Contributing to Math Knowledge Graph

Contributing to the Mathematics Knowledge Graph Wiki

Thank you for your interest in contributing to the Mathematics Knowledge Graph Wiki! This project aims to create a comprehensive, interconnected representation of mathematical knowledge. Your contributions help make mathematics more accessible and understandable to everyone.

How to Contribute

Types of Contributions

1. **Content Creation**: Write new mathematical concepts (definitions, theorems, examples)
2. **Content Review**: Review and improve existing content
3. **Cross-References**: Add missing links between related concepts
4. **Formal Verification**: Add Lean 4 proofs for mathematical statements
5. **Bug Reports**: Report issues with the website or content
6. **Feature Requests**: Suggest new features or improvements

Getting Started

1. **Fork the Repository**

```
git clone https://github.com/RK0429/ModernMath.git
cd ModernMath
```

2. **Set Up Development Environment**

```
poetry install
quarto check
```

3. **Create a New Branch**

```
git checkout -b feature/your-feature-name
```

Content Guidelines

File Structure

Each mathematical concept should have its own `.qmd` file: - Definitions: `content/{domain}/def-{concept}.qm` - Theorems: `content/{domain}/thm-{theorem-name}.qmd` - Examples: `content/{domain}/ex-{example-nam` - Axioms: `content/{domain}/ax-{axiom-name}.qmd`

Required Metadata

Every `.qmd` file must include YAML front matter:

```yaml
---
title: "Definition: Group"
id: "def-group"
type: "Definition"
status: "draft|complete|verified"
requires:
  - "def-set"
  - "def-binary-operation"
lean_id: "Mathlib.Algebra.Group.Defs.Group" # Optional
---
```

Content Format

```markdown
# Definition: Group {#def-group}

A **group** is a @def-set $G$ together with a @def-binary-operation...

## Properties

1. **Closure**: For all $a, b \in G$, we have $a \cdot b \in G$
2. **Associativity**: For all $a, b, c \in G$, $(a \cdot b) \cdot c = a \cdot (b \cdot c)$
...

## Examples

- The integers $\mathbb{Z}$ under addition form a group (see @ex-integers-addition)
- The set of $n \times n$ invertible matrices forms a group under multiplication
```

Cross-Reference Guidelines

Always link to other concepts using the `@` syntax: - `@def-group` - links to the group definition - `@thm-lagrange` - links to Lagrange's theorem - `@ex-integers-addition` - links to an example

Important: When mentioning any mathematical concept that has its own page, you must link to it.

Technical Guidelines

Building the Knowledge Graph

Before submitting:

1. **Validate Metadata**

   ```
   poetry run python scripts/validate_metadata.py
   ```

2. **Build the Graph**

   ```
   poetry run python scripts/build_graph.py
   ```

3. **Generate Visualizations**

   ```
   poetry run python scripts/generate_pyvis.py
   poetry run python scripts/fix_pyvis_css.py
   ```

4. **Preview Your Changes**

```
quarto preview
```

Code Quality

- Run linting: `poetry run flake8 scripts/`
- Format code: `poetry run black scripts/`
- Type check: `poetry run mypy scripts/`

Automated Checks

Our CI/CD pipeline automatically: - Validates all YAML metadata - Checks for broken cross-references - Builds the knowledge graph - Generates visualizations - Runs an LLM review for missing cross-references

Mathematical Domains

Content is organized by domain:

Domain	Directory	Focus Areas
Algebra	`content/algebra/`	Groups, Rings, Fields, Linear Algebra
Analysis	`content/analysis/`	Limits, Derivatives, Integration
Topology	`content/topology/`	Topological Spaces, Compactness, Connectedness
Geometry	`content/geometry/`	Euclidean, Metric Spaces
Number Theory	`content/number-theory/`	Primes, Divisibility
Combinatorics	`content/combinatorics/`	Counting, Graph Theory
Logic & Set Theory	`content/logic-set-theory/`	Sets, Logic, Foundations
Probability & Statistics	`content/probability-statistics/`	Probability Spaces, Distributions
Category Theory	`content/category-theory/`	Categories, Functors, Natural Transformations

Submission Process

1. **Test Your Changes Locally**

   - Ensure all links resolve correctly
   - Verify visualizations generate properly
   - Check that the site builds without errors

2. **Commit Your Changes**

```
git add .
git commit -m "feat: Add definition of compact space"
```

3. **Push and Create Pull Request**

```
git push origin feature/your-feature-name
```

   Then create a pull request on GitHub.

4. **Pull Request Guidelines**

- Use a descriptive title
- Reference any related issues
- Describe what you've added/changed
- Include screenshots if relevant

Style Guide

Mathematical Notation

- Use LaTeX for all mathematical expressions
- Define notation before first use
- Be consistent with standard mathematical conventions

Writing Style

- Write in clear, accessible language
- Define technical terms on first use
- Provide intuitive explanations alongside formal definitions
- Include examples to illustrate abstract concepts

Theorem Environments

Use Quarto's theorem environments:

```
::: {.theorem #thm-unique-identity}
**Uniqueness of Identity**

In any group $(G, \cdot)$, the identity element is unique.
:::

::: {.proof}
Suppose $e$ and $e'$ are both identity elements...
:::
```

Community Guidelines

- Be respectful and constructive in discussions
- Welcome newcomers and help them get started
- Give credit where credit is due
- Focus on mathematical accuracy and clarity

Resources

- Quarto Documentation
- RDF/OWL Primer
- Lean 4 Documentation
- Project Architecture

Getting Help

- **Questions**: Open a GitHub Discussion
- **Bugs**: Create an Issue
- **Chat**: Join our community (coming soon)

Thank you for helping build a comprehensive, accessible resource for mathematical knowledge!