| **MATHEMATICS** | **0580/21** |
|---|---|
| Paper 2 (Extended) | **October/November 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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This document consists of **5** printed pages.

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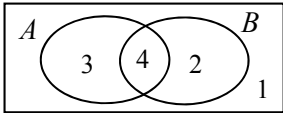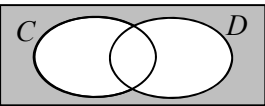
| | |
|---|---|
| cao | correct answer only |
| dep | dependent |
| FT | follow through after error |
| isw | ignore subsequent working |
| oe | or equivalent |
| SC | Special Case |
| nfww | not from wrong working |
| soi | seen or implied |

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

| Question | Answer | Mark | Part marks |
|---|---|---|---|
| **10** | $6x^8$ final answer | **2** | **B1** for $6x^k$, $6 \times x^8$ or $kx^8$ $(k \neq 0)$ as final answer |
| **11** | Correctly eliminating one variable | **M1** | |
| | $[x =] -1$ and | **A1** | If zero scored, **SC1** for 2 values that satisfy one of the original equations **or** **SC1** if no working shown, but 2 correct answers given |
| | $[y = ] 5$ | **A1** | |
| **12 (a)** | $\dfrac{1}{8}$ cao | **1** | |
| **(b)** | $\dfrac{2}{11}$ | **2** | **M1** for $18.\overset{.}{1}\overset{.}{8} - 0.\overset{.}{1}\overset{.}{8}$ oe or **B1** for $\dfrac{2k}{11k}$ ($k$ not 0 or 1) |
| **13 (a)** | $(2p - 3)(2p + 3)$ final answer | **1** | |
| **(b)** | $(a - 2b)(2x - y)$ oe final answer | **2** | **B1** for $2x(a - 2b) - y(a - 2b)$ or $a(2x - y) - 2b(2x - y)$ |
| **14** | $6\frac{2}{3}$ oe | **3** | **M1** for $y = k\sqrt{x + 2}$ oe or better e.g. $2 = k\sqrt{7 + 2}$ **M1** for $[y = ]$ their $k \times \sqrt{98 + 2}$ or **M2** for $\dfrac{y}{2} = \dfrac{\sqrt{98 + 2}}{\sqrt{7 + 2}}$ |
| **15 (a)** | $\begin{pmatrix} 5 \\ 8 \end{pmatrix}$ | **1** | |
| **(b)** | (8) final answer | **2** | **B1** for final answer 8 without brackets |

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

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