

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	B1 [1]		
	(ii) (a) Figs $\frac{4}{91.8} \times (100)$ oe soi = 4.357..., 4.36 (%) After M0, 104.36 seen SC1	M1 A1 [2]	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.	
	(b) Figs $\frac{19200}{21} \times 4 (= 36.57)$ oe Ans. (\$) 37 cao	M1 A1 [2]	E.g. 914.28(95.8 – 91.8) Beware $1.04 \times$ total cost for 2006.	
	(iii) Figs $\frac{100}{90} \times 91.8$ 102 (cents)	M1 A1 [2]	Accept \$1.02	
	(b) (i) 13 500	B1 [1]		
	(ii) 4 500	B2		
	After B0, 240°, 36 000 or $2/3 + 1/4$ soi B1	[2]		
		[10]		
	2	(a) (i) $\frac{5}{AB} = \cos 65$ oe soi (AB =) 11.83, 11.8(m)	M1 A1 [2]	e.g. $\frac{\sin 65}{AB} = \frac{\sin 50}{10}$
		(ii) $\frac{1}{2} \times 10 \times 5 \times \tan 65$ oe 53.3 to 53.7	M1 A1 [2]	e.g. $\frac{1}{2} \times$ their (a) (i) $\times 10 \times \sin 65$ or $\frac{1}{2} \times$ their (a) (i) ² $\times \sin 50$
(iii) $4 \times$ their (a) (ii) + 100 313.2 to 314.5 or $4 \times$ their (a) (ii) + 100 ft (m ²) After M0, 100 seen SC1		M1 A1ft [2]	Accept 10 ²	
(b) (i) 140 (°) After B0, 90 or 220(°) soi B1		B2 [2]		
(ii) 40 or 180 – their (b) (i) (°) ft Use of Grads (a) (i) 9.57 (ii) 40.8 Rads: both ans. negative, therefore A0.		B1 ft [1] [9]	Dep. on 180 – their (b) (i) + ve.	

Page 3	Mark Scheme	Syllabus
	GCE O LEVEL – October/November 2008	4024

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

Page 4	Mark Scheme	Syllabus
	GCE O LEVEL – October/November 2008	4024

5	(a) (i) Angle between tangent and radius	B1 [1]	Must mention both tangent and radius
	(ii) ($\hat{R}OQ =$) 140°	B1 [1]	
	(b) (i) ($\hat{A}ED =$) 40°	B1 [1]	e.g. $\frac{BE + 4}{20} = \frac{\sin 40}{\sin 60}$
	(ii) ($\hat{R}OS =$) 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]	
6	(a) (i) ($p =$) 19	B1 [1]	Accept their (a) (i) – (b) (i) ft and their (a) (ii) – (b) (ii) ft
	(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]	

Page 5	Mark Scheme	Syllabus
	GCE O LEVEL – October/November 2008	4024

7	<p>(a) (i) $\frac{1080}{x}$ seen</p> <p>(ii) $\frac{1080}{x+30}$ seen</p> <p>(b) their $\frac{1080}{x} - \text{their } \frac{1080}{x+30} = \pm \text{their } (\frac{1}{2} \text{ hr})$</p> <p>$\frac{1080}{x} - \frac{1080}{x+30} = \frac{1}{2}$ further</p> <p>leading to $x^2 + 30x - 64\,800 = 0$ nww AG</p> <p>(c) ($x =$) 240 and -270</p> <p>After B0, one correct root B3</p> <p>Signs reversed with correct factors seen SC2</p> <p>Signs reversed SC1</p> <p>or for numerical $\frac{p \pm \sqrt{q}}{r}$ seen or used</p> <p>$p = -30$ and $r = 2$ B1</p> <p>$q = 260\,100$ or $\sqrt{q} = 510$ B1</p> <p>or $(x + \frac{30}{2})^2$ seen B1</p> <p>65 025 or $(\pm)255$ seen B1 [4]</p> <p>(d) (i) $4\frac{1}{2}$ or $\frac{1080}{\text{their } (+ve)x}$ ft isw B1 ft [1]</p> <p>(ii) $\frac{2 \times 1080}{84 + 4.5}$ or $\frac{2 \times 1080}{2 \times \text{their } (d)(i) - \frac{1}{2}}$ M1</p> <p>254.1, 254 or $\frac{2 \times 1080}{2 \times \text{their } (d)(i) - \frac{1}{2}}$ (km/h) A1 ft [2]</p>	<p>B1 [1]</p> <p>B1 [1]</p> <p>M1</p> <p>M1</p> <p>A1 [3]</p> <p>B4</p> <p>B3</p> <p>SC2</p> <p>SC1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1 [4]</p> <p>B1 ft [1]</p> <p>M1</p> <p>A1 ft [2]</p> <p>[12]</p>	<p>Their (a) (i) and (ii) must contain x. Their $\frac{1}{2}$ hr could be 30 (min).</p> <p>Ignore “rejected” at this stage. Accept ans. rounding to 240, -270, but nww</p> <p>Ignore incorrect attempts to convert such as 4.5 hr to hr and min.</p>
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Page 6	Mark Scheme	Syllabus
	GCE O LEVEL – October/November 2008	4024

8	<p>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.</p> <p>(a) (i) $15(^{\circ})$ cao</p> <p>(ii) $(AC^2 =) 15^2 + 10^2 \pm 2.15.10\cos 105$</p> <p>$(AC =) \sqrt{15^2 + 10^2 - 2.15.10 \cos 105}$ $(\sqrt{402.6})$</p> <p>$(AC =) 20.06, 20.1$ (m) After A0, 402.6, 403 or 15.72 (from $\sqrt{247.35}$)</p> <p>(Alternative complete methods get M2 A2)</p> <p>(b) $\frac{\sin \hat{A}DB}{15} = \frac{\sin 105}{30}$ oe soi</p> <p>$\sin \hat{A}DB = \frac{15 \sin 105}{30}$ (= 0.4829)</p> <p>$(\hat{A}DB =) 28.87, 28.9$ ($^{\circ}$)</p> <p>(c) (i) $BF^2 + 15^2 = 27^2$ soi</p> <p>$(EF =) 10.05$ to 10.20</p> <p>(ii) $\sin \theta = \frac{15}{27}$ oe</p> <p>Final Ans 33.748, 33.7 ($^{\circ}$)</p> <p>Grads (a) (ii) 18.7 (A2) 348.5 or 17.4 (A1) (b) 33.2 (from 0.4984) (c) (ii) 37.5</p> <p>Rads (a) (ii) 19.9 397.3 or 15.9 (b) negative (A0) (c) (ii) 0.589</p>	<p>B1 [1]</p> <p>M1</p> <p>M1</p> <p>A2</p> <p>A1</p> <p>[4]</p> <p>M1</p> <p>M1</p> <p>A1 [3]</p> <p>M1</p> <p>A1 [2]</p> <p>M1</p> <p>A1 [2]</p> <p>[12]</p>	<p>NB. This M1 requires an attempt to evaluate the expression using the correct processes, followed by the intention to take the $\sqrt{\quad}$.</p> <p>+2.15.10cos105 has been used. e.g. $\sqrt{(10 \sin 75)^2 + (15 + 10 \sin 15)^2}$</p> <p>e.g. by $\sqrt{27^2 - 15^2 - 20^2}$</p>
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Page 7	Mark Scheme	Syllabus
	GCE O LEVEL – October/November 2008	4024

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) 3cos75 oe	M1	
	Their(3cos75) + 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]		

Page 8	Mark Scheme	Syllabus
	GCE O LEVEL – October/November 2008	4024

10	<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 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.</p> <p>(a) All points plotted</p> <p style="padding-left: 40px;">After P0, at least 4 correct plots P1</p> <p style="padding-left: 40px;">Smooth curve, dep on at least P1</p> <p>(b) 2200 to 2400</p> <p>(c) (i) Drawing tangent at $t = 2.5$ and $\frac{\Delta y}{\Delta x}$ seen 1800 to 2800 (bacteria per hour)</p> <p style="padding-left: 40px;">(ii) Rate of change (of number of bacteria per hour)</p> <p>(d) (i) Ruled straight line (2,4500) to (3,3500) extended to cut the curve. After L0, freehand or shorter line L1</p> <p style="padding-left: 40px;">(ii) 3.025 to 3.075 (hrs) or ft from their graph</p> <p>(e) (i) ($k =$) 50 cao</p> <p style="padding-left: 40px;">(ii) ($a =$) 4</p>	<p>P2</p> <p>P1</p> <p>C1 [3]</p> <p>N1 [1]</p> <p>M1</p> <p>A1 [2]</p> <p>R1 [1]</p> <p>L2</p> <p>[2]</p> <p>T1ft [1]</p> <p>K1 [1]</p> <p>E1 [1]</p> <p>[12]</p>	<p>Not just “increase”: need idea of rate. E.g. accept Speed bacteria produced, but not number of bacteria per hour.</p> <p>Their line must be straight, but not horizontal.</p> <p>Table value</p> <p>Accept $\frac{200}{their k}$</p>
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Page 9	Mark Scheme	Syllabus
	GCE O LEVEL – October/November 2008	4024

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		
	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]	
	(iii) (a) (3, 1) After B0, shear factor 2 or (h, 1) M1	B2		
(b) 2 (units ²) or their (b) (i) ft	B1	[1]		
			[12]	Accept such as $\frac{6}{3}$