

**MARK SCHEME for the October/November 2009 question paper
for the guidance of teachers**

4024/02	4024 MATHEMATICS Paper 2, maximum raw mark 100
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Mark schemes must be read in conjunction with the question papers and the report on the examination.

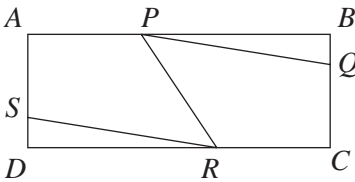
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Question Number	Mark scheme details and sub marks	Part Marks	Comments and other sub marks available
1	(a) $(y =) 3$ B1	1	Accept 2^3 seen isw
	(b) $(p =) 2$ B2	2	After B0 $3p + 4 = 8 - 2p + 6$ oe M1
	(c) $(q =) \pm 6$ B3	3	After B0 $(q =) 6$ SC2 or (i) $18(q + 2) - 16q$ soi M1 $q(q + 2)$ soi M1 (ii) $18(q + 2)$ M1 $q(q + 18)$ M1
	(d) For numerical $\frac{p \pm \sqrt{q}}{r}$ seen or used $p = -1$ and $r = 10$ B1	1	(not $\pm p$) or $(x + \frac{1}{10})^{(2)}$
	$q = 141$ or $\sqrt{q} = 11.8\dots$ (accept 11.9) soi B1	1	or $\frac{705}{500}$ oe or 1.187... if completing the square
	Final answers -1.29 www B1 1.09 www B1	1 1	These marks only, if no working seen
		[10]	After B1 + B1 + B0 + B0 both $-1.287\dots$ and $1.087\dots$ or -1.29 and 1.09 seen B1

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2	(a) (i) Convincing use of $AB - AP = CD - CR$	B1	1	<p>Implied by $AB = DC$, $AP = RC$. Ignore ref to AS and QC</p>  <p>Dependent on congruency case complete, (i.e. B2), but not necessarily named, www. If extra "correct" facts, case must be identified.</p>
	(ii) $PB = RD$ and $BQ = DS$ stated $\hat{B} = \hat{D}$ (may be implied)	B1 B1		
	Conclusion: (may be at the start) triangles are congruent oe	B1	3	
	(iii) $\hat{BPQ} = \hat{DRS}$ Either angle $\text{RPB} = \text{PRD}$ or $\hat{APR} = \hat{CRP}$	B1 B1		
	Conclusion $\text{RPB} - \text{QPB} = \text{PRD} - \text{SRD}$ or $\hat{RPQ} = 180 - (\hat{BPQ} + \hat{APR}) = 180 - (\hat{DRS} + \hat{CRP}) = \hat{PRS}$	B1	3	<p>Dependent on B2 and www After 0, $PQ \parallel SR$ and $\hat{RPQ} = \hat{PRS}$ alternate angles SC1</p>
(b) Parallelogram	B1	1	[8]	

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3	(a) $\frac{d}{50} = \sin 15$ soi	M1	2	Here and elsewhere accept answers rounding to the given 3 sig. fig. ans.	
	(d=) 12.9 (m)	A1			
	(b) $\frac{10}{AB} = \sin 15$ soi	M1	3		
	$AB = \frac{10}{\sin 15}$	M1			
(AB=) 38.6 (m)	A1				
(c) (i) 15(°)	B1	1	Allow ± 0.05 for genuine long methods.		
(ii) $\frac{CM}{10} = \cos$ their (c) (i) oe	M1	2	Accept $10\cos$ their (c) (i) $\sqrt{\quad}$ if triangle BCM is right angled		
(CM=) 9.66 (m)	A1				
			[8]	After 0 in (c), $\widehat{BCM} = 90^\circ$ seen	
4	(a) (i) (a) { 3, 9, 15 }	B1	1	Accept $(8 + \text{their } n(\mathbf{b})) \div 15 \sqrt{\quad}$ Dependent on even numbers in (b) and probability ≤ 1	
	(b) { 6, 12 }	B1	1		
	(ii) $\frac{10}{15}$ oe isw	B1	1		
	(b) (i) (a) $4x$	B1	1		
	(b) $66 - 4x$ or $66 - \text{their (a)}$	B1	1		Accept $q + 4x = 66$. Their (a) must be in terms of x .
	(ii) (a) $(x=) 13$ cao isw	B2	2		After B0, $66 - 4x + x = 27 \sqrt{\quad}$ M1
(b) 90	B1	1	Accept $(77 + \text{their } x) \sqrt{\quad}$		
			[8]		

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5	(a) (i) $\begin{pmatrix} 4 \\ 0 \\ 6 \end{pmatrix}$	B2	2	After B0, one error or $\begin{pmatrix} 6 \\ 12 \\ 0 \end{pmatrix}$ or $\begin{pmatrix} 2 \\ 12 \\ -6 \end{pmatrix}$ seen B1
	(ii) Final ans (29 7)	B2	2	Condone omission of brackets. After B0, either correct or final ans a col. vector B1 SC1
	(b) (i) $\frac{1}{2} \begin{pmatrix} 1 & 3 \\ \pm 0 & 2 \end{pmatrix}$ isw	B2	2	After B0, $\frac{1}{2}$ or $\begin{pmatrix} 1 & 3 \\ \pm 0 & 2 \end{pmatrix}$ soi or detA = 2 B1
	(ii) $h = 8, k = 2$ www	B2	2	After B0, $\begin{pmatrix} 2 & -3 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} h \\ k \end{pmatrix} = \begin{pmatrix} 10 \\ 2 \end{pmatrix}$ or their (b) (i) $\times \begin{pmatrix} 10 \\ 2 \end{pmatrix}$ seen M1
			[8]	
6	(a) 9 : 250 isw	B1	1	Accept 250 : 9, 9 ÷ 250 Condone g
	(b) (i) 9.45 (g)	B1	1	
	(ii) (a) 0.3 (%)	B1	1	
	(b) 0.9 (%)	B3	3	After B0 Figs their (b) (ii) (a) × 21 ÷ fig 7 independent M1 M1
	(iii) 2.205 (g) isw	B2	2	After B0 1.05 seen B1
(c) 2000	B2	2	After B0, division by 8.3 M1	
			[10]	

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7	(a) (i) 9.82 (m)	B4	4	$\left(h = \frac{25000 \times 0.001}{\pi 0.9^2} \right)$ After B0 $\pi 0.9^2 h$ B1
	(ii) (a) $\cos \widehat{EOD} = \frac{0.45}{0.9}$ oe seen	B1	1	Their Volume (must be a volume) = figs 25 M1 10^{-3} oe used correctly at any stage M1 e.g. $\sin ODE = 0.9 \div 1.8$ not just $\frac{1}{2}$. NB $\widehat{EOD} = 60^\circ$ is AG
	(b) 0.497 or 0.498m ²	B3	3	After B0 $\frac{120}{360} \pi 0.9^2 (= 0.848)$ soi M1 $\frac{1}{2} 0.9^2 \sin 120$ oe (= 0.351) M1
	(c) 4880 or 4890	B2	2	After B0 Figs their (a) (i) \times their (ii) (b) or Figs $\frac{\text{their(ii)(b)}}{\pi \times 0.9^2} \times 25$ M1
	(b) ($h =$) 5.00 m	B2	2	After B0 10.00 SC1 $10 \times \frac{2}{3} \pi 0.75^3 = \pi 0.75^2 h$ soi M1
			[12]	

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8	(a) (i) 21	B1	1	
	(ii) All 8 points plotted ft soi. (0 6 6 3 0 0 6 21ft at intervals of 0.5)	P2		After P0, at least 5 correct plots P1
	Smooth curve through all plotted points	C1	3	Dependent on P1. Straight line graphs or ruled sections will be C0
	(iii) 0.2 to 0.35, 1.3 to 1.4 2.8 to 2.95	B2	2	After B0, 1 correct value B1 or clear attempt to read their graph at $y = 4$ M1
	(b) (i) $5 - 2x$ and $4 - 2x$	B1	1	Accept such as $5 - x - x$
	(ii) $x \times$ their $5 - 2x \times$ their $4 - 2x$ $4x^3 - 18x^2 + 20x$ correctly derived	M1 A1	2	Their expressions must be in x AG Expect some intermediate working. Attempts at working back, factorising $4x^3 - 18x^2 + 20x$ must be accurate and convincing.
	(iii) 2.8 to 2.95	B1	1	Or their value in (a) (iii) >2
	(iv) (a) Their max between 0 and 2	B1	1	Accept 6
	(b) 0.7 to 0.8 cao	B1	1	
				[12]

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9	(a) (i) Accurate drawing	B3	3	After B0 Right angles at A and E R1 C correctly placed in relation to B and D e.g. BC = 3 and DC = 2, or angle BCD, correct C1
	(ii) $135^\circ \pm 2^\circ$	B1	1	Independent.
	(b) (i) $DE : ST \neq 1 : 3.5$ oe	B1	1	Accept a correct literal statement that includes DE and ST
	(ii) $(QS^2 =) (12 - 7)^2 + 14^2$ used www	B2	2	AG Condone long methods reaching such as 220.7 and rounding to 221 www After B0, $(12 - 7)$ and 14 seen B1
	(iii) $(\cos QRS =) (10.5^2 + 7^2 - \text{their } 221) / (2 \times 10.5 \times 7)$ 115	M2 A1	3	soi by -0.4200 After M0 their $221 = 10.5^2 + 7^2 \pm 2 \times 10.5 \times 7 \cos \widehat{QRS}$ (soi by 0.4200) M1 65.0 A1
	(iv) $\frac{\sin \widehat{RQS}}{7} = \frac{\sin \text{their (iii)}}{\text{their } \sqrt{221}}$ oe $(\widehat{RQS} =) 25.1$ to 25.5°	M1 A1	2	
			[12]	

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10	(a) (1) (3) 9 43 69 77 79 (80)	B1	1	Table not copied so values not seen	B0
	(b) All 8 points plotted ft	P2		After P0, at least 5 correct plots ft	P1
	Smooth ogive curve through all plotted points	C1	3	Dependent on P1. Straight line graphs or ruled sections will be C0	
	(c) (i) 192 – 198	B1	1	Not 200.	
	(ii) 142 – 148	B1	1	After B0 in (c) , reading their cumulative curve at 40 and 8	M1
	(d) Curve through the points (50,3), (350,80), (250,40), (275,60), (200,20)	P3	3	After P0, 3 correct points plotted 2 correct points plotted	P2 P1
	(e) (i) 71 or 72	B1	1	In (e) (i) and (ii) , accept non integer values rounding to these given.	
	(ii) 47, 48 or 49	B1	1	After B0 in (e) , M1 available for reading both graphs at 260	
(f) B with some support	B1	1	Support such as the probabilities $\frac{11}{80}$ or $\frac{40}{80}$ The reference must imply a direct comparison of the brands at 250.		
			[12]		

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11	(a) (i) 50 (m)	B1	1	
	(ii) 15 (m/s) cao	B2	2	After B0 (their (a) (i) + 20 × 5) ÷ 10 M1
	(iii) (t =) 3 (s)	B2	2	After B0 $\frac{t}{12} = \frac{5}{20}$ oe M1
	(iv) 12t = their (a) (i) + 20(t – 5) (t =) 6.25 (s) cao	M1 A1	2	After M0,A0, a correct area used SC1
	(b) (i) 50 (m) and 150 (m)	B1	1	Accept their d ₁ = their (a) (i) and their d ₂ = their (a) (i) + 100 or 10 × their (a) (i)
	(ii) speed	B1	1	Accept 20 m/s. Not increasing speed
	(iii) 10 (m/s) cao	B1	1	
	(c) 25(.0) (s)	B2	2	25.0 allows for the use of decimals such as 1.33. Accept values rounding to 25.0. Allow recovery of 25 after decimals After B0 , (±) $\frac{12}{9}$ soi e.g. by 15 B1
			[12]	