

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE O Level

MARK SCHEME for the May/June 2006 question paper

4024 MATHEMATICS

4024/02

Paper 2 maximum raw mark 100

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the June 2006 question papers for most IGCSE and GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.



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.
- C Consolation mark, sometimes awarded for an incorrect answer. In some places it may be earned in the working.
- When a part of a question has two or more "method" steps, the M marks are generally independent unless the scheme specifically says otherwise.
- FT implies that the candidate has continued correctly after an error.

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)
CWO	Correct Working Only – often written by a 'fortuitous' answer
FT	Follow through
ISW	Ignore Subsequent Working
MR	Misread
PA	Premature Approximation (resulting in basically correct work that is insufficiently accurate)
SOI	Seen or implied
SOS	See Other Solution (the candidate makes a better attempt at the same question)

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1	(a)	For numerical $\frac{p \pm (or + or -)\sqrt{q}}{r}$ $p = 4$ and $r = 6$ B1 $q = 76$ or $\sqrt{q} = 8.71$ B1 $x = 2.12$ or -0.79 B1 + B1	4	For 'completing the square' $(x - \frac{2}{3})$ seen B1 $2\frac{1}{9}$ oe B1 SC1 for 2.1 to 2.12 AND -0.79 to -0.78
	(b)	$9a^2 + 16b^2 - 24ab$ B2	2	SC1 for $9a^2 + 16b^2$ OR $-24ab$ seen
	(c)	$(4 - y)(3 + 2t)$ B2	2	SC1 for any pair correctly factorised
2	(a)	(i) $2(7 \times 5 + 7 \times 3 + 3 \times 5)$ M1 142 cm^2 A1	2	
		(ii) $x^3 = 7 \times 5 \times 3$ soi M1 4.7 to 4.72 cm A1	2	
	(b)	(i) $\frac{1}{3}\pi 8^2 \times 15$ M1 1005 to 1010 cm^3 A1	2	
		(ii) 17 cm B1	1	
		(iii) $\pi \times 8 \times 17$ M1 427 to 427.3 cm^2 A1	2	
		(iv) 628 to 628.6 f.t. cm^2 B1	1	f.t. 201 + their 427
3	(a)	(i) $D\hat{C}B = 62^\circ$ B1		
		(ii) $D\hat{A}B = 118^\circ$ f.t. B1		f.t. 180 – their 62
		(iii) $O\hat{D}B = 28^\circ$ B1		
		(iv) $C\hat{O}B = 26^\circ$ B1	4	
	(b)	(i) $\frac{140}{360}$ soi B1 78.1 to 78.25 cm^2 B1	2	
		(ii) 220° B1 $2 \times \pi \times 8 \times \frac{220}{360}$ M1 46.7 to 46.73 cm A1	3	

Page 2	Mark Scheme	Syllabus	Paper
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4	(a)	(i)	\$6.05	B1	1		
		(ii)	62.5%	B1	1		
	(b)	(i)	$\cos \hat{HCB} = \frac{60}{80}$ oe 41.4 ° to 41.41 °	M1 A1	2		
		(ii)	$\sin 32 = \frac{40}{CD}$ $CD = \frac{40}{\sin 32}$ 75.48 to 75.5 m	M1 M1 A1	3		
		(iii)	$\tan d = \frac{40}{35}$ $d = 48.8^\circ$ to 49°	M1 A1	2		
		(c)	(i)	$\frac{4.6}{15}$ 0.31 s	M1 A1		3
			(ii)	54 km/h	B1		
	5	(a)	6, 10, 14, 18	B1			4
		(b)	4	B1			
		(c)	(i)	124			
(ii)			2	B1			
6	(a)	(i)	(a) 8 (b) 4 (c) 21 (d) 19 f.t.	B1 B1 B1 B1	4	f.t. 27 – their 8 (nor Spanish)	
		(ii)	Students who study Maths but not Physics or Students who study only Maths	B1 B1	1		
		(b)	(i)	$\frac{8}{6} = \frac{10}{RC}$ or $\frac{8}{14} = \frac{10}{10 + RC}$ oe 7.5 cm	M1 A1		2
			(ii)	$\left(\frac{8}{14}\right)^2$ or $\left(\frac{14}{8}\right)^2$ oe 98 cm ²	M1 A1		2
							e.g. $\left(\frac{10}{10 + \text{their } 7.5}\right)^2$

Page 3	Mark Scheme	Syllabus	Paper
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7	(a)	$\frac{3}{5} \times 5000$ seen	B1	1	f.t. 15 000 + their 12 500 SC1 for \$33 750
	(b)	(i) $\frac{1800}{20000}$ 9%	M1 A1	2	
		(ii) $\frac{2}{5} \times (21800 - 15000)$ \$17 720	M1 A1	2	
	(c)	$\frac{5}{3} \times 7500$ \$12 500 \$27 500 f.t.	M1 A1 B1	3	
	(d)	(i) $\frac{3}{5}(x - 15000)$ oe	B1		
8		(ii) their $\frac{3}{5}(x - 15000) = \frac{x}{2}$ f.t. $x = 90\,000$ $\Rightarrow \$45\,000$	M1 A1 A1	4	
	(a)	2.5	B1	1	lost for straight line, or incomplete
	(b)	All 10 points plotted correctly f.t. (within 1 mm) 8 or 9 points plotted correctly (within 1 mm) (Allow P1) Smooth curve, not grossly thick, thro' all plotted points of which at least 8 are correct	P2 C1	3	
	(c)	(i) $1.4 < x < 1.5$	X1		
		(ii) 6.4 to 6.5	Y1	2	
	(d)	Negative value	G1		
		2.0 to 2.5	G1	2	
	(e)	Line with negative slope thro' (0,12) Also through (6,6)	L1 L1	2	
	(f)	Attempt to simplify $\frac{x^2}{8} + \frac{18}{x} - 5 = 12 - x$ $A = 8$ AND $B = -136$	M1 A1	2	
					Allow M1 for attempt to sub $x = 1.2$ and 7.5 and solve

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9	(a)	(i)	138°	B1	1	All M and A marks available for any COMPLETE alternative method
		(ii)	$\frac{AC}{\sin 48} = \frac{7}{\sin 66}$	M1		
			$AC = \frac{7 \sin 48}{\sin 66}$	M1		
			5.69 to 5.7 km	A1	3	
	(b)	(i)	$\frac{1}{2} \times 7 \times 6.3 \sin 41$	M1		
			14.46 to 14.5 km ²	A1	2	
		(ii)	6.3 sin 41 or $\frac{\text{area}}{3.5}$	M1		
			4.13 to 4.15 km	A1	2	
	(c)		Attempt at Cosine Rule involving $\hat{B}\hat{A}\hat{E}$	M1		
			$\cos A = \frac{9^2 + 7^2 - 5^2}{2 \times 9 \times 7} \left(= \frac{105}{126} \right)$	A1		
			33.5° to 34°	A1		
			(0)56° – 56.5° f.t.	A1	4	f.t. 90 – their $\hat{A}$
10	(a)	(i)	31.8 cm	B1	1	Attempting to take readings at 90 and 30
		(ii)	32.1 – 31.65 cm 0.42 to 0.48 cm	M1 A1	2	
		(iii)	108	B1	1	
	(b)	(i)	9	B1	1	SC1 for any correct equivalent or $\frac{7}{60}$ or $\frac{7}{32}$
		(ii)	$(2 \times 7.5) + (4 \times 11) + (6 \times 13) + (3 \times 15) + (1 \times 18)$ ÷ 16 12.5 min	M1 M1 A1	3	
		(iii)	$\frac{7}{30}$ cao	B2	2	
		(iv)	1.6 cm	B2	2	

Page 5	Mark Scheme	Syllabus	Paper
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11	(a)	(i)	$\begin{pmatrix} -6 & 6 \\ -6 & 8 \end{pmatrix}$	B2	2	SC1 for 3 correct elements
		(ii)	Attempting to find AB or determ $A = 7$ $p = \frac{1}{7}$	M1 A1	2	
		(iii)	$\begin{pmatrix} -2p & 3p \\ -3p & p \end{pmatrix} \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ attempt			
			or $\begin{pmatrix} 1 & -3 \\ 3 & -2 \end{pmatrix} \begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$	M1		
			leading to 4 equations $\frac{1}{7} \begin{pmatrix} 2 & 3 \\ 3 & 1 \end{pmatrix}$	A1	2	
	(b)	(iv)	Reflection in y axis oe	B1 B1		
		(i)	$h = 2$	B1	1	
		(ii)	$\begin{pmatrix} 10 \\ 7 \end{pmatrix}$	B1	1	
		(iii)	-5	B2	2	