

REFLECTIONS ON USING VIDEOS TO TEACH MATHEMATICS

WODU MAJIN

- My motivation for using videos
- Available tools
- How I've used some tools
- Demo's

- Varying backgrounds/entry qualifications
- Struggles with pre-requisite material
- Variety of learning needs

Using Videos to teach Mathematics

WHY? PRO'S OF VIDEO FORMAT

"I could watch it whenever I needed it and as many times as I wanted."

"You can watch them again and again unlike lectures so you don't miss anything."

"I could watch them whilst doing questions over and over again."

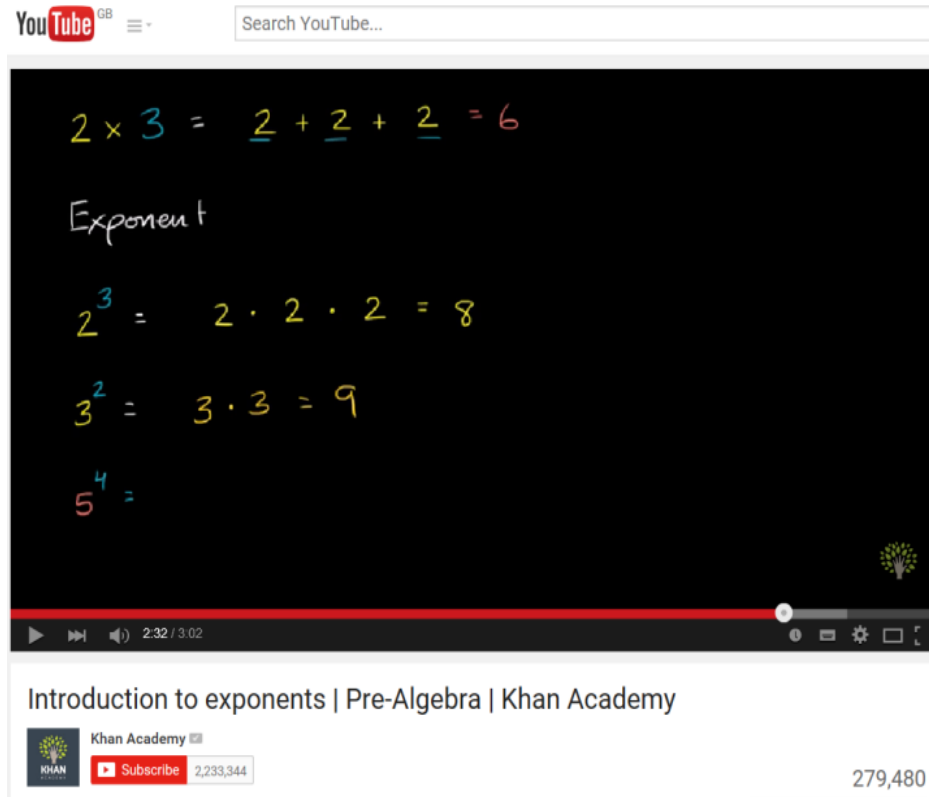
"I could watch it whenever I needed it and as many times as I wanted so it encouraged me to do the questions."

- Saves time
- A variety of topics available
- ‘Someone else’s take’

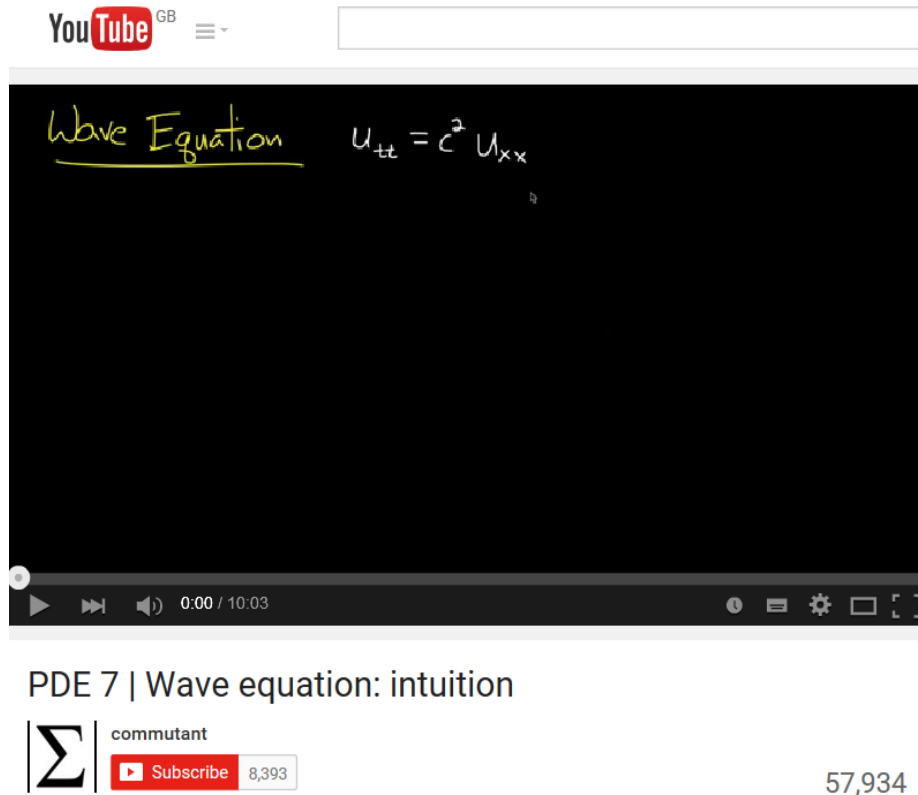
- Saves time
- A variety of topics available
- ‘Someone else’s take’ (**Advantage and disadvantage**)

Using Videos to teach Mathematics

READY-MADE: Khan Academy



- Explains 'how' and 'why'
- Advanced topics (E.g. Line integrals, Stoke's theorem)



- Focused on differential equations (PDEs and ODEs)
- Explains 'how' and 'why'

YouTube GB

Search YouTube...

SOLVE:
 $9x^2 - 9x + 2 = 0$

$a = 9$
 $b = -9$
 $c = 2$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = x$$
$$x = \frac{-(-9) \pm \sqrt{(-9)^2 - 4(9)(2)}}{2(9)}$$

2:24 / 4:27

Solving Quadratic Equations using the Quadratic Formula - Example 1

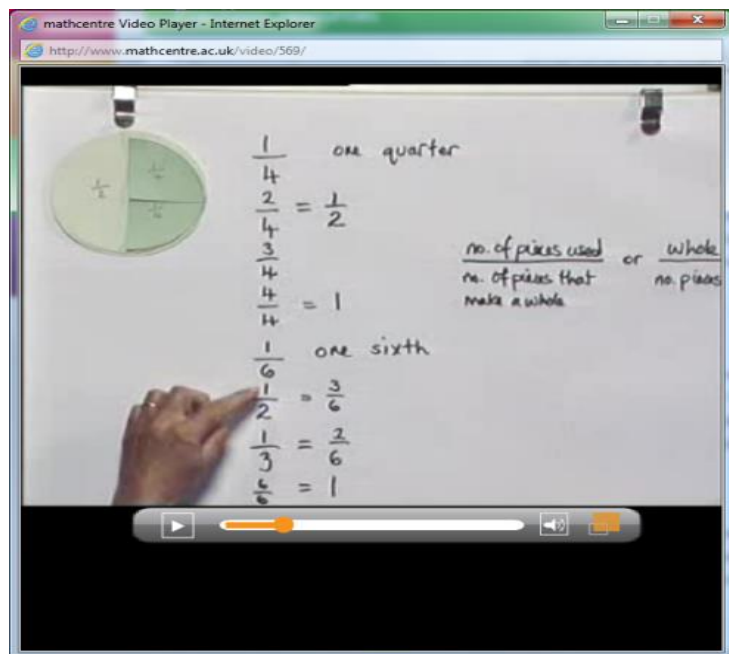
patrickJMT

Subscribe 437,121

37,881

- Clear explanations
- Many examples

An option with accompanying notes...



1. Introduction

What are fractions? Fractions are ways of writing parts of whole numbers. For example if we take a pizza, and divide it up equally between 4 people, each person will have $\frac{1}{4}$ or, written in words, one quarter of the pizza.



If one person were to take 2 quarters of the pizza, they would have $\frac{2}{4}$, which is the same as $\frac{1}{2}$ or half the pizza. So

$$\frac{2}{4} = \frac{1}{2}$$



If three pieces of the pizza have been eaten, then $\frac{3}{4}$ or three quarters has gone, and $\frac{1}{4}$ or one quarter remains.



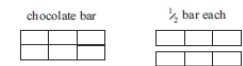
Finally, the whole pizza is $\frac{4}{4}$, or four quarters.

Some chocolate bars are conveniently marked to make them easier to break into pieces to eat. For instance, we might have a bar marked into 6 equal pieces, so each piece is $\frac{1}{6}$, or one sixth of the whole bar. So if we share this bar between 6 people, we would get 1 piece each.



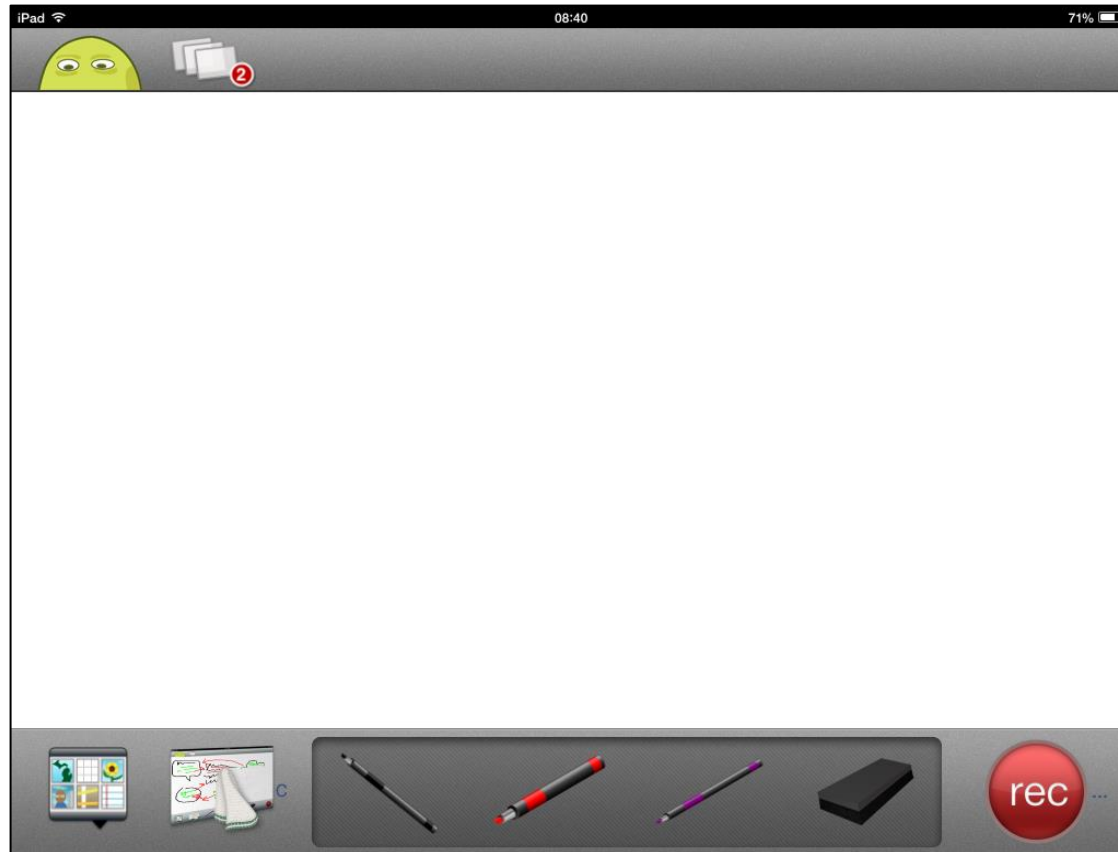
If we share it between just 2 people, we could have half the bar each, which would be 3 pieces each. So

$$\frac{3}{6} = \frac{1}{2}$$

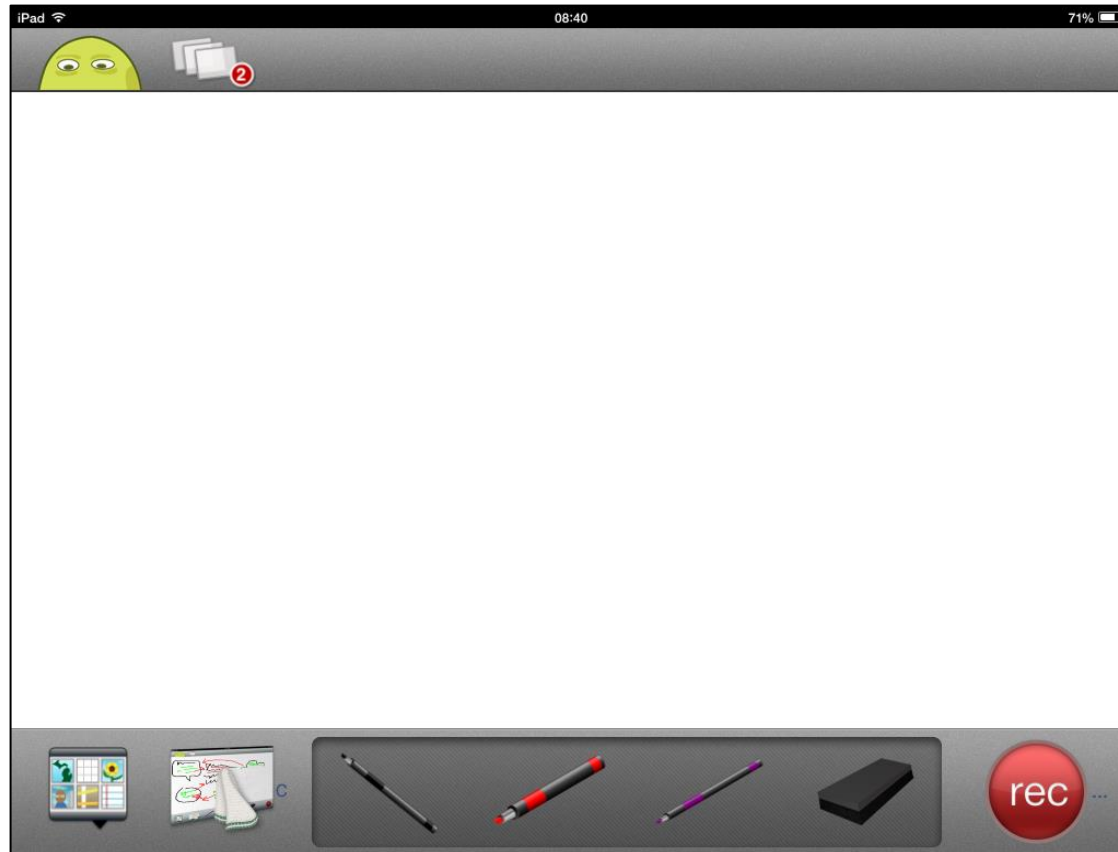


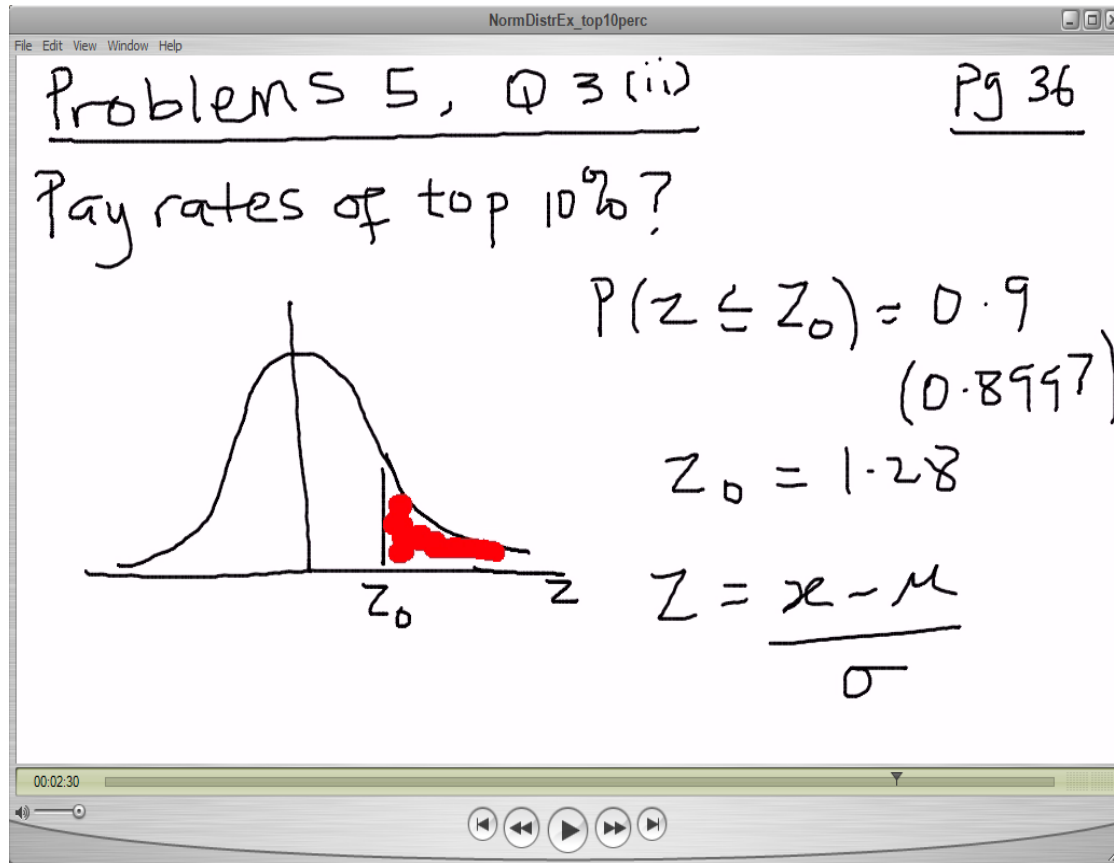
- Can be made to complement course resources
- Can be customised for individual needs

- Can be made to complement course resources
- Can be customised for individual needs
- How to make them?

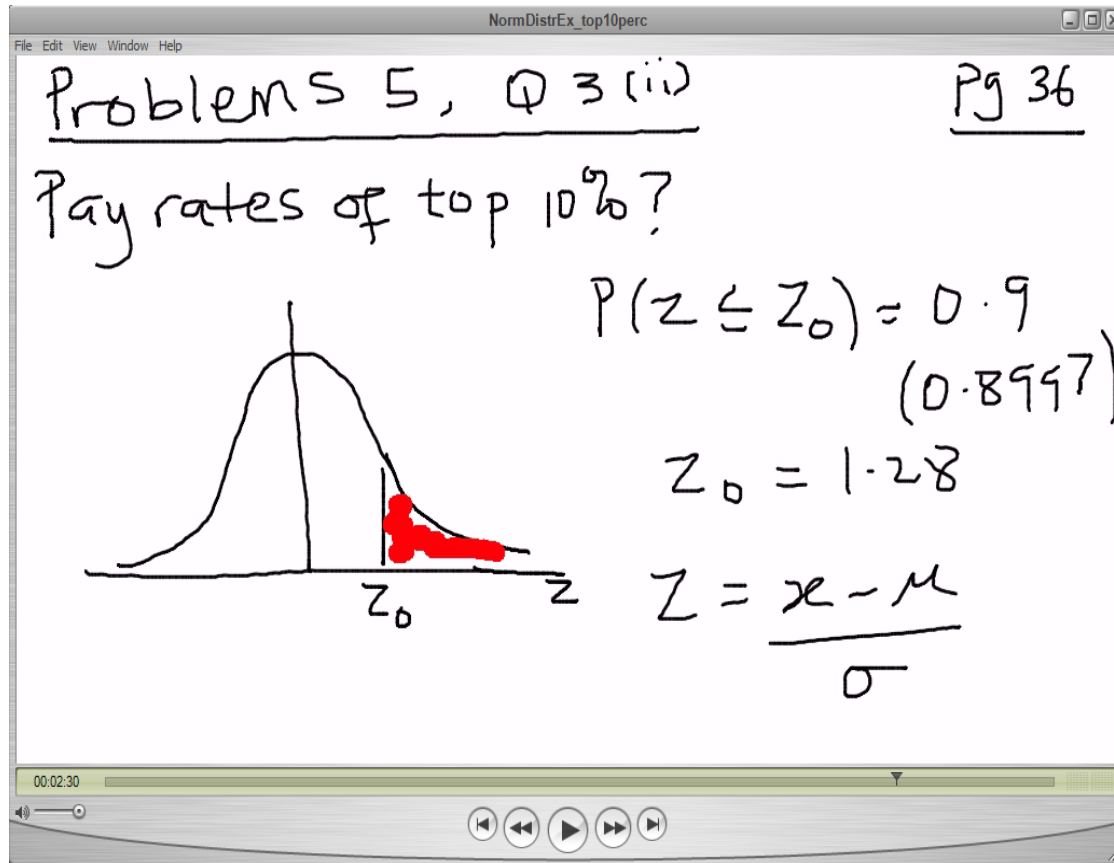


- Free interactive whiteboard on iPad/iPhone
- Write directly on screen
- Record, upload to cloud and share
- Alternatively, download mp4 and share (email individual students, upload to VLE etc.)





Display \propto stylus!



Addressing a knowledge gap: $P(X) = \frac{n!}{(n-X)!X!} p^X q^{n-X}$

What is a factorial?

| Tool | Platform | Cost |
|--------------------------|---|--------|
| ShowMe (Basic) | iPad/iPhone | Free |
| ShowMe (Pro) | | £40/yr |
| Explain Everything | Android device | £3 |
| Screencast-O-Matic | <ul style="list-style-type: none"> • PC • Graphics tablet (From £50) • Stylus (from £20) | Free |
| Screencast-O-Matic (Pro) | | £10/yr |
| Camtasia | | >£130 |

- Smartpen (£100-£170, depending on type)
- Notebook (~£5 for A4 size)
- Paper (can be *printed* for free with appropriate colour laser printer)
- Ink (£10 for 8-pack, a few colours available)
- Smartphone, tablet or PC

BEST OF BOTH WORLDS:

- Write on paper as normal
- Record writing and speech
- Get digital version (PDF or 'Pencast')
- PDF and share

To: Student X

From: Wodu Majin

Subject: Re: Progress File entry of Thursday, 26th March 2015

Message: Dear Student X,

20-4554: Mathematical Methods

'Differential equations again this week. The lecture was at a faster pace than usual and hard to keep up with. In the tutorial I tried to do the exercises for this week but I didn't finish question 1 and couldn't work it out from my notes'

Hi Student X,

Is it question 1 on page 31? Let me know and I can send you a solution.

Wodu

METHODS: Exercise 39, Q1 Solution

$$4 \frac{d^2 y}{dt^2} - 4 \frac{dy}{dt} + y = e^{4t} \quad (1)$$

$$y = C.F. + P.I.$$

$$y = y_c + y_p$$

C.F.

Auxiliary equation: $4m^2 - 4m + 1 = 0$

$$m = \frac{4 \pm \sqrt{16 - 16}}{8}$$

$$m = \frac{4}{8} \Rightarrow m = \frac{1}{2}$$

Repeated root. Using results from notes,

$$y_c = c_1 e^{\frac{1}{2}t} + c_2 t e^{\frac{1}{2}t}$$

P.I

Comparing with R.H.S of (1), try $y_p = A e^{4t}$

Then $y_p' = 4A e^{4t}$, $y_p'' = 16A e^{4t}$ (2)

Substituting (2) into (1)

$$4(16A e^{4t}) - 4(4A e^{4t}) + A e^{4t} = e^{4t}$$


$$64A e^{4t} - 16A e^{4t} + A e^{4t} = e^{4t}$$

$$49A e^{4t} = e^{4t}$$

$$\Rightarrow 49A = 1$$




Using Videos to teach Mathematics

CUSTOM VIDEOS: Smartpen

| |  |  |  |
|---|---|---|---|
| Sync and Transfer | | | |
| Technology used to transfer notes from smartpen | Bluetooth® | WiFi / USB | USB |
| Real-time transfer of notes to supported devices | ● | | |
| Supported systems/platforms (for transfer of content) | iOS 7 or newer | Evernote® | Win/Mac |
| Save, Search and Organize | | | |
| Software/service used to manage notes | Livescribe+ | Evernote | Echo Desktop |
| Search handwriting | ● | ● | ● |
| Organize notes/notebooks with tags | ● | ● | |
| Sort notes into custom notebooks/collections | | ● | ● |
| Convert handwriting to text | ● | | MyScript |
| Use notes to create task lists & reminders | ● | | |
| Send notes to other applications | ● | | |
| Add photos or typed notes alongside handwritten notes | ● | ● | |
| Add documents & webpages alongside handwritten notes | | ● | |
| Record and Playback Pencasts (audio synced to handwriting) | | | |
| Record audio with a smartpen microphone | | ● | ● |
| Record audio with the microphone on paired mobile device | ● | | |
| Replay audio directly from smartpen | | ● | ● |
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OTHER POSSIBLE USES:

- Challenge/engage 'more able' students
- One-on-one (project students, maths support centres)
- Personal use: (mark schemes, audio-enabled notes)

<http://www.livescribe.com/uk/>

<http://www.techsmith.com/screenchomp.html>

<http://www.khanacademy.org>

<http://www.patrickjmt.com>

<http://www.mathcentre.ac.uk/>

<http://www.youtube.com/user/commutant>