

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

**0580 MATHEMATICS**

**0580/42**

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
<b>1</b>	<b>(a)</b> 432	2	<b>M1</b> for $756 \div 7 \times 4$ oe
	<b>(b) (i)</b> 8970	2	<b>M1</b> for $7800 \times 1.15$ oe After 0 scored, <b>SC1</b> for 1170 as answer
	<b>(ii)</b> $\frac{\text{their } 9867(-7800)}{7800} (\times 100)$ or $1.15 \times 1.10$	M2	Their 9867 is their <b>(b)(i)</b> $\times 1.1$ Implied by 1.265 or 0.265 or 126.5 or <b>M1</b> for their <b>(b)(i)</b> $\times 1.10$ (9867 seen or 2067 seen)
	26.5 % cao	A1	www3
	<b>(c)</b> 8100	3	<b>M2</b> for $9720 \div 1.2$ oe or <b>M1</b> for $120\% = 9720$ oe
<b>(d)</b> 562.43 or 562 or 562.4(0) or 562.432	3	<b>M2</b> for $500 \times 1.04^3$ or alt complete method or <b>M1</b> for $1.04^2$ or $1.04^3$ oe soi e.g. \$540.80 or 562.(43..) seen in working	
<b>2</b>	<b>(a) (i)</b> 11	1	
	<b>(ii)</b> 22	1	
	<b>(b)</b> $\frac{x+1}{4}$ oe final answer	2	<b>M1</b> for $x + 1 = 4y$ or $\frac{g(x)+1}{4}$ or $\frac{y+1}{4}$
	<b>(c)</b> $16x^2 - 8x + 7$ final answer	3	<b>M1</b> for $6 + (4x - 1)^2$ and <b>B1</b> for $16x^2 - 4x - 4x + 1$ or better seen
<b>(d)</b> 0.5 or $\frac{1}{2}$ www	3	<b>M2</b> for $16x - 4 - 1 = 3$ or better or <b>M1</b> for $4(4x - 1) - 1 (= 3)$ <b>Alt method</b> <b>M2</b> allow $g^{-1}g^{-1}(3)$ complete method or <b>M1</b> 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) <math>\{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</math> (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><b>B1</b> for 34 seen (could be on graph)</p> <p><b>M1</b> for mid-values soi (allow 1 error/omit) and <b>M1</b> for use of <math>\sum fx</math> with <math>x</math> in correct boundary including both ends (at least 4 products) (4920 seen implies M2) and <b>M1</b> depend on 2<sup>nd</sup> M for dividing by their 80 (or 80) (not 54 or less) 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) <math>\times \left(\frac{32.5}{13}\right)^3</math> oe  3400 or 3410 (3401 to 3407)</p> <p>(c) (<math>r^2 =</math>) <math>550 \div 12\pi</math>  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><b>M1</b> for <math>1/3\pi \times 4^2 \times 13</math> ft their (a) <math>\times 2.3</math> ft <math>50\,000 \div</math> their (a)(ii) and truncated to whole number <b>M1</b> for <math>50\,000 \div</math> their (a)(ii) oe or answers 99.8 or 100</p> <p>or <math>1/3\pi \times 10^2 \times 32.5</math> or <b>M1</b> for <math>(32.5 \div 13)^3 (=15.625)</math> seen or <math>(13 \div 32.5)^3 (=0.064)</math> seen www3</p> <p>(14.58 to 14.6) or <b>M1</b> for <math>12\pi r^2 = 550</math> or better www3</p>

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5	<p>(a) (i) <math>x^2 + (x + 7)^2 = 17^2</math> oe  <math>x^2 + x^2 + 7x + 7x + 49 = 17^2</math>  or better  <math>2x^2 + 14x - 240 = 0</math>  <math>x^2 + 7x - 120 = 0</math></p> <p>(ii) <math>(x + 15)(x - 8)</math></p> <p>(iii) -15 and 8  (iv) 15</p> <p>(b) (i) <math>3x(2x - 1) = (2x + 3)^2</math> oe  <math>4x^2 + 6x + 6x + 9</math> or better seen  <math>6x^2 - 3x = 4x^2 + 12x + 9</math> oe  <math>2x^2 - 15x - 9 = 0</math></p> <p>(ii) <math>\frac{(-)15 \pm \sqrt{((-)15)^2 - 4(2)(-9)}}{2(2)}</math> oe</p> <p>8.06 and -0.56 cao  (iii) 76.5 (76.46 to 76.48)</p>	B1 B1  E1 2  1ft 1ft  M1 B1 E1  1 1  1, 1 1ft	<p>Must be seen</p> <p>Must be shown – correct 3 terms  With no errors seen  <b>M1</b> for <math>(x + a)(x + b)</math> where <math>a</math> and <math>b</math> are integers and <math>a \times b = -120</math> or <math>a + b = 7</math>  Ignore solutions after factors given  Correct or ft dep on at least <b>M1</b> in (ii)  Correct or ft their positive root from (ii) + 7 dep on a positive and negative root given</p> <p>e.g. <math>6x^2 - 3x = 4x^2 + 12x + 9</math> must see equation before simplification  Indep</p> <p>With no errors seen and both sets of brackets expanded</p> <p>In square root <b>B1</b> for <math>(-15)^2 - 4(2)(-9)</math> or better (297)  If in form <math>\frac{p + \sqrt{q}}{r}</math> or <math>\frac{p - \sqrt{q}}{r}</math>,  <b>B1</b> for <math>-(-15)</math> and <math>2(2)</math> or better</p> <p><b>SC1</b> for <math>-0.6</math> or <math>-0.558\dots</math> and <math>8.1</math> or <math>8.058\dots</math>  ft 8 times a positive root to (b)(ii) add 12</p>
6	<p>(a) (i) <math>5480^2 + 3300^2 - 2 \times 5480 \times 3300 \times \cos 165</math></p> <p>8709.5..</p> <p>(ii) <math>(\sin L =) \frac{\sin 165}{8710} \times 3300</math>  (0.09806...)</p> <p>5.6 (5.62 to 5.63)</p> <p>(b) 22 35 or 10 35 pm</p> <p>(c) <math>8710 \div 800</math>  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 <b>and</b> a correct conversion to hrs and mins or minutes  2 hr 52 mins cao</p>	M2  E2  M2  A1  2  M1 A1  M1  A1	<p>(75 856 005) <b>M1</b> for implicit version</p> <p>If E0, <b>A1</b> for 75800000 to 75900000</p> <p><b>M1</b> for <math>\frac{\sin L}{3300} = \frac{\sin 165}{8710}</math> oe (allow 8709.5.)  Could use cosine rule using 8710 or better – <b>M2</b> for explicit form or <b>M1</b> for implicit form (allow 5.6 to 5.63 for A mark)  www3</p> <p>Accept 22 35 pm  <b>B1</b> 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 <b>M1</b>  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) <math>-3, -4.25, -3</math></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 <math>k</math> such that <math>k \leq -3</math> and <b>must</b> be consistent with their graph</p> <p>(d) <math>y = 5x</math> drawn</p> <p><math>-0.6</math> to <math>-0.75, 0.55</math> to <math>0.65</math></p> <p>(e) Tangent drawn at <math>x = -2</math></p> <p><math>y</math> change / <math>x</math> 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 <math>-4.2</math> or <math>-4.3</math> for <math>-4.25</math></p> <p><b>P2ft</b> for 8 or 9 correct</p> <p><b>P1ft</b> 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 <math>y</math>-axis</p> <p><math>-1</math> each extra</p> <p>ft consistent with their graph (If curves are joined then <math>k = -3</math> only)</p> <p>Ruled and long enough to meet curves</p> <p>Indep <math>-1</math> each extra</p> <p>Must be a reasonable tangent, not chord, no clear daylight</p> <p>Depend on <b>T</b> and uses scales correctly. Mark intention – allow <b>one</b> 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 <b>T1</b> earned</p>
8	<p>(a) (i) Correct translation to <math>(3, -5), (5, -6)</math> and <math>(4, -4)</math></p> <p>(ii) Correct reflection to <math>(4, 1), (5, 3)</math> and <math>(6, 2)</math></p> <p>(iii) Correct rotation to <math>(-2, 0), (-1, 2)</math> and <math>(-3, 1)</math></p> <p>(iv) Correct enlargement to <math>(0, -3), (-8, 1)</math> and <math>(-4, -7)</math></p> <p>(b) 16 cao</p> <p>(c) (i) Correct transformation to <math>(-4, 0), (5, 3)</math> and <math>(-2, 0)</math></p> <p>(ii) Shear only</p> <p><math>x</math>-axis oe invariant (factor) 3</p> <p>(iii) <math>\begin{pmatrix} 1 &amp; -3 \\ 0 &amp; 1 \end{pmatrix}</math> 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><b>SC1</b> for translation of <math>\begin{pmatrix} 3 \\ k \end{pmatrix}</math> or <math>\begin{pmatrix} k \\ -7 \end{pmatrix}</math> or vertices only</p> <p><b>SC1</b> for reflection in <math>y = 3</math> or vertices only</p> <p><b>SC1</b> for rotation 90 clockwise around <math>(0, 0)</math> or vertices only</p> <p><b>SC1</b> for two correct points or vertices only</p> <p><b>B2</b> for 3 correct points shown in working but not plotted</p> <p><b>or B1</b> for incorrect shear drawn with <math>x</math>-axis invariant <b>or</b> 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><b>B1</b> for determinant = 1 <b>or</b> <math>k \begin{pmatrix} 1 &amp; -3 \\ 0 &amp; 1 \end{pmatrix}</math> oe</p>

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<p><b>9</b></p>	<p>(a) <math>\frac{4}{11}</math> and <math>\frac{4}{10}</math>, <math>\frac{7}{10}</math> <math>\frac{3}{10}</math></p> <p>(b) (i) <math>\frac{7}{11} \times \frac{6}{10}</math> <math>\frac{42}{110}</math> oe <math>\left(\frac{21}{55}\right)</math></p> <p>(ii) <math>\frac{7}{11} \times \frac{4}{10} + \frac{4}{11} \times \frac{7}{10}</math> <math>\frac{56}{110}</math> oe <math>\left(\frac{28}{55}\right)</math></p> <p>(c) (i) <math>\frac{7}{11} \times \frac{6}{10} \times \frac{5}{9}</math> or their (b)(i) <math>\times \frac{5}{9}</math> <math>\frac{210}{990}</math> oe <math>\left(\frac{7}{33}\right)</math></p> <p>(ii) <math>1 - \left(\frac{4}{11} \times \frac{3}{10} \times \frac{2}{9}\right)</math> oe <math>\frac{966}{990}</math> oe <math>\left(\frac{161}{165}\right)</math></p>	<p>1</p> <p>1, 1</p> <p>M1</p> <p>A1</p> <p>M2</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>M2</p> <p>A1</p>	<p><b>Accept</b> 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 <b>M1</b> for either pair seen</p> <p>www3 0.509(0..)</p> <p>www2 0.212(1..)</p> <p>Longer methods must be complete <b>M1</b> for 4/11, 3/10 and 2/9 seen</p> <p>www3 0.976 (0.9757...)</p>
<p><b>10</b></p>	<p>(a) 21 and 34</p> <p>(b) –5 8</p> <p>(c) (i) 4, 6</p> <p>(ii) <math>x = 28</math> <math>y = -5</math> <math>z = 23</math></p>	<p>1</p> <p>1 + 1</p> <p>3</p> <p>5</p>	<p><b>M1</b> for <math>2 + d = e</math> oe or <math>d + e = 10</math> oe seen and either <b>M1</b> for a correct eqn in <math>d</math> or <math>e</math> seen e.g. <math>2e = 12</math> oe or <math>2d = 8</math> oe or <b>B1</b> for either correct</p> <p><b>B4</b> for any two correct or <b>M3</b> for <b>any</b> of <math>18 = 3x - 66</math> oe or <math>3y + 33 = 18</math> oe or <math>33 - 3z = -36</math> oe</p> <p>or <b>M1</b> for <b>2</b> of <math>y = x - 33</math> oe or <math>y + z = 18</math> oe or <math>x + y = z</math> oe and <b>M1</b> for combining two of the previous equations correctly isw (does not have to be simplified)</p> <p>after 0 scored <b>SC1</b> for <math>-33 +</math> their <math>x =</math> their <math>y</math> or their <math>x +</math> their <math>y =</math> their <math>z</math> or their <math>y +</math> their <math>z = 18</math></p>