## UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

**International General Certificate of Secondary Education** 

# MARK SCHEME for the May/June 2011 question paper for the guidance of teachers

## 0606 ADDITIONAL MATHEMATICS

**0606/21** Paper 2, maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

• Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2011 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

Page 2	Mark Scheme: Teachers' version	Syllabus	Paper
	IGCSE – May/June 2011	0606	21

#### **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 Accuracy 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 √ 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.

Page 3	Mark Scheme: Teachers' version	Syllabus	Paper
	IGCSE – May/June 2011	0606	21

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)

### **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  $\sqrt{}$ " 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 usually discussed at a meeting.
- EX –1 Applied to A or B marks when extra solutions are offered to a particular equation. Again, this is usually discussed at the meeting.

Page 4	Mark Scheme: Teachers' version	Syllabus	Paper
	IGCSE – May/June 2011	0606	21

4		D1	
1	$\frac{\left(5 + 2\sqrt{3}\right)^2 = 37 + 20\sqrt{3}}{2 + \sqrt{3}} \times \frac{2 - \sqrt{3}}{2 - \sqrt{3}}$	B1	
	$(37+20\sqrt{3})$ $2-\sqrt{3}$	) / (1	
	$\frac{1}{2+\sqrt{3}} \times \frac{1}{2-\sqrt{3}}$	M1	
	$14 + 3\sqrt{3}$	$A1 + A1\sqrt{}$	[4]
2 (2)	220 or $\pm \frac{1}{8}$	D1	
2 (i)	$220 \text{ or } \pm \frac{1}{8}$	B1	
	−27.5 oe	B1	
(::)	16.56.2	D1	
(ii)	$16.5(x^2)$ Correct method for collecting terms	B1 M1	
	(66 + (i)) 38.5 oe	A1√	[5]
3	$\overrightarrow{AB} = 6\mathbf{i} + 24\mathbf{j} \text{ (or } \overrightarrow{AC} = 4\mathbf{i} + 16\mathbf{j})$	B1	
	$\overrightarrow{OC} = \overrightarrow{OA} + \frac{2}{3}\overrightarrow{AB}  \left(\mathbf{i} - 4\mathbf{j} + \frac{2}{3}(6\mathbf{i} + 24\mathbf{j})\right)$	) / (	
	$OC = OA + \frac{1}{3}AB \left(1 - 4\mathbf{j} + \frac{1}{3}(6\mathbf{i} + 24\mathbf{j})\right)$	M1	
	$\overrightarrow{OC} = 5\mathbf{i} + 12\mathbf{j}$	A1	
	$\left  \overrightarrow{OC} \right  = \sqrt{5^2 + 12^2}$	M1	
	13	A1	[5]
4	Eliminates y	M1	[2]
	$x^2 + kx - 2x + 16 = 0$	A1	
	Uses $b^2 - 4ac$	M1	
	$k^2 - 4k - 60*0$ or $(k-2)*\pm 8$	A1	
	k = -6  or  10	A1	
	k < -6  or  k > 10	A1	[6]
5 (i)	f(1) = 1 + 8 + p - 25 (= p - 16)	B1	
	f(-2) = -8 + 32 - 2p - 25 (= -2p - 1)	B1	
	p - 16 = 2p + 1 oe	M1	
	p = -17	A1	
(ii)	Evaluates $f(-3)$ or divides by $(x + 3)$ to remainder	M1	
(11)	71 (= 20 - 3p)	A1√	[6]
6 (a)	(i) Evidence of 8, 7, 6, 5, 4, 3, 2, 1 or 8!	M1	
	40320	A1	
	(ii) Evidence of 5! (120) or 4! (or 24)	B1	
	2880	B1	
(b)	$\frac{7 \times 6 \times 5}{3 \times 2(\times 1)} (=35)$ and $\frac{5 \times 4}{2(\times 1)} (=10)$	B1	
	Multiply	M1	
7 (2)	350	A1	[7]
7 (i)	m = 2.5 $c = 2$	B1 B1	
		וע	
	$\lg y = 2.5 \lg x + 2$	M1	
	$2 = \lg 100 \text{ or } \lg 10^2$	B1√	
	$2.5 \lg x = \lg x^{2.5}$	B1√	
	$y = 100 x^{2.5}$	A1	
Z**	S 1 251 1 2 25 2 4	) A 1	
(ii)	Solve $2.5\lg x = \lg 3$ or $x^{2.5} = 3$ correctly	M1	נסז
	1.55	A1	[8]

Page 5	Mark Scheme: Teachers' version	Syllabus	Paper
	IGCSE – May/June 2011	0606	21

8 (i)	70	B1	
		51	
(ii)	39.7	B1	
(iii)	$55e^{-0.1t} = 25 - 15$ oe	B1	
	$0.1t = \ln\left(\frac{55}{10}\right) \text{ oe}$	M1	
	17(.0)	A1	
	(dT)		
(iv)	$\left(\frac{\mathrm{d}T}{\mathrm{d}t}\right) = ke^{-0.1t}$	M1	
	k = -5.5 oe	A1	101
9 (i)	-1.11 Either	A1	[8]
) (I)			
	30/45		
	$\setminus 60$ $\alpha$	B1	
	10/15 D/V		
	$\beta$		
	· ·		
	10 or 45 found	B1	
	Uses cosine rule	M1	
	$D^{2} = 10^{2} + 30^{2} - 2 \times 10 \times 30 \times \cos 60$ or $V^{2} = 15^{2} + 45^{2} - 2 \times 15 \times 45 \times \cos 60$	A1	
	39.7 or 39.8 or $15\sqrt{7}$	A1	
(ii)	$\frac{\sin \alpha}{10/15} = \frac{\sin 60}{D/V}  \text{(or } \frac{\sin \beta}{30} = \frac{\sin 60}{D} \text{ and use } \beta \text{)}$	M1	
	$\alpha = 19.1 \text{ or } \beta = 101$ 251	A1 A1√	[8]
9 (i)	Or		
	30/45		
	$\sqrt{60}$ $\alpha$		
	10/15	B1	
	B/V		
	10	B1	
	$D\sin\alpha = 10\sin60$ and $D\cos\alpha = 25$	B1	
	or $V\sin\alpha = 15\sin60$ and $V\cos\alpha = 37.5$	3.61	
	Solve equations $V = 39.7$ or $39.8$	M1 A1	
	v - 39.7 OI 39.8	711	
(ii)	$\tan \alpha = \frac{10\sin 60}{}$	M1	
(11)	25		
	$\alpha = 19.1$ 251	A1 A1√	[8]
	431	1 7 1 A	լսյ

Page 6	Mark Scheme: Teachers' version	Syllabus	Paper
	IGCSE – May/June 2011	0606	21

126.9   306.9   B1   B1   B1   B1   B1   B1   B1   B	10 (i)	$\tan x = -1.33$	B1	
(ii) $6\cos y + \frac{6}{\cos y} = 13 \text{ or } \frac{6}{\sec y} + 6\sec y = 13$ Forms quadratic in cosy or secy $(6\cos^2y - 13\cos y + 6 = 0)$ M1  Solve 3 term quadratic  48.2  311.8  (iii) $2z - 3 = 0.775$ (or $2.37$ ) radians Solves for $z$ using radians 1.89 and $2.68$ 11  EITHER  (i) $2z - 3 = 0.775$ (or $2.37$ ) radians Solves for $z$ using radians 1.89 and $2.68$ A1  [II]  EOM = $\frac{1}{\cos 0.9}$ $AC = 19.3 - 12 = 7.3$ A1  (ii) Complete method for major arc $(2\pi - 1.8) \times 12$ $33.8$ $AB = 2 \times 12 \tan 0.9$ or cosine rule $30.2$ Complete plan $(53.8 + 30.2 + 2 \times 7.3)$ $98.6$ (iii) Complete method for major sector $\frac{1}{2} \times 12^2 \times (2\pi - 1.8)$ III  OR  (i) Uses product rule $(\frac{dy}{dx} = \sin x + x \cos x)$ $At x = \frac{\pi}{2}$ gradient = 1 Uses $m_1 m_2 = -1$ Correctly reaches conclusion, e.g. $y - \frac{\pi}{2} = -1(x - \frac{\pi}{2})$ with $y = 0$ (ii) $\int \cos x dx - \int x \sin x dx = x \cos x$ $\int x \sin x dx = \int \cos x dx - x \cos x$ $\int x \sin x dx = \int \cos x dx - x \cos x$ $\int x \sin x dx = \int \cos x dx - x \cos x$ $\int x \sin x dx = \int \cos x dx - x \cos x$ $\int x \sin x dx = \int \cos x dx - x \cos x$ $\int x \sin x \cos x dx = \int \cos x dx - x \cos x$ $\int x \sin x dx = \int \cos x dx - x \cos x$ $\int x \cos x dx - x \cos x$ $\int x \cos x dx - x \cos x$ $\int x \cos x dx - x \cos x$ $\int x \cos x dx - x \cos x$ $\int x \cos x dx - x \cos x$ $\int x \cos x dx - x \cos x$ $\int x \cos x dx - x \cos x$ $\int x \cos x dx - x \cos x$ $\int x \cos x dx - x \cos x$ $\int x \cos x dx - x \cos x$ $\int x \cos x dx - x \cos x$ $\int x \cos x dx - x \cos x$ $\int x \cos x$	10 (1)			
Forms quadratic in cosy or seey $(6\cos^2y - 13\cos y + 6 = 0)$ Solve 3 term quadratic $48.2$ $311.8$ A1  (iii) $2z - 3 = 0.775$ (or $2.37$ ) radians Solves for $z$ using radians 1.89 and $z$ 6.8  11 EITHER  (i) $OA = \frac{12}{\cos 0.9}$ $AC = 19.3 - 12 = 7.3$ A1  (ii) Complete method for major arc $(2\pi - 1.8) \times 12$ $53.8$ $AB = 2 \times 12 \tan 0.9$ or cosine rule 30.2 Complete plan $(53.8 + 30.2 + 2 \times 7.3)$ $98.6$ (iii) Complete method for major sector $\frac{1}{2} \times 12^2 \times (2\pi - 1.8)$ M1 $\frac{1}{2} \times 19.3^2 \times \sin 1.8$ or $\frac{1}{2} \times 30.2 \times 12$ M1  11 OR  (i) Uses product rule $\left(\frac{dy}{dx} = \sin x + x \cos x\right)$ A1  A1  A1  A2  (ii) Correctly reaches conclusion. e.g. $y - \frac{\pi}{2} = -1\left(x - \frac{\pi}{2}\right)$ with $y = 0$ A1  (iii) Uses limits of $\pi$ and $\frac{\pi}{2}$ 2.14 or $\pi - 1$ Area triangle $= \frac{1}{2} \times \frac{\pi}{2} \times \frac{\pi}{2}$ or $\frac{\pi^2}{8}$ or 1.23 Subtracts area of triangle			B1√	
Solve 3 term quadratic $48.2$	(ii)	$6\cos y + \frac{6}{\cos y} = 13 \text{ or } \frac{6}{\sec y} + 6\sec y = 13$	B1	
$ \begin{array}{c} 48.2 \\ 311.8 \\ (1ii) \\ 2z-3=0.775 \ ( or \ 2.37) \ radians \\ Solves \ for \ z \ using \ radians \\ 1.89 \ and \ 2.68 \\ \hline                                  $		Forms quadratic in cosy or secy $(6\cos^2 y - 13\cos y + 6 = 0)$	M1	
Sil				
(iii) $2z - 3 = 0.775$ (or $2.37$ ) radians Solves for $z$ using radians 1.89 and $2.68$ M1 A1 [11]  11 EITHER  (i) $OA = \frac{12}{\cos 0.9}$ M1 $AC = 19.3 - 12 = 7.3$ A1  (ii) Complete method for major are $(2\pi - 1.8) \times 12$ M1 $30.2$ M1 $30.2$ Complete plan $(53.8 + 30.2 + 2 \times 7.3)$ M1 $98.6$ A1  (iii) Complete method for major sector $\frac{1}{2} \times 12^2 \times (2\pi - 1.8)$ M1 $\frac{1}{2} \times 19.3^2 \times \sin 1.8$ or $\frac{1}{2} \times 30.2 \times 12$ M1 $32.3$ or $181$ A1  OR  (i) Uses product rule $\left(\frac{dy}{dx} = \sin x + x \cos x\right)$ M1  At $x = \frac{\pi}{2}$ gradient = 1  Uses $m_1 m_2 = -1$ M1  Correctly reaches conclusion. e.g. $y - \frac{\pi}{2} = -1\left(x - \frac{\pi}{2}\right)$ with $y = 0$ A1  (ii) $\int \cos x dx - \int x \sin x dx = x \cos x$ M1 $\int x \sin x dx = \int \cos x dx - x \cos x$ M1  Subtracts area of triangle M1  M1  At a triangle = $\frac{1}{2} \times \frac{\pi}{2} \times \frac{\pi}{2}$ or $\frac{\pi^2}{8}$ or $1.23$ Subtracts area of triangle				
Solves for z using radians   1.89 and 2.68		311.8	AIV	
Solves for z using radians   1.89 and 2.68	(iii)	2z - 3 = 0.775 (or 2.37) radians	B1	
11       EITHER $OA = \frac{1}{\cos 0.9}$ M1         AC = $9 - 1 = 7 - 3$ M1         (ii) Complete method for major arc $(2\pi - 1.8) \times 12$ M1 Al				
(i) $OA = \frac{12}{\cos 0.9}$ $AC = 19.3 - 12 = 7.3$ $A1$ (ii) Complete method for major arc $(2\pi - 1.8) \times 12$ $M1$ $A1$ $A1$ $A1$ $A2$ $A3$ $A4$ $A5 = 2 \times 12 \tan 0.9$ or cosine rule $A1$ $A1$ $A1$ $A1$ $A1$ $A2$ $A3$ $A3$ $A4$ $A5 = 2 \times 12 \tan 0.9$ or cosine rule $A1$ $A1$ $A1$ $A1$ $A2$ $A3$ $A3$ $A1$ $A1$ $A1$ $A1$ $A1$ $A1$ $A1$ $A1$			A1	[11]
(ii) Complete method for major arc $(2\pi - 1.8) \times 12$ $53.8$ $AB = 2 \times 12 \tan 0.9$ or cosine rule $30.2$ $Complete plan (53.8 + 30.2 + 2 \times 7.3)$ $98.6$ (iii) Complete method for major sector $\frac{1}{2} \times 12^2 \times (2\pi - 1.8)$ M1 $\frac{1}{2} \times 19.3^2 \times \sin 1.8 \text{ or } \frac{1}{2} \times 30.2 \times 12$ $323 \text{ or } 181$ $504$ M1  A1  (ii) Uses product rule $\left(\frac{dy}{dx} = \sin x + x \cos x\right)$ A1  Correctly reaches conclusion, e.g. $y - \frac{\pi}{2} = -1\left(x - \frac{\pi}{2}\right)$ with $y = 0$ A1  (iii) Uses $\lim_{x \to \infty} x dx = x \cos x$ $\lim_{x \to \infty} x dx = x \cos x$ A1  (iii) Uses $\lim_{x \to \infty} x dx = x \cos x$ A1  (iii) Uses $\lim_{x \to \infty} x dx = x \cos x$ A1  (iiii) Uses $\lim_{x \to \infty} x dx = x \cos x$ A1	11		N/1	
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(ii) Complete method for major arc $(2\pi-1.8)\times 12$ M1 A1 AB = $2\times 12\tan 0.9$ or cosine rule 30.2 A1 M1 A1 98.6 M1 A1 M1 98.6 M1 A1 $\frac{1}{2}\times 19.3^2\times \sin 1.8$ or $\frac{1}{2}\times 30.2\times 12$ M1 $\frac{1}{2}\times 19.3^2\times \sin 1.8$ or $\frac{1}{2}\times 30.2\times 12$ M1 A1 M1 323 or $181$ A1 $\frac{1}{504}$ M1 A1 $\frac{1}{504}$ M1 Uses product rule $\frac{dy}{dx} = \sin x + x \cos x$ M1 $\frac{1}{5}\cos x dx - \int x \sin x dx = x \cos x$ M1 $\frac{1}{5}\sin x dx = \int \cos x dx - x \cos x$ M1 $\frac{1}{5}\cos x dx - x \cos x + x \cos x$ M1 $\frac{1}{5}\cos x dx - x \cos x + x \cos x + x \cos x \cos x + x \cos x \cos x \cos$			A1	
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$AB = 2 \times 12 \tan 0.9 \text{ or cosine rule}$ $30.2$ $Complete plan (53.8 + 30.2 + 2 \times 7.3)$ $98.6$ (iii) Complete method for major sector $\frac{1}{2} \times 12^2 \times (2\pi - 1.8)$ $\frac{1}{2} \times 19.3^2 \times \sin 1.8 \text{ or } \frac{1}{2} \times 30.2 \times 12$ $323 \text{ or } 181$ $504$ $A1$ (i) Uses product rule $\left(\frac{dy}{dx} = \sin x + x \cos x\right)$ $At \ x = \frac{\pi}{2} \text{ gradient} = 1$ $Uses \ m_1 m_2 = -1$ $Correctly reaches conclusion. e.g. \ y - \frac{\pi}{2} = -1 \left(x - \frac{\pi}{2}\right) \text{ with } y = 0$ $A1$ (ii) $\int \cos x dx - \int x \sin x dx = x \cos x$ $\int x \sin x dx = \int \cos x dx - x \cos x$ $\sin x - x \cos x$ $A1$ (iii) Uses limits of $\pi$ and $\frac{\pi}{2}$ $2.14 \text{ or } \pi - 1$ $Area triangle = \frac{1}{2} \times \frac{\pi}{2} \times \frac{\pi}{2} \text{ or } \frac{\pi^2}{8} \text{ or } 1.23$ Subtracts area of triangle	(ii)			
30.2 Complete plan $(53.8 + 30.2 + 2 \times 7.3)$ 98.6  (iii) Complete method for major sector $\frac{1}{2} \times 12^2 \times (2\pi - 1.8)$ $\frac{1}{2} \times 19.3^2 \times \sin 1.8 \text{ or } \frac{1}{2} \times 30.2 \times 12$ 323 or $181$ 504  11 OR  (i) Uses product rule $\left(\frac{dy}{dx} = \sin x + x \cos x\right)$ $At x = \frac{\pi}{2} \text{ gradient} = 1$ Uses $m_1 m_2 = -1$ Correctly reaches conclusion. e.g. $y - \frac{\pi}{2} = -1\left(x - \frac{\pi}{2}\right)$ with $y = 0$ A1  (ii) $\int \cos x dx - \int x \sin x dx = x \cos x$ $\int x \sin x dx = \int \cos x dx - x \cos x$ $\sin x - x \cos x$ M1  (iii) Uses limits of $\pi$ and $\frac{\pi}{2}$ 2.14 or $\pi - 1$ Area triangle $= \frac{1}{2} \times \frac{\pi}{2} \times \frac{\pi}{2}$ or $\frac{\pi^2}{8}$ or $1.23$ Subtracts area of triangle				
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(iii) Complete method for major sector $\frac{1}{2} \times 12^2 \times (2\pi - 1.8)$ M1 $\frac{1}{2} \times 19.3^2 \times \sin 1.8 \text{ or } \frac{1}{2} \times 30.2 \times 12$ M1 $323 \text{ or } 181$ A1 $504$ M1  (i) Uses product rule $\left(\frac{dy}{dx} = \sin x + x \cos x\right)$ M1 $At x = \frac{\pi}{2} \text{ gradient} = 1$ A1 $Uses m_1 m_2 = -1$ M1 $Correctly reaches conclusion. e.g. \ y - \frac{\pi}{2} = -1\left(x - \frac{\pi}{2}\right) \text{ with } y = 0$ A1 $\int x \sin x dx = \int \cos x dx - x \cos x$ M1 $\int x \sin x dx = \int \cos x dx - x \cos x$ M1 $\sin x - x \cos x$ M1 $\sin x - x \cos x$ M1 $2.14 \text{ or } \pi - 1$ A1 $Area triangle = \frac{1}{2} \times \frac{\pi}{2} \times \frac{\pi}{2} \text{ or } \frac{\pi^2}{8} \text{ or } 1.23$ B1 $Subtracts area of triangle$				
$\frac{1}{2} \times 19.3^2 \times \sin 1.8 \text{ or } \frac{1}{2} \times 30.2 \times 12$ $\frac{1}{323} \text{ or } 181$ $504$ $11$ OR (i) Uses product rule $\left(\frac{dy}{dx} = \sin x + x \cos x\right)$ $At x = \frac{\pi}{2} \text{ gradient} = 1 Uses m_1 m_2 = -1 \text{Correctly reaches conclusion. e.g. } y - \frac{\pi}{2} = -1\left(x - \frac{\pi}{2}\right) \text{ with } y = 0 A1 (ii) \int \cos x dx - \int x \sin x dx = x \cos x \int \sin x dx = \int \cos x dx - x \cos x \sin x - x \cos x A1 (iii) Uses limits of \pi and \frac{\pi}{2} 2.14 \text{ or } \pi - 1 Area triangle = \frac{1}{2} \times \frac{\pi}{2} \times \frac{\pi}{2} \text{ or } \frac{\pi^2}{8} \text{ or } 1.23 Subtracts area of triangle$		98.6	A1	
323 or 181 504  A1 A1 [12]  11  OR  (i) Uses product rule $\left(\frac{dy}{dx} = \sin x + x \cos x\right)$ At $x = \frac{\pi}{2}$ gradient = 1  Uses $m_1 m_2 = -1$ Correctly reaches conclusion. e.g. $y - \frac{\pi}{2} = -1\left(x - \frac{\pi}{2}\right)$ with $y = 0$ A1  (ii) $\int \cos x dx - \int x \sin x dx = x \cos x$ M1 $\int x \sin x dx = \int \cos x dx - x \cos x$ M1 $\sin x - x \cos x$ A1  (iii) Uses limits of $\pi$ and $\frac{\pi}{2}$ 2.14 or $\pi$ - 1  Area triangle = $\frac{1}{2} \times \frac{\pi}{2} \times \frac{\pi}{2}$ or $\frac{\pi^2}{8}$ or 1.23 Subtracts area of triangle	(iii)	Complete method for major sector $\frac{1}{2} \times 12^2 \times (2\pi - 1.8)$	M1	
11 OR  (i) Uses product rule $\left(\frac{dy}{dx} = \sin x + x \cos x\right)$ At $x = \frac{\pi}{2}$ gradient = 1  Uses $m_1 m_2 = -1$ Correctly reaches conclusion. e.g. $y - \frac{\pi}{2} = -1\left(x - \frac{\pi}{2}\right)$ with $y = 0$ A1  (ii) $\int \cos x dx - \int x \sin x dx = x \cos x$ M1 $\int x \sin x dx = \int \cos x dx - x \cos x$ M1 $\sin x - x \cos x$ M1  (iii) Uses limits of $\pi$ and $\frac{\pi}{2}$ 2.14 or $\pi - 1$ Area triangle = $\frac{1}{2} \times \frac{\pi}{2} \times \frac{\pi}{2}$ or $\frac{\pi^2}{8}$ or 1.23  Subtracts area of triangle		$\frac{1}{2} \times 19.3^2 \times \sin 1.8$ or $\frac{1}{2} \times 30.2 \times 12$	M1	
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Area triangle = $\frac{1}{2} \times \frac{\pi}{2} \times \frac{\pi}{2}$ or $\frac{\pi^2}{8}$ or 1.23  Subtracts area of triangle  M1	(iii)	Uses limits of $\pi$ and $\frac{\pi}{2}$	M1	
Subtracts area of triangle M1		2	A1	
		Area triangle = $\frac{1}{2} \times \frac{\pi}{2} \times \frac{\pi}{2}$ or $\frac{\pi^2}{8}$ or 1.23	B1	
0.908 (allow 0.906 or 0.907) or 0.91 or $\pi - 1 - \frac{\pi^2}{8}$		Subtracts area of triangle	M1	
		0.908 (allow 0.906 or 0.907) or 0.91 or $\pi - 1 - \frac{\pi^2}{8}$	A1	[12]