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.

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

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UNIVERSITY of CAMBRIDGE
International Examinations

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**	
			78.7 (km/hr)	(78.7037037)	**A1**	
	(c)	**(i)**	**Increasing** (more slowly)		**B1**	Accept speed going from 15 to 20.
		(ii)	**Decreasing**		**B1**	Accept accel. going from 12.5 to 0
		(iii)	$\frac{15-5}{1.8-1}$		**M1**	
			12.5 (m/s^2)		**A1**	
		(iv)	20 x 7 **or** $\frac{1}{2}\times 3\times 20$		**M1**	Alt Meth. 20 x 10 or $\frac{1}{2}$ x 3 x 20
			Second area **and** addition s.o.i.	dep	**M1**	Sec. area **and** correct subtraction
			170 (m)		**A1**	
		(v)	**Areas above and below broken line are approx. equal**	o.e.	**B1**	
		(vi)	(their 1 7 0 ÷ 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 (cm^2)		**A1**	
	(c)		**14600 to 14605 (cm^3)**		**B1**	
	(d)		their **(b)** x 2		**M1**	indep.
			their **(a)** x 40		**M1**	indep.
			Addition		**M1**	dep.
			3720 to 3730 (cm^2)		**A1**	**11**

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

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 **or** a correct calculation using a value of x. e.g. $x = 4$, $y = 7.5$ $x = 8$, $y = 1.875$
	(f)	**Increases by 25%** o.e.	**B2**	**SC1** for 1.5625 seen
	(g)	Division by y	**M1**	
		Square root	**M1**	**13**
6	**(a)**	$(AC =) \sqrt{(8^2 + 6^2)}$	**M1**	
		$(PE =) \sqrt{(13^2 - [\frac{1}{2} \text{ their } AC]^2)}$	**M1**	dep.
		12	**A1**	
	(b)	$\frac{1}{3} \times 6 \times 8 \times$ their PE	**M1**	
		192 (cm^3)	**A1**	
	(c)	$\sin PCA = \frac{\text{their } PE}{13}$ (0.92307...)	**M1**	$\text{Cos} = \frac{\text{their } CE}{13}$ $\text{Tan} = \frac{\text{their } PE}{\text{their } CE}$
		a.r.t. 67.4° (67.380....)	**A1**	
	(d)	$\tan PME = \frac{\text{their}PE}{4}$ (71.6°)	**M1**	$\tan MPE = \frac{4}{\text{their } PE}$ (18.4°)
		180 – 2 x anglePME dep	**M1**	2 x angleMPE
		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**	dep on first **M1**.
		√40.957... or 6.3998		
		6.40 (cm)	**A1**	**15**

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
			$TM(Q) = (k - 3 + 3 , k - 2 + 2)$ seen	**M1**	chosen and **full working** leads to (k , k)
			$= (k , k)$ so $y = x$	**E1**	(k , k)
	(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**	$\frac{-4 \pm \sqrt{(4^2 - 4.1. - 96)}}{2}$ or better
			$x = -12$ <u>and</u> 8 **c.a.o.**	**A1**	
		(iii)	**8**	**B1**	
		(iv)	0.5 [(2 x their 8 + 4) + (their 8^2 –40)] x their 8	**M1**	Accept $0.5[2x + 4 + x^2 - 40] \times x$
			176 c.a.o.	**A1**	
	(b)	**(i)**	$(2y - 1)^2 = y^2 + (y + 2)^2$ o.e.	**M1**	
			$4y^2 - 4y + 1 = y^2 + y^2 + 4y + 4$ o.e.	**M1**	dep
			$2y^2 - 8y - 3 = 0$	**E1**	No error at any stage. =0 essential
		(ii)	$\frac{p \pm \sqrt{q}}{r}$ where $p = -(-8)$ <u>and</u> $r = 2 \times 2$ o.e	**M1**	
			and $q = (-8)^2 - 4.2. - 3$ 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**

9	(a)	(i)	**1**	**B1**	
		(ii)	**3**	**B1**	
		(iii)	$\frac{29 + \text{their } k + m}{10} = 3.6$ o.e.	**M1**	
			(m =) 4	**A1**	
		(iv)	**9**	**B1**	
	(b)	(i)	mid-values 10, 25, 32.5, 37.5, 45, 55, 70 seen	**M1**	At least 6 correct s.o.i.
			(10 x 10) + (10 x 25) + (15 x 32.5) + (28 x 37.5) + (22 x 45) + (7 x 55) + (8 x 70) [3822.5]	**M1***	Dep on first **M1 <u>or</u>** mid-values ±0.5 Allow 1 more slip.
			Total ÷ 100	**M1**	Dep on second **M1***
			38.2 (38.225)	**A1**	
		(ii)	$\frac{15}{100} \times \frac{14}{99}$	**M1**	
			$\frac{\mathbf{210}}{\mathbf{9900}}$ o.e.	**A1**	
			$\frac{\mathbf{7}}{\mathbf{330}}$ **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**