

Page 1	Mark Scheme	Syllabus
	IGCSE EXAMINATIONS – JUNE 2003	0606

Mark Scheme Notes

- Marks are of the following three types:
 - M Method mark, awarded for a valid method applied to the problem. Method marks are not lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.
 - A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated method mark is earned (or implied).
 - B Mark for a correct result or statement independent of method marks.
- When a part of a question has two or more "method" steps, the M marks are generally independent unless the scheme specifically says otherwise; and similarly when there are several B marks allocated. The notation DM or DB (or dep*) is used to indicate that a particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme. When two or more steps are run together by the candidate, the earlier marks are implied and full credit is given.
- The symbol \surd implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A or B marks are given for correct work only. A and B marks are not given for fortuitously "correct" answers or results obtained from incorrect working.
- Note: B2 or A2 means that the candidate can earn 2 or 0.
B2, 1, 0 means that the candidate can earn anything from 0 to 2.
- The following abbreviations may be used in a mark scheme or used on the scripts:
 - AG Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)
 - BOD Benefit of Doubt (allowed when the validity of a solution may not be absolutely clear)
 - CAO Correct Answer Only (emphasising that no "follow through" from a previous error is allowed)
 - ISW Ignore Subsequent Working
 - MR Misread
 - PA Premature Approximation (resulting in basically correct work that is insufficiently accurate)
 - SOS See Other Solution (the candidate makes a better attempt at the same question)

Page 2	Mark Scheme	Syllabus
	IGCSE EXAMINATIONS – JUNE 2003	0606

Penalties

- **MR –1** A penalty of MR –1 is deducted from A or B marks when the data of a question or part question are genuinely misread and the object and difficulty of the question remain unaltered. In this case all A and B marks then become "follow through \surd " marks. MR is not applied when the candidate misreads his own figures – this is regarded as an error in accuracy.
- **OW –1, 2** This is deducted from A or B marks when essential working is omitted.
- **PA –1** This is deducted from A or B marks in the case of premature approximation.
- **S –1** Occasionally used for persistent slackness.
- **EX –1** Applied to A or B marks when extra solutions are offered to a particular equation.

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JUNE 2003

INTERNATIONAL GCSE

MARK SCHEME

MAXIMUM MARK: 80

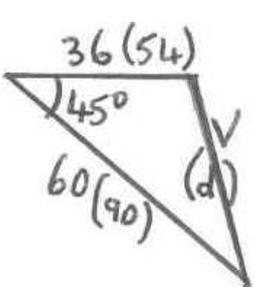
SYLLABUS/COMPONENT: 0606/01

**ADDITIONAL MATHEMATICS
Paper 1**

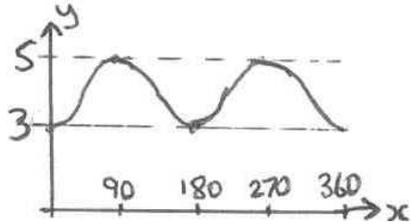


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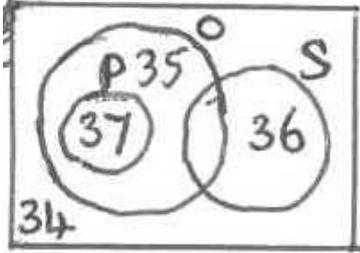
Page 1	Mark Scheme	Syllabus	Paper
	IGCSE EXAMINATIONS – JUNE 2003	0606	1

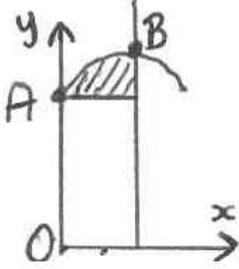
<p>1. x or y eliminated completely Uses the discriminant b^2-4ac on a quadratic set to 0</p> <p>Arrives at $k = 0$ from $32k = 0$ Correct answer $k \geq 0$.</p>	<p>M1 M1 A1 A1 [4]</p>	<p>Allow as soon as x or y eliminated. Condone poor algebra – quadratic must be set to 0 – $b^2-4ac = 0, <0, >0$ all ok. For k and 0. For $k \geq 0$.</p>
<p>2. Length = $(1 + \sqrt{6}) \div (\sqrt{2} + \sqrt{3})$ Multiplying top and bottom by $\pm(\sqrt{3} - \sqrt{2})$ $\rightarrow \sqrt{3} + \sqrt{18} - \sqrt{2} - \sqrt{12}$ Reduces $\sqrt{18}$ to $3\sqrt{2}$ or $\sqrt{12}$ to $2\sqrt{3}$</p> <p>$\rightarrow 2\sqrt{2} - \sqrt{3}$</p> <p>$\rightarrow \sqrt{8} - \sqrt{3}$</p>	<p>M1 M1 DM1 A1 [4]</p>	<p>Multiply both top and bottom by $\pm(\sqrt{3} - \sqrt{2})$.</p> <p>Allow wherever this comes – not DM. Dependent on first M – collects $\sqrt{2}$ and $\sqrt{3}$. Co.</p>
<p>3. (i) $32 - 80x + 80x^2$</p> <p>(ii) $(k + x) \times (i)$ Coeff. of x is $-80k + 32$ Equated with $-8 \rightarrow k = \frac{1}{2}$ or 0.5</p>	<p>B1 x 3 M1 A1 [5]</p>	<p>Allow 2^5 for 32 (if whole series is given, mark the 3 terms).</p> <p>Must be 2 terms considered. For solution of $k = (-8 - a) \div (b)$</p>
<p>4. Liner travels 54km or relative speed of lifeboat is 60km/h.</p>  <p>Correct vel./distance triangle</p> <p>Use of cosine rule in triangle $V^2 = 60^2 + 36^2 - 2.60.36\cos45$ or $d^2 = 90^2 + 54^2 - 2.90.54\cos45$.</p> <p>$V = 42.9$ or $d = 64.4 \rightarrow V = 42.9$</p>	<p>B1 B1 M1 A1 A1 [5]</p>	<p>Anywhere.</p> <p>Triangle must be correct with 54, 45°, 90 or 36, 45°, 60 or even 36, 45°, 90. Allow for other angles. Unsimplified and allow for 135° as well as 45°. Co.</p>

Page 2	Mark Scheme	Syllabus	Paper
	IGCSE EXAMINATIONS – JUNE 2003	0606	1

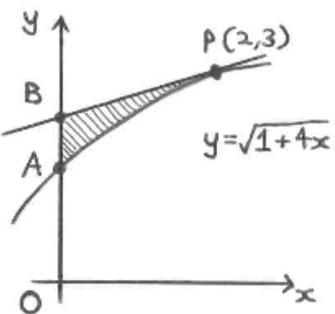
<p>5. Elimination of x or y. $\rightarrow 4x^2 + 6x - 4 = 0$ or $y^2 - 12y + 11 = 0$ Solution of quadratic = 0.</p> <p>$\rightarrow (0.5, 11)$ and $(-2, 1)$</p> <p>Length = $\sqrt{(2.5^2 + 10^2)} = 10.3$</p>	<p>M1 A1 DM1 A1 M1A1 [6]</p>	<p>x or y eliminated completely. Correct equation – not necessarily = 0 Usual method for solving quadratic = 0</p> <p>All correct. Condone incorrect pairing if answers originally correct. Must be correct formula correctly applied.</p>
<p>6. $A^2 = \begin{pmatrix} 2 & -3 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 2 & -3 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 4 & -9 \\ 0 & 1 \end{pmatrix}$</p> <p>$A^{-1} = \frac{1}{2} \times \begin{pmatrix} 1 & 3 \\ 0 & 2 \end{pmatrix}$</p> <p>$B = A^2 - 4A^{-1} = \begin{pmatrix} 2 & -15 \\ 0 & -3 \end{pmatrix}$</p>	<p>M1A1 B1B1 M1A1 [6]</p>	<p>Do not allow M mark if all elements are squared. If correct, allow both marks. If incorrect, some working is needed to give M mark.</p> <p>B1 for $\frac{1}{2}$, B1 for matrix.</p> <p>M mark is independent of first M. Allow M mark for $4A^{-1} - A^2$.</p>
<p>7. $f(x) = 4 - \cos 2x$</p> <p>(i) amplitude = ± 1. Period = 180° or π</p> <p>(ii)</p>  <p>Max $(90^\circ, 5)$ and $(270^\circ, 5)$</p>	<p>B1B1 B2,1 B1B1 [6]</p>	<p>Independent of graph. Do not allow "4 to 5".</p> <p>Must be two complete cycles. 0/2 if not. Needs 3 to 5 marked or implied. Needs to start and finish at minimum. Needs curve not lines.</p> <p>Independent of graph (90, 270 gets B1). Allow radians or degrees.</p>

Page 3	Mark Scheme	Syllabus	Paper
	IGCSE EXAMINATIONS – JUNE 2003	0606	1

<p>8.</p>  <p>(i) O, P, S correct</p> <p>(ii) 34, 35, 36, 37 correct</p> <p>$O \cap S = \text{odd squares} \rightarrow 4$ $O \cup S = \text{odd and even squares}$ $\rightarrow 49 + 5 = 54$</p>	<p>B2,1</p> <p>B2,1</p> <p>B1</p> <p>M1A1 [7]</p>	<p>Give B1 if only one is correct.</p> <p>These 2 B marks can only be awarded only if B2 has been given for part (i).</p> <p>Co.</p> <p>Any correct method. Co.</p>
<p>9. (i) $\log_4 2 = \frac{1}{2}$ $\log_8 64 = 2$ $\rightarrow 2x + 5 = 9^{1.5}$ $\rightarrow x = 11$</p> <p>(ii) Quadratic in 3^y</p> <p>Solution of quadratic = 0</p> <p>$\rightarrow 3^y = 5$ or -10</p> <p>Solution of $3^y = k$</p> <p>$y = 1.46$ or 1.47</p>	<p>B1B1</p> <p>M1A1</p> <p>M1</p> <p>DM1</p> <p>M1</p> <p>A1 [8]</p>	<p>Anywhere.</p> <p>Forming equation and correctly eliminating "log". Co.</p> <p>Recognising that the equation is quadratic.</p> <p>Correct method of solving the equation = 0.</p> <p>Not dependent on first M1. Correct method.</p> <p>Co. (not for $\log 5 \div \log 3$). Ignore ans from $3^y = -10$.</p>

<p>10.</p> <table border="1"> <tr><td>x</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td>y</td><td>9.2</td><td>8.8</td><td>9.4</td><td>10.4</td><td>11.6</td></tr> <tr><td>xy</td><td>18.4</td><td>26.4</td><td>37.6</td><td>52.0</td><td>69.6</td></tr> <tr><td>x²</td><td>4</td><td>9</td><td>16</td><td>25</td><td>36</td></tr> </table> <p>(i) Plots xy against x² or x² against xy to get a line</p> <p>c = 12 to 12.5 or -7.25 to -7.75 m = 1.55 to 1.65 or 0.62 to 0.63 xy = 1.6x² + 12 or x² = 0.625xy - 7.5 → y = 1.6x + 12/x</p> <p>(ii) Reads off at xy = 45 → x = 4.5 to 4.6</p>	x	2	3	4	5	6	y	9.2	8.8	9.4	10.4	11.6	xy	18.4	26.4	37.6	52.0	69.6	x ²	4	9	16	25	36	<p>M1 A2,1</p> <p>B1 B1</p> <p>M1 A1</p> <p>M1A1 [9]</p>	<p>Knows what to do. Points accurate – single line with ruler</p> <p>Allow if y = mx + c used.</p> <p>Allow if y = mx + c used. Must be xy = mx² + c or x² = mxy + c.</p> <p>Algebra is also ok as long as xy = 45 is solved with an equation given M1 above.</p>
x	2	3	4	5	6																					
y	9.2	8.8	9.4	10.4	11.6																					
xy	18.4	26.4	37.6	52.0	69.6																					
x ²	4	9	16	25	36																					
<p>11. y = xe^{2x}</p> <p>(i) d/dx(e^{2x}) = 2e^{2x}</p> <p>dy/dx = e^{2x} + x.2 e^{2x} sets to 0 → x = -0.5</p> <p>(ii) d²y/dx² = 2 e^{2x} + [2 e^{2x} + 4x e^{2x}] = 4 e^{2x}(1 + x) → k = 4</p> <p>(iii) when x = -0.5, d²y/dx² is +ve (0.74) → Minimum</p>	<p>B1</p> <p>M1 M1A1</p> <p>M1A1 A1</p> <p>M1A1 [9]</p>	<p>Anywhere – even if dy/dx = 2x e^{2x} or 2 e^{2x}.</p> <p>Use of correct product rule. Not DM mark. Allow for stating his dy/dx = 0.</p> <p>Use of product rule needed. Allow if he reaches 4e^{2x}(1 + x).</p> <p>No need for figures but needs correct x and correct d²y/dx².</p>																								
<p>12. EITHER</p>  <p>At A, y = 4 dy/dx = 2cosx - 4sinx dy/dx = 0 when tanx = ½</p> <p>At B, x = 0.464 or 26.6°</p>	<p>B1 M1A1 M1A1</p> <p>A1</p>	<p>Anywhere.</p> <p>Any attempt at differentiation. Sets to 0 and recognises need for tangent.</p> <p>Co. Accept radians or degrees here.</p>																								

Page 5	Mark Scheme	Syllabus	Paper
	IGCSE EXAMINATIONS – JUNE 2003	0606	1

$\int (2\sin x + 4\cos x) dx = -2\cos x + 4\sin x$ <p>Area under curve = $[]_{0.464} - []_0$ $\rightarrow -(-2) = 2.$</p> <p>Reqd area = $2 - (4 \times 0.464) = 0.144$ (5 or 6).</p>	M1A1 DM1 M1A1 [11]	Any attempt with trig. functions. x-limits used correctly. If "0" ignored or automatically set to 0, give DM0. Plan mark – must be radians for both M and A.
<p>12. OR</p>  <p>$dy/dx = \frac{1}{2}(1 + 4x)^{-\frac{1}{2}} \times 4$ At P, $m = \frac{2}{3}$</p> <p>Eqn of tangent $y - 3 = \frac{2}{3}(x - 2)$ At B, $x = \frac{1}{3}$</p> <p>$\int \sqrt{1 + 4x} dx = (1 + 4x)^{1.5} \times \frac{2}{3} \div 4$</p> <p>Area under curve = $[]^2 - []^0 = 4\frac{1}{3}$</p> <p>Shaded area = Area of trapezium - $4\frac{1}{3} = \frac{1}{3}$</p> <p>Or Area under $y = \frac{2}{3}x + \frac{1}{3} - 4\frac{1}{3} = \frac{1}{3}$</p> <p>[or $\int x dy = \int (\frac{1}{4}y^2 - \frac{1}{4}) dy$ $= y^3/12 - y/4$</p> <p>area to left of curve = $[]_3 - []_1 = 1\frac{2}{3}$ shaded area = $1\frac{2}{3} - \text{triangle } (\frac{1}{2} \cdot 2 \cdot 1\frac{1}{3})$ $= \frac{1}{3}$</p>	M1A1 M1A1 M1A1 A1 DM1A1 M1 A1 [M1A1 A1 DM1A1 M1 A1] [11]	Any attempt with dy/dx – not for $\sqrt{1 + 4x} = 1 + 2\sqrt{x}$. A mark needs everything. Not for normal. Not for "y + y ₁ " or for m on wrong side. Allow A for unsimplified. Any attempt at integration with (1 + 4x) to a power. Other fn of x included, M1 only. Use of limits 0 to 2 only. Must attempt a value at 0. Plan mark independent of M marks. A1 co. Attempt at differentiation. A1 for each term. Must be limits 1 to 3 used correctly. Plan mark independent of other Ms.
<p>DM1 for quadratic equation. Equation must be set to 0. Formula – must be correctly used. Allow arithmetical errors such as errors over squaring a negative number. Factors – must be an attempt at two brackets. Each bracket must then be equated to 0 and solved. Completing the square – must result in $(x \pm k)^2 = p$. Allow if only one root considered.</p>		

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JUNE 2003

INTERNATIONAL GCSE

MARK SCHEME

MAXIMUM MARK: 80

SYLLABUS/COMPONENT: 0606/02

**ADDITIONAL MATHEMATICS
Paper 2**

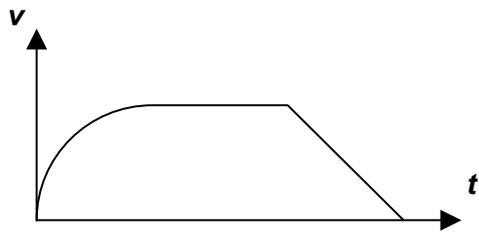


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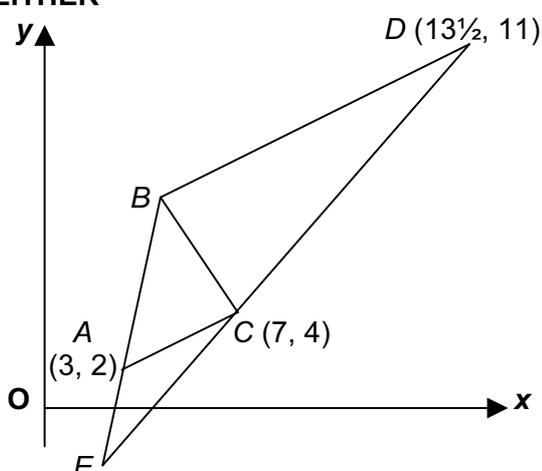
Page 1	Mark Scheme	Syllabus	Paper
	IGCSE EXAMINATIONS – JUNE 2003	0606	2

1	Put $x = -b/2$ (or synthetic or long division to remainder) $\Rightarrow 3b^3 + 7b^2 - 4 = 0$ AG Search $\Rightarrow b = -1$ [or $b = -2$] (1 st root or factor) Attempt to divide $\Rightarrow 3b^2 + 4b - 4$ (or $3b^2 + b - 2$) or further search $\Rightarrow b = -2$ [or $b = -1$] Factorise (or formula) [3 term quadratic] or method for 3 rd value $\Rightarrow b = -2, -1$ or $2/3$	M1 A1 M1 A1 M1 DM1 A1
[7]		
2 (i)	$\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA} = \pm(9\mathbf{i} + 12\mathbf{j})$ Unit vector = $\overrightarrow{AB} \div \sqrt{9^2 + 12^2} = \pm(0.6\mathbf{i} + 0.8\mathbf{j})$ [Accept any equivalent unsimplified version of column vectors, $\pm \begin{pmatrix} 9 \\ 12 \end{pmatrix}, \pm \begin{pmatrix} 0.6 \\ 0.8 \end{pmatrix}$]	M1 M1 A1
(ii)	$\overrightarrow{AC} = \frac{2}{3}\overrightarrow{AB} = 6\mathbf{i} + 8\mathbf{j}$ (or $\overrightarrow{CB} = \frac{1}{3}\overrightarrow{AB} = 3\mathbf{i} + 4\mathbf{j}$)	M1
[6]	$\overrightarrow{OC} = \overrightarrow{OA} + \overrightarrow{AC}$ (or $\overrightarrow{OB} - \overrightarrow{CB}$) = $12\mathbf{i} + 5\mathbf{j}$ (or equivalent)	M1 A1
3	$\int (3x^{0.5} + 2x^{-0.5}) dx = 3x^{1.5}/1.5 + 2x^{0.5}/0.5$ (one power correct sufficient for M mark) $\int_1^8 = (2 \times 8\sqrt{8} + 4\sqrt{8}) - (2 + 4)$ Must be an attempt at integration Putting $\sqrt{8} = 2\sqrt{2}$ (i.e. one term converted $\sqrt{\quad}$ to $k\sqrt{2}$) $\Rightarrow -6 + 40\sqrt{2}$	M1 A1 A1 M1 B1 $\sqrt{\quad}$ A1
[6]		
4	$16^{x+1} = 2^{4x+4}$ or 16×2^{4x} or 16×4^{2x} or 16×16^x $20(4^{2x}) = 20(2^{4x})$ or $5(2^{4x+2})$ or 20×16^x $2^{x-3} 8^{x+2} = 2^{x-3} 2^{3x+6} = 2^{4x+3}$ or 8×2^{4x} or 8×4^{2x} or 8×16^x Cancel 2^{4x+2} or 2^{4x} and simplify $\Rightarrow 4.5$ or equivalent	B1 B1 B1 B1
[4]		
5 (i)	$f(0) = \frac{1}{2}$ $f^2(0) = f(\frac{1}{2}) = (\sqrt{e} + 1)/4 \approx 0.662$ (accept 0.66 or better)	B1 M1 A1
(ii)	$x = (e^y + 1)/4 \Rightarrow e^y = 4x - 1 \Rightarrow f^{-1} : x \mapsto \ln(4x - 1)$	M1 A1
(iii)	Domain of f^{-1} is $x \geq \frac{1}{2}$ Range of f^{-1} is $f^{-1} \geq 0$	B1 B1
[7]		

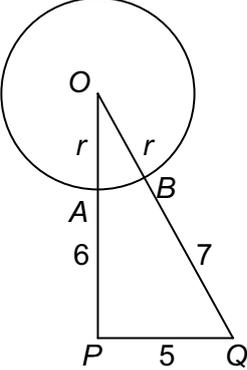
Page 2	Mark Scheme	Syllabus	Paper
	IGCSE EXAMINATIONS – JUNE 2003	0606	2

<p>6 (i)</p> <p>$x^2 - 8x + 12 = 0$ $x^2 - 8x + 12 > 0$</p> <p>(ii)</p> <p>$x^2 - 8x = 0$ $x^2 - 8x < 0$</p> <p>(iii)</p> <p>Solution set of $x^2 - 8x + 6 < 6$ is combination of (i) and (ii) $\{x: 0 < x < 2\} \cup \{x: 6 < x < 8\}$</p> <p>[7]</p>	<p>Factorise or formula \Rightarrow Critical values $x = 2, 6$ $\Rightarrow \{x: x < 2\} \cup \{x: x > 6\}$</p> <p>$\Rightarrow$ Must be an attempt to find 2 solutions $\Rightarrow \{x: 0 < x < 8\}$</p> <p>is combination of (i) and (ii) $\{x: 0 < x < 2\} \cup \{x: 6 < x < 8\}$</p>	<p>M1 A1 A1</p> <p>M1 A1</p> <p>B1 B1 (one for each range)</p>
<p>7 (i)</p> <p>$6! = 720$</p> <p>(ii)</p> <p>M ... $\Rightarrow 5! = 120$</p> <p>(iii)</p> <p>$4! = 24$</p> <p>(iv)</p> <p>$6!/4! \cdot 2! = 15$ Accept ${}_6C_4$ or ${}_6C_2 = 15$</p> <p>(v)</p> <p>$5!/3! \cdot 2! = 10$ (or, answer to (iv) less ways M can be omitted) (Listing – ignoring repeats ≥ 8 [M1] $\Rightarrow 10$ [A1])</p> <p>[8]</p>		<p>B1</p> <p>M1 A1</p> <p>M1 A1</p> <p>B1</p> <p>M1 A1</p>
<p>8 (i)</p> <p>Collect $\sin x$ and $\cos x$ Divide by $\cos x$ $x = 78.7^\circ$ or (258.7°) i.e. 1st solution + 180°</p> <p>(ii)</p> <p>Replace $\cos^2 y$ by $1 - \sin^2 y$ $3\sin^2 y + 4\sin y - 4 = 0$ Factorise (or formula) (3 term quadratic) $\Rightarrow \sin y = \frac{2}{3}$ (or -2) $y = 0.730$ (accept 0.73 or better) or (2.41) i.e. π (or $\frac{22}{7}$) less 1st solution</p> <p>[8]</p>	<p>$\Rightarrow \sin x = 5 \cos x$ $\Rightarrow \tan x = 5$ (accept $\frac{1}{5}$ – for M only)</p> <p>Factorise (or formula) (3 term quadratic) $\Rightarrow \sin y = \frac{2}{3}$ (or -2)</p>	<p>M1 M1 A1 A1√</p> <p>B1</p> <p>M1</p> <p>A1 A1√</p>
<p>9 (i)</p> <p>$\int (12t - t^2) dt = 6t^2 - \frac{1}{3}t^3$</p> <p>From $t = 0$ to $t = 6$ distance = $\int_0^6 = 144$</p> <p>Max. speed = 36 \Rightarrow from $t = 6$ to $t = 12$ distance = $36 \times 6 (= 216)$</p> <p>During deceleration distance = $(0^2 - 36^2) \div 2(-4) = 162$</p> <p>Area of Δ is fine for M mark but value of t must be from <i>constant</i> acceleration <i>not</i> $12 - 2t = \pm 4$</p> <p>Total distance = $144 + 216 + 162 = 522$</p> <p>(ii)</p> <p></p> <p>[8]</p>		<p>M1 A1</p> <p>A1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>B2, 1, 0</p>

Page 3	Mark Scheme	Syllabus	Paper
	IGCSE EXAMINATIONS – JUNE 2003	0606	2

<p>10 (i)</p> <p>(ii)</p> <p>(iii)</p> <p>[9]</p>	$\frac{dy}{dx} = \frac{(x-2)2 - (2x+4)1}{(x-2)^2} = \frac{-8}{(x-2)^2} \Rightarrow k = -8$ <p>Must be correct formula for M mark (accept $\frac{-8}{(x-2)^2}$ as answer)</p> <p>When $y = 0$, $x = -2$ (B mark is for <i>one</i> solution only) NB. $x = 0$, $y = -2$</p> <p>$m_{\text{tangent}} = -8/16 = -1/2 \Rightarrow m_{\text{normal}} = +2$ (M is for use of $m_1 m_2 = -1$, whether numeric or algebraic)</p> <p>Equation of normal is $y - 0 = 2(x + 2)$ (candidate's m_{normal} and $[x]_{y=0}$ for M mark)</p> <p>When $y = 6$, $x = 4$</p> $\frac{dy}{dt} = \frac{dy}{dx} \times \frac{dx}{dt} = \frac{-8}{(x-2)^2} \times 0.05 = \frac{-8}{4} \times 0.05 = -0.1 \text{ (accept } \pm \text{)}$ <p>i.e. $\left[\frac{dy}{dx} \right]_{x=4} \times 0.05$ for M mark.</p> <p>\checkmark is for error in k only. (Condone $S \approx \frac{dy}{dx} \times S$)</p>	<p>M1 A1</p> <p>B1</p> <p>M1</p> <p>M1 A1</p> <p>B1</p> <p>M1 A1\checkmark</p>
<p>11</p>	<p>EITHER</p>  <p>(i) $m_{AC} = (4 - 2)/(7 - 3) = \frac{1}{2}$</p> <p>$m_{BD} = \frac{1}{2}$</p> <p>$m_{BC} = -2$</p> <p>Equation of BD is $y - 11 = \frac{1}{2}(x - 13.5)$ i.e. $4y = 2x + 17$</p> <p>Equation of BC is $y - 4 = -2(x - 7)$ i.e. $y = -2x + 18$</p> <p>Solving $y = 7$, $x = 5.5$</p>	<p>B1</p> <p>B1\checkmark</p> <p>B1\checkmark</p> <p>M1</p> <p>M1</p> <p>M1 A1</p>

Page 4	Mark Scheme	Syllabus	Paper
	IGCSE EXAMINATIONS – JUNE 2003	0606	2

[10]	<p>(ii) $\frac{\Delta EBD}{\Delta EAC} = (\text{ratio of corresponding sides or } x\text{- or } y\text{- steps})^2 = 4/1$ Quadrilateral $ABDC / \Delta EBD = 3/4$</p> <p>[Or, find $E(1/2, -3)$ and then use array method to find <i>one</i> of: area quadrilateral $ABDC = 22.5$ area $\Delta EBD = 30$ Find other area and hence ratio = $3/4$ or equivalent]</p>	M1 A1	A1
11	<p>OR</p>  <p>(i) $(r + 6)^2 + 5^2 = (r + 7)^2$ Solve $\Rightarrow r = 6$ $\tan AOB = 5/12$ $AOB = 0.395$ or 22.6° Length of arc $AB = 6 \times 0.395 = 2.37$ or better</p> <p>(ii) Sector $AOB = \frac{1}{2} \times 6^2 \times 0.395 = 7.11$ Shaded area = $\frac{1}{2} \times 5 \times 12 - 7.11$ All figures in sector and triangle correct \checkmark</p>	M1 M1 M1 M1 M1	A1 A1 A1 A1 A1
[10]	22.9 or better	A1	

Grade thresholds taken for Syllabus 0606 (Additional Mathematics) in the June 2003 examination.

	maximum mark available	minimum mark required for grade:		
		A	C	E
Component 1	80	54	29	20
Component 2	80	60	34	23

Grade A* does not exist at the level of an individual component.