## Cambridge International Examinations

Cambridge International General Certificate of Secondary Education

## 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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[^0]| Page 2 | Mark Scheme | Syllabus | Paper |
| :---: | :---: | :---: | :---: |
|  | Cambridge IGCSE - May/June 2016 | 0580 | 22 |

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 | $5.74 \times 10^{-5}$ | 1 |  |
| 2 | 5.89 or 5.885 to 5.886 | 1 |  |
| 3 | 3.590 cao | 1 |  |
| 4 | Parallelogram | 1 |  |
| 5 (a) (b) | 9 and 16 <br> 11 | $1$ |  |
| 6 | $\frac{1}{8} x^{2}$ or $0.125 x^{2}$ final answer | 2 | B1 for answer $\frac{1}{8} x^{k}$ or $n x^{2}$ |
| 7 | 460 | 2 | B1 for $1 \mathrm{~cm}^{2}$ : $100 \mathrm{~km}^{2}$ oe <br> or M1 for $4.6 \times 1000000^{2} \div 100000^{2}$ 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 | $p=\frac{8 r-5}{r-3}$ oe final answer | 3 | M1 for correctly collecting terms in $p$ on one side and terms not in $p$ on the other side <br> M1 for correct factorising <br> M1 for correct division dependent on $p$ appearing only once in a factorised expression Maximum M2 for an incorrect final answer |
| 11 | $\begin{array}{llll}68 & 76 & 78 & 78\end{array}$ | 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 |


| Page 3 | Mark Scheme | Syllabus | Paper |
| :---: | :---: | :---: | :---: |
|  | Cambridge IGCSE - May/June 2016 | 0580 | 22 |


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


| Page 4 | Mark Scheme | Syllabus | Paper |
| :---: | :---: | :---: | :---: |
|  | Cambridge IGCSE - May/June 2016 | 0580 | 22 |


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


| Page 5 | Mark Scheme | Syllabus | Paper |
| :---: | :---: | :---: | :---: |
|  | Cambridge IGCSE - May/June 2016 | 0580 | 22 |


| Question | Answer | Mark | Part marks |
| :---: | :--- | :---: | :--- |
| $\mathbf{2 4}$ (a) | $\mathbf{a}+\mathbf{b}-\mathbf{c}$ | $\mathbf{1}$ |  |
| (b) | $\frac{1}{2} \mathbf{a}+\frac{1}{2} \mathbf{b}+\frac{1}{2} \mathbf{c}$ | $\mathbf{2}$ | M1 for $\mathbf{c}+1 / 2$ (their (a)) or for a correct route <br> e.g. $\overrightarrow{O C}+\frac{1}{2} \overrightarrow{C B}, \overrightarrow{O Q}$ |
| (c) | $\frac{1}{2} \mathbf{c}-\frac{1}{2} \mathbf{a}-\frac{1}{6} \mathbf{b}$ | $\mathbf{2}$ | M1 for $\frac{1}{3} \mathbf{b}-\frac{1}{2}$ (their (a)) or other correct route <br> e.g. $-\frac{2}{3} \mathbf{b}-\mathbf{a}+$ their $(\mathrm{b}), \overrightarrow{P O}+\overrightarrow{O Q}$ |


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