|  |  |  |
| --- | --- | --- |
| **Question Number** | **Scheme** | **Marks** |
| **1.** |  |  |
|  | det**M** = *x*(4*x* – 11) – (3*x* – 6)(*x* – 2) | M1 |
|  | *x*2 + *x* – 12 (=0) | A1 |
| (*x* + 4)(*x* – 3) (= 0 )🡪 x = ... | M1 |
|  | A1 |
|  |  | **[4]** |

|  |  |  |
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| **Question Number** | **Scheme** | **Marks** |
| **2(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)** |
| **(b)** |  | M1 |
| or | A1 |
|  | or equivalent | M1 |
|  |  | A1 oe |
|  |  | **(4)** |
|  |  | **[7]** |

|  |  |  |
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| **Question Number** | **Scheme** | **Marks** |
| **3(a)** |  | B1 |
|  | M1,B1ft |
|
|  | M1 A1 |
|
|  | A1\*cso |
|  |  | **(6)** |
| **3(b)** |  | M1A1 |
|  |
| **3**f(***n***) – f(*n* or *n*+1) is M0 |  |
|  |  |  |
|  | dM1 |
|  | A1 |
|  |  |
|  | **(4)** |
|  |  | **[10]** |

|  |  |  |
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| **Question Number** | **Scheme** | **Marks** |
| **4** |  |  |
| **(a)** |  | M1 |
|  | A1 cao |
|  | **(2)** |
| **(b)** |  | M1 |
|  | B1 |
|  |  | dM1A1 |
|
|  | **(4)** |
| **(c)** |  | M1 |
|  |  | dM1 |
| *a* = 1, *b* = -1 | A1 |
|  |  |
|  | **(3)** |
| **(d)** |  | M1 |
|  |  | A1 |
|  |  | **(2)** |
|  |  | **[11]** |

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| **Question Number** | **Scheme** | **Marks** |
| **5(a)** |  | M1A1 |
|
| OR |  |
|  |  |
|  | **(2)** |
| **(b)** |  | M1 |
| \* | A1\* cso |
| Numerical approach award 0/2. |  |
|  | **(2)** |
| **(c)** |  | B1 |
|  | M1 |
|  | A1,A1 |
| **Or:** |  |
|  | B1 |
|  | M1 |
|  | A1,A1 |
|  | **(4)** |
|  |  | **[8]** |

|  |  |  |
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| **Question Number** | **Scheme** | **Marks** |
| **6(a)** |  | B1 |
| Assume true for *n* = *k* so that |  |
|  | M1 |
|  | A1 |
|  |  | A1 |
| If true for *n* = *k* then true for *n* = *k* + 1 and as true for *n* = 1 true for all *n* | A1 cso |
|  |  | **(5)** |
| **(b)** | **Condone use of *n* here.** |  |
|  |  | B1 |
|  |
|  |  |
|  |  | M1 |
|  | A1 |
|  |  |
|  | A1 |
| If true for *m* = *k* then true for *m* = *k* + 1 and as true for *m =* 1 true for all *m* | A1 cso |
|  |  | **(5)** |
|  |  | **[10]** |

|  |  |  |
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| **7.** |  |  |
| **(a)** |  | M1,A1 (2) |
|  |  |  |
| **(b)** |  |  |
|  |  |  |
|  |  | M1 |
|  |  |  |
|  |  | M1depA1 (3) |
|  |  | **[5]** |
| **8** |  |  |
| **(a)** | Assume true for : |  |
|  |  |  |
|  | : | M1 |
|  |  |  |
|  |  | M1 |
|  |  |  |
|  |  | M1depA1cso |
|  |  |  |
|  | , also |  |
|  |  |  |
|  | ;   true for all n | A1cso (5) |
|  |  |  |
| **(b)** |  |  |
|  |  |  |
|  |  | M1 |
|  |  |  |
|  | oe | A1 (2) |
|  |  | [7] |

|  |  |  |
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| **9** |  |  |
| **(a)** |  |  |
|  |  |  |
|  |  | B1 (1) |
|  |  |  |
| **(b)** | arg | M1A1 (2) |
|  |  |  |
| **(c)** |  | B1 (1) |
|  |  |  |
| **(d)** |  | M1,A1 (2) |
|  |  | **[6]** |
| **10** |  |  |
| **(a)** |  | **M1** |
|  |  |  |
|  | I F: | **M1** |
|  |  |  |
|  |  | **M1dep** |
|  |  |  |
|  |  | **M1dep** |
|  |  |  |
|  |  | **A1cso (5)** |
|  |  |  |
| **(b)** |  | **M1** |
|  |  |  |
|  |  | **A1ft (2)** |
|  |  |  |
| **(c)** |  |  |
|  |  |  |
|  | or | **M1,A1** |
|  |  |  |
|  |  | **A1cao** |
|  | Alt: Complete square on y = ... or use the original differential equation | **M1** |
|  |  |  |
|  |  | **A1,A1** |
|  | Question 5 | **B1 shape**  **B1 turning points shown somewhere**  **(5)**  **[12]** |

|  |  |  |
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| **11 (a)** |  | M1 |
|  |  |  |
|  |  | M1depA1 |
|  |  |  |
|  |  | M1 |
|  |  |  |
|  | At *P* | M1  not needed |
|  |  |  |
|  | \* | A1cso  (6) |
|  |  |  |
| **(b)** |  |  |
|  |  |  |
|  |  | M1A1 (2) |
|  |  |  |
| **(c)** | Area = | M1 |
|  |  |  |
|  |  | M1 |
|  |  |  |
|  |  | M1A1 |
|  |  |  |
|  |  | M1dep on 2nd M mark |
|  |  |  |
|  |  | M1 dep (all Ms) |
|  |  |  |
|  | \* | A1 (7) |
|  |  | **[15]** |
| **12. (a)** | or | **M1** |
|  | or | **A1** |
|  |  | **(2)** |
| **(b)** | So: = | **M1** |
|  | = | **M1** |
|  | =  ( or  ) | **A1cso** |
|  |  | **(3)** |
|  |  | **[5]** |

|  |  |  |
| --- | --- | --- |
| **13.** | - 9 | M1 A1 |
| Put **= 0** and obtain **…. (Allow sign errors only)** | dM1 |
|  | M1 A1 |
| *y* = | M1 |
| So *y* = 80ln 3 - 41 | A1 |
|  |  | **[7]** |

|  |  |  |
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| **Question**  **Number** | **Scheme** | **Marks** |
| **14 (i)** | detP = -*d* - 1 | B1 |
| **(ii)** | **or** minors  **or**  cofactors  a **correct** first step | B1 |
|  | M1 A1 A1 |
|  |
|  |  | **[5]** |

|  |  |  |  |
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| **15(a)** |  | | M1 |
|  | | M1 |
|  | | A1 |
|  | | (3) |
| **(b)** |  | | M1A1 |
|
|  | | M1 |
| 52 | | dM1 A1 |
|  | | (5) |
| **(c)** |  | | M1A1 |
|
|  |  | | M1: dir = pos.vectordir **(This way round)** |
|  |  | | M1A1 |
|  |  |  | (6) |
|  |  | | **[14]** |