Creating Stand-Alone Workspaces for Student Explorations with Maple™

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Abstract

We will investigate creating stand-alone workspaces based on the pedagogic principle of *Action-Consequence-Reflection* (ACR)[3]. The interactive workbooks we design may be accessed and used on the internet. Maple[1] is the main software tool we use to build the student exploration documents. We take advantage of the *Maple Cloud* for student web access.

Keywords
Action-Consequnce-Reflection Workspace, Stand-Alone Interactive Maple Document, Web-Based Maple Document

1 Introduction

Explorations based on the ACR Principle ask students to take an *action* on a mathematical object, observe the *consequences* of their action, and *reflect* on the mathematics underpinning what they have observed [2]. This paradigm makes very effective didactic use of computer algebra where we can easily create miniature applications, sometimes called "sandboxes," that carefully control what actions students can take on the mathematical object of study.

We'll begin by displaying and discussing several interactive Maple documents that have been used in [1, 3, 4, 5], and [6]. For example, Figure 1 shows a workbook, which is available online, for investigating how the values of several parameters affect the remainder of a rational function. Student's can change the remainder's two roots and the first root's multiplicity with 'sliders' — the *action* — and observe how the graph changes — the *consequence*. They are then asked questions leading to propositions concerning asymptote crossings and convergence speed, etc. — the *reflection*.

Figure 2 shows another workbook, also available online, for investigating how the position of the center of the disk of convergence of a Taylor series in relation to the poles of a function determines the radius of convergence of the disk. Students move the center (red point in the graph) with their mouse — the *action* — and observe the convergence disk's radius changing — the *consequence*. They are asked questions leading to a theorem on the radius of convergence — the *reflection*.

Next, we provide the steps necessary to create an interactive Maple workbook that may contain embedded support documents. We finish the demonstration by showing how to generate a URL and give students web access to the workbook. The session will finish with questions and discussion.

[1]Maple is a trademark of Waterloo Maple Inc.

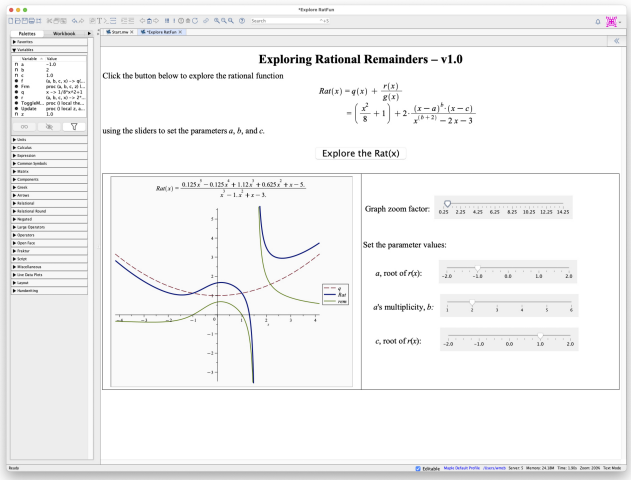

Figure 1: Rational Function's Denominator

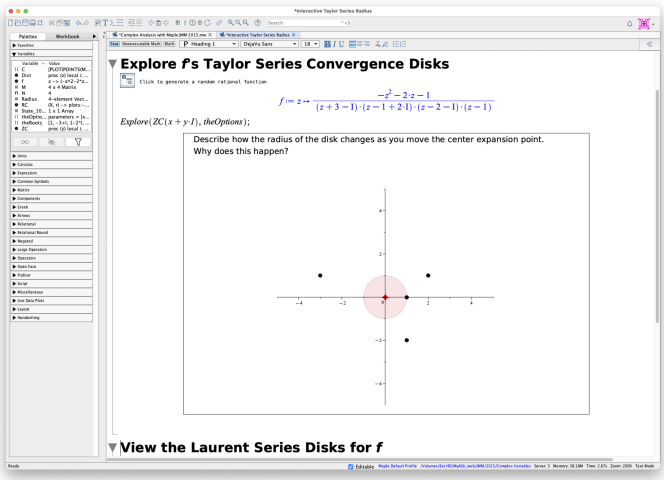

Figure 2: Taylor Series Convergence Disk

References

[1] W. Bauldry. "Microworlds with Maple for Investigating Complex Analysis." Joint Math. Meetings, San Antonio, 2015.

[2] W. Ellis. "Using Inquiry Questions and Action/Consequence Documents to Improve Student Understanding." MSRI - Mathematical Circles and Olympiads, 2004.

[3] W. Ellis and W. Bauldry. "Using and Creating *A-C-R* Documents for Mathematics Instruction with Computer Algebra." 15th ACA, Montreal, 2009.

[4] E. Marland, G. Rhoads, M. Bossé, J. Sanqui, and W. Bauldry. "Q^2: A Measure of Linearity," Electronic J. of Math. & Tech. Vol 14, No. 3 (Oct 2020). Available at: https://ejmt.mathandtech.org/Contents/eJMT_v14n3n2.pdf

[5] J. Post, T. Howell, K. Palmer, W. Bauldry, and M. Bossé. "Graphing the Remainder." Maple Transactions, Vol. 3, No. 1 (2023). Available at: https://doi.org/10.5206/mt.v3i1.14322

[6] J. Post, K. Palmer, W. Bauldry, and M. Bossé. "Getting Around to Rounding." MathAMATYC Educator, Fall 2023, Vol. 15, No. 1.