

Learning Tip:

The Power of Abstraction in Math

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The Power of Abstraction in Math

- ▶ A powerful tool in mathematics is to extract an essential property of an object or problem, and use it to develop generalizations and abstractions.
- ▶ For example, consider the problem of colouring the world map such that countries sharing a boundary (i.e., are adjacent) receive different colours.



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- ▶ We can think of the map colouring problem this way:
 - ▶ We have a collection of **objects** (countries), some of which are **related** (share a boundary).
 - ▶ We assign each object to a **category** (colour) such that related objects must be assigned to different categories.

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- ▶ Now consider the problem of scheduling the final exams for all courses at USask. Some courses have students in common, and we can't schedule their exams at the same time.
- ▶ So...
 - ▶ We have a collection of **objects** (courses), some of which are **related** (have students in common).
 - ▶ We assign each object to a **category** (exam time slot) such that related objects must be assigned to different categories.

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- ▶ Now consider an instance of a Sudoku puzzle: Fill a 9×9 grid so each row, column, and 3×3 box contains 1–9 exactly once.

			3	7	6			
		6				9		
	8						4	
		9					1	
6							9	
3						4		
7					8			
1				9				
2	5	4						

Image Source

- ▶ Again:
 - ▶ We have a collection of **objects** (empty cells), some of which are **related** (share the same row, column or 3×3 box).
 - ▶ We assign each object to a **category** (digits 1–9) such that related objects must be assigned to different categories.

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- ▶ By stripping problems to their essentials we unlock powerful, general solutions — that's the power of abstraction.
- ▶ Abstraction is a skill: it rewards deep understanding and creativity. Learning to see structure lets you solve new problems, discover surprising connections, and do real mathematics.