**Question 1 – 12 marks Start in a new answer booklet**

a. Find the reciprocal of . **2**

b. Solve the following inequality for , and graph your solution

on a number line: **3**

c. Find the co-ordinates of the point which divides the join of and

externally in the ratio . **2**

d. Find the acute angle between the lines and ,  
correct to the nearest minute. **2**

e. By using a substitution of , or otherwise, solve the equation

. **3**

**Question 2 – 12 marks Start in a new answer booklet**

a. Simplify . **1**

b. is the line and

is the line .

i. Describe geometrically what the equation **1**

represents for various values of .

ii. Show that the equation in (i) may be written **1**

.

iii. Solve the equation in (ii) when:

α. ; **1**

β. ; and **1**

γ. explain the significance of the results with regard   
 to the lines and . **1**

c. is a factor of

i. Find the value of . **1**

ii. Find all the roots of . **3**

d. If are the roots of ,  
 find the value of . **2**

**Question 3 – 12 marks Start in a new answer booklet**

a. Solve the equation for . **3**

b. Prove . **3**

*E*

*C*

*B*

*A*

*D*

Diagram not to scale

c.

*A, B, C, D* and *E* are points on the circumference of a circle **3**  
such that *AB* is parallel to *EC.*

Copy the diagram into you answer booklet.

Prove that  *= .*

d. Consider the statement:  *is divisible by 4.* **3**

Show that, if the statement is true for , then it is true for .

**Question 4 – 12 marks Start in a new answer booklet**

a. Find the possible values of if satisfies the equation **3**

.

b. is the limiting sum of the GP

is the limiting sum of the GP

If , find . **3**

Question 4 continues on the next page

c.

*B*

*A*

*Q*

*P*

*h*

*1000 m*

Diagram not to scale

The angle of elevation of a tower *PQ* of height *h* metres at a point *A* due east  
of it is .  
From another point *B*, the bearing of the tower is and the angle of   
elevation is .  
The points *A* and *B* are 1000 metres apart and on the same level as the base *Q* of   
the tower.

i. Show that angle  *= .* **2**

ii. Consider the triangle *APQ* and show that *AQ = .* **1**

iii. Find a similar expression for *BQ* . **1**

iv. Use the cosine rule in the triangle *AQB* to calculate *h*  to the nearest metre. **2**

**Question 5 – 12 marks Start in a new answer booklet**

a. i. Find if . **1**

ii. Hence, or otherwise, find . **2**

b. Prove that the graph of has one turning point, and find its co-ordinates  
 (in terms of *e*). **3**

c. Sketch graph of the three functions:

, and **2**

in the same number plane.

d. Let , where is a positive integer.

Prove by mathematical induction that . **4**

**Question 6 – 12 marks Start in a new answer booklet**

a. Find the number of terms in the series:

whose sum is 420. **3**

b. Consider the series:

**3**

Find the set of values of for which this series has a limiting sum.

c. Consider the circle .   
Show that if the line intersects the circle at two distinct points, then **3**

.

d. Show that the equation of the tangent to the graph of ,  
at the point is . **3**

**Question 7 – 12 marks Start in a new answer booklet**

a. The point lies on the parabola . The focus *S* is the point .  
 The tangent at meets the *y*-axis at *Q*.

Draw a sketch representing this data.

i. Show that the equation of the tangent at is . **1**

ii. Find the co-ordinates of Q. **1**

iii. Prove *SP = SQ.* **2**

iv. Hence show that . **2**

b. Consider the function .

i. State the domain. **1**

ii. Sketch the graph. **1**

iii. Find the area between the arc of the graph from to **2**  
 and the .

iv. The area in part (iii) is rotated about the through one complete **2**  
 revolution; determine the volume of the solid generated.

**End of Assessment**