Question 11 (8 marks)

(a) Determine the equations of all asymptotes of the graph of when

(i) . (2 marks)

(ii) . (2 marks)

<EFOFEX>
id:fxd{ceb15cb5-42b9-4826-b51c-b80f23c89254}

FXData:

</EFOFEX>

(b) The graph of is shown  
in the diagram, together with its  
three asymptotes.  
  
The defining rule is given by  
  
 and are positive  
integer constants.  
  
Determine, with brief reasons, the value of and . (4 marks)

Question 11 (8 marks)

(a) Determine the equations of all asymptotes of the graph of when

(i) . (2 marks)

|  |
| --- |
| Solution |
| Asymptotes: . |
| Specific behaviours |
| ✓ horizontal asymptote  ü all asymptotes |

(ii) . (2 marks)

|  |
| --- |
| Solution |
| Asymptotes: , . |
| Specific behaviours |
| ✓ oblique asymptote  ü all asymptotes |

<EFOFEX>
id:fxd{ceb15cb5-42b9-4826-b51c-b80f23c89254}

FXData:

</EFOFEX>

(b) The graph of is shown  
in the diagram, together with its  
three asymptotes.  
  
The defining rule is given by  
  
 and are positive  
integer constants.  
  
Determine, with brief reasons, the value of and . (4 marks)

|  |
| --- |
| Solution |
| Asymptote .  Root at .  Asymptote .  Asymptote . |
| Specific behaviours |
| ✓üüü each value with appropriate reason |

Question 14 (9 marks)

The graph of is shown on the left-hand axes in the diagram below.

<EFOFEX>
id:fxd{9a1561dd-a499-4f7f-a82a-4331e55ca192}

FXData:

</EFOFEX>

(a) Sketch the graph of on the right-hand axes in the diagram. (5 marks)

(b) Solve the following equations.

(i) . (1 mark)

(ii) . (1 mark)

(iii) . (2 marks)

Question 14 (9 marks)

The graph of is shown on the left-hand axes in the diagram below.

<EFOFEX>
id:fxd{720dddee-b84e-49fe-8884-cfbcbbdb8e64}

FXData:

</EFOFEX>

|  |
| --- |
| Solution (a) |
| See graph. |
| Specific behaviours |
| ✓ indicates all vertical asymptotes  ü correct graph for  ü correct graph for  ü correct graph for  ü correct graph for |

(a) Sketch the graph of on the right-hand axes in the diagram. (5 marks)

(b) Solve the following equations.

(i) . (1 mark)

|  |
| --- |
| Solution |
| For . |
| Specific behaviours |
| ✓ correct solution set |

(ii) . (1 mark)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ correct solution set |

(iii) . (2 marks)

|  |
| --- |
| Solution |
| Roots and intervals where : |
| Specific behaviours |
| ✓ includes roots  ü correct solution set |

Question 16 (8 marks)

(a) Determine all solutions to the equation in exact polar form. (3 marks)

(b) Consider the ninth roots of unity expressed in polar form .

(i) Determine the roots for which . (2 marks)

(ii) Use all nine roots to show that .

(3 marks)

Question 19 (8 marks)

Let where and are constants such that .

The graph of is shown below and passes through the points and .

<EFOFEX>
id:fxd{670468b3-ad5e-4766-9a75-9c5510949299}

FXData:

</EFOFEX>

(a) The equation has an infinite number of solutions. State the value of the constant . (1 mark)

(b) Determine the value of and . (5 marks)

(c) Determine the minimum value of . (2 marks)

Question 19 (8 marks)

Let where and are constants such that .

The graph of is shown below and passes through the points and .

<EFOFEX>
id:fxd{670468b3-ad5e-4766-9a75-9c5510949299}

FXData:

</EFOFEX>

(a) The equation has an infinite number of solutions. State the value of the constant . (1 mark)

|  |
| --- |
| Solution |
| is slope of RH part of . |
| Specific behaviours |
| ✓ correct value |

(b) Determine the value of and . (5 marks)

|  |
| --- |
| Solution |
| Equation of RH part of is and since then  Equation of central part of is and so either  or .  If then but this is impossible given that  Solving and gives .  Solving and gives and .  Values: . |
| Specific behaviours |
| ✓ uses RH part to form equations for and  ü uses central part to form equations for and  ü repeats for and and eliminates impossible pair of equations  ü correct values for and  ü correct values for and |

(c) Determine the minimum value of . (2 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ indicates correct method to obtain -coordinate  ü correct minimum |

Question 9 (8 marks)

The graph of is shown below, where and and are all positive constants.

<EFOFEX>
id:fxd{4e3362be-ae90-4ebf-b5f2-c90e98c8c198}

FXData:

</EFOFEX>

(a) Determine the value of each of the constants and . (3 marks)

(b) Using the graph, or otherwise, solve

(i) . (1 mark)

(ii) . (2 marks)

(iii) . (2 marks)

Question 9 (8 marks)

The graph of is shown below, where and and are all positive constants.

<EFOFEX>
id:fxd{ea5152cc-3885-4dc0-b9f4-36a2324ccc33}

FXData:

</EFOFEX>

(a) Determine the value of each of the constants and . (3 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ value of , ü value of , ü value of |

(b) Using the graph, or otherwise, solve

|  |
| --- |
| Solution |
| intersects when . |
| Specific behaviours |
| ✓ correct solution |

(i) . (1 mark)

(ii) . (2 marks)

|  |
| --- |
| Solution |
| intersects when . |
| Specific behaviours |
| ✓ indicates on graph  ü correct solution |

(iii) . (2 marks)

|  |
| --- |
| Solution |
| intersects when . |
| Specific behaviours |
| ✓ indicates on graph  ü correct range of solutions |

Question 12 (8 marks)

In each part of this question, the dotted curve shown is the graph of .

(a) Sketch the graph of . (2 marks)

<EFOFEX>
id:fxd{9ee40060-160c-4193-bc80-f7234e95816c}

FXData:

</EFOFEX>

(b) Sketch the graph of . (4 marks)

<EFOFEX>
id:fxd{9ee40060-160c-4193-bc80-f7234e95816c}

FXData:

</EFOFEX>

(c) Sketch the graph of . (2 marks)

<EFOFEX>
id:fxd{9ee40060-160c-4193-bc80-f7234e95816c}

FXData:

</EFOFEX>

Question 12 (8 marks)

In each part of this question, the dotted curve shown is the graph of .

(a) Sketch the graph of . (2 marks)

<EFOFEX>
id:fxd{795b75f2-3635-4de6-a978-2c784c601f8d}

FXData:

</EFOFEX>

|  |
| --- |
| Solution |
| See graph |
| Specific behaviours |
| ü traces / reflects  ü cusps and local max near |

(b) Sketch the graph of . (4 marks)

<EFOFEX>
id:fxd{90b31578-6bc2-4ce3-b738-9afe317c1d53}

FXData:
</EFOFEX>

|  |
| --- |
| Solution |
| See graph |
| Specific behaviours |
| ✓ RH curve  ü asymptotes and curve between  ü location of stationary points for  ü LH curve |

(c) Sketch the graph of . (2 marks)

<EFOFEX>
id:fxd{ef37c724-41b7-487e-96f5-d7a29bae2b51}

FXData:

</EFOFEX>

|  |
| --- |
| Solution |
| See graph |
| Specific behaviours |
| ✓ endpoints and cusp at  ü symmetrical curves |

Question 16 (8 marks)

<EFOFEX>
id:fxd{242a1bc5-9bf0-40de-aa4a-e7485dbd0c95}

FXData:
</EFOFEX>The graphs of and  
 are shown at right.  
  
The functions are defined by  
  
and

(a) Explain why the inverse of is not a function. (1 mark)

(b) Determine the definition for the inverse of . (3 marks)

(c) Determine . (1 mark)

(d) Determine the domain for the function . (3 marks)

Question 16 (8 marks)

<EFOFEX>
id:fxd{242a1bc5-9bf0-40de-aa4a-e7485dbd0c95}

FXData:
</EFOFEX>The graphs of and  
 are shown at right.  
  
The functions are defined by  
  
and

(a) Explain why the inverse of is not a function. (1 mark)

|  |
| --- |
| Solution |
| is not a one-to-one function / fails horizontal line test / etc. |
| Specific behaviours |
| ü states valid reason |

(b) Determine the definition for the inverse of . (3 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ interchanges and , cross multiplies and expands  ü factors and obtains correct inverse  ü limits domain to range of |

(c) Determine . (1 mark)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ correct value |

(d) Determine the domain for the function . (3 marks)

|  |
| --- |
| Solution |
|  |
| Specific behaviours |
| ✓ indicates restriction on range of  ü indicates one correct bound of range  ü correct range |





































