Charles Ran (he/him, 18)

Software Developer and STEM Student

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EXPERIENCE

Math et. Al — *Founder, Executive Director, Problem Writer, Lead Developer*

OCTOBER 2021 - PRESENT

- **Founded** a registered STEM nonprofit organization
- **Handles management and logistics** in a community of 300+ members
- **Created engaging events, resources and contests** relating to STEM, like the **Math et. Al: Math + Physics Contest** and **Math et. Al's CHESSKON**
- Wrote the **main website** and maintains the organization **tech and server architecture**
- Wrote the **Virtual Olympiad** platform and **server architecture**

Ontario Competitive Mathematics Committee — *Executive of Mathematics*

JULY 2023 - PRESENT

- **Graded homework** and **student feedback** in OCMC's **Math Enrichment Summer Program**
- **Problemsetter and testsolver** for OCMC contests like **OMC** and **OIME**

Canadian Innovative Community Service Alliance — *Lead Developer*

MAY 2022 - APRIL 2023

- Lead the development of the **CICSA main website** including the **Chinese Cultural Festival** using **Svelte, Typescript, Bulma UI and SCSS**
- Assembled the consolidation of information and logistics to be presented on the online platform

LinkedKey — *Teacher Assistant*

JULY 2020 - AUGUST 2022

- Math Olympiad Assistant Coach: wrote **detailed solutions/feedback** to challenging problems, utilizing extensive expertise with **LaTeX**
- Hosted homework help sessions and managed a **student Discord community**, providing additional resources and **support for classes during COVID-19**

RESEARCH

Canadian Young Physicists' Tournament — *Fluids Researcher*

AUGUST 2022 - APRIL 2023

- Investigated **fluid physics phenomena**
- Published consolidated **research through a contest format** in CaYPT
- Derived novel results using **Fluid Theory**, **Multivariable Calculus** and **Linear Algebra**
- Built robust experimental models using **CAD/CAM** and **Engineering**
- Developed **computer algorithms** and **image processing pipelines** with **Julia** and **OpenCV** to aid phenomena analysis
- Ranked **Top 15 nationwide** and **Invitee to the IYPT National Training Camp** (for the International Stage)

EDUCATION

High School

SEPTEMBER 2020 - JUNE 2024

- Executive of the **Math Club, Physics Club, Computer Science Club** and **Table Tennis Club**
- Took **12 AP exams (only 4s or 5s)**, notably including a **5 on AP Calculus BC in grade 9** and 5 on both AP Physics C: Mechanics and AP Physics C: E&M

SOFTWARE PROJECTS

Virtual Olympiad — Online Platform

DECEMBER 2021 - PRESENT

Massive online platform for the contest math community. Users can host private or public multiplayer contest servers in a professional frontend using **SvelteKit, SCSS, Tailwind, Carbon Design**. Rounds are given extensive customizability in format (normal, teams, relay), problems (AMCs, AIME, time and difficulty) and more by accessing the custom backend in **Node Typescript** with **WebSocket** which accesses **VODB** under the hood. The platform integrates with **Firebase** for **Account Auth and Realtime Storage**.

VODB — API Wrapper & Database

AUGUST 2022 - PRESENT

Typescript **API wrapper** for the Art of Problem Solving Database. Uses **Cheerio** to extract data by parsing the DOM in AoPS Wiki Pages and can **dynamically render content to LaTeX** format on the web with help from KaTeX. Integrates with Postgres as a **easily queryable massive schemafull database of problems**.

Impact — WebGL Library

JULY 2020 - SEPTEMBER 2020

Lightweight **WebGL** boilerplate library supporting initialization for ground-up **rasterization, raytracing, and raymarching shaders**. Dynamically integrates with the WebGL canvas context. Available through CDN.

CERXA — Custom 3D Graphics Engine

AUGUST 2020 - MARCH 2021

From-scratch **rasterization and volumetric raytracing engines** implemented in P5.js and WebGL, respectively. Uses custom **Linear Algebra** and **Multivariable Calculus** implementations to construct primitive shaders implementing **Computer Graphics and Physics Light Transport Techniques**. Features ambient, diffuse and specular lighting, hard shadows, a dynamic camera system and support for fractal rendering through DE (distance estimation).

BrawlTrack — Online Statistics Tracker

FEBRUARY 2021 - AUGUST 2021

Club statistics tracker for the mobile game Brawl Stars. Fetches Brawl Stars public **API data** regularly

SKILLS

Fullstack Web Development
Computer Graphics Rendering
Algorithm Design
Image Processing
UI/UX Design
CAD/CAM
Game Development
Olympiad Level Math
Research Level Physics
Management & Logistics
Teaching
Problem Solving
Leadership & Teamwork

LANGUAGES AND TECHNOLOGIES

Typescript (+JS), Julia, Python, Java, C#, C++, Rust

SvelteKit, React, EJS, HTML, CSS, SCSS, jQuery, Tailwind, Material Design, Carbon Design, Figma, Markdown, LaTeX

Node, .NET, Express, SocketIO, Auth0, Supabase, Firebase, Docker, Nginx, Postgres, SQL(ite), MongoDB, Redis

Server Infrastructure, Email, DNS, Various Cloud Hosting, CMS

OpenGL, WebGL, Processing Graphics Library, Web Canvas API

Git, Linux, OpenCV, Jupyter Notebook

AWARDS

Perfect Score and International Champion on the *Canadian Open Mathematics Competition*

3 time qualifier and placed Top 20 nationwide (g10) in the *Canadian Mathematical Olympiad*, **Qualifier** for the *Asia-Pacific Mathematical Olympiad*

Invitee to the prestigious *Canadian Math Society Winter Olympiad Training Camp* (~15 top olympians nationwide)

Top 15 ranking nationwide and National Camp Invitee for the *Canadian Young Physicists Tournament for Physics Research*

Consistent distinction and honor roll awards in CEMC math and computing competitions, including **Student Champion** on the *Canadian Senior Mathematics Competition*

5 time qualifier for the *American Invitational Mathematics Examination*

Top 1.1% globally and near Distinguished Honor Roll on the *AMC12*

1570 on the *SAT* (one sitting)

First place nationally on the *Ontario Mathematics Competition*

Invitee to the prestigious *Canadian Math Society Junior Olympiad Training Camp* and *Waterloo EMACS Program*

in a **Node Express server** to be stored in **MongoDB** and displayed in a **custom UI** mimicking in-game design using **EJS**. Made for BB Esports as the Lead Developer and was used by various clubs and esports organizations and **2000+ players**.

Vires — Image Processing Pipeline & Analysis Software

AUGUST 2022 - MAY 2023

Image processing pipeline and algorithm suite for fractal analysis. Developed for research purposes in the Canadian Young Physicists Tournament, Vires analyzes images of real-world fractal phenomena. The pipeline can also be implemented in ImageJ. Written in **Julia**.

OTHER ACTIVITIES

Sports: Basketball, Tennis, Varsity Cross Country, Varsity Track & Field, Gym

Peak 1750 CFC Rating in Chess, numerous competition awards

Top 75 Nationally (1%) in Modern Tetris