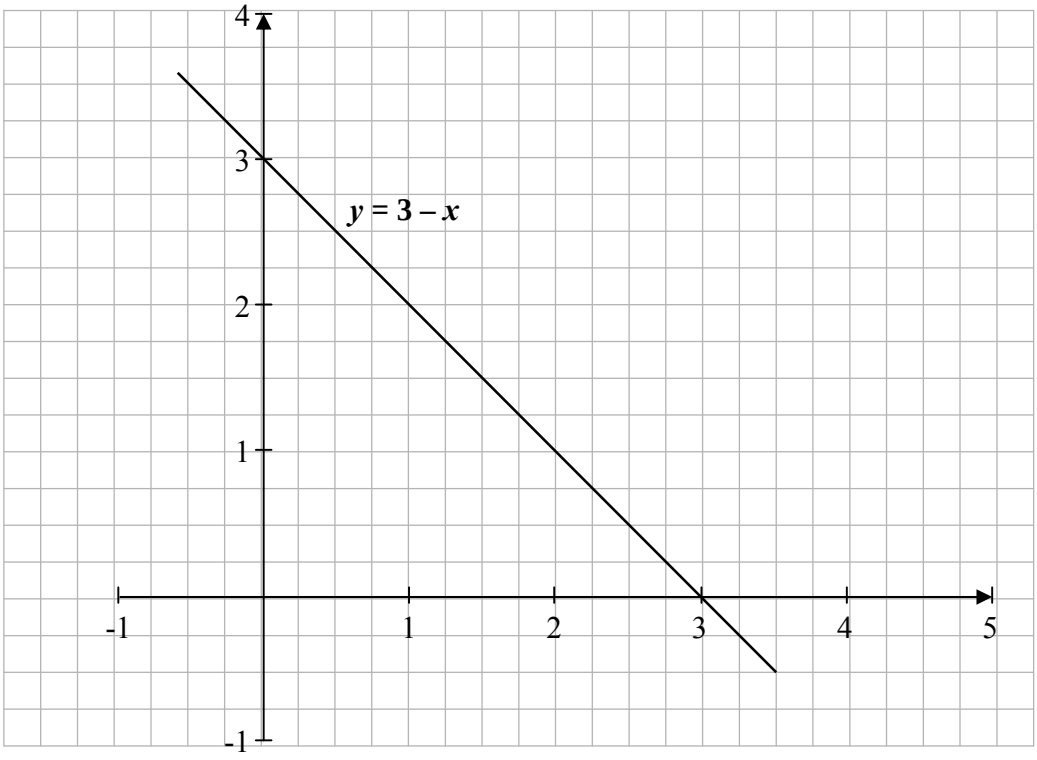
=

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

(c) **(i)** Given that $y = x - 1$, complete the table below.

x	1	2	3	4
y				

On the grid below the graph of the line $y = 3 - x$ is drawn.
Using your answers from **(i),** draw the graph of $y = x - 1$ on the same grid.



(iii) Use the graphs drawn in **6(c) (ii)** to write down the co-ordinates of the point of intersection of the two lines $y = 3 - x$ and $y = x - 1$.

Answer to be written here.

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

(i) Given that $y = x - 1$, complete the table below.

x	1	2	3	4
y	0	1	2	3

*** Accept candidate's values without work**

Slips (-1)
S1 Each 'y' value omitted or incorrect.

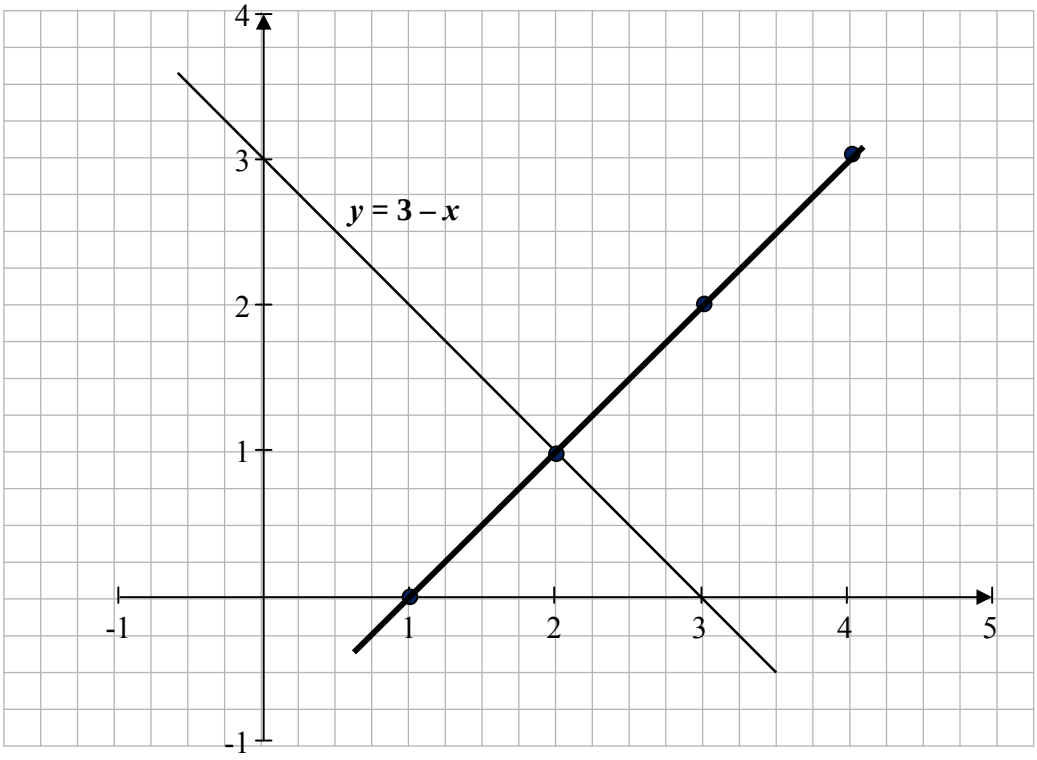
Misreadings (-1)
M1 Treats $y = x - 1$ as $y = x + 1$. (consistent error)

Attempts (2 marks)
A1 Any one correct 'y' value.
A2 Any effort at calculating points.
A3 Treats as $y = -x$ and continues

Worthless (0)
W1 Copies x values into y row.
W2 All 'y' values incorrect with no work shown but (See M1 and A3 above)

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

On the grid below the graph of the line $y = 3 - x$ is drawn.
Using your answers from **(i),** draw the graph of $y = x - 1$ on the same grid.



* **Accept candidates values from previous work**

Blunders (-3)
B1 Reversed co-ordinates plotted.
B2 Points not joined or joined in incorrect order.

Slips (-1)
S1 Each point of candidate graphed incorrectly. {See B1}.
S2 Each point from table not graphed.

Attempts (2 marks)
A1 Any one correct point plotted.
A2 Any incorrect straight line drawn

Worthless (0)
W1 No correct point plotted. {See B1 above}.

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

(2,1)

***** Accept correct answer based on candidate's graph
from c(ii), otherwise, attempt marks at most.

Blunders (-3)
B1 Answer beyond tolerance (± 0.25).
B2 Answer given with co-ordinates reversed, i.e. (y, x).

Slips (-1)
S1 Correct answer written on graph but not presented in the answer box.

Attempts (2 marks)
A1 Algebraic evaluation. (fully correct)

A2 Point of intersection clearly indicated correctly on graph, but not written down.

Worthless (0)
W1 Answer outside of tolerance without graphical indication.
W2 Incorrect answer from candidate's graph.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION

2011

MARKING SCHEME

MATHEMATICS (PROJECT MATHS) ORDINARY LEVEL PAPER 2

QUESTION 1

10 marks **Att 3**

Question 1 **10 marks** **Att 3**

1. (a) Multiply 320 grams by 5 and give your answer in kilograms.

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

320 x5 = 1600 g 1600 /1000 =1·6 kg	or	320/1000 = 0·32 kg 0·32 kg x 5 = 1·6 kg

Blunders (-3)
B1 Correct answer without work
B2 Does not divide by 1,000
B3 Decimal error
B4 Incorrect mathematical operation with work and continues correctly, e.g. divides instead of multiplying
B5 Incorrect conversion or no conversion

Slips (-1)
S1 Numerical slips to a maximum of -3
S2 1,600 g = 1 kg 600 g

Misreadings(-1)
M1 Multiplies 320 by any number other than 5 or multiplies any number by 5

Attempts (3 marks)
A1 Some correct step with work e.g. 1,000 g = 1 kg and stops
A2 $\frac{320}{5}$ or 320 – 5 or 320 + 5 and stops

QUESTION 2

(a)	**5 marks**	**Att 2**
(b)	**10 marks**	**Att 3**
(c)	**5 marks**	**Att 2**

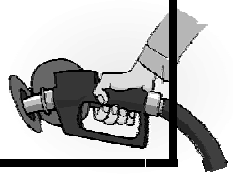
Question 2 **5, 10, 5 marks** **Att 2, 3 ,2**

John travelled by car from Tralee to Galway.
He left Tralee at 09:45 and arrived in Galway at 12:57.

(a) How long did it take John to travel from Tralee to Galway?
Give your answer in hours and minutes.

(b) The distance from Tralee to Galway is 200 km.
Calculate John's average speed, in km/h.

(c) John had estimated it cost 22 cent per km to drive his car.
How much did it cost him to drive his car from Tralee to Galway?



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

12:57− 09:45 = 3:12 or 3 hours 12 minutes

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

Blunders (-3)
B1 Correct answer without work
B2 Incorrect mathematical operation with work and continues

Slips (-1)
S1 Numerical slips to a maximum of -3
S2 Gives answer as 192 minutes or 3.2 hours

Attempts (2 marks)
A1 Subtracts hours or minutes only
A2 3.12 without work

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

Speed = Distance /Time

Distance =200 km Time (3 hours 12 minutes) = 3·2 hours

Speed = $\frac{200}{3 \cdot 2} = 62 \cdot 5$ km/h

* Accept **c**andidates' answer from part (a)
* Accept ratio method

Blunders (-3)
B1 Correct answer without work
B2 Incorrect relevant formula
B3 Decimal error
B4 Error in converting minutes to hours e.g. treats 3 hours 12 minutes as 3.12 hours
B5 Leaves answer as $\frac{200}{3.2}$, i.e. no division

Slips (-1)
S1 Numerical slips to a maximum of -3
S2 Gives answer in km/min or m/hour

Attempts (3 marks)
A1 Correct formula and stops
A2 3 hours 12 minutes = 3.2 hours or 1 hour = 60 minutes and stops

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

200x 22c = 4400c = €44

Blunders (-3)
B1 Correct answer without work
B2 Incorrect mathematical operation with work
B3 Decimal error

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

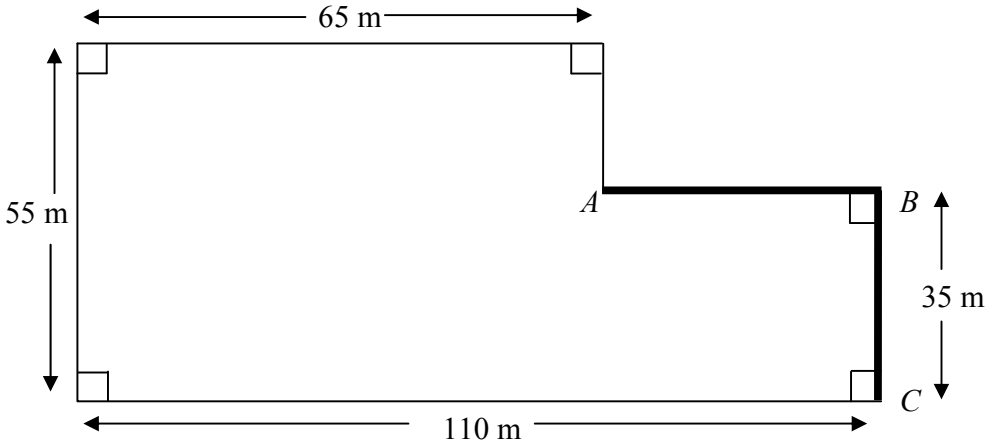
Attempts (2 marks)
A1 Multiplication using 200 or 22

QUESTION 3

(a)	**5 marks**	**Att 2**
(b)	**10 marks**	**Att 3**
(c)	**5 marks**	**Att 2**

Question 3 **5, 10 , 5 marks** **Att 2, 3 , 2**

The shape and measurements of a field are shown in the diagram below.



(a) Find the length $|AB|$.

(b) Find the length of the perimeter of the field.

(c) The sections $[AB]$ and $[BC]$ are stone walls.
A farmer wishes to put fencing around the rest of the field.
The fencing costs €62·50 per 5 metres.
Find the cost of the fencing.

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

$|AB| = 110 - 65 = 45$

***…** Do not penalise same error twice in part (a)

Blunders (-3)
B1 Correct answer without work or correct answer given in diagram

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

Attempts (2 marks)
A1 Gets other unknown side correctly (20 m)

Worthless (0)
W1 Incorrect answer without work

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

Perimeter = $2 \times 110\text{m} + 2 \times 55\text{ m} = 220 + 110 = 330\text{ m}$
or
$P = 55 + 65 + 45 + 20 + 35 + 110 = 330\text{ m}$

* Accept candidates' answer from part (a)

Blunders (-3)
B1 Correct answer without work
B2 Incorrect mathematical operation with work
B3 Each measurement omitted or incorrect
B4 Stops at 220 + 110 or 55 + 65 + 45 +20 + 35 +110

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

Attempts (3 marks)
A1 Some correct step with work and stops
A2 Finds unknown side (20 m) , if previous part not attempted
A3 Adds two of the given numbers correctly
A4 Gets area of field or part of

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

Length Fencing = $330 - (35 + 45) = 330 - 80 = 250$ m

Cost fencing = $250/5 \times 62{\cdot}50 = 50 \times 62{\cdot}50 = €3125$

* Accept candidates' answer to parts (a) and (b)

Blunders (-3)
B1 Correct answer without work
B2 Includes wall / walls in cost calculation
B3 Each measurement omitted or incorrect, if not already penalised
B4 Decimal error
B5 Incorrect mathematical operation with work
B6 Does not divide by 5

Slips (-1)

S1 Numerical slips to a maximum of −3

Attempts (2 marks)
A1 Adds 35 + 45 and stops
A2 Multiplies by € 62.50
A3 € 62.50 ÷ 5 and stops
A4 Calcuates 250 m. correctly and stop

Model Solutions
(Questions 4 to 17)

Note that 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.

Question 4

The average weekly earnings for people working for manufacturing industries in Ireland from 1998 to 2006 are given in the table below. The earnings are given to the nearest euro.

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006
Male	429	453	478	512	538	565	589	610	624
Female	285	298	325	347	365	394	407	430	451
All Persons	375	397	423	457	483	512	534	558	575

Source: Central Statistics Office

(a) Find the difference between the average male earnings and the average female earnings in each of the years 1998 and 2006.

1998

Male = *429*
Female = *285*
Difference = *144*

2006

Male = *624*
Female = *451*
Difference = *173*

(b) Write the average female earnings as a percentage of the average male earnings for each of the years 1998 and 2006. Give your answers correct to two significant figures.

$$\frac{\text{Female earnings}}{\text{Male earnings}} \times \frac{100}{1} =$$

1998

$\frac{285}{429} \times \frac{100}{1}$

$\frac{9500}{143}$

66·4335

66

2006

$\frac{451}{624} \times \frac{100}{1}$

$\frac{11275}{156}$

72·2756

72

(c) From your answers to **(a)** and **(b)** above, would you say that these average wages have become more equal or less equal over these nine years? Give a reason for your answer.

Answer: *More equal* | *Less equal*

Reason: *% gap is narrower* | *gap is bigger (wider)*

(d) The average weekly earnings for "All Persons" in 1998 is €375. This is not the average of €429 and €285. Explain why this might be the case.

There are more men than women in the survey *or*

Not the same number of men and women *or*

It is a weighted mean

Question 5

Tom's third year Physical Education class did a fitness test. The number of sit-ups that each student did in one minute is recorded below:

59	48	27	53	36	29	52	46	45	37	49	51
33	45	38	52	40	51	37	44	47	45	60	41

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

2	*7*	*9*													
3	*3*	*6*	*7*	*7*	*8*										
4	*0*	*1*	*4*	*5*	*5*	*5*	*6*	*7*	*8*	*9*					
5	*1*	*1*	*2*	*2*	*3*	*9*									
6	*0*														
					Key 48 = 4|8										

(b) How many students are in the class? *24*

(c) What is the range of sit-ups for the class? *33*

(d) What is the mode of the data? *45*

(e) Find the mean of the data correct to one decimal place.

$$\frac{59+33+48+\ldots..+51+41}{24}$$

$$\frac{1065}{24}$$

$$44{\cdot}375$$

$$44{\cdot}4$$

(f) Tom did 48 sit-ups in the test. How does this compare to the rest of the class?

Above average *or*
15 did worse *or*
8 did better

Question 6

Mary has a bag of marbles. The number of marbles of each colour is shown in the box.

Contents.
7 yellow marbles
3 green marbles
4 red marbles
2 black marbles

(a) How many marbles are in the bag? *16*

Mary takes a marble from the bag at random.

(b) Complete the sentence below.
The probability that Mary will take a *Red* marble from the bag is $\frac{1}{4}$.

(c) "The probability of taking a red marble is greater that the probability of taking a yellow marble." Is this statement correct? Give a reason for your answer.

Answer: *No*

Reason: *There are more yellow marbles than red marbles.*

Mary found five more black marbles and added them to the bag.

(d) Fill in the number of marbles of each colour in the bag after she has done this.

Contents.
7 yellow marbles
3 green marbles
4 red marbles
7 black marbles

(e) Mary takes a marble from the bag at random. What is the probability that she will take a black marble from the bag?

$\frac{7}{21}$

Question 7

(a) Let $A = \{1, 2, 3, 4, \ldots, 25\}$. Write out all the elements of A that are divisible by 2 but not divisible by 3.

$\{2, 4, 8, 10, 14, 16, 20, 22\}$

(b) What is the probability that a number chosen at random from the set A is divisible by 2 but not divisible by 3?

$\frac{8}{25}$

Question 8

Una rolls a die and flips a coin. One of the possible outcomes is (1, Head).

(a) Write out the remaining eleven possible outcomes in the table below.

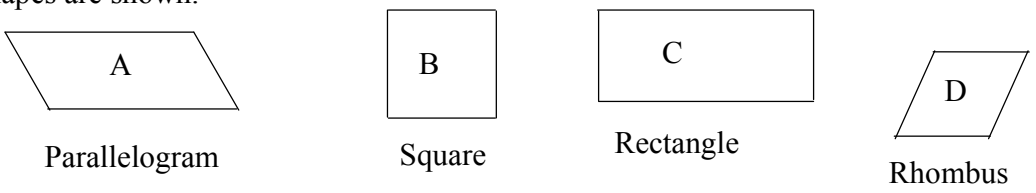
(1, Head)	*(1, Tail)*
(2, Head)	*(2, Tail)*
(3, Head)	*(3, Tail)*
(4, Head)	*(4, Tail)*
(5, Head)	*(5, Tail)*
(6, Head)	*(6, Tail)*

(b) How many outcomes consist of an odd number and a Tail? *3*

(c) What is the probability that the outcome will contain a prime number? $\frac{6}{12}$

Question 9

Four shapes are shown.



Parallelogram Square Rectangle Rhombus

Tick (✓) below to show the shapes for which the statements are always true.

	A	B	C	D
The diagonals bisect each other	✓	✓	✓	✓
Opposite sides are equal in length	✓	✓	✓	✓
All sides are equal in length		✓		✓
The diagonals are equal in length		✓	✓	
Opposite sides are parallel	✓	✓	✓	✓

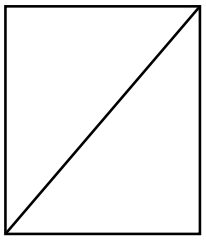
Question 10

The size of an A4 page is 210 mm × 297 mm.

(a) Describe how you would calculate the length of the longest line that could be drawn on an A4 page.

Theorem of Pythagoras *or* *Tan (angle) + Sin/Cos (diagonal)*

(b) Calculate the length of this longest line, correct to the nearest mm.



$h^2 = 210^2 + 297^2$

$h^2 = 44100 + 88209$

$h^2 = 132309$

$h = \sqrt{132309}$

$h = 363{\cdot}7430412$

$h = 364\text{ mm}$

$\text{Tan } A = \frac{297}{210}$

$\text{Tan } A = 1{\cdot}4142$

$A = 54{\cdot}73698°$

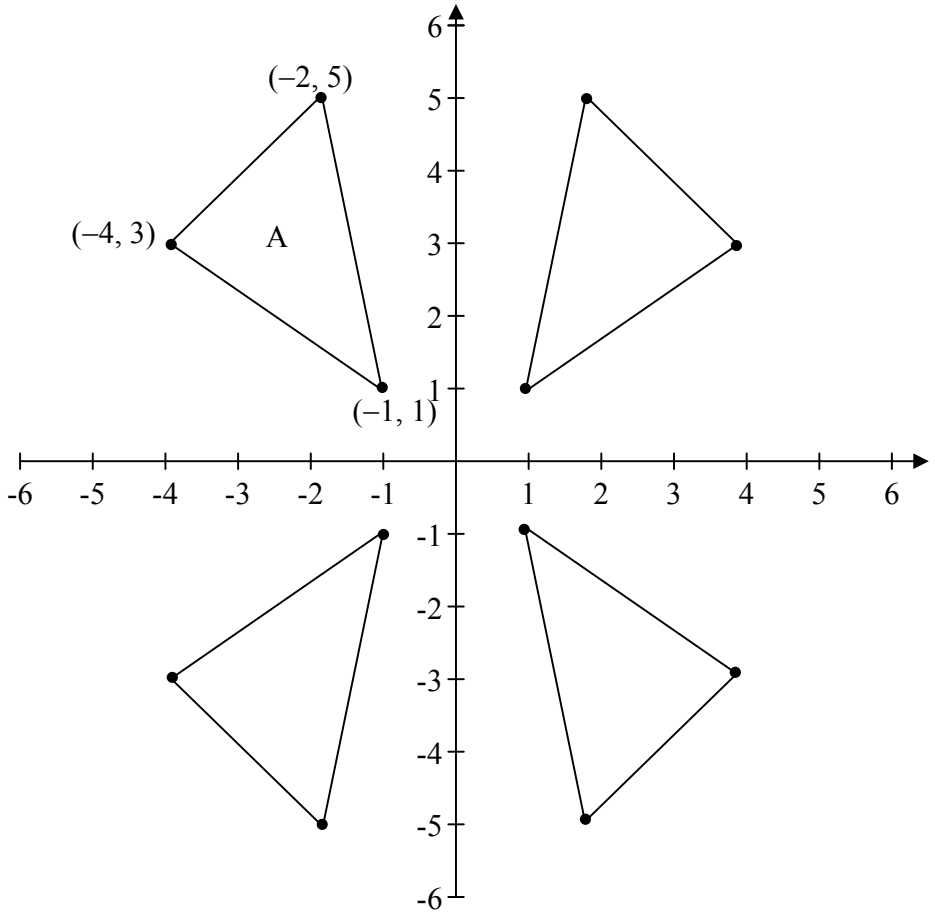
$A \approx 55°$

$\text{Sin } 55° = \frac{297}{h}$ $(\text{Cos } 55° = \frac{210}{h})$

$h = 364\text{ mm}$

Question 11

The diagram below shows a triangle A on the coordinate plane and its image under a number of transformations.

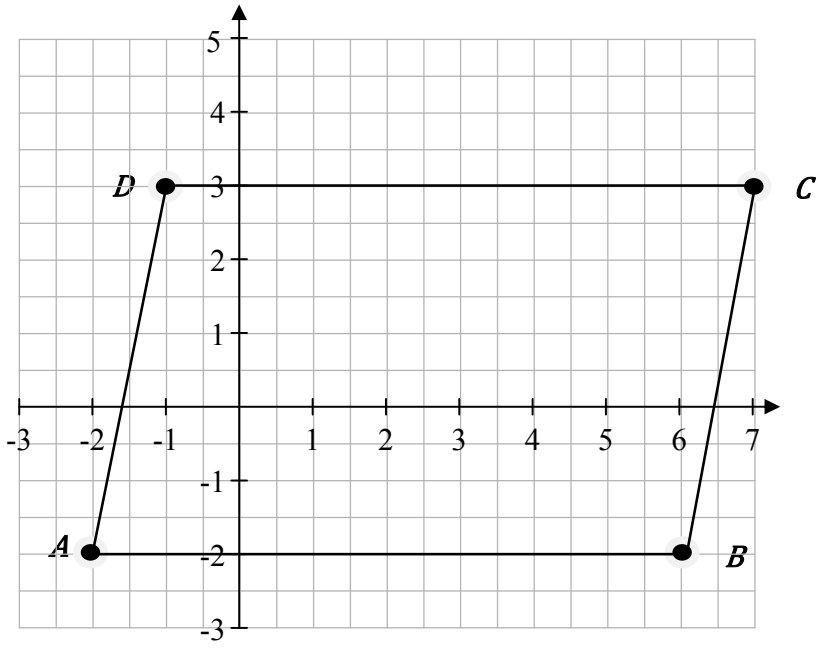


Write down the coordinates of the images of the vertices of A under each of the transformations listed below.

Transformation	Coordinates of vertices
Axial symmetry in the *y*-axis	(1 , 1), (2 , 5), (4 , 3)
Central symmetry in the point (0, 0)	(1 , -1), (2 , -5), (4 , -3)
Axial symmetry in the *x*-axis	(-1 , -1), (-2 , -5), (-4 , -3)

Question 12

(a) Plot the points $A(-2, -2)$, $B(6, -2)$, $C(7, 3)$ on the grid below.



(b) Construct the point D such that $ABCD$ is a parallelogram and write down its coordinates.

$D = (\ -1\ ,\ 3\ )$

(c) In Question 9 on page 9 you identified some properties of a parallelogram. Write down one of these.

The diagonals bisect each other *or*

Opposite sides are equal *or*

Opposite sides are parallel

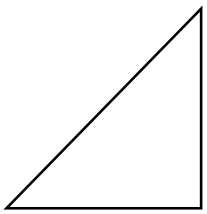
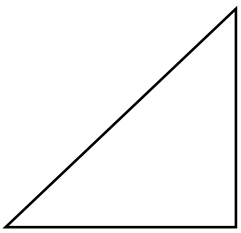
(d) Using co-ordinate geometry formulae, verify that $ABCD$ has the property you wrote down in **(c)** above.

The diagonals bisect each other	*Opposite sides are equal*	*Opposite sides are parallel*
	$\|AB\| = \|DC\| = 8$	*Slope of AB and DC = 0*
Midpoint of AC and DB $= (\frac{5}{2}, \frac{1}{2})$	$\|AD\| = \|BC\| = \sqrt{26}$	*Slope of AD and BC = 5*

Question 13

Vera is standing on level ground beside a building on a sunny day. She is 1·6 m tall. Her shadow is 0·5 m in length. The building casts a shadow which is 6·2 m long.

(a) Draw two triangles to show this.

Vera	Building
	

(b) Explain how this information can be used to find the height of the building.

Similar Triangles or *Tan (angle) + Tan (height)*

(c) Find the height of the building.

$\frac{0·6}{0·5} = \frac{h}{6·2}$ $\left(\text{or } \frac{0·5}{6·2} = \frac{1·6}{h}\right)$

$6·2\,(1·6) = h\,(0·5)$

$9·92 = 0·5\,h$

$\frac{9·92}{0·5} = h$

$h = 19·84\text{ m}$

$\text{Tan } A = \frac{1·6}{0·5} = 3·2$

$A = 72·6459 = 73°$

$\text{Tan } 73° = \frac{h}{6·2}$

$6·2\,(3·2) = h\,(1)$

$h = 19·84\text{ m}$

(d) Find the angle of elevation of the sun, correct to the nearest degree.

$\text{Tan } A = \frac{1·6}{0·5} = 3·2$

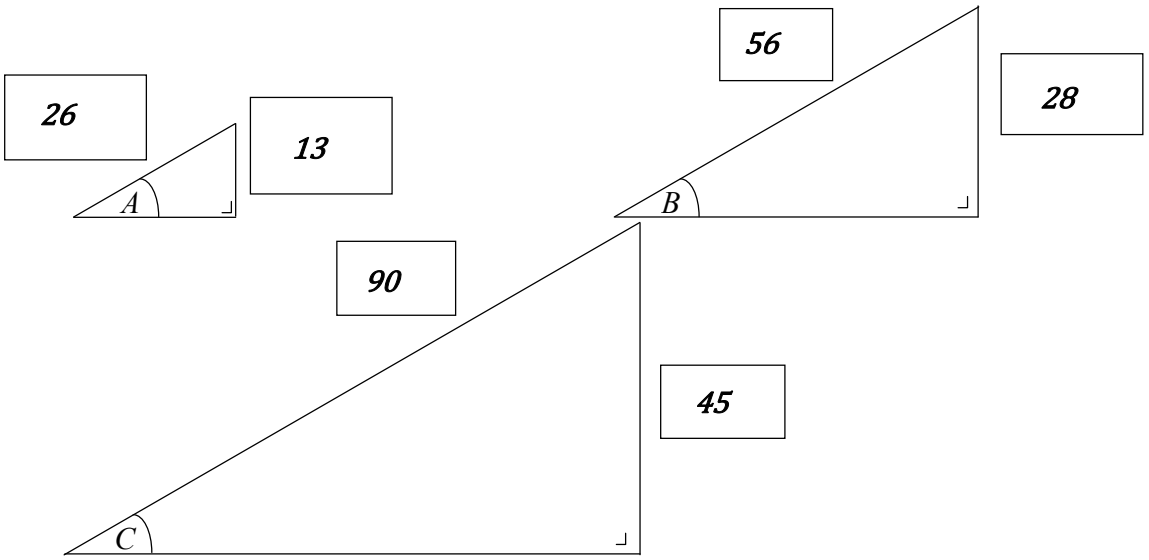
$A = 72·6459$

$A = 73°$

Question 14

(a) What name is given to the longest side in a right-angled triangle? *Hypotenuse*

(b) In the case of each of the three right-angled triangles below, measure the two sides indicated and write the lengths in the boxes provided.



(c) Use your measurements to write $\sin A$, $\sin B$ and $\sin C$ as fractions and also as decimals.

$\sin A =$ Fraction $\frac{13}{26}$ $=$ Decimal *0·5*

$\sin B =$ Fraction $\frac{28}{56}$ $=$ Decimal *0·5*

$\sin C =$ Fraction $\frac{45}{90}$ $=$ Decimal *0·5*

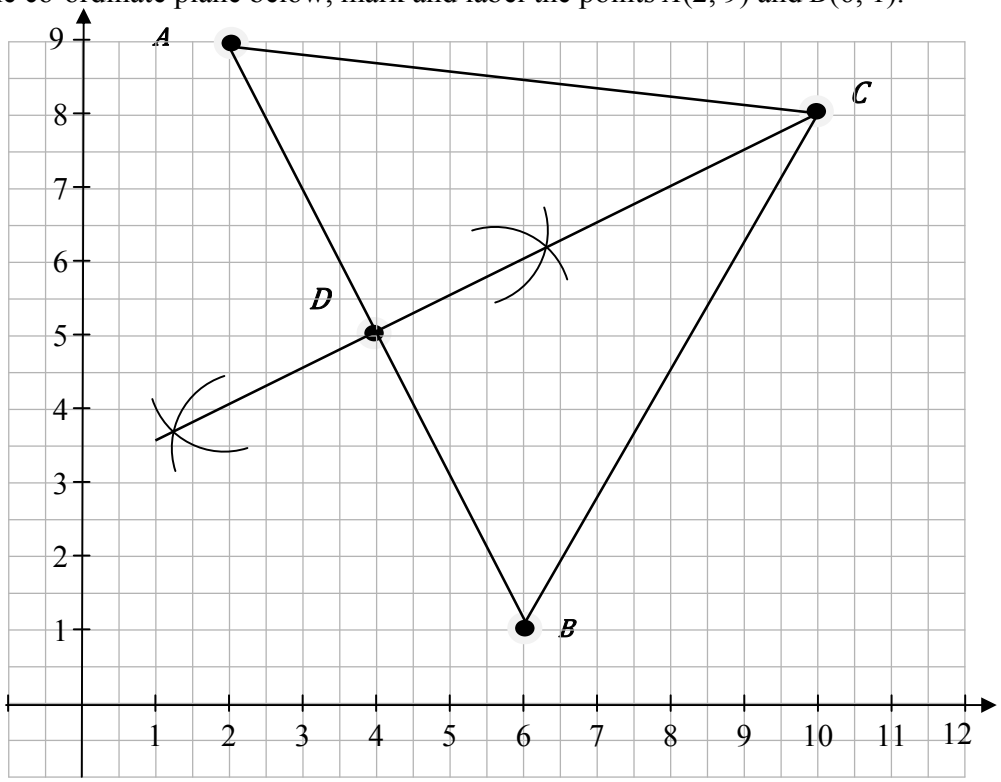
(d) From the above information what can you say about the angles *A, B* and *C*? Give a reason for your answer.

The angles are equal because they have the same decimal value for sin (same sine value) *or*

All the angles are 30°

Question 15

(a) On the co-ordinate plane below, mark and label the points $A(2, 9)$ and $B(6, 1)$.



(b) Using only a compass and straight-edge, construct the perpendicular bisector of the line segment $[AB]$. Show all construction lines clearly.

(c) C is the point (10, 8). Find $|AC|$ and $|BC|$.

$|AC| =$

$\sqrt{(10-2)^2 + (8-9)^2}$

$\sqrt{(8)^2 + (-1)^2}$

$\sqrt{64 + 1}$

$\sqrt{65}$ cm

$|BC| =$

$\sqrt{(10-6)^2 + (8-1)^2}$

$\sqrt{(4)^2 + (7)^2}$

$\sqrt{16 + 49}$

$\sqrt{65}$ cm

(d) What can you conclude about the triangle ABC? Give a reason for your answer.

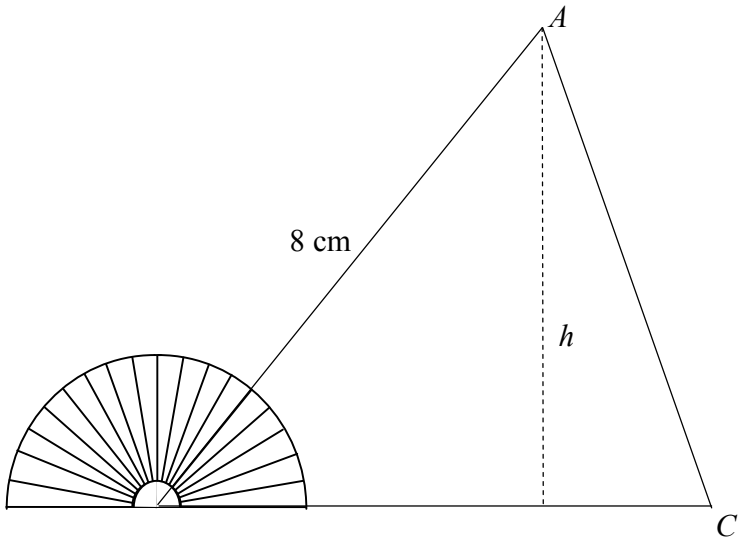
It's an isosceles triangle because 2 sides are the same length.

(e) D is the point where the perpendicular bisector of $[AB]$ crosses $[AB]$. Explain why the triangles DAC and DBC are congruent.

SAS or SSS or RHS or ASA
<u>with</u> justification

Question 16

A group of students want to find the vertical height (h) of the triangle ABC. Mary suggests measuring the angle at B using a protractor and using the sine function to find h.



(a) Estimate $|\angle B|$ from the diagram and hence find $\sin B$.

$|\angle B| =$ *50°* $\sin B =$ *0·7660*

(b) If $|AB| = 8$ cm, use your value of $\sin B$ to find h. Give your answer correct to the nearest whole number.

$$\text{Sin } B = \frac{h}{8}$$

$$\frac{0{\cdot}766}{1} = \frac{h}{8}$$

$$8\,(0{\cdot}766) = 1\,(h)$$

$$6{\cdot}128 = h$$

$$h = 6 \text{ cm}$$

(c) If $|BC| = 7{\cdot}5$ cm use your answer from part **(b)** to find the area of ABC.

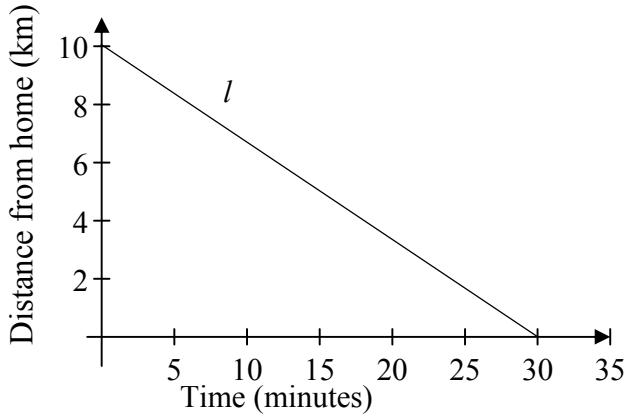
$$\text{Area} = \frac{1}{2}\,a\,h$$

$$\frac{1}{2}\,(7{\cdot}5)\,(6)$$

$$22{\cdot}5 \text{ cm}^2$$

Question 17

John cycles home from school each day at a steady speed. The graph shows his distance from home, plotted against time, on a particular day. The graph is a straight line *l*.



(a) How long did it take John to cycle home from school on that day?

30 minutes

(b) How far from the school does he live?

10 Km

(c) The point (18, 4) is on the line *l*. Explain what this point represents in the context of this journey.

He cycled for 18 minutes and is 4 km from home
or
Travelled 6km in 18 minutes
or
Travelled 6km and should reach home in 12 minutes
or
Has 4km to go and should reach home in 12 minutes

(d) Find the slope of *l*.

$$m = \frac{0-10}{30-0} = \frac{-1}{3}$$

(d) Explain what the slope of *l* represents in the context of this journey.

Every 3 minutes, John is 1km nearer home *or*
Every minute, John travels $\frac{1}{3}$ *km*

Marking scheme for Questions 4 – 17

Structure of the marking scheme for Questions 4 – 17

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
No of categories	2	3	4
2 mark scale	0, 2	0, 1, 2	
5 mark scale	0, 5	0, 3, 5	0, 3, 4, 5
10 mark scale		0, 6, 10	0, 6, 8, 10

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 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 4

(a) 10C

(b) 5C*

(c&d) 5C

Question 5

(a) 10C

(b) 5B

(c) 5C

(d) 5A

(e) 10C*

(f) 5B

Question 6

(a) 5A

(b) 5A

(c) 10B

(d) 5B

(e) 5C

Question 7

(a) 10B

(b) 5B

Question 8

(a) 5C

(b) 10C

(c) 5C

Question 9

5C

Question 10

(a&b) 2B

Question 11

5C

Question 12

(a) 10C

(b) 5C

(c) 5A

(d) 5B

Question 13

(a) 5B

(b,c&d) 5C*

Question 14

(a) 5A

(b) 10C

(c) 5C

(d) 5B

Question 15

(a) 5C

(b) 10C

(c) 5C*

(d&e) 5C

Question 16

(a) 10C

(b) 2B*

(c) 2B*

Question 17

(a) 5A*

(b) 5A*

(c) 2B

(d&e) 2B

Detailed marking notes (Questions 4 – 17)

QUESTION 4

(a) Scale 10C

Full credit: Correct differences with/without work.

High partial credit: Correct data for both years but fails to subtract or subtracts incorrectly.
1 correct difference from correct data.
Both differences calculated correctly using incorrect data from table.

Low partial credit: Any data from 1998/2006 written down/highlighted.

No credit: Incorrect answer without work.

(b) Scale 5C∗

High partial credit: Correct substitution, without work to calculate % for both years.
1 correct % from correct data.
Correct answers without work.

Low partial credit: Any correct substitution (including inverted male/female).
Incorrect substitution but with some work to calculate %.
Any data from 1998/2006 written down/highlighted.

(c) and (d) Scale 5C

Full credit: Both (c) and (d) correct.

(c) Correct answer with valid reason (reason must be consistent with candidate's part (a) and/or part (b)).
AND
(d) Valid explanation.

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

Low partial credit: Correct answer with no reason/unsound reason (part c).
Incorrect answer but gives a valid reason (part c).
Correct reason but no answer (part c).
Incomplete explanation/unsatisfactory explanation but with some element of reasoning using the information given (part d).
Attempt to get average using €429 and €285 (part d).

QUESTION 5

(a) Scale 10C

Full credit: Correct plot, accept leafs unordered, with proper vertical alignment of leaves.

High partial credit: Plot with 4 or fewer errors.

Low partial credit: At least 1 correct leaf.
A line/dot plot or bar chart.

Errors include incorrect leaves or omitted leaves (each time), stem included with leaf (i.e. |2|27|29|) [one error if consistent in diagram] or improper vertical alignment.

(b) Scale 5B

Full credit: 24 or correct number of entries from candidate's part (a).

Partial credit: Gives answer as 29 (stem + leaves) or similar from candidate's part (a).
1065 (sit-up total).

(c) Scale 5C

Full credit: Correct answer with/without work.

High partial credit: Correct Max and Min but fails to subtract or subtracts incorrectly.
Incorrect Max and/or Min but subtracts correctly.

Low partial credit: Max or Min wrote down/highlighted.
Lists all entries but doesn't identify Max/Min.

No credit: Incorrect answer without work.

(d) Scale 5A

Full credit: 45 or correct answer(s) from candidate's part (a).

No credit: Incorrect answer without work.

(e) Scale 10C∗

Full credit: Correct answer with work based on original data or candidate's part (a).

High partial credit: $\frac{1065}{24}$ and stops.
Correct answer without work.
Indicates addition and divides by 24.

Low partial credit: Any indication at addition of relevant data.
Any indication of division by 24.
1065 without work.

No credit: Incorrect answer without work.

(f) Scale 5B

Candidate's answer must be consistent with answer in part (e) if different from the correct mean of 44·4.
Accept ranking in comparative order.

Full credit: Statement that indicates above average sit-ups.

Partial credit: Statement that indicates average sit-ups.
Incorrect comparison to calculated average value.

No credit: Statement that indicates below average sit-ups.

QUESTION 6

(a) Scale 5A

(b) Scale 5A

(c) Scale 10B

Full credit: Correct answer with valid reason.

Partial credit: Correct answer with no reason/unsound reason.
Incorrect answer but gives a valid reason.
Correct reason but no answer.
Writes 7 and/or 4.

(d) Scale 5B

Full credit: All numbers correctly entered.

Partial credit: At least 1 correct entry.

(e) Scale 5C

Full credit: Correct probability, simplified/unsimplified, from candidate's part (d).

High partial credit: $\frac{2}{16}$ or equivalent.

Low partial credit: Correct numerator or denominator.
Either 7 or 21 written down.

QUESTION 7

(a) Scale 10B

Do not penalise candidate's for incorrect set notation.

Full credit: Correct elements identified.

Partial credit: Any 2 correct elements.

No credit: 1 or less correct elements.

(b) Scale 5B

Full credit: Correct probability, simplified/unsimplified, based on candidate's part (a).

Partial credit: Correct numerator or denominator.
$\frac{2}{5}$ (treats A as $\{1,2,3,4,25\}$).
Correct count of answer to part (a).
Either 8 or 25 written down.

QUESTION 8

(a) Scale 5C

Full credit: Correct table/tree diagram.

High partial credit: Table filled with up to 3 errors.
Tree diagram drawn with up to 3 errors.

Low partial credit: Incomplete table/tree diagram with at least 1 correct outcome.

(b) Scale 10C

Full credit: Correct number based on candidate's part (a).

High partial credit: Outcomes identified without stating how many.

Low partial credit: At least 1 correct outcome listed.

No credit: Incorrect answer without work.

(c) Scale 5C

Full credit: Correct probability, simplified/unsimplified, based on candidate's part (a).

High partial credit: Identifies all correct outcomes only.
$\frac{6}{11}$ (ignoring given couple).

Low partial credit: Correct numerator or denominator (allow 11).
1 outcome correctly identified.
$\frac{12}{6}$

QUESTION 9

Scale 5C
Accept yes/true in place of ticks(✓).

Full credit: 16 correct boxes indicated.

High partial credit: At least 12 correct boxes indicated.

Low partial credit: Any 2 correct boxes.

QUESTION 10

(a) and (b) Scale 2B

Full credit: Both (a) and (b) correct.

(a) Mention of the theorem of Pythagoras.
Use of *Tan* (to find angle) followed by *Sin/Cos* (to find diagonal).
AND
(b) Correct answer by theorem of Pythagoras.
Correct answer by trigonometric ratio method.

Partial credit: Mention of diagonal or corner to corner or hypotenuse (part a).
Diagram with diagonal/hypotenuse drawn (part a).
Any use of *Sin/Cos/Tan* (part b).
States theorem of Pythagoras (part b).
210^2 or 297^2 or similar (part b).
$210 + 297$ (part b).
210×297 (part b).

No credit: Rectangle drawn with no diagonal, and nothing else.
Mention of ruler/measurement without reference to any of the above.

QUESTION 11

Scale 5C

Full credit: All image co-ordinates correct.

High partial credit: 2 transformations performed correctly.

Low partial credit: Any 1 image of vertex correct.
An indication of the image of any point of *A* under any of the transformations listed.

QUESTION 12

(a) Scale 10C
Tolerance: $\pm$ 0·5cm

Full credit: 3 points plotted correctly, labelled/unlabelled.
(y, x) plotted correctly for 3 points.

High partial credit: 2 points,$(x, y)/(y, x)$, plotted correctly.

Low partial credit: Any point, $(x, y)/(y, x)$, plotted correctly.

(b) Scale 5C
Tolerance: $\pm$ 0·5cm

Full credit: Correct parallelogram *ABCD* or 2 arcs through point D and co-ordinates of *D*.

High partial credit: Correct co-ordinates of *D* but no construction/incomplete construction.
Correct parallelogram *ABCD* but co-ordinates of D incorrect/not written down.
Correct co-ordinates for incorrect D (i.e parallelogram *ACBD* or *ABDC*).
Co-ordinates reversed e.g. (3, -1), with/without construction.

Low partial credit: Any points *A, B* or C joined.
Attempt to find D by translation (e.g. $\overrightarrow{BC} = \overrightarrow{AD}$).
D indicated without construction or labelling.

(c) Scale 5A
Full credit: Any correct property of a parallelogram listed from the statements in Q9.
Any incorrect property from candidate's work in Q9.

(d) Scale 5B
Tolerance: $\pm$ 0·5cm

Full credit: Statement proved using correct formulae and conclusion.
(Statement disproved using correct formulae and conclusion if incorrect property listed in (c) above.)

Partial credit: 1 use of correct relevant formula involving substitution.
Uses measurement, where relevant to part (c) (allow counting of boxes/intervals).

QUESTION 13

(a) Scale 5B
Full credit: 2 correctly drawn triangles with measurements correctly positioned.
1 combined diagram with measurements correctly positioned.

Partial credit: 1 right-angled triangle drawn with no measurements.
Correctly positioned measurement.

(b) and (c) and (d) Scale 5C∗

Full credit: All 3 parts correct.

(b) Any mention of similar triangles.
Use of *Tan* (to find angle) and use of *Tan* (to find height).
$\frac{h}{0.5} = \frac{1{\cdot}6}{6{\cdot}2}$ or similar.

AND

(c) Allow reasonable rounding if trigonometric method used.

AND

(d) Accept correct angle of elevation found in part (c).

High partial credit: Either (b) or (c) or (d) correct.

Low partial credit: Mention of *Tan* or demonstrates understanding of need to use angle of elevation in solution (part b).

$\frac{1{\cdot}6}{0{\cdot}5} = \frac{h}{6{\cdot}2}$ or similar triangle method (part c)
$Tan\,73° = \frac{h}{6{\cdot}2}$ or similar (e.g. $Tan\,17°$) (part c).
Correct answer without work (part c).
Any 1 correct ratio (part c).
Any substitution into a relevant trigonometric formula (part c).
h labelled correctly on candidate's diagram (part c).
Uses Pythagoras to correctly find the hypotenuse
in Vera's triangle (1·7m) (part c).

Correct angle of elevation found in part (c) but Grad/Rad mode used (part d).
$Tan\,A = \frac{1{\cdot}6}{0{\cdot}5}$ or equivalent (part d).
17° found but failed to subtract from 90° (part d).
Incorrect/inverted trigonometric formula used (part d).
Angle of elevation correctly identified on candidate's diagram (part d).

No credit: Incorrect answer without work.

QUESTION 14

(a) Scale 5A

Full credit: Allow incorrect spelling or Hyp for hypotenuse.

(b) Scale 10C

Tolerance: $\pm$ 0·5cm

Full credit: All 6 boxes correctly filled.

High partial credit: 4 or more boxes correctly filled.

Low partial credit: 1 correct measurement.

(c) **Scale 5C**

Full credit: 6 correct substitutions and 3 correct decimals.

High partial credit: 6 correct substitutions.
Correct substitutions but inverted and decimals calculated correctly.

Low partial credit: 1 correct substitution.
1 decimal correctly calculated from candidate's incorrect substitution.
Substitutions inverted.

No credit: No boxes filled.

(d) Scale 5B

Full credit: Statement indicating the angles are the same and statement indicating the decimals are the same.
$A = B = C = 30\,°$

Partial credit: Statement indicating the angles are the same or statement indicating the decimals are the same.

QUESTION 15

(a) Scale 5C

Tolerance: $\pm$ 0·5cm.

Full credit: 2 points plotted and labelled correctly (either letter/co-ordinate).

High partial credit: 2 points plotted correctly and labelled incorrectly/unlabelled.
1 point plotted correctly and labelled.
(y, x) plotted correctly for both pairs, labelled incorrectly/unlabelled.

Low partial credit: Any point, $(x, y)/(y, x)$, plotted correctly.

(b) Scale 10C

Tolerance: $\pm$ 0.5cm.
Other allowable methods: - as per dividing in 3 or more segments.
- one set of arcs only and set square used to drop perpendicular.

Full credit: Accurate construction including construction lines/arcs.

High partial credit: Accurate construction but without construction lines/arcs.

Low partial credit: Line drawn from *A* to *B*.
Any correct construction line/arc.
Centre indicated/written down correctly.
Attempt to use midpoint formula.

(c) Scale 5C∗
Tolerance: $\pm$ 0·5cm.
Accept correct use of Pythagoras.

Full credit: $|AC|$ and $|BC|$ calculated correctly using correct formula.
$|AC|$ and $|BC|$ measured correctly (within tolerance).

High partial credit: $|AC|$ and $|BC|$ calculated incorrectly using correct formula.
$|AC|$ or $|BC|$ calculated correctly.
$|AC|$ or $|BC|$ measured correctly.

Low partial credit: Plots $C, (x, y)/(y, x)$.
Any use of the distance formula or Pythagoras.

No credit: Incorrect formula used.
$|AB|$ measured.

(d) and (e) Scale 5C
Full credit: Both (d) and (e) correct.

(d) Correct conclusion with valid reason.
AND
(e) Accept congruency correctly disproved based on work in previous parts.
SSS, SAS, ASA or RHS, with justification.

High partial credit: Either (d) or (e) correct.

Low partial credit: Correct conclusion with no reason/unsound reason (part d).
Incorrect conclusion but gives a valid reason (part d).
Correct reason but no answer (part d).
Triangle ABC plotted on plane (part d).
Mention of equilateral triangle (part d).
$|AB|$ calculated correctly ($\sqrt{80}$)/incorrectly
measured correctly (9cm) (part d).
Accept correct answer marked or indicated (part e).
States, SSS, SAS, ASA or RHS (part e).
States same shape/folds onto each other (part e).
D indicated on diagram (either letter/co-ordinates), (part e).

QUESTION 16

(a) Scale 10C
Tolerance: $\pm$ 5°.

High partial credit: Correct angle B but incorrect/omitted sine.
Correct sine from incorrect angle B.

Low partial credit: Correct sine but no angle B written down.
Writes down $\frac{h}{8}$.
130° used.

(b) Scale 2B$*$
Partial credit: Transfers value for $\sin B$ from part (a).
$\frac{h}{8}$ written down.
Multiplies angle B by 8.
Draws a right-angled triangle.

No credit: h measured (6.5cm) from diagram.

(c) Scale 2B$*$
Partial credit: 7·5 multiplied by 8/ h from part (b).
Labels 7·5 on diagram.
Transfers value for h from part (b).
Some use of area of a triangle formula.

QUESTION 17

(a) Scale 5A$*$
Accept minutes or hours as units.

(b) Scale 5A$*$
Accept meters or kilometres as units.

(c) Scale 2B

Full credit: Valid explanation, involving specific distance and time.

Partial credit: Explanation involving specific distance only.
Explanation involving specific time only.
Some indication of (18,4) on diagram.
Mention of 12 minutes or 6 km.
Mention of $\frac{2}{5}$ or $\frac{3}{5}$.

(d) and (e) Scale 2B

Full credit: Both (d) and (e) correct.

(d) Accept correct trigonometric method.
Accept $(18,4)$ as a point for finding the slope.
Correct answer, simplified/unsimplified, with/without work.

AND

(e) Correct explanation explicitly referring to John's journey.

Partial credit: Either (d) or (e) correct.

Correct numerator or denominator (part d).
$\frac{10}{30}$ or $\frac{30}{10}$, without work (part d)
Any correct substitution, $(x, y)/(y, x)$,into formula (part d).
Writes $\frac{Rise}{Run}$ (part d).
Indication that slope is negative (part d).

Incomplete explanation/unsatisfactory explanation but with some element of reasoning referring to John's journey (part e).
Some explanation of what slope means in general. (part e).
Speed $= \frac{Distance}{Time}$ or SDT triangle written down or speed (part e).
Connecting distance and time (part e).
Mention of 3 minutes or 1 km or $\frac{1}{3}$ (part e).

No credit: Answer without reason/explanation/incorrect answer.

Marcanna breise as ucht freagairt trí Ghaeilge

(Bonus marks for answering through Irish)

Ba chóir marcanna de réir an ghnáthráta a bhronnadh ar iarrthóirí nach ngnóthaíonn níos mó ná 75% d'iomlán na marcanna don pháipéar. Ba chóir freisin an marc bónais sin a shlánú **síos**.

Déantar an cinneadh agus an ríomhaireacht faoin marc bónais i gcás gach páipéir ar leithligh.

Is é 5% an gnáthráta agus is é 300 iomlán na marcanna don pháipéar. Mar sin, bain úsáid as an ngnáthráta 5% i gcás iarrthóirí a ghnóthaíonn 225 marc nó níos lú, e.g. 198 marc × 5% = 9·9 ⇒ bónas = 9 marc.

Má ghnóthaíonn an t-iarrthóir níos mó ná 225 marc, ríomhtar an bónas de réir na foirmle [300 – bunmharc] × 15%, agus an marc bónais sin a shlánú **síos**. In ionad an ríomhaireacht sin a dhéanamh, is féidir úsáid a bhaint as an tábla thíos.

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