

MARK SCHEME for the May/June 2014 series

0444 MATHEMATICS (US)

0444/41

Paper 4, maximum raw mark 130

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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
- dep dependent
- FT follow through after error
- isw ignore subsequent working
- oe or equivalent
- SC Special Case
- nfwf not from wrong working
- soi seen or implied

<p>1 (a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p>	<p>8</p> <p>Distance = 36 <i>their</i> $36 \div 3 [= 12]$</p> <p>200</p> <p>Horizontal line at 36 to 13 45 <i>(their</i> 13 45, 36) joined to (16 42, 0)</p>	<p>2</p> <p>B1</p> <p>M1</p> <p>2</p> <p>1</p> <p>1FT</p>	<p>M1 for $12 \div 1.5$ oe</p> <p>M1 for $12 \times 1000 \div 60$ oe e.g. $36000 \div 180$</p> <p>1FT</p>
<p>2 (a)</p> <p>(b)</p> <p>(c)</p> <p>(d) (i)</p> <p>(ii) (a)</p> <p>(b)</p>	<p>62705</p> <p>10.9 or 10.88...</p> <p>127000</p> <p>59112 to 59113 or 59100 or 59110 or 59119 to 59120 or 59100 nfwf</p> <p>0.0125</p> <p>7580 or 7582 or 7581 or 7583 nfwf</p>	<p>2</p> <p>3</p> <p>3</p> <p>1</p> <p>4</p>	<p>M1 for $75246 \div 6$ soi by 12541 or 75246×5</p> <p>M2 for $\frac{(150675-135890)}{135890} \times 100$ oe or M1 for correct fraction soi by 0.1088... or $\frac{150675}{135890} \times 100$ soi by 110.88...</p> <p>M2 for $135890 \div 1.07$ oe or M1 for 135890 associated with 107%</p> <p>M2 for $\pi \times 21 \times (30^2 - 2^2)$ oe or M1 for $\pi \times 21 \times 30^2$ or $\pi \times 21 \times 2^2$</p> <p>M1 for $21 \times 29.7 \times$ <i>their</i> 0.0125 [=7.796 or 7.8[0]] and M1 for <i>their (d)(i) ÷ (21 × 29.7 × their 0.0125)</i> A1 for 7580 to 7583.2 (non integer)</p> <p>If 0 then SC1 for <i>their (d)(i) ÷ (21 × 29.7 × 0.125)</i></p>

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(iii)	0.63	3	<p>M2 for $36 \div \left(\frac{240}{60} \times \frac{180}{60} \right)$ oe</p> <p>M1 for $\frac{240}{60}$ oe or $\frac{180}{60}$ oe</p>
3 (a) (i)	120	1	<p>B1 for $\angle ECB = 32$</p> <p>M1 for $\angle ECD = 90 - \text{their } \angle ECB$</p> <p>M1 for $\angle CED = 0.5(180 - \text{their } \angle ECD)$</p> <p>or M1 for $360 - \text{their } \angle CED - 148$</p> <p>1</p> <p>1</p> <p>1 dep on three correct statements (reasons not needed)</p> <p>1 Circumference, same segment</p> <p>1 Opposite angles</p> <p>1 Dep on 2 pairs of angles identified</p> <p>2</p> <p>M1 for $\frac{8}{12} = \frac{4}{DX}$ oe</p> <p>2</p> <p>M1 for $\left(\frac{2}{3}\right)^2$ or $\left(\frac{3}{2}\right)^2$ seen</p> <p>or $\frac{1}{2} \times 4 \times 4k$</p>
(ii)	151	4	
(b)	Two of $AP = PB$ [given] CP is common $\angle CPA = \angle CPB$ [= 90] Reason with one of the above SAS or in words		
(c) (i)	Any two of $\angle D = \angle C$ with reason $\angle A = \angle B$ with reason $AXD = BXC$ with reason Equiangular oe		
(ii)	6		
(iii)	$8k$		
4 (a)	91.6 or 91.59 to 91.60	2	M1 for $0.5 \times 15 \times 19 \times \sin 40$
(b)	12.2 or 12.22... nfw	3	M1 for $15^2 + 19^2 - 2 \times 15 \times 19 \times \cos 40$ A1 for 149 or 149.3 to 149.4
(c)	97.8 or 97.81... nfw	4	M2 for $\frac{19 \sin 35}{11}$ implied by 0.991 or 0.9907... or 82.2 or 82.18 to 82.19 or M1 for $\frac{11}{\sin 35} = \frac{19}{\sin ADC}$ oe M1 for 180 – an acute angle from sine rule

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5	<p>(a) (i) 0.6 oe</p> <p>(ii) 1500</p> <p>(iii) 0.03 oe</p> <p>(b) $\frac{112}{132}$ oe $\frac{28}{33} = 0.848[4\dots]$</p>	<p>2</p> <p>1</p> <p>2</p> <p>3</p>	<p>M1 for $0.2 + 0.4$</p> <p>M1 for 0.1×0.3</p> <p>M2 for $1 - \frac{5}{12} \times \frac{4}{11}$ or $\frac{7}{12} \times \frac{5}{11} + \frac{5}{12} \times \frac{7}{11} + \frac{7}{12} \times \frac{6}{11}$ or $\frac{7}{12} + \frac{5}{12} \times \frac{7}{11}$</p> <p>or M1 for addition of any two of $\frac{7}{12} \times \frac{5}{11}$, $\frac{5}{12} \times \frac{7}{11}$, $\frac{7}{12} \times \frac{6}{11}$ or sum of 3 products with an error in the numerator of one product or for $\frac{5}{12} \times \frac{4}{11}$ identified</p>
6	<p>(a) (i) Image: $(-5, -1)$, $(-4, -1)$, $(-5, -3)$</p> <p>(ii) Image: $(1, -1)$, $(3, -1)$, $(3, -2)$</p> <p>(b) (i) Enlargement [factor] 3 [centre] $(3, 3)$</p> <p>(ii) Stretch [factor] 3 Invariant line y-axis oe</p>	<p>2</p> <p>2</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>SC1 for translation $\begin{pmatrix} -6 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -4 \end{pmatrix}$</p> <p>SC1 for rotation about the origin but 90° anticlockwise</p> <p>Accept dilation</p> <p>Do not allow column vector for coordinates of centre</p> <p>Accept $x = 0$, stays the same</p>
7	<p>(a) 2.125 and 2.375</p> <p>(b) Correct curve</p>	<p>2</p> <p>B4</p>	<p>B1 for one correct value</p> <p>B3FT for 11 correct plots or B2FT for 9 or 10 correct plots or B1FT for 7 or 8 correct plots</p>

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(c)	Ruled tangent at $x = 2$ Gradient from 7.8 to 10.2	B1 2	No daylight at $x = 2$. Consider point of contact as midpoint between two vertices of daylight, this must be between $x = 1.8$ and 2.2 Dep on B1 awarded Allow integer/integer or a mixed number if within range or M1 dep for $(\text{change in } y) \div (\text{change in } x)$ Dependent on any tangent drawn or close attempt at a tangent at <u>any</u> point Must see correct or implied calculation from a drawn tangent
(d)	0 and -1.75 to -1.65 and 1.65 to 1.75	2	B1 for two correct values
(e)	-1.2 to $-0.8 < k < 2.8$ to 3.2	2	B1 for each correct or SC1 for reversed answers
8	(a) (i) 34 to 34.5 (ii) 18 (iii) 41 to 42 (b) (i) 31.8[4...] nfwf (ii) Correct histogram	1 2 2 4 4	B1 for [UQ =] 43 or [LQ =] 25 B1 for 56 seen or horizontal line drawn at cf = 56 M1 for midpoints soi (condone 1 error or omission) and M1 for use of $\sum ft$ with t in correct interval including both boundaries (condone 1 further error or omission) and M1 (dep on 2nd M1) for $\sum ft \div 80$ ($2547.5 \div 80$) B1 for each correct block with correct width and height If B0 then SC1 for four correct f.d.s or four correct widths
9	(a) (i) 5 (ii) $-2\frac{1}{3}$ oe (iii) $\frac{x+3}{2}$ or $\frac{x}{2} + 1.5$ as final ans	1 2 2	B1 for $[h(-1) =] \frac{1}{3}$ soi or M1 for $2(3^x) - 3$ M1 for $y + 3 = 2x$ or $x = 2y - 3$ or $\frac{y}{2} = x - 1.5$ or better or correct reverse flowchart

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	(iv)	$4x - 9$ as final answer nfw	2	M1 for $2(2x - 3) - 3$
	(v)	$(2x - 3)(x + 1) = 1 + 2(x + 1)$ $2x^2 - 3x + 2x - 3$ or better seen $2x^2 - 3x - 6 = 0$	M1 B1 A1	$(2x - 5)(x + 1) = 1$ (eliminate fractions) $2x^2 - 5x + 2x - 5$ or better seen No errors or omissions seen
	(vi)	$\frac{-(-3) \pm \sqrt{(-3)^2 - 4 \times 2 \times -6}}{2 \times 2}$ 2.64 and -1.14 cao	B2 B1B1	B1 for $\sqrt{(-3)^2 - 4 \times 2 \times -6}$ or better [$\sqrt{57}$] and if in form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ B1 for $p = -(-3)$ and $r = 2 \times 2$ or better SC1 for 2.64 and -1.14 seen in working or 2.6 and -1.1 as final ans or 2.637.. and -1.137.. as final ans or -2.64 and 1.14 as final ans
(b)		$\frac{x-1}{x+5}$ as final answer nfw	4	B3 for $(x - 1)(x - 2)$ and $(x + 5)(x - 2)$ or B2 for $(x - 1)(x - 2)$ or $(x + 5)(x - 2)$ or SC1 for $(x + a)(x + b)$ where $a + b = 3$ or -3 or $ab = 2$ or -10
10	(a) (i)	$(-5, 7)$	1	
	(ii)	5	2	M1 for $\sqrt{(-3)^2 + 4^2}$ or better
(b)	(i) (a)	$\frac{3}{5}\mathbf{a} + \frac{2}{5}\mathbf{b}$ or $\frac{1}{5}(3\mathbf{a} + 2\mathbf{b})$ final answer	2	M1 for any correct vector path for \overrightarrow{ON}
	(i) (b)	$\frac{2}{5}\mathbf{a}$	2	M1 for any correct vector path for \overrightarrow{NY}
(b)	(ii)	$NY = \frac{2}{5}BC$ oe [NY] parallel to [BC]	1dep 1dep	dep on (b)(i)(b) correct dep on $\overrightarrow{NY} = k\mathbf{a}$, $k \neq 1$
11	(a) (i)	$(x - 1.5)^2 - 1.25$ oe	2	M1 for $(x - 1.5)^2$
	(ii)	$(1.5, -1.25)$	2FT	1FT each FT only if in completed square form

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(b)	$[p =] - 2$ $[q =] - 6$ nfw	4	M1 for $1 - p + q = -3$ M1 for $4^2 + 4p + q = 2$ A1 for correct p or q
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