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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.jpg              Hence  and | **M1**  **A1**  **M1**  **A1**  **A1** | 1.1a  1.1b  1.1a  1.1b  1.1b | 2nd  Calculate the modulus/ argument of a complex number |
|  | **(5)** |  |  |

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| **1b** | Hence | **Alt method:**            Hence | **M1**  **A1** | 1.1a  1.1b | 4th  Know how to multiply/divide complex numbers in exponential form |
|  | Hence | Hence | **M1**  **A1**  **A1** | 1.1a  1.1b  2.5 |  |
|  |  | | **(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** | 2.5  2.5 | 2nd  Represent 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 | 4th  Remember and be able to use de Moivre’s theorem |
|  | **(1)** |  |  |
| **2b** |  | **M1**  **A1** | 1.1a  1.1b | 4th  Remember and be able to use de Moivre’s theorem |
|  | **(2)** |  |  |
| **2c** |  | **M1**  **A1**  **A1** | 1.1a  1.1b  1.1b | 4th  Remember 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** | 1.1a  1.1a  1.1b  1.1b  1.1b  1.1b | 5th  Be 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** | 1.1a  1.1b  1.1b  1.1b  2.5  2.5 | 8th  Be 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** | 1.1a  1.1b  1.1b  1.1b  2.5  2.5 | 8th  Be 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** | 1.1b  2.1  1.2 | 4th  Remember and be able to use de Moivre’s theorem |
|  | **(3)** |  |  |
| **5b** |  | **M1**  **A1**  **M1**  **A1**  **M1**  **A1** | 3.1a  1.1b  1.1b  1.1b  1.1b  1.1b | 5th  Be able to derive multiple angle formulae and expressions using de Moivre’s theorem |
|  | **(6)** |  |  |
| **5c** |  | **B1**  **M1**  **A1**  **M1**  **A1** | 3.1a  1.1b  1.1b  1.1b  1.1b | 5th  Be 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 | | | | |