VCE Mathematical Methods Unit 1

Unit 1 Area of Study 1: Functions, relations and graphs

Example of learning activity: Exploring the graphs of power functions

Introduction

This learning activity explores power functions of the form $f\left(x\right)=x^{n}$ by

* Using the graphing functionality of technology to explore power functions $f\left(x\right)=x^{n} $ for varying values of $n$ .
* After observing the patterns and characteristics for the varying sets of values for $n$, students should generalise and summarise their findings.

Part 1

Using technology, have students explore the graph of $f:R\rightarrow R,f\left(x\right)=x^{n}$ for the following sets of values
of $n$. Have students sketch, without technology, the~~ir~~ expected shape of the graphs for each set of $n$ before verifying the correct form using their technology.

1. Consider $n\in \left\{2, 4, 6, 8, 10\right\}$$n\in \left\{0, 2, 4, 6, 8, 10\right\}$ by setting up a slider from $2\leq n\leq 10$$0\leq n\leq 10$ in steps of 2.

Describe how the graph changes as $n$ changes, including when $n=0$.

Explain how these changes relate to the rule of the function.

1. Consider $n\in \left\{1, 3, 5, 7, 9\right\}$ by setting up a slider from $1\leq n\leq 9$ in steps of 2.

Describe how this set of graphs differs to the one in a. and why.

Explain why the graph for $n=1$ looks different from the other graphs.

1. Consider $n\in \left\{-10,- 8, -6, -4, -2\right\}$ by setting up a slider from $-10 \leq n\leq -2$ in steps of 2.

Describe how this set of graphs differs to the one in a. and why.

1. Consider $n\in \left\{-9, 7, -5,- 3, -1\right\}$ by setting up a slider from $-9\leq n\leq -1$ in steps of 2.

Describe how this set of graphs differs to the one in b. and why.

Part 2

Summarise findings from a. to d. above and include a sketch of the generalised shape for each set of values of $n$, noting key characteristics and exceptions.

Part 3

Continue the explorations of the graph of $f:R\rightarrow R,f\left(x\right)=x^{n}$ for fractional values of $n$. Have students sketch their expected shape of the graphs for each set of $n$ before verifying the correct form using their technology.

1. Let $n= \frac{1}{w} $ where $w\in \left\{0, 1, 2, 3, 4, …, 10\right\}$ with a slider from 1 $\leq w\leq 10$ in steps of 1.

Describe how the general shape of the graph differs when $w$ is odd or even.

Explain how these changes relate to the rule of the function and why there is no graph for $n=0$.

1. Let $n= \frac{1}{w} $ where $w\in \left\{-10, -9, -8, -7, …,-1\right\}$ with a slider from $-10\leq w\leq -1$ in steps of 1.

Describe how the general shape of the graph differs when $w$ is odd or even.

Part 4

Extend the summary to include findings from Part 3.

Areas of study

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

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| **Unit 1** |
| **Area of study** | **Content dot point** |
| Functions, relations and graphs | 3 |
| Algebra, number and structure | – |
| Calculus | – |
| Data analysis, probability and statistics  | – |

Outcomes

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

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| **Unit 1** |
| **Outcome** | **Key knowledge dot point(s)** | **Key skills dot points** |
| 1 | 2 | 1, 12 |
| 2 | 2, 4, 5 | 5, 6 |
| 3 | 3, 5, 8 | 3, 4, 7 |