
MATHEMATICS

0580/22

Paper 2 (Extended)

May/June 2016

MARK SCHEME

Maximum Mark: 70

Published

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

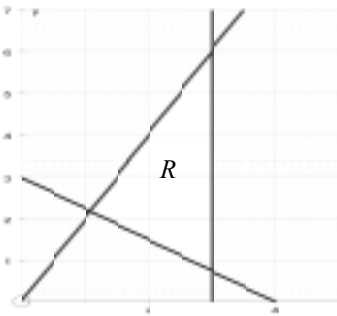
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Mark	Part marks
1	5.74×10^{-5}	1	
2	5.89 or 5.885 to 5.886	1	
3	3.590 cao	1	
4	Parallelogram	1	
5 (a)	9 and 16	1	
(b)	11	1	
6	$\frac{1}{8}x^2$ or $0.125x^2$ final answer	2	B1 for answer $\frac{1}{8}x^k$ or nx^2
7	460	2	B1 for $1 \text{ cm}^2 : 100 \text{ km}^2$ oe or M1 for $4.6 \times 1\,000\,000^2 \div 100\,000^2$ oe seen
8	$x > -9$	2	M1 for $\frac{x}{3} > 2 - 5$ oe or $\left(\frac{x}{3} + 5\right) \times 3 > 2 \times 3$ oe
9	45	3	M2 for $360 \div (180 - 172)$ or M1 for $180 - 172$ or $\frac{180(n-2)}{n} = 172$ oe
10	$p = \frac{8r-5}{r-3}$ oe final answer	3	M1 for correctly collecting terms in p on one side and terms not in p on the other side M1 for correct factorising M1 for correct division dependent on p appearing only once in a factorised expression Maximum M2 for an incorrect final answer
11	68 76 78 78	3	B1 for four values with a mode of 78 B1 for four values with a median of 77 B1 for total of four values is 300

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Question	Answer	Mark	Part marks
12	$\frac{11}{30}$ cao	3	B2 for $\frac{33}{90}$ oe as final answer or M1 for $36.\dot{6} - 3.\dot{6}$ or $36.6^r - 3.6^r$ oe or B1 for $\frac{k}{90}$
13	10 cao nfw	3	M2 for $42.5 \times 2 \div 8.5$ allowing one error in the UB or LB provided it is still $UB \times 2 \div LB$ or M1 for one of 42.5 or 8.5 seen as bounds
14	$\frac{21}{8} \times \frac{3}{7}$ oe $1\frac{1}{8}$ cao final answer	M1 A2	Must be shown A1 for $\frac{9}{8}$ oe e.g. $\frac{63}{56}$
15	$a = 3.5$ or $\frac{7}{2}$ and $b = -17.25$ or $-\frac{69}{4}$	3	B2 for one correct or M2 for $(x + \frac{7}{2})^2 - 5 - (\frac{7}{2})^2$ or M1 for $(x + \frac{7}{2})^2$ oe or $2a = 7$ or $a^2 + b = -5$ after $x^2 + 2ax + a^2$
16	Correctly eliminating one variable $x = 4$ $y = 0.5$ oe	M1 A1 A1	If zero scored SC1 for 2 values satisfying one of the original equations or if no working shown, but 2 correct answers given
17 (a)	Bisector of angle B accurate with two pairs of correct arcs	2	B1 for accurate line with no/wrong arcs or for correct arcs with no/wrong line
(b)	Ruled line parallel to AC at a distance of 3 cm to AC only inside the triangle	1	
18 (a)	$3n + 13$ oe final answer	2	M1 for $3n + c$ or $kn + 13$
(b)	3^{n-1} oe final answer	2	M1 for recognition of terms being powers of 3
19 (a)	7.74 or 7.738 to 7.739 [billion]	2	M1 for $7.23 \times \left(1 + \frac{1.14}{100}\right)^6$
(b)	2042	2	B1 for 28 or 28.6... or 29 or answer 2043

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Question	Answer	Mark	Part marks
20 (a)	240	2	M1 for any three pairs of products from $2.5 \times 12, 2.5 \times 26, 5 \times 15, 5 \times 10, 10 \times 2$
(b)	29.2 or 29.16 to 29.17	2	M1 for $(5 \times 10 + 10 \times 2) / \text{their (a)}$ or for their total of the bars above 10 minutes \div their (a)
21	62 on answer line or clearly identified as $\angle ACB$ and two correct supporting reasons	4	B1 for $\angle AOB = 124$ or for $\text{their } \angle AOB \div 2$ or other appropriate correct angle one step from $\angle ACB$ B1 for any correct reason e.g. isosceles triangle or angles in triangle = 180 B1 for a different correct reason leading directly to $\angle ACB$ e.g. angle at circumference is $\frac{1}{2}$ angle at centre or B1 for 62
22 (a)	$\begin{pmatrix} 20 & 4 \\ -12 & -8 \end{pmatrix}$	1	
(b)	$\begin{pmatrix} 22 & 3 \\ -9 & 1 \end{pmatrix}$	2	B1 for two correct elements
(c)	$-\frac{1}{7} \begin{pmatrix} -2 & -1 \\ 3 & 5 \end{pmatrix}$ or isw	2	M1 for $-\frac{1}{7} \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ or $k \begin{pmatrix} -2 & -1 \\ 3 & 5 \end{pmatrix}$ or $\det = -7$ or soi
23	Correct shading with three ruled accurate solid boundary lines 	5	B2 for $3x + 4y = 12$ line through (0, 3) and (4, 0) or B1 for a diagonal line through one of these points B1 for $y = 2x$ line through (0, 0) and (1, 2) or through (1, 2) and (3, 6) B1 for $x = 3$ line

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Question	Answer	Mark	Part marks
24 (a)	$\mathbf{a + b - c}$	1	
(b)	$\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b} + \frac{1}{2}\mathbf{c}$	2	M1 for $\mathbf{c} + \frac{1}{2}$ (<i>their</i> (a)) or for a correct route e.g. $\overline{OC} + \frac{1}{2}\overline{CB}$, \overline{OQ}
(c)	$\frac{1}{2}\mathbf{c} - \frac{1}{2}\mathbf{a} - \frac{1}{6}\mathbf{b}$	2	M1 for $\frac{1}{3}\mathbf{b} - \frac{1}{2}$ (<i>their</i> (a)) or other correct route e.g. $-\frac{2}{3}\mathbf{b} - \mathbf{a} +$ <i>their</i> (b), $\overline{PO} + \overline{OQ}$