



Using pencasts to extend and enrich the student learning experience

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ulster.ac.uk

Challenges of learning and teaching mathematics

Diverse mathematical background

Time since last studied maths

Memory and concept difficulties

Linguistics and vocabulary difficulties

What is a Pencast?

Interactive
document

digital
notes

synchronised

audio



Equipment I started with ...

Livescribe echo™ smartpen

- Owned since Spring 2012
- Funded by MSOR Network
- ~ RRP £130 /€180

To create a pencast:

- Livescribe Paper
- Computer (Mac or PC)
- Livescribe Desktop software
(replaced by Echo Desktop software)



Why pencasting?

Pen and paper

Portable

Quick setup

Easy to create

Better handwriting

No editing!!



Educational Benefits

Provide step-by-step solutions with **rich** audio explanations

Replay anytime, anywhere

Pause, rewind, fast forward, skip

Slow down, speed up

Show/hide preview ink-strokes



Equipment I now use ...

Livescribe 3 smartpen

Owned since Summer 2015

Funded by Ulster University

as part of its widening and
participation strategy

~ RRP £130 / €180

To create a pencast:

Livescribe Paper

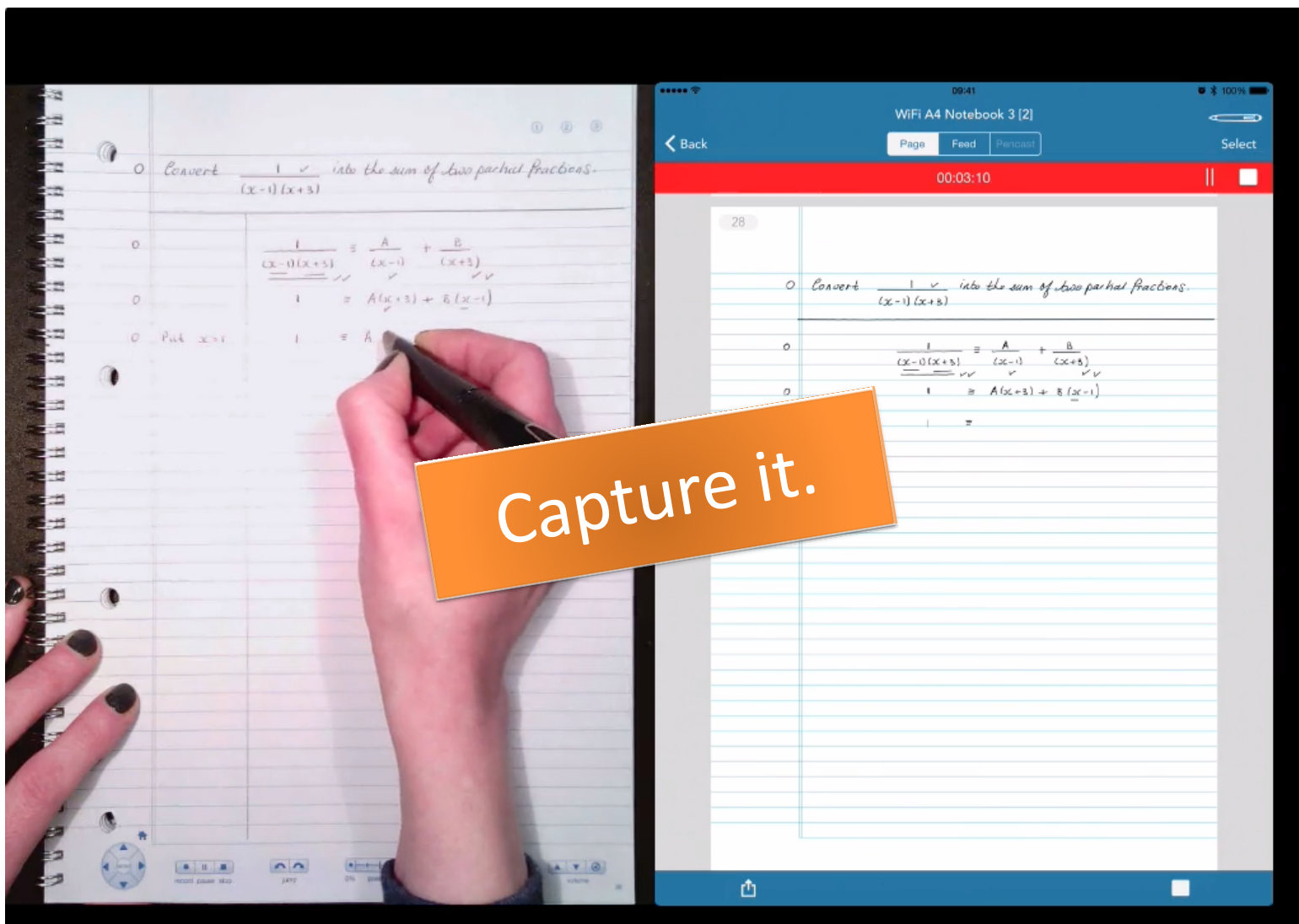
iOS 8+ or Android (KitKat v4.4.2)

Livescribe+ App

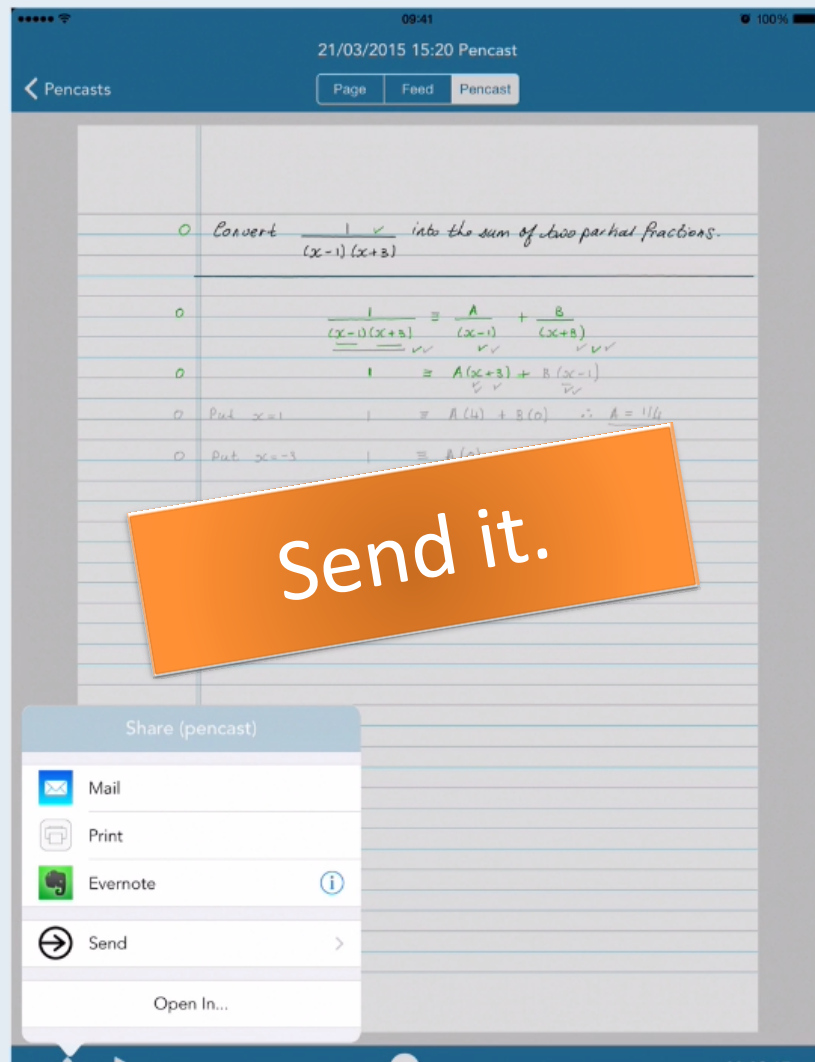
(free on App Store or Play Store)



Livescribe Echo® smartpen Tech Specs [Download PDF >](#)



Screenshot of video on capturing a pencast (mathcast) using Livescribe+ App



Screenshot of video on sending a pencast (mathcast) using Livescribe+ App

Educational Uses

Self-directed learning

- Coursework preparation
- Exam preparation

Self-marking

Self-assessment

One-to-one support



09:41 100%

MATCA2Q6 - 1415 (C7 Homogeneous)(1)

< Back Page Feed Pencast

ANALYTICAL SOLUTION OF DIFFERENTIAL EQUATIONS H. Horn.
(FIRST ORDER HOMOGENEOUS)

Find the general solution of the differential equation
 $x \frac{dy}{dx} = \sqrt{x^2 + y^2} + y$
Express your answer in the form $y = f(x)$ and simplify your answer as far as possible

$\frac{dy}{dx} = \frac{\sqrt{x^2 + y^2}}{x} + \frac{y}{x}$ $\frac{dy}{dx} = r \left(\frac{y}{x} \right)$
 $\frac{dy}{dx} = \frac{\sqrt{x^2 (1 + (y/x)^2)}}{x} + \frac{y}{x} = \frac{x}{x} \sqrt{1 + (y/x)^2} + \frac{y}{x}$
 $\frac{dy}{dx} = \sqrt{1 + (y/x)^2} + \frac{y}{x}$

Put $v = y/x$, $y = vx$ and $\frac{dy}{dx} = v + x \frac{dv}{dx}$
 $v + x \frac{dv}{dx} = \sqrt{1 + v^2} + v$
 $\int \frac{1}{\sqrt{1 + v^2}} dv = \int \frac{1}{x} dx$
 $\sinh^{-1} v = \ln |x| + C$
Put back $v = y/x$
 $\sinh^{-1}(y/x) = \ln |x| + \ln A$
 $\sinh^{-1}(y/x) = \ln Ax$
 $\frac{y}{x} = \sinh(\ln(Ax))$

$y = x \sinh(\ln(Ax))$
 $\sinh(x) = \frac{1}{2} (e^x - e^{-x})$
 $y = \frac{x}{2} (e^{\ln(Ax)} - e^{-\ln(Ax)})$
 $y = \frac{x}{2} \left(Ax - \frac{1}{Ax} \right)$
 $y = \frac{1}{2A} (Ax^2 - 1)$

00:10:26

Upload to Blackboard VLE.

Coursework 1: Pencast Mark Schemes

Enabled: Statistics Tracking

Student self-assessment process: To help you *judge* and *improve the quality of your learning* in each of the assessed topics, you are encouraged to *review* the **pencast mark scheme**, and the **tutor's comments** on your marked solution for each of the questions given in the coursework.

Coursework Learner Score and Reflection quiz: Once you have reviewed and appraised your work should complete the "**Coursework 1: Learner Score and Review Feedback**" quiz.

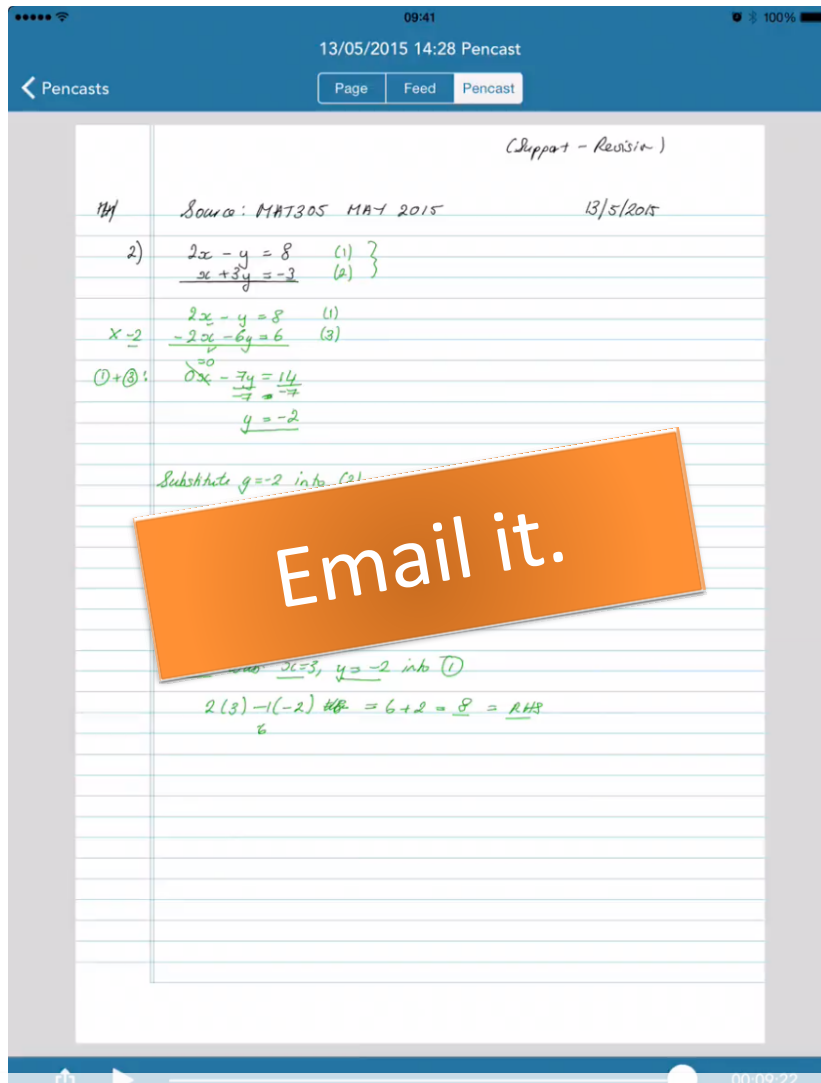
Pencast marks scheme with worked solution:

Hyperlinks to a pencast mark scheme for each mathematics problem is given below.

Question No	Theme of question	Pencast Version A	Pencast Version B	Marks Offered
1	Matrix operations	MCA1AQ1	MCA1BQ1	20
2	Inverse of a matrix using the adjoint method	MCA1AQ2	MCA1BQ2	20
3	Vector operations on Cartesian vectors.	MCA1AQ3a	MCA1BQ3a	20
		MCA1AQ3b	MCA1BQ3b	
4	Application of vectors.	MCA1AQ4	MCA1BQ4	20
5	Algebra of complex numbers.	MCA1AQ5	MCA1BQ5	20

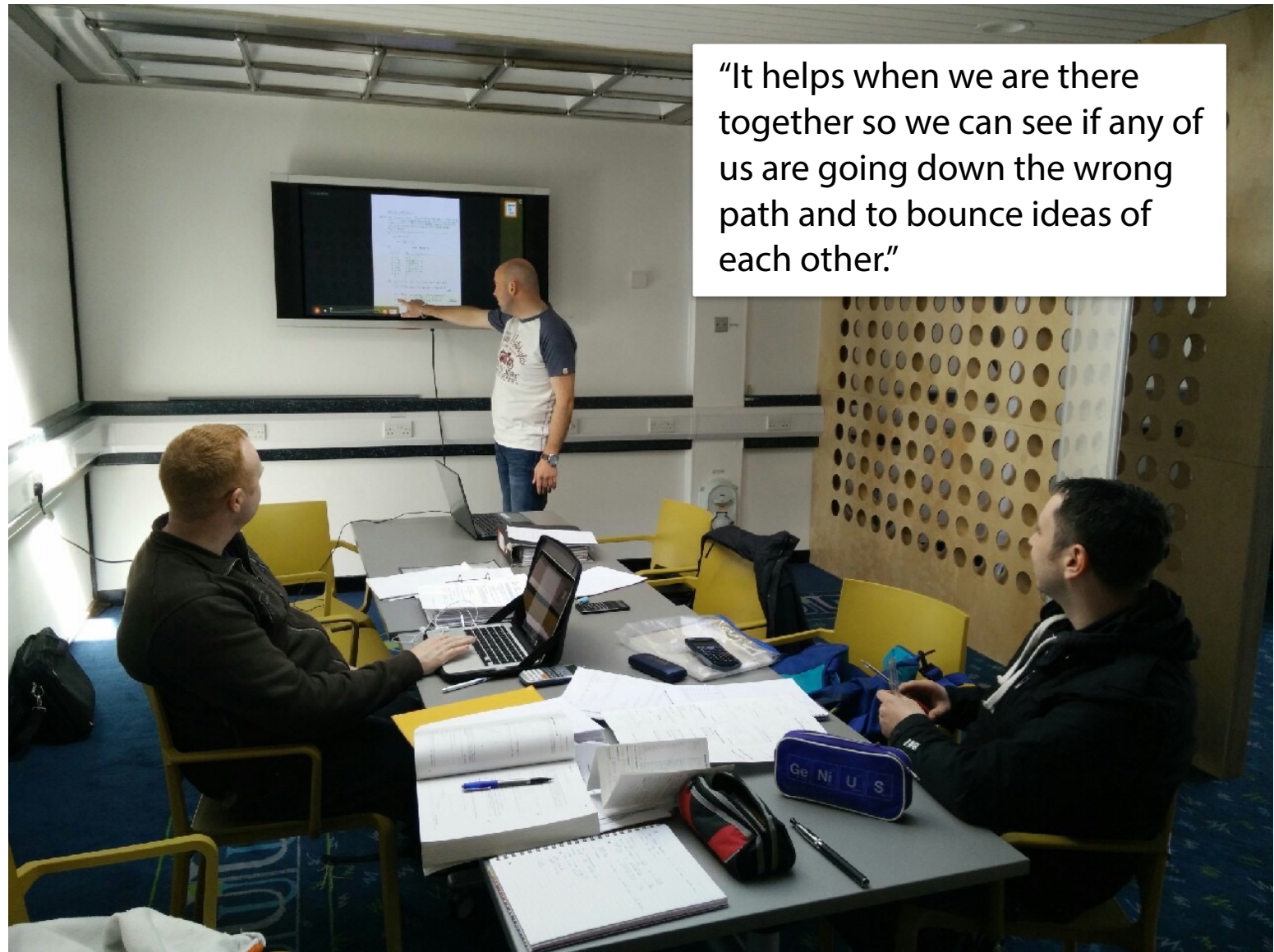


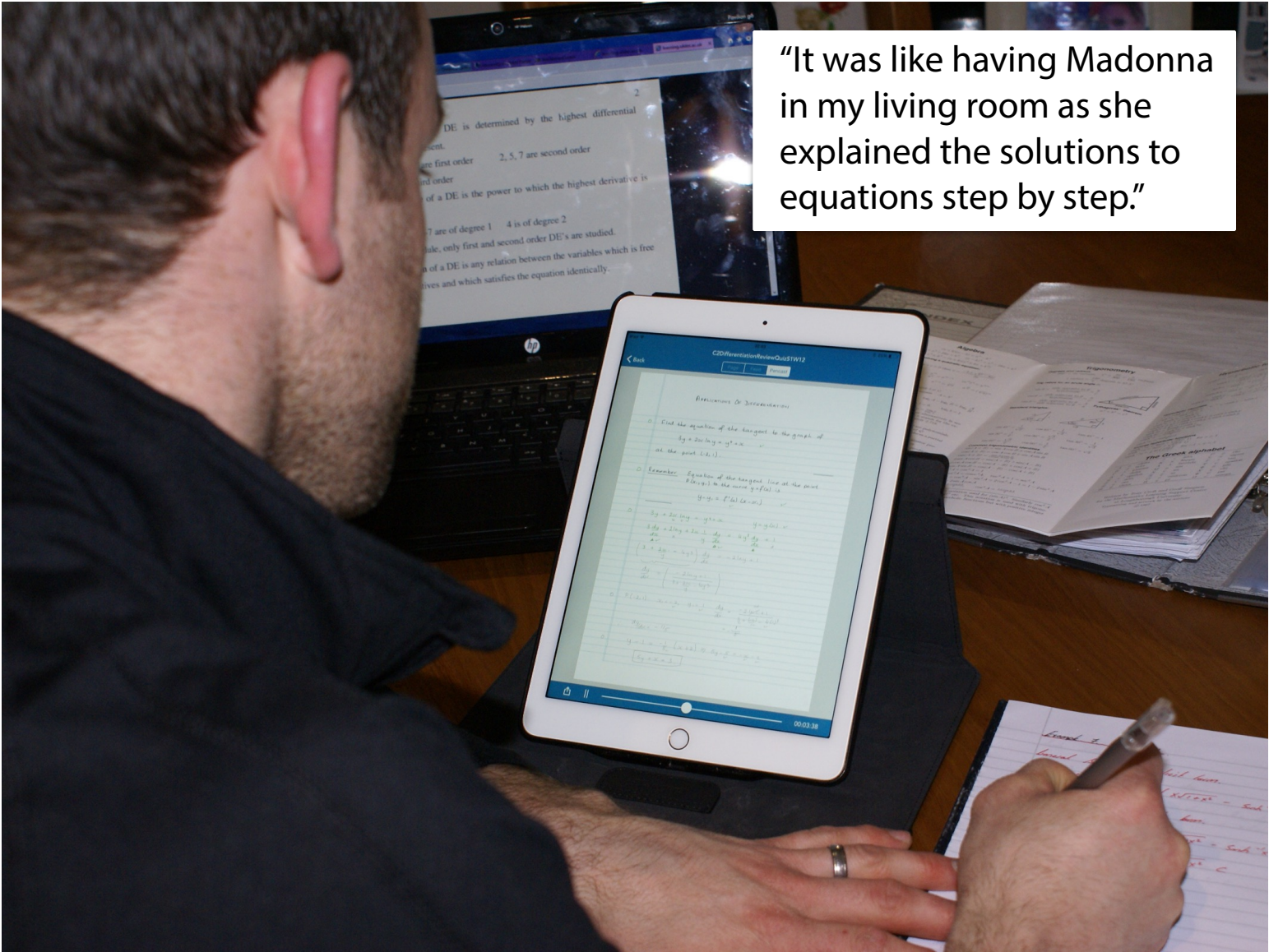
Click [here](#) for sample >



Screenshot of video on emailing a pencast (mathcast) using Livescribe+ App

"It helps when we are there together so we can see if any of us are going down the wrong path and to bounce ideas of each other."





"It was like having Madonna in my living room as she explained the solutions to equations step by step."

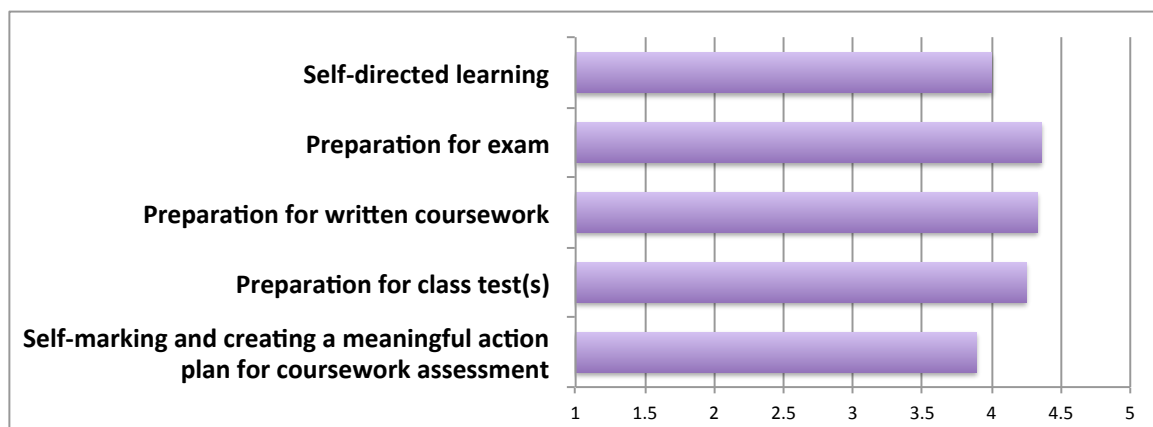
Student feedback

100+ Pencasts.

Playback times: 5 - 30 minutes.

Average size: 4 MB.

If you DID use the pencasts, how helpful did you find them for:



Not at all
helpful

Somewhat
helpful

Extremely
helpful

Student comments - Strengths



“Pencasts are the most useful tool I have ever experienced. This has without a doubt helped improve my maths ability.”

“Being away from education for a while, I find the pencasts a total necessity as a study aid, without them I don’t think I would have ever caught up.”

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

Student comments - Limitations



“Are there any limits? Yes **face to face teaching is best**, with these as an add on makes life easier.”

“In class, you could just ask the teacher there and then for help. With pencasts that isn't the case.”

Advantages



Audio synced with digital handwritten notes

Quick and easy to create

Quick and easy to share

Clear sound

Less storage space required c.f. videos

Print as a standard PDF

Disadvantages



Cannot edit mistakes

Visual element limited to recorded ink-strokes

Several pencast formats

Not interactive

Planning takes time

Students access to technology may be limited

Limited ink colours

Tips and techniques



Use a script

Use visual cues

Pre-draw elements

Pre-draw templates

Keep it short

Practise

Get feedback!



Remember to turn your pen on ... and tap record!

What now? What next?



Train teachers

- pencasting4teachers (CPPD Module)
- improve attainment of maths in NI

Plan active learning in and out of the classroom

- flip classroom
- micro lectures
- create opportunities for mastery learning

Thank-you for listening!

Any Questions?

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