

**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

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

<b>2 (a)</b>	<b>1</b>	<b>B1</b>	
<b>(b)</b>	<b>2.5</b> o.e.	<b>B1</b>	
<b>(c)</b>	<b>2.96</b> c.a.o.	<b>B2</b>	If <b>B0, M1</b> 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
<b>(d)</b>	$60 \times 2.95 (= 177)$ their 177 $-$ their 148 (or $50 \times$ their 2.96)  (Mean of new rolls $\Rightarrow$ ) <b>2.9</b> c.a.o. www3	<b>M1</b> <b>M1</b> <b>A1</b>	<b>Dependent</b> on first <b>M</b> and <u>only if</u> positive <b>or M1</b> for $\frac{\text{their } 148(50 \times \text{their } 2.96) + x(\text{or } 10x)}{60} = 2.95$  then <b>M1</b> for $x(\text{or } 10x) = 60 \times 2.95 - \text{their } 148$ (or $50 \times$ their 2.96) and <u>only if</u> positive  <b>[7]</b>

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<b>3 (a)</b>	$(\sin P) = \frac{48}{0.5 \times 10 \times 14}$ o.e. <u>fraction</u>  $P = 43.29\dots$ cao	<b>M2</b>  <b>A1</b>	<b>M1</b> for $0.5 \times 10 \times 14 \sin P = 48$ o.e. <b>Allow <math>0.5 \times 10 \times 14 \sin 43.3 = 48</math> for M1 but no further credit</b>
<b>(b)</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	<b>M2</b> <b>M1</b>  <b>A1</b>	If <b>M0, M1</b> for correct implicit statement <b>M1 (dependent on M2)</b> for square root of correct combination (not negative) i.e $16 \cos 43.3 (11.64\dots)$ implies <b>M2M0</b> [7]

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

<b>5 (a) (i)</b>	<b>1.5, 3.75, -1.5</b>	<b>B1, B1, B1</b>	
<b>(ii)</b>	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	<b>P3 ft</b>  <b>C1</b>  <b>B1</b>	<b>P2 ft</b> for 10 or 11 points, <b>P1 ft</b> for 8 or 9 points i.s.w. if two branches joined  Independent
<b>(b)</b>	<b><math>-1.4 \leq x \leq -1.1</math> and <math>3.1 \leq x \leq 3.4</math></b>	<b>B1, B1</b>	i.s.w. 3rd answer if curve cuts $y = 1$ again
<b>(c) (i)</b>	Correct ruled tangent at $x = 2$ or $x = -2$ Evidence of rise/run  <b>0.8 to 1.2</b>	<b>M1</b> <b>M1</b>  <b>A1</b>	Long enough to be able to find gradient <b>Dependent</b> – check their graph against gradient of 1 – must be correct side of 1 <b>No tangent drawn M0M0</b>
<b>(ii)</b>	<b>0.8 to 1.2 inc.</b> or same answer as <b>(i)</b> ft	<b>B1 ft</b>	
<b>(d) (i)</b>	Correct ruled line to cut curve for <b>all</b> possible intersections (at least 2)	<b>B1</b>	Within $\frac{1}{2}$ square of $(-1, 1)$ and $(1, -1)$
<b>(ii)</b>	<b>-1.3 to -1.05, 1.05 to 1.3</b> inclusive	<b>B1, B1</b>	i.s.w. any extra answers
<b>(e)</b>	$y = kx$ with $k \geq \frac{1}{2}$ o.e. or $x = 0$	<b>B2</b>	If <b>B0</b> , allow <b>SC1</b> for $y = kx$ with $k < \frac{1}{2}$ or for y-axis stated [19]

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

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

<b>8</b>			Throughout the question ratios score zero. If using decimals, 2 s.f. correct answers to parts <b>(c)</b> and <b>(d)</b> – 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
<b>(a)</b>	$p = \frac{1}{20}, q = \frac{19}{20}$ o.e.	<b>B1</b>	Could be on diagram
<b>(b) (i)</b>	$\frac{1}{400}$ o.e. c.a.o.	<b>B2</b>	0.0025 allow <b>M1</b> for (their $p$ ) <sup>2</sup> o.e.
<b>(ii)</b>	$\frac{38}{400}$ o.e. c.a.o.	<b>B2</b>	0.095 allow <b>M1</b> for 2 (their $p$ )( their $q$ ) o.e.
<b>(c)</b>	$\frac{38}{8000}$ o.e. c.a.o.	<b>B2</b>	0.00475 allow <b>M1</b> for 2(their $p$ ) <sup>2</sup> (their $q$ ) o.e. including their <b>(ii)</b> $\times$ their $p$
<b>(d)</b>	their <b>(b)(i)</b> + their <b>(c)</b> $\frac{58}{8000}$ o.e. c.a.o.	<b>M1</b> <b>A1</b>	0.00725
<b>(e)</b>	their <b>(d)</b> $\times 1000 = 7.25$ o.e. ft	<b>B1 ft</b>	Accept 7 or 8 or an equivalent integer ft <b>[10]</b>

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

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

<b>11 (a)</b>	<b>15, 21, 28, 36</b>	<b>B2</b>	<b>B1</b> for 3 correct
<b>(b) (i)</b>	$10 + 15 = 25, 15 + 21 = 36$ etc	<b>B1</b>	Any two complete and correct statements
<b>(ii)</b>	<b>Square</b>	<b>B1</b>	
<b>(c) (i)</b>	<b>2</b>	<b>B1</b>	
<b>(ii)</b>	$\frac{4 \times 5}{2} = 10$ o.e.	<b>E1</b>	
<b>(iii)</b>	<b>16 290</b> c.a.o.	<b>B1</b>	
<b>(d) (i)</b>	$\frac{(n+1)(n+2)}{2}$ or $\frac{n^2 + 3n + 2}{2}$ seen $\frac{n(n+1)}{2} + \frac{(n+1)(n+2)}{2}$ or $\frac{n^2 + n}{2} + \frac{n^2 + 3n + 2}{2}$ $\frac{(n+1)}{2}(n+n+2)$ $\frac{2n^2 + 4n + 2}{2}$ $\frac{(n+1)(2n+2)}{2}$ $n^2 + 2n + 1$ $\frac{2(n+1)(n+1)}{2} = (n+1)^2$ $(n+1)^2$	<b>M1</b> <b>M1</b> <b>E1</b>	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 <b>Dependent on M1M1.</b> Fully established – no errors
<b>(ii)</b>	<b>1711 and 1770</b> final answers c.a.o.	<b>B2</b>	<b>SC1</b> for <b>59 or 58 or 1711 or 1770</b> seen <b>[12]</b>

Graph for Question 5

