

Hi all,

Here is a summary of some of the practical information for applying to Research Experiences for Undergraduates (REUs), some of which was shared during yesterday's panel:

- What is an REU?
  - See <https://www.nsf.gov/crssprgm/reu/> for a brief description.
- What is the benefit of attending an REU?
  - REUs are an excellent way to determine if a career in mathematical (or other scientific) research would be a good fit for you.
  - Participation in an REU is a highly valuable item to include in your CV(curriculum vitae)/resume, especially if you are interested in applying to graduate school in mathematics (or other sciences). (Remark: Attending an REU is not a requirement for applying to graduate programs. However, attending an REU does strengthen an application.)
  - REUs are rewarding opportunities in and of themselves to learn or discover something new in mathematics!
- What does an REU look like?
  - REUs come in many different shapes and sizes. Most take place during the summer. Some REUs are as short as six weeks, while others may last the entire summer. The workload for an REU is typically “full-time.” The “research” component of an REU can vary. Here is a list of some examples of what this component might look like, listed in the order in which students typically have the experiences: (Remark: most REUs are a combination of these)
    - Learning and training. The objective is for students to learn how to read, present, and write about research-level mathematical literature. Some programs also teach students how to use mathematical software, such as LaTeX and MATLAB. This objective is accomplished through having students study an area of mathematics that is usually not covered in a standard undergraduate curriculum, culminating in a summarizing paper or presentations. Subsequently, this experience provides students with the skills to pursue more “advanced” research opportunities.
    - Expository. The objective is for students to study an area of research-level mathematics in a serious amount of depth in order to write a detailed exposition of what they learned. While this is not “original research,” the papers that are produced are usually the first such comprehensive expositions of their subject matter. These papers are then often uploaded to the internet and read by other students across the world who are interested in learning the material covered in the paper.
    - Research. The objective is for students to produce an original research paper with findings and theorems that have never been published before. The likelihood of producing such a paper can vary. At some REUs, publishing a paper is less of a priority; instead, the primary goal of the program is for students to explore a problem and attempt to solve it, but not necessarily prove a new theorem or publish. These experiences

remain invaluable. It is natural in doing research to not solve a problem or only make partial progress, but still learn a substantial amount of mathematics along the way that could be useful later on. At other REUs, the primary goal is to publish a research paper. At these REUs, problems are typically thought of beforehand by a mentor who is an expert in their subfield and knows it is highly likely that, with sufficient preparation, the students will be able to produce an original research paper. The background for these REUs is highly variable. Some problems are more “elementary,” requiring a serious amount of creative thinking and yet minimal advanced background. Other problems require not so much creativity, but rather “heavy machinery.” With these problems, students need to have a serious amount of background knowledge in order to even begin working on the problem, and the original research paper consists of piecing together this knowledge in a novel way.

- Which REUs should I apply to?
  - A list of REUs can be found at these two links:
    - [https://www.nsf.gov/crssprgm/reu/list\\_result.jsp?unitid=5044](https://www.nsf.gov/crssprgm/reu/list_result.jsp?unitid=5044)
    - <https://sites.google.com/view/mathreu>
  - A student's approach to the application process is highly dependent on their mathematical and personal background, as well as their goals. As mentioned above, REUs can have several different objectives for their participants. REUs may also seek applicants with a specific background, such as students from groups underrepresented in mathematics or students with no prior research experience. One of the best ways for a student to determine whether an REU will be a good fit for them is to consult other students who are familiar with the application process (or even that specific REU) or departmental faculty. Students should feel comfortable emailing their professors or attending office hours in order to ask questions about REUs.
- How many REUs should I apply to?
  - Again, a student's approach to the application process is highly dependent on their mathematical and personal background, as well as their goals. Here are two scenarios a student may find themselves in (or somewhere in between):
    - Some students may be broadly interested in mathematics and are not committed to a specific subfield. In this situation, a student may want to apply to as many REUs as possible that they think would be a good fit (see the previous bullet point) for them.
    - Other students may be interested in a particular subfield of mathematics. In this situation, a student may only be interested in a few REUs which pertain to their area of interest.
- Which professors should I ask to write a letter of recommendation?
  - Once more, a student's approach to the application process is highly dependent on their mathematical and personal background, as well as their goals. This question is answered using the two scenarios from the previous bullet point:

- Broad interests. A student who has broad mathematical interests will want to ask professors from their favorite or their most advanced courses to write their letter of recommendation. Some students may also have professors that they study with independently outside of courses – these professors are especially helpful for writing a letter of recommendation. The more familiar a professor is with the work a student has done, the stronger their letter of recommendation will be. It can also help if a professor is more “senior.”
  - Specific interests. A student who has specific mathematical interests will want to ask at least one professor within their subfield of interest to write a letter of recommendation for them. This significantly increases a student’s chance of being accepted to an REU in this specific subfield, especially if the professor is known by the directors of the REU. To help the professor write more compelling material in their letter, it is recommended that the student pursues an independent study with the professor beforehand. Naturally, this requires having a plan for REU applications at least a semester in advance of the application deadline.
- Are REUs funded?
  - Most REUs provide a living stipend for the duration of the program.
- How do I write a personal statement for an REU application?
  - A personal statement should communicate the following:
    - What is your mathematical background (that is, what have you learned, what do you find interesting, do you have prior research experience (give details)) that is relevant to this REU? Get specific!
    - How does the background you just provided make this REU a good fit for you? It may be helpful to reference previous projects from that REU.
    - What additional mathematical background do you have that may not be relevant to the subject area of the REU, but nonetheless demonstrates a broader interest in mathematics?
    - What are your future goals? How will attending this REU help you achieve your goals? Be brief, but clear.
  - An REU may also ask for you to provide specific information on your personal background, but, besides this, applying to an REU is not similar to applying to college. Your focus should be on discussing in concise detail the mathematics you have seen and are interested in, not a rhetorical narrative about how “you have always loved math.”
  - Ask your peers and look online for examples of personal statements. Successful examples provide useful reference points for how to effectively write your own personal statement.
- What if I am not accepted into an REU?
  - There are alternative ways to participate in similar experiences during the summer. Here are two:
    - The Budapest Semesters in Mathematics Summer Program (see <https://www.budapestsemesters.com/summer-program/>).

- Some UVA professors may be willing to meet with a student on Zoom regularly over the summer through a formal or informal independent study course. Students should feel free to reach out to their professors to seek such opportunities.