



**B O A R D O F S T U D I E S**  
NEW SOUTH WALES

## **2011 HSC Mathematics Extension 2 Marking Guidelines**

### **Question 1 (a)**

<b>Criteria</b>	<b>Marks</b>
• Correct solution	2
• Attempts to use integration by parts	1

### **Question 1 (b)**

<b>Criteria</b>	<b>Marks</b>
• Correct solution	3
• Obtains correct primitive, or equivalent merit	2
• Identifies correct substitution	1

**Question 1 (c) (i)**

Criteria	Marks
• Correct solution	2
• Correctly obtains one constant	1

**Question 1 (c) (ii)**

Criteria	Marks
• Correct solution	2
• Attempts to integrate and makes some progress	1

**Question 1 (d)**

Criteria	Marks
• Correct solution	3
• Obtains $\int \cos \theta d\theta - \int \cos \theta \sin^2 \theta d\theta$ , or equivalent merit	2
• Attempts to use a relevant trigonometric substitution	1

**Question 1 (e)**

Criteria	Marks
• Correct solution	3
• Obtains correct primitive, or equivalent merit	2
• Correctly completes the square, or equivalent merit	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 $\frac{3-4i}{3-4i}$ , or equivalent merit	1

**Question 2 (b) (i)**

Criteria	Marks
• Correct answer	1

**Question 2 (b) (ii)**

Criteria	Marks
• Correct solution	2
• Makes some progress	1

**Question 2 (c)**

Criteria	Marks
• Correct answer	2
• Attempts to use de Moivre's theorem, or equivalent merit	1

**Question 2 (d) (i)**

Criteria	Marks
• Correct solution	1

**Question 2 (d) (ii)**

Criteria	Marks
• Correct proof	3
• Equates real parts	2
• Attempts to use de Moivre's theorem	1

**Question 2 (d) (iii)**

Criteria	Marks
• Correct solution	2
• Obtains a relevant equation for $\cos 3\theta$	1

**Question 3 (a) (i)**

Criteria	Marks
• Correct sketch	1

**Question 3 (a) (ii)**

Criteria	Marks
• Correct limit	1

**Question 3 (a) (iii)**

Criteria	Marks
• Approximately correct sketch	2
• Correctly indicates ONE key feature of the graph	1

**Question 3 (b)**

Criteria	Marks
• Correct solution	3
• Obtains a correct primitive for the volume integral, or equivalent merit	2
• Obtains a correct expression for the area of a cross-section, or equivalent merit	1

**Question 3 (c)**

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

**Question 3 (d) (i)**

Criteria	Marks
• Correct answer	1

**Question 3 (d) (ii)**

Criteria	Marks
• Correct answer	1

**Question 3 (d) (iii)**

Criteria	Marks
• Correct equations	1

**Question 3 (d) (iv)**

Criteria	Marks
• Correct sketch	1

**Question 3 (d) (v)**

Criteria	Marks
• Correct answer	1

**Question 4 (a) (i)**

Criteria	Marks
• Correct solution	2
• Obtains $(x - a)^2 - (x - b)^2 = 1$ or equivalent merit	1

**Question 4 (a) (ii)**

Criteria	Marks
• Correct answer	1

**Question 4 (b) (i)**

Criteria	Marks
• Correct proof	2
• Makes some progress	1

**Question 4 (b) (ii)**

Criteria	Marks
• Correct explanation	1

**Question 4 (b) (iii)**

Criteria	Marks
• Correct proof	2
• Makes some progress	1

**Question 4 (c) (i)**

<b>Criteria</b>	<b>Marks</b>
• Correct solution	2
• Differentiates correctly and attempts to substitute, or equivalent merit	1

**Question 4 (c) (ii)**

<b>Criteria</b>	<b>Marks</b>
• Correct solution	2
• Differentiates correctly and attempts to substitute	1

**Question 4 (c) (iii)**

<b>Criteria</b>	<b>Marks</b>
• Correct solution	3
• Correctly obtains simultaneous equations for $A$ and $B$ , or equivalent merit	2
• Uses the initial conditions to form an equation relating $A$ and $B$ , or equivalent merit	1



**Question 5 (a) (i)**

Criteria	Marks
• Correct solution	2
• Resolves forces horizontally or vertically, on a diagram, or equivalent merit	1

**Question 5 (a) (ii)**

Criteria	Marks
• Correct proof	2
• Attempts to eliminate $F$	1

**Question 5 (a) (iii)**

Criteria	Marks
• Correct solution	2
• Attempts to solve $N = 0$ , or equivalent merit	1

**Question 5 (b)**

Criteria	Marks
• Correct proof	3
• Makes some progress	2
• Identifies correct common denominator	1

**Question 5 (c) (i)**

Criteria	Marks
• Correct solution	2
• Correctly identifies pair of equal angles using reflection property, or equivalent merit	1

**Question 5 (c) (ii)**

Criteria	Marks
• Correct explanation	1

**Question 5 (c) (iii)**

Criteria	Marks
• Correct solution	3
• Makes substantial progress	2
• Evidence of proof using similarity $\triangle OSQ$ , $\triangle S'SR$ , or equivalent merit	1

**Question 6 (a) (i)**

Criteria	Marks
• Correct explanation	1

**Question 6 (a) (ii)**

Criteria	Marks
• Correct solution	3
• Obtains correct partial fraction decomposition, or equivalent merit	2
• Correctly separates variables, or equivalent merit	1

**Question 6 (a) (iii)**

Criteria	Marks
• Correct solution	3
• Correctly evaluates one of the two expressions for time, or equivalent merit	2
• Attempts to substitute relevant speeds into expression from part (ii)	1

**Question 6 (b) (i)**

Criteria	Marks
• Correct proof	2
• Correctly applies the chain rule for differentiation, or equivalent merit	1

**Question 6 (b) (ii)**

Criteria	Marks
• Correct explanation	1

**Question 6 (b) (iii)**

Criteria	Marks
• Correct sketch	3
• Correctly indicates TWO key features of the graph	2
• Correctly indicates ONE key feature of the graph	1

**Question 6 (c)**

Criteria	Marks
• Correct sketch	2
• Makes some progress	1

**Question 7 (a)**

Criteria	Marks
• Correct solution	4
• Converts to integrable form, or equivalent merit	3
• Obtains correct integrand, or equivalent merit	2
• Identifies $r = 1 - x$ , or equivalent merit	1

**Question 7 (b) (i)**

Criteria	Marks
• Correct solution	2
• Correctly uses substitution $u = 4 - x$ , or equivalent merit	1

**Question 7 (b) (ii)**

Criteria	Marks
• Correct solution	3
• Obtains correct partial fraction decomposition, or equivalent merit	2
• Adds the two integrals	1

**Question 7 (c) (i)**

Criteria	Marks
• Correct proof	3
• Obtains correct quadratic equation in $x$ and correct discriminant, or equivalent merit	2
• Obtains correct quadratic in general form or attempt to use $\Delta = 0$ , or equivalent merit	1

**Question 7 (c) (ii)**

Criteria	Marks
• Correct solution	1

**Question 7 (c) (iii)**

Criteria	Marks
• Correct proof	2
• Writes a correct expression for $QS \times Q'S'$ and attempts to simplify	1

**Question 8 (a)**

<b>Criteria</b>	<b>Marks</b>
• Correct proof	3
• Makes substantial progress	2
• Uses integration by parts appropriately	1

**Question 8 (b) (i)**

<b>Criteria</b>	<b>Marks</b>
• Correct answer	1

**Question 8 (b) (ii)**

<b>Criteria</b>	<b>Marks</b>
• Correct solution	1

**Question 8 (b) (iii)**

<b>Criteria</b>	<b>Marks</b>
• Correct solution	2
• Recognises one ball is not selected and one ball selected twice, or equivalent merit	1

**Question 8 (c) (i)**

Criteria	Marks
• Correct solution	2
• Substitutes root of polynomial and attempts to rearrange equation, or equivalent merit	1

**Question 8 (c) (ii)**

Criteria	Marks
• Correct solution	3
• Makes substantial progress	2
• Correctly sums the geometric series	1

**Question 8 (d)**

Criteria	Marks
• Correct solution	3
• Shows $\left  x + \frac{1}{x} \right  \geq 2$ , and correctly applies result from part (c) (ii), or equivalent merit	2
• Correctly applies result from part (c) (ii), or equivalent merit	1



# Mathematics Extension 2

## 2011 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
1 (a)	2	4.1	E8
1 (b)	3	4.1	E8
1 (c) (i)	2	4.1	E4, E8
1 (c) (ii)	2	4.1	E8
1 (d)	3	4.1	E8
1 (e)	3	4.1	E8
2 (a) (i)	1	2.1	E3
2 (a) (ii)	1	2.2	E3
2 (a) (iii)	2	2.1	E3
2 (b) (i)	1	2.3	E3
2 (b) (ii)	2	2.2	E3
2 (c)	2	2.4, 7.4	E3, E4
2 (d) (i)	1	2.1, 8.0	E3, E4
2 (d) (ii)	3	2.1, 2.4	E3, E4
2 (d) (iii)	2	8.0	E2
3 (a) (i)	1	1.1	E6
3 (a) (ii)	1	1.5	E2
3 (a) (iii)	2	1.5	E2
3 (b)	3	5.1	E7
3 (c)	3	8.2	E2
3 (d) (i)	1	3.2	E3
3 (d) (ii)	1	3.2	E3
3 (d) (iii)	1	3.2	E3
3 (d) (iv)	1	3.2	E3
3 (d) (v)	1	3.4	E4
4 (a) (i)	2	2.2	E3
4 (a) (ii)	1	2.5	E3
4 (b) (i)	2	8.1	E2
4 (b) (ii)	1	8.1	E2
4 (b) (iii)	2	8.1	E2
4 (c) (i)	2	8.0	E2
4 (c) (ii)	2	8.0	E2
4 (c) (iii)	3	8.0	E2
5 (a) (i)	2	6.3.3	E5

Question	Marks	Content	Syllabus outcomes
5 (a) (ii)	2	6.3.3	E5
5 (a) (iii)	2	6.3.3	E5
5 (b)	3	8.3	E4
5 (c) (i)	2	3.1	E2
5 (c) (ii)	1	3.1	E2
5 (c) (iii)	3	3.1	E2
6 (a) (i)	1	6.2.3	E5
6 (a) (ii)	3	6.2.3	E5, E8
6 (a) (iii)	3	6.2.3	E5
6 (b) (i)	2	8.0	E6
6 (b) (ii)	1	8.0	E6
6 (b) (iii)	3	1.6	E6
6 (c)	2	2.5	E3
7 (a)	4	5.1	E7
7 (b) (i)	2	4.1	E8
7 (b) (ii)	3	4.1	E8
7 (c) (i)	3	3.1	E4
7 (c) (ii)	1	3.1	E4
7 (c) (iii)	2	3.1	E4
8 (a)	3	4.1	E8
8 (b) (i)	1	8.0	E2
8 (b) (ii)	1	8.0	E2
8 (b) (iii)	2	8.0	E2
8 (c) (i)	2	7.4, 8.3	E4, E9
8 (c) (ii)	3	7.4, 8.3	E4, E9
8 (d)	3	7.4, 8.3	E4, E9