# The potential of handwriting recognition for interactive mathematics textbooks

MathPen

## The Problem

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

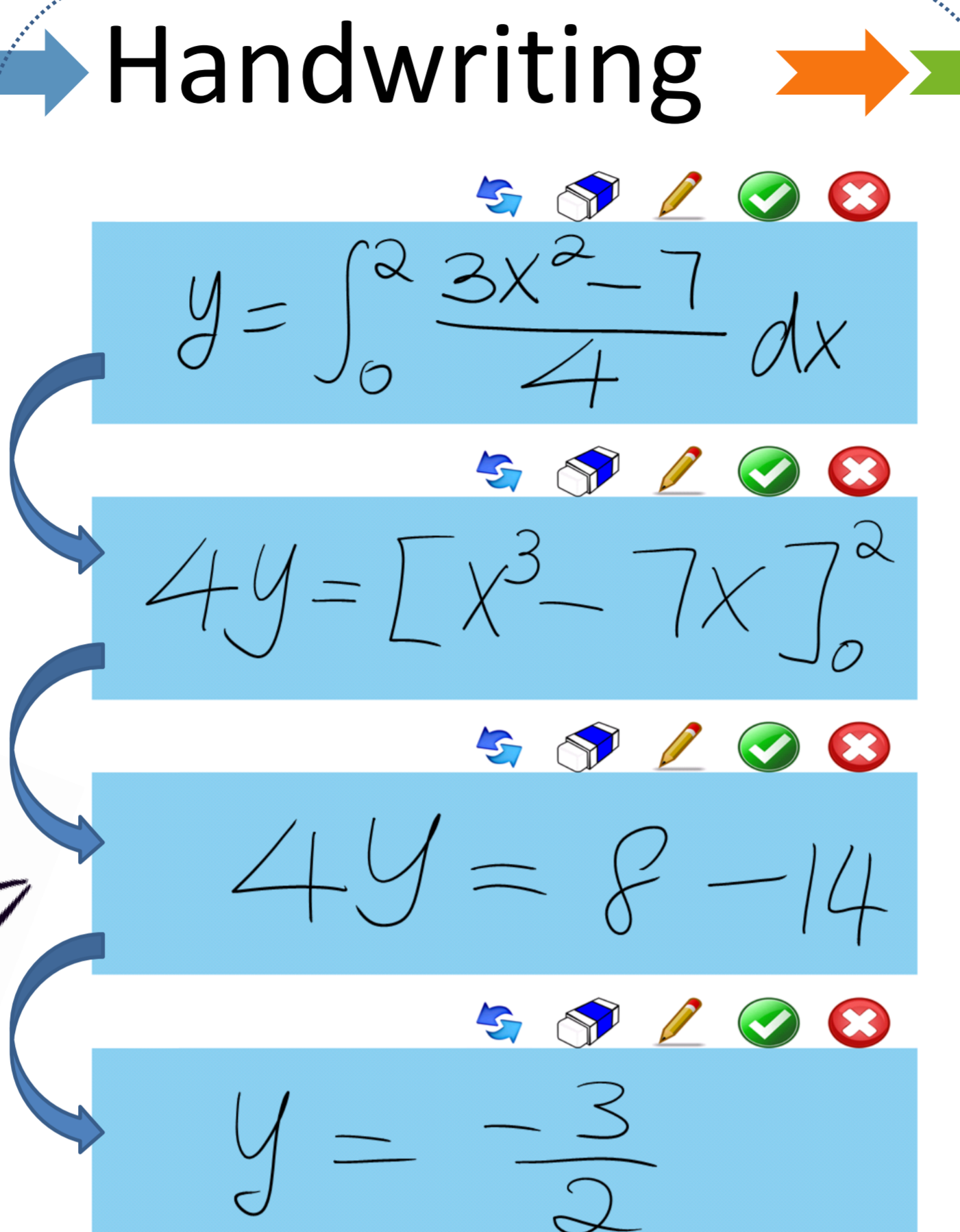```
[TEX]
x=\frac{-b\pm\sqrt
{b^2-4ac}}{2a}
[/TEX]
```

Fig.1: Use of non-intuitive codes interrupts the natural flow of mathematical thinking

## Handwriting

$$y = \int_0^2 \frac{3x^2 - 7}{4}\, dx$$

$$4y = [x^3 - 7x]_0^2$$

$$4Y = 8 - 14$$

$$y = -\frac{3}{2}$$

Fig.2: Writing naturally allows users to focus on the mathematics without technological concerns

## Recognition

Latex Expression

```
y=\int^2_0\frac{3x^2-7}{4}dx

4y=[x^3-7x]^2_0

4y=8-14

y=\frac{-3}{2}
```
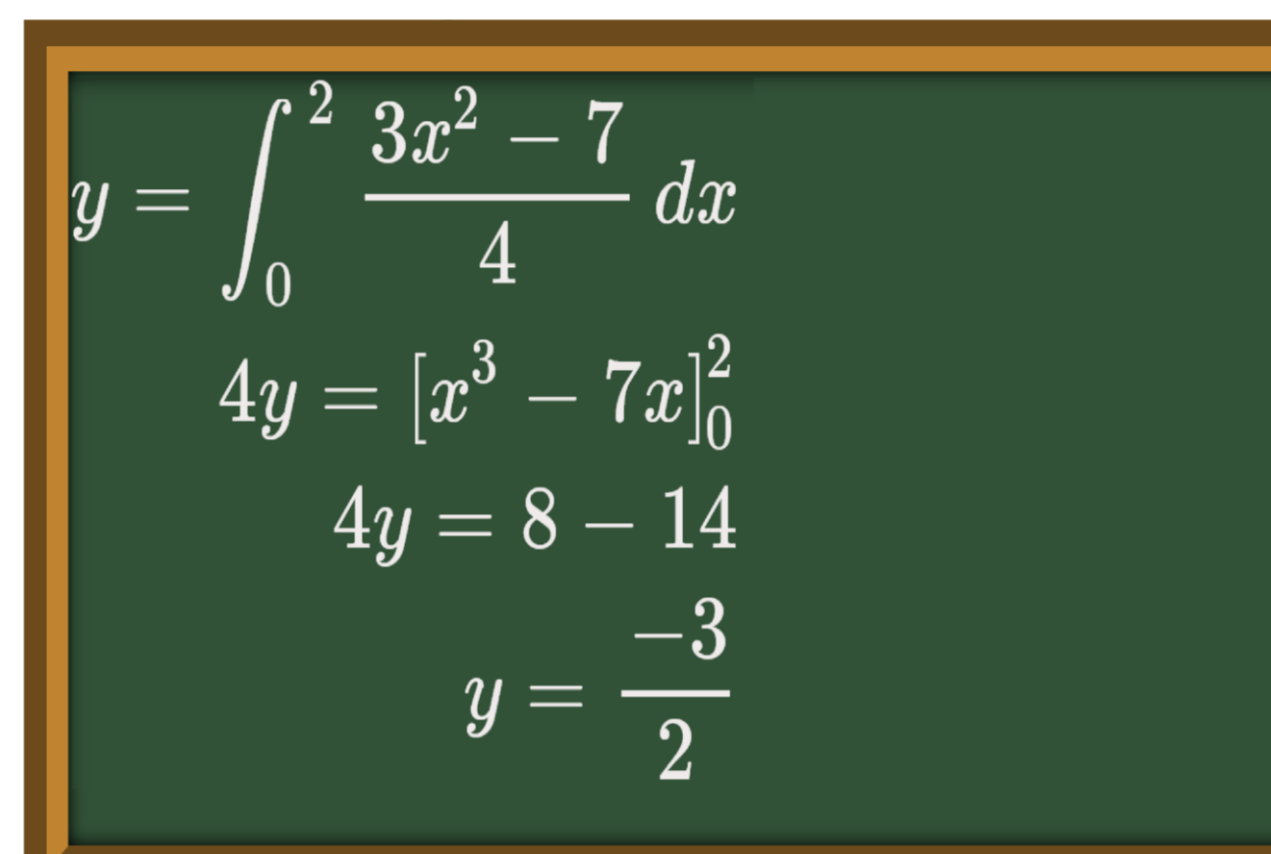
$$y = \int_0^2 \frac{3x^2 - 7}{4}\, dx$$
$$4y = [x^3 - 7x]_0^2$$
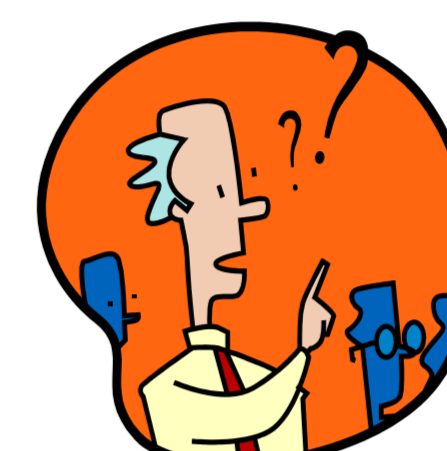$$4y = 8 - 14$$
$$y = \frac{-3}{2}$$

Fig.3: Educationally-informed design to support learning and reduce technical difficulty

## Milestones

**Dec 12 – Mar 14**
Software design and development of 1st prototype

**Apr - Aug 2014**
Piloting and consultation with Partner schools

**Sep 14 – Jan 15**
Tool evaluation with current students in Partner schools

**Post-Doc**
Prototype refinement to make product available for public

## Background Literature

- "the development of e-Learning in the sciences in general, and mathematics in particular, has not met the general expectation"[1]
- This may be, in part, because "practical and intuitive mathematics input for users is still under investigation"[2]
- "Current input methods for online mathematics communication are cumbersome"[3]

## Design Rationale

- Simplify digitisation of mathematics expressions
- Use handwriting recognition techniques to turn handwritten work into computer codes
- Develop educationally-informed interface to reduce technology-induced cognitive overload while working electronically
- Could also be used to interface with interactive textbook and mobile apps

## Acknowledgements

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References: [1] Ahmed (2008). Support Mathematical Instruction in Web-Based Learning System Using Object-Oriented Approach. ICACTE'08. IEEE.
[2] Mikusa et al. (2005). Features and advantages of WME: a Web-based mathematics education system. SoutheastCon'05. IEEE.
[3] Lo et al. (2013). MathPen: identifying and solving the problems of online collaborative learning for mathematics. ICTMT'11.

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