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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **1a** | Multiplies by the complex conjugate:  | **M1** | 2.2a | 2ndUse the complex conjugate to divide two complex numbers |
| Simplifies to find: Award mark for only  seen. | **M1** | 1.1b |
| Recognises  | **M1** | 2.2a |
| Solves to find *p* = 2 or *p* = 8 | **A1** | 1.1b |
|  | **(4)** |  |  |
| **1b** | ,  | **A1** | 1.1b | Transition StepWrite numbers in terms of i, the square root of minus 1 |
|  | **(1)** |  |  |
| **1c** | **Figure 1** | Argand diagram drawn with points clearly labelled. | **B1** | 1.1b | 2ndRepresent complex numbers on an Argand diagram |
|  | **(1)** |  |  |
| (6 marks) |
| Notes |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **2a** | Multiplies by the complex conjugate:  | **M1** | 2.2a | 2ndUse the complex conjugate to divide two complex numbers |
| Finds *z* = 2 – 2i or states *a* = 2 and *b* = −2 | **A1** | 1.1b |
|  | **(2)** |  |  |
| **2b** | States or implies that the complex conjugate, *z* = 2 + 2i is also a root of the quadratic equation. | **M1** | 2.2a | 2ndUnderstand that the complex roots of a quadratic equation with real coefficients occur as a conjugate pair |
| Writes  OrWrites  and  | **M1** | 2.2a |
| Makes an attempt to multiply out the brackets. For example,  is seen.OrCalculates  and  | **M1** | 1.1b |
| Simplifies to  or states *p* = 1, *q* = −4, *r* = 8Accept any multiple of this solution, providing each constant is an integer. | **A1** | 1.1b |
|  | **(4)** |  |  |
| (6 marks) |
| Notes |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **3** | States or implies that  | **M1** | 1.1b | 2ndCalculate the argument of a complex number |
| Uses the definition of argument to write  | **M1** | 2.2a |
| Makes an attempt to solve for *k*, for example 4 + *k* = 2*k* – 2 is seen. | **M1** | 1.1b |
| Finds *k* = 6 | **A1** | 1.1b |
| (4 marks) |
| Notes |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **4a** | Finds *r* = 12, using  | **M1** | 2.2a | 2ndWrite complex numbers in modulus–argument form, i.e. convert from the cartesian form to modulus–argument form |
| Finds . Likely states  and then deduces  | **M1** | 2.2a |
| Writes  | **A1** | 2.2a |
|  | **(3)** |  |  |
| **4b** | States . Award one method mark for  seen and one method mark for  or seen. | **M2** | 2.2a | 4thFind the modulus and argument of quotients of complex numbers |
| States a fully correct answer:  | **A1** | 1.1b |
|  | **(3)** |  |  |
| (6 marks) |
| **Notes** |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **5a** | Deduces that the midpoint of (−8, 6) and (4, −2) is (−2, 2) | **M1** | 2.2a | 5thRepresent perpendicular bisectors as loci on an Argand diagram |
| Calculates that the slope of the line joining (−8, 6) and (4, −2) is  | **M1** | 1.1b |
| Deduces that the slope of the perpendicular bisector is  | **M1** | 2.2a |
| Finds the correct equation of the locus (perpendicular bisector):  | **A1** | 1.1b |
|  | **(4)** |  |  |
| **5b** | **Figure 2**\\192.168.1.10\TypeSetting\Silicon Chips\Pearson_Word Project\Common\Artwork\alevel_unittests_cp1_aw2.png­ | Draws a straight line with a positive slope. | **M1** | 1.1b | 5thRepresent perpendicular bisectors as loci on an Argand diagram |
| Fully correct answer with (0, 5) and  labelled. | **A1** | 1.1b |
|  | **(2)** |  |  |
| **5c** | Demonstrates an understanding of the need to find the point of intersection of  and  | **M1** | 2.2a | 6thSolve geometry problems using loci on an Argand diagram |
| Solves to find  and  | **M1** | 1.1b |
| Finds the distance:  | **A1** | 2.1 |
|  | **(3)** |  |  |
| (9 marks) |
| Notes**5a** An alternative algebraic approach is acceptable. |
| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **6a** | **Figure 3**\\192.168.1.10\TypeSetting\Silicon Chips\Pearson_Word Project\Common\Artwork\alevel_unittests_cp1_aw3.png | Circle drawn with centre (6, 1). | **M1** | 1.1b | 5thRepresent circles as loci on an Argand diagram |
| Circle should clearly cross the real axis and not touch the imaginary axis. | **A1** | 2.2a |
|  | **(2)** |  |  |
| **6b** | Draws a line from the point (11, 10) that is tangential to the circle with centre (6, 1) and radius 5. | **M1** | 2.2a | 5thRepresent half-lines as loci on an Argand diagram |
| States or implies that length of the opposite side is 5 (the radius of the circle). | **M1** | 1.1b |
| Calculates the length of the hypotenuse of this triangle is . | **M1** | 1.1b |
| Deduces that  | **M1** | 1.1b |
| **Figure 4** | Clearly explains that the minimum angle is with explanation referring to a diagram or providing a clear explanation. For example, as shown in the diagram opposite. | **A1** | 2.1 |
|  | **(5)** |  |  |
| (7 marks) |
| Notes |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **7** | **Figure 5***\\192.168.1.10\TypeSetting\Silicon Chips\Pearson_Word Project\Common\Artwork\alevel_unittests_cp1_aw5.png* | Circle drawn with centre (1, 3). | **M1** | 1.1b | 6thSolve geometry problems using regions on an Argand diagram |
| Circle should just touch the real axis and clearly cross the imaginary axis. | **A1** | 1.1b |
| Points (−2, −2) and (−2, 4) indicated on the diagram. | **M1\*** | 1.1b |
| Line drawn at *y* = 1. | **A1** | 2.2a |
| Shades correct region. | **M1** | 3.1a |
| Fully correct solution. | **A1** | 1.1b |
| (6 marks) |
| Notes**7** Award the method mark providing the line *y* = 1 is drawn correctly, even if the points (−2, −2) and (−2, 4) are not indicated. |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **8** | **Figure 6***\\192.168.1.10\TypeSetting\Silicon Chips\Pearson_Word Project\Common\Artwork\alevel_unittests_cp1_aw6.png* | Circle drawn with centre (−3, 5). | **M1** | 1.1b | 6thSolve geometry problems using regions on an Argand diagram |
| Circle should just touch the imaginary axis and clearly not touch the real axis. | **A1** | 1.1b |
| Two half lines drawn on the diagram. | **M1** | 1.1b |
| Half lines start at (−6, 5) and intersect the circle at the top and the bottom. | **A1** | 2.2a |
| Shades correct region. | **M1** | 3.1a |
| Fully correct solution. | **A1** | 1.1b |
| (6 marks) |
| Notes |