VCE Mathematical Methods Unit 2

Unit 2 Area of Study 3: Calculus

Example of learning activity: Numerical approximations for derivatives

Introduction

This learning activity looks at numerical approximations to derivatives by left and right secants and central difference.

If the derivative of a function *f* is defined, then it can be evaluated from first principles by either of the two limits:

 or 

For small positive values of *h*, these correspond to the left secant (backward difference) and right secant (forward difference) approximations for the derivative, that is:

 or 

The central difference is the average of these, and is used by technology to calculate numerical values for derivatives:

.

In the following work let .

Part 1

Consider the quadratic function.

1. Construct a table of values for the left secant, right secant and central difference approximations for this function for *x* from –2 to 5 in steps of 0.5.
2. Plot the corresponding points for the central difference approximation, and draw a straight line through them, stating its rule.
3. Repeat steps a. and b. for several other quadratic functions.

Part 2

Repeat Part 1 for several simple cubic polynomial functions, the square root function and the basic hyperbola.

Part 3

Carry out similar analysis for  over the interval in steps of 0.1. What does the graph of the approximate derivative function look like? Repeat this analysis for  over the interval in steps of 0.1. What does the graph of the approximate derivative function look like?

Areas of study

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

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| **Unit 2** | |
| **Area of study** | **Content dot points** |
| Functions, relations and graphs | – |
| Algebra, number and structure |  |
| Calculus | 1, 2, 3 |
| Data analysis, probability and statistics | – |

Outcomes

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

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