BOARD OF STUDIES
NEW SOUTH WALES

2009 HSC Mathematics Extension 2
Marking Guidelines

Question 1 (a)

Outcomes assessed: E8

MARKING GUIDELINES

Criteria	Marks
• Correct primitive	2
• Attempts substitution, or equivalent merit	1

Question 1 (b)

Outcomes assessed: E8

MARKING GUIDELINES

Criteria	Marks
• Correct primitive	2
• Attempts integration by parts	1

Question 1 (c)

Outcomes assessed: E8

MARKING GUIDELINES

Criteria	Marks
• Correct primitive	3
• Rearranges correctly and attempts to apply appropriate standard integral	2
• Rearranges the integral into an appropriate form, or equivalent merit	1

Question 1 (d)

Outcomes assessed: E8

MARKING GUIDELINES

Criteria	Marks
• Correct solution	4
• Finds correct primitive, or equivalent merit	3
• Obtains correct partial fraction decomposition, or equivalent progress	2
• Attempts partial fraction decomposition, or equivalent merit	1

Question 1 (e)

Outcomes assessed: E8

MARKING GUIDELINES

Criteria	Marks
• Correct solution	4
• Makes substantial progress	3
• Correctly substitutes $x = \tan \theta$, or equivalent merit	2
• Attempts an appropriate substitution	1

Question 2 (a)

Outcomes assessed: E3

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 2 (b)

Outcomes assessed: E3

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 2 (c) (i)

Outcomes assessed: E3

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 2 (c) (ii)

Outcomes assessed: E3

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 2 (c) (iii)

Outcomes assessed: E3

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 2 (d)

Outcomes assessed: E3

MARKING GUIDELINES

Criteria	Marks
• Correct region	2
• Sketches one of the regions	1

Question 2 (e) (i)

Outcomes assessed: E3

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Writes –1 in modulus-argument form, or equivalent merit	1

Question 2 (e) (ii)

Outcomes assessed: E3

MARKING GUIDELINES

Criteria	Marks
• Correct sketch	1

Question 2 (f) (i)

Outcomes assessed: E3

MARKING GUIDELINES

Criteria	Marks
• Correct answer	3
• Writes $a^2 - b^2 = 3$ and $2ab = 4$, or equivalent merit	2
• Writes $(a + ib)^2 = 3 + 4i$, or equivalent merit	1

Question 2 (f) (ii)

Outcomes assessed: E3

MARKING GUIDELINES

Criteria	Marks
• Correct solutions	2
• Obtains $z = \dfrac{x - i \pm \sqrt{3 + 4i}}{2}$, or equivalent merit	1

Question 3 (a) (i)

Outcomes assessed: E6

MARKING GUIDELINES

Criteria	Marks
• Correct sketch	2
• Indicates some important features of the graph	1

Question 3 (a) (ii)

Outcomes assessed: E6

MARKING GUIDELINES

Criteria	Marks
• Correct sketch	2
• Indicates some important features of the graph	1

Question 3 (a) (iii)

Outcomes assessed: E2, E6

MARKING GUIDELINES

Criteria	Marks
• Correct sketch	2
• Indicates some important features of the graph	1

Question 3 (b)

Outcomes assessed: E6

MARKING GUIDELINES

Criteria	Marks
• Correct solution	3
• Makes substantial progress	2
• Shows some understanding of implicit differentiation	1

Question 3 (c)

Outcomes assessed: E4

MARKING GUIDELINES

Criteria	Marks
• Finds correct values for a and b	3
• Finds two equations in a and b, or equivalent merit	2
• Evaluates $P(1)$ to show $6 + a + b = 0$, or equivalent merit	1

Question 3 (d)

Outcomes assessed: E7

MARKING GUIDELINES

Criteria	Marks
• Correct answer	3
• Makes substantial progress	2
• Shows some understanding of the method of cylindrical shells	1

Question 4 (a) (i)

Outcomes assessed: E3, E6

MARKING GUIDELINES

Criteria	Marks
• Correct proof	2
• Differentiates correctly to find the gradient of the tangent, or equivalent merit	1

Question 4 (a) (ii)

Outcomes assessed: E4, E6

MARKING GUIDELINES

Criteria	Marks
• Correct proof	2
• Correctly finds the coordinates of N in terms of a and b, or equivalent merit	1

Question 4 (a) (iii)

Outcomes assessed: E3, E4, E9

MARKING GUIDELINES

Criteria	Marks
• Correct proof	2
• Makes some progress	1

Question 4 (a) (iv)

Outcomes assessed: PE2, E2, E4, E9

MARKING GUIDELINES

Criteria	Marks
• Correct proof	2
• Makes some progress	1

Question 4 (b) (i)

Outcomes assessed: E5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Correctly resolves the forces in one direction	1

Question 4 (b) (ii)

Outcomes assessed: E5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Correctly derives T, or finds N	1

Question 4 (b) (iii)

Outcomes assessed: E5

MARKING GUIDELINES

Criteria	Marks
• Correct proof	2
• Makes some progress	1

Question 4 (b) (iv)

Outcomes assessed: E5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 5 (a) (i)

Outcomes assessed: PE3, E2, E9

MARKING GUIDELINES

Criteria	Marks
• Correct proof	2
• Makes one relevant observation, with justification	1

Question 5 (a) (ii)

Outcomes assessed: PE3, E2, E9

MARKING GUIDELINES

Criteria	Marks
• Correct proof	2
• Makes one relevant observation, with justification	1

Question 5 (a) (iii)

Outcomes assessed: PE3, E2, E9

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Makes one relevant observation, with justification	1

Question 5 (b) (i)

Outcomes assessed: E8

MARKING GUIDELINES

Criteria	Marks
• Correct derivation	2
• Shows some understanding of integration by parts, or equivalent merit	1

Question 5 (b) (ii)

Outcomes assessed: E8

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Makes substantial progress	1

Question 5 (c) (i)

Outcomes assessed: E6

MARKING GUIDELINES

Criteria	Marks
• Correct proof	2
• Finds $f''(x)$ correctly	1

Question 5 (c) (ii)

Outcomes assessed: E6

MARKING GUIDELINES

Criteria	Marks
• Correct proof	2
• Attempts to use the result from part (i) , or equivalent merit	1

Question 5 (c) (iii)

Outcomes assessed: E6

MARKING GUIDELINES

Criteria	Marks
• Correct proof	1

Question 6 (a)

Outcomes assessed: E7

MARKING GUIDELINES

Criteria	Marks
• Correct answer	3
• Makes substantial progress	2
• Finds the correct expression for cross-sectional area, or equivalent merit	1

Question 6 (b) (i)

Outcomes assessed: E4

MARKING GUIDELINES

Criteria	Marks
• Correct solution	1

Question 6 (b) (ii) (1)

Outcomes assessed: E3, E4

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Makes some progress	1

Question 6 (b) (ii) (2)

Outcomes assessed: E3, E4

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Makes some progress	1

Question 6 (c) (i)

Outcomes assessed: PE6, E4

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 6 (c) (ii)

Outcomes assessed: PE6, E4

MARKING GUIDELINES

Criteria	Marks
• Derives equation correctly	2
• Writes $PQ = c - x$	1

Question 6 (c) (iii)

Outcomes assessed: PE6, E4

MARKING GUIDELINES

Criteria	Marks
• Finds S correctly	2
• Finds the vertex, or the focal length, or equivalent merit	1

Question 6 (c) (iv)

Outcomes assessed: PE6, E4, E9

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Makes some progress towards a correct solution	1

Question 7 (a) (i) (1)

Outcomes assessed: E5

MARKING GUIDELINES

Criteria	Marks
• Correct solution, including consideration of initial condition	3
• Correctly integrates with respect to v • Correctly makes $\ddot{x}$ the subject, or equivalent merit	2
• Write $\frac{dx}{dv} = \frac{V}{g - rv}$ OR • Differentiates x with respect to t correctly, or equivalent merit	1

Question 7 (a) (i) (2)

Outcomes assessed: E5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 7 (a) (ii)

Outcomes assessed: E2, E5, E9

MARKING GUIDELINES

Criteria	Marks
• Correct answer	4
• Finds x correctly, or equivalent merit	3
• Finds t correctly, or equivalent merit	2
• Finds $\frac{dx}{dt}$ correctly, or equivalent merit	1

Question 7 (b) (i)

Outcomes assessed: E3

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Shows knowledge of de Moivre's theorem	1

Question 7 (b) (ii)

Outcomes assessed: HE3, E2, E4, E9

MARKING GUIDELINES

Criteria	Marks
• Correct solution	3
• Applies binomial theorem, or equivalent merit	2
• Recognises link to $(\bar{i})$	1

Question 7 (b) (iii)

Outcomes assessed: E2, E8, E9

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Recognises how to use the result in part (ii) , or equivalent merit	1

Question 8 (a) (i)

Outcomes assessed: PE3, E2, E4

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Makes some progress	1

Question 8 (a) (ii)

Outcomes assessed: HE2, E2

MARKING GUIDELINES

Criteria	Marks
• Correct solution	3
• Establishes the induction step	2
• Verifies the result for $n = 1$	1

Question 8 (a) (iii)

Outcomes assessed: HE7, E2, E4, E9

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Makes some progress	1

Question 8 (a) (iv)

Outcomes assessed: HE7, E4

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Substitutes $x = \frac{\pi}{2}$ in the result in part (iii) , or equivalent merit	1

Question 8 (b)

Outcomes assessed: H8, HE7, E2, E6, E9

MARKING GUIDELINES

Criteria	Marks
• Correct proof	2
• Obtains $\frac{1}{n-1} < \left[\ln x\right]_{n-1}^{n} < \frac{1}{n}$, or equivalent merit	1

Question 8 (c) (i)

Outcomes assessed: HE3, E2, E9

MARKING GUIDELINES

Criteria	Marks
• Correct explanation	1

Question 8 (c) (ii)

Outcomes assessed: HE3, E2, E6, E9

MARKING GUIDELINES

Criteria	Marks
• Correct proof	3
• Finds an expression for $\frac{W_m}{W}$ and attempts to use part (b), or equivalent merit	2
• Finds an expression for W_m, or equivalent merit	1

Mathematics Extension 2

2009 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
1 (a)	2	4.1	E8
1 (b)	2	4.1	E8
1 (c)	3	4.1	E8
1 (d)	4	4.1	E8
1 (e)	4	4.1	E8
2 (a)	1	2.1	E3
2 (b)	1	2.1	E3
2 (c) (i)	1	2.2	E3
2 (c) (ii)	1	2.2	E3
2 (c) (iii)	1	2.2	E3
2 (d)	2	2.5	E3
2 (e) (i)	2	2.4	E3
2 (e) (ii)	1	2.2, 2.4	E3
2 (f) (i)	3	2.1	E3
2 (f) (ii)	2	2.1	E3
3 (a) (i)	2	1.5	E6
3 (a) (ii)	2	1.6	E6
3 (a) (iii)	2	1.8	E2, E6
3 (b)	3	1.8	E6
3 (c)	3	7.2	E4
3 (d)	3	5.1	E7
4 (a) (i)	2	3.1	E3, E6
4 (a) (ii)	2	3.1	E4, E6
4 (a) (iii)	2	3.1	E3, E4, E9
4 (a) (iv)	2	3.1	PE2, E2, E4, E9
4 (b) (i)	2	6.3.3	E5
4 (b) (ii)	2	6.3.3	E5
4 (b) (iii)	2	6.3.3	E5
4 (b) (iv)	1	6.3.3	E5
5 (a) (i)	2	8.1	PE3, E2, E9

Question	Marks	Content	Syllabus outcomes
5 (a) (ii)	2	8.1	PE3, E2, E9
5 (a) (iii)	2	8.1	PE3, E2, E9
5 (b) (i)	2	4.1	E8
5 (b) (ii)	2	4.1	E8
5 (c) (i)	2	8.0	E6
5 (c) (ii)	2	8.0	E6
5 (c) (iii)	1	8.0	E6
6 (a)	3	5.1	E7
6 (b) (i)	1	7.4	E4
6 (b) (ii) (1)	2	2.2, 7.4	E3, E4
6 (b) (ii) (2)	2	2.1, 7.4, 7.5	E3, E4
6 (c) (i)	1	8.0	PE6, E4
6 (c) (ii)	2	8.0	PE6, E4
6 (c) (iii)	2	8.0	PE6, E4
6 (c) (iv)	2	8.0	PE6, E4, E9
7 (a) (i) (1)	3	6.2.3	E5
7 (a) (i) (2)	1	6.2.3	E5
7 (a) (ii)	4	6.2.3	E2, E5, E9
7 (b) (i)	2	2.4	E3
7 (b) (ii)	3	8.0	HE3, E2, E4, E9
7 (b) (iii)	2	4.1	E2, E8, E9
8 (a) (i)	2	8.0	PE3, E2, E4
8 (a) (ii)	3	8.2	HE2, E2
8 (a) (iii)	2	8.0	HE7, E2, E4, E9
8 (a) (iv)	2	8.0	HE7, E4
8 (b)	2	8.0	H8, HE7, E2, E6, E9
8 (c) (i)	1	8.0	HE3, E2, E9
8 (c) (ii)	3	8.0	HE3, E2, E6, E9