

A renaissance of  
pen-and-paper  
... in a digital age.

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CETL MSOR Conference 2014

# Renaissance

/rɪˈneɪs(ə)ns,-ɔːs/

*noun*

the revival of European art and literature under the influence of classical models in the 14th–16th centuries.

- the culture and style of art and architecture developed during the Renaissance.

noun: Renaissance

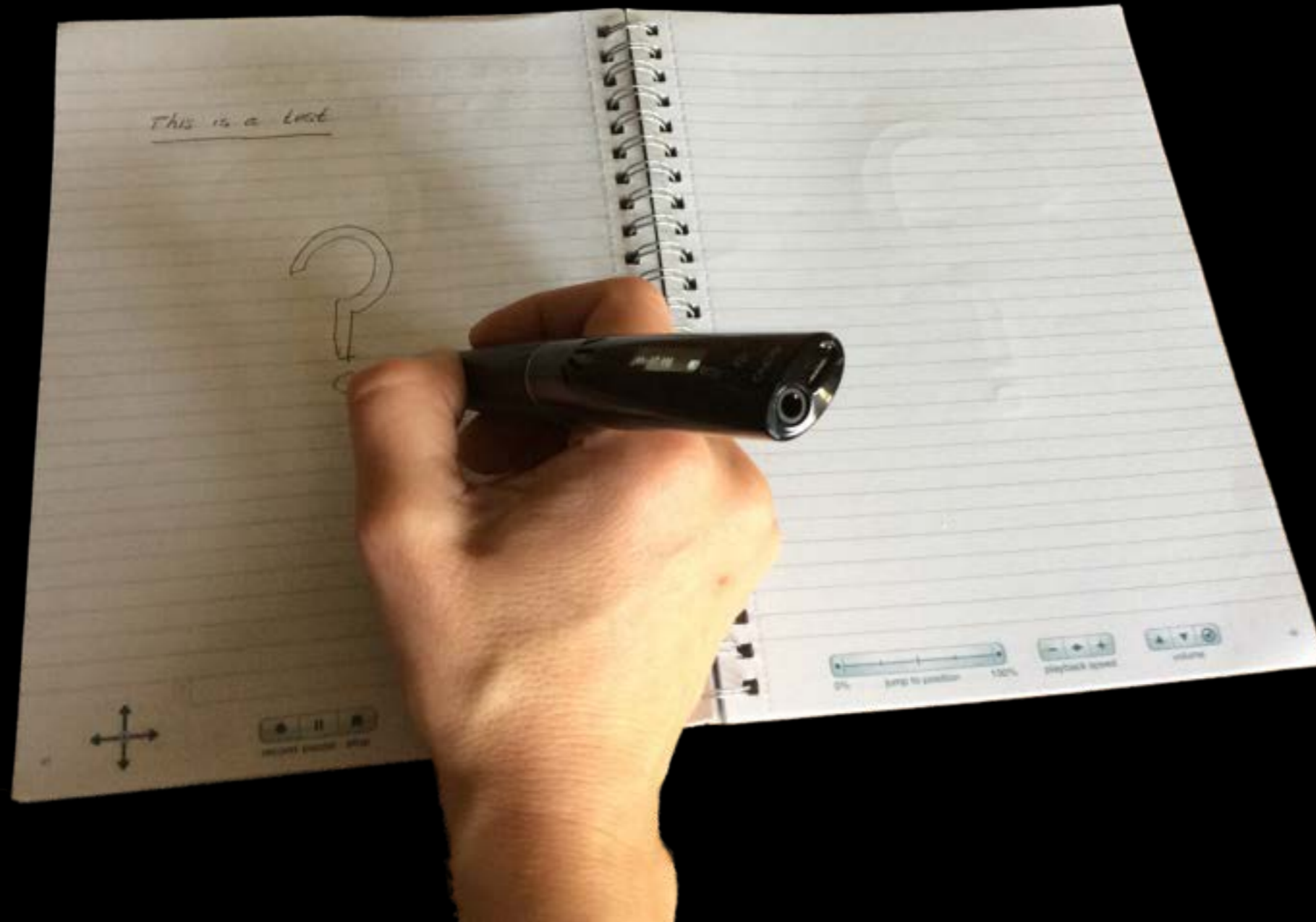
- a revival of or renewed interest in something.

noun: renaissance; plural noun: renaissances

"cinema-going is enjoying something of a renaissance"



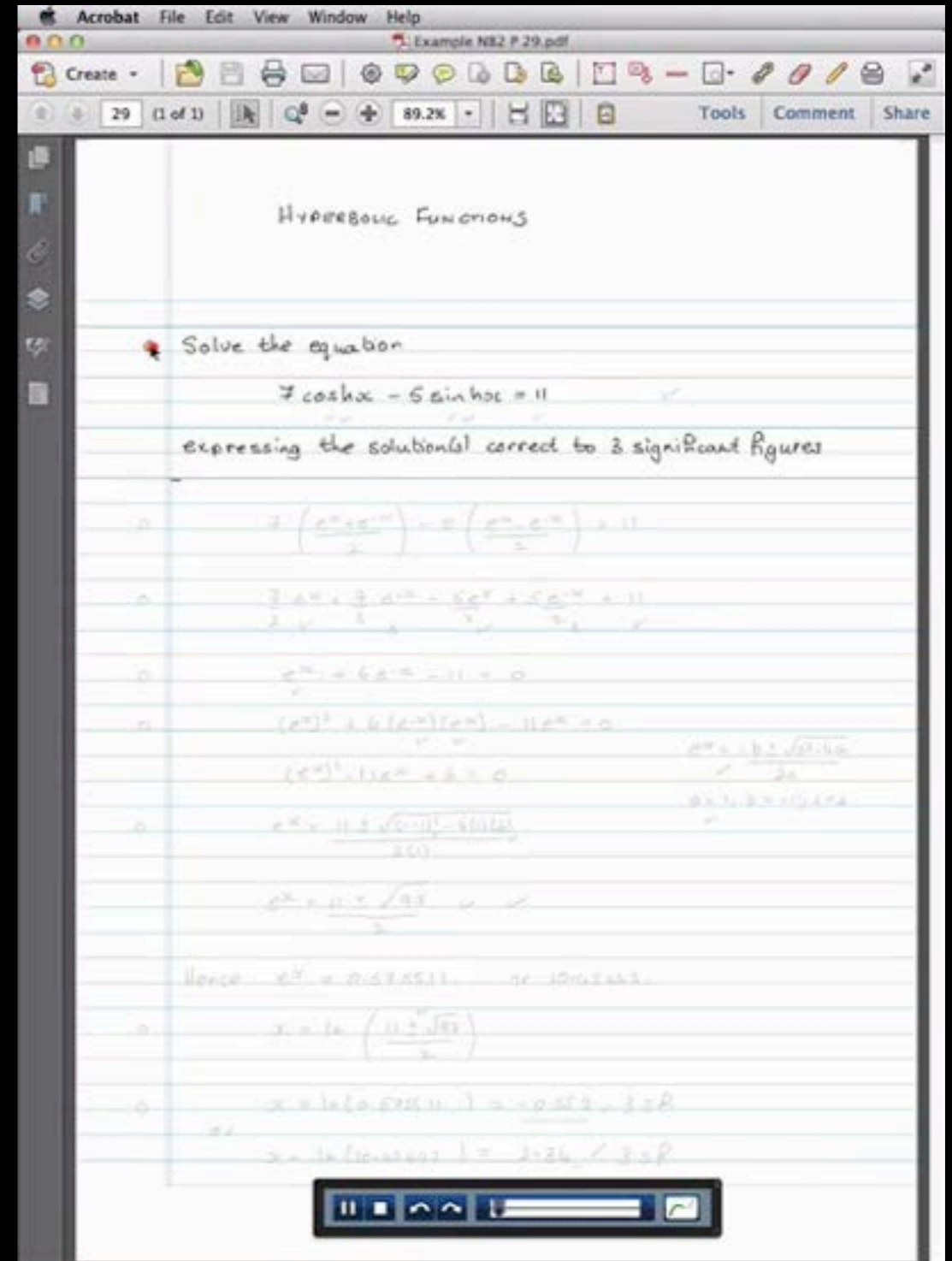
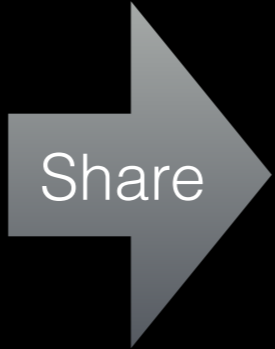
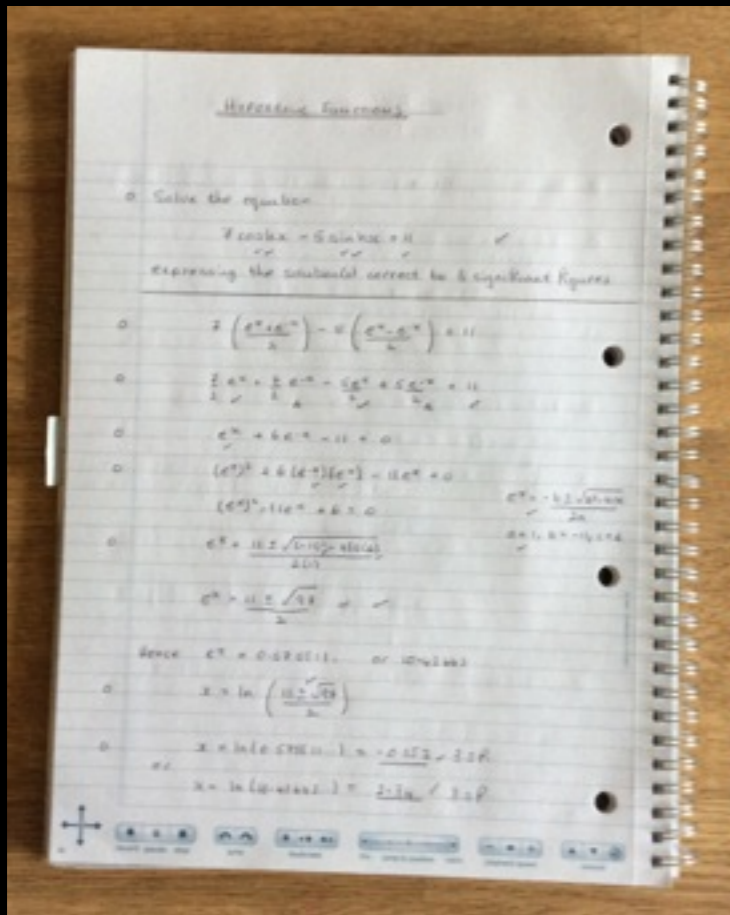
# A digital age ...



# Livescribe™ paper-based computing platform



# Record and Playback



# My view - Sharing

The screenshot shows the Livescribe Desktop application interface. The top menu bar includes 'Livescribe Desktop', 'File', 'Edit', 'View', 'Go', 'Audio Controls', 'Tools', 'Window', and 'Help'. Below the menu bar, there are navigation tabs for 'STORE' and 'COMMUNITY', and a search bar labeled 'search all notebooks'. The left sidebar contains a navigation menu with categories: PAGES (Imported Pencasts, Custom Notebooks, Madonna's 8 GB Echo), AUDIO (Sessions), APPLICATIONS (Smartpen Applications), CONNECT (Computer, Email, Evernote®, Facebook, Google™ Docs, Google™ Sites, MyLivescribe, Mobile), and LIVESCRIBE ONLINE (My Livescribe, Livescribe Store). The main content area displays a sharing interface for a file named 'CETL-MSOR Example'. A prominent orange warning icon and text state: 'In July 2014, we will begin phasing out the Livescribe Community, and it will close this winter. To download the pencasts you have uploaded to the Livescribe Community, go to [www.livescribe.com/community](http://www.livescribe.com/community), convert your pencasts into Livescribe PDFs, and save them to your computer.' Below this, there are sharing options: 'Email a Friend!', 'Get a link to this file', 'Share on Facebook', 'Embed this file', and 'Share on our Community'. A 'Sharing Preferences' section allows users to 'Make this File Private' or 'Edit Access List'. A yellow banner indicates 'This file is currently public' and 'Visitors will not be required to log in to view this file.' The file details include: 'Posted by: You on: Sep 04, 2014', 'File Size: 3.9MB', 'Category: Unspecified', 'Views: 0', 'Rating: ★★★★★', and 'Description: click to edit...'. A 'DELETE PENCAST' button is also visible. At the bottom, there is a 'Viewer Comments' section with the prompt 'Be the first to add a comment!' and an 'Add a Comment' button. The footer contains the copyright notice: 'Copyright © 2007-2013 Livescribe, Inc. All rights reserved.'

# Students view - Shared

The screenshot shows a web browser window with the Livescribe logo and navigation menu. The main content area displays a document titled "CETL-MSOR Example" posted by Madonna Herron on Sep 04, 2014. The document content is partially visible, showing mathematical equations. A sidebar on the left offers sharing options like "Email a friend", "Get a link to this file", "Share on Facebook", and "Embed this file". A "Viewer Comments" section is at the bottom.

The top image shows the title "Hyperbolic Functions" and the problem: "Solve the equation  $7 \cosh x - 5 \sinh x = 11$  expressing the solution correct to 3 significant figures".

The bottom image shows the same problem with a detailed solution:

$$7 \left( \frac{e^x + e^{-x}}{2} \right) - 5 \left( \frac{e^x - e^{-x}}{2} \right) = 11$$

$$\frac{7}{2} e^x + \frac{7}{2} e^{-x} - \frac{5}{2} e^x + \frac{5}{2} e^{-x} = 11$$

$$e^x + 6e^{-x} - 11 = 0$$

$$(e^x)^2 + 6(e^x)(e^{-x}) - 11e^x = 0$$

$$(e^x)^2 - 11e^x + 6 = 0$$

$$e^x = \frac{11 \pm \sqrt{121 - 24}}{2} = \frac{11 \pm \sqrt{97}}{2}$$

Since  $e^x > 0$  for all  $x$ , we take the positive root:

$$x = \ln \left( \frac{11 + \sqrt{97}}{2} \right)$$

$$x = \ln(10.478) = 2.349$$

The final answer is  $x = 2.35$  (to 3 significant figures).



# Print on paper and watermarking

Original PDF Content



Pencast PDF

Topic Numerical Methods - Integration  
Method Simpson's Rule

Use Simpson's rule, with 4 steps, to obtain an approximate value of the integral

$$I(x) = \int_1^2 \frac{x^2}{1+x^2} dx.$$

Work to five decimal places and quote your final answer to three decimal places.

Simpson's Rule:  
 $\int_a^b y dx = \frac{h}{3} (y_0 + 4y_1 + 2y_2 + 4y_3 + 2y_4 + \dots + 2y_{n-2} + 4y_{n-1} + y_n),$   
where  $h = \frac{b-a}{n}$  and  $n$  is even.

i	x	y	w
0	1	0	1
1	1.25	0.23222	4
2	1.5	0.5429	2
3	1.75	0.84446	4
4	2	1	1

To calculate ordinates using the table mode function on CASIO fx-83GT PLUS  
To invoke the table mode, enter **mode** **3**  
Enter (carefully) the function

f(x)=	ALPHA	X	^	2	÷	(	1	-	ALPHA	X	^	2	=
Start?	0	=											
End?	2	=											
Step?	0.5	=											

$$I_4 = \frac{h}{3} [(y_0 + y_4) + 4(y_1 + y_3) + 2(y_2)]$$

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where  $h = \frac{b-a}{n}$  and  $n$  is even.

$a=1, b=2, n=4 \therefore h = \frac{2-1}{4} = \frac{1}{4} \quad y_0 = \frac{1^2}{1+1^2}$

i	x	y	w
0	1	0	1
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Start?	0	=											
End?	2	=											
Step?	0.5	=											

$$I_4 = \frac{h}{3} [(y_0 + y_4) + 4(y_1 + y_3) + 2(y_2)]$$
$$I_4 = \frac{0.25}{3} [(0.44444) + 4(0.23222 + 0.84427) + 2(0.6)]$$
$$\approx 0.73176 \dots$$
$$I_4 \approx 0.732 \quad \text{3d}$$

Generic Feedback Total Mark 6

Handwritten notes on lined paper showing the same mathematical problem and solution as the other panels, but with a green pencil watermark and annotations.

**watermarked Pencast PDF**

# Pros and Cons

- Syncs audio to your handwritten notes.
- Accurate synchronisation.
- Excellent sound quality.
- Simple to use.
- Portable, both equipment and digital recordings.
- Facilitates a variety of learning modes.
- Excellent online support.
- Wide-range of apps.

# Pros and Cons

- Must use paper printed with a special microdot pattern.
- Audio session can not be edited.
- Online or PDF Ink colours limited to 3.
- Audio lost when viewing pencast PDFs on IOS devices.

# Pencasts for enhanced learning

- Created for first year undergraduate students studying mathematical methods.
- Access to 60+ pencasts.
- Average size of a pencast is 7 MB.
- Duration of 5 to 30 minutes.

# Feedback from students

82% of students found they helped them *understand* where they could *improve*.



# Feedback from students

79% of students found the pencasts *easy to understand*.



# Feedback from students

“... brilliant, it's like you are back in the classroom, can fully understand what is going on and the working out is clear.”

“... one thing reading a textbook ..., but actually seeing it carried out, with talking, really makes things easier to pick up and learn.”

“... great resource. Easy to listen to and follow, and having the recording to pause, rewind and so on makes it so much easier.”

# Some pencasting tips

- Use a script
- Speak after writing
- Pre-draw elements
- Pre-draw templates
- Pause and pop!
- Use visual cues
- Add annotations
- Keep it short
- Practise
- Get feedback

Remember to turn you pen on!



# Cost to get started!

Livescribe 2 GB echo smartpen ( $\approx$  £105)

Livescribe echo smartpen Edu Essential Bundle ( $\approx$  £140)

- Livescribe Echo 2GB Smartpen
- Livescribe Wifi/Echo 3D Recording Headset
- Livescribe A4 Single Subject Notebook

Livescribe echo smartpen Edu Bundle Extra ( $\approx$  £150)

- Same as above but with:
  - Livescribe Wifi/Echo/Pulse Ink Refill 5-pack (4 Blue, 1 Red)
- Livescribe Sky WiFi 2GB, 4GB Edu ( $\approx$  £160), 8GB smartpen
- Livescribe 3 smartpen - £130 - Pro ( $\approx$  £170) (iOS7 iPhone/iPad)

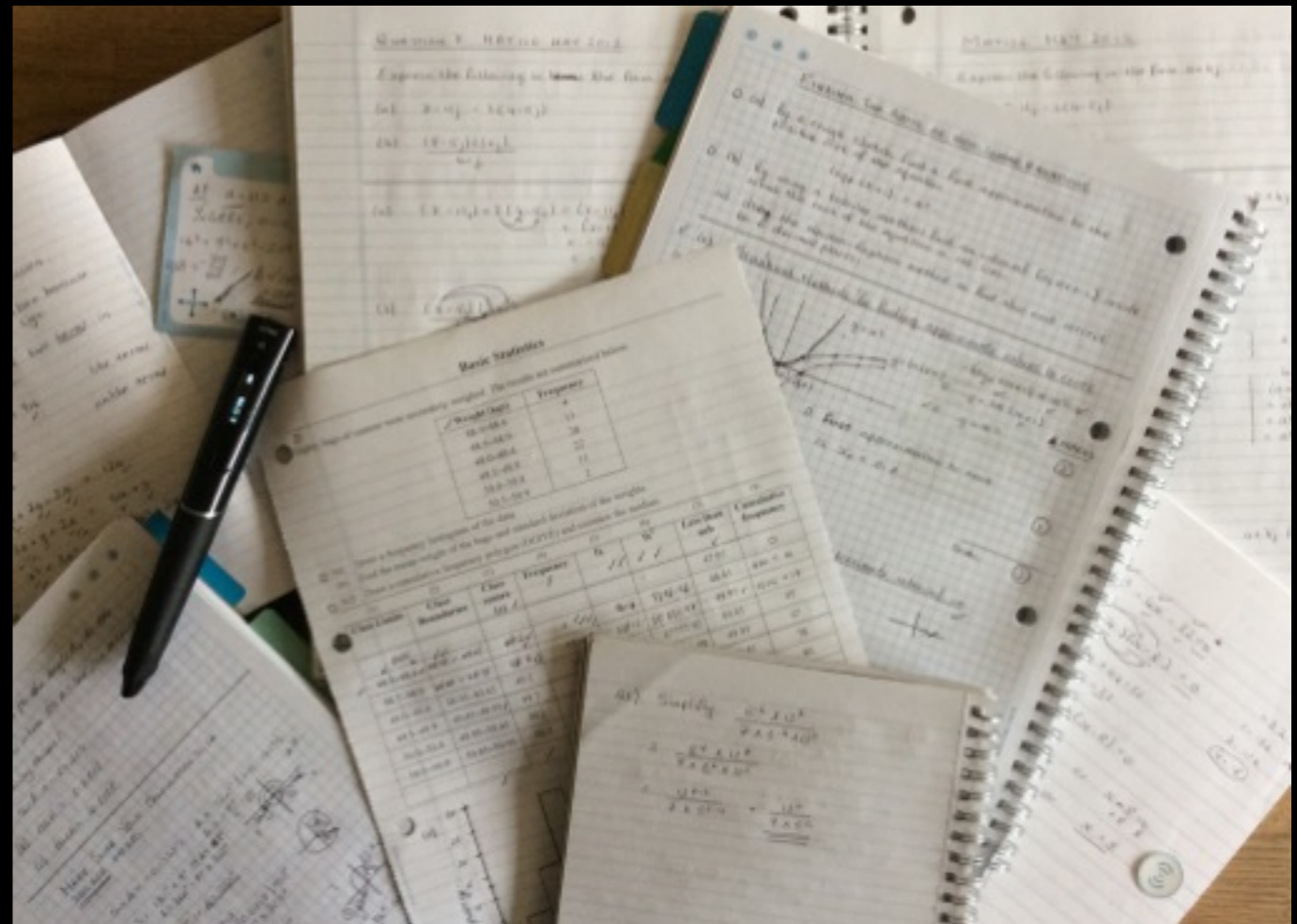
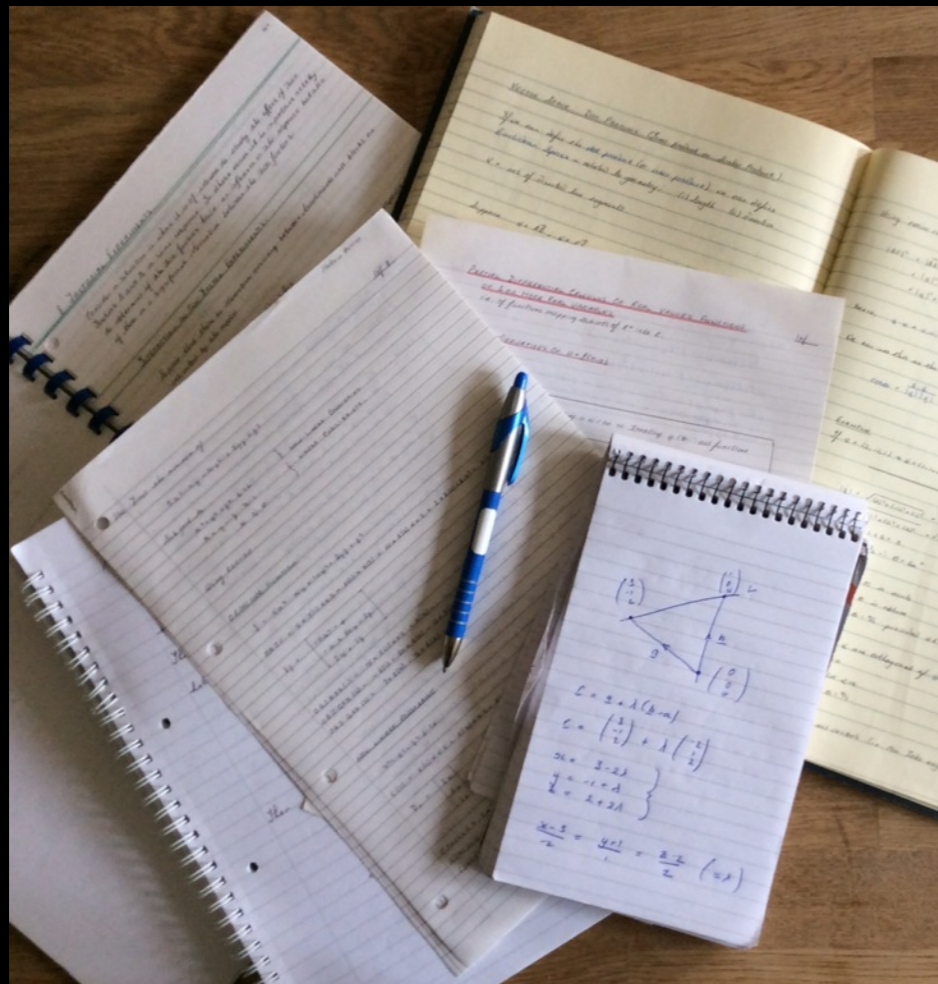
# What next?

- Workshop to train maths teachers.
- Student partnerships.
- Practice pencasting techniques.
- Keep using pen and paper!

# Summary

From this ....

To this ....



Thank-you for listening!

Any Questions?