UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2007 question paper

4024 MATHEMATICS

4024/02 Paper 2, maximum raw mark 100

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.

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 discussions or correspondence in connection with these mark schemes.

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UNIVERSITY of CAMBRIDGE
International Examinations

Type of mark

In general:

(i) 'M' marks are awarded for any correct method applied to the appropriate numbers, even though a numerical error may be involved.

a) Once earned they cannot be lost.

b) They are earned for a numerical statement which is usually explicit as regards the quantity to be found.

c) e.g. the use of a wrong formula, wrong trigonometrical ratio or misapplication of 'Pythagoras' is wrong method.

(ii) 'A' marks are awarded for a numerically correct stage, for a correct result or for an answer lying within a specified range.

a) They are given only if the relevant 'M' mark has been earned.

b) They are not given for a correct result following an error in working.

(iii) 'B' marks are independent of method and are usually awarded for an accurate result or statement.

(iv) In graph or drawing questions some marks may carry a letter (e.g. G4 for drawing the graph, Q1 for quality, L3 for drawing loci) to make their identification easier.

Abbreviations which may be used in mark schemes or in comments on scripts:

A.G.	Answer given
b.o.d.	Benefit of doubt
c.a.o.	Correct answer only
(in)dep	(In) dependent
Ex.Q.	Extra question
✓	Follow through
✗	Further error made
I.S.W.	Ignore subsequent working
M.R.	Misread
o.e.	Or equivalent
O.W.	Omission of essential working
P.A.	Premature approximation
S.C.	Special case
s.o.i.	Seen or implied
S.O.S.	See other solution
t.&e.	Trial and error
W.W.	Without working (i.e. answer only seen)
W.W.W.	Without wrong working
(£) or (°)	Condone the omission of the £ or degree sign etc.

1	**(a)**	**(i)**	**(a)**	($)9.60	**B1**		96c or 1.20	**B0**	9.60	**B1**
			(b)	($) 23.20	**B1**		12.40	**B1**	40	**B1**
		(ii)		$\frac{16-12}{0.8}$ or $\frac{4}{0.8}$ or 5	**B1**		$\frac{16-1.2}{0.8}$ o.e.	**B1**		
				15	**B1**	**4**	28.5	**B1**	12	**B1**
	(b)	**(i)**		13(h) 16(m)	**B1**					
		(ii)		$10\ 00 + \frac{22\ 56 - 10\ 00}{2}$ or $\frac{10\ 00 + 22\ 56}{2}$	**M1**					
				16 28	**A1**	**3**	Allow 16 h 28 min			
	(c)			'figs 15 × figs 2' OR 'figs 3'	**B1**					
				4800	**B1**	**2**				
2	**(a)**			$\cos D\hat{B}E = \frac{1.5}{1.9}$ o.e.	**M1**		All M and A marks available for any COMPLETE alternative method.			
				37.86 – 37.9	**A1**	**2**				
	(b)			$\tan 68 = \frac{1.5}{AE}$ o.e.	**M1**		condone $\frac{\sin 22}{AE} = \frac{\sin 68}{1.5}$ for **M1**			
				0.6 – 0.61	**A1**	**2**				
	(c)			$\frac{1.3}{\sin D} = \frac{1.9}{\sin 76}$ o.e.	**M1**					
				$\sin D = \frac{1.3 \sin 76}{1.9}$	**M1**		dep on first **M1**			
				41.59 – 42	**A1**	**3**				
3	**(a)**			$\frac{11}{18a}$	**B2**	**2**	**SC1** for any equiv. unsimplified form or figs $^{11}/_{18}$ in final answer.			
	(b)			$b^2 - 3b + 8$ (final answer)	**B2**	**2**	**SC1** for 2 collected terms correct in final answer (without b^3, b^4 …) OR: for a correct form without brackets.			
	(c)	**(i)**		127	**B1**					
		(ii)	**(a)**	132	**B1**					
			(b)	$n^3 + 2 + n$ o.e.	**B1**	**3**	e.g. accept $n^3 + 3 + n - 1$.			
	(d)	**(i)**		$(y =)\ x - 38$ o.e.	**B1**		e.g. accept $x + 22 - 60$.			
		(ii)	**(a)**	$x + 60 = 3\ (x - 38)$ ʃ	**B1**		ʃ $x + 60 = 3 \times$ their $(x - 38)$			
				87	**B1**					
			(b)	196 ʃ strict ʃ on positive x	**B1**	**4**	ʃ 2 × their 87 + 22			

4	**(a)** **(i)**	60	**B1**		
	(ii)	9 : 4	**B1**		Accept 4 : 9 Not $^9/_4$ or 2.25 : 1
	(iii)	165	**B2**	**4**	**SC1** for $\frac{44 \times 360}{96}$ or $\frac{44 \times 100}{26 \text{ to } 27}$
	(b) **(i)**	$D\hat{A}C = 33$	**B1**		
	(ii)	$D\hat{T}C = 24$	**B1**		
	(iii)	$A\hat{D}C = 57$	**B1**		
	(iv)	$A\hat{B}C = 123$ ♪	**B1**	**4**	♪ 180 – their 57
5	**(a)** **(i)**	Mode = 3	**B1**		If 6 is mentioned 3 must be the clearly intended answer
	(ii)	Median = 4	**B1**		
	(iii)	(2 × 2) + (3 × 6) + ….. (115) 4.6	**M1** **A1**	**4**	
	(b) **(i)**	$^9/_{25}$	**B1**		Accept 36% or 0.36.
	(ii)	1	**B1**	**2**	Accept 100%; Not $^{25}/_{25}$ or $^1/_1$
	(c) **(i)**	$\frac{1}{50}$	**B1**		
	(ii)	$\frac{2}{25} \times \frac{5}{24}$ $\frac{1}{30}$	**M1** **A1**	**3**	$\frac{10}{600}$ or better implies **M1**
6	**(a)**	Rotational (symmetry) Order 2, centre (3, 0) o.e.	**B1** **B1**	**2**	–1 if line symmetry stated or implied.
	(b) **(i)**	$\overrightarrow{CD} = \begin{pmatrix} 0 \\ 8 \end{pmatrix}$	**B1**		
	(ii)	$\overrightarrow{OC} = \begin{pmatrix} 6 \\ -4 \end{pmatrix}$	**B1**		
	(iii)	$\overrightarrow{DO} = \begin{pmatrix} -6 \\ -4 \end{pmatrix}$	**B1**	**3**	
	(c)	Isosceles	**B1**	**1**	
	(d)	(3, –2) Shear	**B1** **B1**	**2**	

7	**(a)** **(i)**	$20 \times 7 \times 4$ $(3\times)\frac{1}{2}\times\frac{4}{3}\times\pi\times 2.5^3$ $461.7 \rightarrow 462$ (cm^3)	**M1** **M1** **A1**	**3**	560 implies **M1** 32.7… or 98.2… imply **M1**
	(ii)	216 (cm^3)	**B1**	**1**	
	(iii) **(a)**	$(3\times)\frac{1}{2}\times 4\times\pi\times 2.5^2$ $117.7 \rightarrow 118$ (cm^2)	**M1** **A1**	**2**	39.2… implies **M1**
	(b)	$(20\times 7-3\times)\pi\times 2.5^2$ $81 \rightarrow 81.2$ (cm^2)	**M1** **A1**	**2**	19.6.. or 58.9.. implies **M1**
	(b) **(i)**	$V = kx^3 \Rightarrow k = \frac{1}{3}$ or $\left(\frac{6}{12}\right)^3$ o.e. seen $71 \rightarrow 72$ (cm^3)	**B1** **B1**	**2**	
	(ii)	$15.7 \rightarrow 16.4$ (cm)	**B2**	**2**	
8	**(a)**	Correct scales 10 correct plots (within 1 mm) Smooth curve (not grossly thick)	**S1** **P1** **C1**	**3**	
	(b)	5.7 to 5.9	**T1**	**1**	Must be clearly identified if written on the graph.
	(c) **(i)**	Negative value 4 to 6 } final answer	**G1** **G1**		Accept $\frac{a}{b}$ if, a, b integers
	(ii)	Speed or velocity.	**G1**	**3**	Accept ‘rate of change of distance with time’.
	(d) **(i)** **(a)**	15 (m)	**D1**		
	(b)	9 (m)	**D1**		
	(ii)	Straight line –*ve* slope Through (0, 15) and (6, 6)	**L1** **L1**		(6, 6) within 2 mm
	(iii)	7 – 7.4	**B1**	**5**	Must be clearly identified if written on the graph.

9	**(a)**	Attempt at cosine rule $BD^2 = 61^2 + 30^2 - 2.30.61 \cos 41$ $= 1850 - 1860$ BD = 43.1 to 43.12	**M1** **M1** **A1** **A1**	**4**	e.g. $61^2 + 30^2 \pm (2).30.61 \cos 41$ BD can be implied.
	(b)	$\frac{1}{2} \times 61 \times 30 \times \sin 41 (= 600.2...)$	**B2**		A.G.
	(c)	Same height ⇒ 45 : 30 (or common vortex)	**B1**		A.G. Accept use of $^1/_2\ ab \sin C$.
	(d)	900 → 901 (cm^2)	**B1**	**4**	
	(e)	$900 = \frac{1}{2} \times 43.1 \times CN$ ✓ 41.7 – 41.9	**M1** **A1**	**2**	✓ their $900 = \frac{1}{2}$ their $BD \times CN$
	(f)	$\sin e = \frac{15}{41.8}$ ✓ 21.0° – 21.1°	**M1** **A1**	**2**	✓ $\sin e = \frac{15}{\text{their} CN}$ **SC1** for final answer 68.9° → 69°
10	**(a)**	3	**B1**		
	(b)	2 o r –2	**B1+B1**	**3**	
	(c) **(i)**	3	**B1**		
	(ii)	$-\frac{12}{5}$ o.e.	**B1**	**2**	
	(d)	$3x^2 = 5y + 12$ $x = \sqrt{\frac{5y+12}{3}}$ o.e.	**M1** **A1**	**2**	NB $x^2 = \frac{5}{3}y + 4$ or $\frac{\sqrt{5y+12}}{3}$ score **M1**
	(e) **(i)**	$\frac{t-3}{2} = \frac{3t^2-12}{5}$ o.e. ⇒ $5(t-3) = 2(3t^2 - 12)$ ⇒ Given result	 **B1**	 **1**	method must be clear and accurate must reach $6t^2 - 5t - 9 (= 0)$
	(ii)	For numerical $\frac{p +/- \sqrt{q}}{r}$ p = +5 and r = 12 q = 241 of $\sqrt{q}$ = 15.5… (s.o.i.) 1.7 or -0.88	 **B1** **B1** **B1+B1**	 **4**	For 'completing the square' $\left(t - \frac{5}{12}\right)^2$ **B1**, $\frac{241}{144}$, … **B1** **SC1** for 1.7 – 1.72 AND – 0.88 to – 0.87 or for any 2 ans to 2 sig figs

11	**(a)** **(i)**	Translation $\begin{pmatrix}-3\\0\end{pmatrix}$ o.e.	**B1** **B1**	**2**	With 2nd transformation **BO BO** Coords don't score
	(ii)	Rotation 90° AC, centre (0, 1)	**B1** **B1**	**2**	With 2nd transformation **BO BO**
	(iii)	$\begin{pmatrix}-1 & 0\\0 & 1\end{pmatrix}$	**B2**	**2**	
	(b) **(i)**	–2	**B1**		Allow $^{-2}/_{1}$
	(ii)	(3, 1)	**B1**	**2**	Allow $\begin{pmatrix}3\\1\end{pmatrix}$
	(c) **(i)**	2	**B1**		
	(ii)	$\frac{1}{2}\begin{pmatrix}4 & -3\\2 & -1\end{pmatrix}$ ∫ I.S.W.	**B1**		∫ $\frac{1}{\text{their}2}$
	(iii)	$\begin{pmatrix}2 & -1\frac{1}{2}\\1 & -\frac{1}{2}\end{pmatrix}\begin{pmatrix}4\\-2\end{pmatrix}$ ∫ OR $\begin{pmatrix}-1 & 3\\-2 & 4\end{pmatrix}\begin{pmatrix}x\\y\end{pmatrix}=\begin{pmatrix}4\\-2\end{pmatrix}$ $\begin{pmatrix}11\\5\end{pmatrix}$ $x=11, y=5$	**M1** **A1**	 **4**	∫ from their **(c)(ii)**