

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Education
Advanced Level Examination
June 2015

Mathematics

MFP2

Unit Further Pure 2

Tuesday 16 June 2015 1.30 pm to 3.00 pm

For this paper you must have:

- the blue AQA booklet of formulae and statistical tables.
- You may use a graphics calculator.

Time allowed

- 1 hour 30 minutes

- Instructions**
- Use black ink or black ball-point pen. Pencil should only be used for drawing.
 - Fill in the boxes at the top of this page.
 - Answer **all** questions.
 - Write the question part reference (eg (a), (b)(i) etc) in the left-hand margin.
 - You must answer each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do **not** use the space provided for a different question.
 - Do not write outside the box around each page.
 - Show all necessary working; otherwise marks for method may be lost.
 - Do all rough work in this book. Cross through any work that you do not want to be marked.

- Information**
- The marks for questions are shown in brackets.
 - The maximum mark for this paper is 75.

- Advice**
- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
 - You do not necessarily need to use all the space provided.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	



J U N 1 5 M F P 2 0 1

Answer **all** questions.

Answer each question in the space provided for that question.

1 (a) Express $\frac{1}{(r+2)r!}$ in the form $\frac{A}{(r+1)!} + \frac{B}{(r+2)!}$, where A and B are integers.

[3 marks]

(b) Hence find $\sum_{r=1}^n \frac{1}{(r+2)r!}$.

[2 marks]

QUESTION
PART
REFERENCE

Answer space for question 1



QUESTION
PART
REFERENCE

Answer space for question 1

A large rectangular area with horizontal dotted lines for writing an answer.

Turn over ►



2 (a) Sketch the graph of $y = \tanh x$ and state the equations of its asymptotes. **[3 marks]**

(b) Use the definitions of $\sinh x$ and $\cosh x$ in terms of e^x and e^{-x} to show that

$$\operatorname{sech}^2 x + \tanh^2 x = 1$$

[3 marks]

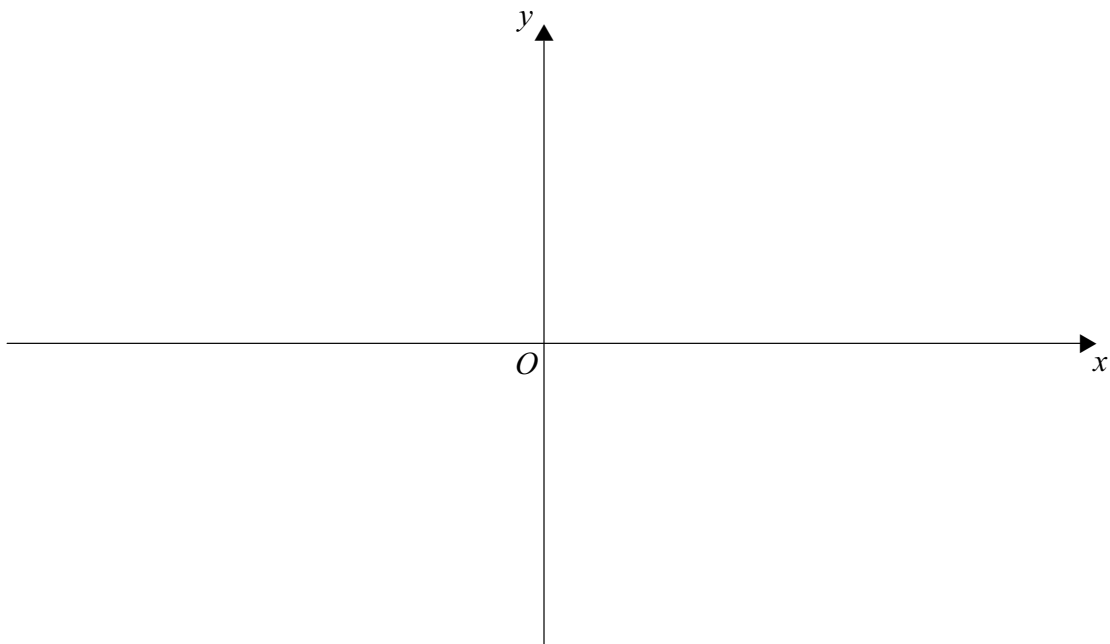
(c) Solve the equation $6 \operatorname{sech}^2 x = 4 + \tanh x$, giving your answers in terms of natural logarithms.

[5 marks]

QUESTION
PART
REFERENCE

Answer space for question 2

(a)



QUESTION
PART
REFERENCE

Answer space for question 2

A large rectangular area with horizontal dotted lines for writing an answer.

Turn over ►



QUESTION
PART
REFERENCE

Answer space for question 3

A large rectangular area with horizontal dotted lines for writing an answer.

Turn over ►



- 4** The expression $f(n)$ is given by $f(n) = 2^{4n+3} + 3^{3n+1}$.
- (a)** Show that $f(k+1) - 16f(k)$ can be expressed in the form $A \times 3^{3k}$, where A is an integer. **[3 marks]**
- (b)** Prove by induction that $f(n)$ is a multiple of 11 for all integers $n \geq 1$. **[4 marks]**

QUESTION
PART
REFERENCE

Answer space for question 4



QUESTION
PART
REFERENCE

Answer space for question 4

A large rectangular area with horizontal dotted lines for writing an answer.

Turn over ►



5 The locus of points, L , satisfies the equation

$$|z - 2 + 4i| = |z|$$

(a) Sketch L on the Argand diagram below.

[3 marks]

(b) The locus L cuts the real axis at A and the imaginary axis at B .

(i) Show that the complex number represented by C , the midpoint of AB , is

$$\frac{5}{2} - \frac{5}{4}i$$

[4 marks]

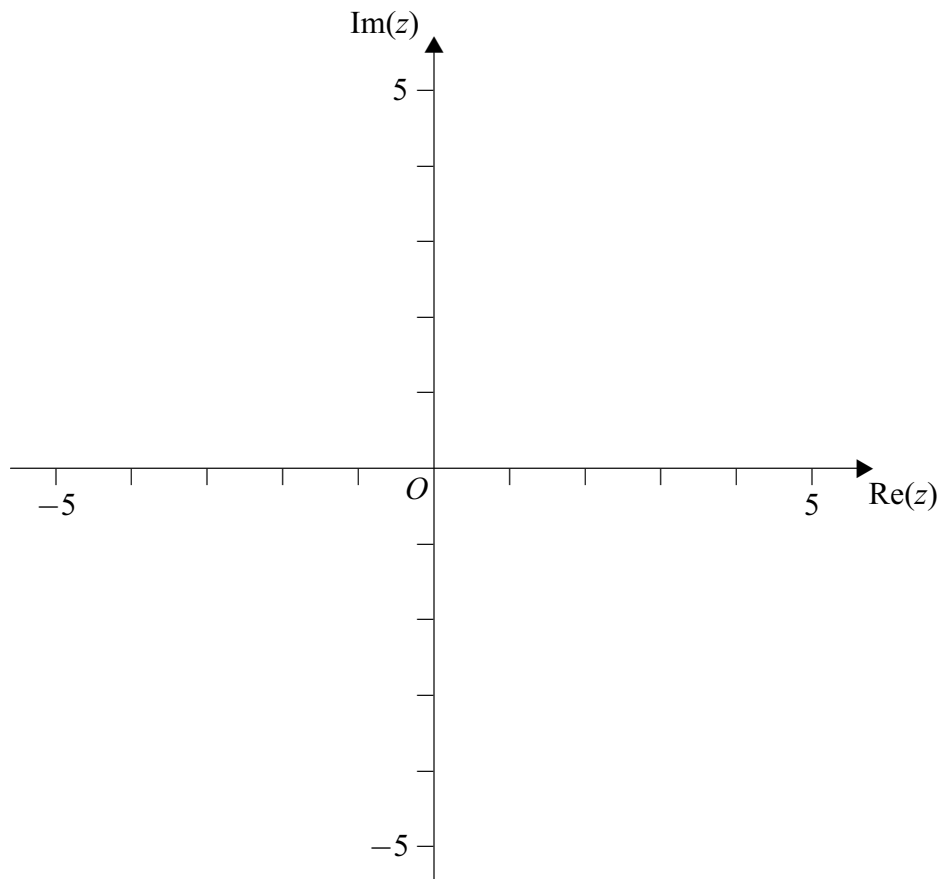
(ii) The point O is the origin of the Argand diagram. Find the equation of the circle that passes through the points O , A and B , giving your answer in the form $|z - \alpha| = k$.

[2 marks]

QUESTION
PART
REFERENCE

Answer space for question 5

(a)



QUESTION
PART
REFERENCE

Answer space for question 5

A large rectangular area with horizontal dotted lines for writing an answer.

Turn over ►



QUESTION
PART
REFERENCE

Answer space for question 6

A large rectangular area containing horizontal dotted lines for writing an answer.

Turn over ►



QUESTION
PART
REFERENCE

Answer space for question 7

A large rectangular area with horizontal dotted lines for writing an answer.



QUESTION
PART
REFERENCE

Answer space for question 7

A large rectangular area containing horizontal dotted lines for writing an answer.



QUESTION
PART
REFERENCE

Answer space for question 7

A large rectangular area with horizontal dotted lines for writing an answer.

Turn over ►



QUESTION
PART
REFERENCE

Answer space for question 8

A large rectangular area with horizontal dotted lines for writing an answer.

Turn over ►



QUESTION
PART
REFERENCE

Answer space for question 8

A large rectangular area with horizontal dotted lines for writing an answer.

END OF QUESTIONS

Copyright © 2015 AQA and its licensors. All rights reserved.

