Iteration*

A glimpse into what practitioners say:

- Spreadsheets can be used to make iteration as part of the UK A-level mathematics course more interesting. Smith (1990) explains how this can be done when using the Newton-Raphson method or linear interpolation[1].

- Graphing calculators can be very useful for solving equations using iteration. Hayes (1990) explains how the calculator *'updates'* itself by using its memory function to remember the result of the most recent calculation[2].

Some useful links:

- You can find a description of how iteration is introduced to the UK GCSE syllabus and how it would be examined in the blog below:
https://colleenyoung.wordpress.com/2015/05/24/gcse-new-content-iterative-methods-for-numerical-solution-of-equations/
- AQA advice and resources about helping students understand iterative procedures:
https://allaboutmaths.aqa.org.uk/attachments/5309.pdf
- You can find an explanation on how iteration work in the video below:
https://m.youtube.com/watch?v=du3cJ3MmR

Some problems you can try with your class …

1. An approximate solution to an equation is found using this iterative process:

$$x_{n+1} = \frac{x_n^3 - 3}{8} \quad \text{and} \quad x_1 = -1$$

(a) Work out the values of x_2 and x_3.

(b) Work out the solution to 6 decimal places.

2. (a) Show that the equation $x^3 + 4x = 1$ can be rearranged into $x = \frac{1}{4} - \frac{x^3}{4}$.

(b) Starting with $x_0 = 0$, use the iteration formula

$$x_{n+1} = \frac{1}{4} - \frac{x_n^3}{4}$$ twice, to find an estimate of the solution

of $x^3 + 4x = 1$.

3. Find correct to 3 d.p. a root of the equation

$$f(x) = x^3 - 2x + 3$$

given that there is a solution near $x = -2$.

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[1] Smith, M. (1990) Iteration with spreadsheets. *Mathematics in School, 19(1),* 38-39.
[2] Hayes, T. (1990) The old box and ladder problem, revisited. *Mathematics in School, 19(2),* 42-43.

* Resources selected and summarised by Rebecca Potiphar. Let us know whether they are useful and how we can improve them at @mathtask or email Irene Biza at i.biza@uea.ac.uk