BOARD OF STUDIES
NEW SOUTH WALES

2010 HSC Mathematics Extension 2
Marking Guidelines

Question 1 (a)

Criteria	Marks
• Correct solution	2
• Shows evidence of implicitly or explicitly substituting $u = 1 + 3x^2$	1

Question 1 (b)

Criteria	Marks
• Correct solution	3
• Obtains correct primitive	2
• Recognises $\tan x = \dfrac{\sin x}{\cos x}$	1

Question 1 (c)

Criteria	Marks
• Correct solution	3
• Correct partial fraction decomposition, or equivalent merit	2
• Attempts partial fraction decomposition	1

Question 1 (d)

Criteria	Marks
• Correct solution	4
• Obtains correct primitive, or equivalent merit	3
• Obtains $\int \frac{2}{(1+t)^2}\,dt$, or equivalent merit	2
• Correctly substitutes for dx in terms of t, or for $\sin x$ in terms of t, or equivalent merit	1

Question 1 (e)

Criteria	Marks
• Correct solution	3
• Makes substantial progress	2
• Makes an appropriate substitution	1

Question 2 (a) (i)

Criteria	Marks
• Correct answer	1

Question 2 (a) (ii)

Criteria	Marks
• Correct answer	1

Question 2 (a) (iii)

Criteria	Marks
• Correct solution	2
• Attempts to multiply by $\frac{5+i}{5+i}$	1

Question 2 (b) (i)

Criteria	Marks
• Correct solution	2
• Correct modulus OR correct argument	1

Question 2 (b) (ii)

Criteria	Marks
• Correct solution	2
• Obtains $2^6\left(\cos 7\pi + i\sin 7\pi\right)$, or equivalent merit	1

Question 2 (c)

Criteria	Marks
• Correct sketch	2
• Correctly sketches one of the regions	1

Question 2 (d) (i)

Criteria	Marks
• Shows that $OA = OB = 1$	1

Question 2 (d) (ii)

Criteria	Marks
• Correct solution	1

Question 2 (d) (iii)

Criteria	Marks
• Correct proof	2
• Makes some progress	1

Question 2 (d) (iv)

Criteria	Marks
• Correct deduction	1

Question 3 (a) (i)

Criteria	Marks
• Correct sketch	1

Question 3 (a) (ii)

Criteria	Marks
• Correct sketch	2
• Identifies the vertical asymptotes, or equivalent merit	1

Question 3 (b)

Criteria	Marks
• Correct solution	4
• Obtains a correct primitive	3
• Obtains a correct integral	2
• Makes progress towards obtaining a correct integral	1

Question 3 (c)

Criteria	Marks
• Correct solution	2
• Observes that $P\left(1-P\right)=0.24$ (where P = probability heads, or tails)	1

Question 3 (d) (i)

Criteria	Marks
• Correct solution	2
• Finds the gradient of QA correctly, or equivalent merit	1

Question 3 (d) (ii)

Criteria	Marks
• Correct answer	1

Question 3 (d) (iii)

Criteria	Marks
• Correct solution	2
• Attempts to solve simultaneously the equations for ℓ_1 and ℓ_2, or equivalent merit	1

Question 3 (d) (iv)

Criteria	Marks
• Correct description (i.e. the top branch of the hyperbola)	1

Question 4 (a) (i)

Criteria	Marks
• Correct solution	2
• Attempts to differentiate implicitly	1

Question 4 (a) (ii)

Criteria	Marks
• Correct sketch vertical at (0, 1) and horizontal at (1, 0)	2
• Sketch showing some relevant features	1

Question 4 (a) (iii)

Criteria	Marks
• Correct sketch	1

Question 4 (b) (i)

Criteria	Marks
• Correct solution	3
• Resolves forces, and attempts to eliminate N	2
• Resolves forces horizontally or vertically, or equivalent merit	1

Question 4 (b) (ii)

Criteria	Marks
• Correct solution	1

Question 4 (c)

Criteria	Marks
• Correct proof	3
• Deduces that a solution exists when $k \geq 4$, or equivalent merit	2
• Obtains a relevant quadratic equation in a, or equivalent merit	1

Question 4 (d) (i)

Criteria	Marks
• Correct answer	1

Question 4 (d) (ii)

Criteria	Marks
• Correct solution	2
• Obtains $\begin{pmatrix} 12 \\ 4 \end{pmatrix} \times \begin{pmatrix} 8 \\ 4 \end{pmatrix}$, or equivalent merit	1

Question 5 (a) (i)

Criteria	Marks
• Correct answer	1

Question 5 (a) (ii)

Criteria	Marks
• Correct solution	1

Question 5 (a) (iii)

Criteria	Marks
• Correct equation	2
• Finds the gradient of the tangent, or equivalent merit	1

Question 5 (a) (iv)

Criteria	Marks
• Correct solution	2
• Finds where one of the tangents cuts the x axis, or equivalent merit	1

Question 5 (b)

Criteria	Marks
• Correct solution	2
• Attempts to differentiate $\ln\left(\frac{y}{1-y}\right)$, or attempts to use partial fractions on $\frac{1}{y(1-y)}$, or equivalent merit	1

Question 5 (c) (i)

Criteria	Marks
• Correct solution	1

Question 5 (c) (ii)

Criteria	Marks
• Correct solution	3
• Attempts to solve a correct equation for y	2
• Obtains $\ln\left(\frac{y}{1-y}\right) = ax + c$	1

Question 5 (c) (iii)

Criteria	Marks
• Correct answer	1

Question 5 (c) (iv)

Criteria	Marks
• Correct solution $\left(\text{ie inflection at } y = \frac{1}{2} \text{ or, graph is steepest when } y = \frac{1}{2}\right)$	1

Question 5 (c) (v)

Criteria	Marks
• Correct sketch	1

Question 6 (a) (i)

Criteria	Marks
• Correct solution	2
• Attempts to use appropriate similar triangles, or equivalent merit	1

Question 6 (a) (ii)

Criteria	Marks
• Correct solution	2
• Obtains volume $= \int_0^h \left(a - \frac{a-b}{h} x \right)^2 dx$, or equivalent merit	1

Question 6 (b)

Criteria	Marks
• Correct proof	3
• Makes substantial progress	2
• Checks that the formula holds for $n = 0$ and $n = 1$, or equivalent merit	1

Question 6 (c) (i)

Criteria	Marks
• Correct expansion	1

Question 6 (c) (ii)

Criteria	Marks
• Correct solution	3
• Correctly equates imaginary parts of the two expansions, or equivalent merit	2
• Correct use of de Moivre's theorem, or equivalent merit	1

Question 6 (c) (iii)

Criteria	Marks
• Correct deduction	1

Question 6 (c) (iv)

Criteria	Marks
• Correct solution	1

Question 6 (c) (v)

Criteria	Marks
• Correct solution	1

Question 6 (c) (vi)

Criteria	Marks
• Correct solution	1

Question 7 (a) (i)

Criteria	Marks
• Correct proof	2
• Identifies any pair of equal angles	1

Question 7 (a) (ii)

Criteria	Marks
• Correct solution	2
• Obtains a relevant ratio, or equivalent merit	1

Question 7 (a) (iii)

Criteria	Marks
• Correct solution	2
• Obtains lengths of sides and diagonals of an appropriate cyclic quadrilateral	1

Question 7 (b)

Criteria	Marks
• Correct graphs, or equivalent merit	1

Question 7 (c) (i)

Criteria	Marks
• Correct solution	1

Question 7 (c) (ii)

Criteria	Marks
• Correct solution	1

Question 7 (c) (iii)

Criteria	Marks
• Correct graph and correct explanation	2
• Finds that the curve $y = P(x)$ has a minimum at (1, 0) and a maximum at (0, 1), or recognises that $P(x) \to \infty$ as $x \to \infty$, and $P(x) \to -\infty$ as $x \to -\infty$, or equivalent merit	1

Question 7 (c) (iv)

Criteria	Marks
• Correct solution	2
• Shows that $P\left(-\frac{1}{2}\right) \geq 0$, or equivalent merit	1

Question 7 (c) (v)

Criteria	Marks
• Correct solution	2
• Recognises that the zeros are $1, 1, \alpha, \beta, \overline{\beta}$, or equivalent merit	1

Question 8 (a)

Criteria	Marks
• Correct solution	2
• Uses integration by parts appropriately	1

Question 8 (b)

Criteria	Marks
• Correct solution	1

Question 8 (c)

Criteria	Marks
• Correct solution	3
• Makes substantial progress	2
• Uses integration by parts to introduce a factor of x^2 into the integral	1

Question 8 (d)

Criteria	Marks
• Correct solution	1

Question 8 (e)

Criteria	Marks
• Correct solution	2
• Shows that $\sum \frac{1}{k^2} = 2\left(\frac{B_0}{A_0} - \frac{B_n}{A_n}\right)$, or correctly calculates $\frac{B_0}{A_0}$, or equivalent merit	1

Question 8 (f)

Criteria	Marks
• Correct solution	1

Question 8 (g)

Criteria	Marks
• Correct solution	1

Question 8 (h)

Criteria	Marks
• Correct solution	2
• Substitutes $x = \frac{\pi}{2}\sin t$ correctly	1

Question 8 (i)

Criteria	Marks
• Correct solution	1

Question 8 (j)

Criteria	Marks
• Correct solution	1

Mathematics Extension 2

2010 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
1 (a)	2	4.1	E8
1 (b)	3	4.1	E8
1 (c)	3	4.1, 7.6	E8
1 (d)	4	4.1	E8
1 (e)	3	4.1	E8
2 (a) (i)	1	2.1	E3
2 (a) (ii)	1	2.1	E3
2 (a) (iii)	2	2.1	E3
2 (b) (i)	2	2.2	E3
2 (b) (ii)	2	2.4	E3
2 (c)	2	2.5	E3
2 (d) (i)	1	2.3	E3
2 (d) (ii)	1	2.3	E3
2 (d) (iii)	2	2.3	E3
2 (d) (iv)	1	2.3	E3
3 (a) (i)	1	1.1	E6
3 (a) (ii)	2	1.5	E6
3 (b)	4	5.1	E7
3 (c)	2	8.0	HE3, E9
3 (d) (i)	2	3.3	E4
3 (d) (ii)	1	3.3	E4
3 (d) (iii)	2	3.3	E4
3 (d) (iv)	1	3.3	E4, E9
4 (a) (i)	2	1.8	E6
4 (a) (ii)	2	1.8	E6, E9
4 (a) (iii)	1	1.3, 1.8	E6, E9
4 (b) (i)	3	6.3.4	E5
4 (b) (ii)	1	6.3.4	E5
4 (c)	3	8.0	E2, E9
4 (d) (i)	1	8.0	HE3, E9
4 (d) (ii)	2	8.0	HE3, E9
5 (a) (i)	1	3.1	E4
5 (a) (ii)	1	3.1	E4
5 (a) (iii)	2	3.1	E4
5 (a) (iv)	2	3.1	E4, E9
5 (b)	2	4.1	E2

Question	Marks	Content	Syllabus outcomes
5 (c) (i)	1	6.1	E2, E6
5 (c) (ii)	3	6.1	E2
5 (c) (iii)	1	6.1	E5, E9
5 (c) (iv)	1	6.1	E2, E6, E9, HE4
5 (c) (v)	1	1.1, 1.8, 1.5, 6.1	E6
6 (a) (i)	2	5.1	E2, E7
6 (a) (ii)	2	5.1	E7
6 (b)	3	8.2	E2, E9
6 (c) (i)	1	8.0	E3
6 (c) (ii)	3	2.4	E3
6 (c) (iii)	1	7.4	E4
6 (c) (iv)	1	7.4	E4
6 (c) (v)	1	7.4	E4
6 (c) (vi)	1	2.4, 7.4	E2, E4
7 (a) (i)	2	8.1	E2, E9
7 (a) (ii)	2	8.1	E2, E9
7 (a) (iii)	2	8.1	E2, E9
7 (b)	1	1.9	E2, E6
7 (c) (i)	1	7.2	E2, E4, E6
7 (c) (ii)	1	7.2	E2, E6
7 (c) (iii)	2	7.2, 7.3	E2, E4
7 (c) (iv)	2	7.2	E2, E4
7 (c) (v)	2	7.2, 7.5	E2, E4
8 (a)	2	4.1	E8
8 (b)	1	4.1	E8
8 (c)	3	4.1	E8
8 (d)	1	4.1	E2, E8, E9
8 (e)	2	4.1	E2, E8, E9
8 (f)	1	4.1	E2, E8, E9
8 (g)	1	4.1	E2, E8, E9
8 (h)	2	4.1	E2, E8, E9
8 (i)	1	4.1, 8.0	E2, E8, E9
8 (j)	1	4.1, 8.0	E2, E8, E9