## Summary


### HL Calculus (differential equations, Maclaurin series, L'hopital's rule)

| Subject | Year | Start date | Duration |
|---|---|---|---|
| Mathematics: analysis and approaches | IB2 | Week 3, October | 7 weeks |

Course Part

Description

In this chapter we aim to solve differential equations. Differential equations are equations involving a derivative of a function.


## Inquiry & Purpose

### Inquiry / Higher Order Questions

| Type | Inquiry Questions |
|---|---|
| Skills-based | Use differential equations to solve Newton's law of cooling, population growth, and carbon dating |
| Skills-based | Develop Maclaurin series from differential equations |

## Curriculum

### Aims

Employ and refine their powers of abstraction and generalization

### Objectives

**Knowledge and understanding: Recall, select and use their knowledge of mathematical facts, concepts and techniques in a variety of familiar and unfamiliar contexts.**

### Syllabus Content

**AHL Content**

AHL 5.13

The evaluation of limits of the form $\lim_{x \to a} \frac{f(x)}{g(x)}$ and $\lim_{x \to \infty} \frac{f(x)}{g(x)}$ using l'Hôpital's rule or the Maclaurin series.

Repeated use of l'Hôpital's rule.

AHL 5.18

First order differential equations.

Numerical solution of $\frac{\mathrm{d}y}{\mathrm{d}x} = f(x, y)$ using Euler's method.

Variables separable.

Homogeneous differential equation $\frac{\mathrm{d}y}{\mathrm{d}x} = f\left(\frac{y}{x}\right)$ using the substitution $y = vx$.

Solution of $y' + P(x)y = Q(x)$, using the integrating factor.

AHL 5.19

Maclaurin series to obtain expansions for $\mathrm{e}^x, \quad \sin x, \quad \cos x, \quad \ln(1+x), \quad (1+x)^p$ $p \in \mathbb{Q}$

Use of simple substitution, products, integration and differentiation to obtain other series.

Maclaurin series developed from differential equations.

## ATL Skills

### Approaches to Learning

**Thinking**

- In this unit, we will

  ask students to formulate a reasoned argument to support their opinion or conclusion

  give students time to think through their answers before asking them for a response

  reward a new personal understanding, solution or approach to an issue

  ask open questions

  set students a task which required higher-order thinking skills (such as analysis or evaluation)

  build on a specific prior task

  help students to make their thinking more visible (for example, by using a strategy such as a thinking routine)

  require students to take an unfamiliar viewpoint into account when formulating arguments

  ask questions that required the use of knowledge from a different subject from the one you are teaching

  include a reflection activity

  make a link to TOK

## Developing IB Learners

### Learner Profile

- Inquirers
- Knowledgeable
- Thinkers
- Communicators
- Open-minded
- Risk-takers (Courageous)
- Reflective