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**MATHEMATICS**

**0580/22**

Paper 2 (Extended)

**May/June 2019**

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.

Cambridge International will not enter into discussions about these mark schemes.

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This document consists of **6** printed pages.

**Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

**GENERIC MARKING PRINCIPLE 1:**

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

**GENERIC MARKING PRINCIPLE 2:**

Marks awarded are always **whole marks** (not half marks, or other fractions).

**GENERIC MARKING PRINCIPLE 3:**

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

**GENERIC MARKING PRINCIPLE 4:**

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

**GENERIC MARKING PRINCIPLE 5:**

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

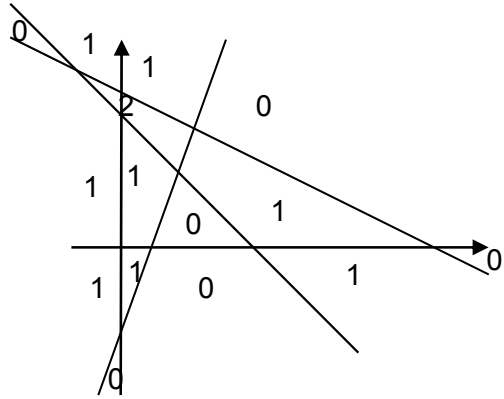
**GENERIC MARKING PRINCIPLE 6:**

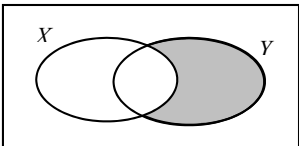
Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

**Abbreviations**

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

| Question | Answer                                         | Marks | Partial Marks                                                                                                                                          |
|----------|------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | 53 or 59                                       | 1     |                                                                                                                                                        |
| 2        | 0.839 or 0.8386 to 0.8387                      | 1     |                                                                                                                                                        |
| 3        | $\frac{7}{9}$                                  | 1     |                                                                                                                                                        |
| 4(a)     | Trapezium                                      | 1     |                                                                                                                                                        |
| 4(b)     | Obtuse                                         | 1     |                                                                                                                                                        |
| 5        | 56.4 or 56.44...                               | 2     | <b>M1</b> for $\frac{254}{\text{their } 4.5}$ or $\frac{254}{\text{their } 270} [\times 60]$                                                           |
| 6        | 2                                              | 2     | <b>M1</b> for $9f - 3f$ oe or $23 - 11$ oe                                                                                                             |
| 7        | 14.7                                           | 2     | <b>M1</b> for $\frac{1}{2} \times 8.4 \times 3.5$ oe                                                                                                   |
| 8(a)     | 0.048 cao                                      | 1     |                                                                                                                                                        |
| 8(b)     | $5.27 \times 10^{-3}$                          | 1     |                                                                                                                                                        |
| 9        | 6                                              | 2     | <b>M1</b> for $2 \times 3^2 \times 5$ or $2^4 \times 3$<br>or for $2 \times 3$ as final answer<br>or <b>B1</b> for 2 or 3 as final answer              |
| 10       | 2.1                                            | 2     | <b>M1</b> for $\frac{33.6 \times 25000^2}{100000^2}$ oe<br>or answer figs 21                                                                           |
| 11       | $\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix}$ | 2     | <b>B1</b> for one row or one column correct in a 2 by 2 matrix in the final answer<br>or <b>SC1</b> for $\begin{pmatrix} 0 & 3 \\ 3 & 0 \end{pmatrix}$ |
| 12(a)    | $10m^5$ final answer                           | 2     | <b>B1</b> for $10m^k$ or $km^5$ as final answer                                                                                                        |
| 12(b)    | $x^{24}$ final answer                          | 1     |                                                                                                                                                        |

| Question | Answer                                                                                            | Marks     | Partial Marks                                                                                                                    |
|----------|---------------------------------------------------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------|
| 13       | $\frac{9}{4} \times \frac{7}{3}$ or $\frac{63}{28} \div \frac{12}{28}$ oe with common denominator | <b>M2</b> | <b>B1</b> for $\frac{9}{4}$ oe seen<br>or <b>M1</b> for <i>their</i> $\frac{9}{4} \times \frac{7}{3}$                            |
|          | $5\frac{1}{4}$ cao                                                                                | <b>A1</b> |                                                                                                                                  |
| 14       | Correctly eliminating one variable                                                                | <b>M1</b> |                                                                                                                                  |
|          | $[x =] -4$<br>$[y =] 3$                                                                           | <b>A2</b> | <b>A1</b> for one correct<br><br>If <b>M0</b> scored, <b>SC1</b> for 2 values satisfying one of the original equations           |
| 15       | 495                                                                                               | <b>3</b>  | <b>M2</b> for $435.6 \div \frac{100-12}{100}$ oe<br>or <b>B1</b> for recognising 435.6 as 88[%]                                  |
| 16(a)    | $R$ identified correctly                                                                          | <b>2</b>  | <b>B</b> marks<br>                           |
| 16(b)    | 7                                                                                                 | <b>1</b>  |                                                                                                                                  |
| 17       | $\frac{3x^2 - 4x + 9}{(x+3)(x-5)}$ final answer                                                   | <b>3</b>  | <b>B1</b> for common denominator $(x+3)(x-5)$ oe isw<br><br><b>M1</b> for $2x(x-5) + (x+3)(x+3)$ or better                       |
| 18       | 12.8<br>4.4<br>0.8                                                                                | <b>3</b>  | <b>B2</b> for 2 correct heights or 3 correct freq densities<br><br>or <b>B1</b> for 1 correct height or 2 correct freq densities |

| Question  | Answer                                                                              | Marks       | Partial Marks                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------|-------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 19        | $m = \frac{k}{P-1}$ final answer                                                    | 4           | <b>B3</b> for final answer $\frac{k}{P-1}$<br>OR<br><b>M1</b> for multiplying or dividing by $m$ correctly<br><br><b>M1</b> for term(s) in $m$ on one side correctly and terms not in $m$ on the other side correctly<br><br><b>M1</b> for correctly factorising $m$ with a 2-term bracket oe<br><br><b>M1</b> for correct division by <i>their</i> 2-term bracket with $m$ as the subject<br>To a maximum of <b>M3</b> for an incorrect answer |
| 20        | $\frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-10)}}{2 \times 3}$                            | <b>B2</b>   | <b>B1</b> for $\sqrt{(-2)^2 - 4(3)(-10)}$ or better<br><br>and if in form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ then<br><b>B1</b> for $p = -(-2)$ and $r = 2(3)$                                                                                                                                                                                                                                                                 |
|           | –1.52 and 2.19 final ans cao                                                        | <b>B1B1</b> | If B0B0, <b>SC1</b> for –1.5 and 2.2<br>or –1.523 to –1.522... and 2.189...<br>or 1.52 and –2.19<br>or –1.52 and 2.19 seen in working                                                                                                                                                                                                                                                                                                           |
| 21(a)     |  | 1           |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 21(b)(i)  | $\frac{9}{16}$ oe                                                                   | 2           | <b>B1</b> for $\frac{9}{k}$ or $\frac{k}{16}$ provided fraction is less than 1                                                                                                                                                                                                                                                                                                                                                                  |
| 21(b)(ii) | 46                                                                                  | 1           |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 22(a)     | $\begin{pmatrix} 6 & 15 \\ 3 & 7 \end{pmatrix}$                                     | 2           | <b>B1</b> for 2 correct elements                                                                                                                                                                                                                                                                                                                                                                                                                |
| 22(b)     | $\begin{pmatrix} -3 & 7 \\ 1 & -2 \end{pmatrix}$ oe isw                             | 2           | <b>B1</b> for $k \begin{pmatrix} 3 & -7 \\ -1 & 2 \end{pmatrix}$ soi or $\det = -1$ soi                                                                                                                                                                                                                                                                                                                                                         |

| Question | Answer                                 | Marks | Partial Marks                                                                                                                                                                                                                                                                                                          |
|----------|----------------------------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 23(a)    | $\frac{5}{3}p - 2q$ oe simplified      | 2     | <b>M1</b> for correct unsimplified answer<br>or $cp - 2q$ or $\frac{5}{3}p + cq$ $c \neq 0$<br>or for a correct route                                                                                                                                                                                                  |
| 23(b)    | $\frac{5}{6}$                          | 2     | <b>B2FT</b> for $\frac{\text{their } c}{2}$ if <i>their (a)</i> is $cp - 2q$ oe<br><b>M1</b> for $\overline{MX} = \frac{5}{6}p - q$<br>or $\overline{MX} = \frac{1}{2} \text{their (a)}$<br>or $\overline{BX} = \frac{1}{2} \overline{AN}$<br>or $q + \frac{1}{2} \text{their (a)}$ or $q + \overline{MX} - kp = 0$ oe |
| 24       | 31.9 or 31.85...                       | 4     | <b>M3</b> for $\tan = \frac{12}{\sqrt{18^2 + 7^2}}$ oe<br>or <b>M2</b> for $\sqrt{18^2 + 7^2}$<br>or <b>M1</b> for $18^2 + 7^2$<br>or <b>B1</b> for identifying correct angle <i>CAG</i>                                                                                                                               |
| 25(a)    | Rotation<br>90° clockwise oe<br>(1, 0) | 3     | <b>B1</b> for each                                                                                                                                                                                                                                                                                                     |
| 25(b)    | Enlargement<br>– 2<br>(0, 2)           | 3     | <b>B1</b> for each                                                                                                                                                                                                                                                                                                     |