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**MATHEMATICS**

**0580/21**

Paper 2 (Extended)

**October/November 2017**

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.

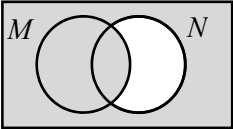
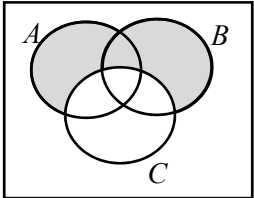
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**Abbreviations**

|     |                            |
|-----|----------------------------|
| 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                                               | Mark | Partial marks                                                                                                                                                                                                      |
|----------|------------------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | 101                                                  | 1    |                                                                                                                                                                                                                    |
| 2        | 2                                                    | 1    |                                                                                                                                                                                                                    |
| 3(a)     | 1.49220....                                          | 1    |                                                                                                                                                                                                                    |
| 3(b)     | 1.5                                                  | 1FT  | FT <i>their</i> answer to (a) rounded correctly to 2 significant figures                                                                                                                                           |
| 4        | 88                                                   | 2    | M1 for $\frac{68+81+74+89+x}{5} = 80$ oe<br>or B1 for 400                                                                                                                                                          |
| 5        | $3x(4x + 5y - 3)$ final answer                       | 2    | B1 for $3(4x^2 + 5xy - 3x)$ or $x(12x + 15y - 9)$<br>allow in working or correct answer spoiled<br><br>If zero scored,<br>SC1 for $3x(4x + 5y - 3)$ with only 2 correct elements in the brackets, allow in working |
| 6(a)     | (-2, 3)                                              | 1    |                                                                                                                                                                                                                    |
| 6(b)     | Correct rhombus with 4th point at (2,2)              | 1    |                                                                                                                                                                                                                    |
| 7        | Diagonal line from (0, 0) to (30, 12)                | 1    |                                                                                                                                                                                                                    |
|          | and<br><br>Horizontal line from (30, 12) to (70, 12) | 1FT  | FT for horizontal line from (30, $k$ ) to (70, $k$ ) where $k$ is <i>their</i> 12                                                                                                                                  |
| 8        | 19.65 cao                                            | 2    | B1 for 6.55 seen (must be evaluated, not $6.5 + 0.05$ )<br>or M1 for $3 \times (6.5 + 0.05)$                                                                                                                       |
| 9        | 7615.15                                              | 2    | M1 for $12\,400 \times \left(1 - \frac{15}{100}\right)^3$ oe                                                                                                                                                       |

| Question | Answer                                                                              |                                       | Mark      | Partial marks                                                                                                                                             |
|----------|-------------------------------------------------------------------------------------|---------------------------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10       | $\frac{5}{3}$                                                                       | $\frac{2}{3} + \frac{4}{15}$          | <b>B1</b> | Allow $\frac{5k}{3k}$                                                                                                                                     |
|          | $\frac{25}{15}$ [and $\frac{11}{15}$ ]                                              | $\frac{10}{15}$ [and $\frac{4}{15}$ ] | <b>M1</b> | Correct method to find common denominator<br>e.g. $\frac{75}{45}$ and $\frac{33}{45}$<br>Follow through <i>their</i> $\frac{5}{3}$ for the <b>M1</b> mark |
|          | $\frac{14}{15}$ cao                                                                 | $\frac{14}{15}$ cao                   | <b>A1</b> |                                                                                                                                                           |
| 11       | 54                                                                                  |                                       | <b>3</b>  | <b>M2</b> for $\frac{180 \times (5-2)}{5}$ or $180 - \frac{360}{5}$<br>or <b>M1</b> for $180 \times (5-2)$ or $\frac{360}{5}$                             |
| 12(a)    | 343                                                                                 |                                       | <b>1</b>  |                                                                                                                                                           |
| 12(b)    | -11                                                                                 |                                       | <b>1</b>  |                                                                                                                                                           |
| 12(c)    | 343                                                                                 |                                       | <b>1</b>  |                                                                                                                                                           |
| 13(a)    | $m^{10}$ final answer                                                               |                                       | <b>1</b>  |                                                                                                                                                           |
| 13(b)    | $20x^5y^2$ final answer                                                             |                                       | <b>2</b>  | <b>B1</b> for 2 out of 3 elements correct in final answer or correct answer spoiled                                                                       |
| 14(a)    | (9, -4)                                                                             |                                       | <b>1</b>  |                                                                                                                                                           |
| 14(b)    | -5                                                                                  |                                       | <b>2</b>  | <b>M1</b> for $t^2 + 12^2 = 13^2$ oe<br>or <b>SC1</b> for answer 5 or $\pm 5$                                                                             |
| 15(a)    | Fewer than 6 elements from {1, 2, 3, 4, 5, 6} or $\emptyset$                        |                                       | <b>1</b>  |                                                                                                                                                           |
| 15(b)    |  |                                       | <b>1</b>  |                                                                                                                                                           |
|          |  |                                       | <b>1</b>  |                                                                                                                                                           |

| Question | Answer                                                                          | Mark | Partial marks                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------|---------------------------------------------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16       | Enlargement                                                                     | 1    |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|          | $\frac{1}{3}$                                                                   | 1    |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|          | (2, 1)                                                                          | 1    |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 17(a)    | $(y =) \frac{72}{(x+1)^2}$ oe                                                   | 2    | <b>M1</b> for $y = \frac{k}{(x+1)^2}$                                                                                                                                                                                                                                                                                                                                                                                                      |
| 17(b)    | 32                                                                              | 1FT  | <b>FT</b> correct evaluation from <i>their</i> equation in (a) using 0.5                                                                                                                                                                                                                                                                                                                                                                   |
| 18       | Correct position of <i>S</i> with 2 pairs of correct construction arcs for line | 4    | <p><b>B3</b> for correct position of <i>S</i> with missing/incorrect construction arcs but correct line</p> <p>or</p> <p><b>B2</b> for correct ruled line equidistant from the two trees with correct arcs</p> <p>or <b>B1</b> for correct line with no/wrong arcs or correct arcs with no line</p> <p>and</p> <p><b>B1</b> for arc centre bird bath, radius 5 cm or <i>S</i> in correct position with no/incorrect working</p>            |
| 19       | $\frac{x^2 + 20x + 31}{2(x-3)(x+7)}$ final answer                               | 4    | <p><b>B1</b> for a common denominator of <math>[2](x-3)(x+7)</math> seen isw</p> <p><b>M1</b> for <math>2 \times 5 \times (x+7) + 2 \times 3 \times (x-3) + (x-3)(x+7)</math> oe</p> <p><b>and</b> must have attempted to expand all the brackets in the numerator</p> <p><b>M1</b> for <math>10x + 70 + 6x - 18</math></p> <p><b>or</b> <math>x^2 - 3x + 7x - 21</math></p> <p><b>or</b> <math>[2](5x + 35 + 3x - 9)</math> or better</p> |
| 20(a)    | 1480                                                                            | 1    |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 20(b)    | 30                                                                              | 3    | <p><b>M2</b> for <math>10 \times \sqrt{\frac{3960}{440}}</math> or <math>10 \div \sqrt{\frac{440}{3960}}</math></p> <p>or <b>M1</b> for <math>\sqrt{\frac{3960}{440}}</math> or <math>\sqrt{\frac{440}{3960}}</math> or</p> <p><math>\left(\frac{h}{10}\right)^2 = \frac{3960}{440}</math> oe</p>                                                                                                                                          |

| Question | Answer                              | Mark | Partial marks                                                                                                                                                                                                                                                                                                                                               |
|----------|-------------------------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 21       | 46.7 or 46.68 to 46.69              | 4    | <p><b>M3</b> for <math>\tan [\dots] = \frac{9}{\frac{1}{2}\sqrt{12^2 + 12^2}}</math> oe</p> <p>or</p> <p><b>M1</b> for <math>\left[\frac{1}{2} \times\right] \sqrt{12^2 + 12^2}</math> oe e.g. <math>\sqrt{\frac{12^2}{2}}</math></p> <p>and <b>M1</b> for identifying angle <i>MCE</i></p>                                                                 |
| 22(a)    | 80 to 84                            | 2    | <b>M1</b> for 116 to 120                                                                                                                                                                                                                                                                                                                                    |
| 22(b)    | Correct curve or ruled lines        | 3    | <p><b>B2</b> for 7 or 8 correct points</p> <p><b>B1</b> for 5 or 6 correct points</p>                                                                                                                                                                                                                                                                       |
| 22(c)    | 26                                  | 2    | <p><b>B1</b> for 156 or 130</p> <p>or</p> <p>for <i>their</i> 130 from <i>their</i> <b>increasing</b> curve (or lines)</p>                                                                                                                                                                                                                                  |
| 23(a)    | $x + y \leq 16$ oe<br>$x \geq 4$ oe | 2    | <p><b>B1</b> for each mark final answers</p> <p>If zero scored, <b>SC1</b> for <math>x + y &lt; 16</math> <b>and</b> <math>x &gt; 4</math></p>                                                                                                                                                                                                              |
| 23(b)    | Correct shading                     | 3    | <p><b>M2</b> for lines at <math>x = 4</math> <b>and</b> <math>x + y = 16</math></p> <p>or for correct shading of <math>x &lt; 4</math></p> <p>or <math>x + y &gt; 16</math></p> <p>or <b>M1</b> for line at <math>x = 4</math> or <i>their</i> <math>x = 4</math></p> <p>or for line at <math>x + y = 16</math> or <i>their</i> <math>x + y = 16</math></p> |
| 23(c)    | 144                                 | 2    | <p><b>M1</b> for (8, 8) selected</p> <p>or for <math>10 \times x + 8 \times y</math> for any numerical point which is inside or on the boundary of <i>their</i> unshaded region</p>                                                                                                                                                                         |