| **Question** | **Scheme** | | **Marks** |
| --- | --- | --- | --- |
| **1** | (*x* – 5) is a factor of f(*x*) so f(*x*) =  ) | | M1 |
| f(*x*) = | | A1 |
| Solve to give *x* = | | M1 |
| ( and 5) | | A1cao A1ft |
|  |  | | **(5 marks)** |
| **2(a)** |  | |  |
|  | | B1 |
|  |  | | **(1)** |
| **2(b)** |  | |  |
|  | | M1 A1 |
| So, | | M1 |
|  | | A1 |
|  |  | | **(4)** |
|  |  | | **(5 marks)** |
| **3** |  | |  |
|  | | B1 |
|  | | M1A1 |
|  | | M1 |
|  | | A1 |
|  |  | | **(5 marks)** |
| **4(a)** |  | | M1 |
|  | | M1 |
|  | | A1A1 |
|  |  | | **(4)** |
| **4(b)** | ` | | M1 |
|  | | dM1 |
|  | |  |
|  | |  |
|  | | dM1A1 |
| **OR** | |  |
|  | | M1 |
| oe | | dM1 |
| oe | |  |
|  | | dM1A1 |
|  |  | | **(4)** |
|  |  | | **(8 marks)** |
| **5(a)** |  | |  |
|  | | B1 |
|  |  | | **(1)** |
| **5(b)** |  | | M1 |
| A1 |
|  |  | | **(2)** |
|  |  | | **(3 marks)** |
| **6(a)** |  | or or | M1 |
|  | or -45 or awrt -0.785 (oe e.g  ) | A1 |
|  | **Correct answer only 2/2** | | **(2)** |
| **6(b)** |  | At least 3 correct terms (Unsimplified) | M1 |
|  | cao | A1 |
|  |  |  | **(2)** |
| **6(c)** |  | Multiply top and bottom by (1 + i) | M1 |
|  |  | A1 |
|  | or | A1 |
|  | **Correct answers only in (b) and (c) scores no marks** | | **(3)** |
|  |  | | **(7 marks)** |
| **7(a)** |  |  |  |
|  |  |  |
|  | An attempt to multiply out the brackets to give four terms (or four terms implied).  *zw* is M0 | M1 |
|  |  | A1 |
|  |  | Answer only 2/2 | **(2)** |
| **7(b)** |  |  |  |
|  | Multiplies  by | M1 |
|  | Simplifies realising that a real number is needed on the denominator and applies  on their numerator expression and denominator expression. | M1 |
|  |  |  |
|  | or  and  or equivalent  Answer as a single fraction A0 | A1 |
|  |  |  | **(3)** |
|  |  |  | **(5 marks)** |
| **8(a)** |  | or awrt 2.24 | B1 |
|  |  |  | **(1)** |
| **8(b)** |  | or  or or  or or | M1 |
|  | awrt 2.68 | A1 oe |
|  | |  |
|  |  |  | **(2)** |
| **8(c)** |  |  |  |
|  | An attempt to use the quadratic formula (usual rules) | M1 |
|  |  |  |
|  |  |  |
|  | Attempt to simplify their  in terms of i,. e.g. i  or i | M1 |
| So, . |  | A1 oe |
|  |  |  | **(3)** |
| **8(d)** | *x*  *y* | Note that the points are  and |  |
| The point plotted correctly on the Argand diagram with/without label. | B1 |
| The distinct points  and  plotted correctly and symmetrically about the *x*-axis on the Argand diagram with/without label. | B1 |
|  |  |  | **(2)** |
|  |  |  | **(8 marks)** |
| **9(a)** |  | | M1 A1cao |
|  |  | | **(2)** |
| **9(b)** | **=  =** | | M1 A1 |
|  |  | | **(2)** |
| **9(c)** | =10 | | M1 A1ft |
|  |  | | **(2)** |
| **9(d)** |  | | M1 |
| so  or | | A1 cao |
|  |  | | **(2)** |
|  |  | | **(8 marks)** |
| **10(a)** |  | |  |
|  | | B1 |
|  |  | | **(1)** |
| **10(b)** |  | | M1A1 |
|  | | M1 |
|  | | A1A1 |
| f(1+5i)=0 or f(1-5i)=0 | | M1 |
| and | | A1 |
|  | | M1  A1A1 |
|  |  | | **(5)** |
| **10(c)** |  | | B1  B1 |
|  |  | | **(2)** |
|  |  | | **(8 marks)** |
| **11(a)** | **Ignore part labels and mark part (a) and part (b) together.** | |  |
|  | | M1 |
|  | | dM1 |
| k = 30 | | A1 cao |
| **Alternative using long division:** | |  |
|  | | M1 |
|  | | dM1 |
|  | | A1 |
| **Alternative by inspection:** | |  |
|  | | M1dM1 |
| k = 30 | | A1 |
|  |  | | **(3)** |
| **11(b)** |  | | M1 |
| or | | A1 |
| or equivalent | | M1 |
|  | | A1 oe |
|  |  | | **(4)** |
|  |  | | **(7 marks)** |
| **12(a)** |  | |  |
|  | | M1 |
|  | | A1 A1 |
|  |  | | **(3)** |
| **12(b)** | o.e. seen anywhere. | | M1 |
|  | | A1 |
|  |  | | **(2)** |
| **12(c)** |  | |  |
|  | | M1 |
|  | | A1 |
|  | | A1 |
|  |  | | **(3)** |
|  |  | | **(8 marks)** |
| **13(a)** |  | | M1 |
|  | | A1 |
|  |  | | **(2)** |
| **13(b)** |  | | M1 |
| The modulus of  is 3 | | A1 |
| and attempts to find | | M1 |
| and the argument is | | A1 |
|  |  | | **(4)** |
| **13(c)** |  | | M1  A1 |
|  |  | | **(2)** |
|  |  | | **(8 marks)** |
| **14(a)** |  | | M1 |
|  | | M1 |
|  | | A1A1 |
|  |  | | **(4)** |
| **14(b)** |  | | M1 |
|  | | M1 |
|  | | A1 |
|  | | M1 |
|  | | A1 |
|  |  | | **(5)** |
|  |  | | **(9 marks)** |
| **15(a)** |  | |  |
|  | | M1 A1 |
|  | | M1 |
|  | |  |
|  | | A1 |
|  |  | | **(4)** |
| **15(b)** | *O*  *x*  *y* | | B1ft  B1ft |
|  |  | | **(2)** |
|  |  | | **(6 marks)** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Source paper** | **Question number** | **New spec references** | **Question description** | **New AOs** |
| 1 | FP1 2015 | 1 |  | Complex numbers | 1.1b, 3.1a |
| 2 | FP1 2012 | 1 |  | Complex numbers | 1.1b, 3.1a |
| 3 | FP1 2014R | 1 |  | General complex numbers | 1.1b, 3.1a |
| 4 | FP1 2014 | 1 |  | General complex numbers | 1.1b, 3.1a |
| 5 | FP1 2013R | 1 |  | Complex numbers | 1.1b, 3.1a |
| 6 | FP1 Jan 2012 | 1 |  | Complex numbers | 1.1b, 3.1a |
| 7 | FP1 2011 | 1 |  | Complex numbers | 1.1b |
| 8 | FP1 2011 | 2 |  | Complex numbers | 1.1b |
| 9 | FP1 Jan 2013 | 2 |  | Complex numbers | 1.1b, 3.1a |
| 10 | FP1 2014 | 3 |  | General complex numbers | 1.1b, 3.1a |
| 11 | FP1 2013 | 3 |  | Complex numbers | 1.1b, 3.1a |
| 12 | FP1 2017 | 4 |  | Complex numbers | 1.1b, 3.1a |
| 13 | FP1 2015 | 4 |  | Complex numbers | 1.1b, 3.1a |
| 14 | FP1 2014R | 4 |  | General complex numbers | 1.1b, 3.1a |
| 15 | FP1 2013R | 4 |  | Complex numbers | 1.1b, 3.1a |