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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **1a** | P:\Text_Extraction\UK\GCE_ALevel\raw\Corrections\Batch05\Batch 5 Second proof to CSC\D60992_MS_Q1a_figure_1.jpgHence  and  | **M1****A1****M1****A1****A1** | 1.1a1.1b1.1a1.1b1.1b | 2ndCalculate the modulus/ argument of a complex number |
|  | **(5)** |  |  |

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| **1b** | Hence  | **Alt method:**Hence  | **M1****A1** | 1.1a1.1b | 4thKnow how to multiply/divide complex numbers in exponential form |
|  | Hence  | Hence  | **M1****A1****A1** | 1.1a1.1b2.5 |  |
|  |  | **(5)** |  |  |

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| **1c** | P:\Text_Extraction\UK\GCE_ALevel\raw\Corrections\Batch05\Batch 5 Second proof to CSC\D60992_MS_Q1c_figure_2.jpg | **B1****B1** | 2.52.5 | 2ndRepresent complex numbers on an Argand diagram |
|  | **(2)** |  |  |
| (12 marks) |
| Notes**1a**: **M1** for use of Pythagoras **A1** for both values correct **M1** for use of trigonometry to find *α* and/or *β* **A1** for correct values of arguments **A1** for both correct final answers in correct form**1b**: **M1** for multiplying moduli and adding angles **A1** cao **M1** for dividing moduli and subtracting angles **A1** for correct *r* and  **A1** cao**1c**: **B1B1** for each correct |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **2a** |  | **B1** | 1.1b | 4thRemember and be able to use de Moivre’s theorem |
|  | **(1)** |  |  |
| **2b** |    | **M1****A1** | 1.1a1.1b | 4thRemember and be able to use de Moivre’s theorem |
|  | **(2)** |  |  |
| **2c** |  | **M1****A1****A1** | 1.1a1.1b1.1b | 4thRemember and be able to use de Moivre’s theorem |
|  | **(3)** |  |  |
| (6 marks) |
| Notes**2a**: **B1** accept terms in either order**2b**: **M1** for product of two complex numbers with index of –2 or –6*θ* seen **A1** accept terms in either order**2c**: **M1** for product of two complex numbers with 8 and 9 or –9 seen **A1** accept terms in either order |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **3** | Hence  | **M1****M1****A1****M1****M1****A1** | 1.1a1.1a1.1b1.1b1.1b1.1b | 5thBe able to derive multiple angle formulae and expressions using de Moivre’s theorem |
| (6 marks) |
| Notes**M1** for use of de Moivre’s theorem**M1** for use of binomial expansion**A1** for correct expansion**M1** for choosing real terms**M1** for replacing **A1** cao |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **4a** | P:\Text_Extraction\UK\GCE_ALevel\raw\Corrections\Batch05\Batch 5 Second proof to CSC\D60992_MS_Q4a_figure_3.jpg | **B1****M1****A1****A1****B1****B1** | 1.1a1.1b1.1b1.1b2.52.5 | 8thBe able to find the *n*th roots of equations of the form  and know that they form the vertices of a regular *n*-gon in the Argand diagram |
|  | **(6)** |  |  |

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| **4b** | P:\Text_Extraction\UK\GCE_ALevel\raw\Corrections\Batch05\Batch 5 Second proof to CSC\D60992_MS_Q4b_figure_4.jpg | **B1****M1****M1****A1****B1****B1** | 1.1a1.1b1.1b1.1b2.52.5 | 8thBe able to find the *n*th roots of equations of the form  and know that they form the vertices of a regular *n*-gon in the Argand diagram |
|  | **(6)** |  |  |
| (12 marks) |

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| Notes**4a**: **B1** for rewriting equation **M1** for use of de Moivre’s theorem **A1** for at least four roots found by substituting *n* **A1** for all roots correct in the interval of the principal argument **B1** for all lines the same length **B1** for correct spacing around the circle**4b**: **B1** for rewriting equation **M1** for rewriting in terms of cos and sin **M1** for use of de Moivre’s theorem **A1** for substitutes values for *n* and use of the interval of the principal argument **B1** for all roots the same length **B1** for correct spacing around the circle |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **5a** | Subtracting:  | **M1****A1****B1** | 1.1b2.11.2 | 4thRemember and be able to use de Moivre’s theorem |
|  | **(3)** |  |  |
| **5b** |  | **M1****A1****M1****A1****M1****A1** | 3.1a1.1b1.1b1.1b1.1b1.1b | 5thBe able to derive multiple angle formulae and expressions using de Moivre’s theorem |
|  | **(6)** |  |  |
| **5c** |  | **B1****M1****A1****M1****A1** | 3.1a1.1b1.1b1.1b1.1b | 5thBe able to derive multiple angle formulae and expressions using de Moivre’s theorem |
|  | **(5)** |  |  |
| (14 marks) |
| Notes**5a**: **B1** (may be implied) for stating *z* = cos + isin **M1** for correct use of de Moivre’s theorem **A1** cso – must be clearly seen as A.G**5b**: **M1** for use of binomial expansion **A1** all terms correct – may be simplified or unsimplified **M1** for attempting to simplify and collect terms **A1** cao **M1** for substituting expression given in **a** (allow *n*) **A1** cso – must be clearly seen as A.G**5c**: **B1** for use of correct expression **M1** for integrating with sin changed to –cos at least once **A1** all terms correct **M1(dep)** for substituting upper and lower limits into *their* expression **A1** cao |