

MARK SCHEME for the May/June 2014 series

0580 MATHEMATICS

0580/41

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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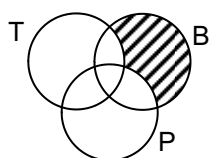
Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Qu		Answers	Mark	Part Marks
1	(a) (i)	$\begin{pmatrix} 6 & 4 \\ -2 & 2 \end{pmatrix}$	1	B1 for one row or column correct B1 for $\frac{1}{5}\begin{pmatrix} a & c \\ b & d \end{pmatrix}$ seen or $k\begin{pmatrix} 1 & -2 \\ 1 & 3 \end{pmatrix}$ seen
	(ii)	Not possible	1	
	(iii)	$\begin{pmatrix} 6 & 4 \\ -2 & 2 \end{pmatrix}$	2	
	(iv)	$\frac{1}{5}\begin{pmatrix} 1 & -2 \\ 1 & 3 \end{pmatrix}$ oe isw	2	
	(b)	1 column in C and 2 rows in D	1	
	(c)	Enlargement [Factor] 2 [Centre] (0, 0) oe	1 1 1	
2	(a)	8	2	M1 for $12 \div 1.5$ oe
	(b)	[Distance =] 36 <i>their</i> $36 \div 3$ [= 12] oe	B1 M1	
	(c)	200	2	M1 for $12 \times 1000 \div 60$ oe e.g. $36000 \div 180$
	(d)	Horizontal line at 36 to 13 45 <i>(their</i> 13 45, 36) joined to (16 42, 0)	1 1FT	
3	(a)	62 705	2	M1 for $75246 \div 6$ soi by 12 541 or 75246×5
	(b)	10.9 or 10.88...	3	M2 for $\frac{(150\,675 - 135\,890)}{135\,890} \times 100$ oe or M1 for correct fraction soi by 0.1088... or $\frac{150\,675}{135\,890} \times 100$ soi by 110.88...

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Qu	Answers	Mark	Part Marks
(c)	127 000	3	M2 for $135\,890 \div 1.07$ oe or M1 for 135 890 associated with 107%
(d) (i)	59 112 to 59 113 or 59 100 or 59 110 or 59 119 to 59 120 or 59 100 nfw	3	M2 for $\pi \times 21 \times (30^2 - 2^2)$ oe Or M1 for $\pi \times 21 \times 30^2$ or $\pi \times 21 \times 2^2$
(ii) (a)	0.0125	1	
(b)	7580 or 7582 or 7581 or 7583 nfw	4	M1 for $21 \times 29.7 \times \text{their } 0.0125$ [=7.796 or 7.8[0]] and M1 for <i>their (d)(i)</i> $\div (21 \times 29.7 \times \text{their } 0.0125)$ A1 for 7580 to 7583.2 (non integer) If 0 then SC1 for <i>their (d)(i)</i> $\div (21 \times 29.7 \times 0.125)$
4	(a) $4 - x$ correctly placed $5 - x$ correctly placed 7 correctly placed (b) $4 + 11 + (6 - x) + x + 9 + (4 - x) + (5 - x) + 7 = 40$ oe $46 - 2x = 40$ nfw $x = 3$ (c) (i) $\frac{9}{40}$ or 0.225 or 22.5% (ii) 2 (iii) 15 (iv) 25 (v) 4 (d) Correct region shaded.	1 1 1 M1 A1 B1 1 1FT 1FT 1FT 1 1	SC3 for 1, 2 and 7 all correctly placed instead of expressions in x FT from their Venn diagram, condone omission of one subset Must be in the form $a + bx = c$, ie each side simplified, or better ISW cancelling or conversion after correct answer seen FT from their Venn diagram and their x provided $n(B \cap P \cap T') \neq 5$ FT from their Venn diagram FT from their Venn diagram



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Qu		Answers	Mark	Part Marks
5	(a)	[0]44 to [0]48	1	
	(b)	12.6 to 13.2	2	B1 for 8.4 to 8.8 seen
	(c)	340	1	
	(d)	1 : 150 000	2	M1 for $\times 100\,000$ soi
	(e)	Arcs for perp bisector of <i>SL</i>	1	Two pairs of correct arcs
		Ruled perp bisector of <i>SL</i>	1	Within tolerance of overlay
		Arcs for bisector of angle <i>PSL</i>	1	Marks on <i>PS</i> and <i>SL</i> plus one pair of correct arcs
Ruled bisector of angle <i>PSL</i>		1	Within tolerance of overlay	
	B marked within accuracy	1	Within tolerance of overlay Dep on two correct bisectors drawn	
(f)	3.375	2	M1 for 1.5×1.5^2 or $(2/3)^2$ seen	
6	(a) (i)	0.6 oe	2	M1 for $0.2 + 0.4$
	(ii)	1500	1	
	(iii)	0.03 oe	2	M1 for 0.1×0.3
	(b)	$\frac{112}{132}$ oe $\frac{28}{33} = 0.848[4\dots]$	3	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 $\frac{7}{12} + \frac{5}{12} \times \frac{7}{11}$ 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

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Qu		Answers	Mark	Part Marks
7	(a) (i)	Image: $(-4, -3), (-4, -1), (-3, -1)$	2	SC1 for translation $\begin{pmatrix} -5 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -4 \end{pmatrix}$
	(ii)	Image: $(1, -1), (3, -1), (3, -2)$	2	SC1 for rotation about the origin but 90° anticlockwise
	(b) (i)	Image: $(2, 1), (2, 3), (4, 3)$	3	B2 for 2 correct vertices plotted or SC2 for 3 vertices shown in working or SC1 for 2 vertices shown in working or M1 $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix} \times \begin{pmatrix} 1 & 1 & 2 \\ 1 & 3 & 3 \end{pmatrix}$
	(ii)	Stretch [factor] 2 Invariant line y-axis oe	1 1 1	Accept $x = 0$, stays the same
8	(a)	2.125 and 2.375	2	B1 for one correct value
	(b)	Correct curve	B4	B3FT for 11 correct plots or B2FT for 9 or 10 correct plots or B1FT for 7 or 8 correct plots
	(c)	Ruled tangent at $x = 2$	B1	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
		Gradient from 7.8 to 10.2	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	

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Qu		Answers	Mark	Part Marks
9	(a)	(i) 37.5 to 38.5	1	
		(ii) 19.5 to 20.5 nfw	2	B1 for [LQ =] 23.5 to 24 or [UQ =] 43.5 to 44
		(iii) 43	2	B1 for 56 seen or horizontal line drawn at cf = 56
	(b)	(i) 31.8[4...] nfw	4	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)
		(ii) Correct histogram	4	B1 for each correct block with correct width and height If B0 then SC1 for four correct f.d.s or four correct widths
10	(a)	(i) 5	1	
		(ii) $-2\frac{1}{3}$ oe	2	B1 for [h(-1) =] $\frac{1}{3}$ soi or M1 for $2(3^x) - 3$
	(iii) $\frac{x+3}{2}$ or $\frac{x}{2} + 1.5$ as final ans	2	M1 for $y + 3 = 2x$ or $x = 2y - 3$ or $\frac{y}{2} = x - 1.5$ or better or correct reverse flowchart	
	(iv) $4x - 9$ as final answer nfw	2	M1 for $2(2x - 3) - 3$	
	(v)	$(2x - 3)(x + 1) = 1 + 2(x + 1)$	M1	$(2x - 5)(x + 1) = 1$ (eliminate fractions)
		$2x^2 - 3x + 2x - 3$ or better seen	B1	$2x^2 - 5x + 2x - 5$ or better seen
$2x^2 - 3x - 6 = 0$		A1	No errors or omissions seen	

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Qu		Answers	Mark	Part Marks
	(vi)	$\frac{-(-3) \pm \sqrt{(-3)^2 - 4 \times 2 \times -6}}{2 \times 2}$ <p>2.64 and – 1.14 cao</p>	B2	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
	(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
11	(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}
		(b) $\frac{2}{5}\mathbf{a}$	2	M1 for any correct vector path for \overrightarrow{NY}
	(ii)	$NY = \frac{2}{5}BC$ oe [NY] parallel to [BC]	1dep 1dep	dep on (b)(i)(b) correct dep on $\overrightarrow{NY} = k\mathbf{a}$, $k \neq 1$