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LEAVING CERTIFICATE EXAMINATION 2002

Marking Scheme

MATHEMATICS - FOUNDATION LEVEL

PAPER 1

General Instructions to Examiners:

Note: The slips, misreadings, blunders and attempts listed in the Marking scheme are not exhaustive.

1. Penalties:

(a) Numerical slips e.g. $4 \times 8 = 36$ (-1)

(b) Misreading, if not serious (-1)

(c) Mathematical blunders, omissions (-3)

(d) Serious blunders, misreadings or omissions may result in the loss of all marks for a particular section or may result in the attempt mark being awarded.

(e) The same error in the same section of a question is penalised once only.

2. Marking scripts:

(a) Mark scripts in red or a colour not used by the candidate.

(b) Mark deductions as (–1) or (–3) on the script where they occur.

(c) Show section marks in the right hand margin.

(d) Indicate attempt marks on the right margin as Att. 4, for example.

(e) Show total marks awarded for each question on the left hand margin near the start of the question and ring the mark.

(f) Worthless or irrelevant work should be marked 0.

(g) Scrutinise all pages and indicate by marking pages.

(h) Mark all questions, including cancelled non-repeated questions and allow the highest scoring answers.

3. Attempt Marks:

(a) If deductions result in a mark which is lower than the attempt mark, award the attempt mark.

(b) The attempt mark for a section is the final mark for that section and so a mark between 0 and the mark may not be awarded.

(c) The attempt mark must be awarded for any relevant work.

(d) Particular cases or verifications qualify for the attempt mark in general.

QUESTION 1

Each part **10 marks** **Att 4**

Part (i) **10 marks** **Att 4**

(i) Find $\sqrt{125}$, correct to one decimal place.

$\sqrt{125} = 11.18 =$ **11.2**

Blunders (-3)
B1: Square root mistaken for square (Ans. 15625)
B2: Square root mistaken for half (Ans. 62.5)

Slips (-1)
S1: If $125\sqrt{125} = 1397.54$
S2: Incorrect or omitted round-off
S3: Misplacing decimal point e.g. 1118 or 111.8

Misreadings (-1)
M1: $\sqrt{12.5} = 3.53$
M2: $\sqrt{1.25} = 1.11$
M3: $\sqrt{0.125} = 0.35$
M4: Misreading column in Tables e.g. $\sqrt{124} = 11.14$ or $\sqrt{126} = 11.22$

Attempts
Att: Writes 125^2 and stops
Att: Writes 125/2 and stops
Att: Writes 125×2 and stops
Att: Work at estimating answer

Part (ii) **10 marks** **Att 4**

(ii) Find $(2.7)^3$, correct to two decimal places.

$(2.7)^3 = 19.683 = \mathbf{19.68}$

Blunders (-3)
B1: Calculates (2.7)3; (Ans. 8.1)
B2: Calculates (2.7)/3; (Ans. 0.9)
B3: Third root calculated instead of power of 3; (Ans. 1.392)
B4: Interprets $(2.7)^3$ as 2.7×10^3; (Ans. 2700)
B5: Calculates $(2.7)^2$; (Ans. 7.29)

Slips (-1)
S1: Incorrect or omitted round off
S2: Misplacing decimal point

Misreadings (-1)
M1: Power other than 3 or 2 worked

Attempts
Att: Writes (2.7)3 and stops
Att: Writes 2.7/3 and stops
Att: Writes 2.7×10^3 and stops

Part (iii) **10 marks** **Att 4**

(iii) Find $\sqrt{40.5} + \sqrt{86.49}$, correct to the nearest whole number.

$\sqrt{40.5} + \sqrt{86.49} = 6.36 + 9.3 = 15.66 =$ **16**

Blunders (-3)
B1: Square root mistaken for square (Ans. 1640.25 and 7480.52)
B2: Square root mistaken for half (Ans. 20.25 and 43.245)
B3: Blunder in precedence
B4: Square root not found, each time

Slips (-1)
S1: Misplacing the decimal point, each time
S2: Incorrect or omitted round off
S3: Addition omitted

Misreadings (-1)
M1: Misplaced digits or misread numbers, each time
M2: Misplacing decimal point

Attempts
Att: Writes 40.5^2 or 86.49^2 and stops
Att: Writes 40.5/2 or 86.49/2 and stops
Att: Writes 40.5×2 or 86.49×2 and stops
Att: Work at estimating answer

Part (iv) **10 marks** **Att 4**

(iv) Find the value of $\frac{1}{0.025} - \frac{2^4}{0.625}$.

$$\frac{1}{0.025} - \frac{2^4}{0.625} = 40 - \frac{16}{0.625} = 40 - 25.6 = \mathbf{14.4}$$

or

$$\frac{1}{0.025} - \frac{2^4}{0.625} = \frac{1}{0.025} - \frac{16}{0.625} = \frac{0.625 - 16 \times 0.025}{0.025 \times 0.625} = \frac{0.625 - 0.4}{0.015625} = \mathbf{14.4}$$

Blunders (-3)
B1: Omits power – calculates 2/0.625 = 3.2
B2: Blunder in calculating fraction
B3: Each omitted or incorrect step of 3

Slips (-1)
S1: Misplacing decimal point, e.g. 1/0.025 = 4, each time
S2: Slip in subtraction

Misreadings (-1)
M1: Calculates power of 2 other than 4
M2: Reads + for – (Ans. 65.6)

Attempts
Att: Writes (1/0.025)× 100 and stops
Att: Writes 1 – 0.025 = 0.975

Part (v) **10 marks** **Att 4**

(v) Find 28% of €35.52, correct to the nearest cent.

€35.52 × 0.28 = €9.9456 = **€9.95**

Blunders (-3)
B1: Blunder in calculating percentage e.g 28% ≠ 0.28 or 28% ≠ 28/100
B2: Calculates 28% of 35 (Ans. €9.80)
B3: Calculates (35.52/28)100 (Ans. €126.857)
B4: Calculates (28/35.52)100 (Ans. €78.828)
B5: Calculates (28/35.52)/100 (Ans. €0.0078828)
B6: Calculates 1% of 35.52

Slips (-1)
S1: Misplacing decimal point in calculating
S2: Omitted or incorrect round off
S3: Numerical slips in calculation

Misreadings (-1)
M1: Misreading of digits, each time
M2: Calculates 128% (Ans. €45.4656)
M3: Calculates 72% (Ans. €25.5744)

Attempts
Att: Answer given is 35.52/28 or 28/35.52 and stops
Att: Writes 28/100 without working

Part (vi) **10 marks** **Att 4**

(vi) €1 is worth 120 Japanese yen.
Find, to the nearest euro, the value of 6250 Japanese yen.

$$\frac{6250}{120} = 52.08 = \textbf{€52}$$

Blunders (-3)
B1: Calculates 6250×120 (Ans. 750 000)
B2: Calculates 120/6250 (Ans. 0.0192)

Slips (-1)
S1: Incorrect or omitted round off
S2: Misplacing decimal point

Attempts
Att: Calculates 1/120 = 0.0083
Att: Calculates 1/6250 = 0.00016

Part (vii) **10 marks** **Att 4**

(vii) In a game, a person scored 183 points out of a possible maximum of 270. Express this score as a percentage, correct to two significant figures.

$$\frac{183}{270} \times 100 = 67.77 = \mathbf{68\%.}$$

Blunders (-3)
B1: Calculates 270/183 (Ans. 1.4754)
B2: Omits multiplication by 100
B3: Calculates 183 _ (270/100) (Ans. 494.1)

Slips (-1)
S1: Omitted or incorrect round off
S2: Misplacing decimal point in calculating

Misreadings (-1)
M1: Misreading of digits in number e.g. 180 or 273

Attempts
Att: Answer given is 183/270 or 270/183 and stops

Part (viii) **10 marks** **Att 4**

(viii) Find $\frac{2}{5} + \frac{3}{17}$, correct to two decimal places.

$\frac{2}{5} + \frac{3}{17} = 0.4 + 0.176 = 0.576 = \mathbf{0.58}$

or

$\frac{2}{5} + \frac{3}{17} = \frac{2\times17+3\times5}{5\times17} = \frac{34+15}{85} = \frac{49}{85} = 0.576 = \mathbf{0.58}$

Blunders (-3)

B1: Calculates 5/22 (Ans. 0.227)
B2: Calculates 34/15 or 15/34 (Ans. 2.266 or Ans. 0.441)
B3: Calculates 2/22 or 3/22 (Ans. 0.0909 or 0.136)
B4: Calculates 32/2 or 17/22 (Ans. 16 or 0.772)
B5: Inverting fraction e.g. 85/49 = 1.734
B6: Each step of three omitted

Slips (-1)

S1: Incorrect or omitted round off

Misreadings (-1)

M1: Reads × for + (Ans. 6/85 = 0.0705)

Attempts

Att: Writes 5/22 without further work
Att: Answer 14/15 or 35/51 or 15/17 or inverted
Att: Effort at "cross-multiplication"
Att: 2/5 + 3/17 => 2/5 = 3/17 => 34 = 15 => 34 +15
Att: Answer of 0.85 without work shown (other combinations worthless)
Att: Answer of 49

Part (ix) **10 marks** **Att 4**

(ix) Find, to the nearest hundred, the value of

$$\left(3.8\times10^{6} + 9.5\times10^{5}\right) \div 7.7\times10^{2}.$$

$\left(3.8\times10^{6} + 9.5\times10^{5}\right) \div 7.7\times10^{2}$ = (3 800 000 + 950 000) ÷ 770

= 4 750 000 ÷ 770 = 6168.8 = **6200**.

or

$\left(3.8\times10^{6} + 9.5\times10^{5}\right) \div 7.7\times10^{2} = \left(3.8\times10^{6} + 0.95\times10^{6}\right) \div 7.7\times10^{2}$

$= 4.75\times10^{6} \div 7.7\times10^{2} = 0.6168\times10^{4} =$ **62×10^{2}**

Blunders (-3)

B1: Blunders in dealing with scientific notation

B2: Blunders in order of precedence

B3: Each omitted or incorrect step, if slips not clear

B4: Blunder 3.8×60, once only

Slips (-1)

S1: Any number incorrect by factor of 10 when written in decimal form

S2: Omitted or incorrect round off

Attempts

Att: Some correct work, e.g. approximation with correct order of magnitude

Att: $\dfrac{3.8+9.5}{7.7} = 1.727$

Part (x) **10 marks** **Att 4**

(x) Find the value of

$$\frac{(25.3 + 4.7) \times 6.04}{22.8 - 11.7}$$

correct to three decimal places.

$$\frac{(25.3 + 4.7) \times 6.04}{22.8 - 11.7} = \frac{30 \times 6.04}{11.1} = \frac{181.2}{11.1} = 16.3243 = \mathbf{16.324}$$

Blunders (-3)
B1: Blunders in order of precedence, applied once
B2: Each omitted or incorrect step if slips not clear
B3: Fraction inverted (Ans. 0.0612)

Slips (-1)
S1: Omitted or incorrect round off
S2: Numerical slips, including misplacing decimal point – max. of 3

Misreading (-1)
M1: Uses + instead of $\times$ or $-$ instead of $\div$, each time

Attempt
Att: Some correct step
Att: Work at estimating answer

Note: $25.3 + (4.7 \times 6.04) \div 11.1 = 4.8367$
$(25.3 + 4.7) \div 22.8 - (6.04 \div 11.7) = 0.7795$
$25.3 \div 22.8 - (4.7 \_ 6.04 \div 11.7) = -1.3166$
$[(25.3 + 4.7) \times 6.04] \div 22.8 - 11.7 = -3.7526$

QUESTION 2

Part (a)	**10 marks**	**Att 4**
Part (b)	**25 marks**	**Att 10**
Part (c)	**15 marks**	**Att 6**

Part (a) **10 marks** **Att 4**

(a) A bag contains two books.
One has a mass of 1.3 kg and the other a mass of 750 g. Find their total mass.

1.3 + 0.75 = **2.05 kg**

or

1300 + 750 = **2050 g**

Blunders (-3)
B1: Incorrect conversion factor e.g. 750 g = 7.5 kg
B2: Writes 1000 ÷ 750 (Ans. 1.333)
B3: Adds without converting to get 751.3

Slips (-1)
S1: Misplacing decimal point in the addition
S2: Omits addition having converted one mass

Misreading (-1)
M1: Misreads digits

Attempt
Att: 1.3 + 750 or other indication of addition
Att: 750/1.3 or 750 × 1.3 or similar effort

Part (b) **25 (10 + 5 + 10) marks** **Att 10 (4 + 2 + 4)**

(b) A person worked a 43-hour week. The basic rate of pay for the first 35 hours was €7.20 per hour. Extra hours were paid at the overtime rate of 1.5 times the basic rate.
Find
(i) the total income for the first 35 hours
(ii) the overtime rate per hour
(iii) the total income for the 43 hours worked.

(i) Income €7.20 x 35 = **€252.00**
(ii) Overtime rate €7.20 x 1.5 = **€10.80**
(iii) Overtime worked is 43 – 35 = 8 hours
Overtime pay is €10.80 × 8 = €86.40
Total income is €252.00 + €86.40 = **€338.40**

Apply maximum of three slips if long multiplication used.

Section (i):
Blunders (-3)
B1: Writes 7.20×35 and stops
B2: Works 7×35 or 8×35 (Ans. 245 or 280)
Slips (-1)
S1: Misplacing decimal point
S2: Calculates 7.20×43 (Ans 309.6)
Attempts
Att: 35 $\pm$ 7.20, worked

Section (ii):
Blunders (-3)
B1: Writes 7.20×1.5 and stops
B2: Works 7×1.5 or 7.2×2 or 43×1.5 or 35×1.5 (Ans. 10.5, 14.4, 64.5, 52.5)

Section (iii):
Blunders (-3)
B1: Calculates 43×7.20 (Ans. 309.60)
B2: Calculates 43×10.80 (Ans. 464.40)
B3: Calculates 35×10.80 (Ans. 378)
B4: Calculates 7.20 + 1.5 = 8.70
Slips (-1)
S1: Incorrect calculation of number of hours of overtime
S2: Omits addition of €252.00 + €86.40
Attempts
Att: 7.2 + 10.80 or 7.2×10.8 or 9

Part (c) **15 (10 + 5) marks** **Att 6(4 + 2)**

(i) A car travels a distance of 220 km in 2 hours 45 minutes.
Find its average speed for the journey.

(ii) The next day, the car travels the same distance, with the [average] speed reduced by 10%.
Find, to the nearest minute, how much longer this journey takes.

(i) Average speed $= \frac{\text{distance}}{\text{time}} = \frac{220}{2.75} =$ **80 km per hour**

(ii) New speed $= 80 \times 0.9 = 72$

or

Reduction $= 80 \times 0.1 = 8.$ New speed $= 80 - 8 = 72$

Time $= \frac{\text{distance}}{\text{speed}} = \frac{220}{72} = 3.0555$ hours $=$ 3 hours 3 minutes

Takes 3 hours 3 minutes – 2 hours 45 minutes = **18 minutes longer**

Section (i)
Blunders (-3)
B1: Blunder in formula for speed
B2: Calculates 220×2.75 (Ans. 605)
B3: Calculates 2.75/220 (Ans. 0.0125)
B4: Calculates 165/220 (Ans. 0.75)
B5: Incorrect conversion of hours and minutes

Section (ii)
Blunders (-3)
B1: Blunder in formula for time
B2: Incorrect conversion of hours and minutes, if not penalised above
B3: Calculates time for journey but does not subtract
B4: Answer given as 0.3055 hours

Slips (-1)
S1: Early round-off of decimal
S2: Misplacing decimal point

Misreadings (-1)
M1: Increases speed by 10%

Attempts
Att: Effort at calculating time of journey
Att: Effort at calculating a speed

QUESTION 3

Part (a)	**10 marks**	**Att 4**
Part (b)	**20 marks**	**Att 8**
Part (c)	**20 marks**	**Att 8**

Part (a) **10 (5 + 5) marks** **Att 4 (2 + 2)**

(a) An estimate for repairing a CD player was €30.
The actual cost of the repair was €31.57.
Find
(i) the error in the estimate
(ii) the percentage error, correct to one decimal place.

(i) Error = 31.57 – 30 = **€1.57**

(ii) Percentage error = $\frac{1.57}{31.57} \times 100 = 4.97\% =$ **5.0%**

Blunders (-3)
B1: Takes 30 + 31.57 (Ans. 61.57)
B2: Blunders in percentages e.g. 31.57/1.57 (Ans. 20.10)
B3: Divides by 30 (Ans. 0.0523)

Slips (-1)
S1: Writes (30/31.57)× 100 = 95.0%
S2: Incorrect or omitted round-off

Attempts
Att: Writes 30/31.57 and stops (Ans. 0.950)
Att: Writes 31.57/30 and stops (Ans. 1.052)
Att: Writes 30× 31.57 and stops (Ans. 947.10)
Att: Writes 100/30 (Ans. 3.333)
Att: Writes 31.57× 100 or 31.57/100 or 100/31.57 (Ans. 3.167)
Att: Mean of 31.57 and 30 found (Ans. 30.785)

Part (b) **20 marks** **Att 8**

(b) €1250 is invested at 3.5% per annum compound interest.
Find, to the nearest euro, its value at the end of three years.

$A = €1250(1 + 0.035)^3 = €1250(1.035)^3 = €1250(1.1087)$
$= €1385.875 = €\mathbf{1386}$

or

Year 1: Principal €1250, Interest €43.75
Year 2: Principal €1293.75, Interest €45.28125
Year 3: Principal €1339.03, Interest €46.86605
Amount after 3 years €1385.90 = €**1386**

Blunders (-3)
B1: Blunder in calculating percentage e.g. 3.5% ≠ 0.035 or 3.5% ≠ 3.5/100
B2: Blunder in formula as written by student or incorrect formula
B3: Blunder in substituting into formula, once
B4: Takes $(1.035)^3 = (1.035)3 = 3.105$
B5: Takes $(1.035)^3 = 1.035/3 = 0.345$
B6: Writes $1250/(1.035)^3$ (Ans. 1127.446)
B7: Writes $1250/(0.965)^3$ (Ans. 1391.003)
B8: Writes $1250 \times (0.965)^3$ (Ans. 1123.290)

Slips (-1)
S1: Incorrect or omitted round off
S2: Numerical slips in calculation
S3: Incorrect principal used to calculate an annual interest, each time
S4: Final amount incorrect or not calculated

Misreadings (-1)
M1: $(1.035)^n$, $n = 2$ or $n \geq 4$ used in formula

Attempts
Att: $1250 \div 3.50 = 357.142$
Att: $1250 \times 3.50 = 4375$
Att: $1250 \div 0.035 = 35714.28$
Att: Interest not compounded i.e. simple interest (Ans. 1381.25)

Part (c) **20 (10 + 10) marks** **Att 8 (4 + 4)**

(c) A one-year old car is valued at €12 000. It has depreciated in value by 20% during the first year. What was its value when new?

If depreciation continues at 20% per annum, what will be its value when it is three years old?

80% of cost is €12 000

Cost $= \frac{12000}{80} \times 100 =$ **€15 000**

Value after two years is $12\,000 \times 0.8 =$ €9600

Value after three years is $9600 \times 0.8 =$ **€7680**

or

Value after three years is $12\,000(0.8)^2 = 12\,000(0.64) =$ **€7680**

Blunders (-3)

B1: Calculates 20% of 12 000 (Ans. €2400)
B2: Blunder in formula for depreciation, if used
B3: Takes $(0.8)^2 = 0.8 \_ 2$ or 0.8/2
B4: Takes $12\,000/(0.8)^2$ (Ans. €18 750)
B5: Takes $12\,000/(1.2)^2$ (Ans. €8333.33)
B6: Takes $12000 \_ 1.2^2$ (Ans. €17280)
B7: Depreciation not compounded for the two years

Slips (-1)

S1: Numerical slips
S2: Finds depreciation and stops
S3: Subtracts 20% (€3000) instead of adding

Misreadings (-1)

M1: Calculates 3 years, by formula, beginning with €12 000

Attempts

Att: Effort at calculating percentage of 12 000

QUESTION 4

Part (a)	**10 marks**	**Att 4**
Part (b)	**20 marks**	**Att 8**
Part (c)	**20 marks**	**Att 8**

Part (a) **10 marks** **Att 4**

(a) Solve $9x - 3 = 3x + 18$.

$9x - 3 = 3x + 18 \Rightarrow 9x - 3x = 18 + 3 \Rightarrow 6x = 21 \Rightarrow \boldsymbol{x = 3.5}$

Award full marks for a correct answer with no work shown

Blunders (-3)
B1: Blunders in grouping terms e.g. $9x - 3 = 6x$
B2: Each step omitted
B3: $6x = 21 \Rightarrow x = 15$ or $x = 27$ or $x = 126$

Slips (-1)
S1: Slips in signs on crossing "=", each time

Attempts
Att: Some correct step towards solution
Att: Stops after one transposition
Att: Effort at trial and error, by substitution

Part (b) **20 (15 + 5) marks** **Att 8 (6 + 2)**

(b) Solve the simultaneous equations

$$3x - 5y = 16$$
$$2x + y = 2.$$

$3x - 5y = 16 \quad \Rightarrow \quad 3x - 5y = 16$

$2x + y = 2 \quad \Rightarrow \quad 10x + 5y = 10$

$13x = 26 \quad \Rightarrow \quad \boldsymbol{x = 2}$

$2x + y = 2 \quad \Rightarrow \quad 4 + y = 2 \quad \Rightarrow \quad y = 2 - 4 \quad \Rightarrow \quad \boldsymbol{y = -2}$

First variable found: 15 marks, att 6; Second variable found: 5 marks, att 2

Blunders (-3)
B1: Blunder in multiplying equation by 5, or failing to multiply equation, once only
B2: Blunder in cancelling, once
B3: Blunder in substituting e.g. y value for x
B4: $13x = 26 \Rightarrow x = 13$ or $x = 39$ or $x = 338$

Slips (-1)
S1: Slips in signs

Random x picked, y calculated and stops - award 5 marks
Random x picked, y calculated and then y used to calculate an x value - award A6 + 5
Substitution of correct values in both equations – award A8
Substitution of correct values in both equations and verification shown – award 20

Attempts - First variable - Att 6
Att: Effort at equalising coefficients of x's or y's
Att: Effort at cancelling one variable

Attempts - Second variable - Att 2
Att: Effort at substituting first variable
Att: Effort at cancelling second variable

Attempts - Att 8
Attempt at finding a solution by trial and error

Worthless (0)
W1: Incorrect answers, no work shown

Part (c) **20 (10 + 5 + 5) marks** **Att 8 (4 + 2 + 2)**

(c) **(i)** Solve $5x - 1 \leq 14$.

(ii) Solve $4 - 3x \leq 7$.

(iii) Write down all the whole numbers, positive and negative, which satisfy both $5x - 1 \leq 14$ and $4 - 3x \leq 7$.

(i) $5x - 1 \leq 14 \Rightarrow 5x \leq 15 \Rightarrow \boldsymbol{x \leq 3}$

(ii) $4 - 3x \leq 7 \Rightarrow -3x \leq 3 \Rightarrow \boldsymbol{x \geq -1}$

(iii) **{–1, 0, 1, 2, 3}**

If equality used in parts (i) and (ii), no marks can be awarded for part (iii).
If equality used in parts (i) or (ii), award attempt mark at most for part (iii).

Blunders (-3)
B1: Blunder in grouping terms e.g. $5x - 1 = 4x$
B2: Blunder in direction of inequality when multiplying by "minus" in (ii)
B3: Blunder in transposing e.g. $4 - 3x \leq 7 \Rightarrow -3x \leq 7/4$
B4: Replaces inequality sign with equality sign, applied once

Slips (-1)
S1: Slips in signs on crossing inequality, each time
S2: Each value omitted in (iii)
S3: Each value outside range

Misreading (-1)
M1: Misreading direction of inequality
M2: Uses $<$ for $\leq$

Attempts
Att4: Some effort at rearranging terms
Att4: Substitutes in a value - trial and error
Att2: Any correct value listed in (iii)

Worthless (0)
W1: Incorrect answers, no work shown

QUESTION 5

Part (a)	**10 marks**	**Att 4**
Part (b)	**20 marks**	**Att 8**
Part (c)	**20 marks**	**Att 8**

Part (a) **10 (5 + 5) marks** **Att 4(2 + 2)**

(a) **(i)** Write down all of the whole number factors of 28.
(ii) Find the sum of these factors.

(i) **1, 2, 4, 7, 14, 28**
(ii) **1 + 2 + 4 + 7 + 14 + 28 = 56**

Section (i)
Slips (-1)
S1: Each omitted or incorrect factor

Attempts
Att: Any one correct value

Section (ii)
Accept sum of values given in (i) for award of marks
Slips (-1)
S1: Slips in addition

Attempts
Att: Attempt at adding numbers to give 28

Part (b) **20 marks** **Att 8**

(b) Solve the quadratic equation $2x^2 + 7x - 2 = 0$.
Give your answers correct to two decimal places.

$$2x^2 + 7x - 2 = 0 \Rightarrow x = \frac{-7 \pm \sqrt{49 - 4(2)(-2)}}{2(2)} = \frac{-7 \pm \sqrt{49+16}}{4} = \frac{-7 \pm \sqrt{65}}{4} \; *$$

$$\Rightarrow x = \frac{-7 \pm 8.062}{4} = \frac{1.062}{4} \; or \; \frac{-15.062}{4} \Rightarrow x = 0.2655 \; or \; -3.7655$$

$$\Rightarrow x = \mathbf{0.27} \quad \textbf{\textit{or}} \; \mathbf{-3.77}$$

* The maximum deductions for errors or omissions beyond this point is 7 marks.

Blunders (-3)
B1: Incorrect choice of variables *a, b, c* applied once
B2: Incorrect substitution into formula – refer S2 below
B3: Blunder in application of formula
B4: Omits $\pm$ in formula
B5: Each step omitted in completing work

Slips (-1)
S1: Slips in signs on substitution into formula, each time
S2: Incorrect sign on coefficient, applied each time

Attempts
Att: Effort at substitution into formula
Att: Incorrect formula with substitution
Att: Attempt at finding factors $(2x \quad)(x \quad)$
Att: If quadratic element eliminated (e.g. $4x + 7x - 2 = 0$) and attempts to solve

Part (c) **20 (10 + 10) marks** **Att 8**
(4 + 4)

(c) When 3 is subtracted from four times a certain number the result is the same as twice that number added to 10.

Let x represent this certain number and write this information as an equation in x.

Hence, solve the equation for x.

$4x - 3 = 10 + 2x$

$4x - 3 = 10 + 2x \Rightarrow 4x - 2x = 10 + 3 \Rightarrow 2x = 13 \Rightarrow \mathbf{x = 6.5}$

There must be an effort to set up equation in x, including 3 or 10, for the award of any of the first 10 marks.
For award of marks for solving – use candidate's equation.

Blunders (-3)
B1: Blunder in setting up equation e.g. $4 + x$ for $4x$
B2: Each omitted step of three steps, $4x$, $4x - 3$, $10 + 2x$

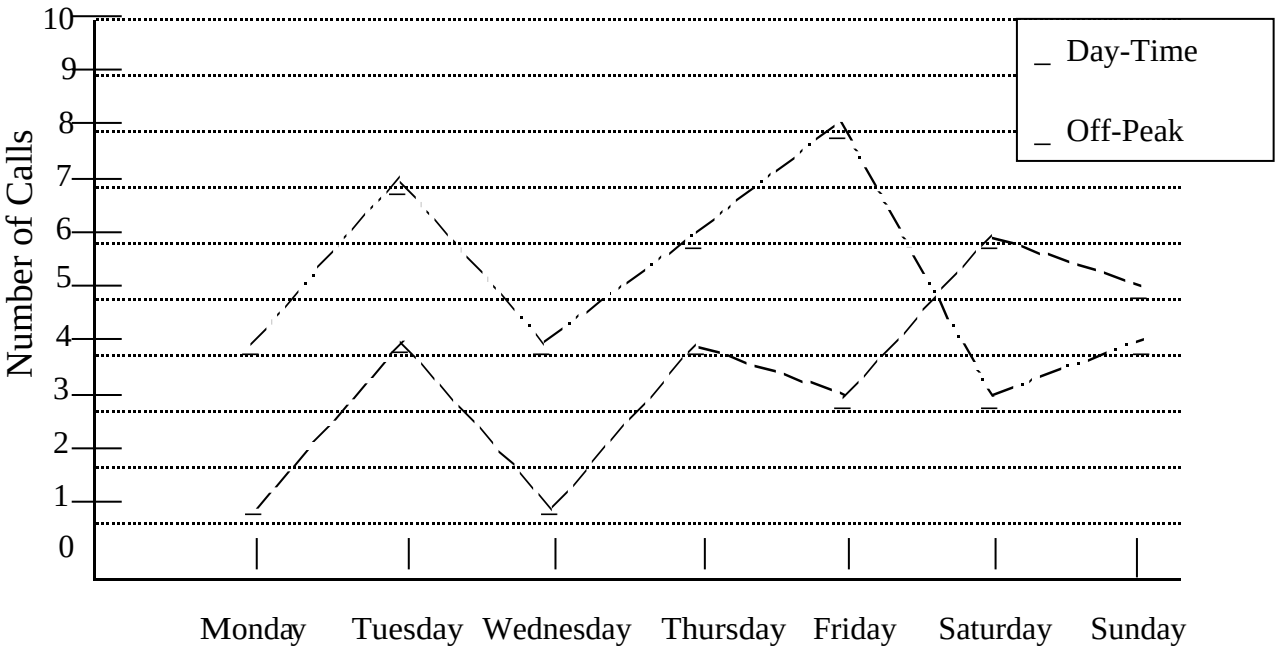
Slips (-1)
S1: Slips in signs

Attempts
Att: Set-up: Writes $4x$ or $x - 3$ and stops
Att: Effort at trial and error

QUESTION 6

Part (i)	**10 marks**	**Att 4**
Part (ii)	**10 marks**	**Att 4**
Part (iii)	**10 marks**	**Att 4**
Part (iv)	**10 marks**	**Att 4**
Part (v)	**10 marks**	**Att 4**

The graph below shows the number of calls made on a mobile phone during a seven-day period. Calls have been separated into two types: Day-Time and Off-Peak. For example, on Monday, one Day-Time call and four Off-Peak calls were made.



Part (i) **10 marks** **Att 4**

(i) How many Day-Time calls were made on Tuesday?

4 calls

Blunders (-3)
B1: Answer is 7
B2: Answer is 11

Attempts
Att: Answer is 1, 3, 5 or 6

Part (ii) **10 marks** **Att 4**

(ii) What is the total number of calls made over the seven days?

$(1 + 4 + 1 + 4 + 3 + 6 + 5) + (4 + 7 + 4 + 6 + 8 + 3 + 4) = 24 + 36 =$ **60**

Blunders (-3)
B1: Only Day-Time or Off-Peak calls taken

Slips (-1)
S1: Each omitted or incorrect value, max. of 3
S2: Incorrect or omitted addition, applies once

Attempts
Att: One correct value given
Att: Incorrect answer (except 24 or 36) with no work shown

Part (iii) **10 marks** **Att 4**

(iii) Over the seven days, what percentage of calls were Day-Time calls?

$\frac{24}{60} \times 100 = 0.4 \times 100 =$ **40%**

Accept candidate's total from (ii)
Blunders (-3)
B1: Off-Peak calls taken instead of Day-Time
B2: Other incorrect numerator without work shown
B3: Blunder in calculating percentage

Slips (-1)
S1: Each omitted or incorrect value in calculating numerator, max of 3

Attempts
Att: Some effort at finding percentage
Att: One correct value read

Part (iv) **10 marks** **Att 4**

(iv) On which days of the week were more than 10 calls made?

Tuesday, Friday

Blunders (-3)
B1: A correct day omitted

Slips (-1)
S1: Each incorrect day included

Attempts
Att: 0 days or no days given as answer

Worthless (0)
W1: No correct days listed

Part (v) **10 marks** **Att 4**

(v) Find the average number of calls made per day.

$\frac{60}{7} = \mathbf{8.6}$

Accept candidate's total from (ii)
Blunders (-3)
B1: Division by 14
B2: Numerator used is Day-Time or Off-Peak total
B3: Other incorrect numerator used with no work shown
B4: Incorrect formula for average

Slips (-1)
S1: Numerical slips
S2: Division not continued past a whole number

Attempts
Att: Indication that student knows how to find average
Att: Total calls divided by any number other than 7, 14

QUESTION 7

Graph	**30 marks**	**Att 12**
Values	**20 marks**	**Att 8**
Table	**20 marks**	**Att 8**
Graph	**10 marks**	**Att 4**

Draw the graph of the function

$$f: x \rightarrow 2x^2 - 5x + 2 \quad \text{for } -1 \leq x \leq 3, \quad x \in \mathbf{R}.$$

Blunders (-3)

B1: Additional line in table

B2: Blunder such as $2x^2 = (2x)^2$ or $4x$, or $2 = x + 2$ or $2 = x$ consistently across full line. Otherwise (-1) applied to each incorrect value in the line.

Slips (-1)

S1: Each incorrect or omitted value in body of table

S2: Each incorrect or omitted *f(x)* value, calculated from candidate's work

S3: Error in sign applied consistently across a line

Attempts:

Att: Any four correct calculated values in the table or in function form.

Plotting Graph:

Accept candidate's values in table for plotting points.

Blunders (-3)

B1: Points joined in incorrect order

B2: Blunders in scales on axes, including reversing + and –.

Slips (-1)

S1: Each point plotted incorrectly, using candidate's values

S2: Each pair of successive points not joined, maximum of 3

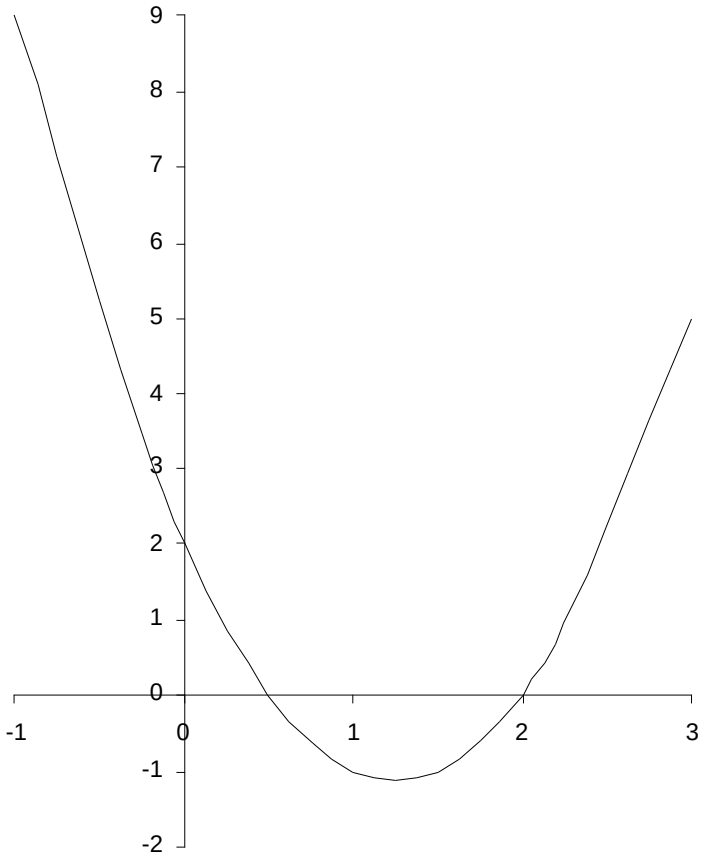
S3: Points joined by line segments in the correct order

S4: Axes reversed.

Attempts:

Att: Any two of candidate's points plotted.

x	-1	0	1	2	3
$2x^2$	2	0	2	8	18
$-5x$	5	0	-5	-10	-15
$+2$	2	2	2	2	2
$f(x)$	9	2	-1	0	5



Values **20 (5 + 5 + 5 + 5) marks** **Att 8 (2 + 2 + 2 + 2)**

Use your graph to find as accurately as possible

(i) $f(0.5)$

(ii) the values of x for which $f(x) = 3$

(iii) the minimum (least) value of $f(x)$

(iv) the range of values of x for which $f(x)$ is decreasing.

(i) $f(0.5) =$ **0**

(ii) $f(x) = 3$ for $x = -$ **0.2** or $x =$ **2.7**

(iii) Minimum value of $f(x) =$ **−1.1**

(iv) $f(x)$ decreasing for **$-1 \leq x < 1.2$**

Accept candidate's value from graph for award of marks
Allow tolerance in reading values of $\pm$ 0.2

Blunders (-3)
B1: Each value outside the tolerance
B2: Only one value given in part (ii)

Misreadings (-1)
M1: Misreads the value of x corresponding to the minimum of $f(x)$
M2: Misreads increasing for decreasing

Attempts
Att: Effort at reading values from graph
Att: For solving equation algebraically, correctly.