

MARK SCHEME for the October/November 2007 question paper

4024/02	4024 MATHEMATICS Paper 2, maximum raw mark 100
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All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

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Abbreviations

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

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Question Number		Sub (part) mark	Comments
1	<p>(a) $\tan \hat{CAB} = \frac{200}{65}$ oe $\hat{CAB} = 72.(0)^\circ$ accept 71.95 to 72.05</p> <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) $\cos \hat{PRS} = \frac{300}{750}$ or $\sin \hat{PSR} = \frac{300}{750}$ $\hat{PRS} = 66.4^\circ$ or $\hat{PSR} = 23.6^\circ$ (Bearing of S from R =) 113.6, accept 114, or 180 – their \hat{PRS} ✓ or 90 + their \hat{PSR} ✓</p>	<p>M1 A1 (2)</p> <p>M1 A1 B1 (3)</p> <p>M1 A1 B1 (3)</p> <p>(8)</p>	<p>Their 00 09 is whatever they think the time is, written in 24 hr. clock style.</p> <p>Expect these angles to be identified, possibly by the final answer. (Degree signs optional)</p>
2	<p>(a) (i) 2.71 After B0, 2.709..., or their 2.709.... correctly rounded, or 2.7(0) www B1</p> <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> <p>(b) (i) $8x - 27$ oe After B0, $5x$ or $8x + k$ seen B1</p> <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> <p>(iii) 40 or their (b)(ii) ✓ rounded down to the next whole number.</p>	<p>B2 (2)</p> <p>B3</p> <p>M1 (3)</p> <p>B2 (2)</p> <p>M1 A1 (2)</p> <p>B1 ✓ (1) (10)</p>	<p>e.g. $(\pm)\sqrt{(x-a)^2 - a^2}$</p>

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3	(a) (i) 56	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	Reason not required for 1 st B1
	convincingly deduces triangles (VWX and YZX) are equiangular	B1 (2)	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.
	(ii) $\frac{YZ}{25} = \frac{160}{40}$ oe soi (YZ =) 100 cao	M1 A1 (2) (6)	
4	(a) <u>Final ans.</u> \$ 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 × by 100	M1 M1	
	indep.		
	After B0, M0 115 seen	SC1	
		(3) (8)	

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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 $(AD) = \sqrt{24^2 + 16^2 - 2 \times 24 \times 16 \cos 112} (= \sqrt{1119.697...})$ $(AD) = 33.5$ (from 33.46..., accept 33.45 to 33.55) After A0 and at least M1, 1119.697... seen or $(AD) = 23.3$ (from $\sqrt{544.30...}$) A1 (anw 2) (4)</p> <p>(ii) $\frac{\sin(\widehat{BCD})}{16} = \frac{\sin(180-112)}{20}$ oe $\sin \widehat{BCD} = \frac{16 \sin(180-112)}{20} (=0.7417...)$ $\widehat{BCD} = 47.9$ (from 47.88...), accept 47.85 to 47.95 (anw 2) (3)</p> <p>(iii) $\frac{1}{2} \times 24 \times 16 \sin 112$ oe $= 178$ (cm²)</p> <p>(b) 60 (k) cao</p>	<p>M1 M1 A2 A1 M1 M1 A1 (2)</p> <p>M1 A1 (2)</p> <p>B1 (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 $\frac{\text{their } \widehat{AOB}}{360} \text{their } \pi 15^2 - \frac{\text{their } \widehat{AOB}}{360} \text{their } \pi 5^2 - \text{their } \pi 5^2$ = 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) After MO, 2π5 seen SC1 (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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7	<p>(a)(i) $\frac{k}{3+2+1} \times 75$ $k=1,2$ or 3. = 25 (litres)</p> <p>(ii) e.g. 40, 35, 36 (cents/litre) seen Final ans. 25 (litre bag) (<i>anw 0</i>)</p> <p>(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 (<i>anw 3</i>)</p> <p>(ii) $\frac{75}{\text{their } b(i)}$ soi 34 or their (ii) rounded down \checkmark</p> <p>(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...) 272 or their (b)(ii) $\times 8 \checkmark$ or $\frac{75}{\text{their } 2.199} \times 8 \checkmark$ rounded down</p>	<p>M1 A1 (2)</p> <p>M1 A1 (2)</p> <p>M1</p> <p>M1 M1</p> <p>A1 (4)</p> <p>M1</p> <p>A1 \checkmark (2)</p> <p>M1</p> <p>A1 \checkmark (2) (12)</p>	

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Question Number		Sub (part) mark	Comments
8	<p>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. Penalties 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.</p> <p>(a) $(x =) 12$ or -2</p> <p>After B0, correct factors of their quadratic or their $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ M1</p> <p>(b)(i) All 6 given points plotted. 4 correct points P1</p> <p>Smooth curve, not grossly thick, through all plotted points, dep on P1 C1</p> <p>(ii) Curve drawn to $(12,0)$ or $\sqrt{\quad}$ from (a) D1</p> <p>(iii) 45 (m) or 45 ± 0.5 if read from the graph. H1</p> <p>(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</p> <p>(c)(i) $(p =) 49$ A1</p> <p>(ii)(a) 49 (m) cao B1</p> <p>(b) 5 (m) cao B1</p>	<p>B1 B1</p> <p>(2)</p> <p>P2</p> <p>(3)</p> <p>(1)</p> <p>(1)</p> <p>(2)</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>(3)</p> <p>(12)</p>	<p>Ignore drawn to negative x Follow through only if the shape remains reasonably parabolic.</p>

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Question Number		Sub (part) mark	Comments
9	<p>(a) $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$</p> <p>(b)(i)(a) $-b$</p> <p>(b) $2(b-a)$ or $2b-2a$</p> <p>(c) $2a$ or their $(a) + 3a + b - a$ ✓</p> <p>(d) a or $-2b + 3a + \text{their } (b)$ ✓</p> <p>(ii)(a) Trapezium dep on the ans. a in (i)(d) Two sides $(AD, BC) \parallel$ also dep on the ans. a in (i)(d)</p> <p>(b) 1:2:3 cao independent</p> <p>(c) In this part give –1 once for omission of appropriate reason.</p> <p>(i) $(\widehat{CEA} =) 146^\circ$: Angle in the same segment.</p> <p>(ii) $(\widehat{CBA} =) 73^\circ$: Angle at the centre twice angle at circumf.</p> <p>(iii) $(\widehat{CFA} =) 34^\circ$: Angles in opposite segments supplementary</p> <p>(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.</p> <p>(<i>anw 3</i>)</p>	<p>B1 (1)</p> <p>B1</p> <p>B1</p> <p>B1 ✓</p> <p>B1 ✓</p> <p>(4)</p> <p>B1 B1 (2)</p> <p>B1 (1)</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1 ✓</p> <p>(4) (12)</p>	<p>Must be simplified.</p> <p>Must be simplified</p> <p>Or opposite angles of cyclic quads AOCE and AECF</p> <p>May have been justified in (i)</p>

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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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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>	<p>M1 A1 (2)</p> <p>B2</p> <p>B1 (2)</p> <p>B1 (1)</p> <p>M1 A1 (2)</p> <p>B1 (1)</p> <p>B1 (1)</p> <p>M1 A1 (2)</p> <p>B1 ✓ (1) (12)</p>	<p>e.g. $y = -\frac{3}{2}x + 12$</p> <p>And no other transformation stated.</p> <p>Method mark must be earned here.</p> <p>Allow either.</p>