

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

**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.

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
<b>1</b>	<b>(a) (i)</b> 5	<b>2</b>	<b>M1</b> for $\frac{3 \times 15}{(5 + 3 + 1)}$
	<b>(ii)</b> 108	<b>2</b>	<b>M1</b> for $60 \times \frac{9}{5}$ oe
	<b>(b)</b> Correct conversion of money $J \times 0.718$ or $A \div 0.718$	<b>M1</b>	Correct conversion of money soi by 146.83[1] rounded or truncated to 3sf or 134.26[1...] rounded or truncated to 3 sf if done 1 <sup>st</sup>
	Correct equalising of weights e.g. $J \times \frac{2[0]}{3[0]}$ or $A \times \frac{3[0]}{2[0]}$ or $J \div 3$ and $A \div 2$ or $J \div 30$ and $A \div 20$	<b>M1</b>	Correct equalising of weights or money Accept other methods that give a pair of comparable values for method and accuracy marks This mark can be implied by values seen correct to 3 sf or better
	97 to 98 or 201[.39...] <b>and</b> Ann <u>48.9[4..]</u> <b>and</b> 48.2[0] <b>and</b> Ann or 68[.16] to 68.[2] <b>and</b> <u>67[.13]</u> <b>and</b> Ann 4.88... to 4.9 <b>and</b> 4.82 <b>and</b> Ann or 6.8[1..] to 6.82 <b>and</b> <u>6.7[1...]</u> <b>and</b> Ann www	<b>A2</b>	The underlined values imply <b>M1</b> for the money conversion  Or <b>A1</b> for 97 to 98 or 201[.39...] or a correct pair of values with wrong/no conclusion
	<b>(c)</b> 302 Final answer	<b>3</b>	<b>M1</b> for $60 \times 60 \times 4$ soi by 14400 or figs 6048 or figs 3024 and <b>M1</b> for $\div (1000 \times 20)$ soi Answer 302.4 implies <b>M2</b>
<b>(d)</b> 13.6[0]	<b>3</b>	<b>M2</b> for $\frac{15.3[0]}{1.125}$ oe or <b>M1</b> for 15.3[0] associated with 112.5%	
<b>(e)</b> 12	<b>1</b>		

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<p>2</p>	<p>(a) (i) <math>[\cos A =] \frac{32^2 + 64^2 - 43^2}{2 \times 32 \times 64}</math></p> <p>37.00[...]</p> <p>(ii) 616 or 616.2 to 616.4...</p> <p>(b) <math>[\sin ADC =] \frac{64 \sin 55}{70}</math> soi by 48.49...rounded or truncated or <math>x^2 - (73.41 \text{ to } 73.42)x - 804 [= 0]</math></p> <p><math>\frac{70 \sin(125 - \text{their } 48.5)}{\sin 55}</math> or <math>64^2 + 70^2 - 2 \times 64 \times 70 \cos(125 - \text{their } 48.5)</math> or solving their 3 term quadratic equation</p> <p>228 or 228.0 to 228.1      www</p>	<p>M2</p> <p>A2</p> <p>2</p> <p>M2</p> <p>M2</p> <p>A2</p>	<p>M1 for correct implicit version <math>43^2 = 32^2 + 64^2 - 2 \times 32 \times 64 \cos A</math></p> <p>A1 for <math>\frac{3271}{4096}</math> or 0.798 to 0.799</p> <p>M1 for <math>\frac{1}{2} \times 32 \times 64 \times \sin 37</math> oe</p> <p>M1 for correct implicit version of sine rule or cosine rule with <math>x</math></p> <p>M1 for implicit sine rule or cosine rule or for one error in quadratic solution</p> <p>Ignore negative solutions</p> <p>A1 for 83.0 to 83.1</p>
<p>3</p>	<p>(a) (i) <math>2(2x + 1)(x - 5)</math> final answer</p> <p>(ii) <math>-1/2</math>oe , 5</p> <p>(b) <math>\frac{[-7] \pm \sqrt{([-7])^2 - 4(2)(-10)}}{2(2)}</math></p> <p><math>-1.09</math> , <math>4.59</math>      final answers</p>	<p>3</p> <p>1ft</p> <p>B2</p> <p>B1B1</p>	<p>B1 for <math>2(2x^2 - 9x - 5)</math> and B1 for <math>(2x + 1)(x - 5)</math> or SC2 for expansion of brackets gives 3 correct terms e.g. <math>(2x + 1)(2x - 10)</math> or <math>(4x + 2)(x - 5)</math> or SC1 for expansion of brackets gives 2 correct terms e.g. <math>(2x - 1)(2x + 10)</math> or <math>(4x - 2)(x - 4)</math></p> <p>Correct or ft their 2 brackets</p> <p>B1 for <math>\sqrt{([-7])^2 - 4(2)(-10)} [= \sqrt{129}]</math></p> <p>If in form <math>\frac{p + \sqrt{q}}{r}</math> or <math>\frac{p - \sqrt{q}}{r}</math>,</p> <p>B1 for <math>-- 7</math> and <math>2(2)</math> or better</p> <p>If B0, SC1 for <math>-1.1</math> and <math>4.6</math> as final answers or <math>-1.089..</math> and <math>4.589..</math> as final answers or <math>-1.09</math> and <math>4.59</math> seen</p>

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	(c) $\frac{-10}{(3x-1)(x-2)}$ or $\frac{-10}{3x^2-7x+2}$ as final answer	3	<b>M1</b> for $6(x-2) - 2(3x-1)$ or better. Allow recovery after missing bracket[s] and <b>B1</b> for $(3x-1)(x-2)$ as common denominator seen (may be as two fractions)
4	(a) (i) 148  (ii) 74  (iii) 21  (iv) 20.9 or 20.92...	2  <b>1ft</b>  2  3	<b>B1</b> for tangent/radius = $90^\circ$ seen. May be on diagram  ft <i>their</i> (a)(i) $\div 2$ dep on (a)(i) $< 180$  <b>M1</b> for $360 - 90 - 143 - 32 - \textit{their}$ (ii) oe e.g. using quadrilateral <i>AOCD</i>  <b>M2</b> for $6 \tan 74$ oe or explicit sine rule Or <b>M1</b> for implicit version
	(b) (i) 51  (ii) 56  (iii) <u>Angle at centre twice</u> oe angle at <u>circumference</u>  (iv) 22  (v) 68.3 or 68.27 to 68.29	2  2  1  1  3	<b>M1</b> for $ABC = 90^\circ$ . May be on diagram.  <b>M1</b> for $39 + 17$ or $180 - (73 + \textit{their}$ 51) or [ $AXB =$ ] $180 - (39 + 17)$  1  1  3  Allow $\frac{326}{15}\pi$ as final answer  <b>M2</b> for $\frac{360-34}{360} \times 2\pi \times 12$  or $2\pi \times 12 - \frac{34}{360} \times 2\pi \times 12$  or $\pi \times 12 + \frac{180-34}{360} \times 2\pi \times 12$  or <b>M1</b> for use of $\frac{\theta}{360} \times 2\pi \times 12$  for $\theta \neq$ multiples of $90^\circ$

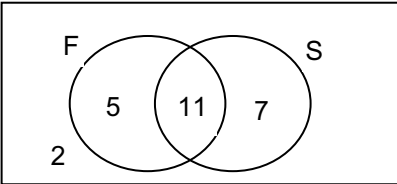
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5	<p>(a) 20, 60, 100, 140, 180, 220  <math>(6 \times 20 + 10 \times 60 + 28 \times 100 + 76 \times 140 + 22 \times 180 + 16 \times 220)</math>  <math>(= 21640)</math></p> <p style="text-align: center;"><math>\div 158</math> or <math>\sum f</math></p> <p style="text-align: center;">137 or 136.9 to 137.0</p> <p>(b) (i) 16, 126</p> <p>(ii) rectangular bar of height 0.2  rectangular bar of height 1.05</p> <p style="text-align: center;">correct widths of 80 and 120  with no gaps</p> <p>(c) 135</p>	<p><b>M1</b></p> <p><b>M1</b></p> <p><b>M1</b></p> <p><b>A1</b></p> <p><b>1, 1</b></p> <p><b>1ft</b> <b>1ft</b></p> <p><b>1</b></p> <p><b>3</b></p>	<p>At least 5 correct mid - values soi</p> <p><math>\sum fm</math> where <math>m</math> is in the correct interval, allow either end of interval as <math>m</math>  allow one further slip</p> <p>Depend on second method</p> <p><b>SC2</b> for 137 or better ww</p> <p>Strict fit from <i>their</i> 16  Strict fit from <i>their</i> 126</p> <p><b>M2</b> for <math>\frac{15 \times 136 + 3 \times 130}{15 + 3}</math>  or <b>M1</b> for <math>15 \times 136</math> and <math>3 \times 130</math>  [2040] and [390]</p>
6	<p>(a) 5.83 or 5.830 to 5.831</p> <p>(b) (i) Vector drawn from <math>P</math> to <math>Q</math> at (14, 3)</p> <p>(ii) Points at (8, 11) and (13, 14)</p> <p>(c) <math>3\mathbf{a} - 2\mathbf{b}</math></p> <p>(d) <math>\begin{pmatrix} 7 \\ -6 \end{pmatrix}</math></p> <p>(e) (i) <math>\mathbf{b} - \mathbf{c}</math> oe</p>	<p><b>2</b></p> <p><b>1</b></p> <p><b>1, 1</b></p> <p><b>2</b></p> <p><b>1</b> <b>1</b></p> <p><b>1</b></p>	<p>Allow <math>\sqrt{34}</math> as final answer  <b>M1</b> for <math>(3^2 + ([-]5)^2)</math></p> <p>Must have arrow in correct direction</p> <p><b>SC1</b> for points at (8, 5) and (3, 2)</p> <p><b>M1</b> for <math>\mathbf{a} - 3\mathbf{b} + 2\mathbf{a} + \mathbf{b}</math> or <math>\overrightarrow{CD} + \overrightarrow{DE}</math> oe  Allow mixtures of vector notation.</p> <p>Allow unsimplified</p>

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	<p>(ii) <math>MX = MB + BX</math></p> <p><math>\pm \frac{1}{4}</math> or <math>\pm \frac{3}{4}</math> used</p> <p><math>\frac{3}{4}c - \frac{1}{4}b</math> or <math>\frac{1}{4}(3c - b)</math> or <math>\frac{3c}{4} - \frac{b}{4}</math></p>	<p><b>M1</b></p> <p><b>M1</b></p> <p><b>A2</b></p>	<p>Any order for the M marks For a correct route</p> <p><b>A1</b> for <math>\frac{1}{2}b + \frac{3}{4}(c - b)</math> oe Any correct unsimplified After <b>0</b> scored <b>SC2</b> for <math>2/3c - 1/6b</math></p>
7	<p>(a) (i) <math>x \geq 5</math></p> <p><math>y \leq 8</math></p> <p><math>x + y \leq 14</math></p> <p><math>y \geq \frac{1}{2}x</math> oe</p> <p>(ii) <math>x = 5</math> ruled <math>y = 8</math> ruled <math>x + y = 14</math> ruled <math>y = \frac{1}{2}x</math> ruled region indicated</p> <p>(b) (i) 480</p> <p>(ii) 6, 8</p>	<p><b>4</b></p> <p><b>1</b></p> <p><b>1</b></p> <p><b>1</b></p> <p><b>1</b></p> <p><b>1dep</b></p> <p><b>2</b></p> <p><b>1</b></p>	<p><b>B1</b> for each correct inequality Penalise the first occurrence only when strict inequalities used</p> <p>Each line long enough to be boundary of region Check at intercepts Check at (10, 5) <b>Dependent</b> on 4 lines correct</p> <p><b>M1</b> for <math>20 \times x + 45 \times y</math> where <math>x</math> and <math>y</math> are integers and <math>(x, y)</math> is in their quadrilateral</p> <p>In correct order</p>
8	<p>(a) (i) Tangent drawn at <math>x = 2.5</math></p> <p>(ii) 1.55 to 2.2</p> <p>(b) 1.42 to 1.45 and 2.8 to 2.82</p> <p>(c) (i) 4.4, 2.5, 1.5</p>	<p><b>1</b></p> <p><b>2dep</b></p> <p><b>1, 1</b></p> <p><b>2</b></p>	<p>reasonable tangent at correct point, no daylight, or chord, crossing <math>x</math>-axis between 1.7, 2.0 when extended if necessary</p> <p><b>Dependent</b> on correct tangent or close attempt at tangent at <math>x = 2.5</math></p> <p><b>M1dep</b> attempts <math>y</math> step / <math>x</math> step with correct scales</p> <p><b>B1</b> for 2 correct values</p>

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	<p>(ii) 6 correct points plotted</p> <p>curve through all 6 points and correct shape</p> <p>(iii) 0.75 to 0.9</p> <p>1.6 to 1.7</p> <p>2.6 to 2.7</p>	<p><b>P2ft</b></p> <p><b>C1</b></p> <p><b>1</b></p> <p><b>1</b></p> <p><b>1</b></p>	<p><b>P1ft</b> for 4 or 5 correct plots</p> <p>Smooth curve but last 3 points may be ruled. In absence of plot[s], allow curve to imply plot[s]</p> <p>Solutions may be in any order</p>
9	<p>(a) (i)</p>  <p>(ii) 9</p> <p>(iii) 14</p> <p>(iv) <math>\frac{11}{25}</math></p> <p>(v) <math>\frac{42}{600}</math> oe <math>= \frac{7}{100}</math></p>	<p><b>2</b></p> <p><b>1ft</b></p> <p><b>1</b></p> <p><b>1ft</b></p> <p><b>2ft</b></p>	<p><b>B1</b> for 2 outside of circles in diagram or all three of 5, 11, 7 correctly placed</p> <p>ft <i>their</i> 2 + <i>their</i> 7</p> <p>ft <i>their</i> 11 from diagram / 25</p> <p>isw incorrect cancelling</p> <p>ft <i>their</i> 7 from diagram for numerator</p> <p><b>M1</b> for <math>\frac{\text{their}7}{25} \times \frac{\text{their}(7-1)}{24}</math></p> <p>After 0 scored, <b>SC1</b> for <math>\frac{\text{their}7}{25} \times \frac{\text{their}(7)}{25}</math></p>

	<p>(b) (i)</p> <p>(ii) 28</p>	<p>4</p> <p>1ft</p>	<p><b>B1</b> for any correct diagram with blanks or zeros where needed and labelled unambiguously  <b>B1</b> for 4 in correct place  <b>B1</b> for 12 in correct place  <b>B1</b> for 5 and 7 in correct place</p> <p>Correct or ft from <i>their</i> diagram</p>
<p>10</p>	<p>(a) (i) 20</p> <p>(ii) <math>n - 4</math> oe  <math>n + 4</math> oe  <math>n + 6</math> oe</p> <p>(iii) <math>(n - 4)(n + 4) - (n - 6)(n + 6)</math></p> $n^2 - 4n + 4n - 16 - (n^2 - 6n + 6n - 36)$ <p>20</p> <p>(b) (i) 24</p>	<p>1</p> <p>2</p> <p>M1</p> <p>E1</p> <p>1</p>	<p>Accept unsimplified</p> <p><b>B1</b> for two correct</p> <p>ft from their algebraic expressions can be implied by <math>n^2 - 4n + 4n - 16 - (n^2 - 6n + 6n - 36)</math> or <math>n^2 - 16 - (n^2 - 36)</math></p> <p>Must have a line of algebra</p> <p>With no errors or omission of brackets</p>



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<p><b>(ii)</b> <math>(n - 5)(n + 5) - (n - 7)(n + 7)</math> isw or <math>n^2 - 25 - (n^2 - 49)</math> isw or <math>n^2 - 25 - n^2 + 49</math> isw</p>	<b>2</b>	<p><b>M1</b> for <math>n - 5, n + 5, n - 7, n + 7</math> seen</p>
<p><b>(c)</b> <math>(11 \times 23) - (9 \times 25)</math> <math>253 - 225</math> [= 28]</p>	<b>E1</b>	<p>Allow algebraic solution from <math>(n - 6)(n + 6) - (n - 8)(n + 8)</math></p>
<p><b>(d)</b> <math>4t</math> oe</p>	<b>1</b>	<p>Accept unsimplified e.g. <math>n^2 - (t - 1)^2 - [n^2 - (t + 1)^2]</math></p>
<p><b>(e)</b> <math>c = 28</math> and <math>d = 30</math> 52</p>	<b>1</b> <b>1</b>	