

**GRADE 12 SEPTEMBER 2015**

**ADVANCED PROGRAMME MATHEMATICS**

**PAPER 1 ALGEBRA AND CALCULUS**

**2 HOURS 200 MARKS**

**INSTRUCTIONS:**

1. Answer all the questions.

2. This question paper consists of 12 questions and 4 information sheets and a diagram sheet for question 4.2 and 12.

3. Non-programmable and non-graphical calculators may be used.

4. All necessary calculations must be clearly shown and writing must be legible.

5. All answers should be given to 2 decimal places.

6. Pace yourself. Aim to answer 50 marks in 30 minutes.

**QUESTION 1**

Given the formula 

1.1 Determine the value of the first three terms of the series. (3)

1.2 Using Mathematical Induction, prove the formula true for all

natural values of *n*. (13)

 **[16]**

**QUESTION 2**

2.1 Solve for where (8)

2.2 Solve the equation , giving your answers in the

 form , where and are rational numbers. (6)

2.3 Solve for : (8)

2.4 Decompose into its partial fractions. (6)

 **[28]**

**QUESTION 3**

3.1 The polynomial is divisible by

 Find the value of and (8)

3.2 Find the values of the two real numbers and such

 that . (10)

 **[18]**

**QUESTION 4**

4.1 The function of is represented by the graph below:



 Give all the values of for which:

 (a) the limit exists, but the function is not defined. (2)

 (b) the left and right hand limits both exist, but they are

unequal. (2)

(c) is continuous but not differentiable. (2)

(d) (3)

(e) State reason. (3)

4.2 The diagram shows the graph of the function



**Answer this question on the diagram sheet.**

Using the diagram and without solving for and draw separate sketches on the set of axes provided, clearly showing all intercepts

with the axes, and asymptotes where applicable.

 (a) (3)

 (b) The inverse function, (5)

 **[20]**

**QUESTION 5**

5.1 Find the derivative of . (Do not Simplify your answer.) (6)

5.2 Find the gradient of the tangent to the curve defined by the equation at the point . (16)

5.3 If

 (a) determine (4)

 (b) prove that (5)

 **[31]**

**QUESTION 6**

The diagram shows in which

The circle, centre radius 3 cuts at ; the circle, centre radius 3, cuts at

6.1 Determine the size of angle CAB, giving your answer in radians

 to four decimal places. (4)

6.2 The region shaded in the diagram, is bounded by the arcs

 and the straight line . Calculate:

 (a) the perimeter of the region (4)

 (b) the area of sector (2)

 (c) the area of the region (6)

 **[16]**

**QUESTION 7**

It is required to solve : using Newton’s method.

If is a reasonable first approximation, solve for the nearest

solution, correct to 5 decimal places. Show proof of iteration. **[8]**



**QUESTION 8**

Use Riemann Sums to determine the

shaded area bounded by the curve

 , the axes and the line

 **[10]**

**QUESTION 9**

Determine the following integrals:

9.1 (4)

9.2 (6)

9.3 (4)

9.4 (10)

 **[24]**

**QUESTION 10**

Given the function

10.1 Determine the equation of the oblique asymptote of the

 graph of (6)

10.2 Does the oblique asymptote intersect the graph? Motivate

 your answer. (3)

 **[9]**

**QUESTION 11**

The fuel tank on the wing of a jet is formed by

rotating the region bounded by

 about the axis between

 and where units are measured in

metres.



11.1 Write down the definite integral to calculate the volume of the

 fuel tank. (4)

11.2 Show by calculation that the volume is cubic metres. (6)

 **[10]**

**QUESTION 12**

There is a small amount of water currently in a W-shaped container

below . The container is a prism with W-cross section throughout.

A tap is turned on so that the water flows at a constant rate into the

left side of the container.

**Sketch a graph on the diagram sheet** of the height of the water, ,

as recorded on the metre –stick shown in the left side of the

container as a function of time, . Clearly label your graph all the

salient points and added explanations where necessary.



 **[10]**

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| TOTAL MARKS = 200 |

**GRADE 12 APM P1 DIAGRAM SHEET NAME……………………..**

4.2 (a)



4.2 (b)

**GRADE 12 APM P1 DIAGRAM SHEET NAME……………………..**

12.

