# Curriculum Vitae: Preston Tranbarger

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# Education

## University of North Texas

**Denton, TX;** *Texas Academy of Math and Science*;
**Final GPA:** *3.718*; **Final Mathematics GPA:** *3.833*; **Date of Graduation:** *Spring 2021*

The Texas Academy of Math and Science (TAMS) is a two-year residential early college program. Students are able to enroll full time in in-person college classes at the University of North Texas to apply to both high school and college credit. More information can be found here: `https://tams.unt.edu/`.

## Texas A&M University

**College Station, TX;** *Bachelor of Science in Mathematics*;
**Current GPA:** *3.906*; **Current Mathematics GPA:** *3.842*; **Expected Graduation:** *Fall 2022*

Currently pursuing a Bachelor of Science in Mathematics and working on a masters application through the FastTrack program at Texas A&M University. If accepted will graduate in the Spring of 2024 with a Bachelors of Science in Mathematics in addition to a Masters of Science in Mathematics. More information can be found here: `https://www.math.tamu.edu/graduate/fasttrack/`.

# Employment

## University of North Texas

**Denton, TX;** *Undergraduate Student Researcher*; **March 2020 - April 2021**

Devised a novel methodology of solving linear Diophantine equations in addition to quantifying and highlighting the solution's intriguing and useful properties (see *Research Experience* below for more details).

## Texas A&M University

**College Station, TX;** *Student Grader*; **August 2021 - December 2021**

Assisted a professor by grading papers and providing feedback for approximately 100 students across multiple sections of a linear algebra course.

**College Station, TX;** *Paid Intern*; **May 2020 - April 2022**

Creating a novel computer application intended to streamline various common methodologies of repeat photography by utilizing an array of modern programming techniques.

**College Station, TX;** *Undergraduate Student Researcher*; **August 2021 - Present**

Working on multiple research projects including a project regarding the distribution of eigenvalues of matrices of cubic residue symbols and an NSF RETTL funded project targeted at using AR to better help students understand rotation matrices and quaternions (see *Research Experience* below for more details).

# Research Experience

## University of North Texas

**Advisor: *Dr. Stephen Jackson*; March 2020 - May 2021;**
**Topic: *A Particular Solution to Linear Diophantine Equations***

This research project's purpose was to examine the properties of a novel recursive method of solving a specific class of linear Diophantine equations. This study uncovered some notable properties which revealed that this method was particularly good at approximating optimal solutions to the change making problem while requiring low computational resources.

## Texas A&M University

**Advisor: *Dr. Matthew Young*; August 2021 - Present;**
**Topic: *The Distribution of Eigenvalues of Matrices of Cubic Residue Symbols***

This research project seeks to expand upon previous results which examined the distribution of eigenvalues of a particular form of matrix with elements which are all quadratic residue symbols. In particular, this project examined the same distribution in the case that every element is a cubic residue symbol instead of a quadratic residue symbol. In working on this project, a new set of computer programs have been developed to assist further investigation into this topic with future plans in the works to release this code for other researchers to utilize alongside a publication detailing the findings of this research.

**Advisors: *Dr. Philip Yasskin, Dr. Wei Yan*; January 2022 - Present;**
**Topic: *Teaching Quaternions and Rotation Matrices Through Augmented Reality***

This research project examines the ability for augmented reality to serve as a supplemental instruction method to further develop student's geometric intuition on rotations in three dimensional space. It is funded through a grant provided by the NSF RETTL program, and this project represents a collaboration between the architecture, computer science, and mathematics departments at Texas A&M University.

**Advisor: *Dr. Matthew Young*; May 2022 - Present;**
**Topic: *REU in Number Theory, Fast Computation of Generalized Dedekind Sums***

Developed a novel algorithm utilizing combinatorial group theory to compute generalized Dedekind sums. This algorithm represents a significant improvement over previous methods by reducing a previously exponential time algorithm to polynomial time.

# Service

## Previous Service

### *TAMS Eureka! High School Math Tutoring*; August 2020 - May 2021

Helped tutor high school students in the Dallas-Fort Worth area in the subjects of Precalculus, Calculus I, and Calculus II through the TAMS Eureka! club.

### *Texas A&M University High School Math Competition*; November 2021

Assisted in the grading of the yearly Texas A&M University High School Math Competition alongside graduate students and professors. Planning to participate once more in the grading process after the 2022 competition date is announced.

## Ongoing Service

### *Texas A&M University Math Circle*; August 2021 - Present

The Texas A&M University Math Circle is an organization which seeks to help students grades 5-12 gain exposure to interesting topics which otherwise may not be presented in regular coursework. Assisting in both the facilitation and instruction of the learning environment created by the Texas A&M University Math Circle.

# Relevant Skills

## Mathematics

Will be well versed in the areas of mathematics covered by the following courses at the end of the fall 2022 semester as per the transcript:

- **Calculus Courses:** Calculus I, Calculus II, Calculus III, Differential Equations I, Advanced Calculus I (Analysis for Calculus)

- **Analysis Courses:** Real Analysis I, Introduction to Functions of a Complex Variable, Advanced Calculus I (Analysis for Calculus)

- **Algebra Courses:** Linear Algebra and Vector Geometry, Number Theory, Abstract Algebra I/Modern Algebra I, Abstract Algebra II/Modern Algebra II, Graduate Algebraic Number Theory, Graduate Algebra I

- **Combinatorics and Probability:** Mathematical Probability, Graduate Combinatorics

Other mathematical skills acquired outside of these courses include knowledge acquired and utilized in the aforementioned research projects.

## Programming

Some of my code can be found here: `https://github.com/prestontranbarger`.

- Advanced level of knowledge in C, C++, Java, Mathematica, Python, R, SageMath.

- Intermediate level of knowledge in BASIC, CSS, HTML, Javascript, and Maple.

- Advanced level of knowledge in the C/C++ packages and libraries: cmath, cstdlib, ctime, iomanip, iostream, random, stdio.h, stdlib.h, string, string.h, and vector; the Python packages and libraries: cv2, math, matplotlib, numpy, os, random, re, and time; and the R packages and libraries: DT, dplyr, ggplot2, magick, OpenImageR, reticulate, shiny, shinycssloaders, shinydashboard, shinydashboardPlus, and tidyr.

- Intermediate level of knowledge in the C/C++ packages and libraries: assert.h, cctype, fstream; the Python packages and libraries: functools, multiprocessing, numba, and PIL; and the R packages and libraries: exifr, ggmap, rgdal, sf, shinyBS, shinyjs, and sp.

## Other

- Extensive experience with and knowledge of LaTeX through near daily application.

# Awards

***Mary and Robert N. Walker Endowed Scholarship**; Fall 2021 - Spring 2025*

This scholarship is awarded to a freshman mathematics major by the Texas A&M University mathematics department. More information can be found here: `https://www.math.tamu.edu/undergraduate/scholarships/`.