

# 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}.qmd  
- Theorems: content/{domain}/thm-{theorem-name}.qmd - Examples: content/{domain}/ex-{example-name}.qmd  
- Axioms: content/{domain}/ax-{axiom-name}.qmd

#### Required Metadata

Every .qmd file must include YAML front matter:

```

---
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

```

# 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	<code>content/algebra/</code>	Groups, Rings, Fields, Linear Algebra
Analysis	<code>content/analysis/</code>	Limits, Derivatives, Integration
Topology	<code>content/topology/</code>	Topological Spaces, Compactness, Connectedness
Geometry	<code>content/geometry/</code>	Euclidean, Metric Spaces
Number Theory	<code>content/number-theory/</code>	Primes, Divisibility
Combinatorics	<code>content/combinatorics/</code>	Counting, Graph Theory
Logic & Set Theory	<code>content/logic-set-theory/</code>	Sets, Logic, Foundations
Probability & Statistics	<code>content/probability-statistics/</code>	Probability Spaces, Distributions
Category Theory	<code>content/category-theory/</code>	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!