

MARK SCHEME for the October/November 2008 question paper

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

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began.

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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the October/November 2008 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

| | | | |
|--------|-------------------------------------|----------|-------|
| Page 2 | Mark Scheme | Syllabus | Paper |
| | GCE O LEVEL – October/November 2008 | 4024 | 02 |

| 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 | Paper |
|--------|-------------------------------------|----------|-------|
| | GCE O LEVEL – October/November 2008 | 4024 | 02 |

| | | | |
|-----------------|---|--|---|
| <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 M1 $+63$ leading to $y - x = 7$ nww AG A1 [2]</p> <p>(ii)(a) $(10x + y) + (10y + x) = 99$ seen M1 leading to $x + y = 9$ nww AG [1]</p> <p>(ii)(b) $x = 1$ B1 $y = 8$ 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 [2]</p> <p>[11]</p> | <p>Clear intention to deal correctly with the 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”.</p> <p>After H0, at least 4 correct columns H2 at least 1 correct column H1</p> <p>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 [3]</p> <p>B1 [1]</p> <p>C1 [1]</p> <p>D2 [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 | Paper |
|--------|-------------------------------------|----------|-------|
| | GCE O LEVEL – October/November 2008 | 4024 | 02 |

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

| Page 5 | Mark Scheme | Syllabus | Paper |
|--------|-------------------------------------|----------|-------|
| | GCE O LEVEL – October/November 2008 | 4024 | 02 |

| | | | |
|---|--|--|--|
| 7 | <p>(a) (i) $\frac{1080}{x}$ seen</p> <p>(ii) $\frac{1080}{x+30}$ seen</p> <p>(b) their $\frac{1080}{x} - \text{their } \frac{1080}{x+30} = \pm \text{their } \left(\frac{1}{2} \text{ hr}\right)$</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 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</p> <p>B1</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> |
|---|--|--|--|

| Page 6 | Mark Scheme | Syllabus | Paper |
|--------|-------------------------------------|----------|-------|
| | GCE O LEVEL – October/November 2008 | 4024 | 02 |

| | | | |
|----------|---|---|---|
| 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) $(AC^2 \Rightarrow) 15^2 + 10^2 \pm 2.15.10\cos 105$</p> <p>$(AC \Rightarrow) \sqrt{15^2 + 10^2 - 2.15.10 \cos 105}$ $(\sqrt{402.6})$</p> <p>$(AC \Rightarrow) 20.06, 20.1$ (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>$(\hat{A}DB \Rightarrow) 28.87, 28.9 (^{\circ})$</p> <p>(c) (i) $BF^2 + 15^2 = 27^2$ soi</p> <p>$(EF \Rightarrow) 10.05$ 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 [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> |
|----------|---|---|---|

| Page 7 | Mark Scheme | Syllabus | Paper |
|--------|-------------------------------------|----------|-------|
| | GCE O LEVEL – October/November 2008 | 4024 | 02 |

| | | | |
|--|---|----------|---|
| 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] | | |

| | | | |
|----|---|---|---|
| 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</p> <p style="padding-left: 40px;">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.</p> <p style="padding-left: 40px;">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>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 style="text-align: center;">[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 Accept $\frac{200}{\text{their } k}$</p> |
|----|---|---|---|

| Page 9 | Mark Scheme | Syllabus | Paper |
|--------|-------------------------------------|----------|-------|
| | GCE O LEVEL – October/November 2008 | 4024 | 02 |

| | | | | | |
|---|---|-----|------|--|--|
| 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] | | eg $\overrightarrow{RS} = \begin{pmatrix} -12 \\ 35 \end{pmatrix}$ soi |
| | (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 | | | Accept such as $\frac{6}{3}$ |
| (b) 2 (units ²) or their (b) (i) ft | B1 | [1] | | | |
| | | | [12] | | |