

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 $650 \div (9 + 4) \times 9$ ($\div 14$ does not imply $9 + 4$)
(b) (i)	(\$ 120)	B2	M1 for 0.8×150 o.e.
(ii)	(\$ 80 ft)	B2 ft	M1 for $(150 - \text{their(b)(i)}) \div 0.375$ 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) $\div 400 \times 100$ 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 $\frac{400 \times r \times 2}{100} = \text{their (i)} - 400$ or their (i) $\div 400 \times 100$ 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)	$60 \times 2.95 (= 177)$ their 177 $-$ their 148 (or $50 \times$ their 2.96) (Mean of new rolls \Rightarrow) 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 $50 \times$ their 2.96) and <u>only if</u> positive [7]

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3 (a)	$(\sin P) = \frac{48}{0.5 \times 10 \times 14}$ o.e. <u>fraction</u> $P = 43.29\dots$ cao	M2 A1	M1 for $0.5 \times 10 \times 14 \sin P = 48$ o.e. Allow $0.5 \times 10 \times 14 \sin 43.3 = 48$ for M1 but no further credit
(b)	$10^2 + 14^2 - 2 \times 10 \times 14 \cos 43.3 (= 92.2)$ Evaluating square root $(QR =) 9.6(0) (9.60 \text{ to } 9.603\dots)$ 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 $16 \cos 43.3 (11.64\dots)$ implies M2M0 [7]

4 (a)	$(AB =) \frac{250}{\sin 126} \times \sin 23$ (s.o.i by 120...) 121 (120.7 to 121) (m) c.a.o. www3	M2 A1	M1 for $\frac{AB}{\sin 23} = \frac{250}{\sin 126}$ 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 $\frac{1}{2}$ 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]

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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 \times 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 $\frac{9 \times 12 + 5}{12}$ or $\frac{565}{60}$ or $\frac{9 \times 60 + 25}{60}$ 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. $y = 4.5$ c.a.o. www2	M1 A1	o.e. means with common denominator or better (Trial and error scores 2 or 0.)
(iv)	(Total dist =) $(3 \times \text{their } y) + 2 + (\text{their } y) + 4$ 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]

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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) $\sqrt[3]{\quad}$ (seen or implied by correct answer to more than 2 dp) 0.649 – 0.651	M1 M1 M1 dep A1	$4200 \times \frac{4}{3}\pi r^3 = 4840$ ($r^3 =$) $4840 \div (4200 \times \frac{4}{3}\pi)$ $\sqrt[3]{\quad}$ 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 $4200 \times \text{their (ii)}$ (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 $(\text{their } p)^2$ 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) \times their p
(d)	their (b)(i) + their (c) $\frac{58}{8000}$ o.e. c.a.o.	M1 A1	0.00725
(e)	their (d) $\times 1000 = 7.25$ o.e. ft	B1 ft	Accept 7 or 8 or an equivalent integer ft [10]

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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	s.o.i. allow 1 slip Use of Σfx where the x 's are in/on their intervals (allow one more slip) (17 230) (dependent on second M) $\div 100$
(ii)	155, 165, 175, 185 (their $10 \times 155 + \text{their } 25 \times 165 + 47 \times 175 + 18 \times 185$)	M1	
	$\div 100$	M1	
	172 or 172.3 (cm) c.a.o. www 4	A1	

10 (a) (i)	-2,	B1	
(ii)	26,	B1	
(iii)	$\frac{1}{8}$ o.e.	B1	
(b)	$\frac{y+1}{2} (= x)$ $(f^{-1}(x) =) \frac{x+1}{2}$ o.e. www2	M1 A1	If switch x and y first then M1 for $x = 2y - 1$ or If use a diagram/chart then M1 for any evidence of $+1$ then result $\div 2$
(c)	$z = x^2 + 1$ $z - 1 = x^2$ $(x =) \sqrt{z-1}$ www2	M1 M1	Correct rearrangement at any stage for x or x^2 . Correct sq root at any stage Ignore $+$, $-$ or \pm in front of $\sqrt{\quad}$
(d)	$(2x-1)^2 + 1$ $= 4x^2 - 4x + 2$ or $2(2x^2 - 2x + 1)$ www 2	M1 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 $(x^2 + 4x - 1 = 0)$ $(x =) \frac{-4 \pm \sqrt{4^2 - 4(1)(-1)}}{2 \times 1}$ ft $(x =) -4.24, 0.24$ c.a.o. www 4 (final answers)	B1 M1 M1 A1,A1	$\sqrt{4^2 - 4(1)(-1)}$ or better seen If in form $\frac{p \pm or - \sqrt{q}}{r}$ for -4 and 2×1 or better Ft their 1, 4 and -1 from quadratic equation seen After A0A0, SC1 for -4.2 or -4.235 or $-4.236\dots$ and 0.2 or 0.235 or $0.236\dots$ 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 $\frac{n^2 + n}{2} + \frac{n^2 + 3n + 2}{2}$ $\frac{(n+1)(n+n+2)}{2}$ $\frac{2n^2 + 4n + 2}{2}$ $\frac{(n+1)(2n+2)}{2}$ $n^2 + 2n + 1$ $\frac{2(n+1)(n+1)}{2} = (n+1)^2$ $(n+1)^2$	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

