

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
International General Certificate of Secondary Education

**MARK SCHEME for the October/November 2012 series**

<b>0580 MATHEMATICS</b>	
<b>0580/43</b>	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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### 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	<p>(a) (i) [0]9 15 [am]</p> <p>(ii) 64.9 or 65.[0] or 64.92 to 64.98</p> <p>(iii) 11.76...or 11.8</p> <p>(iv) 80</p> <p>(b) (i) <math>150 \div (11 + 16 + 3)</math> or <math>150 \times 3</math> oe then <math>\times 3</math> or <math>\div 30</math></p> <p>(ii) 11 : 9 final answer</p>	<p>1</p> <p>2</p> <p>1</p> <p>3</p> <p>M1</p> <p>E1</p> <p>2</p>	<p>Any acceptable form of time</p> <p>M1 for <math>92 \div (1 \text{ and } 25 \text{ mins})</math> or <math>92/85 \times 60</math> oe or <math>92 \div (1.41 \text{ to } 1.42)</math></p> <p>M2 for <math>92 \div 1.15</math> oe or M1 for 115% associated with 92</p> <p>Correct first step</p> <p>Correct conclusion</p> <p>M1 for <math>8.25 : (15 - 8.25)</math> oe For M1 e.g. allow <math>1 : 0.818</math> [0.8181 to 0.8182] or <math>1.22 : 1</math> [1.222...] After M0, SC1 for 9 : 11 as final answer</p>
2	<p>(a) (i) Image at <math>(-3, 1), (-7, 7), (-3, 7)</math></p> <p>(ii) Image at <math>(-4, -1), (-4, -4), (-2, -4)</math></p> <p>(b) (i) Reflection, <math>y = 1</math></p> <p>(ii) Rotation, <math>(3, 2), 180</math> oe or enlargement, <math>(3, 2),</math> (factor) – 1</p> <p>(iii) Stretch, (factor) 0.5, Invariant line <math>y</math>-axis or <math>x = 0</math></p>	<p>2</p> <p>2</p> <p>2</p> <p>3</p> <p>3</p>	<p>SC1 for translation <math>\begin{pmatrix} -11 \\ k \end{pmatrix}</math> or <math>\begin{pmatrix} k \\ -1 \end{pmatrix}</math></p> <p>SC1 for enlargement factor 0.5 and correct orientation</p> <p><b>In each part of (b) must be one transformation only – if more then lose all marks for that part</b></p> <p>B1 B1 independent</p> <p>B1 B1 B1 independent</p> <p>B1 B1 B1 independent – must be clear on <b>invariant</b> line</p>

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	(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 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

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

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

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7	<p>(a) (i) <math>\frac{2}{20}</math> oe</p> <p>(ii) <math>\frac{6}{20}</math> oe</p> <p>(iii) <math>\frac{14}{20}</math> oe</p> <p>(b) (i) 7</p> <p>(ii) 42</p> <p>(iii) <math>\frac{7}{50}</math></p> <p>(iv) <math>\frac{7}{9}</math> [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] throughout but not in ratio or words  <b>isw incorrect cancelling or converting and do not accept ratios or words</b>  Pen –1 once for 2sf answers  ft probability if <math>0 &lt; p &lt; 1</math></p> <p><b>M1</b> for <math>\frac{2}{5} \times \frac{1}{4}</math> oe</p> <p><b>M2</b> for <math>2 \times \frac{1}{5} \times \frac{1}{4} + 2 \times \frac{2}{5} \times \frac{1}{4}</math> oe</p> <p><b>M1</b> for pairs 1, 4 <b>and</b> 2, 3 clearly identified and no other incorrect pairings  <b>or</b> 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><b>M2</b> for 24 at <i>B</i> <b>or</b> 128 at <i>X</i> <b>and</b> 28 at <i>D</i>.  or <b>M1</b> for 28 at <i>D</i> <b>or</b> 128 at <i>X</i>  allow on diagram</p> <p><b>M2</b> for <math>360 - 22x = 2 \times 25x</math> oe or better  or <math>22x = 2(180 - 25x)</math> oe or better  or <math>11x + 25x = 180</math> oe or better  or <b>M1</b> for  <math>P = 11x</math> or reflex <math>O = 360 - 22x</math> or reflex <math>O = 50x</math>  allow on diagram</p>

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

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