

# Coimisiún na Scrúduithe Stáit State Examinations Commission 

## LEAVING CERTIFICATE 2008

MARKING SCHEME

MATHEMATICS

## FOUNDATION LEVEL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

# LEAVING CERTIFICATE 2008 

MARKING SCHEME

## MATHEMATICS

## FOUNDATION LEVEL

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Coimisiún na Scrúduithe Stáit
State Examinations Commission

# LEAVING CERTIFICATE 2008 

## MARKING SCHEME

MATHEMATICS - PAPER 1

## FOUNDATION LEVEL

## MARKING SCHEME

## LEAVING CERTIFICAE EXAMINATION 2008

## MATHEMATICS - FOUNDATON LEVEL - PAPER 1

## GENERAL GUIDELINES FOR EXAMINERS - PAPER 1

1. Penalties of three types are applied to candidates' work as follows:

- Blunders
- mathematical errors/omissions
- Slips - numerical errors
- 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 $\mathrm{W} 1, \mathrm{~W} 2, \ldots$ 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. Any examiner unsure of the validity of the approach adopted by a particular candidate to a particular question should contact his/her advising examiner.
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 $€ 5,50$.

## NOTES ON APPLYING THE SCHEME, A.T.B.L. MATHEMATICS PAPER 1.

## Question 1

- Computational decimal error: Blunder (-3).
- Misplacement of decimal point when a number is being transferred onwards in a question. [Transfer decimal error]: Slip ( -1 ).
- Arithmetic slips ( -1 ), if calculation by hand is shown, to a maximum of $(-3)$ in each operation.
- Incorrect or omitted rounding off: Blunder ( -3 ).
- Misreading refers to a misreading of the question that does not oversimplify the problem. The misreading must be clear and obvious.
- Incorrect or omitted units (except monetary units): Slip ( -1 ) per question.


## All Other Questions

- Computational decimal error: Slip (-1).
- Misplacement of decimal point when a number is being transferred onwards in a question. [Transfer decimal error]: Slip ( -1 )
- Arithmetic slips ( -1 ), if calculation by hand is shown, to a maximum of ( -3 ) in each operation.
- Incorrect or omitted rounding off: Slip (-1)
- Misreading refers to a misreading of the question that does not oversimplify the problem. The misreading must be clear and obvious.
- Incorrect or omitted units (except monetary units): Slip ( -1 ) per question.
- If a worthless answer in one part of a question is used in another part of that question, then that part's mark is the attempt mark at most.

Note: Specified instances cited within the scheme take precedence dherabove notes: e.g. taking $\sqrt{87 \cdot 32}$ as $\sqrt{873 \cdot 2}$ is treated as a Blunder- $\boldsymbol{\beta}$ ), not as a misreading ( $\mathbf{1}$ ), within the scheme.
(i) Find $\sqrt{87 \cdot 32}$, correct to two decimal places.
(i)

10 marks

## Att 4

$$
\text { (i) } \sqrt{87 \cdot 32}=9 \cdot 34451 \ldots=\mathbf{9 . 3 4}
$$

Accept correct answer with no work.

## Blunders (-3)

B1 $\sqrt{8732}=[93 \cdot 44517 \ldots]=93 \cdot 45$.
B2 $\sqrt{873 \cdot 2}=[29 \cdot 54995 \ldots]=29 \cdot 55$.
B3 $\sqrt{8 \cdot 732}=[2 \cdot 954995 \ldots]=2 \cdot 95$.
B4 $\sqrt{0.8732}=[0.934451 \ldots]=0.93$.
B5 Root other than square root indicated and correctly worked. $\sqrt[3]{87 \cdot 32}=4 \cdot 44$.
B6 Incorrect or omitted rounding-off.

## Misreadings (-1)

M1 $\sqrt{87 \cdot 23}=[9 \cdot 33970 \ldots .]=.9 \cdot 34$.
M2 $\sqrt{78 \cdot 23}=[8 \cdot 84477 \ldots]=8 \cdot 84$.
M3 $\sqrt{78 \cdot 32}=[8 \cdot 84985 \ldots]=8 \cdot 85$.

## Attempts (4 marks)

A1 $(87 \cdot 32)^{2}=7624 \cdot 78(24)$.
A2 $\frac{87 \cdot 32}{2}=43 \cdot 66$.
A3 $\quad(87 \cdot 32) \times 2=174 \cdot 64$.
A4 Work at estimating answer: $\sqrt{87 \cdot 32}=9$.
A5 Any effort at finding or estimating another root with work shown.
A6 An incorrect figure correctly rounded off, to two decimal places.
A7 Any other answers as B1, B2, B3 and B4 but with misplaced decimal point and no work shown.

Worthless (O marks)
W1 Incorrect answers with no work, other than those in scheme.
(ii) Find the exact value of $(4 \cdot 2)^{2}-(3 \cdot 6)^{2}$.
(ii)

10 marks
Att 4
(ii) $\quad(4 \cdot 2)^{2}-(3 \cdot 6)^{2}=17 \cdot 64-12 \cdot 96=4 \cdot 68$.

$$
(4 \cdot 2+3 \cdot 6)(4 \cdot 2-3 \cdot 6)=(7 \cdot 8)(0 \cdot 6)=\mathbf{4} \cdot \mathbf{6 8}
$$

Accept correct answer with no work.

## Blunders ( -3 )

B1 $\sqrt{4 \cdot 2}-\sqrt{3 \cdot 6}=2 \cdot 04939 \ldots-1 \cdot 897366 \ldots=0 \cdot 152023 \ldots$.
B2 $(42)^{2}-(36)^{2}=1764-1296=468$.
B3 $(0 \cdot 42)^{2}-(0 \cdot 36)^{2}=0 \cdot 1764-0 \cdot 1296=0 \cdot 0468$.
B4 Blunder in precedence giving $(0 \cdot 6)^{2}=0 \cdot 36$.
B5 Square not found, each time.
B6 $\left(4 \cdot 2 \times 10^{2}\right)-\left(3 \cdot 6 \times 10^{2}\right)=420-360=60$.
B7 Any incorrect rounding off within the working. (Once only).
B8 Subtraction omitted.
B9 $17 \cdot 64+12 \cdot 96=30 \cdot 6$
Misreadings $(-1)$
M1 $(2 \cdot 4)^{2}-(3 \cdot 6)^{2}=5 \cdot 76-12 \cdot 96=-7 \cdot 2$.
M2 $(4 \cdot 2)^{2}-(6 \cdot 3)^{2}=17 \cdot 64-39 \cdot 69=-22 \cdot 05$.
M3 $(2 \cdot 4)^{2}-(6 \cdot 3)^{2}=5 \cdot 76-39 \cdot 69=-33 \cdot 93$.

## Slips(-1)

S1 Numerical Errors.

## Attempts (4 marks)

A1 $(4 \cdot 2 \times 2)-(3 \cdot 6 \times 2)=8 \cdot 4-7 \cdot 2=1 \cdot 2$.
A2 $\frac{4 \cdot 2}{2}-\frac{3 \cdot 6}{2}=2 \cdot 1-1 \cdot 8=0 \cdot 3$.
A3 Work at estimating answer: e.g. $16-9=7$.
A4 Any other answers as B1, B2, B3 and B4, B6 but with misplaced decimal point and no work shown

## Worthless (O marks)

W1 Incorrect answers with no work, other than those in scheme.
(iii) $\quad \operatorname{Find}(3 \cdot 1)^{2}-\frac{1}{(3 \cdot 1)}$, correct to one decimal place.
(iii)

## 10 marks

Att 4
(iii) $\quad(3 \cdot 1)^{2}-\frac{1}{(3 \cdot 1)}=9 \cdot 61-0 \cdot 322580 \ldots=9 \cdot 28741 \ldots=\mathbf{9 . 3}$

Accept correct answer with no work.

## Blunders (-3)

B1 $\sqrt{3 \cdot 1}-\frac{1}{3 \cdot 1}=1 \cdot 7606 \ldots-0 \cdot 32258 \ldots=1 \cdot 43802 \ldots=1 \cdot 4$.
B2 $(31)^{2}-\frac{1}{3 \cdot 1}=961-0 \cdot 32258 \ldots=960 \cdot 67742=960 \cdot 7$.
B3 $\quad(3 \cdot 1)^{2}-\frac{1}{31}=9 \cdot 61-0 \cdot 032258 \ldots=9 \cdot 5777=9 \cdot 6$.
B4 $(31)^{2}-\frac{1}{31}=961-0 \cdot 032258 \ldots=960 \cdot 967 \ldots=961$.
B5 $\quad(0 \cdot 31)^{2}-\frac{1}{3 \cdot 1}=0 \cdot 0961-0 \cdot 32258 \ldots=-0 \cdot 22648 \ldots=-0 \cdot 2$.
B6 $\quad(0 \cdot 31)^{2}-\frac{1}{0 \cdot 31}=0 \cdot 0961-3 \cdot 2258 \ldots=-3 \cdot 1297=-3 \cdot 1$.
B7 Square not found.
B8 Reciprocal not found.
B9 No subtraction.
B10 Error in precedence e.g. $\left\lfloor(3 \cdot 1)^{2}-1\right] \div 3 \cdot 1=2 \cdot 7774 \ldots=2 \cdot 8$.
B11 Incorrect or omitted rounding-off.

## Misreadings (-1)

M1 $(1 \cdot 3)^{2}-\frac{1}{3 \cdot 1}=1 \cdot 69-0 \cdot 32258 \ldots=1 \cdot 367 . .=1 \cdot 4$.
M2 $(3 \cdot 1)^{2}-\frac{1}{1 \cdot 3}=9 \cdot 61-0 \cdot 7692 \ldots=8 \cdot 8408=8 \cdot 8$.
M3 $0 \cdot 322580-9 \cdot 61=-9 \cdot 28741=-9 \cdot 3$.

## Slips (-1)

S1 Numerical errors.

## Attempts (4 marks)

A1 Work at estimating answer: e.g. 9 or 0.3333 .
A2 Any other answers as B2, B3, B4, and B5 but with misplaced decimal point and no work shown.

Worthless (0 marks)
W1 Incorrect answers with no work, other than those in scheme.
(iv) Find the exact value of $17 \cdot 2-6.4 \times 2 \cdot 81$

* Accept correct answer with no work.

Blunders ( -3 )
B1 Error in precedence: $10 \cdot 8 \times 2 \cdot 81=30 \cdot 348$.
B2 Any step omitted.
B3 The use of a wrong operator or operators is indicated. (Once only)

## Misreadings ( -1 )

M1 A clear and obvious numerical misreading not involving the decimal point.
M2 Answer given as $+0 \cdot 784$

## Attempts (4 marks)

A1 A different ordering of the numbers indicated and correctly worked out.
A2 Work at estimating answer: e.g. $17-6 \times 3=-1$ or 33 .
A3 Work towards some correct step: e.g. long multiplication begun.

## Worthless (O marks)

W1 Incorrect answers with no work, other than those in scheme.
(v) A cinema has 500 seats. One night 200 seats were empty.

What percentage of seats were occupied?
(v)

10 marks
Att 4
Method 1
Method 2
(v) $\quad 500-200=300 \Rightarrow \frac{300}{500} \times 100=\mathbf{6 0 \%}: \frac{200}{500} \times 100=40 \% \Rightarrow 100 \%-40 \%=\mathbf{6 0 \%}$.

Accept correct answer with no work.

## Blunders (-3)

## Method 1

B1 Incorrect or no subtraction.
B2 Error(s) in establishing $\frac{300}{500} \times 100$. [All three elements must be present otherwise attempt only].
B3 Incorrect or incomplete answer or no answer. [Use candidate's answer from above].

## Method 2.

B1 Error(s) in establishing $\frac{200}{500} \times 100$.[All three elements must be present otherwise attempt only]
B2 Incorrect or incomplete answer or no answer. [Use candidate's answer from above].
B3 Incorrect or no subtraction. [Use candidate's answer from above].

Attempts (4 marks)
A1 Gives $\frac{300}{500}$ or $\frac{500}{300}$ only.
A2 Gives $\frac{200}{500}$ or $\frac{500}{200}$ only.
A3 $500-200=300$ and stops.

## Worthless (O marks)

W1 Incorrect answers with no work, other than those in scheme.
(vi) Given an exchange rate of $€ 1=9 \cdot 272$ Swedish Kronor, find the value in euro of 700 Swedish Kronor.
(vi) 10 marks
(vi)

$$
\frac{700}{9 \cdot 272}=75 \cdot 49611734=[€ 75 \cdot 5]
$$

* Accept correct answer with no work.
* Accept candidate's degree of rounding.

Blunders ( -3 )
B1 $700 \times 9 \cdot 272=6490 \cdot 4$
B2 $\frac{700}{0 \cdot 09272}=7549 \cdot 611734$, except if answer is given as $7549 \cdot 611734$ cents.

Slips (-1)
S1 Answer given in cents.

## Attempts (4 marks)

A1 Some use of the given data.

## Worthless (O marks)

W1 Incorrect answers with no work, other than those in scheme.
(vii) A prize of $€ 300$ is divided between $1^{\text {st }}$ and $2^{\text {nd }}$ place in the ratio of 3:2. How much does each person get?
(vii)

## 10 marks

Att 4
(vii)
$3: 2$
$\Rightarrow \frac{300}{5}=60$
$1^{s t}=60 \times 3=€ 180$
$2^{\text {nd }}=60 \times 2=€ 120$

| or <br> $3+2=5$ | or |
| :--- | :--- |
| $\frac{1}{5}=60$ | $3 x: 2 x$ |
| $\frac{3}{5}=€ 180\left(1^{s t}\right)$ | $\Rightarrow x=300$ |
| $\Rightarrow 300-180=€ 120\left(2^{n d}\right)$. | $\Rightarrow 3 x=€ 180\left(1^{s t}\right)$ |
|  | $\Rightarrow 2 x=€ 120\left(2^{n d}\right)$. |

*Accept correct answer with no work.

## Blunders (-3)

B1 Divisor $\neq 5$ only and continues.
B2 Incorrect multiplier or fails to multiply. (Each time).
B3 Error in transposition.
B4 Fails to find second amount.
B5 Addition instead of subtraction e.g. $300+180=480$.

## Attempts (4 marks)

A1 Divisor $\neq 5$ e.g. $\frac{300}{3}$ and /or $\frac{300}{2}$ and stops.
A2 Indicates 5 parts or 3 parts or 2 parts or $\frac{3}{5}$ or $\frac{2}{5}$ or $3+2=5$ and stops.
A3 Indicates multiplication of 300 by 3 and/or 2 and stops.

## Worthless (O marks)

W1 Incorrect answer with no work shown, other than those in scheme.
(viii) Find the exact value of $\frac{167 \cdot 3}{\sqrt{12 \cdot 25}}$.
(viii) 10 marks

Att 4
(viii)

$$
\frac{167 \cdot 3}{\sqrt{12 \cdot 25}}=\frac{167 \cdot 3}{3 \cdot 5}=47 \cdot 8=\mathbf{4 7 \cdot 8}
$$

Accept correct answer with no work.

Blunders (-3)
B1 $\frac{167 \cdot 3}{\sqrt{12 \cdot 25}}=\frac{167 \cdot 3}{(12 \cdot 25)^{2}}=\frac{167 \cdot 3}{150 \cdot 0625}=1 \cdot 114868 \ldots$
B2 $\quad 167 \cdot 3 \times 3.5=585 \cdot 55$.
B3 $167 \cdot 3 / 3 \cdot 5$ and stops.

Misreadings (-1)
M1 A clear and obvious numerical misreading not involving the decimal point.

Attempts (4 marks)
A1 $\sqrt{12 \cdot 25}=12 \cdot 25 \times 2=24 \cdot 5$.

Worthless (O marks)
W1 Incorrect answer with no work shown, other than those in scheme.
(ix) Find $\frac{\left(5.78 \times 10^{9}\right)-\left(3.46 \times 10^{5}\right)}{4.32 \times 10^{4}}$, correct to three significant figures..
(ix)

$$
10 \text { marks }
$$

Att 4
(ix) $\frac{5 \cdot 779654 \times 10^{9}}{4 \cdot 32 \times 10^{4}}=1 \cdot 33788287 \times 10^{5}=\mathbf{1 3 3 7 8 8} \cdot \mathbf{2 8 7}=\mathbf{1 3 4} \mathbf{0 0 0}$

$$
\text { Or } \frac{5780000000-346000}{43200}=\frac{5779654000}{43200}=133788 \cdot 287=\mathbf{1 3 4} \mathbf{0 0 0}
$$

Accept correct answer with no work.

## Blunders (-3)

B1 Error in precedence.
B2 Each omitted or incorrect step if slips not clear.
B3 Misplaced decimal or wrong order of magnitude each time.
B4 Inverts final fraction giving $0 \cdot 000007474 \ldots$ as answer.
B5 Any incorrect rounding off within the working. (Once only).
B6 The use of a wrong operator or operators is indicated. (Once only).
B7 $\frac{5779654000}{43200}$ and stops.
B8 Answer not correct to three significant figures.
Slips (-1)
S1 Numerical slips

## Attempts (4 marks)

A1 $\quad 10^{9}$ treated as $90,10^{5}$ treated as $50 \mathrm{and} /$ or $10^{4}$ treated as 40.
A2 Some work towards estimation.
A3 $10^{9}$ as $10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$, and/or likewise with $10^{5}$ and $10^{4}$.
A4 An incorrect number correctly rounded off to three significant figures

## Worthless (O marks)

W1 Incorrect answer with no work shown, other than those in scheme.
(x) Find $\frac{47 \cdot 3-8 \cdot 9}{3 \cdot 25 \times 1 \cdot 47}$, correct to two decimal places.
(x)
(x) $\quad \frac{47 \cdot 3-8 \cdot 9}{3 \cdot 25 \times 1 \cdot 47}=\frac{38 \cdot 4}{4 \cdot 7775}=8 \cdot 037676609=\mathbf{8 . 0 4}$.
*Accept correct answer with no work.

## Blunders (-3)

B1 Error(s) in precedence. (Once only)
B2 $\frac{4 \cdot 7775}{38 \cdot 4}=0 \cdot 124414062$
B3 The use of a wrong operator or operators is indicated. (Once only)
B4 Any step omitted e.g.38-4/4.7775 and stops.
B5 Any incorrect rounding off within the working. (Once only)
B6 Incorrect or no rounding off.

Slips (-1)
S1 Numerical errors.

## Misreadings (-1)

M1 Clear and obvious misreading not involving the decimal point.

## Attempts (4 marks)

A1 Work at estimating answer.
A2 An incorrect number correctly rounded off to two decimal places.

## Worthless (O marks)

W1 Incorrect answer with no work shown, other than those in scheme.

## QUESTION 2

| Part (a) | $10(5,5)$ marks | Att $(2,2)$ |
| :--- | :---: | ---: |
| Part (b) | $20(10,5,5)$ marks | Att $(4,2,2)$ |
| Part (c) | $20(10,10)$ marks | Att $(4,4)$ |
|  |  |  |
| Part (a) | $10(5,5)$ marks | Att $(2,2)$ |

(a) (i) Change 750 cm to metres.
(ii) Change 2.56 kg to grams.
(a)
$10(5,5)$ marks
Att (2, 2)
(a) (i) $750 \mathrm{~cm}=\frac{750}{100}=7 \cdot 5=\mathbf{7 \cdot 5}$ metres.
(ii) $2 \cdot 56 \mathrm{~kg}=2 \cdot 56 \times 1000=2560=\mathbf{2 5 6 0}$ grams.

Accept correct answer with no work.

## Blunders (-3)

B1 Incorrect conversion factor
B2 Misuse of conversion factor: e.g. $750 \times 100=75000$
B3 Misuse of conversion factor: e.g. $\frac{2 \cdot 56}{1000}=0 \cdot 00256$..

Slips (-1)
S1 Incorrect units, e.g. $7 \cdot 5 \mathrm{~cm}$.
S2 Numerical errors.
S3 Answer given as 7 m 50 cm .

Attempts ( 2 marks)
A1 $750 \times 2 \cdot 56=1920$
Worthless (O marks)
W1 Incorrect answer with no work shown, other than those in scheme.
(b) The charges for Helen's bill-pay phone per month are as follows:

Fixed charge:
Call charges:
First 40 minutes: 25 cent per minute
Additional minutes: 15 cent per minute
Text messages: $\quad 12$ cent each
During March, Helen used 60 minutes call time and sent 30 text messages.
(i) Calculate the total charge for all her phone calls.
(ii) Calculate the charge for her text messages.
(iii) Calculate Helen's bill, after VAT at $21 \%$ is added to all the above charges. Give your answer correct to the nearest cent.
(b)(i) $60=40+20 \Rightarrow 40 \times 25+20 \times 15=1000+300=1300$ cent $=\boldsymbol{€ 1 3}$

Accept correct answer without work.
Blunders (-3)
B1 $40 \times 25+20 \times 15$ and stops.
B2 Any error(s) in calculation of $40 \times 25+20 \times 15$. (to a max -3 )
B3 Incorrect break up of 60 minutes. e.g. $60=40+30$
Slips(-I)
S1 Decimal error.
S2 Numerical errors.
S3 Adds fixed charge.

## Attempts (4 marks)

A1 60 minutes call time not broken into 40 minutes and additional minutes.
A2 $40 \times 25=1000$ and stops.
A3 $20 \times 15=300$ and stops.
A4 $60=40+20$ and stops.
A5 Some use of the given data.
(b)(ii)

5 marks
Att 2
(b)(ii)
$30 \times 12=360=€ 3 \cdot 60$
Accept correct answer without work.

## Blunders (-3)

B1 Incorrect multiplier.

## Slips (-1)

S1 Decimal error.
S2 Numerical errors.
S3 Adds fixed charge, except if penalised S3 in part (i).
Attempts (2 marks)
A1 Some use of the given data.
(b)(iii) $10+13+3 \cdot 60=26 \cdot 6: \mathrm{VAT}=\frac{26 \cdot 6}{100} \times 21=5 \cdot 586 \Rightarrow$ Bill $=26 \cdot 6+5 \cdot 586=€ 32 \cdot 186=\boldsymbol{€ 3 2 \cdot 1 9}$ or Bill with VAT $=\frac{26 \cdot 6}{100} \times 121=32 \cdot 186=\mathbf{€ 3 2 \cdot 1 9}$

* Accept correct answer without work.
* Use Candidate's answers from previous parts.


## Blunders ( -3 )

B1 Error(s) in establishing $\frac{26 \cdot 6}{100} \times 21$ [All three elements must be present otherwise att only]
B2 Error(s) in establishing $\frac{26 \cdot 6}{100} \times 121$ [All three elements must be present otherwise att only]
B3 Element of bill omitted.
B4 Calculates VAT as $21 \%$ but fails to add to find total bill.

Slips (-1)
S1 Numerical errors.
S2 Incorrect or no rounding off to nearest cent.

Attempts (2 marks)
A1 $10+13+3 \cdot 60=26 \cdot 6$ only.
(c) John earns $€ 11$ per hour and works a 40 hour week. His rate of tax is $20 \%$ and he has tax credits of $€ 50$ per week.
(i) Calculate the tax payable by John.
(ii) John also pays PRSI at the rate of $4 \%$ of his gross weekly wage. Calculate John's weekly take-home pay.

## (c)(i)

10 marks
Att 4
(c)(i) Gross weekly wage $=11 \times 40=€ 440$.
$€ 440 \times 0 \cdot 2=88 \Rightarrow$ Tax payable $=88-50=€ 38$

* Accept correct answer without work.
* Accept candidate's answer for gross wage when calculating tax.


## Blunders (-3)

B1 Error in calculating \% e.g. $440 \times 1 \cdot 20$.
B2 Adds tax credit to gross tax. (138).
B3 €402 given as tax payable or take home (net) pay.

Slips (-1)
S1 Decimal error.
S2 Numerical errors.

## Attempts (4 marks)

A1 Any mishandling or ignoring of the Tax Credit other than B2.
A2 Some effort at getting \%.

## Worthless (O marks)

W1 Incorrect answer with no work shown, other than those in scheme.
(c)(ii) PRSI: $440 \times 0 \cdot 04=17 \cdot 6$ : Take-home pay: $440-38-17 \cdot 6=\boldsymbol{€ 3 8 4 \cdot 4}$

* Accept correct answer without work
* Accept candidate's answer from part (i).


## Blunders (-3)

B1 Error in calculating \% e.g. $€ 440 \times 0 \cdot 4$.
B2 Error(s) in establishing $\frac{440}{100} \times 4$ [All three elements must be present, otherwise attempt only]
B3 Calculates 4\% of gross tax or tax payable or pay after tax.
B4 Uses wrong Gross wage.
B5 Uses a Tax other than that calculated in (c) (i)above.
B6 Adds Tax.
B7 Uses a PRSI amount other than that calculated.
B8 Adds the PRSI amount.
B9 Subtraction not completed.

## Slips (-1)

S1 Incorrect rounding off of answer.
S2 Numerical errors.

## Attempts (4 marks)

A1 Some use of 100 .
A2 Some spurious number subtracted from Gross wage

## Worthless (O marks)

W1 Incorrect answer with no work shown, other than those in scheme.
(a) The estimated building cost of a community hall was $€ 600000$.

The actual cost was $€ 750000$.
(i) Find the error in the estimate.
(ii) Find the percentage error.

## (i) $\quad$ Error $=750000-600000=\boldsymbol{€ 1 5 0 , 0 0 0}$

Accept correct answer with no work.

## Blunders ( -3 )

B1 $750000-600000$ and stops.

## Slips (-1)

S1 Numerical errors.

## Attempts (2 marks)

A1 Some use of the given data; e.g. $600000 \times 750000$.

## Worthless (O marks)

W1 Incorrect answer with no work shown, other than those in scheme.
(a)

5 marks
Att 2
(ii) Percentage error $=\frac{150000}{750000} \times 100=20=20 \%$

* Accept correct answer with no work.


## Blunders ( -3 )

B1 Error(s) in establishing $\frac{150000}{750000} \times 100$ [All three elements must be present; else attempt only].
B2 Incorrect or incomplete answer or no answer. [Use candidate's answer from Part (a) (i)].

## Worthless (O marks)

W1 Incorrect answer with no work shown, other than those in scheme.
(b) $€ 4000$ is invested for three years at $2 \cdot 5 \%$ per annum compound interest.

Find the value of the investment at the end of the three years, correct to the nearest cent.
(b) Substitute into formula

10 marks
Att 4 Simplify bracket 5 marks

Att 2
Finish
5 marks
Att 2
(b) $\mathrm{A}=4000\left(1+\frac{2 \cdot 5}{100}\right)^{3}=4000(1 \cdot 025)^{3}=4000(1 \cdot 076890625)=4307 \cdot 5625=\mathbf{€ 4 3 0 7 \cdot 5 6}$

Accept correct answer with no work.

* $\mathrm{A}=4000\left(1+\frac{2 \cdot 5}{100}\right)^{3} \Rightarrow 10$ marks.
* $\mathrm{A}=4000(1 \cdot 025)^{3} \Rightarrow 15$ marks.
* $\mathrm{A}=€ 4307 \cdot 56 \Rightarrow 20$ marks
* $\mathrm{A}=4000\left(1+\frac{2 \cdot 5}{100}\right)^{3}=$ incorrect answer, without further work $\Rightarrow 14$ marks. $(10+2+2)$


## Substitute into formula

## 10 marks

Att 4

## Blunders (-3)

B1 Error in formula as written by student or incorrect formula e.g. depreciation
B2 Error in substituting into formula, once only.
Attempts (4 marks)
A1 $4000 / 2 \cdot 5$ or $4000 / 2 \cdot 5=1600$
A2 $(4000)(2 \cdot 5)$ or $(4000)(2 \cdot 5)=10000$.
A3 $4000 / 0 \cdot 025=160000$.
Simplify bracket
B1 $A=4000\left(1+\frac{2 \cdot 5}{100}\right)^{3} \neq 4000(1 \cdot 025)^{3}$.

## Finish

5 marks
Att 2

* Use candidate's answer to simplification of $A=4000\left(1+\frac{2 \cdot 5}{100}\right)^{3}$

B1 $\quad(1 \cdot 025)^{3}=(1 \cdot 025) \times 3=3 \cdot 075$ or $(1 \cdot 025)^{3}=(1 \cdot 025) / 3=0 \cdot 341666 \ldots$.
B2 $\frac{4000}{(1 \cdot 025)^{3}}=3714 \cdot 399 \ldots$ or $\frac{4000}{(0 \cdot 975)^{3}}=4315 \cdot 651 \ldots$.
B3 $4000 \times(0.975)^{3}=3707.4375$
Slips (-1)
S1 Incorrect or omitted rounding off to nearest cent.
S2 Numerical error
Misreadings (-1)
M1 $(1.025)^{n}, n=2$ or $n \geq 4$ used in formula

## Worthless (O marks)

W1 Incorrect answer with no work shown, other than those in scheme.

## OR

(b) Amount year 1

10 marks
Att 4
Amount year 2
5 marks
Att 2
Amount year 3
5 marks
Att 2
(b) Amount at end of year 1: $4000 \times 1.025=4100$

Amount at end of year $2: 4100 \times 1 \cdot 025=4202 \cdot 5$
Amount at end of year 3:4202.5 $\times 1 \cdot 025=4307 \cdot 5625=€ 4307 \cdot 56$.

## OR

Compound Interest Year 1: $4000 \times \frac{2 \cdot 5}{100}=100 \Rightarrow$ Principal Yr $2=4100$
Compound Interest Year 2:4100 $\times \frac{2 \cdot 5}{100}=102 \cdot 5 \Rightarrow$ Principal Yr $3=4202 \cdot 5$
Compound Interest Year 3: $4202.5 \times \frac{2 \cdot 5}{100}=105.0625 \Rightarrow$ Principal Yr $4=4307.56(25)$
$\Rightarrow$ Amount $=4307 \cdot 56(25)$

* Accept correct answer with no work.
* Amount year $1=4100 \Rightarrow \quad 10$ marks
* Amount year $2=4202 \cdot 5 \Rightarrow \quad 15$ marks
* Amount year $3=4307 \cdot 56(25) \Rightarrow 20$ marks
* Using Simple Interest only to give $300 \Rightarrow 8$ marks $(4+2+2)$, with or without work.


## Amount at end of year 1

10 marks
Att 4
Blunders (-3)
B1 $4000 \times 1 \cdot 25=5000$.
B2 Error(s) in establishing $4000 \times \frac{2.5}{100}$ [All three elements must be present; else attempt only]
B3 Stops at interest and fails to find amount.
B4 Subtracts interest to find amount.

## Slips (-1)

S1 Numerical errors.

## Attempts (4 marks)

A1 Some use of 100 in attempt to find percentage

## Worthless (O marks)

W1 Incorrect answer with no work shown, other than those in scheme.

* Use candidate's answer for amount at end of year 1


## Blunders (-3)

B1 Error(s) in calculating percentage.
B2 Uses a principal other than calculated above.
B3 Stops at interest and fails to find amount.
B4 Subtracts interest to find amount. Do not penalise if B4 above in Year 1.

Slips (-1)
S1 Numerical errors.
S2 Incorrect or omitted rounding off.

## Worthless (O marks)

W1 No effort at compounding.
W2 Incorrect answer with no work shown, other than those in scheme.

* Use candidate's answer for amount at end of year 2.


## Blunders (-3)

B1 Error(s) in calculating percentage.
B2 Uses a principal other than calculated above.
B3 Stops at interest and fails to find amount.
B4 Subtracts interest to find amount. Do not penalise if B4 above in Year 1 or Year 2.

## Slips (-1)

S1 Numerical errors.
S2 Total compound interest only given.[307•56]
S3 Incorrect or omitted rounding off.

## Worthless (0 marks)

W1 No effort at compounding.
W2 Incorrect answer with no work shown, other than those in scheme.
(c) The value of a computer depreciates at the rate of $20 \%$ per year. At the end of the first year a computer is worth $€ 656$.
(i) Find the value of the computer when it was new.
(ii) What will the computer be worth at the end of the third year? Give your answer to the nearest euro.
(c)(i) 10 marks

Att 4
(c)(i)
$P=\frac{656}{\left(1-\frac{20}{100}\right)}=\frac{656}{0 \cdot 8}=€ 820$ or $656=P\left(1-\frac{20}{100}\right) \Rightarrow 656=P(0 \cdot 8) \Rightarrow P=€ 820$
or $\frac{4}{5}=656 \Rightarrow \frac{1}{5}=164 \Rightarrow \frac{5}{5}=€ 820$
or $80 \%=€ 656$
$\Rightarrow 1 \%=€ 8.20$
$\Rightarrow 100 \%=€ 820$

* Accept correct answer with no work.


## Blunders (-3)

B1 Error in formula as written by student or incorrect formula e.g. Compound Interest.
B2 Error in substituting into formula, once only.
B3 Error in transposition.
B4 $\mathrm{P}=\frac{656}{\left(1-\frac{20}{100}\right)} \neq \frac{656}{0 \cdot 8}$

## Slips (-1)

S1 Numerical errors

## Attempts (4 marks)

A1 $656 / 20$ or $656 / 20=32 \cdot 8$
A2 $(656)(20)$ or $(656)(20)=13120$ or $656 / 0 \cdot 2=3280$.
A3 $656 \times \frac{20}{100}=131.20$ giving a total of $€ 787.20$
A4 $€ 787.20$ without work or 524.80 without work.

## Worthless (0 marks)

W1 Incorrect answer with no work shown, other than those in scheme.
(c)(ii) $\quad \mathrm{A}=820\left(1-\frac{20}{100}\right)^{3}=820(0 \cdot 8)^{3}=419 \cdot 84=€ 420$ or $\mathrm{A}=820\left(\frac{4}{5}\right)^{3}$

$$
A=656\left(1-\frac{20}{100}\right)^{2}=656(0 \cdot 8)^{2}=419 \cdot 84=€ 420 \text { or } A=656\left(\frac{4}{5}\right)^{2}
$$

* Accept correct answer with no work.
* Accept candidate's answer from part (i).


## Blunders ( -3 )

B1 Error in formula as written by student or incorrect formula e.g. Compound Interest.
B2 Error in substituting into formula, once only.
B3 Incorrect number of years for candidate's chosen starting amount.
B4 A $=820\left(1-\frac{20}{100}\right)^{3} \neq 820(0 \cdot 8)^{3}$.
B5 $\quad(820)(1 \cdot 2)^{3}=1416.96$
B6 $\frac{820}{(0 \cdot 8)^{3}}=1601 \cdot 5625$ or $\frac{820}{(1 \cdot 2)^{3}}=474 \cdot 537$
B7 Above blunders apply to 656 when taken as starting amount.

Attempts (4 marks)
A1 $\frac{820}{20}$ or $\frac{820}{20}=41$
A2 $\quad(820)(20)$ or $(820)(20)=16400$ or $\frac{820}{0 \cdot 2}=4100$.
A3 Above attempts apply to 656 taken as starting amount.

Slips (-1)
S1 Incorrect or omitted rounding off to the nearest euro.
S2 Numerical errors.
Misreadings ( -1 )
M1 $(0 \cdot 8)^{n}, n \geq 4$ used in formula.

## Worthless (O marks)

W1 Incorrect answer with no work shown, other than those in scheme.

## OR

(c)(ii) (year-by-year method)
(c) Value at the end of year 1: $820 \times 0.8=656$

Value at the end of year $2: 656 \times 0 \cdot 8=524 \cdot 8$
Value at the end of year 3: $524 \cdot 8 \times 0 \cdot 8=419 \cdot 84=€ 420$
or $\quad$ Depreciation at end of year 2: $656 \times \frac{20}{100}=131 \cdot 20 \Rightarrow$ Value $2=524 \cdot 8$
Depreciation at end of year 3:524.8 $\times \frac{20}{100}=104 \cdot 96 \Rightarrow$ Value $3=419 \cdot 84$
$\Rightarrow$ final value $=€ 420$.

* Accept correct answer with no work.
* Using Simple Interest only to give $492 \Rightarrow 4$ marks, with or without work.


## Blunders (-3)

B1 $\quad(820)(0.08)=65.6$
B2 Error(s) in establishing (820)(20)/100 [All three elements must be present; else attempt only].
B3 Stops at depreciation and fails to find value. (Each time)
B4 Adds depreciation to find value. (Once only)
B5 Error(s) in calculating percentage.
B6 Uses a value other than calculated above.
B7 Each step omitted for the candidate's chosen starting amount.

## Slips (-1)

S1 Numerical errors.
S2 Incorrect or no rounding off to nearest euro.

## Attempts (4 marks)

A1 Some use of 100 in attempt to find percentage.

## Worthless (O marks)

W1 Incorrect answer with no work shown, other than those in scheme.

## QUESTION 4

| Part (a) | 10 marks | Att 4 |
| :--- | :---: | ---: |
| Part (b) | $20(15,5)$ marks | Att (6, 2) |
| Part (c) | $20(10,5,5)$ marks | Att (4, 2, 2) |

Part (a)
10 marks
Att 4
(a) Solve for $x$

$$
5 x-2=3 x+14
$$

(a)
(a) $\quad 5 x-2-3 x=14 \Rightarrow 2 x-2=14 \Rightarrow 2 x=14+2 \Rightarrow 2 x=16 \Rightarrow x=8$.

Award full marks for a correct answer by $\mathrm{T}+\mathrm{E}$ with verification.

## Blunders (-3)

B1 Blunders in grouping terms e.g. $5 x-2=3 x$. (Each time).
B2 Transposition error(s). (Once only).
B3 Each step omitted e.g. $2 x=16$ and stops
B4 $x=8$ without work.
Slips(-1)
S1 Numerical errors.
Attempts (4 marks)
A1 Some correct work.
A2 Effort at T+E by substitution.

## Worthless (O marks)

W1 Incorrect answer without work.
(b) Solve the simultaneous equations

$$
\begin{aligned}
3 x-4 y & =8 \\
x+2 y & =16 .
\end{aligned}
$$

## First variable found

15 marks
Att 6
Second variable 5 marks Att 2
(b)

$$
\begin{array}{rlrl}
3 x-4 y & =8 & \\
x+2 y & =16 & & \\
\hline 3 x-4 y & =8 & 8+2 y & =16 \\
2 x+4 y & =32 & 2 y & =8 \\
\hline 5 x & =40 & y & =4
\end{array}
$$

* Random $x$ picked, $y$ calculated (or vice-versa) - award 5 marks (second variable found).
* Substitution of correct values in both equations and verification shown - Award 15+5 marks.


## Blunders(-3)

B1 Error(s) in establishing the first equation in terms of $x$ only [ $5 x=40]$ or the first equation terms of $y$ only $[-10 y=-40]$.
B2 Blunder in substitution e.g. $y$ value for $x$.
B3 Transposition error(s). (Once only).

Attempts -First variable - (6 marks)
A1 Effort at equalising coefficients of $x$ 's or $y$ 's.
A2 Effort at cancelling one variable or combining variables.
A3 Effort at writing $x$ in terms of $y$ (or vice-versa).

## Attempts- Second variable - (2 marks)

A4 Effort at substituting first variable.
A5 Effort at cancelling second variable or second effort at combining variables.

## Attempts ( $6+2$ marks)

A6 Attempt at finding a solution by $\mathrm{T}+\mathrm{E}$.
A7 Correct answers with no work shown.
A8 Any correct work, even in the context of an approach of no merit (Att 6, or Att $6+$ Att 2 ).

## Worthless (O marks)

W1 Incorrect answer(s), no work shown.
(c) Alan, Barry and Colm each bought a ticket for a concert. Barry paid $€ 5$ more than Alan for his ticket. Colm paid twice as much as Barry. Alan's ticket cost $€ x$.
(i) Write an expression in $x$ for the price that Barry paid.
(ii) Write an expression in $x$ for the price that Colm paid
(iii) Given that the total paid out by the three friends was $€ 95$, how much did Alan pay?
(c) (i)

10 marks
Att 4
(c) (i)
$x+5$

## Blunders (-3)

B1 $x-5$.
B2 $5 x$.

## Attempts (4 marks)

A1 Assigns a numerical value to $x$ that is then used to find a numerical value for Barry's cost.
A2 Some use of the given data e.g. $\frac{x}{5}, \frac{5}{x}, 5-x$

## Worthless (O marks)

W1 No use of $x$ or 5 .
W2 $x=5$ and stops.
(c) (ii) 5 marks
(c) (ii) $2(x+5)$ or $2 x+10$

Accept candidate's answer from part (i).

Blunders (-3)
B1 $x+10$
B2 $2 x+5$

Attempts (2 marks)
A1 $2 x-5$
A2 $x-10$
A3 $x^{2}$

Worthless (0 marks)
W1 No use of 2 and/or 10
(c) (iii) $\quad x+(x+5)+(2 x+10)=95 \Rightarrow 4 x+15=95 \Rightarrow 4 x=80 \Rightarrow \boldsymbol{x}=\mathbf{2 0}$.

* Accept candidate's answer from part (i) and part (ii).
* $\quad 4 x+15$ or $4 x+15=95$ as starting work can earn marks for parts (i) and (ii).


## Blunders (-3)

B1 Incorrectly formed equation.
B2 Blunders in grouping terms e.g. $4 x+15=19 x$. (Each time).
B3 Transposition error(s). (Once only).
B4 Each step omitted.
B5 $x=20$ without work.
Slips(-1)
S1 Numerical errors.

## Attempts (2 marks)

A1 Some correct work.
A2 Effort at T+E by substitution.
A3 No equation formed.

Worthless (O marks)
W1 Incorrect answer without work.

## QUESTION 5

Part (a)
$10(5,5)$ marks
Att (2, - )
Part (b)
$20(10,10)$ marks
Att $(4,4)$
Part (c)
$20(10,5,5)$ marks
Att (4, 2, 2)
Part (a)
$10(5,5)$ marks
Att (2, - )
(a) (i) List the first five multiples of 3 and list the first five multiples of 4 .
(ii) Hence, or otherwise, write down the lowest common multiple of 3 and 4.
(a)(i)

5 marks
Att 2
(ii)

## 5 marks

Hit/Miss
(a)
(i) $3,6,9,12,15$.
$4,8,12,16,20$.
(ii) 12

## Part (a)(i)

Slips (-1)
S1 Each omitted or incorrect entry, from each list, provided at least one in each list is correct. (to a max of ( -3 )

## Attempts (2 marks)

A1 At least one correct entry, in either list.

## Part(a)(ii)

Lowest common multiple - hit or miss. Accept 12 or $3 \times 4$.
(b) (i) Solve the quadratic equation $x^{2}+4 x+3=0$.
(ii) Solve the quadratic equation $2 x^{2}-9 x+6=0$, correct to two decimal places.
(b) (i)

10 marks
Att 4
(b) (i) $x^{2}+4 x+3=0 \Rightarrow(x+3)(x+1)=0 \Rightarrow x=-3, x=-1$

## Blunders(-3)

B1 Last step omitted.
B2 Sign error(s) in factors (Once only).
B3 Sign error(s) in solution (Once only)).
B4 Incorrect relevant factors and continues.
B5 Errors in using formula as in (ii).

## * without work

2 correct answers, both verified: full marks 2 correct answer and one verified: $1 \times$ B ( -3 ) 2 correct answers, neither verified: Att 4 marks 1 correct answer, and verified: Att 4 marks 1 correct answer but not verified: 0 marks

## Attempts(4 marks)

A1 Effort at finding factors.
A2 Attempt at T + E.

## Worthless (O marks)

W1 Quadratic reduced to linear.
(b) (ii)
(ii) $2 x^{2}-9 x+6=0 \Rightarrow x=\frac{9 \pm \sqrt{(-9)^{2}-4(2)(6)}}{2(2)} \Rightarrow \frac{9 \pm \sqrt{81-48}}{4} \Rightarrow \frac{9 \pm \sqrt{33}}{4} \quad[\dagger$ $\Rightarrow x=\frac{9 \pm 5 \cdot 744 . .}{4}=3 \cdot 686 \ldots$ or $0 \cdot 813 \ldots \Rightarrow x=3 \cdot 69$ or $x=0 \cdot 81$.

* Maximum deductions beyond point $[\dagger]$ is 3 marks.
* $\frac{9 \pm \sqrt{\text { neg no. }}}{4}$ implies 6 marks.


## Blunders ( -3 )

B1 Blunder in application of formula.
B2 Omits $\pm$ in formula.
Slips(-1)
S1 Slips in substitution into the formula (to a max of -5 )
S2 $81-48=129$.
S3 Incorrect or omitted rounding off, each time.

## Attempts(4 marks)

A1 Effort at substitution into formula.
A2 Incorrect formula with substitution.
A3 Attempt at finding factors e.g. $\left(\begin{array}{ll}2 x & ) \\ (x)\end{array}\right)$ or guide no. $=12$.
A4 Appearance of the variable in the answer.

## Worthless (O marks)

W1 Quadratic reduced to linear.
(c) (i) Solve $3 x-2 \leq 17, x \in \mathbf{N}$.
(ii) Solve $5-2 x \leq 1, x \in \mathbf{N}$.
(iii) Write down the values of $x$ which satisfy both of the above inequalities?

## (c)(i)

10 marks

## Att 4

(i) $3 x-2 \leq 17 \Rightarrow 3 x \leq 19 \Rightarrow x \leq 6.33 \Rightarrow\{1,2,3,4,5,6\}$ OR $\{0,1,2,3,4,5,6\}$

Listing not required.

## Blunders (-3)

B1 Blunders in grouping terms e.g. $3 x-2=x$. (Each time).
B2 Transposition error(s). (Once only).
B3 Each step omitted.
B4 $x \leq 6 \cdot 33$ or $19 / 3$ without work.
B5 Replaces inequality sign with equality sign.

Misreadings (-1)
M1 Uses $<$ for $\leq$.
Attempts (4 marks)
A1 Some correct work.
A2 Effort at T+E by substitution.
Worthless (0 marks)
W1 Incorrect answer without work.

## (c)(ii)

(ii) $5-2 x \leq 1 \Rightarrow 4 \leq 2 x \Rightarrow 2 \leq x \Rightarrow\{2,3,4, \ldots\}$

* Listing of $\{2,3,4, \ldots\}$ not required.

Blunders (-3)
B1 Blunders in grouping terms e.g. 5- $2 x=3 x$. (Each time).
B2 Transposition error(s). (Once only).
B3 Blunder in direction of inequality when multiplying by "minus".
B4 Each step omitted.
B5 $x \geq 2$ without work.
B6 Replaces $\leq$ with equality sign. Do not penalise if B5 is incurred in (i).
Misreadings (-1)
M1 Uses $<$ for $\leq$.
Attempts (2 marks)
A1 Some correct work.
A2 Effort at T+E by substitution.
A3 $5+2 x \leq 1$.
Worthless (0 marks)
W 1 Incorrect answer without work.

* Accept candidate's answers from part (i) and part (ii).
* If equality used in (i) and (ii), then attempt mark at most here.

Slips(-1)
S1 Each omitted or incorrect entry, provided at least one is correct. (to a max of -3)
Attempts(2 Marks)
A1 At least one correct entry.

Part (i)
Part (ii)
Part (iii)
Part (iv)
Part (v)

10 marks
Att 4
10 marks
Att 4
10 marks
10 marks
10 marks
Att 4
Att 4
Att 4
6. A student spends her free time at home watching television and listening to music. The following chart shows the amount of time spent in minutes by this student doing these activities in one particular week.
For example, on Friday, she spent 50 minutes watching television and 30 minutes listening to music.

(i) On what day did she spend the least amount of time watching television?
(ii) Which day shows the greatest difference between time spent watching television and time spent listening to music?
(iii) On which days did she spend more than two hours in total watching television and listening to music?
(iv) What is the average time per day she spent watching television during that week?
(v) During that week, how much more of her free time did she spend watching television than listening to music?
(i) Thursday

## Blunders ( -3 )

B1 Music instead of television $\Rightarrow$ Wednesday and Friday
B2 Saturday, the greatest, given as the least.

## Attempts (4 marks)

A1 Wednesday only or Friday only given.

## Worthless (O marks)

W1 Incorrect answer without work, other than those in the scheme.
(ii) Wednesday

## Blunders ( -3 )

B1 Tuesday, the least difference, given as greatest.

## Attempts(4 Marks)

A1 Saturday given as the answer.

## Worthless (O marks)

W1 Incorrect answers with no work, other than those in scheme.
(iii)

10 marks
Att 4
(iii) Saturday \& Sunday

Blunders (-3)
B1 Each omitted or incorrect day.
B2 Gives Monday, Tuesday, Wednesday, Thursday and Friday as greater than two hours.

## Worthless (O marks)

W1 Incorrect answers with no work, other than those in scheme.
(iv)

10 marks
Att 4
(iv) $35+50+80+30+50+100+75=420 \Rightarrow 420 / 7=60$ minutes.

* Accept correct answer without work.
* For TV time on Monday, accept 35 or $35 \pm 2$ minutes. Likewise for Sunday.


## Blunders (-3)

B1 Calculating average time listening to music.
B2 Stops at 420/7.
B3 50, the mode given as average.
B4 $\quad 750 / 7=107 \cdot 14$
Slips (-1)
S1 Each omitted time, or incorrect time, provided at least one is correct.
S2 Uses a divisor other than 7.
S3 Numerical errors.

## Attempts(4 Marks)

A1 Stops at 420. or candidates answer.

## Worthless (0 marks)

W1 Incorrect answers with no work, other than those in scheme.
(v) $420-(60+55+30+50+30+55+50) \Rightarrow 420-330=90$.

* Accept correct answer without work.
* For Music time on Tuesday, accept 55 or $55 \pm 2$ minutes. Likewise for Saturday.


## Blunders (-3)

B1 Fails to subtract 420-330 or adds $420+330$.
Slips (-1)
S1 Numerical errors.
S2 Each omitted time, or incorrect time, provided at least one is correct. ( to a max -3 )
S3 Interchanges television and music giving -90 as answer.

## Attempts (4 marks)

A1 Some effort at finding totals.

## Worthless (O marks)

W1 Incorrect answers with no work, other than those in scheme.

## 20 marks

## Att 8

Table / evaluation
10 marks
Graph Att 4
Draw the graph of the function

$$
f: x \rightarrow 2 x^{2}-3 x-5, \text { for }-2 \leq x \leq 3, x \in \mathbf{R} .
$$

Use your graph to estimate
Table method

| $\boldsymbol{x}$ | $\mathbf{- 2}$ | $\mathbf{- 1}$ | $\mathbf{0}$ | $\mathbf{1}$ | $\mathbf{2}$ | $\mathbf{3}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathbf{2 \boldsymbol { x }}^{\mathbf{2}}$ | 8 | 2 | 0 | 2 | 8 | 18 |
| $\mathbf{- 3 \boldsymbol { x }}$ | 6 | 3 | 0 | -3 | -6 | -9 |
| $\mathbf{- 5}$ | -5 | -5 | -5 | -5 | -5 | -5 |
| $\boldsymbol{f} \boldsymbol{x} \boldsymbol{x})$ | $\mathbf{9}$ | $\mathbf{0}$ | $\mathbf{- 5}$ | $\mathbf{- 6}$ | $\mathbf{- 3}$ | $\mathbf{4}$ |

* Accept correct $f(x)$ values without work.


## Blunders (-3)

B1 $x$-values added on when calculating $f(x)$ values.
B2 Consistent errors across full line.
Otherwise slips applied.

Misreadings ( -1 )
M1 - 5 treated as 5 across the line.

## Slips (-1)

S1 Each incorrect or omitted value in body of table.
S2 Each incorrect or omitted $y / f(x)$ value, calculated from candidate's work.

Attempt (8 marks)
A1 Any four correct calculated values in the table.
A2 Function treated as linear e.g. $x^{2}=2 x$ or $x$ or $2 x^{2}=4 x$ or $x$.

## OR

Function evaluation method

$$
\begin{aligned}
& f(-2)=2(-2)^{2}-3(-2)-5=9 \\
& (-1)=2(-1)^{2}-3(-1)-5=0 \\
& (0)=2(0)^{2}-3(0)-5=-5 \\
& (1)=2(1)^{2}-3(1)-5=-6 \\
& (2)=2(2)^{2}-3(2)-5=-3 \\
& f(3)=2(3)^{2}-3(3)-5=4
\end{aligned}
$$

## Blunders (-3)

B1 Consistent errors in the evaluation of $2 x^{2}$.
B2 -5 omitted from the evaluation.
B3 Each incorrect $f(x)$ value when no work is shown to a max of $3(-3)$ provided that at least one $f(x)$ value is correct. All $f(x)$ values incorrect without work $\Rightarrow 0$ marks. Otherwise slips applied when work is shown.

## Misreadings (-1)

M1 - 5 consistently treated as 5 in the evaluation.

Slips (-1)
S1 Each incorrect or omitted value from the evaluation after substitution.
S2 Each incorrect or omitted $f(x)$ value, calculated from candidate's work.

## Attempt (8 marks)

A1 Any four correct calculated values in the function evaluation.
A2 Function treated as linear e.g. $x^{2}=2 x$ or $x$ or $2 x^{2}=4 x$ or $x$.

## Worthless (O marks)

W1 Incorrect answers with no work, other than those in scheme.


* Accept values from candidate's table.
* Fully correct graph drawn with no work shown: Award 30 marks.


## Blunders (-3)

B1 Points joined in incorrect order.
B2 Blunders in scales on axis or axes. (Once only.)

## Slips (-1)

S1 Each point, from table, plotted incorrectly.
S2 Each pair of successive points not joined, to maximum -3.
S3 Not a smooth curve.
S4 The graph of the function is not in the conventional position or orientation.

## Attempts (4 marks)

A1 At least two of candidate's points plotted.
A2 Any $\cup$-shaped graph.
A3 Axes Drawn.

Use your graph to estimate
(i) the minimum value of $f(x)$
(ii) the value of $f(-0.5)$
(iii) the roots of $f(x)=0$
(iv) the range of values of x for which $f(x)$ is decreasing.

| Part (i) |  | 5 marks |
| :--- | :--- | ---: |
| Part (ii) |  | $\mathbf{5}$ marks |
| Part (iii) |  | $\mathbf{5}$ marks |
| Part (iv) |  | Att 2 |
| (i) | $-6 \cdot 125$ | Att 2 |
| (ii) | -3 | Att 2 |
| (iii) | $-1,2.5$ |  |
| (iv) | $-2 \leq x<0.75$ |  |

* Accept candidate's values from graph.
* Allow tolerance $\pm 0.3$ units on $x$-axis, $\pm 0.5$ units on $y$-axis.


## Blunders (-3)

B1 Value omitted, or extra value. Applies in part (iii) and (iv).
B2 $f(-0 \cdot 5)$ treated as $f(x)=-0 \cdot 5$

Misreading (-1)
M1 Gives the value of $x$ corresponding to the minimum of $f(x)$ in part (i).

## Slips (-1)

S1 Answers indicated correctly on axes, but not specified.

## Attempt (2 marks)

A1 Effort at reading value(s) from graph.
A2 Correctly solving equation algebraically: part (iii).


Coimisiún na Scrúduithe Stáit
State Examinations Commission

## LEAVING CERTIFICATE 2008

## MARKING SCHEME

## MATHEMATICS - PAPER 2

## FOUNDATION LEVEL

## MARKING SCHEME

## LEAVING CERTIFICAE EXAMINATION 2008 <br> MATHEMATICS - FOUNDATON LEVEL - PAPER 2

## GENERAL GUIDELINES FOR EXAMINERS - PAPER 2

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. Any examiner unsure of the validity of the approach adopted by a particular candidate to a particular question should contact his/her advising examiner.
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 1

Part (a)
10 marks
Att 4
Part (b)
$40(35,5)$ marks Att (14, 2)

10 marks Att 4
Part(a)
(a)

The parallel sides of a trapezium measure

(a)

$$
\text { Area }=\frac{h(a+b)}{2}=\frac{7(25+15)}{2}=140 \mathrm{~cm}^{2}
$$

## Blunders (-3)

B1 Incorrect substitution
B2 Failure to divide by 2
B3 Multiplication for addition

## Slips (-1)

S1 Numerical errors to a max of 3
S2 Omits units
Attempts (4)
A1 Defines length or area
(b) The diagram below shows a corner of a lawn that needs to be replanted with grass seed.


Offsets of lengths $6,9,10,12,14$ and 17 metres are measured at intervals of 6 metres as shown.
(i) Use Simpson's rule to calculate an estimate of the area of this corner of the lawn.
(ii) One box of lawn seed is needed for every $40 \mathrm{~m}^{2}$ of the lawn. How many boxes of seed will be needed?
(b)(i)
(ii) 5 marks
Area $=\frac{1}{3}$ width $[$ First + last $+2($ odd $)+4($ even $)]$
(i)

$$
\begin{aligned}
& \text { Area }=\frac{6}{3}[0+17+2(9+12)+4(6+10+14)] \\
& \text { Area }=2[17+2(21)+4(30)]=2[17+42+120]=2(179) \\
& \text { Area }=358 m^{2}
\end{aligned}
$$

(ii) Number of boxes $=\frac{358}{40}=8.95$ or 9

## Blunders (-3)

B1 Uses four odd and twice even e.g. 2(30) $+4(21)$
B2 Omits 2 or 4 in the formula or both
B3 Omits $h$ or uses an incorrect $h$ or does not divide $h$ by 3
B4 Multiplies by 40
Slips (-1)
S1 Numerical errors to a max of 3
S2 Omits units
S3 Each incorrect or omitted altitude

## Attempts (14, 2)

A1 Gives Simpson's Formula only.
A2 Copies diagram

## QUESTION 2

Part (a)
10 marks
Att 4
Part (b)
15 marks
Att 6
Part (c)
$25(15,10)$ marks
Part(a)
10 marks
Att 4
2. (a) A rectangular chocolate bar is 9 cm long, 3 cm wide and 1 cm thick.

Calculate the volume of chocolate in the bar.

(a)

10 marks
Att 4
Volume $=l \times b \times h=9 \times 3 \times 1=27 \mathrm{~cm}^{3}$
Blunders (-3)
B1 Incorrect substitution
B2 Addition for multiplication
Slips (-1)
S1 Numerical errors to a max of 3
S2 Omits units
Attempts (4)
A1 Correct formula without substitution
Part(b)
15 marks
Att 6
(b) The diagram shows two circles inscribed in a rectangle.

The radius of each circle is 6 cm
Find the area of the rectangle

(b)

15 marks
Att 6

$$
\begin{aligned}
\text { Length } & =4 \times 6=24 \mathrm{~cm} \quad \text { Width }=2 \times 6=12 \mathrm{~cm} \\
\text { Area } & =24 \times 12=288 \mathrm{~cm}^{2}
\end{aligned}
$$

## Blunders (-3)

B1 Each incorrect dimension
Slips (-1)
S1 Numerical errors to a max of 3
S2 Omits units
Attempts (6)
A1 Defines length or area
A2 Finds area of circle
(c) A sphere and a cylinder have the same volume.

The sphere has a radius of 9 cm .
(i) Calculate the volume of the sphere in terms of $\pi$.
(ii) The height of the cylinder is 27 cm . Calculate the radius of the cylinder.

(i)

15 marks
Att 6
Volume $=\frac{4 \pi r^{3}}{3}=\frac{4 \times \pi \times 9^{3}}{3}=972 \pi \mathrm{~cm}^{3}$

## Blunders (-3)

B1 Incorrect substitution

## Slips (-1)

S1 Numerical errors to a max of 3
S2 Omits units
S3 Omits $\pi$ or gives answer as 3053.6 or 3052.08 or similar
Attempts ( 6 )
A1 Correct formula without substitution
(ii)

$$
\begin{aligned}
& \pi \times r^{2} \times 27=972 \pi \\
& \Rightarrow r^{2}=\frac{972 \pi}{27 \pi}=36 \quad \Rightarrow r=6 \mathrm{~cm}
\end{aligned}
$$

## Blunders (-3)

B1 Incorrect substitution
B2 Error in balancing equation

## Slips (-1)

S1 Numerical errors to a max of 3
S2 Omits units

## Attempts (4)

A1 Correct formula without substitution
A2 Correct volume of cylinder and stops

## QUESTION 3

Part (a)
Part (b)
Part (c)
$10(5,5)$ marks
$20(5,5,5,5)$ marks
$20(5,5,5,5)$ marks
$10(5,5)$ marks

Att (2, 2)
Att (2, 2, 2, 2)
Att (2, 2, 2, 2)

Part(a)
Att (2,2)
3. (a) Find the value of $x$ and the value of $y$.

(a)
$10(5,5)$ marks
Att (2, 2)
Ans: $x=70^{\circ}, y=40^{\circ}$
Blunders (-3)
B1 Geometrical error
Slips (-1)
S1 Numerical errors to a max of 3
Attempts (2, 2)
A1 Incorrect answer of some merit
(b) The diagram shows a parallelogram.

Find the measure of
(i) the angle $A$
(ii) the angle $B$
(iii) the angle $C$
(iv) the angle $D$.


Each part
5 marks
Att 2 Ans: (i) $A=60^{\circ}$ (ii) $B=60^{\circ}$ (iii) $C=40^{\circ} \quad$ (iv) $D=80^{\circ}$

## Blunders (-3)

B1 Geometrical error
Slips(-1)
S1 Numerical errors to a max of 3
Attempts (2, 2, 2, 2)
A2 Incorrect answer of some merit
(c) The diagram shows a circle with centre $o$ and radius 6.5 cm .
(i) Write down the measure of the angle $\angle p q s$.
(ii) Write down the length of [oq].
(iii) Write down the length of the diameter of the circle.
(iv) If $|q s|=5 \mathrm{~cm}$, find the length of $[p q]$.


Each part

| Ans: (i) $\|\angle p q s\|=90^{\circ}$ | (ii) $\|o q\|=6.5 \mathrm{~cm}$ | (iii) $d=13 \mathrm{~cm}$ | (iv) $\|p q\|=12 \mathrm{~cm}$ |
| :--- | :--- | :--- | :--- |

## Blunders (-3)

B1 Geometrical error
B2 Any error in Pythagoras
Slips (-1)
S1 Numerical errors to a max of 3

$$
\text { (iv) } \begin{aligned}
|p q|^{2}+25 & =169 \\
|p q|^{2} & =169-25 \\
|p q|^{2} & =144 \\
|p q| & =12 \mathrm{~cm}
\end{aligned}
$$

S2 Omits units
Attempts (2, 2, 2, 2)
A1 Incorrect answer of some merit
(a) $\quad p(-2,1)$ and $q(4,3)$ are two points.
(i) Plot the points $p$ and $q$ on graph paper.
(ii) Find the midpoint of $[p q]$.
(i)

10 marks
Att 4
(ii)

5 marks
(i)

(ii) Midpoint $=\left(\frac{-2+4}{2}, \frac{1+3}{2}\right)=\left(\frac{2}{2}, \frac{4}{2}\right)$ or $(1,2)$

Blunders (-3)
B1 Error in scales
B2 Omits 2 in midpoint formula
B3 Incorrect substitution once only
B4 Each point ommitted
Slips (-1)
S1 Numerical errors to a max of 3
S2 Each incorrectly plotted point
Attempts(4, 2)
A1 Draws axes.
(b) $\quad a(-6,6)$ and $b(-3,4)$ are two points
(i) Find the length of $[a b]$.
(ii) Find the slope of $a b$.
(iii) Find the equation of the line $a b$.

Each part
(i) Length $=\sqrt{(-3-(-6))^{2}+(4-6)^{2}}=\sqrt{(3)^{2}+(-2)^{2}}=\sqrt{13}$
(ii) Slope $=\frac{4-6}{-3-(-6)}=\frac{-2}{3}$
(iii) $y-6=\frac{-2}{3}(x+6)$ or $2 x+3 y-6=0$

Blunders (-3)
B1 No square root
B2 Incorrect substitution once only
B3 Mathematical error
Slips (-1)
S1 Numerical errors to a max of 3
Attempts (2, 2, 2)
A1 Draws axes.
Part(c)
(c) The line $L$ has equation $2 y=5 x+2$.

The point $r$ has co-ordinates $(0,1)$.
(i) Show that the point $r$ lies on the line $L$.
(ii) Find the slope of $L$.
(iii) Find the equation of the line $K$, which is perpendicular to $L$ and contains the point $r$.
(i)
(ii)
(iii)

## 5 marks

Att 2
5 marks
Att 2
10 marks
(i) $2 y=5 x+2 \Rightarrow 2(1)=5(0)+2 \Rightarrow 2=2$
(ii) slope $=\frac{5}{2}$
(iii) $y-1=\frac{-2}{5}(x-0)$ or $2 x+5 y-5=0$

## Blunders (-3)

B1 Incorrect substitution once only
B2 Incorrect slope of $L$
B3 Incorrect slope of $K$
B4 Error in balancing equation
Slips (-1)
S1 Numerical errors to a max of 3
Attempts (2, 2, 4)
A1 Draws axes.

## QUESTION 5

Part (a)
Part (b)
Part (c)

15 marks

## Part (a)

$20(10,10)$ marks
Att (4, 4)
5. (a) The diagram shows a right-angled triangle with sides of length 9,12 and 15 and angles named $A$ and $B$.
(i) Write down $\cos A$ as a fraction.
(ii) Write down $\tan B$ as a fraction.


12
(i)

## 10 marks

Att 4
(ii)

10 marks
Att 4

$$
\cos A=\frac{12}{15} \quad \tan B=\frac{12}{9}
$$

## Blunders (-3)

B1 Uses incorrect numerator or denominator each time
Slips (-1)
S1 Calculates the angle approx $\mathrm{A}=37^{\circ}$ or $\mathrm{B}=53^{\circ}$
S2 Answer not in fraction form.

## Attempts (4, 4)

A1 Defines cos or tan

## Part (b)

15 marks
Att 6
(b) Find the measure of the angle $X$ in the diagram, correct to the nearest degree.

(b)

## 15 marks

Att 6

$$
\sin X=\frac{5}{13} \quad \Rightarrow \quad X=\sin ^{-1}\left(\frac{5}{13}\right) \quad \Rightarrow \quad X=22.619^{\circ} \approx 23^{\circ}
$$

## Blunders (-3)

B1 Incorrect trig ratio
B2 Error in balancing equation

Slips (-1)
S1 Fails to round off
S2 Wrong mode

## Attempts (6)

A1 Measures from diagram.

Wrong mode
Rad: $\quad x=0.3947 \approx 0$
Grad: $x=25.133 \approx 25$
(c) A boat that is anchored out at sea can be seen from the top of a vertical cliff.

The angle of depression from the top of the cliff to the boat is $59^{\circ}$, as shown in the diagram.

The boat is 100 m from the foot of the cliff.
Find $h$, the height of the cliff, correct to the nearest metre.

(c) 15 marks

Att 6
$\frac{h}{100}=\tan 59^{\circ} \Rightarrow h=100 \tan 59^{\circ} \Rightarrow h=166.42 \approx 166 m$

## Blunders (-3)

B1 Incorrect trig ratio
B2 Error in balancing equation

## Slips (-1)

S1 Fails to round off
S2 Numerical errors to a max of 3
S3 Wrong mode

Wrong mode
Rad: $h=-82.577$
Grad: $h=133.1 \approx 133$

## Attempts (6)

A1 Measures from diagram
A2 Evaluates $\sin 59^{\circ}, \cos 59^{\circ}$, or $\tan 59^{\circ}$ and stops

Part (a)
Part (b)
Part (c)

10 marks
$20(5,5,5,5)$ marks
$20(5,5,5,5)$ marks

Att 4
Att (2, 2, 2, 2)
Att (2, 2, 2, 2)

Part (a)
10 marks
Att 4
(a) A factory produces a range of wigs, as follows:

- The wigs can have either short hair or long hair.
- The colour can be blond or black or red.
- The hair can either be straight or curly.

How many different wigs in this range can the factory produce?
(a)

10 marks
Att 4
Ans : $2 \times 3 \times 2=12$
Blunders (-3)
B1 $2+3+2=7$ or 7 written down
B2 2 ! Etc
B3 2 by $2+3$ by $3+2$ by 2 or similar
Slips (-1)
S1 Numerical errors to a max of 3
Attempts (4)
A1 Incorrect answer of some merit

## Part (b)

$\mathbf{2 0}(5,5,5,5)$ marks
Att (2, 2, 2, 2)
(b) A bag contains 5 apples, 4 pears, 3 oranges and 2 bananas.

A child chooses a piece of fruit at random from the bag.
Find the probability that the fruit chosen is
(i) a pear
(ii) an orange
(iii) an apple or an orange
(iv) not a banana.

Each Part
5 marks
Att 2
Answers: (i) $\frac{4}{14}$
(ii) $\frac{3}{14}$
(iii) $\frac{8}{14}$
(iv) $\frac{12}{14}$

## Blunders (-1)

B1 Incorrect $\mathrm{n}(\mathrm{S})$ apply once only
B2 Incorrect n(E)
B3 Inverted fraction
B4 No division

## Slips (-1)

S1 Numerical errors to a max of 3

Answers:(i) 4 (ii) 3 (iii) 8 (iv) 12 merits 17 marks
or
Answers:(i) $\frac{1}{4}$ (ii) $\frac{1}{3}$ (iii) $\frac{1}{8}$ (iv) $\frac{1}{12}$ merits 17 marks

Attempts (2, 2, 2, 2)
A1 Incorrect answer of some merit
(c) The table below shows how a class of 90 students normally travel to school.

|  | Walk | Car | Bus |
| :---: | :---: | :---: | :---: |
| Girls | 9 | 15 | 21 |
| Boys | 10 | 16 | 19 |

A student is chosen at random.
What is the probability that the student
(i) is a boy who comes to school by bus
(ii) is a girl
(iii) travels to school by car
(iv) does not walk to school.

Each part
5 marks
Att 2
$\begin{array}{llll}\text { Answers: (i) } \frac{19}{90} & \text { (ii) } \frac{45}{90} & \text { (iii) } \frac{31}{90} & \text { (iv) } \frac{71}{90}\end{array}$

## Blunders(-1)

B1 Incorrect $\mathrm{n}(\mathrm{S})$ apply once only.
B2 Incorrect n(E)
B3 Inverted fraction
B4 No division

## Slips (-1)

S1 Numerical errors to a max of 3

Attempts (2, 2, 2, 2)
A1 Incorrect answer of some merit
(a) Find the mode of the numbers
$3,2,2,3,1,3$.
Mode $=3$

## Slips(-1)

S1 Calculates mean
S2 Finds median
Attempts (2)
A1 Incorrect answer of some merit
(b) The table below shows the time taken by 60 people to get ready for work in the morning, correct to the nearest minute.

| Number of minutes | $0-15$ | $16-30$ | $31-45$ | $46-60$ | $61-75$ |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Number of people | 3 | 15 | 26 | 14 | 2 |

Copy and complete the cumulative frequency table.

| Number of minutes | $\leq 15$ | $\leq 30$ | $\leq 45$ | $\leq 60$ | $\leq 75$ |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Number of people |  |  |  |  |  |

Draw the cumulative frequency curve. Use your curve to estimate
(i) the median number of minutes taken to get ready
(ii) the number of people who took more than 20 minutes to get ready.

Cumulative Frequency Table
5 marks
Att 2

| Time Taken (in Minutes) | $\leq 15$ | $\leq 30$ | $\leq 45$ | $\leq 60$ | $\leq 75$ |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Number of Employees | 3 | 18 | 44 | 58 | 60 |

## Slips (-1)

S1 Each incorrect or omitted value in the table

## Attempts (2)

A1 Copies table


* Tolerance of $\pm 2$ units

Blunders(-3)
B1 Plots on the midpoints
B2 Error in scales, one blunder
B3 Points not joined

## Slips (-1)

S1 Each incorrectly plotted point
S2 Reverses axes
S3 Joins points with straight lines.
Attempts (4)
A1 Draws axes only
(i)
(i) Median $=35$
(ii) More than 20 minutes $=60-7=53$

## Blunders(-3)

B1 Uses wrong axis for median.
Slips (-1)
S1 Median not specified
S2 Fails to subtract reading in (ii)
(c) (i) Find the mean of the numbers $3,4,6,8,9$.
(ii) Find the standard deviation of the numbers $3,4,6,8,9$, correct to two decimal places.

Mean

## 5 marks

Standard Deviation
15 marks
(i) Mean $=\frac{\sum x}{n}=\frac{3+4+6+8+9}{5}=\frac{30}{5}$ or 6
(ii) Standard Deviation $=\sqrt{\frac{\sum d^{2}}{n}}$

$$
\begin{aligned}
& =\sqrt{\frac{(3-6)^{2}+(4-6)^{2}+(6-6)^{2}+(8-6)^{2}+(9-6)^{2}}{5}} \\
& =\sqrt{\frac{9+4+0+4+9}{5}} \\
& =\sqrt{\frac{26}{5}} \\
& =2.2803 \\
& \approx 2.28
\end{aligned}
$$

## Blunders (-3)

B1 $3+4+6+8+9$ or 30 and stops
B2 Incorrect substitution
Slips (-1)
S1 Numerical errors to a max of 3

## Attempts (2, 6)

A1 Any addition
A2 Work on SD or defines SD

## QUESTION 8

10 marks
$20(5,5,5,5)$ marks
$20(5,5,5,5)$ marks
10 marks
Att 4
(a) Construct a triangle $x y z$ where $|x y|=7 \mathrm{~cm},|y z|=5 \mathrm{~cm},|\angle x y z|=30^{\circ}$.
(a)

10 marks
Att 4


## Blunders(-3)

B1 Each omitted side.
B2 Incorrect angle $\pm 5^{\circ}$
Slips (-1)
S1 Each given side outside tolerance of $\pm 1 \mathrm{~cm}$
(b) The rectangle $a b^{\prime} c^{\prime} d^{\prime}$ is an enlargement of the rectangle $a b c d$. The centre of the enlargement is $a$.
$|d c|=4 \mathrm{~cm},|b c|=3 \mathrm{~cm},\left|d^{\prime} c^{\prime}\right|=10 \mathrm{~cm}$.

(i) Find the scale factor.
(ii) Find the length of $\left[b^{\prime} c^{\prime}\right]$.
(iii) Find the length of $\left[b b^{\prime}\right]$
(iv) Find the area of the rectangle $a b^{\prime} c^{\prime} d^{\prime}$.
(i)
(ii)
(iii)
(iv)
(i) scale factor $=\frac{10}{4}$ or $2 \cdot 5$.
(ii) $\left|b^{\prime} c^{\prime}\right|=3 \times 2.5=7.5 \mathrm{~cm}$
(iii) $\left|b b^{\prime}\right|=10-4=6 \mathrm{~cm}$
(iv) Area $a b^{\prime} c^{\prime} d^{\prime}=7.5 \times 10=75 \mathrm{~cm}^{2}$, or area $=4 \times 3 \times 2.5^{2}=75 \mathrm{~cm}^{2}$.

## Blunders(-3)

B1 Incorrect scale factor
B2 Error in area formula
B3 Does not square scale factor

## Slips (-1)

S1 Numerical errors to a max of 3
S2 Multiplication for division or vice versa

## Attempts (2, 2, 2, 2)

A1 Incorrect answer of some merit
(c) The diagram shows a patterned hexagonal tile.
(i) State whether the tile has a central symmetry (that is, a point of symmetry).
(ii) How many axial symmetries does the tile have?
(iii) How many rotational symmetries does the tile have?

(iv) List the angles of the rotational symmetries.
(i)
(ii)

5 marks
Att 2
(iii)

5 marks
Att 2
(iv)

5 marks
Att 2
Ans: (i) No
(ii) 3
(iii) 3
(iv) $0^{0}, 120^{0}, 240^{\circ}$

Blunders(-3)
B1 Answer greater than 3

## Slips (-1)

S1 Each symmetry omitted.
S2 Each angle omitted
S3 Each additional angle in list

## 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 $\times 5 \%=9.9 \Rightarrow$ bónas $=9$ marc.

Má ghnóthaíonn an t-iarrthóir níos mó ná 225 marc, ríomhtar an bónas de réir na foirmle [300 - bunmharc] $\times 15 \%$, 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 |

