

MARK SCHEME for the October/November 2007 question paper

4024/02

4024 MATHEMATICS

Paper 2, maximum raw mark 100

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Abbreviations

- cao correct answer only
- oe or equivalent
- soi seen or implied
- www without wrong working

Question Number		Sub (part) mark	Comments
1	<p>(a) $\tan \widehat{CAB} = \frac{200}{65}$ oe $\widehat{CAB} = 72.(0)^\circ$ accept 71.95 to 72.05</p>	M1 A1 (2)	
	<p>(b) (i) Figs $\frac{750}{5}$ soi 0.15 <u>h</u> oe 23 05 or 22 56 + their 00 09 ✓</p> <p>(ii) $\cos \widehat{PRS} = \frac{300}{750}$ or $\sin \widehat{PSR} = \frac{300}{750}$ $\widehat{PRS} = 66.4^\circ$ or $\widehat{PSR} = 23.6^\circ$ (Bearing of S from R =) 113.6, accept 114, or 180 – their \widehat{PRS} ✓ or 90 + their \widehat{PSR} ✓</p>	M1 A1 B1 (3)	Their 00 09 is whatever they think the time is, written in 24 hr. clock style.
2	<p>(a) (i) 2.71 After B0, 2.709..., or their 2.709.... correctly rounded, or 2.7(0) www B1</p>	B2 (2)	
	<p>(ii) Final ans (b=) $(\pm)\sqrt{x^2 - 2ax}$ oe After B0, $x - a = \sqrt{a^2 + b^2}$ soi M1 and $(x - a)^2 = a^2 + b^2$ further M1</p>	B3 M1 (3)	e.g. $(\pm)\sqrt{(x - a)^2 - a^2}$
	<p>(b) (i) $8x - 27$ oe After B0, $5x$ or $8x + k$ seen B1</p>	B2 (2)	
	<p>(ii) Their $8x - 27 < 300$ (provided it is an expression in x) $x < 40.875$ (accept 40.9 or 41) After M0, Final ans. 40.875 (accept 40.9 or 41) SC1</p>	M1 A1 (2)	
	<p>(iii) 40 or their (b)(ii) ✓ rounded down to the next whole number.</p>	B1 ✓ (1) (10)	

Question Number		Sub (part) mark	Comments
3	(a) (i) 56	B1	Reason not required for 1 st B1
	(ii) 68 or $180 - 2 \times \text{their(i)}$	B1✓ (2)	
	(b) (i) $\widehat{WXV} = \widehat{YZZ}$ (vertically opposite) or $\widehat{VWX} = \widehat{XZY}$ ($WV \parallel YZ$) stated	B1	For the 2 nd B1 accept (i) 3 pairs of equal angles stated, with one of the above reasons given as appropriate. (ii) 2 pairs of equal angles, with reason and conclusion (iii) A solution using the ratios of corresponding sides, provided that the equal angle used is justified, and that similarity has not been assumed.
	convincingly deduces triangles (VWX and YZX) are equiangular	B1 (2)	
	(ii) $\frac{YZ}{25} = \frac{160}{40}$ oe soi	M1	
	(YZ =) 100 cao	A1 (2) (6)	
4	(a) Final ans. \$ 13.44 or 1344 c	B1	
		(1)	
	(b) $\frac{35-28}{28} \times (100)$ oe	M1	
	25(%)	A1	
	After M0, use of figs $\frac{35}{28}$ soi	SC1	
		(2)	
	(c) 5(%)	B2	
	After B0 figs $\frac{35 \times 1200 - 399}{35 \times 1200}$ oe	M1	
		(2)	
	(d) (\$) 4	B3	
	After B0 ÷ by 115	M1	
	× by 100	indep. M1	
	After B0, M0 115 seen	SC1	
		(3)	
		(8)	

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Question Number		Sub (part) mark
5	<p>Nonsense in one part may be used to earn M marks in any other part of the question. Throughout, accept equivalent complete methods and decimal angles without degree sign, but degree sign essential if answer in degrees and minutes.</p> <p>(a) (i) $(AD^2 =) 24^2 + 16^2 \pm 2 \times 24 \times 16 \cos 112$ soi</p> <p>$(AD =) \sqrt{24^2 + 16^2 - 2 \times 24 \times 16 \cos 112}$ $(= \sqrt{1119.697\dots})$</p> <p>$(AD =) 33.5$ (from 33.46..., accept 33.45 to 33.55)</p> <p>After A0 and at least M1, 1119.697... seen or $(AD =) 23.3$ (from $\sqrt{544.30\dots}$) A1</p> <p>(anw 2)</p> <p>(ii) $\frac{\sin(\widehat{BCD})}{16} = \frac{\sin(180-112)}{20}$ oe</p> <p>$\sin \widehat{BCD} = \frac{16 \sin(180-112)}{20}$ $(=0.7417\dots)$</p> <p>$\widehat{BCD} = 47.9$ (from 47.88...), accept 47.85 to 47.95</p> <p>(anw 2)</p> <p>(iii) $\frac{1}{2} \times 24 \times 16 \sin 112$ oe</p> <p>$= 178$ (cm²)</p> <p>(b) 60 (k) cao</p>	<p>M1</p> <p>M1</p> <p>A2</p> <p>(4)</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>(3)</p> <p>M1</p> <p>A1</p> <p>(2)</p> <p>B1</p> <p>(1)</p> <p>(10)</p>

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Question Number		Sub (part) mark	Comments
6	<p>(a)(i) 6</p> <p>(ii) (a) π (their 15)² 707 (cm²) accept 706.5 to 707.5</p> <p>(b) $\frac{1}{6}(\pi 15^2 - 7\pi 5^2)$ oe or $\frac{1}{6}(\text{their}(a) - \text{their}7\pi 5^2)$ or $\frac{\text{their}A\bar{O}B}{360}\text{their}\pi 15^2 - \frac{\text{their}A\bar{O}B}{360}\text{their}\pi 5^2 - \text{their}\pi 5^2$ = 26.2 (cm²) accept 26.15 to 26.25</p> <p>(b) (i) 60(°)</p> <p>(ii) $\frac{\text{their}(i)}{360} \times 2\pi 5$ $\frac{\text{their}(i)}{360} \times 2\pi(\text{their}15)$ $\frac{\text{their}(i)}{360} \times 2\pi 5 + \frac{\text{their}(i)}{360} \times 2\pi(\text{their}15) + 2\pi 5$ oe indep = 52.4 (cm) (accept 52.35 to 52.45)</p> <p>After MO, 2π5 seen SC1</p> <p>(anw 2)</p>	<p>B1 (1)</p> <p>M1 A1 (2)</p> <p>M1 A1 (2)</p> <p>B1 (1)</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>SC1</p> <p>(4)</p> <p>(10)</p>	<p>For diameter 5, only method marks are available throughout.</p> <p>Accept radian form</p> <p>Expressions may be constructed using radians.</p> <p>i.e. if no other marks are scored, a correct circumference of a small circle gets 1 mark.</p>

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Question Number		Sub (part) mark	Comments
7	(a)(i) $\frac{k}{3+2+1} \times 75$ $k = 1, 2$ or 3. = 25 (litres)	M1	
		A1 (2)	
	(ii) e.g. 40, 35, 36 (cents/litre) seen Final ans. 25 (litre bag) (anw 0)	M1	
		A1 (2)	
	(b)(i) $\frac{1}{3} \pi 10^2 \times 24$ soi - $\frac{1}{3} \pi 5^2 \times 12$ oe e.g. $\frac{7}{8} (\frac{1}{3} \pi 10^2 \times 24)$ a further 2199.1... or their <u>volume</u> in $\text{cm}^3 \div 10^3$ indep 2.20 (litres) (accept 2.195 to 2.205) cao (anw 3)	M1	
		M1	
		M1	
		A1 (4)	
	(ii) $\frac{75}{\text{their}(i)}$ soi 34 or their (ii) rounded down \checkmark	M1	
		A1 \checkmark (2)	
	(iii) Use of (ratio of vols. =) $10^3 : 5^3$ seen or use of $\frac{1}{3} \pi 5^2 \times 12 - \frac{1}{3} \pi 2.5^2 \times 6$ (= 274.89..)	M1	
272 or their (b)(ii) $\times 8 \checkmark$ or $\frac{75}{\text{their} 2.199} \times 8 \checkmark$ rounded down	A1 \checkmark (2)		
	(12)		

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Question Number		Sub (part) mark	Comments
8	Condone inaccuracies of up to 1 mm in plotting and drawing. If plots are not visible, allow P marks if curve passes within 1 mm of correct plot. Both P and dep C marks can be recovered following a grossly wrong plot if the plot is ignored and the curve passes within 1 mm of the correct point. Lined or plain paper used : no penalty, extend tolerances to 2 mm. <u>Penalties</u> deducted from P and C marks only: Wrong scale(s) –1 once. Interchanged axes : no penalty if labelled, -1 otherwise. Non-uniform scale : -2 after marking as generously as possible.		
	(a) $(x =) 12$ or -2	B1 B1	
	After B0, correct factors of their quadratic or their $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	M1	
		(2)	
	(b)(i) All 6 given points plotted. 4 correct points	P1	
		P2	
	Smooth curve, not grossly thick, through all plotted points, dep on P1	C1	
		(3)	
	(ii) Curve drawn to $(12,0)$ or \surd from (a)	D1	Ignore drawn to negative x Follow through only if the shape remains reasonably parabolic.
		(1)	
	(iii) 45 (m) or 45 ± 0.5 if read from the graph.	H1	
		(1)	
(iv) Using $y = 30$ (e.g. 0.6 to 0.8 and/or 9.3 to 9.5 seen) (distance travelled =) 8.5 to 8.9 (m)	M1 A1		
	(2)		
(c)(i) $(p =) 49$	B1		
(ii)(a) 49 (m) cao	B1		
(b) 5 (m) cao	B1		
	(3)		
	(12)		

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Question Number		Sub (part) mark	Comments
9	(a) $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$	BI (1)	
	(b)(i)(a) $-b$	BI	
	(b) $2(b-a)$ or $2b-2a$	BI	
	(c) $2a$ or their $(a) + 3a + b - a$ ✓	BI ✓	Must be simplified.
	(d) a or $-2b + 3a +$ their (b) ✓	BI ✓ (4)	Must be simplified
	(ii)(a) Trapezium	BI	
	Two sides $(AD, BC) \parallel$	BI	
	also dep on the ans. a in (i)(d)	(2)	
	(b) 1:2:3 cao	BI	
	independent	(1)	
	(c) In this part give -1 once for omission of appropriate reason.		
	(i) $(\widehat{CEA} =) 146^\circ$: Angle in the same segment.	BI	Or opposite angles of cyclic quads AOCF and AECF
	(ii) $(\widehat{CBA} =) 73^\circ$: Angle at the centre twice angle at circumf.	BI	
	(iii) $(\widehat{CFA} =) 34^\circ$: Angles in opposite segments supplementary	BI	May have been justified in (i)
(iv) $(\widehat{DCF} =) 73^\circ$ or $180 - (\text{their(ii)} + \text{their(iii)})$ ✓ Opposite angles in a cyclic quad and/or angle sum of a triangle.	BI ✓ (4)		
(anw 3)	(12)		

Question Number		Sub (part) mark	Comments
10	<p>The general instructions given in Q8 apply here.</p> <p>(a)(i) $4 \times 75 + 56 \times 125 + 84 \times 175 + 76 \times 225 + 36 \times 275 + 4 \times 325$ condone consistent use of other value in each interval, and one error or omission</p> <p>50300 (g) oe cao</p> <p>(ii) 193 (g) (accept 192.5 to 193.5) or their (i) $\div 260$ ✓</p> <p>After M0 in (a), 50300 soi SC1</p> <p>(b) (i) (0 4 60) 144 220 256 (260)</p> <p>(ii) All 7 points plotted ✓</p> <p>5 points plotted ✓ P1</p> <p>Smooth curve, not grossly thick, through all plotted points, dep on P1 and ogive shape</p> <p>(iii)(a) 190.0 to 197.5 (g) clearly intended as the answer.</p> <p>(b) Intention to read graph at 65 and 195 e.g. 152.5 to 157.5 and 230 to 235 seen</p> <p>(I.Q. range =) 72.5 to 82.5 (g)</p> <p>(c) $260 - 144$ (table value) (= 116) 5 (sacks)</p>	<p>M1</p> <p>A1</p> <p>B1 ✓</p> <p>(3)</p> <p>B1</p> <p>(1)</p> <p>P2 ✓</p> <p>C1</p> <p>(3)</p> <p>B1</p> <p>(1)</p> <p>M1</p> <p>A1</p> <p>(2)</p> <p>M1</p> <p>A1</p> <p>(2)</p> <p>(12)</p>	<p>E.g. if the answer only is given here, the mark is B1 + SC1.</p>

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Question Number		Sub (part) mark	Comments
11	<p>(a)(i) $\sqrt{(2-4)^2 + (9-6)^2}$ oe 3.61 or better (3.605....)</p> <p>(ii) $3x + 2y = 24$ or any 3 term equivalent After B0, $m = \frac{-3}{2}$ or $c = 12$ soi or their line through (2,9) or (4,6)</p> <p>(b)(i) $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$</p> <p>(ii) Reflection in the line $y = x$</p> <p>(iii)(a) $\begin{pmatrix} -3 \\ -3 \end{pmatrix}$</p> <p>(b) $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} h \\ k \end{pmatrix} + \begin{pmatrix} -3 \\ -3 \end{pmatrix}$ seen</p> <p>(c) $(h, k) = (-k-3, h-3)$ oe soi $h = 0$ and $k = -3$</p> <p>(d) (0, -3) or (their h, their k) ✓</p>	M1 A1 (2)	
		B2	e.g. $y = -\frac{3}{2}x + 12$
		B1	
		(2)	
		B1	
		(1)	
		M1 A1 (2)	And no other transformation stated.
		B1 (1)	
		B1 (1)	
		M1 A1 (2)	Method mark must be earned here.
		B1 ✓ (1) (12)	Allow either.