Mathematical Methods Exam 2 – MA113

2025 VCE Assessment Guide

VCAA Marking Policies and Procedures

Consistency of Marking

The Assessment Guide indicates the basis for awarding marks for each item. This may involve either counting correct answers/features of a response or marking holistically, whereby making a judgement about the overall quality/qualities of a response.

The Assessment Guide will demonstrate how marks are to be awarded for a response, not where or how marks are to be deducted. The Assessment Guide will address specific examples and relevant application where appropriate. The following provides a checklist that all assessors should follow for consistent approaches to marking VCE external examinations.

Assessors should contact the Chief Assessor in cases where they believe that by following any of the directions below, a student will not be marked fairly.

Assessors must use the final version of the Assessment Guide as confirmed at the end of the Assessor Training Meeting.

Concern	Advice
Responses 'off task' or contradictory	A response that does not address the subject of the question cannot be awarded any marks. If contradictory responses are given (i.e.: the response conflicts with earlier comments or working out) full marks cannot be awarded.
Responses not addressed in the Assessment Guide	Assessors should refer the matter to the Chief Assessor for determination.
Spelling	Unless otherwise instructed in the Assessment Guide (i.e.: as part of a criteria), incorrect spelling should not affect the scoring of a student's response.
Specified Number of Examples/Reasons	Where a student provides more than the required number, the assessor should only assess the required number of responses. These should be assessed in the order in which they appear.
Working Out	Where a question explicitly requires the student to show working out, and this is specified in the examination instructions or in the question, full marks should be awarded if: • The response is correct and the working out is correct • Two sets of working out are shown, both attempts are correct, and the answer is correct

	Where a question explicitly requires the student to show working out, partial marks should be awarded for correct completion of key steps required to produce the correct answer.
Consequential Errors	Where a question requires a series of sequential steps to arrive at the correct response, the Assessment Guide will allocate marks for the key steps required to produce the correct response. In these cases, the effect of a consequential error on a subsequent response will be considered.
Half Marks	Half marks must not be awarded for a response or carried over to subsequent questions.
Crossing Out	If a student response has been crossed out, the part crossed out should not be considered. If the entire response is crossed out, this is awarded zero ('0').
Modules	Where a student responds to more modules than required, the assessor must assess all responses.
Options	Where a student responds to more than one option, the assessor must assess all responses according to the criteria in the Assessment Guide and award the student the highest score, indicating the option selected.
Not Attempted vs Zero (0)	Where a student has **not made a genuine attempt** to respond to the question, assessors should score the response as 'Not Attempted'. This may include: • Blank responses • 'I don't know' • Repeating the question, task, source material, or any other text directly from the examination • A response with no relevance to the question Where a student **has made a genuine attempt** to respond to the question, assessors should score the response as '0' (zero) where: • The student has crossed out their whole response or • The student's response does not meet the assessment criteria to be awarded any marks

Student Concern

Occasionally, assessors encounter a response that may raise concerns about the welfare of the student. Examples may include:

- suggestions or claims of abuse or neglect
- indications of distress, self-harm or suicidal tendencies
- threats of violence, harm, or criminal acts involving others.

In such cases, assessors should assess the student work in accordance with the Assessment Guide and send the student script/item to be reviewed according to the instructions on the next page.

Any matter of concern that an assessor believes requires urgent attention should be referred to the VCAA immediately via call to the VCAA Helpdesk: 1800 820 122.

Sending Student Responses to Review

During marking, assessors may identify student responses to be escalated for review by the Chief Assessor or to be noted by VCAA staff. The review categories are:

Category	To be used when:
Assessment guide	There is confusion of how to mark this item.
Image problem	The item cannot be viewed properly, i.e.: folded page, blurry, too faint to read, etc. This is **not** for responses that are difficult to read due to handwriting.
Incomplete student work	The student appears to be missing part of their response or has indicated it continues in another area that is not attached.
Incorrect writing task	The item is in the wrong place in marking platform, or the student has written in the wrong place, i.e.: response to Q5b is written in Q5a.
Student concern	There are concerns for the student's welfare.

Below are some examples of issues and corresponding actions to take:

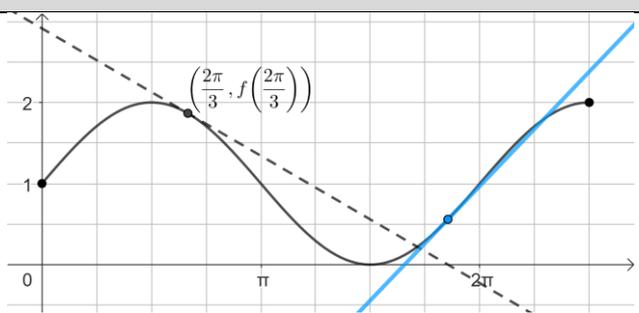| Issue	Action
Evidence of student distress or concern. **Note:** Student concern does not include unfinished work or work that is off-task.	Assess the student response using the Assessment Guide. Send the student response for review, selecting the 'student concern' review category.
The student's handwriting is too faint to read, and you are unable to read and score the student response accurately. **Note:** Some student responses may include different handwriting or typed responses. This is usually due to Special Examination Arrangements and therefore does not need to be reported to the VCAA.	Make every effort to read the student's work. If unable to read the response, send the script for review, selecting the 'illegible response' review category.
The student's response appears to be unfinished, or they have indicated their response continues on another page that is not attached.	Refer to the Assessment Guide and score this as the student's response, and send the student response for review, selecting 'incomplete student work' review category.
The control of the mechanics of language is not sufficient to communicate a coherent response.	Refer to the Assessment Guide and score this as the student's response. You may contact the Chief Assessor for advice on how best to score the response.
Responses in Languages other than English	Unless otherwise stated, responses in a language other than English should be scored zero (0).

Marking Guide

Q1	Marks	Solutions	Mark allocation and notes
1a.	2	(0,0) and (1,1)	A – (0,0) , A (1,1) (2 correct *x* values 1 mark)
1b.	2		A – intercepts (0,0) and $\left(\dfrac{4}{3},0\right)$ A – local max at (1,1) and graph shape
1c.	2	One possible way to complete the table is: 	x	-1	0	$\dfrac{1}{2}$	 |---|---|---|---| 	$g'(x)$	24	0	$\dfrac{3}{2}$		A – middle column has $x=0$ and $g'(x)=0$ A – left column has a -ve *x* value and a +ve gradient, right column has an *x* value in the interval $(0,1)$ and a +ve gradient.
1d.	2	$\dfrac{1}{2-0}\displaystyle\int_0^2 g(x)\,dx$ $=-\dfrac{8}{5}$	M – allow a missing *dx*. A
1e.	3	1. Reflect in *y*-axis 2. Dilate by factor 2 from *y*-axis <u>3. Translate 1 unit right</u> 1. Dilate by factor 2 from y-axis 2. Translate 1 unit left <u>3. Reflect in *y*-axis </u> 1. Reflect in *y*-axis 2. Translate 0.5 units right <u>3. Dilate by factor 2 from *y*-axis </u> 1. Translate 0.5 units left 2. Dilate by factor 2 from *y*-axis 3. Reflect in *y*-axis	A – reflect in *y*-axis (anywhere) A – dilate by factor 2 from *y*-axis (anywhere) A – 3 correct transformations in a correct order There are other answers.
1f.	2	$\Pr(X \geq 3)$ $=\Pr(X=3)+\Pr(X=4)$ $=4p^3(1-p)+p^4$ $=4p^3-3p^4$ $=g(p)$	M – evidence of binomial formula with either $\Pr(X=3)=4p^3(1-p)$ or $\Pr(X=4)=p^4$ M – complete algebraic working to *show that* $\Pr(X \geq 3)=4p^3-3p^4$

Q2	Marks	Solutions	Mark allocation and notes
2a.	3	$1 = Ae^{-12k}$ ...(1) , $8 = Ae^{2k}$ ...(2) Divide (2) by (1): Sub back into (1): $8 = e^{14k}$ $1 = Ae^{-12\left(\frac{3}{14}\log_e(2)\right)}$ $14k = \log_e(8)$ $1 = Ae^{\frac{-18}{7}\log_e(2)}$ $14k = 3\log_e(2)$ $k = \frac{3}{14}\log_e(2)$ $1 = A \times 2^{\frac{-18}{7}}$ $A = 2^{\frac{18}{7}}$	A – simultaneous equations M – for $14k = \log_e(8)$ or equivalent M – substitution and more correct steps of algebraic working to find *A*.
2b.	1	$b = \frac{3}{14}$ (accept $\frac{k}{\log_e(2)}$)	A – $0.2\overline{142857}$
2c.	2	$\int_{-12}^{2} f(x) - g(x)\,dx$ OR $\int_{-12}^{2} \frac{x}{2} + 7 - Ae^{kx}\,dx$ OR $\int_{-12}^{2} \frac{x}{2} + 7 - 2^{\frac{3x}{14}+\frac{18}{7}}\,dx$ OR $\frac{14}{2}(1+8) - \int_{-12}^{2} Ae^{kx}\,dx$ = 15.87	M – correct method involving definite integral, allow missing *dx* A – 15.8719…
2d.i.	1	$\frac{1}{2} - \frac{6\ln(2)}{7}2^{\frac{3x}{14}+\frac{4}{7}} = \dfrac{-\left(12 \cdot 16^{\frac{1}{7}} \cdot 2^{\frac{3x}{14}} \ln(2) - 7\right)}{14}$	A – accept equivalent forms $\frac{1}{2} - Ake^{kx}$
2d.ii.	1	1.72	A –1.71974…
2e.	2	**Method 1 (symmetry)** Recognise $y = 2(x-7)$ is the inverse of $y = \frac{x}{2} + 7$ **Method 2 (using rule for inverse)** Inverse is $g^{-1}(x) = \dfrac{2(7\ln(x) - 7\ln(8) + 3\ln(2))}{3\ln(2)}$ $(1, -12)$ and $(8, 2)$	M – statement about symmetry or diagram OR finding rule for inverse A – both (method implied)

Q2	Marks	Solutions	Mark allocation and notes
2f.i.	2	$F(x) = \dfrac{1}{4}x^2 + 7x + c$ Sub one point in to find c Using $F(-12) = 1$, $c = 49$ But $F(2) = 64$ when $c = 49$ So $F(x)$ cannot pass through $(2,8)$ OR Using $F(2) = 8$, $c = -7$ But $F(-12) = -55$ when $c = -7$ So $F(x)$ cannot pass through $(-12,1)$	M – quadratic general anti-derivative and attempt to find one value of c M – justification that no anti-derivative passes through both points. May also use $F(-12) = 1$, $c = 49$ and $F(2) = 8$, $c = -7$ then explain that c cannot have two different values.
2f.ii.	2	$m \cdot F(-12) = 1$, $m \cdot F(2) = 8$ $m = \dfrac{1}{9}$ and $c = 57$	M – simultaneous equations with their $F(x)$ A – both (method implied)

Q3	Marks	Solutions	Mark allocation and notes
3a.i.	1	39	A
3a.ii.	2	**Method 1:** $$\text{sd}(T) = \sqrt{\int_{29}^{59} t^2 \, f(t)\,dt - (39)^2} = \sqrt{1549.57.. - (39)^2}$$ **Method 2:** $$\text{sd}(T) = \sqrt{\int_{29}^{59} (t-39)^2 \, f(t)\,dt}$$ $$= \frac{10\sqrt{14}}{7} = \sqrt{\frac{200}{7}} = 10\sqrt{\frac{2}{7}}$$	C – either correct formula with their mean from **3a.i.** A – exact, other forms (5.34… or var 1 mark only)
3b.i.	1	$\int_{47}^{59} f(t)\,dt$ or $\int_{47}^{\infty} f(t)\,dt$	A
3b.ii.	2	**Method 1:** $$1 - (1-0.08704)^5$$ $$= 0.3658$$ **Method 2:** Let $Y \sim \text{Bi}(5, 0.08704)$ $$\Pr(Y \geq 1) = 0.3658$$	M – either method A 0.365752…
3b.iii.	2	$\Pr(2 \leq Y \leq 3)$ $= 0.0631$	M – seeing 2 and 3 A – 0.063145…
3b.iv.	2	$$1-(1-p)^5 \quad \text{or} \quad 1-\left(1-\int_{k}^{59} f(t)\,dt\right)^5$$ $$p = 1 - \frac{5^{\frac{4}{5}} 2^{\frac{2}{5}}}{5} = 1 - \left(\frac{4}{5}\right)^{\frac{1}{5}} = 0.0436...$$ $$\int_{k}^{59} f(x)\,dx = 0.0436$$ $$k = 49$$	M – setting up an expression for the probability of being late at least once in terms of p or k OR correct p value. A
3c.i.	1	0.95	A – 0.9522…
3c.ii.	1	0.49	A – 0.4869…
3d.	2	<table><tr><td>y</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>$\Pr(Y=y)$</td><td>$\frac{63}{125}$</td><td>$\frac{199}{500}$</td><td>$\frac{23}{250}$</td><td>$\frac{3}{500}$</td></tr></table>	A – at least two correct A – all correct (accept equivalent fractions or exact decimals 0.504, 0.398, 0.092, 0.006)

Q4	Marks	Solutions	Mark allocation and notes
4a.	1	$\dfrac{\sqrt{3}}{2} + 1 = \dfrac{2+\sqrt{3}}{2} = \dfrac{1}{2}\left(2+\sqrt{3}\right)$	A – accept equivalent forms
4b.	1	$\dfrac{\pi}{6}, \dfrac{5\pi}{6}, \dfrac{13\pi}{6}$	A
4c.	2	$k = 2\pi$, $a = \dfrac{\pi}{2}$	A, A
4d.	1	$y = -\dfrac{x}{2} + \dfrac{2\pi + 3\left(\sqrt{3}+2\right)}{6} = -\dfrac{x}{2} + \dfrac{\pi}{3} + \dfrac{\sqrt{3}}{2} + 1$	A – accept equivalent forms Must have $y =$
4e.i.	1	5.2	A – 5.2036…
4e.ii.	1		A – Tangent should be a straight line, with the point of tangency directly above the x-intercept of the dashed line.
4f.i.	2	$f'(x) = \cos(x)$, $f'(p) = \cos(p)$ $y - y_1 = \cos(p)(x - x_1)$ Use point $(p, \sin(p)+1)$ $y - (\sin(p)+1) = \cos(p)(x - p)$ $t(x) = \cos(p)(x - p) + \sin(p) + 1$	M – obtaining $f'(p) = \cos(p)$ M – correct substitution and working
4f.ii.	2	$\max = 1 + \pi$, $\min = 1 - 2\pi$	AA – (1 mark if approx. 4.1,-5.2)
4f.iii.	2	Solving $t\left(\dfrac{3\pi}{2}\right) = 0$ for p gives $p = 2.38$ or $p = 7.04$	M – for $t\left(\dfrac{3\pi}{2}\right) = 0$ or $x = \dfrac{3\pi}{2}$ A – both (method implied)
4g.i.	2	$g(0) = f(0)$ $\qquad$ $g'(0) = f'(0)$ $\quad d = \sin(0) + 1$ $\qquad$ $c = \cos(0)$ $\quad d = 1$ $\qquad\qquad$ $c = 1$	M – *show that d = 1* M – *show that c = 1*
4g.ii.	2	$g(2\pi) = 1$ and $g'(2\pi) = 1$, $a = \dfrac{1}{2\pi^2}$ and $b = \dfrac{-3}{2\pi}$ Area $= \displaystyle\int_0^{\pi} f(x) - g(x)\, dx + \int_{\pi}^{2\pi} g(x) - f(x)\, dx$ $= 1.53$	M – correct a and b or integral expression $2\displaystyle\int_0^{\pi} f(x) - g(x)\, dx$ A – 1.5325…
4g.iii.	2	$br^2 + r = \sin(r)$ and $2br + 1 = \cos(r)$ $b \approx -0.31831$ and $r \approx 3.14159$ $r = \pi$ and $b = \dfrac{-1}{\pi}$	M – obtaining two equations for b and r or approx. values or one exact value A – both exact (method implied)