

Mathematics



Why are 60 percent of HMC's math majors accepted into Ph.D. programs—great teachers, great students or a rigorous curriculum? We think it's all of the above. The results coming out of our Mathematics department are truly amazing as many HMC students do exceptionally well in national and international competitions. For example, HMC won top honors in the International Mathematical Modeling Contest in 2010, and placed fifth behind larger institutions like MIT and Harvard in the 2003 William Lowell Putnam Mathematical Competition, the only undergraduate college to land in the top five in the past 30 years. In 2006, the department was awarded the very first Award for Exemplary Program by the American Mathematical Society for the strength of our overall program.

Of the 60 percent entering PhD programs, surely the highest of any college or university in the nation, almost all of these students received full tuition scholarships and additional financial support through research and/or teaching fellowships. In the past five years, our graduating seniors have begun graduate programs in mathematics, applied mathematics, computer science, physics, and economics at Princeton, MIT, Harvard, Cambridge, Columbia, Stanford, Chicago, Cornell, Johns Hopkins, Berkeley, Wisconsin, U. Penn, Brown, Caltech, just to name a few.

Mathematicians have different needs than their colleagues in engineering or science. Doing mathematics often involves collaborating with colleagues at HMC and other institutions so many of our needs do not fall under "equipment." Nevertheless, while some areas of mathematical research do require physical laboratory space (to allow for physical manipulation of objects, fluids, chemicals, and so on), computers are our primary "laboratories." Mathematicians, both pure and applied, increasingly rely on computers to perform experiments, verify theories through simulation, and visualize, process and verify data. And of course, these advances in mathematical knowledge must also be communicated to our students, along with instruction on the effective use of computation in mathematics.

The heavy computational component of our mathematical work means that significant computational resources are required to carry out both day-to-day research and teaching. The college does not currently provide adequate support for our computing needs, so the HMC mathematics department has supported these needs in three ways: external grants, faculty start-up funds, and other ad hoc funds (such as summer math income, Mathematics Clinic Program, and special grants from the Dean of Faculty). These funding sources are unpredictable, so computer equipment in our department is often used well past its usual life cycle until funds can be secured for maintenance or upgrades.

The HMC Math Department's long-term computing needs are listed below. The items that are in most critical need of maintenance or upgrade are listed first.

- **Computational servers:** Two servers with fast processors and RAM to handle large computations. Estimate: \$40K (\$20K each), replaced every three years
- **Departmental servers:** Four servers to support authentication, mail, web, and other services. Estimate: \$40K (\$10K each), replaced every three years.
- **Storage and backup systems:** Disk arrays and backup systems. Estimate: \$15K, replaced every five years.
- **Power and cooling systems:** Uninterruptible power supplies and cooling to protect servers. Estimate: \$5K, replaced every five years.
- **Workstations:** 14 faculty workstations, 10 clinic workstations, 10 lab workstations, 3 staff workstations. Estimate: \$100K (\$2-4K each), replaced every three years.
- **Networking infrastructure:** Routers and switches for networking. Estimate: \$5K, replaced every five years.
- **Software:** License costs for mathematical software (such as Mathematica, Maple, Matlab). Estimate: \$10K per year.

Funding of creative collaborative research and teaching spaces will open up new opportunities for the Mathematics Department and HMC students to flourish. The architecture of the buildings that house mathematical activity should be designed to reflect and support a high level of creative activity in mathematics. This includes:

Common Space: Common collaborative meeting and working areas.

- **Sprague Third Experiential Workspace:** The Math Department is developing an integrated experiential learning center including a seminar space, a library, research pods for Clinic and other small group work.
- **Laboratories:** Research and Demo/Teaching Laboratories including a fluid mechanics testbed.