

MARK SCHEME for the October/November 2008 question paper

4024/02	4024 MATHEMATICS
Paper 2, maximum raw mark 100	

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Question Number	Mark scheme details	Sub (part) mark	Comments
1	(a) (i) 16 cao (ii) (a) Figs $\frac{4}{91.8} \times (100)$ oe soi $= 4.357\ldots, 4.36 (\%)$ After M0, 104.36 seen SC1 (b) Figs $\frac{19200}{21} \times 4 (= 36.57)$ oe Ans. (\$) 37 cao (iii) Figs $\frac{100}{90} \times 91.8$ 102 (cents) (b) (i) 13 500 (ii) 4 500 After B0, 240°, 36 000 or $2/3 + 1/4$soi B1	B1 [1] M1 A1 [2] M1 A1 [2] M1 A1 [2] B1 [1] B2 [2] [10]	E.g. 104.357 seen followed by ans 4%. Beware 4% from $(4 \div 95.8) \times 100 = 4.175$ Here and elsewhere, accept ans rounding to the given 3 sig. fig. ans. unless a particular range is specified. E.g. 914.28(95.8 – 91.8) Beware $1.04 \times$ total cost for 2006. Accept \$1.02
2	(a) (i) $\frac{5}{AB} = \cos 65$ oe soi $(AB =) 11.83, 11.8(\text{m})$ (ii) $\frac{1}{2} \times 10 \times 5 \times \tan 65$ oe 53.3 to 53.7 (iii) $4 \times$ their (a) (ii) + 100 313.2 to 314.5 or $4 \times$ their (a) (ii) + 100 ft (m²) After M0, 100 seen SC1 (b) (i) 140 (°) After B0, 90 or 220(°) soi B1 (ii) 40 or 180 – their (b) (i) (°) ft Use of Grads (a) (i) 9.57 (ii) 40.8 Rads: both ans. negative, therefore A0.	M1 A1 [2] M1 A1 [2] M1 A1ft [2] B2 [2] B1 ft [1] [9]	e.g. $\frac{\sin 65}{AB} = \frac{\sin 50}{10}$ e.g. $\frac{1}{2} \times$ their (a) (i) $\times 10 \times \sin 65$ or $\frac{1}{2} \times$ their (a) (i)² $\times \sin 50$ Accept 10² Dep. on 180 – their (b) (i) + ve.

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3	(a) $(p =) -5$ After B0 $2(2p + 1) = k + 3(p - 3)$ soi M1 $4p + 2 = 6 + 3p - 9$ cao soi A1 p correctly evaluated ft A1ft	B3 [3]	Clear intention to deal correctly with the two fractions. Correct solution of their linear equation clear of brackets and fractions
	(b) Final ans. $\frac{2}{v+1}$ After B0, $2(v - 3)$ seen B1 $(v - 3)(v + 1)$ seen B1	B3 [3]	Not necessarily in the numerator Not necessarily in the denominator
	(c) (i) Equation $(10y + x) - (10x + y) = \pm 63$ seen +63 leading to $y - x = 7$ nww AG	M1 A1 [2]	
	(ii)(a) $(10x + y) + (10y + x) = 99$ seen leading to $x + y = 9$ nww AG	M1 [1]	
	(ii)(b) $x = 1$ $y = 8$ After B0, M1	B1 B1 [2]	Reaches such as $ky = 16$ or $hx = 2$.
		[11]	
4	(a) Histogram with Columns to 3 4 5 6 4 0.5 vertically and widths 5 5 5 5 20 at correct “heights”. After H0, at least 4 correct columns H2 at least 1 correct column H1 After 0, “correct” Histogram SC2 At least 4 “correct” cols. SC1	H3 [3]	Axes: ignore labels, but the vertical scale must give heights of 3, 4,..... No penalty for Histogram not our size. E.g. no vertical or horizontal scale, or the numbers are frequencies.
	(b) 5	B1 [1]	Accept 4
	(c) $\frac{1}{8}$ cao	C1 [1]	
	(d) $\frac{870}{14280}$ or $\frac{29k}{476k}$ or 0.061 After D0 $\frac{870}{14400}$ or $\frac{29k}{480k}$ or 0.0604. D1 or $\frac{30 \times 29}{120 \times 119}$ seen isw M1	D2 [2]	i.e. even if $\times 2$.
			[7]

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5	(a) (i) Angle between tangent and radius	B1 [1]	Must mention both tangent and radius.
	(ii) ($\hat{ROQ} =$) 140°	B1 [1]	
	(b) (i) ($\hat{AED} =$) 40°	B1 [1]	
	(ii) ($\hat{ROS} =$) 60° After B0, $\hat{DAE} = 80^\circ$	B2 [2]	
	(iii) ($BE =$) 11 (cm) or 10.84 after sine rule.	B2	
	After B0, $\frac{BE + 4}{17 + 3} = \frac{3}{4}$ oe M1	[2]	
		[7]	e.g. $\frac{BE + 4}{20} = \frac{\sin 40}{\sin 60}$
6	(a) (i) ($p =$) 19	B1 [1]	
	(ii) ($q =$) 29	B1 [1]	
	(b) (i) ($j =$) 16	B1 [1]	
	(ii) ($k =$) 25	B1 [1]	
	(iii) ($S_n =$) n^2	B1 [1]	
	(c) (i) 3, 4	B1 [1]	
	(ii) $n - 1$ cao	B1 [1]	
	(iii) $n^2 + n - 1$ oe or their (b) (iii) + (c) (ii) ft	B1 [1]	
		[8]	Accept their (a) (i) – (b) (i) ft and their (a) (ii) – (b) (ii) ft

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7	(a) (i) $\frac{1080}{x}$ seen (ii) $\frac{1080}{x+30}$ seen (b) their $\frac{1080}{x} - \text{their } \frac{1080}{x+30} = \pm \text{their } (\frac{1}{2} \text{ hr})$ $\frac{1080}{x} - \frac{1080}{x+30} = \frac{1}{2}$ further leading to $x^2 + 30x - 64\,800 = 0$ nww AG (c) ($x =$) 240 and -270 After B0, one correct root B3 Signs reversed with correct factors seen SC2 Signs reversed SC1 or for numerical $\frac{p \pm \sqrt{q}}{r}$ seen or used $p = -30$ and $r = 2$ B1 $q = 260\,100$ or $\sqrt{q} = 510$ B1 or $(x + \frac{30}{2})^2$ seen B1 65 025 or $(\pm)255$ seen B1 [4] (d) (i) $4\frac{1}{2}$ or $\frac{1080}{\text{their } (+ve)x}$ ft isw B1 ft [1] (ii) $\frac{2 \times 1080}{84 + 4.5}$ or $\frac{2 \times 1080}{2 \times \text{their } (d)(i) - \frac{1}{2}}$ M1 254.1, 254 or $\frac{2 \times 1080}{2 \times \text{their } (d)(i) - \frac{1}{2}}$ (km/h) A1 ft [2]	B1 [1] B1 [1] M1 M1 A1 [3] B4 Ignore “rejected” at this stage. Accept ans. rounding to 240, -270, but nww Ignore incorrect attempts to convert such as 4.5 hr to hr and min.
	[12]	

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8	Here and elsewhere in Trigonometry questions, 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 given in degrees and minutes.		
	(a) (i) $15(^{\circ})$ cao (ii) $(AC^2 \Rightarrow) 15^2 + 10^2 \pm 2.15.10\cos 105$ $(AC \Rightarrow) \sqrt{15^2 + 10^2 - 2.15.10\cos 105}$ ($\sqrt{402.6}$) $(AC \Rightarrow) 20.06, 20.1$ (m) After A0, 402.6, 403 or 15.72 (from $\sqrt{247.35}$) (Alternative complete methods get M2 A2) (b) $\frac{\sin \hat{A}DB}{15} = \frac{\sin 105}{30}$ oe soi $\sin \hat{A}DB = \frac{15 \sin 105}{30}$ (= 0.4829) ($\hat{A}DB \Rightarrow$) 28.87, 28.9 ($^{\circ}$) (c) (i) $BF^2 + 15^2 = 27^2$ soi ($EF \Rightarrow$) 10.05 to 10.20 (ii) $\sin \theta = \frac{15}{27}$ oe Final Ans 33.748, 33.7 ($^{\circ}$) Grads (a) (ii) 18.7 (A2) 348.5 or 17.4 (A1) (b) 33.2 (from 0.4984) (c) (ii) 37.5 Rads (a) (ii) 19.9 397.3 or 15.9 (b) negative (A0) (c) (ii) 0.589	B1 [1] M1 M1 A2 A1 [4] M1 M1 A1 [3] M1 A1 [2] M1 A1 [2] [12]	NB. This M1 requires an attempt to evaluate the expression using the correct processes, followed by the intention to take the $\sqrt{\quad}$. +2.15.10cos105 has been used. e.g. $\sqrt{(10 \sin 75)^2 + (15 + 10 \sin 15)^2}$ e.g. by $\sqrt{27^2 - 15^2 - 20^2}$

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9	(a) (i) $\pi a^2 - \pi b^2$	M1	With a = 30 or b = 10
	2510 cm ²	A1 [2]	(Accept answers correcting to 2510)
	(ii) Figs their 2513.27 × 200 (= 502654.82..)	M1	
	0.503, or $\frac{\text{their } 2513.27 \times 200}{10^6}$ ft (m ²)	A1ft [2]	
	(iii) Figs $\frac{\text{their(a)(ii)}}{150 \times 2}$ or Figs $\frac{\text{their(a)(i)}}{150 \times 100}$	M1	The volume version is shown in metres and the area version in cm. Figs allows the units to be inconsistent.
	1.676 or $\frac{\text{their(a)(ii)}}{150 \times 2} \times 10^3$	A1ft	
	or $\frac{\text{their(a)(i)}}{150 \times 100} \times 10$ ft (mm)	[2]	
	(b) (i) $2\pi \frac{3.5}{2}$ oe seen	M1	e.g. (curved SA of cone =) $\pi \times \frac{3.5}{2} \times 3$
	$\frac{\theta}{360} 2\pi 3$ oe seen	M1	e.g. (area of sector =) $\theta/(360) \times \pi \times 3^2$ Accept with $\theta = 210$.
	$2\pi \frac{3.5}{2} = \frac{\theta}{360} 2\pi 3$ oe leading to $\theta = 210$ AG	A1 [3]	Condone methods reaching the range 209.5 to 210.5
	(ii) $3\cos 75$ oe	M1	
	Their $(3\cos 75) + 3$ (= 3.776)	M1	This M is independent of the first.
	Final ans. 4	A1 [3]	
	(b) (ii) Grads 5 (from 4.148) Rads 6 (from 5.765)	[12]	

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10	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 dependent 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) All points plotted	P2		
	After P0, at least 4 correct plots	P1		
	Smooth curve, dep on at least	P1	C1 [3]	
	(b) 2200 to 2400	N1 [1]		
	(c) (i) Drawing tangent at $t = 2.5$ and $\frac{\Delta y}{\Delta x}$ seen	M1		
	1800 to 2800 (bacteria per hour)	A1 [2]		
	(ii) Rate of change (of number of bacteria per hour)	R1 [1]		Not just “increase”: need idea of rate. E.g. accept Speed bacteria produced, but not number of bacteria per hour.
	(d) (i) Ruled straight line (2,4500) to (3,3500) extended to cut the curve.	L2		
	After L0, freehand or shorter line	L1	[2]	
	(ii) 3.025 to 3.075 (hrs) or ft from their graph	T1ft [1]		Their line must be straight, but not horizontal.
	(e) (i) ($k =$) 50 cao	K1 [1]		Table value
	(ii) ($a =$) 4	E1 [1]		Accept $\frac{200}{\text{their } k}$
			[12]	

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11	(a) (i) (a) 37	B1	[1]	Throughout this question, condone missing brackets if clear. In (a), condone fraction lines, but confusion between column vectors and coordinates is –1 once.
	(b) $\begin{pmatrix} 16 \\ -21 \end{pmatrix}$	B1	[1]	
	(ii) $(\overrightarrow{PT}) = \begin{pmatrix} 14 \\ -28 \end{pmatrix}$	B2		
	After B0, $\overrightarrow{QT} = \begin{pmatrix} 2 \\ 7 \end{pmatrix}$ soi M1		[2]	
	(iii) (–6, 51)	B2		eg $\overrightarrow{RS} = \begin{pmatrix} -12 \\ 35 \end{pmatrix}$ soi
	After B0, uses $\overrightarrow{RS} = \overrightarrow{QP}$ M1		[2]	
	(b) (i) 2 (units ²)	B1	[1]	
	(ii) (a) (–2, 3)	B1	[1]	
	(b) 32 (units ²) or 16 × their (b) (i) ft	B1	[1]	Accept such as $\frac{6}{3}$
	(iii) (a) (3, 1) After B0, shear factor 2	B2		
	or (h, 1) M1		[2]	
	(b) 2 (units ²) or their (b) (i) ft	B1	[1]	
			[12]	