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# Course Catalog

2020-2021

Including Full Year and Semester 1 Courses



**Loudoun School**  
for Advanced Studies

# CONTENTS

MATHEMATICS .....	4
Pre-algebra .....	4
Algebra 1 .....	4
Geometry .....	4
Algebra 2 .....	4
Trigonometry .....	4
Precalculus.....	5
Foundations in Calculus .....	5
AP Calculus AB .....	5
AP Calculus BC .....	5
SCIENCE.....	6
The Great Naturalists .....	6
Life Science .....	6
Physical Science .....	6
Middle School Data Analysis .....	6
Biology .....	7
Chemistry .....	7
Conceptual Physics .....	7
AP Physics 1 .....	7
AP Physics C .....	8
Physical Astronomy .....	8
Modern Astronomy.....	8
LANGUAGE ARTS.....	9
English Composition 1 .....	9
English Composition 2 .....	9
Epic and Drama in British Literature .....	9
American Literature .....	9
AP Language and Composition .....	10
SOCIAL SCIENCE .....	11
Conversations in US History: Part 2 .....	11
European History .....	11
Reckoning With US History .....	11
World History .....	11
US Government: Current Events & Predictions .....	11
American Iliads: Remembering War the American Way .....	12
FOREIGN LANGUAGE.....	13
Spanish .....	13
French.....	14
ADDITIONAL COURSES .....	15
Design in the Marketplace .....	15
Music .....	15
Computer Science .....	15
Physical Computing .....	15
Physical Computing 2: Advanced Topics .....	16
Drawing and Painting .....	16
Photography .....	16
Physical Education .....	16

# MATHEMATICS

## **Pre-algebra (full year)**

*Rita Lahiri*

Pre-algebra encompasses the study of integers, proportional reasoning, order of operations, expressions, and equations. This course emphasizes mathematical concepts with real-world applications. While learning the language of algebra, students develop critical thinking skills and problem-solving skills. This course also highlights effective class participation and study skills.

## **Algebra 1 (full year)**

*Rita Lahiri*

Algebra 1 is designed to give students a foundation for all future math courses. In this course, students will learn to use variables to represent unknown quantities to solve algebraic equations and inequalities. Modeling and problem solving are at the heart of the curriculum. Mathematical modeling consists of recognizing and clarifying mathematical structures that are embedded in other contexts, in mathematical terms: using mathematical strategies to reach a solution and interpreting the solution in the context of the original problem. Students must be able to solve practical problems by representing and analyzing the situation using symbols, graphs, tables, or diagrams.

## **Geometry (full year)**

*Julie Sohl*

Geometry is primarily the study of spatial relationships with a principal focus on two-dimensional and three-dimensional space. We will begin with lines and angles and then progress to various families of shapes and their relationships: triangles, quadrilaterals, circles, etc. Besides understanding fundamental concepts, we will also look at how objects change as they undergo various transformations: translations, rotations, reflections, and dilations. Emphasis will be on building students' confidence in problem-solving and on persevering when challenged with difficult problems. Practical as well as whimsical applications of geometry will be explored.

## **Algebra 2 (fall semester)**

*Wendy Huth*

Algebra 2 provides students with a foundation for upper level mathematics by incorporating mathematical reasoning, communication skills, and increasingly sophisticated real-world problems. Students will learn to manipulate more advanced mathematical functions and algorithms. Quadratic functions are thoroughly investigated, including graphing and multiple methods of solving which require an introduction to complex numbers and advanced algebraic techniques. Real-world applications will be investigated by modeling of quadratic functions. Students will also explore rational functions and master working with radicals and rational exponents.

## **Trigonometry (spring semester)**

*Wendy Huth*

In this course, students learn trigonometric functions as well as the application of the functions in real-life problems. The students will analyze, graph, and solve

trigonometric functions. In order to improve logical thinking and mathematical reasoning, there is an emphasis on the verification of trigonometric identities using all of the fundamental trigonometric identities.

## **Precalculus (fall semester)**

*Sasha Draganov*

Precalculus applies advanced data analysis techniques to working with a variety of functions. Students will examine conic sections and logarithmic, exponential, and polynomial functions. Sequences and series will also be explored. Students will strengthen their conceptual understanding of problems and mathematical reasoning in solving problems. We will consider numerical, graphical, and algebraic solutions for all functions and discuss when each of these solutions is applicable. The course's focus on problem solving is enhanced with the use of technology.

## **Foundations in Calculus (spring semester)**

*Sasha Draganov*

This course is designed to prepare students for Advanced Placement Calculus and SAT math subject level exams. In this course, students use symbolic reasoning and analytical methods to represent mathematical situations, to express generalizations, and to study mathematical concepts and the relationships among them for an understanding of a broad variety of mathematical relationships. Students also connect ideas in algebra, geometry, probability, statistics, trigonometry, function families and graphing. Students will use concrete, numerical, algorithmic, and graphical tools and technology to model functions and equations.

## **AP Calculus AB (full year)**

*Wendy Huth*

This course teaches students to approach calculus concepts and problems when they are represented graphically, numerically, analytically, and verbally, and to make connections amongst these representations. Calculus concepts will be applied to the functions students have studied the past few years. The real-world applications of calculus will be explored using derivatives, integration, and differential equations. Students learn how to use technology to solve problems, experiment, interpret results, and support conclusions.

## **AP Calculus BC (full year)**

*Wendy Huth*

AP Calculus BC is roughly equivalent to both first and second semester college calculus courses. It extends the content learned in AB to different types of equations (polar, parametric, vector-valued) and new topics (such as Euler's Method, integration by parts, partial fraction decomposition, and improper integrals), and introduces the topic of sequences and series. The AP course covers topics in differential and integral calculus, including concepts and skills of limits, derivatives, definite integrals, the Fundamental Theorem of Calculus, and series.

# SCIENCE

## Middle School Courses

Our middle school science program is led by the same faculty that teach our high school courses. Therefore, students benefit from meaningful experiences that directly correspond with their future endeavors. The close relationships between students and teachers built in the middle school years inform the future of our high school program.

### **The Great Naturalists (full year)**

*Ashley Gam*

In this class, students in grade 6 will investigate the origin of some of the great ideas of natural history, biology, and ecology: the invention of the microscope, the connectedness of species, the specific roles of species within an ecosystem, the ability of populations to change over time, the complexity of animal behavior, and how humans can influence and disrupt these natural processes. We will do this by hearing the unique stories of individual naturalists, scientists who have played key roles in the development of these scientific ideas and discoveries. We will practice the techniques and methodologies they employ and examine the evidence they used to support their ideas. By doing this, we will (1) gain content knowledge in areas of ecology, biology, and evolution, (2) practice the techniques, methodologies, and habits used by great naturalists including biological surveying, making observations, scientific illustration, using microscopes, collecting data, and analyzing data, and (3) gain a more intimate understanding of the history and nature of science.

### **Life Science (full year)**

*Julie Sohl*

Students in grade 7 will learn topics in chemistry and biology as they explore the roles of water, matter, and energy in living things. Students will learn to design controlled experiments, analyze data, and communicate the results orally and in writing. The class will culminate with students integrating knowledge to design ecosystems and to understand threats to the Earth's ecosystems.

### **Physical Science**

*David Romero*

Students in grade 8 will be introduced to topics in physics, chemistry, and engineering. Topics covered will include motion, atomic theory, and energy. Lab skills and engineering practices will be spread throughout the course. The goal of the course is to improve students' understanding of the physical world and expand their scientific curiosity.

### **Middle School Data Analysis**

*David Romero*

MS Data Analysis is designed as a supplement to a student's main science course. Students are introduced to different phenomena through a cycle of observation, questioning, data collection, and analysis. The overarching goal is for students to better understand and share the data they personally collect.

# Introductory High School Courses

There is no prescribed sequence, but take the following into account:

- Students interested in the life sciences should plan to take Chemistry before Biology to get the most out of the course.
- Students interested in physics or mechanical/electrical engineering should plan on taking an introductory Physics course early. This will allow for more advanced electives early on. Conceptual Physics and AP Physics 1 are offered in alternate years. Either course will fulfill the physics requirement.

## **Biology (full year)**

*Ashley Gam*

In this course, we will examine major themes of biology: biochemistry, genetics, physiology, evolution, natural selection, and ecology. This will be done using case studies to integrate themes of biology and create deeper understandings of biological phenomena. Modeling of biological processes, reading of scientific literature, formal scientific writing, discourse, biological techniques, and data analysis will be practiced and developed throughout the year.

## **Chemistry (full year)**

*Julie Sohl*

This course is intended to help students realize the important role that chemistry plays in the world around them as well as its connections to technology and other sciences. Topics to be studied include: the classification and structure of matter, ratio and proportion of chemical reactions, reaction stoichiometry, acid-base chemistry, kinetics, and thermodynamics. Students will be taught laboratory safety and perform experiments whenever possible. In addition, students will learn to document, analyze, and communicate their experimental results.

## **Conceptual Physics [offered 2021-22 and 2023-24] (full year)**

*David Romero*

The goal of this course is for students to critically analyze information and generate new knowledge. Students will develop certain scientific abilities or habits of mind and practice thinking like a physicist. For pedagogical purposes, we will focus on topics that are relatively simple. For aesthetic purposes, we will focus on those topics considered fundamental to our understanding of nature. Topics covered include: motion, dynamics, light & waves, and electric & magnetic fields. Conceptual Physics is a gentler introduction to physics. It can serve as a good foundation for either AP Physics 1 (algebra-based) or AP Physics C (calculus-based).

## **AP Physics 1 [offered 2020-21 and 2022-23] (full year)**

*David Romero*

The philosophy and routines in this course are very similar to Conceptual Physics since they are both introductory courses; however, this course covers much more material. The workload is higher and we have 50% more class time than a standard class. More attention is paid to mathematical rigor and methods. \*Math prerequisite: Algebra 1 and Geometry.

# Additional High School Courses

Students are required to complete the corresponding introductory science course before enrolling in these courses.

## **AP Physics C: Mechanics/AP Physics C: Electricity and Magnetism (full year)**

*David Romero*

AP Physics C is a calculus-based, college-level physics course, especially appropriate for students planning to specialize or major in physics or engineering. The mechanics portion explores topics such as kinematics; Newton's laws of motion; work, energy, and power; systems of particles and linear momentum; circular motion and rotation; oscillations; and gravitation. The electricity and magnetism portion focuses on electrostatics; conductors, capacitors, and dielectrics; electric circuits; magnetic fields; and electromagnetism. Due to the fast-paced nature of this course, students must have successfully completed an introductory calculus course before enrollment. \*Math prerequisite: AP Calculus AB

## **Physical Astronomy: A Historical Perspective (fall semester)**

*David Romero*

This course serves as an introduction to the known objects in the night sky and their physical properties. Students will be asked to focus on the history behind the question: How do we know what we know? The observations, experiments, and the people behind them will serve as guides for the creation of new scientific truths and models. Astronomy, as one of the oldest natural sciences, has a long and complex history. Therefore, we will choose to look more closely at the story behind three modern stories:

- The explosion in research into the physical properties of stars due in large part to the analysis by the women at the Harvard Observatory. The reading for this topic is *Glass Universe* by Dava Sobel.
- The discovery of planet-like objects by Mike Brown's group and the Pluto controversy. The reading for this topic is *How I Killed Pluto* by Mike Brown.
- The first image of a black hole captured by the Event Horizon Telescope team with emphasis on the contribution by computer scientist Kate Bouman. The readings for this topic are press releases and an academic paper from the team ([eventhorizontelescope.org](http://eventhorizontelescope.org)).

\*Science prerequisite: A HS Introductory Physics Course

## **Modern Astronomy (spring semester)**

*David Romero*

This course picks up where Physical Astronomy leaves off but with a greater emphasis on astronomy's mathematical and experimental aspects. Students will peek at the current open questions in astronomy by analyzing the experiments and data that have brought us to our present point. A goal is to have students eventually work with real data and participate in at least one observation night. \*Science prerequisite: Physical Astronomy

# LANGUAGE ARTS

## Middle School Courses

### English Composition 1 (full year)

*Sarah Derr*

This class provides students with a foundation of skills upon which to build their advanced English coursework at LSAS and beyond. Students will write frequently and for a variety of purposes. Each semester's writing lessons will culminate in a final, polished essay which students will add to their digital portfolios. Through both writing and discussion, students will practice close reading skills and learn how to use textual evidence to build support for their claims. Socratic seminar is another key component of this course: students will learn and practice speaking, listening, and self-awareness habits in discussions, so as to gain the tools key to building productive dialogue in any setting.

### English Composition 2 (full year)

*Sarah Derr*

This course builds upon the work done in English Composition 1 with increasingly challenging texts and writing assignments of greater length and complexity. Students will produce at least one five-paragraph essay each semester, which will be included in their digital portfolios. They will continue to engage in Socratic seminar, including developing their own higher-level thinking questions.

## High School Courses

### Epic and Drama in British Literature (fall semester)

*Dan Clinton*

What is a monster? In art and literature, these unusual creatures seem to appear when ordinary explanations fail, when our ideas about human nature and natural law do not seem to be enough. We invent these characters to mark unexplored territory: "Here be dragons." The readings for this course will help us explore the many ways that monsters figure in our understanding of cultural norms, moral rules, and natural forces. The secondary goal of this course is to familiarize students with classic works of epic poetry, tragic drama, theater of the absurd, and film. We will discuss how these different genres of literature present different cultural associations and formal parameters. Students should expect a creative project in the first quarter and an analytic paper in the second quarter.

### American Literature (fall semester)

*Dan Clinton*

This course focuses on American literature in the years leading up to the Civil War. As the debate over slavery was intensifying, American writers struggled to capture (or invent) the voice of a nation grappling with its principles and its cultural identity. "There are new lands, new men, new thoughts," wrote Ralph Waldo Emerson. "Let us demand our own works and laws and worship." For Emerson and many others, American

life was caught between the excitement of a fresh beginning and the lingering influence of old customs and compromises. We will read texts by Phyllis Wheatley, Herman Melville, Harriet Jacobs, Ralph Waldo Emerson, Frederick Douglass, Walt Whitman, P.T. Barnum, and others. The readings will address the limits and the meaning of American freedom through the eyes of writers and artists who lived through a generation of rapid change and struggled to create a distinctly American culture.

## **AP Language and Composition (full year)**

*Dan Clinton*

This college-level course is designed to prepare students for the AP exam in AP English Language and Composition. Organized around three units (rhetorical analysis, argumentation, and synthesis), AP Language introduces students to nonfiction texts from 18th-21st century American and British authors. Students should expect this class to be both reading and writing intensive.

# SOCIAL SCIENCE

## Middle School Courses

### **Conversations in US History: Part 2 (full year)**

*Jim Percoco*

Picking up where Conversations in US History: Part 1 ended, this course will be a continuation of a survey of American history, primarily focusing on 20th Century America. There will be a focus on social justice issues in the 20th Century as well as issues that face contemporary America.

### **European History (full year)**

*Kevin Oliveau*

This is an 8th grade European History course which will follow the AP European History timeline but in less depth: think of it as “AP European History light.” The course will cover the Renaissance, the Age of Exploration, the Reformation and Counter-Reformation, Absolutism and Constitutionalism, the Scientific Revolution, the Enlightenment, the French Revolution, the Industrial Revolution, Nationalism, Imperialism, the World Wars, and the Cold War.

## High School Courses

### **Reckoning with US History (full year)**

*Jim Percoco*

This non-AP US history survey course will cover United States history from 1607 to the present. There will be a focus on intellectual history as well as a critical examination of social justice issues throughout the range of US history from colonization to the present. Students will read books connected with the various themes and tenets of American history, as well as submit formal essay writings in which students will develop a thesis and then present an argument. There will also be assorted projects and hands-on activities.

### **World History (full year)**

*Kevin Oliveau*

The high school world history course will cover the story of humanity from the Ancient World to the present. Content will cover the rise of civilization, the ancient world, the Middle Ages, the Renaissance, the Age of Reason, and the modern world. The course will be global in outlook and not just a survey of western civilization.

### **US Government: Current Events and Predictions (fall semester)**

*Kevin Oliveau*

We will be following and discussing the major events which make 2020 a historic year: the Pandemic, Black Lives Matter, and the Presidential Election, plus any new major current events as they develop in the fall. Students will also learn historical context for these threads. Finally, we will be making near-term forecasts about where events are

headed using the book *Superforecasting* as our guide.

## **American Iliads: Remembering War the American Way (fall semester, elective)**

*Jim Percoco*

In this course, students will explore how critical moments in American history are reflected through Hollywood and documentary films that examine the warring nature of the American experience. Specific battles to be studied will be the Alamo, Gettysburg, Little Big Horn, Pearl Harbor, and D-Day. Students will compare how the same battle, such as the Alamo, has been portrayed differently by filmmakers during various eras of American history. Students will also explore the role of public memory in US history as it relates to commemoration of specific events.

# FOREIGN LANGUAGE

## Spanish

### **Spanish 1 (full year)**

*Vanessa Moreno*

This is an introductory course to both the Spanish language and the cultures where the Spanish language is spoken. This course aims to develop basic and intermediate communicative skills in Spanish as a second language and to build basic knowledge about the cultures of the Spanish-speaking world. This course emphasizes fundamental grammatical structures and the acquisition and assimilation of practical vocabulary in conjunction with the development of the four language skills: writing, reading, speaking and listening. The use of audio and visual materials in class help students develop listening and speaking skills, enabling them to express themselves in Spanish from the start of the course.

### **Spanish 2 Beginners (full year)**

*Vanessa Moreno*

This class is a continuation of the first year course. By the spring semester, second year work is beginning and the classes are conducted primarily in Spanish. Supplementary readings and other materials are introduced for reinforcement. Conversational language is emphasized. At the intermediate level, we will focus on more advanced grammatical structures and the continuation of acquisition and assimilation of more precise vocabulary in conjunction with the development of the four language skills: writing, reading, speaking and listening.

### **Spanish 2 Intermediate (full year)**

*Vanessa Moreno*

At the intermediate level, we will focus on more advanced grammatical structures and the continuation of acquisition and assimilation of more precise vocabulary in conjunction with the development of the four language skills: writing, reading, speaking and listening.

### **Spanish 3 (full year)**

*Vanessa Moreno*

The objectives of this course are identical to those of Spanish 2 Intermediate but this course is at a higher level. The pace will be faster and the second half of *Descubre 3* is used as the third year program in an articulated sequence of instruction.

### **Advanced Spanish (full year)**

*Vanessa Moreno*

This course is designed to enhance the Spanish language learning process through exposure to historical, cultural, literary themes, as well as daily news. In addition, with the acquisition of more grammatical instruction and vocabulary, students will do individual and group projects, read works of short fiction, and follow current events in the Hispanic world. This course will use informative and thought-provoking films

to focus on the contemporary history, art, and culture of Spain and Latin America. Supplementary literature, texts, articles, video clips, music, and presentations will provide background to historical events. Students will participate in debates and activities that promote effective oral and written communication.

## French

### French 1 (full year)

*Carmen Carraway*

In this course, students learn the basics of communication in French. With a strong emphasis on conversation, our curriculum takes us from basic greetings to units that center around food, household objects, places in a city, family, and daily activities. Students create and maintain a vlog throughout the year in which they describe themselves, their friends, and their surroundings.

### French 2 (full year)

*Carmen Carraway*

In French 2, our studies center around a year-long class project in which each student takes on the persona of an imaginary resident of an apartment building in Aix-en-Provence, France. Using this structure as our starting point, students get to know their neighbors, make friends and enemies, plan parties, and even solve a murder mystery! Class is almost exclusively in French. Throughout the year, students will encounter many new vocabulary units, and they will learn to communicate fluently in the past and future.

### French 3 (full year)

*Carmen Carraway*

At this level, we use authentic resources such as French films, news articles, novels, poems and podcasts to study advanced structures and learn sophisticated vocabulary. Class is conducted entirely in French, and students frequently use the language to deepen their understanding of French culture.

### French 4/French 5 (full year)

This course is designed around six themes: global challenges, science and technology, contemporary life, personal and public identities, families and communities, and beauty and aesthetics. Students read articles, listen to podcasts, watch videos and engage in meaningful discussions throughout the year, with the goal of being able to sustain informed, nuanced conversations in French about topics such as politics, social issues, and world events.

# ADDITIONAL COURSES

## Middle School

### **Design in the Marketplace** (fall and spring semesters)

*Danielle Ferrin*

Combining the tools of making in the marketplace with the problem-solving process of “Design Think”, this class will focus on how creativity appears around us every day. We will study successful design and designers, as well as add our own ideas that could impact us for good. This semester will include experimenting with many different materials and creating 2D & 3D design items. Whether creating a community logo for a non-profit, your food truck with signature food items and branding, or a product such as custom tennis shoes, we will be creating in a way you likely haven’t before.

### **Music** (fall and spring semesters)

*Ellen Broetzmann*

The goal of this course is to expose students to all areas of music, including: basic music theory (pitches and rhythms on the grand staff, key and time signatures, chords, and more), music history and style, and developing a musical ear. Topics will be presented in a variety of ways, such as hands-on activities with DIY instruments, research and short presentations, and small group work when appropriate. Whether students have taken private lessons for years or are being exposed to music for the first time, this class is a way for them to use the artistic part of their brain and have fun making and learning about music in a group setting.

### **Computer Science** (fall and spring semesters)

*Kevin Oliveau*

This middle school computer science course provides an introduction for students new to programming. Students will learn new concepts and apply them to projects. For students with prior experience, we encourage students to go further by mentoring and frequent feedback.

## High School

### **Physical Computing** (fall semester)

*David Romero*

This is a course on the interaction of code with the outside world. The programming in this course is not advanced but makes heavy use of fundamentals such as variables, arrays, functions, and loops. Students will learn basic electrical engineering and design simple circuits that sense and interact with their environment. This course is more design heavy, with readings on design, interactivity, and various methods of signal transduction. Students who continue on in the spring will focus on developing a semester-long project of their choosing. This course is modeled on a graduate course of the same name at NYU’s Tisch School of the Arts.

## **Physical Computing 2: Advanced Topics (spring semester)**

*David Romero*

Students will be introduced to advanced topics such as classes, library creation, and data logging. Topics will be added and removed based on student project proposals. Long-term student projects serve as the capstones to Physical Computing. Students will outline a project for themselves, set deadlines, and create something of their own. Along the way, they will have to pick up new skills and learn more about programming.

## **Drawing and Painting (fall semester)**

*Danielle Ferrin*

Drawing and painting are both built on the same basics - the “grammar” of art - which are composition, proportion, space, perspective, value, texture, and color. In this class, we’ll learn what these are and how these all play together. Learning the basics of line (contour and construction) and building objects from shapes will help students realistically create what they want to draw, then we will work on compositional techniques and learn tools for accurate proportions. Within these two mediums, we will look at how shadows and light, textures, linear perspective, color theory, and color mixing apply to still lifes, figures, landscapes and spaces, and even our own plein aire landscape painting. This is a class students can take as beginners to learn a foundation, but will also stretch and challenge the more experienced artists. Students who want to try digital marking will have the chance to try using tablets and online programs to “draw and paint” for an assignment as well.

## **Photography (spring semester)**

*Danielle Ferrin*

Everybody carries around a quality camera right in their pocket most every moment of the day. Beginning with photography using phone cameras (a DSLR camera will also be available), students will discover that a great picture doesn’t rely on equipment, but rather on being able to see and think critically about their surroundings. Students will learn the foundational blocks of constructing the photo - including framing, background, perspective, and layering - and use those as we explore the vast neighborhood around school (and beyond, if determined safe) to capture amazing shots of nature, people, emotions and relationships, and macro photography. We will view both the mundane and the extraordinary in new, unexpected ways. Students will also learn the art and application of photo journalism/photo essays and choose a project in which they will tell a story with pictures. We will also learn about editing digital photos, printing options and organization, including marketplace avenues for sale. Guest professionals will speak to the class throughout the semester.

## **Middle & High School**

### **Physical Education (full year)**

*Dan Merold*

All middle school students take physical education classes. The program fosters integrity, respect, responsibility, and participation by focusing on cooperation, effort, and development in a fun environment over winning and losing. A primary goal for

students is to enjoy being active in order to create lifelong habits of physical activity. Students learn to take risks, try something new, and develop their physical fitness in a safe and positive environment. Classes increase their self-confidence while providing them with experiences in teamwork, sportsmanship, collaboration, critical thinking, and resourcefulness.

## **CLUBS & EXTRACURRICULARS**

Clubs vary year-to-year as determined by student interest in the fall: recent favorites have included Model UN, Odyssey of the Mind, Harry Potter club, and intramural sports. In addition, we offer private piano lessons on site during school hours. We have active chapters of both the National Junior Honor Society and National Honor Society.

