

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

**MARK SCHEME for the October/November 2010 question paper
for the guidance of teachers**

0581 MATHEMATICS

0581/42

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.

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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	(a) 432	2	M1 for $756 \div 7 \times 4$ oe
	(b) (i) 8970	2	M1 for 7800×1.15 oe After 0 scored, SC1 for 1170 as answer
	(ii) $\frac{\text{their } 9867(-7800)}{7800} (\times 100)$ or 1.15×1.10	M2	Their 9867 is their (b)(i) $\times 1.1$ Implied by 1.265 or 0.265 or 126.5 or M1 for their (b)(i) $\times 1.10$ (9867 seen or 2067 seen)
	26.5 % cao	A1	www3
	(c) 8100	3	M2 for $9720 \div 1.2$ oe or M1 for $120\% = 9720$ oe
(d) 562.43 or 562 or 562.4(0) or 562.432	3	M2 for 500×1.04^3 or alt complete method or M1 for 1.04^2 or 1.04^3 oe soi e.g. \$540.80 or 562.(43..) seen in working	
2	(a) (i) 11	1	
	(ii) 22	1	
	(b) $\frac{x+1}{4}$ oe final answer	2	M1 for $x + 1 = 4y$ or $\frac{g(x)+1}{4}$ or $\frac{y+1}{4}$
	(c) $16x^2 - 8x + 7$ final answer	3	M1 for $6 + (4x - 1)^2$ and B1 for $16x^2 - 4x - 4x + 1$ or better seen
(d) 0.5 or $\frac{1}{2}$ www	3	M2 for $16x - 4 - 1 = 3$ or better or M1 for $4(4x - 1) - 1 (= 3)$ Alt method M2 allow $g^{-1}g^{-1}(3)$ complete method or M1 for $g(x) = g^{-1}(3)$	

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3	<p>(a) (i) 63 to 63.5 (ii) 50 to 50.5 (iii) 21.5 to 22.5</p> <p>(b) 46</p> <p>(c) (i) 12, 14 (ii) $\{35 \times 8 + 45 \times \text{their } 12 + 55 \times 14 + 65 \times 22 + 75 \times \text{their } 14 + 85 \times 10\} \div \text{their } 80$ (or 80)</p> <p>61.5 cao</p>	<p>1 1 1</p> <p>2</p> <p>1, 1</p> <p>M3</p> <p>A1</p>	<p>B1 for 34 seen (could be on graph)</p> <p>M1 for mid-values soi (allow 1 error/omit) and M1 for use of $\sum fx$ with x in correct boundary including both ends (at least 4 products) (4920 seen implies M2) and M1 depend on 2nd M for dividing by their 80 (or 80) (not 54 or less)</p> <p>www4</p>
4	<p>(a) (i) 218 (217.7 to 218) (ii) 501 (500.7 to 501.4) (iii) 99</p> <p>(b) their (a)(i) $\times \left(\frac{32.5}{13}\right)^3$ oe</p> <p>3400 or 3410 (3401 to 3407)</p> <p>(c) ($r^2 =$) $550 \div 12\pi$</p> <p>3.82 (3.818 to 3.821)</p>	<p>2 1ft 2ft</p> <p>M2</p> <p>A1</p> <p>M2</p> <p>A1</p>	<p>M1 for $1/3\pi \times 4^2 \times 13$ ft their (a) $\times 2.3$ ft 50 000 \div their (a)(ii) and truncated to whole number M1 for 50 000 \div their (a)(ii) oe or answers 99.8 or 100</p> <p>or $1/3\pi \times 10^2 \times 32.5$ or M1 for $(32.5 \div 13)^3 (=15.625)$ seen or $(13 \div 32.5)^3 (= 0.064)$ seen</p> <p>www3</p> <p>(14.58 to 14.6) or M1 for $12\pi r^2 = 550$ or better</p> <p>www3</p>

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5	<p>(a) (i) $x^2 + (x + 7)^2 = 17^2$ oe $x^2 + x^2 + 7x + 7x + 49 = 17^2$ or better $2x^2 + 14x - 240 = 0$ $x^2 + 7x - 120 = 0$</p> <p>(ii) $(x + 15)(x - 8)$</p> <p>(iii) -15 and 8 (iv) 15</p> <p>(b) (i) $3x(2x - 1) = (2x + 3)^2$ oe $4x^2 + 6x + 6x + 9$ or better seen $6x^2 - 3x = 4x^2 + 12x + 9$ oe $2x^2 - 15x - 9 = 0$</p> <p>(ii) $\frac{(-)15 \pm \sqrt{((-)15)^2 - 4(2)(-9)}}{2(2)}$ oe</p> <p>8.06 and -0.56 cao (iii) 76.5 (76.46 to 76.48)</p>	<p>B1 B1 E1 2 1ft 1ft M1 B1 E1 1 1 1, 1 1ft</p>	<p>Must be seen</p> <p>Must be shown – correct 3 terms With no errors seen M1 for $(x + a)(x + b)$ where a and b are integers and $a \times b = -120$ or $a + b = 7$ Ignore solutions after factors given Correct or ft dep on at least M1 in (ii) Correct or ft their positive root from (ii) + 7 dep on a positive and negative root given</p> <p>e.g. $6x^2 - 3x = 4x^2 + 12x + 9$ must see equation before simplification Indep</p> <p>With no errors seen and both sets of brackets expanded</p> <p>In square root B1 for $((-15)^2 - 4(2)(-9))$ or better (297) If in form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$, B1 for $-(-15)$ and $2(2)$ or better</p> <p>SC1 for -0.6 or $-0.558\dots$ and 8.1 or $8.058\dots$ ft 8 times a positive root to (b)(ii) add 12</p>
6	<p>(a) (i) $5480^2 + 3300^2 - 2 \times 5480 \times 3300 \times \cos 165$</p> <p>8709.5..</p> <p>(ii) $(\sin L =) \frac{\sin 165}{8710} \times 3300$ (0.09806...)</p> <p>5.6 (5.62 to 5.63)</p> <p>(b) 22 35 or 10 35 pm</p> <p>(c) $8710 \div 800$ 10.88 to 10.9 with no conversion to h/min or 10 (hrs) 52 (mins) to 10 (hrs) 54 (mins) oe 13 hrs 45 mins – their time in hrs and mins oe or 13.75 – their decimal time and a correct conversion to hrs and mins or minutes 2 hr 52 mins cao</p>	<p>M2 E2 M2 A1 2 M1 A1 M1 A1</p>	<p>(75 856 005) M1 for implicit version</p> <p>If E0, A1 for 75800000 to 75900000</p> <p>M1 for $\frac{\sin L}{3300} = \frac{\sin 165}{8710}$ oe (allow 8709.5.) Could use cosine rule using 8710 or better – M2 for explicit form or M1 for implicit form (allow 5.6 to 5.63 for A mark)</p> <p>www3</p> <p>Accept 22 35 pm B1 for 15 35 or 3 35 pm seen or answers 22h 35 mins or (0)8 35(am) or 10 35(am)</p> <p>Implied by correct final ans 2hrs 52 mins if not shown</p> <p>Dep on first M1 e.g. 13 hrs 45mins – 11 hrs 29 mins or 13.75 – 10.9 then 2hrs 51 mins</p> <p>www4 (2 hrs 51.75 mins)</p>

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7	<p>(a) $-3, -4.25, -3$</p> <p>(b) 10 correct points plotted</p> <p>Smooth curve through their 10 points and correct shape</p> <p>Two separate branches</p> <p>(c) (i) 0.7 to 0.85</p> <p>(ii) Any value of k such that $k \leq -3$ and must be consistent with their graph</p> <p>(d) $y = 5x$ drawn</p> <p>-0.6 to -0.75, 0.55 to 0.65</p> <p>(e) Tangent drawn at $x = -2$</p> <p>y change / x change attempt</p> <p>2.7 to 4.3</p>	<p>1, 1, 1</p> <p>P3ft</p> <p>C1</p> <p>B1ft</p> <p>1</p> <p>1ft</p> <p>L1</p> <p>1, 1</p> <p>T1</p> <p>M1</p> <p>A1</p>	<p>Allow -4.2 or -4.3 for -4.25</p> <p>P2ft for 8 or 9 correct</p> <p>P1ft for 6 or 7 correct</p> <p>Correct shape not ruled, (curves could be joined)</p> <p>Indep but needs two 'curves' on either side of y-axis</p> <p>-1 each extra</p> <p>ft consistent with their graph (If curves are joined then $k = -3$ only)</p> <p>Ruled and long enough to meet curves</p> <p>Indep -1 each extra</p> <p>Must be a reasonable tangent, not chord, no clear daylight</p> <p>Depend on T and uses scales correctly. Mark intention – allow one slight slip e.g. sign error from coords but not scale misread</p> <p>If no working shown and answer is out of range – check their tangent for method</p> <p>Answer in range gets 2 marks after T1 earned</p>
8	<p>(a) (i) Correct translation to $(3, -5)$, $(5, -6)$ and $(4, -4)$</p> <p>(ii) Correct reflection to $(4, 1)$, $(5, 3)$ and $(6, 2)$</p> <p>(iii) Correct rotation to $(-2, 0)$, $(-1, 2)$ and $(-3, 1)$</p> <p>(iv) Correct enlargement to $(0, -3)$, $(-8, 1)$ and $(-4, -7)$</p> <p>(b) 16 cao</p> <p>(c) (i) Correct transformation to $(-4, 0)$, $(5, 3)$ and $(-2, 0)$</p> <p>(ii) Shear only</p> <p>x-axis oe invariant (factor) 3</p> <p>(iii) $\begin{pmatrix} 1 & -3 \\ 0 & 1 \end{pmatrix}$ oe</p>	<p>2</p> <p>2</p> <p>2</p> <p>2</p> <p>1</p> <p>3</p> <p>1</p> <p>1</p> <p>1</p> <p>2</p>	<p>SC1 for translation of $\begin{pmatrix} 3 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -7 \end{pmatrix}$ or vertices only</p> <p>SC1 for reflection in $y = 3$ or vertices only</p> <p>SC1 for rotation 90 clockwise around $(0, 0)$ or vertices only</p> <p>SC1 for two correct points or vertices only</p> <p></p> <p>B2 for 3 correct points shown in working but not plotted</p> <p>or B1 for incorrect shear drawn with x-axis invariant or two correct points shown</p> <p>If more than one transformation given – no marks available</p> <p>Accept fixed, constant oe for invariant</p> <p></p> <p>B1 for determinant = 1 or $k \begin{pmatrix} 1 & -3 \\ 0 & 1 \end{pmatrix}$ oe</p>

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9	<p>(a) $\frac{4}{11}$ and $\frac{4}{10}$, $\frac{7}{10}$ $\frac{3}{10}$</p> <p>(b) (i) $\frac{7}{11} \times \frac{6}{10}$ $\frac{42}{110}$ oe $\left(\frac{21}{55}\right)$</p> <p>(ii) $\frac{7}{11} \times \frac{4}{10} + \frac{4}{11} \times \frac{7}{10}$ $\frac{56}{110}$ oe $\left(\frac{28}{55}\right)$</p> <p>(c) (i) $\frac{7}{11} \times \frac{6}{10} \times \frac{5}{9}$ or their (b)(i) $\times \frac{5}{9}$ $\frac{210}{990}$ oe $\left(\frac{7}{33}\right)$</p> <p>(ii) $1 - \left(\frac{4}{11} \times \frac{3}{10} \times \frac{2}{9}\right)$ oe $\frac{966}{990}$ oe $\left(\frac{161}{165}\right)$</p>	1 1, 1 M1 A1 M2 A1 M1 A1 M2 A1	<p>Accept fraction, %, dec equivalents (3sf or better) throughout but not ratio or words i.s.w. incorrect cancelling/conversion to other forms Pen -1 once for 2 sf answers</p> <p>www2 0.382 (0.3818...)</p> <p>ft their tree M1 for either pair seen</p> <p>www3 0.509(0..)</p> <p>www2 0.212(1..)</p> <p>Longer methods must be complete M1 for 4/11, 3/10 and 2/9 seen</p> <p>www3 0.976 (0.9757...)</p>
10	<p>(a) 21 and 34</p> <p>(b) -5 8</p> <p>(c) (i) 4, 6</p> <p>(ii) $x = 28$ $y = -5$ $z = 23$</p>	1 1 + 1 3 5	<p>M1 for $2 + d = e$ oe or $d + e = 10$ oe seen and either M1 for a correct eqn in d or e seen e.g. $2e = 12$ oe or $2d = 8$ oe or B1 for either correct</p> <p>B4 for any two correct or M3 for any of $18 = 3x - 66$ oe or $3y + 33 = 18$ oe or $33 - 3z = -36$ oe</p> <p>or M1 for 2 of $y = x - 33$ oe or $y + z = 18$ oe or $x + y = z$ oe and M1 for combining two of the previous equations correctly isw (does not have to be simplified)</p> <p>after 0 scored SC1 for $-33 +$ their $x =$ their y or their $x +$ their $y =$ their z or their $y +$ their $z = 18$</p>