Computational algebra *(& semigroup theory)*

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Computers in maths

- Basic mathematical operations
- Statistics
- Data analysis
- Abstract computation
- Algebra: *creating algorithms to answer algebraic questions*

Computational algebra

- Graph theory:
  - Find a k-colouring
  - Find the chromatic number
  - Find the maximal cliques
  - Determine various properties
  - Are two graphs isomorphic?

Computational algebra

- Linear algebra:
    - Solve a system of linear equations
    - Diagonalisation
    - Calculate the determinant
    - Calculate the rank
    - Calculate the inverse

Computational algebra

- Group theory:
  - Calculate the normal subgroups
  - Calculate the conjugacy classes
  - Calculate the size
  - Are two groups isomorphic?
  - Identify a group

Pure maths at St Andrews

- Fractal geometry
- Dynamical systems
- Combinatorics
- Group theory and semigroup theory
- Computational algebra

Computational algebra at St Andrews

- Centre for Interdisciplinary Research in Computational Algebra
- GAP
- SEMIGROUPS package for GAP

Semigroup theory

Definition (Semigroup)

A semigroup is a set with an associative binary operation.

What do I actually do?

- Research semigroups
- Think up good algorithms
- Implement algorithms
- Publish software
- Analyse complexity

There is lots of potential

- Come up with algorithms where none exist
- Implement new algorithms
- Improve on existing algorithms:
  - New mathematical ideas
  - New programming techniques
- Parallelisation
- Use computational algebra tools to help your research

End.