# **Course Overview**

Highfields State

Faculty: Mathematics

Subject: Mathematical Methods

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Highfields State Secondary College

## **Course Outline**

# **Unit requirements**

Subject matter describes the concepts, ideas, knowledge, understanding and skills that students are to learn in Unit 1. It is organised into topics and sub-topics. Notional time allocations have been provided for each sub-topic.

#### UNIT 1 **Topic 1: The logarithmic function 2** Subject matter; Logarithmic laws and logarithmic functions In this sub-topic, students will: • establish and use logarithmic laws and definitions • interpret and use logarithmic scales such as decibels in acoustics, the Richter scale for earthquake magnitude, octaves in music, pH in chemistry solve equations involving indices with and without technology recognise the qualitative features of the graph of $y=\log_{10}(x)y=\log_{10}(x)$ (a>1)a>1), including • asymptotes, and of its translations $y = \log_{10}(x) + by = \log_{10}(x) + b$ and $y = \log_{10}(x+c)y = \log_{10}(x+c)$ solve equations involving logarithmic functions with and without technology identify contexts suitable for modelling by logarithmic functions and use them to solve practical • problems; verify and evaluate the usefulness of the model using qualitative statements and quantitative analysis. **Topic 2: Further differentiation and applications 2** Subject matter; Calculus of exponential functions (8 hours) In this sub-topic, students will: estimate the limit of ah-1h as $h \rightarrow 0$ using technology, for various values of a >0 • recognise that e is the unique number a for which the above limit is 1 ٠ define the exponential function ex • establish and use the formula ddx(ex)=ex and ddxef(x)=f'(x)ef(x)• identify contexts suitable for mathematical modelling by exponential functions and their derivatives ٠ and use the model to solve practical problems; verify and evaluate the usefulness of the model using qualitative statements and quantitative analysis. Calculus of logarithmic functions (8 hours) In this sub-topic, students will: • define the natural logarithm $\ln(x) = \log(x)$ • recognise and use the inverse relationship of the functions y=ex and y=ln(x)• establish and use the formulas ddx(ln(x))=1x and ddx(lnf(x))=f'(x)f(x)• use logarithmic functions and their derivatives to solve practical problems. Calculus of trigonometric functions (8 hours) In this sub-topic, students will: establish the formulas ddxsin(x) = cos(x), and ddxcos(x) = -sin(x) by numerical estimations of the limits and informal proofs based on geometric constructions

- identify contexts suitable for modelling by trigonometric functions and their derivatives and use the model to solve practical problems; verify and evaluate the usefulness of the model using qualitative statements and quantitative analysis
- use trigonometric functions and their derivatives to solve practical problems; including trigonometric functions of the form y=sin(f(x)) and y=cos(f(x)).

### Differentiation rules (5 hours)

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Year level:

In this sub-topic, students will:

• select and apply the product rule, quotient rule and chain rule to differentiate functions; express derivatives in simplest and factorised form.

### Topic 1: The logarithmic function

- Subject matter
- Logarithmic laws and logarithmic functions (8 hours)
- In this sub-topic, students will:
- establish and use logarithmic laws and definitions
- interpret and use logarithmic scales such as decibels in acoustics, the Richter scale for earthquake magnitude, octaves in music, pH in chemistry
- solve equations involving indices with and without technology
- recognise the qualitative features of the graph of y=loga(x)y=loga<sup>(m)</sup>(x) (a>1)a>1), including asymptotes, and of its translations y=loga(x)+by=loga<sup>(m)</sup>(x)+b and y=loga(x+c)y=loga<sup>(m)</sup>(x+c)
- solve equations involving logarithmic functions with and without technology
- identify contexts suitable for modelling by logarithmic functions and use them to solve practical problems; verify and evaluate the usefulness of the model using qualitative statements and quantitative analysis.

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