



The Open University

## E-Learning and a distance masters programme

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## Introduction

- Distance learning masters in mathematics
- Started in 1985
- Most modules are based on text books with study notes
- Assessment is by written assignments and 3 hour examination
- Student support uses part time tutors
  - ▶ telephone
  - ▶ conventional post
  - ▶ more recently email



## Online forums

- Online forums allow asynchronous discussion between students.
- These were introduced about 10 years ago.
- Example
  - ▶ The following discussion had about 70 readers.
  - ▶ There are about 140 students on the course.



## Sample posting

### Exercise 6.2 and monotonic functions

The solution to Exercise 6.2 states that the Euler-Lagrange equation for a particular system is

$$z''G'(z)^2 + G''(z)G'(z)z'^2 = 0$$

It then divides through by  $G'(z)$  to get

$$z''G'(z) + G''(z)z'^2 = 0$$

Justifying this on the basis that  $G(z)$  is monotonic, so  $G'(z) \neq 0$ . However, a function being monotonic only ensures that it is either non-decreasing or non-increasing and so the first derivative does not change sign. It does not guarantee that the first derivative is non-zero. For that  $G'(z)$  must be *strictly* increasing or decreasing. Given that, is the derivation valid?

# Response 1



I thought the idea was that  $G'(z)$  must not be constant 0.



## Response 2

I think it is valid, just presented a bit sloppily: the equation can be written  $G'(z)(z''G'(z) + G'''(z)z'^2) = 0$ , and then you seek a function  $G'$  which makes the L.H.S. zero:  $G'(z)$  can be the constant zero, but we are not interested in this triviality.  $G'$  can also be a solution to the smaller problem  $z''G'(z) + G'''(z)z'^2 = 0$  in which case the above factorization demonstrates that this would also be a solution of the full problem.

``Dividing  $G'$  out'' is just a short-circuited way of saying the same thing.



## Challenges

- Participation
- Inappropriate postings (eg links to illegal downloads)
- Too many trivial postings
- Managing expectations

Good moderation resolves many of these



## The use of a Virtual Learning Environment

- Introduced about 3 years ago
- Everything in one place
- Participation in forums has increased
- Some resources are now only available online

▶ Programme website

▶▶ Electronic marking



# The web page



MSCMATHS-11B MSc in Mathematics

### MSc in Mathematics



### News

**New eTutorial date announced for M828**  
16 May

**New forum** 5 May

**Date for your diary - eColloquium 7 September** 3 May

[View all messages in full](#)

### Forums

- Cafe (Unread posts)
- Module choice (Unread posts)
- M820-11B (Unread posts)
- M821-11B (Unread posts)
- M823-11B (Unread posts)

### Module Resources

Your progress ?

#### Tutor-only area

- Maths eTMA documentation
- Elluminate tutorials
- Word 2007 Guide
- AL Pack 2011B (654.6KB)
- MSc Maths Tutor Website
- Tutors

#### Maths eTMA system

- Guide to the maths eTMA system
- Link to the maths eTMA system

#### Programme-related information

- Programme material
- eColloquium on fractals (27.7MB)  
Here is a recording of the eColloquium given on 13 April 2010 by Prof Kenneth Falconer of the University of St. Andrews entitled "Symmetry and Enumeration of Fractals".
- eColloquium on networks (20.9MB)  
Here is a recording of the eColloquium given on 24 February 2011 by Prof Ian Stewart of the Warwick Mathematics Institute entitled "The emerging science of networks".  
You can visit Prof Stewart's home page [here](#).
- There will be an eColloquium on 7 September on computability and/or complexity. More information will be given nearer the time.
- Link to eColloquium room

#### Module-related information

- Material for M820 (The calculus of variations and advanced calculus)



## History of marking

- Paper submission
- Majority of departments made electronic submission compulsory 5 - 10 years ago
- Relatively small number of tutors meant Maths MSc suitable for trial
- Now in our third year

# Students



- Electronic submission does not mean electronic production
- Scanned handwritten,  $\text{\LaTeX}$ produced, Word etc allowed for
- Now moving to requiring pdf format submissions
  - ▶ 'How to convert to pdf' instructions are being piloted

# Tutors



- Printing > marking > scanning is not an option
- Tutors are loaned tablet laptops with pdf annotation software
- Most problems have been with our downloading and uploading systems

# Sample



and

(\*)

$$(B_{n+2}f)^n = \sum_{k=0}^n \frac{n!}{k!(n-k)!} x^k (1-x)^{n-k} \left(\frac{n+1}{n+2}\right) f''(\xi_k) \quad \checkmark \text{ Excellent}$$

where  $\xi_k$  is in the interval  $\frac{k}{n+2} \leq \xi_k \leq \frac{k+2}{n+2}$  for  $k=0,1,\dots,n$

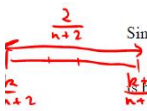
Then using the Bernstein Operator we get

$$|B_n(f'') - (B_{n+2}f)^n| = \left| \sum_{k=0}^n \frac{n!}{k!(n-k)!} x^k (1-x)^{n-k} \left( f''\left(\frac{k}{n}\right) - \left(\frac{n+1}{n+2}\right) f''(\xi_k) \right) \right|$$

$$\leq \max_{k=0,1,\dots,n} \left| f''\left(\frac{k}{n}\right) - f''(\xi_k) \right| \leq \omega\left(\frac{1}{n+2}\right)$$

*this factor is close to 1, but you can't just replace it by 1 here*

-4



Since  $\frac{n+1}{n+2} < 1$  for all  $n$  and  $\omega$  is the modulus of continuity for function  $f''$ , given that  $k/n$

is between  $\frac{k}{n+2}$  and  $\frac{k+2}{n+2}$

*instead use the triangle inequality*

$$|f''\left(\frac{k}{n}\right) - \frac{n+1}{n+2} f''(\xi_k)| \leq |f''\left(\frac{k}{n}\right) - f''(\xi_k)| + \frac{1}{n+2} |f''(\xi_k)|$$

$$\leq \omega\left(\frac{2}{n+2}\right) + \frac{1}{n+2} \|f''\|_\infty$$

$$\rightarrow 0 \quad \rightarrow 0$$

Now since the equality is independent of  $x$  then

$$\lim_{n \rightarrow \infty} \|B_n(f'') - (B_{n+2}f)^n\|_\infty \leq \lim_{n \rightarrow \infty} \omega\left(\frac{2}{n+2}\right) = 0$$

as required.



## Current situation

- Electronic submissions steadily increasing
- Tutors are managing
- Administration much easier
- We are testing cheaper alternatives such as slates



## Online lectures and tutorials

- Historically there were no face to face sessions
- Now possible to deliver lectures/tutorials
  - ▶ Tutor/Lecturer with good internet link eg broadband at home
  - ▶ Students with internet link (dial-up is possible)
  - ▶ Audio is possible for both tutors and students
  - ▶ Chatbox facility works well
  - ▶ Tutors often use tablet laptops to aid drawing/writing on the whiteboard
  - ▶ Recording is possible
- These are proving very popular



## eColloquia with visiting speakers

- Uses the same software (Elluminate) as tutorials
- Gives distance learners opportunities not previously possible
- The last one (Ian Stewart) had around 200 attending





## Short 5 - 10 minute screencasts

Mathematics Statistics and Operational Research network funded miniproject

- Short screencasts showing worked examples are being produced and evaluated
- Early results indicate that they are very popular

*They were fantastically helpful, and paced just right. I would like to see screencasts on every topic! But, of course, if I hadn't attempted the work beforehand, they would be much less useful.*

▶ [Screencast website](#)

▶ [Partial differentiation screencast](#)



## Where are we?

- Improvement in retention/progression???
- Administration pluses and minuses
- Managing expectations
- Improved collegiate experience for both tutors and students
- Accessibility issues