

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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Page 1	Mark Scheme	Syllabus	Paper
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1	(a) (i)	850 ÷ 80 10.625 (hrs) Must be exact	M1 A1	Accept speed going from 15 to 20. Accept accel. going from 12.5 to 0 Alt Meth. 20 x 10 or $\frac{1}{2} \times 3 \times 20$ Sec. area and correct subtraction	16
	(ii)	10 hours 37 mins 30 secs	B1		
	(b) (i)	(0)6 08 (a.m.)	B1		
	(ii)	850 ÷ 10 hrs 48 mins 78.7 (km/hr) (78.7037037)	M1 A1		
	(c) (i)	Increasing (more slowly)	B1		
	(ii)	Decreasing	B1		
	(iii)	$\frac{15-5}{1.8-1}$ 12.5 (m/s ²)	M1 A1		
	(iv)	20 x 7 or $\frac{1}{2} \times 3 \times 20$ Second area and addition s.o.i. dep	M1 M1		
		170 (m)	A1		
	(v)	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		
2	(a)	Arc length = $\frac{\pi \times 24}{4}$ (18.8...) Perimeter = 6 + 22 + 18 + 10 + their arc 74.8 to 74.9 (cm)	M1 M1 A1	indep. indep. dep.	11
	(b)	Sector area = $\frac{\pi \times 12^2}{4}$ (113. ...) Area = (6 x 22) + (12 x 10) + their sector o.e.	M1 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		

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3	(a)	(i)	1	B1	These must be seen. No feedback from the graph. x from –2 to 3 y to accommodate their values. ft P2 for 7 or 8 points correct. Ft P1 for 5 or 6 points correct. ft provided correct shape maintained. SC1 for complete freehand line or for short correct ruled line crossing the curve and y-axis. Spoilt if y coordinate also given.
		(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	
			Smooth curve through all 9 points (1 mm)	C1	
	(c)	(i)	Correct ruled straight line of full length.	B2	
4		(ii)	1.52 to 1.57 (correct for their graph)	B1	Ft SC1 if $\pm 2^\circ$ and ± 2 mm
		(iii)	1	B1	
	(a)		Circle radius 5 cm (± 2 mm)	B1	
			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)		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	
					15
					11

Page 3	Mark Scheme	Syllabus	Paper
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5	(a)	$y \propto \frac{1}{x^2}$ or $y = \frac{k}{x^2}$	o.e.	M1	
		$k = 4.8 \times 5^2$		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	SC1 for $(2x)^2y = 120$ o.e. seen <u>or</u> a correct calculation using a value of x. e.g. $x = 4$, $y = 7.5$ $x = 8$, $y = 1.875$ SC1 for 1.5625 seen
	(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	dep.
		$(PE =) \sqrt{(13^2 - [\frac{1}{2} \text{ their } AC]^2)}$		M1	
		12		A1	
	(b)	$\frac{1}{3} \times 6 \times 8 \times \text{their } PE$		M1	$\text{Cos} = \frac{\text{their } CE}{13}$ $\text{Tan} = \frac{\text{their } PE}{\text{their } CE}$
		192 (cm³)		A1	
	(c)	$\sin PCA = \frac{\text{their } PE}{13}$	(0.92307...)	M1	
		a.r.t. 67.4°	(67.380....)	A1	$\tan MPE = \frac{4}{\text{their } PE}$ (18.4°) 2 x angleMPE
	(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	dep on first M1 .
	(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	ft from (a)(i) SC1 for a correct column SC2 if a numerical value of k is chosen and full working leads to (k, k) SC1 for determinant = -1 or for “self-inverse” SC1 for 3 correct numbers.
	(ii)	(3, 5)	1+1	
	(b)	$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$	B2	
	(c)	$M(Q) = (k - 3, k - 2)$ seen $TM(Q) = (k - 3 + 3, k - 2 + 2)$ seen $= (k, k)$ so $y = x$	M1 M1 E1	
	(d)	$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$	B2	
	(e) (i)	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$	B2	
	(ii)	Rotation Centre (0, 0) 270° <u>or</u> clockwise 90°	B1 B1 B1	15
8	(a) (i)	$(x^2 - 40) + (x + 2) + (2x + 4) + x = 62$ o.e. $x^2 + 4x - 96 = 0$ o.e.	M1 A1	$\frac{-4 \pm \sqrt{4^2 - 4 \cdot 1 \cdot -96}}{2}$ or better Accept $0.5[2x + 4 + x^2 - 40] \times x$ dep No error at any stage. =0 essential
	(ii)	$(x + 12)(x - 8) (=0)$	M1	
		$x = -12$ <u>and</u> 8 c.a.o.	A1	
	(iii)	8	B1	
	(iv)	$0.5 [(2 \times \text{their } 8 + 4) + (\text{their } 8^2 - 40)] \times \text{their } 8$ 176 c.a.o.	M1 A1	
	(b) (i)	$(2y - 1)^2 = y^2 + (y + 2)^2$ o.e. $4y^2 - 4y + 1 = y^2 + y^2 + 4y + 4$ o.e. $2y^2 - 8y - 3 = 0$	M1 M1 E1	
	(ii)	$\frac{p \pm \sqrt{q}}{r}$ where $p = -(-8)$ <u>and</u> $r = 2 \times 2$ o.e. and $q = (-8)^2 - 4 \cdot 2 \cdot -3$ o.e.	M1 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)	(iv)	9	B1	
		(i)	mid-values 10, 25, 32.5, 37.5, 45, 55, 70 seen	M1	At least 6 correct s.o.i.
			$(10 \times 10) + (10 \times 25) + (15 \times 32.5) + (28 \times 37.5) + (22 \times 45) + (7 \times 55) + (8 \times 70)$ [3822.5]	M1*	Dep on first M1 <u>or</u> mid-values ± 0.5 Allow 1 more slip.
			Total $\div$ 100	M1	Dep on second M1 *
			38.2 (38.225)	A1	
	(c)	(ii)	$\frac{15}{100} \times \frac{14}{99}$	M1	
			$\frac{210}{9900}$ o.e.	A1	
			$\frac{7}{330}$ Final Answer	A1	
		(i)	$p = 20$	B1	
	(ii)		$q = 72$	B1	
			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