

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2006 question paper

0580 and 0581 MATHEMATICS

0580/04 and 0581/04

Paper 4, maximum raw mark 130

These mark schemes are published as an aid to teachers and students, to indicate the requirements of the examination. They show the basis on which Examiners were initially instructed to award marks. They do 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*.

The minimum marks in these components needed for various grades were previously published with these mark schemes, but are now instead included in the *Report on the Examination* for this session.

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1	(a) (i)	850 ÷ 80	M1		
		10.625 (hrs)	Must be exact A1		
	(ii)	10 hours 37 mins 30 secs	B1		
	(b) (i)	(0)6 08 (a.m.)	B1		
		(ii)	850 ÷ 10 hrs 48 mins		M1
	(c) (i)	78.7 (km/hr)	(78.7037037) A1		
		Increasing (more slowly)	B1		
		(ii)	Decreasing		B1
		(iii)	$\frac{15-5}{1.8-1}$		M1
		(iv)	12.5 (m/s ²)		A1
			20 x 7 or $\frac{1}{2} \times 3 \times 20$		M1
	(v)	Second area and addition s.o.i.	dep M1		
170 (m)		A1			
Areas above and below broken line are approx. equal		o.e. B1			
(vi)		(their 170 ÷ 10) x 3.6	o.e. M1		
		61.2 (km/hr)	A1	16	
2	(a)	Arc length = $\frac{\pi \times 24}{4}$	(18.8...) M1		
		Perimeter = 6 + 22 + 18 + 10 + their arc	M1		
		74.8 to 74.9 (cm)	A1		
	(b)	Sector area = $\frac{\pi \times 12^2}{4}$	(113. ...) M1		
		Area = (6 x 22) + (12 x 10) + their sector	o.e. M1		
		365 to 365.2 (cm²)	A1		
	(c)	14600 to 14605 (cm³)	B1		
	(d)	their (b) x 2	M1		
		their (a) x 40	M1		
		Addition	M1		
	3720 to 3730 (cm²)	A1	indep. indep. dep.	11	

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3	(a)	(i)	1	B1	<p>These must be seen. No feedback from the graph.</p> <p>x from -2 to 3</p> <p>y to accommodate their values.</p> <p>ft P2 for 7 or 8 points correct.</p> <p>Ft P1 for 5 or 6 points correct.</p> <p>ft provided correct shape maintained.</p> <p>SC1 for complete freehand line or for short correct ruled line crossing the curve and y-axis.</p> <p>Spoilt if y coordinate also given.</p>	
		(ii)	-1	B1		
		(iii)	$\frac{3}{2}$ or $1\frac{1}{2}$ or 1.5	B1		
	(b)	(i)	(r =)	0.25		B1
			(s =)	1		B1
			(t =)	8		B1
	(ii)	Scales correct	S1			
(iii)	Their 9 points plotted correctly. They must be in correct square and within 1 mm.	P3				
(c)	(i)	Smooth curve through all 9 points (1 mm)	C1			
		Correct ruled straight line of full length.	B2			
		(ii)	1.52 to 1.57 (correct for their graph)	B1		
(iii)	1	B1	15			
4	(a)	Circle radius 5 cm (± 2 mm)	B1	<p>Ft SC1 if $\pm 2^\circ$ and ± 2 mm</p>		
		Circle radius 2 cm (± 2 mm)	B1			
		AB is perpendicular to CD ($\pm 1^\circ$)	B1			
		Lines parallel to roads at 0.5 cm from them (all 4 pairs) (Within 1 mm)	B1			
	(b)	(i)	Accurate ($\pm 1^\circ$) angle bisector with arcs		B2	
		(ii)	T correct (± 1 mm) and labelled		T1	
	(c)	(i)	Accurate ($\pm 1^\circ$ and ± 1 mm) perpendicular bisector of TB (using their T)		B2	
P correct (2.9 to 3.1 cm from 0) and labelled			B1			
(d)	Their TP measured <u>with km</u> (± 0.1 km)	B1	11			

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5	(a)	$y \propto \frac{1}{x^2}$ or $y = \frac{k}{x^2}$	o.e.	M1	<p>SC1 for $(2x)^2y = 120$ o.e. seen <u>or</u> a correct calculation using a value of x. e.g. $x = 4, y = 7.5$ $x = 8, y = 1.875$</p> <p>SC1 for 1.5625 seen</p>
		$k = 4.8 \times 5^2$		A1	
	(b)	30		B1	
	(c)	$10x^2 = 120$	o.e.	M1	
		3.46	(3.464101.....)	A1	
	(d)	$x^2 \times x = 120$	o.e.	M1	
		4.93	(4.932424.....)	A1	
(e)	Divided by 4	o.e.	B2		
(f)	Increases by 25%	o.e.	B2		
(g)	Division by y		M1		
	Square root		M1	13	
6	(a)	$(AC =) \sqrt{(8^2 + 6^2)}$		M1	<p>dep.</p> <p>$\text{Cos} = \frac{\text{their } CE}{13}$ $\text{Tan} = \frac{\text{their } PE}{\text{their } CE}$</p> <p>$\text{tan } MPE = \frac{4}{\text{their } PE}$ (18.4°)</p> <p>2 x angle MPE</p> <p>dep on first M1.</p>
		$(PE =) \sqrt{(13^2 - [\frac{1}{2} \text{ their } AC]^2)}$		M1	
		12		A1	
	(b)	$\frac{1}{3} \times 6 \times 8 \times \text{their } PE$		M1	
		192 (cm³)		A1	
	(c)	$\sin PCA = \frac{\text{their } PE}{13}$	(0.92307...)	M1	
		a.r.t. 67.4°	(67.380....)	A1	
	(d)	$\tan PME = \frac{\text{their } PE}{4}$	(71.6°)	M1	
		$180 - 2 \times \text{angle } PME$	dep	M1	
		36.8° to 36.9°		A1	
(e) (i)	$\cos PBC = \frac{3}{13}$		M1		
	76.7°	(76.6576...)	A1		
(ii)	$(KC^2 =) 4^2 + 6^2 - 2 \times 4 \times 6 \cos(\text{their } PBC)$		M1		
	Square root of correct combination		M1		
	$\sqrt{40.957...}$ or 6.3998				
	6.40 (cm)		A1	15	

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7	(a) (i)	(5, 3)		B1		
	(ii)	(3, 5)		1+1	ft from (a)(i)	
	(b)	$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$		B2	SC1 for a correct column	
	(c)	$M(Q) = (k - 3, k - 2)$	seen	M1	SC2 if a numerical value of k is chosen and full working leads to (k, k)	
		$TM(Q) = (k - 3 + 3, k - 2 + 2)$	seen	M1	(k, k)	
		= (k, k) so $y = x$		E1		
(d)	$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$		B2	SC1 for determinant = -1 or for "self-inverse"		
(e)	(i)	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$		B2	SC1 for 3 correct numbers.	
	(ii)	Rotation		B1		
		Centre (0, 0)		B1		
		270° <u>or</u> clockwise 90°		B1		
					15	
8	(a) (i)	$(x^2 - 40) + (x + 2) + (2x + 4) + x = 62$	o.e.	M1		
		$x^2 + 4x - 96 = 0$	o.e.	A1		
	(ii)	$(x + 12)(x - 8) (=0)$		M1	$\frac{-4 \pm \sqrt{4^2 - 4 \cdot 1 \cdot -96}}{2}$	
		$x = -12$ and 8	c.a.o.	A1	or better	
	(iii)	8		B1		
	(iv)	0.5 [(2 x their 8 + 4) + (their 8 ² - 40)] x their 8		M1	Accept 0.5[2x + 4 + x ² - 40] x x	
		176	c.a.o.	A1		
	(b) (i)		$(2y - 1)^2 = y^2 + (y + 2)^2$	o.e.	M1	dep
			$4y^2 - 4y + 1 = y^2 + y^2 + 4y + 4$	o.e.	M1	No error at any stage. =0 essential
		$2y^2 - 8y - 3 = 0$		E1		
(ii)	$\frac{p \pm \sqrt{q}}{r}$ where $p = -(-8)$ and $r = 2 \times 2$	o.e.	M1			
	and $q = (-8)^2 - 4 \cdot 2 \cdot -3$	o.e.	M1			
	4.35 c.a.o.		A1			
	-0.35 c.a.o.		A1			
(iii)	13.8 c.a.o.	(13.81125)	B2	SC1 for $\frac{y(y+2)}{2}$ seen		
					16	

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9	(a)	(i)	1	B1		
		(ii)	3	B1		
		(iii)	$\frac{29 + \text{their } k + m}{10} = 3.6$	o.e. M1		
			(m =) 4	A1		
	(b)	(i)		9	B1	
				mid-values 10, 25, 32.5, 37.5, 45, 55, 70 seen	M1	At least 6 correct s.o.i.
				$(10 \times 10) + (10 \times 25) + (15 \times 32.5) + (28 \times 37.5) + (22 \times 45) + (7 \times 55) + (8 \times 70)$	M1*	Dep on first M1 <u>or</u> mid-values ± 0.5 Allow 1 more slip.
				[3822.5]		
			Total \div 100	M1	Dep on second M1*	
			38.2 (38.225)	A1		
		(ii)		$\frac{15}{100} \times \frac{14}{99}$	M1	
				$\frac{210}{9900}$	A1	
			$\frac{7}{330}$	o.e. A1		
			Final Answer	A1		
(c)	(i)		$p = 20$	B1		
			$q = 72$	B1		
	(ii)	Horizontal scale correct	S1	Implied by correct use. Ignore the vertical scale.		
		For each block of correct width		For scale error (halved), award		
	Height 3.3 cm	H1	H1, H1, H1 for correct ft heights.			
	Height 12 cm	H1				
	Height 2 cm	H1	After H0, H0, H0, give SC1 for <u>correct</u> frequency densities written. (0.67, 2.4, 0.4) 18			