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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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)	($) **450**	**B2**	**M1** for 650 ÷ (9 + 4) × 9 (÷ 14 does not imply 9 + 4)
(b) (i)	($) **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 × 1 + 10 × 2 + 7 × 3 + 5 × 4 + 6 × 5 + 7 × 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 $0.5 \times 10 \times 14 \sin P = 48$ [illegible] **Allow 0.5 × 10 × 14 sin 43.3 = 48 i[illegible]** **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 ba 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	**C1**	
	vertex on positive y-axis	**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