

MARK SCHEME for the October/November 2012 series

0581 MATHEMATICS

0581/43

Paper 4 (Extended), maximum raw mark 130

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, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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| | | | |
|---------------|--------------------------------------|-----------------|--------------|
| Page 2 | Mark Scheme | Syllabus | Paper |
| | IGCSE – October/November 2012 | 0581 | 43 |

Abbreviations

| | |
|-----|----------------------------|
| cao | correct answer only |
| cso | correct solution only |
| dep | dependent |
| ft | follow through after error |
| isw | ignore subsequent working |
| oe | or equivalent |
| SC | Special Case |
| www | without wrong working |
| art | anything rounding to |
| soi | seen or implied |

| Qu. | Answers | Mark | Part Marks |
|-----|--|------------------------|--|
| 1 | (a) (i) [0]9 15 [am] | 1 | Any acceptable form of time |
| | (ii) 64.9 or 65.[0] or 64.92 to 64.98 | 2 | M1 for $92 \div (1 \text{ and } 25 \text{ mins})$ or $92/85 \times 60$ oe or $92 \div (1.41 \text{ to } 1.42)$ |
| | (iii) 11.76...or 11.8 | 1 | |
| | (iv) 80 | 3 | M2 for $92 \div 1.15$ oe or M1 for 115% associated with 92 |
| | (b) (i) $150 \div (11 + 16 + 3)$ or 150×3 oe then $\times 3$ or $\div 30$ | M1 E1 | Correct first step Correct conclusion |
| | (ii) 11 : 9 final answer | 2 | M1 for $8.25 : (15 - 8.25)$ oe For M1 e.g. allow $1 : 0.818$ [0.8181 to 0.8182] or $1.22 : 1$ [1.222...] After M0, SC1 for 9 : 11 as final answer |
| 2 | (a) (i) Image at $(-3, 1), (-7, 7), (-3, 7)$ | 2 | SC1 for translation $\begin{pmatrix} -11 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -1 \end{pmatrix}$ |
| | (ii) Image at $(-4, -1), (-4, -4), (-2, -4)$ | 2 | SC1 for enlargement factor 0.5 and correct orientation In each part of (b) must be one transformation only – if more then lose all marks for that part |
| | (b) (i) Reflection, $y = 1$ | 2 | B1 B1 independent |
| | (ii) Rotation, $(3, 2), 180$ oe or enlargement, $(3, 2),$ (factor) – 1 | 3 | B1 B1 B1 independent |
| | (iii) Stretch, (factor) 0.5, Invariant line y -axis or $x = 0$ | 3 | B1 B1 B1 independent – must be clear on invariant line |

| Page 3 | Mark Scheme | Syllabus | Paper |
|--------|-------------------------------|----------|-------|
| | IGCSE – October/November 2012 | 0581 | 43 |

| | | | |
|---|---|--|---|
| | (c) $\begin{pmatrix} 0.5 & 0 \\ 0 & 1 \end{pmatrix}$ | 2 ft | ft <i>their</i> factor in (b)(iii) only if stretch not 0 or 1 SC1 for $\begin{pmatrix} k & 0 \\ 0 & 1 \end{pmatrix}$ [$k \neq 0$ or 1] or $\begin{pmatrix} 1 & 0 \\ 0 & 0.5 \end{pmatrix}$ ft <i>their</i> factor only if stretch in (b)(iii) |
| 3 | (a) 7.407..... or 7.41 (b) 9 (c) (i) 6.36 to 6.37 www (ii) 508 to 510 (d) $\sqrt{2}$ or 1.41 [1.414...] www | 1 2 3 2 2 | M1 for $1080 \div (12 \times 10)$ oe M2 for $\sqrt[3]{\frac{1080}{\frac{4}{3}\pi}}$ oe or M1 for $\frac{1080}{\frac{4}{3}\pi}$ oe [257.7 to 258.7] Accept 4.18 to 4.19 for $4/3\pi$ M1 for $4 \times \pi \times (\text{their (c)(i)})^2$ Allow over 1 or $\sqrt{2} : 1$ etc M1 for $(R/r)^2 = 2$ oe or $[R^2 =] (2 \times \text{their (c)(ii)})/4\pi$ or $[R^2 =] 2 \times (\text{their (c)(i)})^2$ |
| 4 | (a) 5, -1 (b) 12 points plotted ft Smooth curve through at least 12 points Two separate branches (c) (i) 0.55 to 0.65 (ii) 0.65 to 0.75 (d) $\frac{1}{3}$ | 2 P3ft C1 B1 1 2 2 | B1 B1 P2ft for 10 or 11, P1ft for 8 or 9 In absence of plot[s], allow curve to imply plot[s]. No ruled sections Not touching y-axis M1 for $y = 3x$ drawn (ruled) to cross curve Accept 0.333[3....] or $0.\dot{3}$ M1 for $\frac{2}{x^2} - 3x = 3x$ or better |

| Page 4 | Mark Scheme | Syllabus | Paper |
|--------|-------------------------------|----------|-------|
| | IGCSE – October/November 2012 | 0581 | 43 |

| | | | |
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| | <p>(e) (i) Ruled line through $(-1, 5)$ and $(3, -9)$</p> <p>(ii) $y = -3.5x + 1.5$ oe final answer</p> <p>(iii) Tangent</p> | <p>1</p> <p>3</p> <p>1</p> | <p>B2 for $y = kx + 1.5$ [$k \neq 0$] oe or $y = -3.5x + d$ oe</p> <p>B1 for gradient = -3.5 oe accept integer/integer or $y = kx + [1.4 \text{ to } 1.6]$ oe</p> <p>SC2 for answer $-3.5x + 1.5$ [no 'y=']</p> |
| 5 | <p>(a) 0.57</p> <p>(b) (i) $\frac{5}{x} + \frac{6}{x+2} = 1$ oe</p> <p>$5(x+2) + 6x = x(x+2)$ oe</p> <p>$5x + 10 + 6x = x^2 + 2x$ oe</p> <p>$0 = x^2 - 9x - 10$</p> <p>(ii) $(x-10)(x+1)$</p> <p>(iii) 21</p> | <p>B4</p> <p>M2</p> <p>A1</p> <p>E1</p> <p>2</p> <p>2ft</p> | <p>Condone use of other variables</p> <p>M1 for $2w + 3l = 3.6$ oe</p> <p>and M1 for $l = w + 0.25$ oe</p> <p>A1 for correct $aw = b$ or $cl = d$</p> <p>or M2 for $2w + 3(w + 0.25) = 3.6$ oe or $2(l - 0.25) + 3l = 3.6$ oe</p> <p>or M1 for $w + 0.25$ or $l - 0.25$ seen</p> <p>A1 for $2w + 3w = 3.6 - 0.75$ or better</p> <p>or $2l + 3l = 3.6 + 0.5$ or better</p> <p>$l = 0.82$ implies M2A1</p> <p>trial & error scores B4 or zero</p> <p>accept answer 57 if written 57 cents</p> <p>after M0, SC3 if answer 57</p> <p>e.g. $\left(1 - \frac{5}{x}\right)(x+2) = 6$</p> <p>M1 for $\frac{5}{x}$ seen or $\frac{6}{x+2}$ seen</p> <p>or $xy = 5$ and $(x+2)Y = 6$ oe</p> <p>or $xy = 5$ and $(x+2)(1-y) = 6$ oe</p> <p>e.g. $(x-5)(x+2) = 6x$</p> <p>Allow $5x + 10 + 6x = x^2 + 2x$ and allow all over correct denominator but must see this line</p> <p>One correctly expanded line seen</p> <p>No errors or omissions</p> <p>SC1 for $(x+a)(x+b)$ where $ab = -10$ or $a+b = -9$</p> <p>ft a positive x into $2\left(x + \frac{5}{x}\right)$</p> <p>M1 for 0.5 seen or 5 / their positive root</p> |

| Page 5 | Mark Scheme | Syllabus | Paper |
|--------|-------------------------------|----------|-------|
| | IGCSE – October/November 2012 | 0581 | 43 |

| | | | |
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| | <p>(c) (i) $(2x+3)^2 = (x+3)^2 + 5^2$ oe</p> <p>$4x^2 + 6x + 6x + 9 =$ $x^2 + 3x + 3x + 9 + 25$ oe $3x^2 + 6x - 25 = 0$</p> <p>(ii) $\frac{-6 \pm \sqrt{6^2 - 4(3)(-25)}}{2(3)}$</p> <p>– 4.06, 2.06 final answer</p> <p>(iii) 12.63 to 12.65 or 12.6 or 12.7</p> | <p>M1</p> <p>B1</p> <p>B1</p> <p>E1</p> <p>B2</p> <p>B2</p> <p>2ft</p> | <p>for $4x^2 + 6x + 6x + 9$ or $4x^2 + 12x + 9$ for $x^2 + 3x + 3x + 9$ or $x^2 + 6x + 9$</p> <p>No errors or omissions</p> <p>B1 for $\sqrt{6^2 - 4(3)(-25)}$ or better seen If in form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ oe B1 for $p = -6$ and $r = 2(3)$ or better</p> <p>B1 B1 After B0 B0 SC1 for – 4.1 and 2.1 or – 4.055... and 2.055... or –4.06 and 2.06 seen</p> <p>ft (a positive $x + 3$) $\times 2.5$ SC1 for $0.5 \times$ <i>their</i> positive value $\times 5$ written</p> |
| 6 | <p>(a) $\sin [\] = \frac{130}{0.5 \times 16 \times 25}$ oe</p> <p>40.54... = 40.5</p> <p>(b) 16.51 to 16.53... or 16.5 wwww</p> <p>(c) 10.39 to 10.4[0]</p> | <p>M2</p> <p>E1</p> <p>4</p> <p>2</p> | <p>M1 for $0.5 \times 16 \times 25 \times \sin [\] = 130$ oe but if 40.54... reached from implicit method then M2</p> <p>Must see 40.54.. and conclusion Use of 40.5 alone in implicit expression scores M1.</p> <p>M2 for $16^2 + 25^2 - 2 \times 16 \times 25 \times \cos (40.5)$ oe [allow 40.54...] (M1 for $\cos 40.5 = \frac{16^2 + 25^2 - AC^2}{2 \times 16 \times 25}$) [allow 40.54...] A1 for 272.6 to 273.0...(which implies M2)</p> <p>M1 for $0.5 \times 25 \times \text{distance} = 130$ or $\frac{\text{dist}}{16} = \sin[40.5]$ oe [allow 40.54....]</p> |

| Page 6 | Mark Scheme | Syllabus | Paper |
|--------|-------------------------------|----------|-------|
| | IGCSE – October/November 2012 | 0581 | 43 |

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| 7 | <p>(a) (i) $\frac{2}{20}$ oe</p> <p>(ii) $\frac{6}{20}$ oe</p> <p>(iii) $\frac{14}{20}$ oe</p> <p>(b) (i) 7</p> <p>(ii) 42</p> <p>(iii) $\frac{7}{50}$</p> <p>(iv) $\frac{7}{9}$ [0.777[7].. or 0.778]</p> | <p>2</p> <p>3</p> <p>1ft</p> <p>1</p> <p>1</p> <p>1ft</p> <p>1ft</p> | <p>Accept fraction, %, dec equivalents [3sf or better] throughout but not in ratio or words Isw incorrect cancelling or converting and do not accept ratios or words Pen –1 once for 2sf answers ft probability if $0 < p < 1$</p> <p>M1 for $\frac{2}{5} \times \frac{1}{4}$ oe</p> <p>M2 for $2 \times \frac{1}{5} \times \frac{1}{4} + 2 \times \frac{2}{5} \times \frac{1}{4}$ oe</p> <p>M1 for pairs 1, 4 and 2, 3 clearly identified and no other incorrect pairings or for one appropriate product isw</p> <p>ft 1 – <i>their</i> (a)(ii) or recovery to correct ans</p> <p>ft <i>their</i> 7/50 from Venn diagram or correct recovery</p> <p>ft <i>their</i> 7/<i>their</i> 9 from Venn diagram or correct recovery</p> |
| 8 | <p>(a) 24</p> <p>(b) 5 www</p> | <p>3</p> <p>3</p> | <p>M2 for 24 at <i>B</i> or 128 at <i>X</i> and 28 at <i>D</i>. or M1 for 28 at <i>D</i> or 128 at <i>X</i> allow on diagram</p> <p>M2 for $360 - 22x = 2 \times 25x$ oe or better or $22x = 2(180 - 25x)$ oe or better or $11x + 25x = 180$ oe or better or M1 for $P = 11x$ or reflex $O = 360 - 22x$ or reflex $O = 50x$ allow on diagram</p> |

| Page 7 | Mark Scheme | Syllabus | Paper |
|--------|-------------------------------|----------|-------|
| | IGCSE – October/November 2012 | 0581 | 43 |

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| | (c) 6.32 to 6.34 www | 5 | <p>B1 for OLM 90° (seen or implied) allow on diagram and M1 for $LM = 8 \tan 44$ [7.7255...] or $OM = 8 \div \cos 44$ [11.1213...] and M1dep on previous M for $0.5 \times 8 \times \text{their } LM$ or $0.5 \times 8 \times (\text{their } OM) \sin 44$ and M1 for $\frac{44}{360} \times \pi \times 8^2$ oe [24.5 to 24.6]</p> |
| 9 | <p>(a) (i) 72</p> <p>(ii) 68</p> <p>(iii) 8</p> <p>(iv) 164</p> <p>(b) (i) 11</p> <p>(ii) 35, 45, 55, 65, 75, 85</p> <p>$(9 \times 35 + \text{their } 11 \times 45 + 16 \times 55 + 28 \times 65 + 108 \times 75 + 28 \times 85)$ [13990]</p> <p>$\div 200$ or <i>their</i> $\sum f$</p> <p>69.95 or 69.9 or 70[.0] cao</p> | <p>1</p> <p>1</p> <p>1</p> <p>2</p> <p>1</p> <p>M1</p> <p>M1</p> <p>M1dep</p> <p>A1</p> | <p>M1 for 36 seen may be on the graph</p> <p>At least 5 correct mid - values soi</p> <p>$\sum fx$ where x is in the correct interval allow one further slip</p> <p>Depend on second method</p> <p>isw conversion to mins/secs & reference to classes SC2 for correct answer without working</p> |
| 10 | <p>(a) A 1, $13 - 2n$ oe</p> <p>B 36, n^2 oe</p> <p>C 42, $n(n + 1)$ oe</p> <p>D 729, 3^n oe</p> <p>E 687, $3^n - n(n + 1)$ oe</p> | <p>3</p> <p>2</p> <p>3</p> <p>2</p> <p>2ft</p> | <p>B1, B2 (M1 for $k - 2n$) oe</p> <p>B1, B1</p> <p>B1, B2 (B1 for a quadratic in n)</p> <p>B1, B1</p> <p>B1ft <i>their D – their C</i>, B1ft <i>their D – their C</i> only if both in terms of n</p> |

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|---------------|--------------------------------------|-----------------|--------------|
| Page 8 | Mark Scheme | Syllabus | Paper |
| | IGCSE – October/November 2012 | 0581 | 43 |

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| | (b) (i) – 187 | 1ft | ft if A is linear |
| | (ii) 10 100 | 1ft | ft if C is quadratic |
| | (c) 8 | 1 | |
| | (d) 58 939 | 1 | |