Project title: Reading project in pure mathematics I, II
Supervisor: Dr. Amy Pang

In this project, you will learn some mathematics through reading, then explain it with your own examples. The topic of your project is flexible; below are some ideas, you can also suggest your own. Interested students should meet with Dr. Pang (Zoom or on campus) before selecting this project, to find topics that interest both me and you. Email amypang@hkbu.edu.hk to make an appointment, individually or as a group.

(Dr. Pang can also supervise projects related to math education, if you have something to propose.)

Topic ideas:

- Something from advanced undergraduate or masters level, that is not in a course we currently offer, e.g.
  - Non-Euclidean geometry (e.g. why a triangle on the surface of a sphere has angles adding up to more than 180°.)
  - Topology
  - Functional Analysis
  - Advanced topics in abstract algebra

  This may be useful if you're applying to research postgraduate degrees, or just for interest in pure math. For the more difficult topics, Dr. Pang will suggest references and exercises.
- Explain the theory behind some "popular mathematics", e.g. these puzzles/games:
  - Pursuit-evasion games - e.g. cops and robbers on graphs (`https://en.wikipedia.org/wiki/Pursuit-evasion`, `https://arxiv.org/pdf/1204.5490`)
  - Logic puzzles involving prisoners and hats (`https://en.wikipedia.org/wiki/Hat_puzzle`, `https://arxiv.org/abs/1801.01512`)
  - River crossing puzzles (`https://en.wikipedia.org/wiki/River_crossing_puzzle`, `https://arxiv.org/abs/1802.09369`)
  - Graph Ramsey games - e.g. 井字棋 / 過三關 (`https://en.wikipedia.org/wiki/Sim_(pencil_game)`, `https://arxiv.org/abs/cs/9911004`)
  - Dots and Boxes game (`https://arxiv.org/abs/1811.10747`)
  - Coin-weighing puzzles (`https://en.wikipedia.org/wiki/Balance_puzzle`), which are related to compressed sensing and group-testing for Covid
  - Matching problems - e.g. the system matching students to FYP supervisors, JUPAS admission system (`https://en.wikipedia.org/wiki/Stable_marriage_problem`)

  Dr. Pang does not know much about these games. Your task is to teach her something about one of them. You are required to look up references by yourself, read them independently, and combine their ideas together with your own examples into one coherent presentation. Your project should include some general theory about these games (e.g. what conditions are necessary and/or sufficient for solutions to exist), not just a strategy to solve the puzzle.

Prerequisites: Interest in your chosen topic, and motivation to learn about it. Mathematical prerequisites depend on the topic, i.e. which topics are accessible to you will depend on what classes you have taken.