UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2009 question paper

for the guidance of teachers

0580, 0581 MATHEMATICS

0580/04, 0581/04 Paper 4 (Extended), maximum raw mark 130

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UNIVERSITY of CAMBRIDGE
International Examinations

Abbreviations

cao correct answer only
cso correct solution only
dep dependent
ft follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
www without wrong working

1 (a)	($) **450**	**B2**	**M1** for $650 \div (9 + 4) \times 9$ ($\div 14$ does not imply $9 + 4$)
(b) (i)	($) **120**	**B2**	**M1** for 0.8×150 o.e.
(ii)	($) **80 ft**	**B2 ft**	**M1** for (150 – their**(b)(i)**) ÷ 0.375 o.e. only if +ve. After **M0, SC1** for answer 320
(c) (i)	($) **441**	**B2**	**M1** for 400×1.05^2 o.e. or for answer 41
(ii)	$\frac{1}{2}$ their ((**i**) – 400) ÷ 400 × 100 o.e. **5.125** or **5.13** or **5.12** c.a.o. www3	**M2** **A1**	**If use Simple Int in (i), M0, M0 in this part** i.e. a full explicit method for r If **M0**, **M1** for $\frac{400 \times r \times 2}{100}$ = their **(i)** – 400 or their **(i)** ÷ 400 × 100 then – 100 or $\frac{\text{their (i)} - 400}{400} \times 100$ (s.o.i. by 10.25) If still **M0**, **SC1** for answers 55.125 or 55.12 or 55.13 or 55.1 or 0.05125 or 0.0512 or 0.0513 **[11]**

2 (a)	**1**	**B1**	
(b)	**2.5** o.e.	**B1**	
(c)	**2.96** c.a.o.	**B2**	If **B0, M1** for $15 \times 1 + 10 \times 2 + 7 \times 3 + 5 \times 4 + 6 \times 5 + 7 \times 6$ (allow one slip) implied by 148 seen Ignore subsequent rounding
(d)	60×2.95 (= 177) their 177 – their 148 (or 50 × their 2.96) (Mean of new rolls =) **2.9** c.a.o. www3	**M1** **M1** **A1**	**Dependent** on first **M** and <u>only if</u> positive **or M1** for $\frac{\text{their } 148(50 \times \text{their } 2.96) + x(\text{or } 10x)}{60} = 2.95$ then **M1** for $x(\text{or } 10x) = 60 \times 2.95 - \text{their } 148$ (or 50 × their 2.96) and <u>only if</u> positive **[7]**

3 (a)	$(\sin P) = \dfrac{48}{0.5\times10\times14}$ o.e. fraction P = **43.29….** cao	**M2** **A1**	**M1** for $0.5 \times 10 \times 14 \sin P = 48$ o.e. **Allow 0.5 × 10 × 14 sin 43.3 = 48 for M1 but no further credit**
(b)	$10^2 + 14^2 - 2 \times 10 \times 14\cos 43.3$ (= 92.2) Evaluating square root (QR =) **9.6**(0) (**9.60 to 9.603…**) c.a.o. ww2	**M2** **M1** **A1**	If **M0, M1** for correct implicit statement **M1** (**dependent on M2**) for square root of correct combination (not negative) i.e 16cos43.3 (11.64..) implies **M2M0** **[7]**

4 (a)	$(AB =)\dfrac{250}{\sin 126}\times\sin 23$ (s.o.i by 120…) **121** (**120.7 to 121**) (m) c.a.o. www3	**M2** **A1**	**M1** for $\dfrac{AB}{\sin 23} = \dfrac{250}{\sin 126}$ o.e. (implicit)
(b) (i)	**280**	**B1**	
(ii)	**(0)69** c.a.o.	**B2**	**SC1** for answer 249 **[6]**

5 (a) (i)	**1.5, 3.75, –1.5**	**B1,B1,B1**	
(ii)	12 points plotted **ft** Curve through at least 10 points and correct shape over full domain Two separate branches, one on each side of y-axis, neither in contact with y-axis	**P3 ft** **C1** **B1**	**P2** ft for 10 or 11 points, **P1** ft for 8 or 9 points i.s.w. if two branches joined Independent
(b)	**–1.4** $\leq x \leq$ **–1.1** and **3.1** $\leq x \leq$ **3.4**	**B1,B1**	i.s.w. 3rd answer if curve cuts $y = 1$ again
(c) (i)	Correct ruled tangent at $x = 2$ or $x = –2$ Evidence of rise/run **0.8 to 1.2**	**M1** **M1** **A1**	Long enough to be able to find gradient **Dependent –** check their graph against gradient of 1 – must be correct side of 1 **No tangent drawn M0M0**
(ii)	**0.8 to 1.2** inc. or same answer as **(i)** ft	**B1 ft**	
(d) (i)	Correct ruled line to cut curve for **all** possible intersections (at least 2)	**B1**	Within ½ square of (–1, 1) and (1, –1)
(ii)	**–1.3 to –1.05, 1.05 to 1.3** inclusive	**B1, B1**	i.s.w. any extra answers
(e)	$y = kx$ with $k \geq \frac{1}{2}$ o.e. or $x = 0$	**B2**	If **B0**, allow **SC1** for $y = kx$ with $k < \frac{1}{2}$ or for y-axis stated **[19]**

6 (a) (i)	$0.5\,[(x + 6) + (x + 2)] \times (x + 1)\ (= 40)$ or better $0.5(2x + 8)(x + 1)\ (= 40)$ o.e. $0.5(2x^2 + 10x + 8)\ (= 40)$ o.e. $x^2 + 5x + 4 = 40$ o.e. $x^2 + 5x - 36 = 0$	**M1A1** **E1**	**M1** for any algebraic use of half base × height (Brackets may be implied later) May be first line If this first line, then **M0** **Dependent on M1A1**. Fully established – no errors throughout and at least 2 steps, one with 40 or 80, after first line
(ii)	**–9, 4**	**B1,B1**	**If B0, SC1** for +9 and –4
(iii)	$(BC^2 =)$ (their $x + 1)^2 + $ (their $x + 2)^2$ $(BC =)$ **7.81(0…))** c.a.o. www2	**M1** **A1**	Their x must be positive Ignore any extra solutions
(b) (i)	$9\frac{5}{12}$ or $\frac{108+5}{12}$ or $\frac{9\times12+5}{12}$ or $\frac{565}{60}$ or $\frac{9\times60+25}{60}$ seen	**E1**	Must be fractional form Condone $113/12 \times 60 = 565$; $9 \times 60 + 25 = 565$ Not for decimals
(ii)	$\frac{3y+2}{3}$ or $\frac{y+4}{2}$ o.e. $\frac{2(3y+2)}{6} + \frac{3(y+4)}{6}$ o.e.	**B1** **B1**	 or $\frac{6y+4}{6} + \frac{3y+12}{6}$ o.e.
(iii)	$\frac{2(9y+16)}{12} = \frac{113}{12}$ o.e. $\boldsymbol{y = 4.5}$ c.a.o. www2	**M1** **A1**	o.e. means with common denominator or better (Trial and error scores 2 or 0.)
(iv)	(Total dist =) (3 × their y) + 2 + (their y) + 4 o.e. (Average speed =) $\frac{\text{their } 24}{9\frac{5}{12}}$ o.e. **2.55** (km/h) (2.548 – 2.549) c.a.o. www 3	**M1** **M1** **A1**	(= 24) (dependent) Must be km divided by hours o.e. for full method Accept fractions in range **[15]**

7 (a)	$250x^2 = 4840$ o.e. $x^2 = 19.36$ **or** $(x =) \sqrt{4840 \div 250}$ (= 4.4)	**M1** **E1**	Allow **M1** for $250 \times 4.4^2 = 4840$ Then **E1** for $250 \times 19.36 = 4840$
(b)	**42.6** (kg) cao (42.592 or 42.59)	**B2**	**SC1** for figures 426 or 4259…
(c)	**26.4** (cm) c.a.o.	**B2**	If **B0**, **M1** for any of following $88 \div 4.4 = 20$ and $120 \div 20 = 6$ (accept 6 bars high o.e.) or $88h = 4.4^2 \times 120$ or $250 \times 88 \times h = 120 \times 4840$
(d) (i)	$4840 \div 4200$ (implied by 1.15(2)) $\div \frac{4}{3}\pi$ (implied by 0.274 to 0.276) $\sqrt[3]{}$ (seen or implied by correct answer to more than 2 dp) **0.649 – 0.651**	**M1** **M1** **M1 dep** **A1**	$4200 \times \frac{4}{3}\pi r^3 = 4840$ $(r^3 =)$ $4840 \div (4200 \times \frac{4}{3}\pi)$ $\sqrt[3]{}$ Third M **dependent** on **M1M1** Must be 3dp or better
(ii)	**5.31** (**5.306 – 5.31**) (cm^2)	**B1**	
(iii)	$\frac{4200 \times \text{their (ii)}}{2 \times 4.4^2 + 4 \times 4.4 \times 250} \times 100$ **501.9 – 503** (%) c.a.o. www4	**M3** **A1**	If **M0**, **M1** for $4200 \times$ **their (ii)** (22299) **and M1** (independent) for correct method for surface area of solid cuboid (4438.72) **[15]**

8			Throughout the question ratios score zero. If using decimals, 2 s.f. correct answers to parts **(c)** and **(d)** – penalty of 1 once Use of words e.g. 1 in 400 or 1 out of 400, Correct answers – penalty of one For method marks only accept probabilities p and q between 0 and 1
(a)	$p = \frac{1}{20}$, $q = \frac{19}{20}$ o.e.	**B1**	Could be on diagram
(b) (i)	$\frac{1}{400}$ o.e. c.a.o.	**B2**	0.0025 allow **M1** for (their $p)^2$ o.e.
(ii)	$\frac{38}{400}$ o.e. c.a.o.	**B2**	0.095 allow **M1** for 2 (their p)(their q) o.e.
(c)	$\frac{38}{8000}$ o.e. c.a.o.	**B2**	0.00475 allow **M1** for 2(their $p)^2$ (their q) o.e. including their **(ii)** × their p
(d)	their **(b)(i)** + their **(c)** $\frac{58}{8000}$ o.e. c.a.o.	**M1** **A1**	 0.00725
(e)	their **(d)** × 1000 = 7.25 o.e. **ft**	**B1 ft**	Accept 7 or 8 or an equivalent integer ft **[10]**

9 (a) (i)	**174 to 174.25** (cm) c.a.o.	**B1**	
(ii)	**167** (cm) c.a.o.	**B1**	
(iii)	**12** (cm) c.a.o.	**B1**	
(iv)	**37** c.a.o.	**B2**	If **B0, B1** for 63 seen in working space
(b) (i)	**10, 25**	**B1**	
(ii)	155, 165, 175, 185	**M1**	s.o.i. allow 1 slip
	(their 10 × 155 + their 25 × 165 + 47 × 175 + 18 × 185)	**M1**	Use of Σfx where the x's are in/on their intervals (allow one more slip) (17 230)
	÷ 100	**M1**	(dependent on second M) ÷ 100
	172 or 172.3 (cm) c.a.o. www 4	**A1**	**[10]**

10 (a) (i)	**–2,**	**B1**	
(ii)	**26,**	**B1**	
(iii)	$\frac{1}{8}$ o.e.	**B1**	
(b)	$\frac{y+1}{2}(=x)$	**M1**	If switch x and y first then **M1** for $x = 2y - 1$ or
	$(f^{-1}(x) =)\ \frac{x+1}{2}$ o.e. www2	**A1**	If use a diagram/chart then **M1** for any evidence of +1 then result ÷ 2
(c)	$z = x^2 + 1$		
	$z - 1 = x^2$	**M1**	Correct rearrangement at any stage for x or x^2.
	$(x =)\ \sqrt{z-1}$ www2	**M1**	Correct sq root at any stage Ignore +, – or ± in front of $\sqrt{}$
(d)	$(2x-1)^2 + 1$	**M1**	
	$= 4x^2 - 4x + 2$ or $2(2x^2 - 2x + 1)$ www 2	**A1**	Final answer but condone one minor factorising slip if first answer seen
(e)	9	**B1**	
(f)	$2(2x - 1) + x^2 + 1\ (= 0)$ or better	**B1**	
	$(x^2 + 4x - 1 = 0)$		
	$(x =)\ \frac{-4 \pm \sqrt{4^2 - 4(1)(-1)}}{2 \times 1}$ **ft**	**M1**	$\sqrt{4^2 - 4(1)(-1)}$ or better seen
		M1	If in form $\frac{p + or - \sqrt{q}}{r}$ for – 4 and 2 × 1 or better **Ft** their 1, 4 and –1 from quadratic equation seen
	$(x =)$ **–4.24, 0.24** c.a.o. www 4 (final answers)	**A1,A1**	**After A0A0, SC1** for – 4.2 or – 4.235 or – 4.236… **and** 0.2 or 0.235 or 0.236….. The **SC1's** www imply the **M** marks
(g) (i)	Straight line with positive gradient and negative y-intercept	**L1**	
(ii)	U-shape Parabola vertex on positive y-axis	**C1** **V1**	**Dependent** **[18]**

11 (a)	**15, 21, 28, 36**	**B2**	**B1** for 3 correct
(b) (i)	10 + 15 = 25, 15 + 21 = 36 etc	**B1**	Any two complete and correct statements
(ii)	**Square**	**B1**	
(c) (i)	**2**	**B1**	
(ii)	$\frac{4\times 5}{2}=10$ o.e.	**E1**	
(iii)	**16 290** c.a.o.	**B1**	
(d) (i)	$\frac{(n+1)(n+2)}{2}$ or $\frac{n^2+3n+2}{2}$ seen $\frac{n(n+1)}{2}+\frac{(n+1)(n+2)}{2}$ or $\frac{n^2+n}{2}+\frac{n^2+3n+2}{2}$ $\frac{(n+1)}{2}(n+n+2)$ $\frac{2n^2+4n+2}{2}$ $\frac{(n+1)(2n+2)}{2}$ n^2+2n+1 $\frac{2(n+1)(n+1)}{2}=(n+1)^2$ $(n+1)^2$	**M1** **M1** **E1**	Denominator could be their k May be implied by next line This line must be seen and at least one more step, without any error, to gain the E mark **Dependent on M1M1**. Fully established – no errors
(ii)	**1711 and 1770** final answers c.a.o.	**B2**	**SC1** for 59 **or** 58 **or** 1711 **or** 1770 seen **[12]**

Graph for Question 5