

**MARK SCHEME for the May/June 2012 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) (i)</b> 6 correct plots	<b>2</b>	<b>P1</b> for 4 or 5 correct plots.
	<b>(ii)</b> Positive	<b>1</b>	
	<b>(iii)</b> Line of best fit	<b>1</b>	<b>Ruled</b> line at least from $x = 5$ to $x = 48$ , with at least 3 points on each side and cuts axes between (5, 0) and (0, 20)
	<b>(iv)</b> English (integer) value on line at $M = 22$	<b>1ft</b>	<b>Strict ft</b> from their single ruled line $5 \leq x \leq 48$ .
	<b>(b)</b> $(26 + 39 + 35 + 28 + 9 + 37 + 45 + 33 + 16 + 12) \div 10$	<b>M2</b>	<b>M1</b> for $26 + 39 + 35 + 28 + 9 + 37 + 45 + 33 + 16 + 12$ , condone one slip <b>or SC1</b> , for at least 2 values eg $(26 + 39 + \dots) \div 10$
<b>(c)</b> 46 cao www 3	<b>3</b>	<b>M2</b> for $(31 \times 12 - 28 \times 10) \div 2$ soi by $92 \div 2$ <b>or M1</b> for $31 \times 12$ soi by 372 or 92	
<b>2</b>	<b>(a)</b> 445 final answer www 3	<b>3</b>	<b>M2</b> for $351.55 \div (1 - 0.21)$ oe or <b>M1</b> for $351.55 = (100 - 21) (\%)$
	<b>(b)</b> 640 or 4640 4622.5 or 622.5	<b>2</b> <b>2</b>	<b>M1</b> for $4000 \times 0.08 \times 2$ oe <b>M1</b> for $4000 \times (1.075)^2$ oe or $4000 \times 0.075 (= 300)$ <b>and</b> $(4000 + \text{their } 300) \times 0.075$ <b>and</b> total interest = the sum of their 2 interests.
	Alex by 17.5(0) cao final answer www 6	<b>2</b>	<b>M1</b> for S I amount – C I amount or reverse or simple interest – compound interest or reverse

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<b>3</b>	<b>(a) (i)</b> $x > 4$	<b>1</b>	
	<b>(ii)</b> $y > 9$	<b>1</b>	
	<b>(iii)</b> $x + y < 20$	<b>1</b>	
	<b>(b)</b> $5x + 10y < 170$ seen	<b>1</b>	
	<b>(c) (i)</b> $x = 4$ ruled $y = 9$ ruled	<b>1</b> <b>1</b>	Each line long enough to enclose their region Condone good freehand or dotted $y = 9$ must be <b>between</b> 8.8 and 9.2
	$x + y = 20$ ruled	<b>2</b>	<b>B1</b> for gradient = $-1$ or $y$ intercept = 20 or $x$ intercept = 20. Exclude lines parallel to either axis.
	$x + 2y = 34$ ruled	<b>2</b>	<b>B1</b> for $y$ intercept = 17 or $x$ intercept = 34. Exclude lines parallel to either axis.
	Correct region indicated cao	<b>1</b>	<b>Dependent</b> on all 6 marks for the 4 lines.
	<b>(ii)</b> 145 cao (from 11, 9) www 2	<b>2</b>	<b>M1</b> for using $5x + 10y$ when $x + y = 20$ and integers $(x, y)$ is in their region

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<b>4</b>			In all parts of <b>(a)</b> candidates may refer to angles marked in diagram. Allow if clear even if reason is more complicated as long as it is full. Reasons dependent on correct answers
	<b>(a) (i)</b>	42 Alternate oe	<b>1</b> <b>1</b> Not <b>alternate segment</b>
	<b>(ii)</b>	90 semicircle oe	<b>1</b> <b>1</b> Allow <b>diameter</b>
	<b>(iii)</b>	42 same segment oe	<b>1</b> <b>1</b> <b>same arc</b>
	<b>(iv)</b>	138 cyclic quad oe	<b>1</b> <b>1</b> <b>key words must not be spoiled</b>
	<b>(b)</b>	10.9 (10.90 to 10.91) www 3	<b>3</b> <b>M2</b> for $\sqrt{12^2 - 5^2}$ oe i.e explicit or <b>M1</b> for $12^2 = 5^2 + PQ^2$ oe i.e implicit Allow full marks for $\sqrt{119}$ as final answer Use of trig method must be complete to explicit expression for possible <b>M2</b>
	<b>(c) (i)</b>	$AD = CD$ and $DE = DG$ (Angle) $CDG = (\text{angle})ADE$ (Sides of) square or $90^\circ + \text{angle } ADG$ oe	<b>1</b> <b>1</b> <b>R1</b> Extra pair of sides loses this mark. Extra pair of angles loses this mark As in <b>(a)</b> , for all 3 marks allow references to diagram if completely clear. <b>R</b> mark dep on at least one pair of sides stated or pair of angles stated
	<b>(ii)</b>	Congruent	<b>1</b>

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5	(a)	(£) 2.37 or 2.371 to 2.372 www 2	2	M1 for $34.95 \div 1.17$ implied by 29.87... or 29.9 or SC1 for 2.77 or 2.78 or 2.775
	(b)	154 days 4 hours cao	3	M1 for $4.07 \times 10^{12} \div (1.1 \times 10^9)$ implied by figs 37 or 154. (...) A1 for 3700 seen or $3.7 \times 10^3$ seen or $154\frac{1}{6}$ oe or 154 rem 4
	(c) (i)	9.25	1	
	(ii)	Lower = 51.3375 final answer Upper = 52.8275 final answer	1 1	After 0 scored SC1 for answers reversed or 9.35 and 5.65 seen or 51.3375 and 52.8275 seen
6	(a)	( $x =$ ) 64 www 3	3	B2 for $x + 2x + x = 360 - 114 + 10$ or better or M1 for $x + 2x + 114 + x - 10 = 360$
	(b) (i)	-1 $n^2$ oe $5n$ oe $n^2 + 5n$ oe	1 1 1 1	
	(ii)	20	2	M1 for their $n^2 + 5n = 500$ or 20 and 25 seen
	(c)	Final answer $\frac{x-4}{2x-1}$ cao www 4	4	B1 for $(x-4)(x+4)$ B2 for $(2x-1)(x+4)$ or SC1 for $(2x+a)(x+b)$ where either $a+2b=7$ or $ab=-4$
7	(a)	(5, 3)	1	
	(b) (i)	$3a + c$	1	
	(ii)	$3a + \frac{1}{2}c$ or $\frac{1}{2}(6a + c)$	2	M1 for $\overrightarrow{OM}$ oe e.g. $OA+AM$ or correct unsimplified answer
	(iii)	$a + c$	1	
	(iv)	$\frac{3}{2}a + \frac{1}{2}c$ or $\frac{1}{2}(3a + c)$	2	M1 for $-c + \frac{3}{2} \times$ their (iii) or $a + \frac{1}{2} \times$ their (iii) or correct unsimplified answer or any correct route e.g. $CE + ED$
	(c)	( $CD$ ) parallel (to $OB$ ) oe cao $CD = \frac{1}{2}OB$ oe cao	1dep 1dep	Part (c) dependent on simplified (i) and (iv) Dep on (i) = $k \times$ (iv) Dep on (i) = $2 \times$ (iv) must be scalars

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8	(a) (i)	$\frac{2}{3}$	1	<p><b>Throughout question, penalise non-reduced fraction only once;</b> isw any conversion and allow decimals in working and on branches but not final answers if fractions not seen.</p> <p><b>B1</b> for <math>\frac{1}{3}</math> and <math>\frac{2}{3}</math> and <math>\frac{3}{5}</math> or <math>\frac{5}{6}</math> correctly placed</p> <p>For method marks in (b) and (c), ft tree with each probability <math>0 &lt; p &lt; 1</math></p> <p><b>M2</b> for <math>1 - \frac{2}{3} \times \frac{5}{6}</math> or <math>\frac{1}{3} + \frac{2}{3} \times \frac{1}{6}</math> or <math>\frac{1}{3} \times \frac{2}{5} + \frac{1}{3} \times \frac{3}{5} + \frac{2}{3} \times \frac{1}{6}</math> <b>M1</b> for <math>\frac{1}{3} + \frac{2}{3} \times \frac{5}{6}</math> or <b>two</b> of <math>\frac{1}{3} \times \frac{2}{5}, \frac{1}{3} \times \frac{3}{5}, \frac{2}{3} \times \frac{1}{6}</math> <b>added</b></p> <p><b>M2</b> for <math>\frac{1}{3} \times \frac{3}{5} + \frac{2}{3} \times \frac{1}{6}</math> or their <math>\frac{4}{9} - \frac{1}{3} \times \frac{2}{5}</math> <b>M1</b> for one of <math>\frac{1}{3} \times \frac{3}{5}</math> or <math>\frac{2}{3} \times \frac{1}{6}</math> from a maximum of two products added.</p>
	(a) (ii)	$\frac{1}{3}, \frac{2}{3}, \frac{2}{5}, \frac{3}{5}, \frac{1}{6}, \frac{5}{6}$ correctly placed	2	
	(b)	$\frac{4}{9}$ cao www 3	3	
	(c)	$\frac{14}{45}$ cao www 3	3	
9	Accurate ruled perp. bisector with correct intersecting arcs		2	<b>B1</b> for accurate with no/wrong arcs or <b>M1</b> for correct intersecting arcs Ignore one extra perp. bisector
	Accurate ruled angle bisector with correct intersecting arcs		2	<b>B1</b> for accurate with no/wrong arcs or <b>M1</b> for correct intersecting arcs Ignore one extra angle bisector
	Compass drawn arc centre $F$ radius 5.5 cm long enough to enclose region		2	<b>M1</b> for compass drawn arc centre $F$
	Correct region indicated cao		1	Accept dotted lines but not freehand for all three

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<p><b>10 (a) (i)</b></p> <p><b>(ii)</b></p> <p><b>(b)</b></p> <p><b>(c) (i)</b></p> <p><b>(ii)</b></p> <p><b>(d)</b></p>	<p><math>8x^6y^9</math> <b>final answer</b></p> <p><math>\frac{x^2}{3}</math> oe but not <math>\frac{1}{3x^{-2}}</math> oe <b>final answer</b></p> <p><math>6x^2 + 11xy - 10y^2</math> <b>final answer</b></p> <p><math>\frac{V - \pi r^3}{2\pi r^2}</math> or <math>\frac{V}{2\pi r^2} - \frac{r}{2}</math> oe but not triple fractions <b>final answer</b></p> <p><math>\frac{V^2}{3}</math> <b>final answer</b></p> <p><math>\frac{5x}{12}</math> <b>final answer</b></p>	<p><b>2</b></p> <p><b>3</b></p> <p><b>3</b></p> <p><b>2</b></p> <p><b>2</b></p> <p><b>2</b></p>	<p><b>B1</b> for any two of <math>8, x^6, y^9</math> in a single term in answer</p> <p><b>B2</b> for <math>\frac{3}{x^2}</math> or <math>3x^{-2}</math> or <math>\frac{1}{3x^{-2}}</math> as answer</p> <p>or <b>B1</b> for <math>\frac{x^6}{27}</math> oe as answer or <math>\frac{1}{\sqrt[3]{27}}</math> seen</p> <p>or <b>SC1</b> for 3 or <math>x^2</math> or <math>x^{-2}</math> seen in answer</p> <p><b>B2</b> for 3 of <math>6x^2 - 4xy + 15xy - 10y^2</math> (<math>11xy</math> implies 2 terms)</p> <p>or <b>B1</b> for 2 of <math>6x^2 - 4xy + 15xy - 10y^2</math></p> <p><b>M1</b> for correct subtraction or correct division by <math>2\pi r^2</math> <b>seen</b></p> <p><b>B1</b> for <math>V^2 = 3h</math> or <math>\frac{V}{\sqrt{3}} = \sqrt{h}</math> or <math>h = \left(\frac{V}{\sqrt{3}}\right)^2</math></p> <p><b>B1</b> for 2 of <math>\frac{6x}{12}, \frac{20x}{12}, \frac{-21x}{12}</math> oe implied by <math>\frac{10x}{24}</math> ie 2 with common denominator = at least 6</p>
<p><b>11 (a)</b></p> <p><b>(b)</b></p> <p><b>(c)</b></p>	<p>452 or 452.1 to 452.4...</p> <p>59.9 or 59.86 to 59.91 cao www 5</p> <p>11 ÷ cos50 soi by 17.(11...) oe (their <math>AC</math>)<sup>2</sup> + 31<sup>2</sup> – 2 × their <math>AC</math> × 31cos100 art 37.9 cao www 6</p>	<p><b>2</b></p> <p><b>5</b></p> <p><b>M2</b></p> <p><b>M2</b></p> <p><b>A2</b></p>	<p><b>M1</b> for <math>\pi \times 12^2</math> Allow full marks for <math>144\pi</math> as final answer</p> <p><b>M1</b> for <math>\pi \times 24 \times 7</math> (soi by 527 to 528) oe or <math>\frac{22}{360} \times \pi \times 24</math> oe (soi by 4.60 to 4.61)</p> <p><b>and M1 dep</b> for <math>\frac{22}{360} \times \pi \times 24 \times 7</math> (soi by 32.2 to 32.3)</p> <p><b>and M1</b> for <math>\frac{22}{360} \times</math> their (a) oe may restart (soi by 27.6 to 27.7)</p> <p><b>and M1 dep on M3</b> for adding two areas</p> <p><b>M1</b> for <math>\cos 50 = \frac{11}{AC}</math> oe i.e. implicit</p> <p><b>M1</b> for implicit cos rule</p> <p><b>A1</b> for 1433 to 1443</p>

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<p><b>12 (a)</b></p>	<p><math>10x + 4y = 10.7</math> oe  <math>8x + 6y = 10.1</math> oe</p> <p>Multiplying or dividing equation(s) by number(s) suitable for elimination</p> <p>Elimination of one variable</p> <p><math>x = 0.85</math> cao  <math>y = 0.55</math> cao</p>	<p><b>1</b>  <b>1</b></p>	<p><b>M1</b> Allow one arithmetic error. If substitution, correctly making one variable the subject of one equation.</p> <p><b>M1</b> Allow one arithmetic error. If substitution method then M is for the actual substitution.</p> <p><b>A1</b> <b>SC1</b> for correct fractions  <b>A1</b> After <b>M0</b>, <b>SC2</b> for <b>both</b> correct answers</p> <p>If working in cents, likely mark is 0 for equations, <b>M2</b> for method, <b>A2</b> if answers converted to dollars, <b>A1</b> if left in cents</p>
<p><b>(b)</b></p>	$\frac{- -5 \pm \sqrt{(-5)^2 - 4.2. - 8}}{2.2}$ <p>3.61 or -1.11 <b>final answer</b></p>	<p><b>B2</b></p>	<p><b>B1</b> for <math>\sqrt{(-5)^2 - 4.2. - 8}</math> (<math>\sqrt{89}</math>)</p> <p><b>B1</b> for <math>\frac{p + \sqrt{\quad}}{r}</math> or <math>\frac{p - \sqrt{\quad}}{r}</math> with <math>p = -5</math> or <math>5</math> and <math>r = 2 \times 2</math> or <math>4</math></p> <p>Completing the square <b>B1</b> for <math>\left(x - \frac{5}{4}\right)^2</math> and</p> <p><b>B1</b> for <math>\sqrt{4 + \frac{25}{16}}</math></p> <p><b>B1B1</b> After B0 B0 for answers, <b>SC1</b> for 3.6 or 3.608... and -1.1 or -1.108 or 3.61 and -1.11 seen  <b>Correct answers without working score max 2</b></p>