CATHOLIC SECONDARY SCHOOLS ASSOCIATION OF NSW

2011 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

GENERAL MATHEMATICS – MARKING GUIDELINES/SOLUTIONS

Section 1
22 marks

Question 1 – Question 22 (1 mark each)

Question	Answer	Content	Syllabus Assessed	Targeted Performance Bands
1	D	FM1: Earning money	P2	2-3
2	A	AM2: Modelling linear relationships	P5	2-3
3	D	DA5: Interpreting sets of data	H4	2-3
4	C	M2: Applications of area and volume	P2	2-3
5	D	DA7: Correlation	H4, H5	2-3
6	D	FM5: Annuities and loan repayments	H2	2-3
7	B	DA3:Displaying single data sets	P2	3-4
8	D	PB2: Relative frequency and probability	P11	3-4
9	C	DA6: The normal distribution	H9	3-4
10	A	AM4: Modelling linear and non-linear relationships.	H11	3-4
11	B	PB4: Applications of probability	H10	3-4
12	A	M7: Spherical geometry	H2, H7	4-5
13	C	FM4: Credit and borrowing	P8	4-5
14	A	M6: Applications of trigonometry	H6, H7	3-4
15	C	PB3: Multi-stage events	H10	4-5
16	A	DA4: Summary statistics	P9	4-5
17	C	M1: Units of measurement	P2	3-4
18	B	FM4 : Credit and borrowing	H8	4-5
19	A	M5: Further applications of area and volume	H1, H6, H7	4-5
20	B	FM6: Depreciation	H8	5-6
21	B	M1: Units of measurement	P7	5-6
22	C	AM3: Algebraic skills and techniques	H2	5-6

Section II

Question 23

(a) (2 marks)

Content: M1: Units of Measurement, M3: Similarity of two-dimensional figures
Outcomes assessed: P2, P7
Targeted Performance Bands: 2-3

Solution	Criteria	Marks
$250\,000 \times 6{\cdot}2 = 1\,550\,000$ cm Kilometres = 15.5 km	**2 marks** for correct answer **1 mark** for correct use of scale	2

(b) (i)(1 mark)

Content: DA2: Data collection and sampling
Outcomes assessed: P9
Targeted Performance Bands: 2-3

Solution	Criteria	Mark
Discrete as we can count the number of goals.	**1 mark** for correct answer	1

(b) (ii) (1 mark)

Content: DA4: Summary statistics
Outcomes assessed: P2, P7
Targeted Performance Bands: 3-4

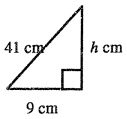
Solution	Criteria	Mark
$\sigma_n = 1.51\,(1.51325...)$	**1 mark** for correct answer No penalty for rounding.	1

(b) (iii) (1 mark)

Content: DA4: Summary statistics
Outcomes assessed: H2, H4, H9, H11
Targeted Performance Bands: 3-4

Solution	Criteria	Mark
Matthew was more consistent because his standard deviation is lower.	**1 mark** for a statement that includes the standard deviation. Consideration must be given for an incorrect answer in ii)	1

(c) (i) (1 mark)
Content: M4: Right angled triangles
Outcomes assessed: P2, P6
Targeted Performance Bands: 2-3

Solution	Criteria	Mark
 $41^2=h^2+9^2$ $h^2=1600$ $h = 40$ cm	**1 mark** for correct working	1

(c) (ii) (1 mark)
Content: M2: Applications of area and volume
Outcomes assessed: P2, P6, P7
Targeted Performance Bands: 3-4

Solution	Criteria	Mark
Volume $= \frac{1}{3}\times 18\times 18\times 40$ $= 4\,320\ \text{cm}^3$ Capacity = 4320 mL	**1 mark** for correct capacity Ignore units	1

(d) (i) (1 mark)
Content: FM3: Taxation
Outcomes assessed: P8
Targeted Performance Bands: 2-3

Solution	Criteria	Mark
$52000+435-1500$ $=\$50935$	**1 mark** for correct working	1

(d) (ii) (1 mark)
Content: FM3: Taxation
Outcomes assessed: P8
Targeted Performance Bands: 3-4

Solution	Criteria	Mark
$10150+(50935-35000)\times 0.30$ $=\$14930.50$	**1 mark** for correct answer	1

(d) (iii) (2 marks)

Content: FM3: Taxation

Outcomes assessed: P2, P8

Targeted Performance Bands: 3-4

Solution	Criteria	Marks
$\$80000-\$35000$ $=\$45000$ $\$45000\times0.30=\$13500$ $\$13500+\$10150=\$23650$	**2 marks** for correct answer **1 mark** for significant progress (getting \$13500)	2

(e) (2 marks)

Content: M5: Further applications of area and volume

Outcomes assessed: H2, H6

Targeted Performance Bands: 3-4

Solution	Criteria	Marks
$\text{Arc} = 2\times\pi\times90\times\frac{125}{360}$ $= 196{\cdot}35$ m $\therefore \text{Perimeter} = 90 + 90 + 196{\cdot}35$ $= 376{\cdot}35$ m	**2 marks** for correct answer **1 mark** for arc length No penalty for rounding	2

Question 24

(a) (1 mark)

Content: DA7: Correlation

Outcomes assessed: H1

Targeted Performance Bands: 3-4

Solution	Criteria	Mark
Measures the strength of the relationship between TWO variables.	**1 mark** for mentioning strength between TWO things	1

(b) (i) (1 mark)

Content: DA4: Summary statistics

Outcomes assessed: P2, P4

Targeted Performance Bands: 3-4

Solution	Criteria	Mark
Mode = 4 televisions	**1 mark** for correct answer	1

(b) (ii) (2 marks)

Content: DA4: Summary statistics

Outcomes assessed: P2, P4

Targeted Performance Bands: 4-5

Solution	Criteria	Marks
$0 + 1\times4 + 2\times8 + 3\times3 + 4\times9 = 65$ Mean = $65 \div 25 = 2.6$	**2 marks** for correct answer **1 mark** for correctly adding up numbers or finding there are 25 numbers	2

(b) (iii) (1 mark)

Content: DA3: Displaying single data sets

Outcomes assessed: H2, H6

Targeted Performance Bands: 3-4

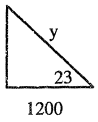
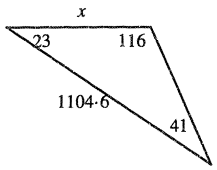
Solution	Criteria	Mark
Natasha would need to have THREE or more TV's to enable to median to increase. (Must have more than the median which is 2)	**1 mark** for correct statement	1

(c) (3 marks)

Content: M6: Applications of trigonometry

Outcomes assessed: H2, H6

Targeted Performance Bands: 4-5

Solution	Criteria	Marks
 $\cos 23° = \frac{1200}{y}$ $y = 1\,303{\cdot}6$ m (1.d.p)  $\frac{x}{\sin 41} = \frac{1303.6}{\sin 116}$ x = 952 (nearest metre)	**3 marks** for correct answer **2 marks** for finding a side and an attempt at sine rule **1 mark** for correctly finding a side in one triangle or correctly working out all angles No penalty for rounding	3

(d) (i) (1 mark)

Content: FM4: Credit and borrowing

Outcomes assessed: H5, H8

Targeted Performance Bands: 2-3

Solution	Criteria	Mark
$0.20 \times 1200 = \$240$	**1 mark** for correct answer	1

(d) (ii)(2 marks)

Content: FM4: Credit and borrowing

Outcomes assessed: H5, H8

Targeted Performance Bands: 3-4

Solution	Criteria	Marks
$240+36\times40$ $=\$1680$	**2 marks** for correct answer **1 mark** for progress (36 x 40)	2

(d) (iii)(2 marks)

Content: FM4: Credit and borrowing

Outcomes assessed: H5, H8

Targeted Performance Bands: 4-5

Solution	Criteria	Marks
$I = 1680 - 1200$ $= 480$ $P = 1200 - 240$ $= 960$ $I = \Pr n$ $480 = 960 \times r \times 3$ $r\% = \frac{480}{2880} \times 100$ $= 16.7\%$	**2 marks** for correct answer **1 mark** for progress (finding I or P) No penalty for rounding	2

Question 25

(a) (2 marks)

Content: FM5: Annuities and loan repayments

Outcomes assessed: H5, H8

Targeted Performance Bands: 3-4

Solution	Criteria	Marks
$A = 1500\left\{\frac{(1+0.06)^5 - 1}{0.06}\right\}$ $= \$8455.64$ n=5 I=6 PV=0 FV = \$8455.64 PMT=-1500 FV = ? P/Y=1 C/Y =1	**2 marks** for correct answer **1 mark** for progress (correct substitution)	2

(b) (i) (1 mark)

Content: AM4: Modelling linear and non-linear relationships

Outcomes assessed: H3, H5

Targeted Performance Bands: 3-4

Solution	Criteria	Mark
Line B represents the income received from selling the books.	**1 mark** for a statement about income	1

(b) (ii) (1 mark)

Content: AM4:Modelling linear and non-linear relationships

Outcomes assessed: H3, H5

Targeted Performance Bands: 3-4

Solution	Criteria	Mark
The lines crossing indicate the break-even point, the point where the student makes just enough money to cover his expenses.	**1 mark** for logical statement about break-even point	1

(b) (iii) (1 mark)

Content: AM4: Modelling linear and non-linear relationships

Outcomes assessed: H3, H5

Targeted Performance Bands: 2-3

Solution	Criteria	Mark
\$1000 – \$750 = \$250	**1 mark** for approximate answer	1

(c) (1 mark)

Content: FM2: Investing money

Outcomes assessed: P8

Targeted Performance Bands: 3-4

Solution	Criteria	Mark
$\frac{0.32}{4.34} \times 100$ $= 7.4\%$	**1 mark** for correct answer. No penalty for rounding.	1

(d) (3 marks)

Content: DA5: Interpreting sets of data

Outcomes assessed: H4, H9

Targeted Performance Bands: 4-5

Solution	Criteria	Marks
<table><tr><th></th><th>*Before*</th><th>*After*</th></tr><tr><td>Shape</td><td>Positively</td><td>Symmetrical</td></tr><tr><td>Spread (Range)</td><td>30</td><td>48</td></tr><tr><td>Location (Median)</td><td>28</td><td>40.5</td></tr></table>	**3 marks** for complete answer **2 marks** for 2 correct measures **1 mark** for each correct measure (shape, spread, location) Can use mean/IQR	3

(e) (i) (1 mark)
Content: PB2: Relative frequency and probability
Outcomes assessed: P10
Targeted Performance Bands: 2-3

Solution	Criteria	Mark
P(winning a prize) $= \frac{1}{3}$	**1 mark** for correct answer	1

(e) (ii) (2 marks)
Content: PB4: Applications of probability
Outcomes assessed: H10
Targeted Performance Bands: 4-5

Solution	Criteria	Marks
$FE = \left(\frac{1}{6} \times 10\right) + \left(\frac{1}{6} \times 5\right) - \left(\frac{4}{6} \times 3\right)$ $= \$0.50$	**2 marks** for correct answer **1 mark** for showing evidence of understanding financial expectation	2

(e) (iii) (1 mark)
Content: PB4: Applications of probability
Outcomes assessed: H10, H11
Targeted Performance Bands: 4-5

Solution	Criteria	Mark
No as she will expect to lose money.	**1 mark** for correct reason	1

Question 26

(a) (2 marks)

Content: AM1: Basic algebraic skills

Outcomes assessed: P3

Targeted Performance Bands: 2-3

Solution	Criteria	Marks
$x(x+6)-3(4-x)=x^2+6x-12+3x$ $=x^2+9x-12$	**2 marks** for correct expression **1 mark** for correct expansion with errors in simplification	2

(b) (i) (1 mark)

Content: FM6: Depreciation

Outcomes assessed: H5

Targeted Performance Bands: 3-4

Solution	Criteria	Mark
About 4 ½ years	**1 mark** for correct answer	1

(b) (ii) (1 mark)

Content: FM6: Depreciation

Outcomes assessed: H5, H8

Targeted Performance Bands: 3-4

Solution	Criteria	Mark
\$60 000	**1 mark** for correct answer – scale is important (No mark for \$60)	1

(b) (iii) (1 mark)

Content: FM6: Depreciation

Outcomes assessed: H8

Targeted Performance Bands: 4-5

Solution	Criteria	Mark
\$25 000	**1 mark** for correct answer	1

(b) (iv) (1 mark)

Content: AM2: Modelling linear relationships

Outcomes assessed: P5

Targeted Performance Bands: 4-5

Solution	Criteria	Mark
$S=150000-25000N$	**1 mark** for correct answer (no penalty for Y =150000-25000X)	1

(c) (i) (2 marks)
Content: DA6: The normal distribution
Outcomes assessed: H4, H5, H9
Targeted Performance Bands: 4-5

Solution	Criteria	Marks
100-68=32 32÷2=16 16% ×975 = 156	**2 marks** for correct answer **1 mark** for correct percentage	2

(c) (ii) (1 mark)
Content: DA6: The normal distribution
Outcomes assessed: H5, H9, H11
Targeted Performance Bands: 4-5

Solution	Criteria	Mark
The fisherman's statement is probably not valid. 3 standard deviations above the mean is 5kg. Although not impossible, it is highly unlikely that a fish would weigh 6.5 kg.	**1 mark** for correct answer with explanation	1

(d) (i) (1 mark)

Content: AM4: Modelling linear and non-linear relationships

Outcomes assessed: H5, H11

Targeted Performance Bands: 4-5

Solution	Criteria	Mark
$d = kt^2$	**1 mark** for correct answer	1

(d) (ii) (2 marks)

Content: AM4: Modelling linear and non-linear relationships

Outcomes assessed: H5, H11

Targeted Performance Bands: 4-5

Solution	Criteria	Marks
If $d = 100$ when $t = 5$ then : $100 = 25k$ $k = 4$ After 8 seconds: $d = 4x8^2$ $= 256$ metres	**2 marks** for correct answer **1 mark** for correct value of k	2

(d) (iii) (1 mark)

Content: AM4: Modelling linear and non-linear relationships

Outcomes assessed: H5, H11

Targeted Performance Bands: 4-5

Solution	Criteria	Mark
$400 = 4t^2$ $t^2 = 100$ $t = 10$ seconds	**1 mark** for correct answer	1

Question 27

(a) (i) (2 marks)

Content: DA5: Interpreting sets of data

Outcomes assessed: H2

Targeted Performance Bands: 2-3

Solution	Criteria	Marks
A = 14 B = 140	**2 marks** for correct answers **1 mark** for each correct answer	2

(a) (ii) (1 mark)

Content: DA5: Interpreting sets of data

Outcomes assessed: H2

Targeted Performance Bands: 2-3

Solution	Criteria	Mark
$\frac{64}{90}=\frac{32}{45}$	**1 mark** for correct answer	1

(a) (iii) (1 mark)

Content: DA5: Interpreting sets of data

Outcomes assessed: H2

Targeted Performance Bands: 5-6

Solution	Criteria	Mark
This only takes into account one month and only 1 hospital and so the statement may or may not be true in any other month.	**1 mark** for a discussion justifying your answer	1

(b) (i) (2 marks)

Content: PB3: Multi-stage events

Outcomes assessed: H11

Targeted Performance Bands: 3-4

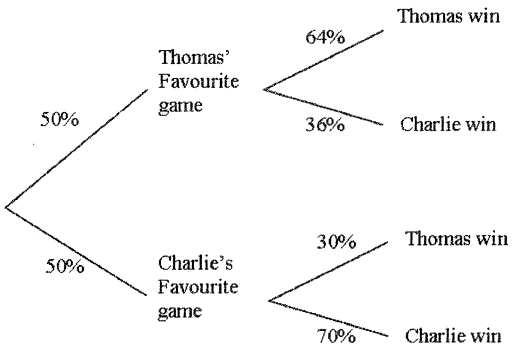
Solution	Criteria	Marks
$0.3\times0.3\times0.3=0.027$	**2 marks** for correct answer **1 mark** for identifying correct probability for 1 game (0.3) OR use incorrect probability but still multiply correctly	2

(b) (ii) (1) (2 marks)

Content: PB3: Multi-stage events

Outcomes assessed: H10

Targeted Performance Bands: 4-5

Solution	Criteria	Marks
	**2 marks** for correct probability tree **1 mark** for showing some progress towards correct answer	2

(b) (ii) (2) (1 mark)

Content: PB3: Multi-stage events

Outcomes assessed: H10

Targeted Performance Bands: 4-5

Solution	Criteria	Mark
$P(Thomas) = 0.5 \times 0.64 + 0.5 \times 0.3$ $= 0.47$	**1 mark** for correct answer	1

(c) (i) (2 marks)

Content: FM5: Annuities and loan repayments

Outcomes assessed: H8

Targeted Performance Bands: 4-5

Solution	Criteria	Marks
$300000 = M\left\{\dfrac{(1+0.01)^{300}-1}{0.01(1+0.01)^{300}}\right\}$ $M = \dfrac{300000}{94.94655125}$ $= \$3159.67$	**2 marks** for correct working **1 mark** for correct rate and term	2

(c) (ii) (2 marks)

Content: FM5: Annuities and loan repayments

Outcomes assessed: H2 H5, H8,

Targeted Performance Bands: 5-6

Solution	Criteria	Marks
$N = 3159.67\left\{\dfrac{(1+0.01)^{180}-1}{0.01(1+0.01)^{180}}\right\}$ $= \$263268.96$ OR n=120 I=12 PV=300000 PMT=-3159.67 FV = ? P/Y=12 C/Y =12 FV = \$263 269.72	**2 marks** for correct answer **1 mark** for progress towards answer	2

Question 28

(a) (2 marks)

Content: AM3: Algebraic skills and techniques

Outcomes assessed: H3

Targeted Performance Bands: 4-5

Solution	Criteria	Marks
$3AP \div 6P^2 = \frac{A}{2P}$	**2 marks** for correct answer **1 marks** for progress towards answer	2

(b) (i) (1 mark)

Content: M7: Spherical geometry

Outcomes assessed: H6, H7

Targeted Performance Bands: 4-5

Solution	Criteria	Mark
Angular distance = 4 + 14 = 18 Nautical Miles = 18 × 60 = 1080 (or 2000.16 km)	**1 mark** for correct answer	1

(b) (ii) (2 marks)

Content: M7: Spherical geometry

Outcomes assessed: P6, H6

Targeted Performance Bands: 5-6

Solution	Criteria	Marks
48 hours = 2 days to sail Time difference = 18 × 4 = 72 minutes difference Nauru = Thursday 6:48am	**2 marks** for correct answer **1 mark** for correct time or day	2

(c) (i) (2 marks)

Content: M5: Further Applications of area and volume

Outcomes assessed: H2, H6

Targeted Performance Bands: 4-5

Solution	Criteria	Marks
Area $= \frac{h}{3}(0+4\times19+110)+\frac{h}{3}(110+4\times96+58)$	**2 marks** for Simpson's Rule involving 2 applications **1 mark** for correct use of at least one application of Simpson's Rule	2

(c) (ii) (2 marks)

Content: AM3: Algebraic skills and techniques

Outcomes assessed: H2, H3, H7

Targeted Performance Bands: 5-6

Solution	Criteria	Marks
$\text{Area of Land} = \frac{h}{3}(0+4\text{x}19+110)+\frac{h}{3}(100+4\text{ x }96+58)$ $=\frac{h}{3}(186)+\frac{h}{3}(552)$ $=62h+184h$ $11070=246h$ $h=45m$	**2 marks** for finding the value of h **1 mark** for work towards solving equation	2

(d) (i) (2 marks)

Content: M6: Applications of trigonometry

Outcomes assessed: H2, H6, H7

Targeted Performance Bands: 5-6

Solution	Criteria	Marks
$\cos\theta = \frac{(4a)^2+(2a)^2-(3a)^2}{2(4a)(2a)}$ $=\frac{11a^2}{16a^2}$ $\theta = 47°$	**2 marks** for correct manipulation of cosine rule **1 mark** for attempt at cosine rule.	2

(d) (ii) (1 mark)

Content: M6: Applications of trigonometry

Outcomes assessed: H2, H6

Targeted Performance Bands: 4-5

Solution	Criteria	Mark
$A = \frac{1}{2} \times 2a \times 4a \times \sin 47^\circ$ $= 4a^2 \sin 47°$	**1 mark** for correct answer	1

(d) (iii) (1 mark)

Content: M6: Applications of trigonometry

Outcomes assessed: H6, H7, H11

Targeted Performance Bands: 5-6

Solution	Criteria	Mark
The area will be FOUR times larger.	**1 mark** for correct answer	1

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