UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2008 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)**	$\pi \times (\text{fig } 7)^2 \times 15$ or figs 23 $\pi \times 0.07^2 \times 15$ or $\pi 7^2 \times 1500$ 0.23 to 0.231	**M1** **A1** **A1**	**[3]**	Condone 14/2 for M1 SC1 for $0.92 \rightarrow 0.924$
	(b) **(i)**	$\cos T\hat{P}A = \frac{15}{23}$	**M1**		For any <u>complete</u> methods allow appropriate M+ A marks
		49.29 to 49.3	**A1**	**[2]**	GRAD ANSWERS **(i)** 54.77…
	(ii)	$\frac{12}{\sin T} = \frac{15}{\sin 37}$	**M1**		**(ii)** 28.94…→
		$\sin T = \frac{12\sin 37}{15} = (28.7 - 29)$	**M1**		**(iii)** 33.97
		$B\hat{P}T = 114 - 114.22$	**A1**	**[3]**	
	(iii)	$\tan A = \frac{15}{23}$ A = 33 to 33.12	**M1** **A1**	**[2]**	SC1 for 56.8 to 56.9
2	**(a)** **(i)**	31.2 to 31.3	**B1**	**[1]**	
	(ii)	$\frac{128-40}{50}$ o.e. 1.76	**M1** **A1**	**[2]**	
	(b) **(i)**	($)5.6(0)	**B1**	**[1]**	560 (c) ✓
	(ii)	shop B ($)14.1(2) soi 28(c)	**B1** **B1**	**[2]**	($)0.28 ✓
	(iii)	16	**B2**	**[2]**	SC1 for 15
3	**(a)**	$75 \times 60 \times 24 \times 7 \times 50$ or figs 378 or figs 37 or figs38 3.78×10^7	**M1** **A1**	**[2]**	
	(b)	$\frac{18}{2} = \frac{x}{15}$ o.e. 135	**M1** **A1**	**[2]**	e.g. $\frac{x}{15} = \frac{18+x}{17}$ or $\frac{x}{15} = \frac{2x+18}{32}$

(c)	**(i)**	156	**B1**		
	(ii)	40	**B1**		
	(iii)	$220-\frac{5H}{4}$ o.e. … isw	**B2**	**[4]**	SC1 for (±) $\frac{5H}{4}$ soi or any correct expression for –n
4	**(a)**	Ext. angle = $\frac{360}{8}$ or			
		Sum of int $\angle = (2.8-4)\times 90$ o.e.	**M1**		
		Correct method → 135	**A1**	**[2]**	AG
	(b) **(i)**	$x = 22\frac{1}{2}$	**B1**		
		$y = 45$	**B1**		
		$z = 45$	**B1**		
		$t = 67\frac{1}{2}$	**B1**	**[4]**	
	(ii)	Trapezium	**B1**	**[1]**	Any recognizable word.
	(iii)	CE = $\sqrt{100+100}$ or $\frac{10}{\sin/\cos 45}$	**M1**		
		= 14.1 → 14.2	**A1**	**[2]**	
	(iv) **(a)**	$y = z,\ B\hat{G}F = E\hat{G}C, (F\hat{B}G = G\hat{E}C)$	**B1**		Accept any 2.
	(b)	1.96 → 2.02	**B1**	**[2]**	Or any equivalent integer fraction.
5	**(a)** **(i)**	24	**B1**		
	(ii)	8	**B1**		
	(iii)	31	**B1**	**[3]**	
	(b) **(i)**	$\frac{5}{36}$	**B1**		
	(ii)	$\frac{1}{9}$ o.e.	**B1**		–1 once for un-simplified answers in **(b)(i), (ii), (iii)**
	(iii)	$\frac{1}{6}$ o.e.	**B2**	**[4]**	SC1 for $\frac{1}{12}$

(c)	**(i)**	(215)	**B1**		Condone 215
	(ii)	(Total) distance (travelled)	**B1**		Dep. on single element in **(c)(i)**.
	(iii)	43(km/h) ♩	**B1**	**[3]**	♩ their 215 ÷ 5, can be from 3 elements in **(c)(i).**
6 **(a)**	**(i)**	64.2	**B1**		} Accept answers correcting to any of these values
	(ii)	Either 64.5 or 63.6 0.9	**M1** **A1**		
	(iii)	50 cao	**B1**	**[4]**	
(b)		Paul – smaller IQR ♩	**B1**	**[1]**	Provided answer to **(a)(ii)** is < 1.5
7 **(a)**	**(i)**	7500×0.88^2 o.e. 5808 or 5810	**M1** **A1**	 **[2]**	
	(ii)	$6490 \times \frac{100}{88}$ o.e. 7375 or 7370 or 7380	**M1** **A1**	 **[2]**	
	(iii)	100, 88, 77, 68, (60, 53, 46.4) o.e. 6^{th} day or Sunday	**M1** **A1**	 **[2]**	
(b)	**(i)**	$\frac{4}{3}\pi . 18^3 \times \frac{1}{2}$ $12200 \rightarrow 12220$	**M1** **A1**	 **[2]**	SC1 for $24400 \rightarrow 24440$
	(ii)	$2\pi 18^2 + \pi 18^2$ $3050 \rightarrow 3055$	**M1** **A1**	 **[2]**	
(c)		Use of $\left(\frac{h}{12}\right)^3$ or $\left(\frac{1080}{5000}\right)^{\frac{1}{3}}$ $7.1 \rightarrow 7.3$	**M1** **A1**	 **[2]**	

8	**(a)**	0.2	**B1**	**[1]**	
	(b)	Correct scales	**S1**		Condone reversed axes.
		8 correct plots (within 1mm)	**P1**		Accept if curve goes through correct point(s) [Ignore $x < -1$]
		Smooth increasing curve (not grossly thick) through at least 5 of his plots	**C1**	**[3]**	
	(c)	0	**B1**	**[1]**	
	(d)	Clear attempt at tangent (be generous)	**T1**		
		$4 \rightarrow 5$	**G1**	**[2]**	Accept integer fractions.
	(e) (i)	Straight line thro' (08)	**L1**		Produce if necessary.
		And thro' (4,0)	**L1**	**[2]**	
	(ii)	Approx (2.2, 3.6) [each coord ± 0.1]	**B1**	**[1]**	
	(iii)	$A = -2\frac{1}{2}$	**B1**		SC1 for $\frac{4}{5}2^x = 8 - 2x$ seen
		B = 10	**B1**	**[2]**	
9	**(a) (i)**	222°	**B1**		
		107°	**B1**	**[2]**	
	(b) (i)	Attempt at cosine rule	**M1**		e.g. $4.5^2 + 2.8^2 \pm (2)\ 4.5 + 2.8 \cos 115/65$
		$HL^2 = 4.5^2 + 2.8^2 - 2 \times 4.5 \times 2.8 \cos 115$	**M1**		HL can be implied by later working
		38.7 to 38.74	**A1**		
		6.2 to 6.23	**A1**	**[4]**	
	(ii)	$\frac{1}{2} \times 4.5 \times 2.8 \times \sin 115$	**M1**		Possible GRAD ANSWERS **(b) (i)** 33.77
		5.7 to 5.71	**A1**	**[2]**	5.83 **(ii)** 6.13
	(c) (i)	$\frac{\text{Area}}{2.25}$ or 2.8 sin 65	**M1**		**(c) (i)** 2.39 or 2.72
		2.53 to 2.54	**A1**	**[2]**	
	(ii)	$\frac{\text{DistHA}}{\text{Speed}} = \frac{4.5}{3}$	**M1**		
		0650 (h)	**A1**	**[2]**	6 50 (am)

10	**(a)** **(i)**	$8 - x$	**B1**		
	(ii)	$\frac{1}{2}x(8-x)$	**B1**	**[2]**	Condone omission of brackets.
	(b)	$\frac{1}{2}x(12-x)$	**B1**		Condone omission of brackets.
		$12 \times 8 - x(8-x) - x(12-x)$	**M1**		
		Correct working to $2x^2 - 20x + 96$	**A1**	**[3]**	Must see at least one step. AG
	(c)	$2x^2 - 20x + 96 = 60$ & working	**B1**	**[1]**	AG
	(d)	For numerical $\frac{p \pm \sqrt{q}}{r}$	**B1**		– ¯10 not far enough but can be implied.
		$p = 10$ and $r = 2$			
		$\sqrt{q} = 5.29$ or $q = 28$	**B1**		
		7.65 and 2.35 or 2.36	**B1**	**[3]**	
	(e) **(i)**	$k = 46$	**B1**		
	(ii)	Area = 46 or his k	**B1**		
		$x = 5$	**B1**	**[3]**	
11	**(a)** **(i)**	Translation	**B1**		
		$\begin{pmatrix} -6 \\ 3 \end{pmatrix}$	**B1**	**[2]**	Accept in words but not (–6, 3) NB: mention of 2nd transf. loses both marks in each part
	(ii)	Enlargement	**B1**		
		SF $-\frac{1}{2}$, Centre (–2, 1)	**B1**	**[2]**	
	(iii)	Rotation	**B1**		
		90° AC o.e. Centre (–1 0)	**B1**	**[2]**	Accept +90°
	(iv)	$\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$	**B1**	**[1]**	
	(b) **(i)** **(a)**	$p + 2q$ o.e.	**B1**		–1 once for unsimplified answers.
	(b)	$2p - 2q$ o.e.	**B1**		
	(c)	$\frac{1}{3}p + \frac{2}{3}q$ o.e.	**B2**	**[4]**	SC1 for $\overrightarrow{QS} = \overrightarrow{QR} + \frac{1}{6}\overrightarrow{RT}$ o.e. soi or ans. of $-\frac{1}{3}p - \frac{2}{3}q$
	(ii)	$\frac{1}{3}$ cao	**B1**	**[1]**	Allow only if correct OR and QS seen