A logo with a blue circle and black text

AI-generated content may be incorrect.

9811 Introduction to AEA worksheet

Questions

**1.**

*y*

**![A white background with black dots

Description automatically generated]()A graph of a function

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*O*

–1



*R*

*x*

*C*

**Figure 1**





Figure 1 shows a sketch of part of the curve *C* with equation 

1. Determine the value of *k*

**(1)**

The finite region *R*, shown shaded in Figure 1, is bounded by the *x*-axis, the line with

  equation , *C* and the line with equation .

1. Show that the area of *R* is  where *a*, *b*, *c* and *d* are constants to be determined.

**(4)**

**(Total for Question 1 is 5 marks) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**2.**



The curve with equation  has the range  where *a* and *b* are

constants.

(a) Determine the value of *a* and the value of *b*.

**(3)**

(b) Sketch, for , the curve with equation



Show on your sketch the coordinates of any points of intersection with the axes and the

coordinates of any stationary points.

**(2)**

**(Total for Question 2 is 5 marks) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**3.** (a) Show that the coefficient of  in the binomial expansion of  is



**(3)**

(b) Hence show that the coefficient of  in the expansion of



is



where *A* and *B* are constants to be determined.

**(4)**

The infinite series *S*, is given by



Given that *S* can be written as



where *A* and *B* were determined in part (b) and for some value of *x*,

(c) determine the value of *S*.

**(3)**

A student attempts to use the same approach to find the sum of the infinite series



(d) Give one reason why the student will be unsuccessful in using this approach.

**(1)**

**(Total for Question 3 is 10 marks) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**4.**

A diagram of circles with a number of letters

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**Figure 2**

Figure 2 shows a sequence of circles,  which satisfy the following conditions:

*  touches the positive *y*-axis
*  has centre  and radius 
*  touches the positive *x*-axis for all 
*  touches  once for all 
*  for all 
*  forms a strictly increasing sequence.

1. Determine an equation for 

**(2)**

1. Show that



**(3)**

1. Show that



where  is a fully simplified function to be determined.

**(2)**

1. Prove that the centres of the circles lie on a straight line.

**(3)**

1. Show that



**(3)**

**(+S1)**

**(Total for Question 4 is 14 marks) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**5.** A particle is projected from a point *H* metres above a horizontal plane.

The particle

* has initial speed *U* m s-1
* is projected an angle of elevation  above the horizontal, where  may vary
* moves freely under gravity until it strikes the horizontal plane

When the particle has travelled a horizontal distance *x* metres, its height above the horizontal plane is *y* metres.

1. Show that



**(5)**

Given that the maximum horizontal distance travelled by the particle, *R* metres, is achieved when 

1. show that



**(5)**

1. Hence, show that



**(5)**

**(+S1)**

**(Total for Question 5 is 16 marks) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**(TOTAL FOR QUESTION PAPER IS 50 MARKS)**