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**MATHEMATICS**

**0580/21**

Paper 2 (Extended)

**October/November 2016**

MARK SCHEME

Maximum Mark: 70

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**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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<b>Page 2</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>Cambridge IGCSE – October/November 2016</b>	<b>0580</b>	<b>21</b>

### 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
<b>1</b>	-7	<b>1</b>	
<b>2 (a)</b>	[0].0402	<b>1</b>	
<b>(b)</b>	[0].040	<b>1</b>	
<b>3</b>	[0].67	<b>2</b>	<b>M1</b> for $14 \times 0.905$ [-12] or 12.67 If zero scored, <b>SC1</b> for answer [0].74[0]
<b>4</b>	$\frac{8}{12}$ and $\frac{3}{12}$ oe $\frac{5}{12}$ cao	<b>M1</b> <b>A1</b>	Correct fractions with common denominator
<b>5 (a)</b>	$\frac{1}{125}$	<b>1</b>	
<b>(b)</b>	$4.56 \times 10^{-3}$	<b>1</b>	
<b>6</b>	42	<b>2</b>	<b>M1</b> for $Q = 90$ or $WPQ = 90 - 42$ or $WPQ = 48$
<b>7</b>	$\frac{x^2 + 2y^2}{xy}$ or $\frac{x}{y} + \frac{2y}{x}$ final answer	<b>2</b>	<b>B1</b> for $xy(x^2 + 2y^2)$ or <b>M1</b> for $\frac{x^2y + 2y^3}{xy^2}$ or $\frac{x^3 + 2xy^2}{x^2y}$
<b>8</b>	$\frac{pt - 2t - 3p}{pt}$ final answer	<b>2</b>	<b>B1</b> for $pt - 2t - 3p$ or $1 - \frac{2t + 3p}{pt}$
<b>9</b>	[x =] 55 [y =] 125	<b>1</b> <b>1FT</b>	correct or <b>FT</b> (180 – their x)

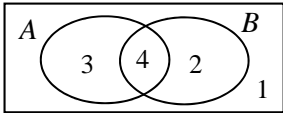
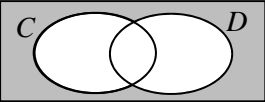
Page 3	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0580	21

Question	Answer	Mark	Part marks
10	$6x^8$ final answer	2	<b>B1</b> for $6x^k$ , $6 \times x^8$ or $kx^8$ ( $k \neq 0$ ) as final answer
11	Correctly eliminating one variable  [x =] -1 and  [y = ] 5	<b>M1</b>  <b>A1</b>  <b>A1</b>	If zero scored, <b>SC1</b> for 2 values that satisfy one of the original equations <b>or</b> <b>SC1</b> if no working shown, but 2 correct answers given
12 (a)	$\frac{1}{8}$ cao	1	
(b)	$\frac{2}{11}$	2	<b>M1</b> for $18.1\dot{8} - 0.1\dot{8}$ oe <b>or</b> <b>B1</b> for $\frac{2k}{11k}$ ( $k$ not 0 or 1)
13 (a)	$(2p - 3)(2p + 3)$ final answer	1	
(b)	$(a - 2b)(2x - y)$ oe final answer	2	<b>B1</b> for $2x(a - 2b) - y(a - 2b)$ <b>or</b> $a(2x - y) - 2b(2x - y)$
14	$6\frac{2}{3}$ oe	3	<b>M1</b> for $y = k\sqrt{x+2}$ oe or better e.g. $2 = k\sqrt{7+2}$ <b>M1</b> for [y = ] their $k \times \sqrt{98+2}$  <b>or</b> <b>M2</b> for $\frac{y}{2} = \frac{\sqrt{98+2}}{\sqrt{7+2}}$
15 (a)	$\begin{pmatrix} 5 \\ 8 \end{pmatrix}$	1	
(b)	(8) final answer	2	<b>B1</b> for final answer 8 without brackets

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0580	21

Question	Answer	Mark	Part marks
16	6.35 or 6.349 to 6.350	3	<p><b>M2</b> for <math>\frac{8}{h} = \sqrt[3]{\frac{0.5}{0.25}}</math> oe</p> <p>or <b>M1</b> for <math>\left(\frac{8}{h}\right)^3 = \frac{0.5}{0.25}</math> oe</p> <p>or for <math>\sqrt[3]{\frac{0.5}{0.25}}</math> or <math>\sqrt[3]{\frac{0.25}{0.5}}</math> oe</p>
17 (a)	Accurate arc, centre <i>B</i> , radius 5 cm meeting both <i>BA</i> and <i>BC</i>	1	<p><b>B1</b> for accurate line from <i>B</i> to at least <i>AC</i> or <b>M1</b> for correct arcs</p>
(b)	Accurate bisector through angle <i>B</i> with 2 pairs of correct arcs and reaching to at least <i>AC</i>	2	
(c)	Correct region identified	1	
			
18 (a)	4	2	<b>B1</b> for 25 or -21
(b)	$\sqrt{y - qr}$ oe final answer	2	<p><b>M1</b> for <math>y - qr = p^2</math></p> <p>or</p> <p><b>M1</b> for correctly square rooting <i>their</i> function of <i>y</i>, <i>q</i> and <i>r</i></p>
19 (a)	$6n + 1$ oe final answer	2	<b>B1</b> for $6n + c$ or for $kn + 1$ ( $k \neq 0$ )
(b)	$(n + 2)^2$ final answer	2	<b>M1</b> for any quadratic expression or reaching second difference of 2
20 (a)	$\frac{3mx}{50}$ or $0.06mx$	2	<b>M1</b> for $m \times x \times 60 \div 1000$ oe
(b)	35	2	<b>M1</b> for $5 \times x \times 60 \div 1000 = 10.5$ oe or for substituting $m = 5$ in <i>their</i> (a) and equating to 10.5 oe

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2016	0580	21

Question	Answer	Mark	Part marks
21	$y \geq 0$ and $x \geq 1$ oe and $x + y \leq 4$ oe	4	<p><b>SC3</b> for <math>y &gt; 0, x &gt; 1</math> and <math>x + y &lt; 4</math> oe or <b>B1</b> for <math>y \geq 0</math> <b>B1</b> for <math>x \geq 1</math> oe and <b>B2</b> for <math>x + y \leq 4</math> oe or <b>M1</b> for grad = -1 soi</p> <p>If <b>B0</b> scored for first two <b>B</b> marks, <b>SC1</b> for <math>y = 0</math> and <math>x = 1</math> or with incorrect inequality sign</p>
22 (a) (i)		2	<b>B1</b> for $n(A \cap B) = 4$
(ii)	$\frac{2}{10}$ oe	1FT	allow correct answer or <b>FT</b> $\frac{\text{their } 2}{10}$
(b)		1	
23	$\sqrt{(3)^2 - 4(2)(-3)}$ oe or better  $\frac{-3 + \sqrt{k}}{2(2)}$ or $\frac{-3 - \sqrt{k}}{2(2)}$ oe  -2.19, 0.69	<b>B1</b>  <b>B1</b>  <b>B1B1</b>	<p>If completing the square, <b>B1</b> for <math>\left(x + \frac{3}{4}\right)^2</math> oe</p> <p><b>B1</b> for <math>-\frac{3}{4} + \sqrt{\frac{3}{2} + \left(\frac{3}{4}\right)^2}</math> or <math>-\frac{3}{4} - \sqrt{\frac{3}{2} + \left(\frac{3}{4}\right)^2}</math> oe</p> <p><b>SC1</b> for -2.2 or -2.186... and 0.7 or 0.686.. or -2.19 and 0.69 seen but not final answer or 2.19 and -0.69 <b>Maximum score without working is 2</b></p>
24 (a)	13.9 or 13.85 to 13.86	3	<p><b>M2</b> for <math>\sqrt{8^2 + 8^2 + 8^2}</math> oe or <b>M1</b> for <math>8^2 + 8^2</math> or better for one face</p>
(b)	35.1 to 35.5[4...]	2	<p><b>M1</b> for <math>\sin = \frac{8}{\text{their (a)}}</math> or <math>\cos = \frac{\sqrt{8^2 + 8^2}}{\text{their (a)}}</math> or <math>\tan = \frac{8}{\sqrt{8^2 + 8^2}}</math> oe</p>