A logo with a blue circle and black text

AI-generated content may be incorrect.

9811 Introduction to AEA worksheet

Mark scheme

| **Question Number** | **Scheme** | | **Marks** | **AOs** |
| --- | --- | --- | --- | --- |
| **1(a)** |  | cao but condone, e.g., | **B1** | 2 |
|  |  | **(1)** |  |
| **(b)** | or | Attempts to integrate the reciprocal term  or | **M1** | 1 |
|  | Correct integration ignoring the treatment of their limits, so allow for  or, e.g.,    Ignore any inclusion of + *c* | **A1** | 1 |
| **or** | Complete strategy to find the required area. | **M1** | 3 |
|  | cso but allow exact equivalents e.g. | **A1** | 2 |
|  |  | **(4)** |  |
| **(Total 5 marks)** | | | | |

| **Question Number** | **Scheme** | | **Marks** | **AOs** |
| --- | --- | --- | --- | --- |
| **2(a)** |  | Correct function for *y* in terms of *x* which may be implied by correct *a* or *b* | **M1** | 1 |
| o.e. | Either value correct | **A1** | 3 |
| o.e. | Both values correct | **A1** | 2 |
|  |  | **(3)** |  |
| **(b)** | A diagram of a function  AI-generated content may be incorrect. | Shape – must be only in quadrants 1 and 2  with two of the four intercepts/stationary points labelled correctly following through on their *a* and *b* | **B1ft** | 3 |
| Fully correct, with all intercepts and turning points labelled and roughly symmetric about | **B1** | 2 |
|  |  | **(2)** |  |
| **(Total 5 marks)** | | | | |

| **Question Number** | **Scheme** | | **Marks** | **AOs** |
| --- | --- | --- | --- | --- |
| **3(a)** |  | Correct form for the coefficient (or term) condoning absence of (–1)*r* | **B1** | 1 |
|  | Absorbs the  (–1)*r* across the terms in the numerator | **M1** | 3 |
| \* | cso Convincing proof with evidence of the correct terms in the numerator and some clear cancelling | **A1\*** | 2 |
|  |  | **(3)** |  |
| **(b)** |  | Two of the three required terms correct | **B1** | 1 |
|  | Expands and collects like terms in the numerator to achieve product of a linear and a quadratic factor where the quadratic term may or may not cancel | **M1** | 3 |
| \* | cso | **A1\*** | 2 |
|  |  | **(3)** |  |
| **(c)** | e.g.    or | Attempts to use the given expression for *S* and their answer to part (b) to relate the series to a sum – the LHS and the 3 might not be seen or they might have simply deduce the | **M1** | 3 |
|  | Deduces the correct sum and attempts to link to | **dM1** | 3 |
|  | cao | **A1** | 2 |
|  |  | **(3)** |  |
| **(d)** | Either:   * Requires substitution of  but the expansion is only valid for * The series diverges | Any correct reason. | **B1** | 2 |
|  |  | **(1)** |  |
| **(Total 10 marks)** | | | | |

| **Question Number** | **Scheme** | | **Marks** | **AOs** |
| --- | --- | --- | --- | --- |
| **4(a)** |  | Correct form for equation with correct radius. | **M1** | 1 |
|  | Correct answer only. | **A1** | 1 |
|  |  | **(2)** |  |
| **(b)** |  | Attempts Pythagoras using the difference in centres and sum of radii. May be implied. | **M1** | 3 |
|  | Expands and collects like terms. Condone if they also expand the  bracket. | **dM1** | 3 |
| \* | cso  Penalise inclusion of | **A1\*** | 2 |
|  |  | **(3)** |  |
| **(c)** |  | Substitutes in for  and  and attempts to simplify. | **M1** | 1 |
|  | cso – no need to state  but requires correct work. | **A1** | 2 |
|  |  | **(2)** |  |
| **(d)** |  | Attempts the gradient between successive centres. Must be generalised. Follow through on their | **M1** | 2 |
|  | Correct gradient independent of *n*. | **A1** | 3 |
| (Each line segment joining successive centres has a shared point and)  The gradient between successive centres is constant. Hence the centres lie on a straight line. | Fully correct work with justification that the centres lie on a straight line. | **A1**  **(S+)** | 2 |
|  |  | **(3)** |  |
| **(e)** |  | Correct equation of the straight line through centres for their gradient. | **B1** | 3 |
|  | Substitutes  and  into their straight line. | **M1** | 3 |
| \* | Achieves the given answer with no errors and at least one intermediate step. | **A1\*** | 2 |
|  |  | **(3)** |  |
|  | Award S1 for:   * a fully correct solution that is succinct but does not include the S+ point * a fully correct solution that may be laboured but includes the S+ point * a succinct solution that scores 11+ marks that includes the S+ point. | | **S1** | 2 |
| S+ for good proof of linearity of the centres. | | | | |
| **(Total 13+1 marks)** | | | | |
| **Alt (e) by sum of geometric series**  **(There are other similar approaches to this that should be marked in the same way)** | for | Correct equation of the straight line through centres for their | **M1** | 3 |
|  | Attempts sum of a geometric series for their | **dM1** | 3 |
| \* | Achieves the given answer with no errors and at least one intermediate step. | **A1\*** | 2 |
|  |  | **(3)** |  |

| **Question Number** | **Scheme** | | **Marks** | **AOs** |
| --- | --- | --- | --- | --- |
| **5(a)** |  | cao  Condone missing | **B1**  **B1** | 1  1 |
|  | Full attempt to eliminate *t* | **M1** | 3 |
| **and**  used | seen before replacing with and  replaced with | **dM1** | 1 |
| \* | cso  The *H* + may be recovered if justified. | **A1\*** | 2 |
|  |  | **(5)** |  |
| **(b)** |  | Sets *y* = 0 and attempts to differentiate implicitly wrt  Correct differentiation | **M1**  **A1** | 3  1 |
|  | Sets  (may occur at the same time as differentiating in which case the A1 may also be scored) | **dM1**  **(S+)** | 3 |
|  | Attempts to factorise and make *R* the subject or rearranges to make *R* the subject with correct algebra (may still be in terms of *x* and ) | **ddM1** | 1 |
| \* | cso may change to *R* and  at the final stage | **A1\*** | 2 |
|  |  | **(5)** |  |
| **(c)** |  | Replaces *x* with *R* and *y* with 0 and  with  in the given answer to (a) but condone use of  throughout | **M1** | 3 |
| **and** e.g. | Cancels  and (may not be seen due to trivial cancellation) and simplifies to  o.e. | **dM1** | 3 |
| e.g.  o.e. | Correct intermediate equation in one trig term | **A1**  **(S+)** | 1 |
|  | Makes ,   or  the subject | **ddM1** | 3 |
| \* | cso with sufficient steps shown proceeding to the given answer with no errors. | **A1\*** | 2 |
|  |  | **(5)** |  |
|  | Award S1 for:   * a fully correct solution that is succinct but does not include any S+ points * a fully correct solution that may be laboured but includes an S+ point * a succinct solution that scores 10+ marks that includes an S+ point. | | **S1** | 2 |
| S+ In part (b), changes to *R* and  when  is used.  S+ In part (c) clear and concise cancelling of terms and/or use of trigonometric identities. | | | | |
| **(Total 15+1 marks)** | | | | |