VCE Specialist Mathematics   
Units 3 and 4

Sample application task – graphs of rational functions

Introduction

A context such as the following can be used to investigate key features of the graphs of simple rational functions of a real variable. For simple examples, relevant calculations and sketch graphs should be done by hand; and for more general investigation, technology should be used. For each function the graph should be drawn (sketched or plotted as applicable), the maximal domain and range identified, and key features such as axis intercepts, asymptotes, stationary points, points of inflection and symmetry identified.

Where parameters are involved in the specification of the rule of a family of rational functions, the location of key features should be determined with respect to these parameters, and different types of graphs classified.

Part 1

1. Consider the rational function with rule.  
   Draw the graph of the function and analyse its key features.
2. Draw graphs from the family of functions generated by  where *n* is a real constant, and analyse their key features and appearance.
3. Repeat the analysis from b. for the family of functions generated by  where *n* is a real constant and *m* is an integer.

Part 2

1. Investigate the nature of graphs of functions generated by  where *n* is a real constant.
2. Investigate the nature of graphs of functions generated by  where *m and n* are real constants.

Part 3

Investigate the nature of graphs of functions generated by .

Areas of study

The following content from the areas of study is addressed through this task.

|  |  |
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| **Areas of study** | **Content dot point** |
| Functions and graphs | 1 |
| Calculus | 2 |

Outcomes

The following outcomes, key knowledge and key skills are addressed through this task.

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| **Outcome** | **Key knowledge dot point** | **Key skill dot point** |
| **1** | 1, 5, 7 | 1, 13 |
| **2** | 1, 2, 3, 4 | 1, 2, 4, 5, 7 |
| **3** | 1, 2, 3, 4, 6 | 1, 2, 4, 5, 6, 8, 9, 10, 11 |