

## People also ask :

What does OER mean? ^

### Open Educational Resources

**Open Educational Resources (OER)** are teaching, learning and research materials in any medium – digital or otherwise – that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions.

# Open educational resources for math on USG's OpenALG

## Perimeter College Math OER Committee

### Post-Project Savings per Student

\$190.74

### Projected Total Annual Student Savings per Academic Year

\$181,584.48

Robert Blitzer), which costs \$119.95. In fall 2019 and spring 2020, we will pilot a low- or no-cost option for homework assignments, which will provide a savings of about \$100 per student (a total of \$ 30,000 savings). We will share our course

### Post-Project Savings per Student

at least \$104

### Projected Total Annual Student Savings per Academic Year

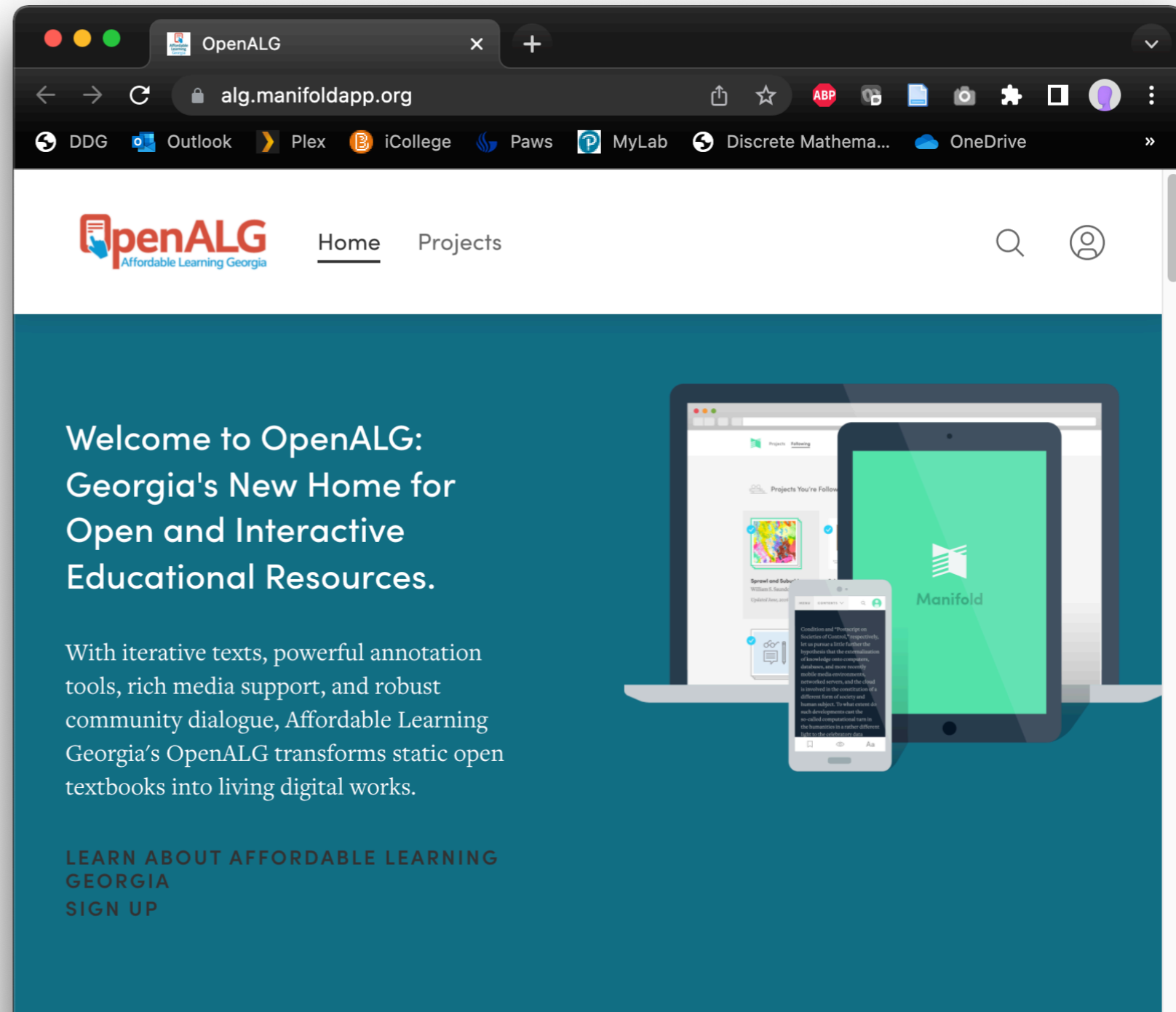
\$34,320

*This document and any errors therein: Julie La Corte (Dunwoody Math)*

*Last revised: Jan. 30, 2022*

# Overview of OpenALG

[OpenALG](#) is  
USG's repository  
for free and open  
educational  
materials *created*  
*and used by*  
*USG instructors.*



The screenshot shows a web browser window with the URL `alg.manifoldapp.org`. The browser's address bar and tabs are visible at the top. The website's header features the OpenALG logo (Affordable Learning Georgia) and navigation links for "Home" and "Projects". The main content area has a teal background and includes the following text:

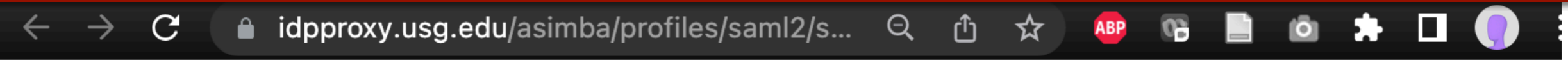
Welcome to OpenALG:  
Georgia's New Home for  
Open and Interactive  
Educational Resources.

With iterative texts, powerful annotation tools, rich media support, and robust community dialogue, Affordable Learning Georgia's OpenALG transforms static open textbooks into living digital works.

LEARN ABOUT AFFORDABLE LEARNING  
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The page also features an illustration of a laptop, a tablet, and a smartphone displaying the Manifold application interface, which includes a search bar and a list of projects.

# Schools producing OpenALG math materials



Select your institution:

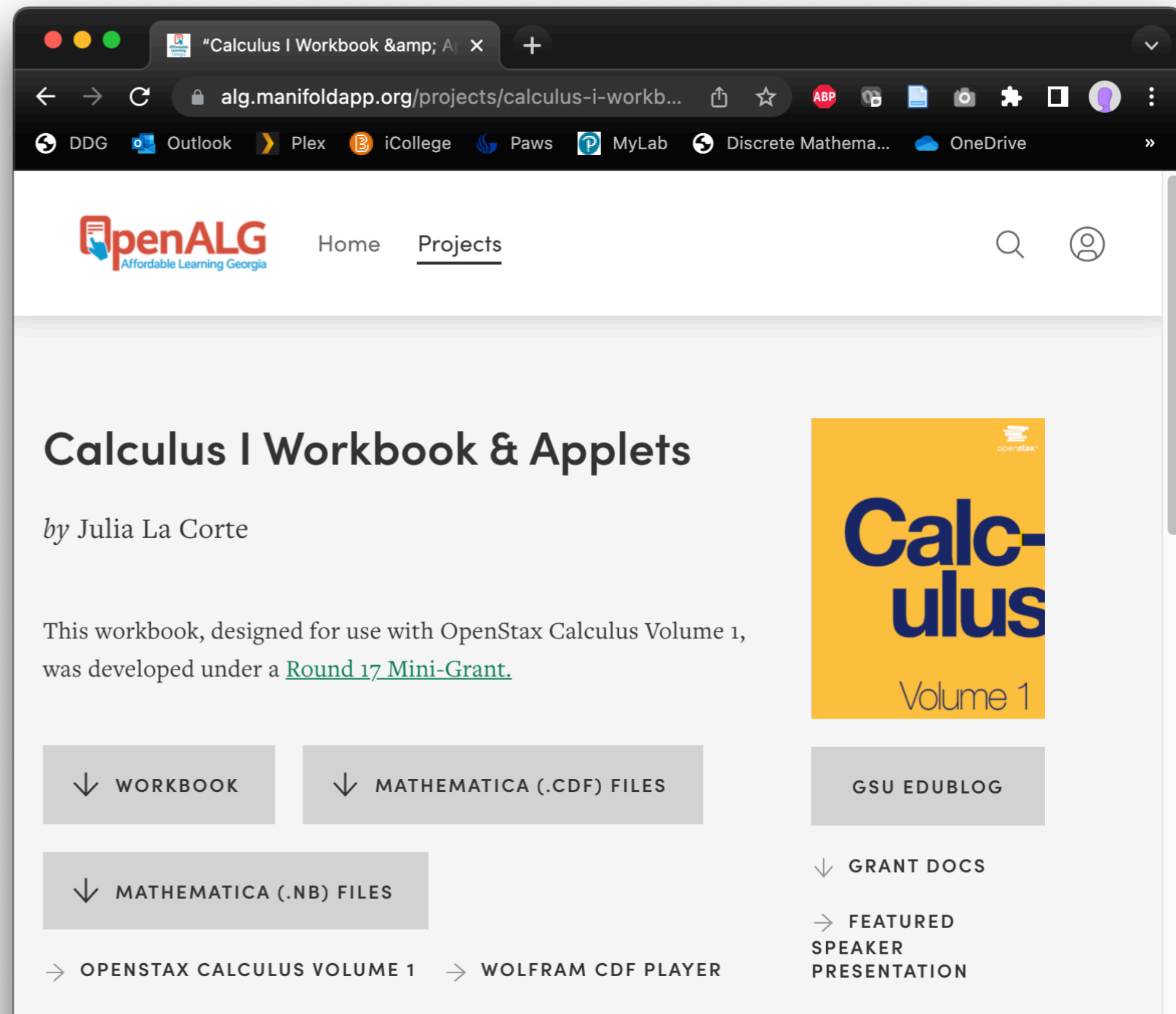
these schools are among the most *community-oriented* in USG



# Overview of OpenALG

Each project was piloted in the classroom.

Projects were funded by [Affordable Learning Georgia](#), a USG initiative.



The screenshot shows a web browser window displaying the OpenALG website. The browser's address bar shows the URL `alg.manifoldapp.org/projects/calculus-i-workb...`. The website header includes the OpenALG logo (Affordable Learning Georgia) and navigation links for Home and Projects. The main content area features the title "Calculus I Workbook & Applets" by Julia La Corte. Below the title, there is a description: "This workbook, designed for use with OpenStax Calculus Volume 1, was developed under a [Round 17 Mini-Grant](#)." To the right of the text is a yellow book cover for "Calculus Volume 1" with the OpenStax logo. Below the text and book cover are several buttons for downloading files: "WORKBOOK", "MATHEMATICA (.CDF) FILES", and "MATHEMATICA (.NB) FILES". On the right side, there are additional links: "GSU EDUBLOG", "GRANT DOCS", and "FEATURED SPEAKER PRESENTATION". At the bottom, there are links to "OPENSTAX CALCULUS VOLUME 1" and "WOLFRAM CDF PLAYER".

# Overview of OpenALG

An initial proposal and a final report is linked from each project page.

The screenshot shows a web browser window with several tabs. The active tab is titled "Microsoft Word - ALG Report\_QR 45..." and displays a PDF document. The browser's address bar shows the URL "jlacorte.edublogs.org/files/2022/01/454\_report.pdf". The PDF content is visible, showing page 8 of 18. The text on the page discusses the implementation of Open Education Resources (OER) for MATH 1001 Quantitative Reasoning. It mentions that the course has adopted a no-cost textbook and learning materials, which has saved students more than \$106,206 in one year. The text also describes the goals of the project, such as eliminating the cost of textbooks and enhancing student engagement.

Microsoft Word - ALG Report\_QR 45... 8 / 18 | 100%

in the textbook. This further helped students to get convinced that minimum benefits of course material quality was attainable. There was internet access in all classrooms and all students were able to use their smartphones and computers to access GeorgiaVIEW instruction and classroom activities.

The five project goals delineated above were accomplished. Successful transformation provided by the use of OER textbook and learning materials, as well as the materials by the team has set a pathway for future implementation of Quantitative Reasoning at low cost to the students. Our goal is to utilize this accomplishment to propagate the advantages of having a well-developed no-cost textbook course, the appended course and other associated learning materials. Furthermore, we will share this course and outcomes with deans, chairs, and other faculty members teaching *Quantitative Reasoning*.

*1. To eliminate the cost of textbook and other course related materials to students by using no-cost course materials, software, and free online textbook.*

MATH 1001 Quantitative Reasoning instructors have the Open Education Resource (OER) Quantitative Reasoning e-book placed on the course sections Georgia VIEW (D2L) platform. The e-book has been adopted as the standard textbook for the course. Students download a PDF version of the book on their computers smart phones, and other smart portable devices. Instructors assign reading materials, and homework problems to students. Instructors assign problems to students in class during problem-solving sessions, whereby students complete individualized or collaborative work. This has saved students more than \$106,206 in one year.

*Goal 2. To strengthen student engagement in learning of MATH 1001-Quantitative Reasoning and to enhance student success and achievement in the course.*

There was enhanced student engagement in-class and out-of-class. Students did not skip their assignments without giving any excuses for not completing assigned work.

# Overview of OpenALG

Different projects provide different types of materials.

This document lists all OER math pilot projects on OpenALG which provide *at least one* of the following:

- a **textbook** covering an entire course,
- **online homework** assignments covering an entire course,  
or
- **supplementary materials** (videos, guided notes, etc.).

# Overview of resources surveyed

		textbook?	homework?	more?
Quantitative Reasoning	Sykes et al.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Fang et al.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Abbott et al.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Lippman et al.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Onkonkwo et al.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
College Algebra	Dolo and Muche	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Chiorescu et al.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Precalculus	Epstein and Chiorescu	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Elementary Statistics	Muse et al.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Onkonkwo et al.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Dancs and Matos	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Pace and Ralston	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Pace et al.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Calculus 1	La Corte	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Chapman and Royal	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Pinzon and Roberts	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Marion and Kunwar	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Calculus 2 and 3	Tiemeyer and Schlieper	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Discrete Math	Jamaloodeen et al.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Levin	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

# Quantitative Reasoning



# Quantitative Reasoning

## MATH 1001

### Summary of available resources:

		textbook?	homework?	more?
Quantitative Reasoning	Sykes et al.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Fang et al.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Abbott et al.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Lippman et al.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Onkonkwo et al.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

# “Quantitative Skills and Reasoning” (2021)

S. Sykes, J. Bellon, R. Burnham, K. Carter, W. Gay, N. Rehfuss  
(University of West Georgia)

Type of resource:	Textbook
Scope of coverage:	Complete course
ALG repository:	<a href="#">Quantitative Skills and Reasoning</a>
Format:	PDF



License

59d694190ed611... 177 / 419 | 52%

176

177

Here is the scatter plot of the data set with the regression line that we've created.

$x$ (Cardio Days Per Week)	1	2	2	3	4	4
$y$ (Body Fat Percent)	23	18	16	12	9	4

Example: Adam is a personal trainer with 6 clients. He's reviewing their progress and notices the more cardio days per week ( $x$ ) his clients have, the lower the body fat percent ( $y$ ) they have. He records this data in the table below.

Construct the linear regression line for the data set. Round your slope and  $y$ -intercept to two decimal places.

164

# “Quantitative Skills and Reasoning” (2020)

H. Fang, N. Shukla, E. McInnis  
(Columbus State University)

Type of resource:	Slideshows and videos
Scope of coverage:	Complete course
ALG repository:	<a href="#">Quantitative Skills and Reasoning</a>
Videos:	<a href="#">HoubinFang.com</a>



License



## Inductive Reasoning



• Inductive reasoning is the process of coming to a conclusion by observing specific examples, often by locating a pattern.

- If you examine a list of numbers and use an established pattern to predict the next number in the list, you are using inductive reasoning.
- Use inductive reasoning to predict the next number in the following lists:

$\begin{array}{cccccc} & +4 & +4 & +4 & +4 & +4 \\ 2, & 6, & 10, & 14, & 18, & ? \\ & +1 & +2 & +3 & +4 & +5 \\ 1, & 2, & 4, & 7, & 11, & ? \end{array}$

Each successive number is 4 larger than the preceding number. We predict **22** to be the next number.

The difference between the first two numbers is 1. The next two differ by 2... We predict **16** to be the next number.

MATH 1001: Truth Tables

### Truth Tables

• Construct a table for  $\neg(p \vee \neg q) \vee p$ .

	1	2	3	4	5	6
$p$	T	T	F	F	T	T
$q$	T	F	T	T	F	F
$\neg q$	F	T	F	F	T	T
$p \vee \neg q$	T	T	F	F	T	T
$\neg(p \vee \neg q)$	F	F	T	T	F	F
$\neg(p \vee \neg q) \vee p$	T	T	T	T	T	T

you don't have to do this step.

4:43 / 14:04

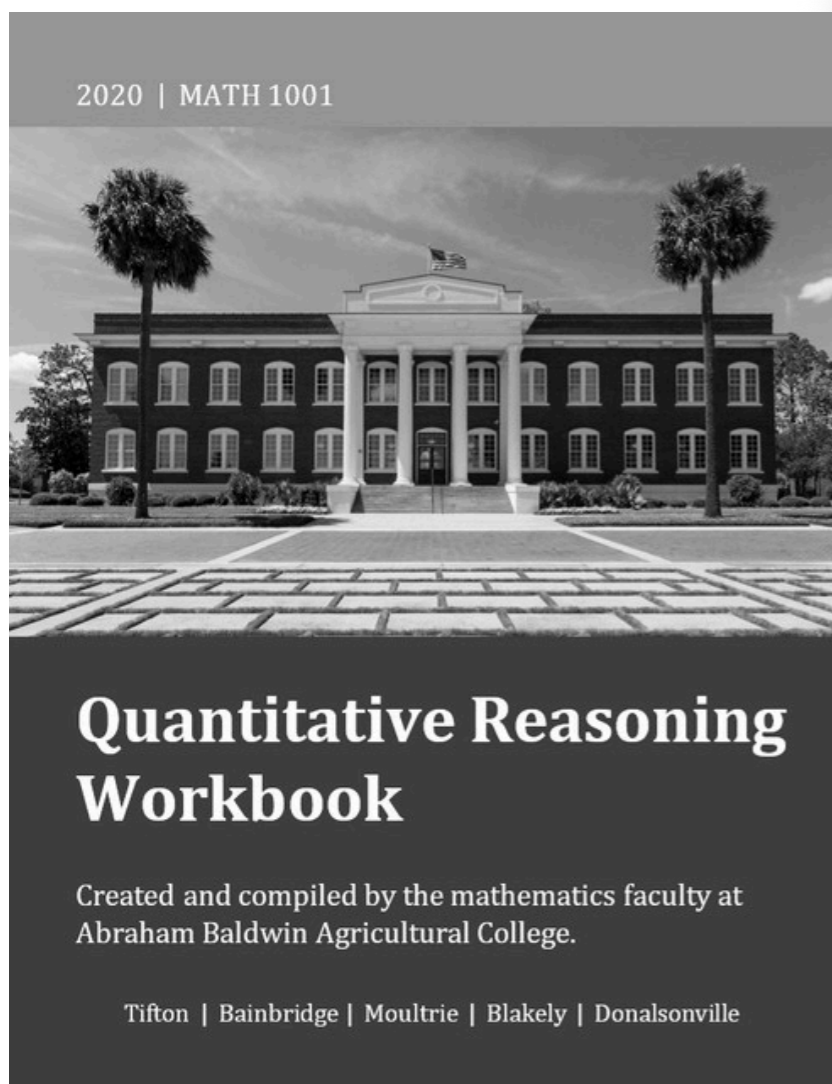
# “Quantitative Reasoning Workbook” (2021)

A. Abbott, E. Coston, G. Dicks, J. Gregus, S. McLendon, A. Urquhart  
(Abraham Baldwin Agricultural College)

Type of resource:	Practice exercises
Scope of coverage:	Complete course
ALG repository:	<a href="#">Quantitative Reasoning Workbook</a>
Author(s) presentation:	<a href="#">ALG Featured Speaker Series, Jan. 2021</a>



License



2.6 Exponential and Logarithmic Equations

(5) Dalia deposits \$1,200 in an account that earns 5% interest per year, compounded continuously. How much will the account be worth in 3 years? Round your answer to the nearest dollar.

The *logarithmic equation*  $y = \log_a(x)$  means the same as the exponential equation \_\_\_\_\_, where  $a > 0$ ,  $a \neq 1$ , and  $y \neq 0$ .

**Example D:**  $3 = \log_2(8)$  means  $2^3 = 8$

The *power rule* states that \_\_\_\_\_

**Example E:** How long will it take for an initial investment of \$30,000 to grow to \$110,000 with an interest rate of 10% compounded continuously?

$$\begin{aligned} A &= Pe^{rt} \\ 110,000 &= 30,000e^{0.10t} \\ \frac{110,000}{30,000} &= e^{0.10t} \\ \ln\left(\frac{11}{3}\right) &= 0.10t \ln(e) \\ \frac{\ln(11/3)}{0.10} &= t \cdot 1 \\ t &\approx 13 \text{ years} \end{aligned}$$

(6) For an initial investment of \$3,000, compounded continuously at 3.25% annual interest, find, to the nearest tenth of a year, when this investment grows to \$7,000 in value.

(7) For an initial investment of \$2,000, compounded continuously at 6.82% annual interest, find, to the nearest tenth of a year, when this investment grows to \$11,000 in value.

Chapter 2 Algebraic Equations and Graphs

**Example E:** Solve the exponential equation  $5^x = 125$ .

$$\begin{aligned} 5^x &= 125 \\ \ln(5^x) &= \ln(125) \\ x(\ln 5) &= \ln(125) \\ x &= \frac{\ln(125)}{\ln(5)} \\ x &= 3 \end{aligned}$$

Solve for  $x$  in each of the following exponential equations.

(8)  $5 = 5^x$

(9)  $10^x = 1,000$

(10)  $40 = 7^x$

(11)  $69 = 2^x$

(12)  $e^{3x} = 20$

(13)  $e^{0.09x} = 3$

# “Math in Society” (2017)

D. Lippman, et al.  
(Pierce College)

Type of resource:	Textbook
Scope of coverage:	Complete course
Link to textbook:	<a href="#">Math in Society Edition 2.5</a>
Formats:	PDF, MS Word, print



License

The screenshot shows the Open Textbook Library website. At the top, there is a search bar with the text "Search the Library" and a "GO" button. Below the search bar, there are navigation links: "Browse Subjects", "About Open Textbooks", "Submit", and "Discovery". The main content area displays the search results for "Math in Society - Edition 2.5". On the left, there is a book cover for "Math in Society" by David Lippman. To the right of the cover, the title "Math in Society - Edition 2.5" is displayed, along with "(15 reviews)", a star rating of 4.5 out of 5, and the author "David Lippman, Pierce College". Below this, it lists "Copyright Year: 2017", "Publisher: David Lippman", and "Language: English".

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# “Math in Society” (2020)

Z. Okonkwo, A. Devarapu, A. Smith, J. Swords, V. Kunwar, L. Paudel  
(Albany State University)

Type of resource:	Pilot program report
Scope of coverage:	Complete course
Author(s) presentation:	<a href="#">Report</a> (mirrored on Julie’s Edublog)



License

The screenshot shows a web browser with multiple tabs. The active tab is 'Math in Society Ad...', displaying a PDF report from 'jlacorte.edublogs.org/files/2022/01/454\_report.pdf'. The report content includes:

in the textbook. This further helped students to get convinced that minimum benchmark in terms of course material quality was attainable. There was internet access in all classrooms on campus, and all students were able to use their smartphones and computers to access GeorgiaVIEW during instruction and classroom activities.

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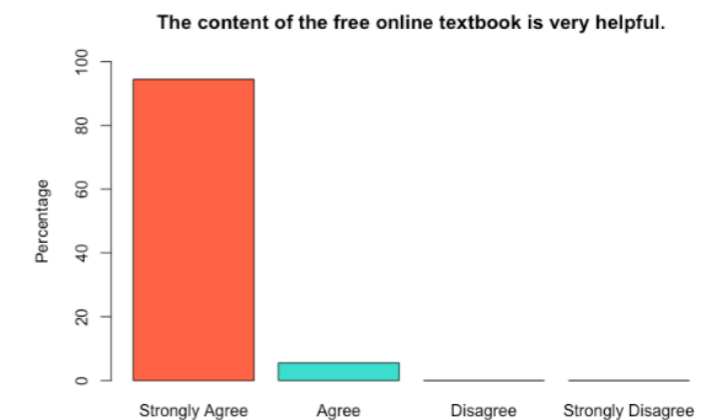
*1. To eliminate the cost of textbook and other course related materials to students by providing no-cost course materials, software, and free online textbook.*

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*Goal 2. To strengthen student engagement and to enhance student success.*

There was enhanced student engagement... their assignments without giving any excuses for...

Q3



Of the 18 students who completed the survey, all or 100% of them strongly agree or agree with the statement that the online textbook is helpful.

one year. This has saved students more than \$106,206 over the past

# College Algebra

(...for completeness's sake)

# College Algebra

## MATH 1111

### Summary of available resources:

		textbook?	homework?	more?
College Algebra	Dolo and Muche	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Chiorescu et al.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>



# “OpenStax College Algebra and Trigonometry Adoption” (2021)

S. Dolo, T. Muche  
(Savannah State University)

Type of resource:	Pilot program report
Scope of coverage:	Complete course
Link to textbook:	<a href="#">OpenStax Algebra and Trigonometry</a>
Author(s) presentation:	<a href="#">ALG Featured Speaker Series, Mar. 2021</a>



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**The Effectiveness of College Algebra Redesign At Savannah State University**

By:  
Tilahun Muche  
Samuel Dolo  
(Savannah State University: Department of Math)

designed or newly adopted course materials are going, and any challenges that they ran into, and so

ALG Featured Speaker Series: OpenStax Algebra and Trigonometry Adoption (March 2021)

9 views · Mar 26, 2021

Affordable Learning Georgia  
180 subscribers

Once a month, join Affordable Learning Georgia to hear from recent Affordable Materials Grant completers about their affordability projects, the challenges they faced, and the results

### ACMS Standard for All USG College Algebra Courses

Review Topics	Uniform Requirements	Additional Topics
At MOST 20% of class time will be spent reviewing the following topics:	Between 50% and 70% of class time will be spent covering the following topics:	Between 10% and 30% of class time will be spent covering one or more of these areas:
<ul style="list-style-type: none"><li>• Sets and set operations</li><li>• Special products and factoring</li><li>• Fundamental operations with polynomial &amp; rational expressions</li><li>• Integer and rational exponents and radicals</li><li>• Linear equations in one unknown</li><li>• Linear inequalities in one unknown</li><li>• Recta</li><li>• System of two linear equations in two unknowns</li></ul>	<ul style="list-style-type: none"><li>• Relations, functions and their graphs</li><li>• Quadratic and rational inequalities</li><li>• Linear functions of single variable</li><li>• Quadratic functions of a single variable</li><li>• Systems of equations</li><li>• Polynomial function of a single variable</li><li>• Exponential and logarithmic functions</li></ul>	<ul style="list-style-type: none"><li>• <b>Absolute value equations and inequalities</b></li><li>• Fundamental operations with complex numbers</li><li>• Matrices</li><li>• Arithmetic and geometric sequences and series</li><li>• Mathematical induction and the binomial theorem</li><li>• Variation with applications</li><li>• Permutations, combinations and probability</li><li>• Linear programming</li><li>• Conic sections</li></ul>

and then for the additional topics, 10% must be 10% to 50% of class time

# “College Algebra”

## OpenStax

Type of resource:	Textbook
Scope of coverage:	Complete course
Link to textbook:	<a href="#">OpenStax College Algebra</a>
Available formats:	Kindle, PDF, print

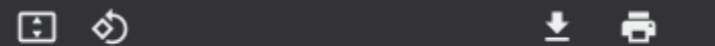


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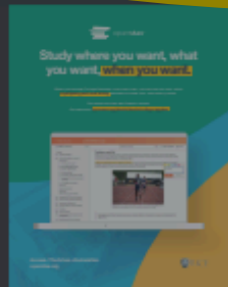
With philanthropic support, this book is used in **740** classrooms, saving students **38,299,811** dollars this school year. [Learn more about our impact](#) and how you can help.

Does the Kindle format provide accessibility options for the visually impaired?



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6



7

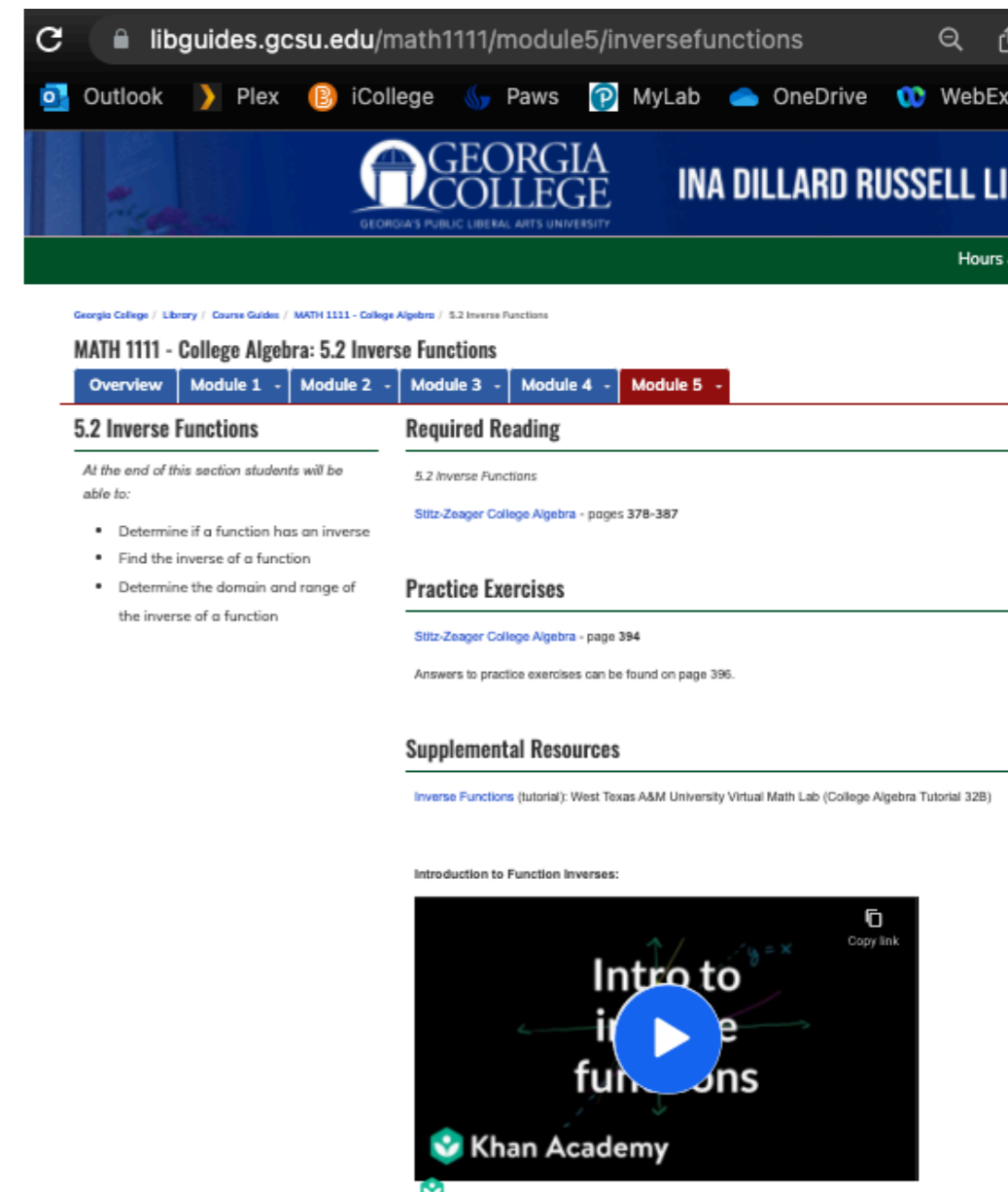
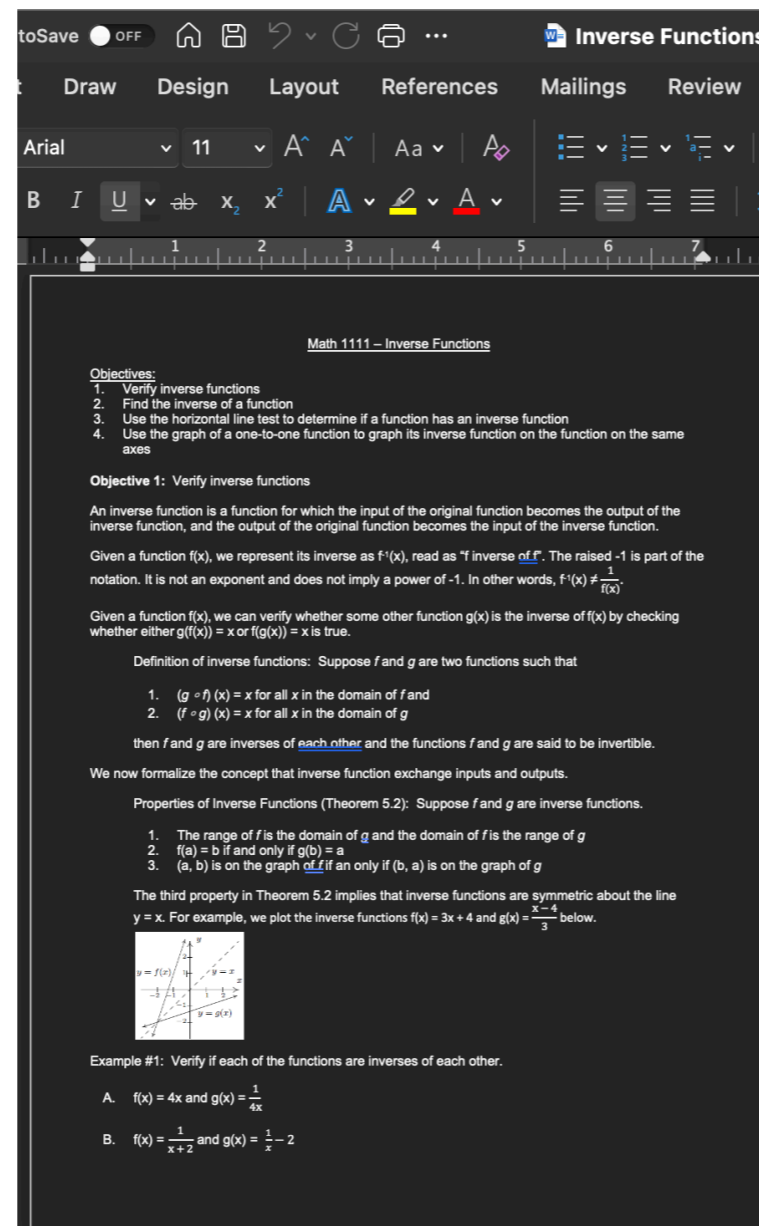
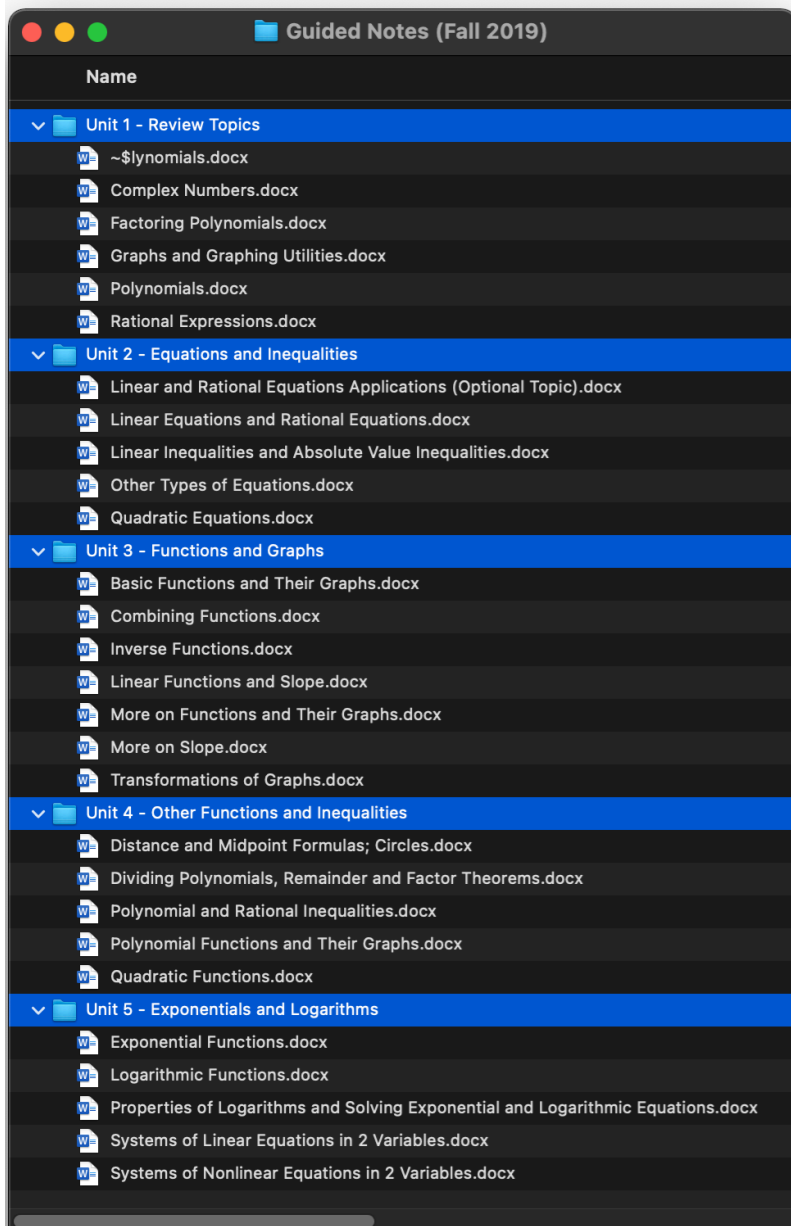
# “College Algebra Open Course” (2021)

M. Chiorescu, R. Shahbaz, J. Alves, B. Kidane  
(Georgia College and State University)

Type of resource:	Open course; Guided notes
Scope of coverage:	Complete course
Link to course:	<a href="https://libguides.gcsu.edu/math1111">https://libguides.gcsu.edu/math1111</a>
Link to guided notes:	<a href="#">Guided Notes for OpenStax College Algebra</a>



License



# Precalculus

# Precalculus

## MATH 1113

### Summary of available resources:

		textbook?	homework?	more?
Precalculus	Epstein and Chiorescu	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

# “OpenStax Precalculus Ancillary Materials” (2020)

R. Epstein, M. Chiorescu  
(Georgia College and State University)

Type of resource:	Pilot program report; Worksheets; Activities; Homework
Scope of coverage:	Complete course
ALG repository:	<a href="#">OpenStax Precalculus Ancillary Materials (OpenALG)</a>
Link to Libguide:	<a href="#">How to use these materials</a>



License

## Pre- calc- ulus

In her sections, Chiorescu put the students in groups of 3-4 depending on the size of the class to work on the group activity designed for the day. At the end of the activity, one of the team members (chosen by the team by rotation) shared the team answers with the class.

We also created several written homework assignments, which ask the students to write about math in complete sentences. We used the Transparency in Learning and Teaching (TILT) method developed by Dr. Mary-Ann Winkelmes to make these assignments more transparent and equitable. Two of the assignments involved some history of mathematics.

For more standard homework, we researched online homework systems. Epstein was planning to use Rover by OpenStax in Fall 2019, but their launch was delayed, so she used Edfinity instead. She ended up liking Edfinity, so decided not to switch to Rover for Spring 2020. The cost for the students was \$12.65. One of the Edfinity assignments was an optional practice assignment to help students review material necessary for the course. Epstein did not make the assignment worth any credit and consequently found that few students completed it and many did not even start it. Chiorescu made the assignment worth some credit to encourage students to review the basics algebra skills needed for the course.

# Elementary Statistics

# Elementary Statistics

## MATH 1401

### Summary of available resources:

		textbook?	homework?	more?
Elementary Statistics	Muse et al.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Onkonkwo et al.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Dancs and Matos	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Pace and Ralston	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Pace et al.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>



# “OpenStax Introductory Statistics Adoption” (2021)

B. Muse, C. Almada, M. Bhandary, K. Lilly  
(Columbus State University)

Type of resource:	Pilot program report
Scope of coverage:	Complete course
ALG repository:	<a href="#">Saylor Introductory Statistics and OpenStax Introductory Statistics Adoption</a>
Links to textbooks:	<a href="#">OpenStax text</a> (PDF, print, iBooks, Kindle) — <a href="#">Saylor text</a>



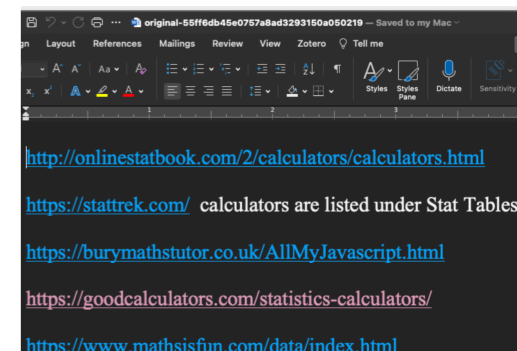
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Another key outcome was reducing technology costs for calculations. The premium online homework system includes an application for calculations (StatCrunch) and WebAssign with the OpenStax book does not. So, to avoid additional technology costs for this group of students we used free RStudio and free online statistics calculators (list is attached). 94 TI-83 graphing calculators were purchased for the purpose of offering students using the free textbook a \$10/semester calculator rental option at a savings of about \$87 per student compared to the Amazon calculator purchase price. So far, savings from rental calculators has been less than we had hoped. We didn't receive them until late fall and only managed to rent 7 of them in the spring for a savings of \$609. Beginning summer, we will do a better job of informing students early about this rental option.

The free textbooks we used include: Introductory Statistics, at [https://saylordotorg.github.io/text\\_introductory-statistics/index.html](https://saylordotorg.github.io/text_introductory-statistics/index.html) and OpenStax Introductory Statistics, at <https://openstax.org/details/books/introductory-statistics> Of course, it is challenging to change our ways. We each had taught STAT 1401 many times before and felt that our courses were well oiled machines that shouldn't be changed.

However, we understood the importance of making education more affordable and so agreed to the effort of making different materials work. Overall, the new materials were received well and student performance improved.



# “OpenStax Introductory Statistics Adoption” (2021)

Z. Okonkwo, A. Devarapu, C. Ofodile, A. Smith, L. Feng, V. Kunwar, L. Paudel, E. Benson  
(Albany State University)

Type of resource:	Pilot program report
Scope of coverage:	Complete course
ALG repository:	<a href="#">OpenStax Introductory Statistics Adoption</a>



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3	To motivate students' interest in the use of online based technology to solve real-life problems encountered in Statistics, including large scale data analysis using R-Studio.	(i)	Due to COVID -19 pandemic, many students completed all assignments virtually. Classes delivered synchronously using Cisco Webex, teaching and learning availed instructors a platform to increase course engagement.
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# “WeBWorK Problems for OpenStax Introductory Statistics” (2020)

M. Dancs, C. Matos  
(Clayton State University)

Type of resource:	Online problem sets
Scope of coverage:	Partial
ALG repository:	<a href="https://webwork.maa.org/">WeBWorK Problems for OpenStax Intro Stats</a>
General info about WeBWorK:	<a href="https://webwork.maa.org/">https://webwork.maa.org/</a>



License

## WebWork Problems for OpenStax Introductory Statistics

by Michael Dancs, Catherine Matos

This problem set for Chapters 8-12 of [OpenStax Introductory Statistics](#) was created through a [Round 14 ALG Mini-Grant](#). The set uses the open-source homework platform [WeBWorK](#) by the Mathematical Association of America.

Topics include mean with a known or unknown sigma, proportion, two-sample mean and proportion, goodness of fit, homogeneity, independence, correlation, and regression.



↓ GRANT DOCS

Although the WeBWorK software is free to use, students sometimes struggle due to a lack of features available on commercial platforms, e.g.: guided solutions, similar examples, and personalized feedback. While WeBWorK does provide a framework for these features, individual problems must be specifically designed and written to leverage this functionality, and there are very few that currently do so.

# “OpenStax Introductory Statistics Ancillary Materials” (2020)

C. Pace, L. Ralston  
(Georgia Highlands College)

Type of resource:	Online homework and practice problems; Notes
Scope of coverage:	Partial
ALG repository:	<a href="#">WeBWork Problems for OpenStax Intro Stats</a>



License

## Proposed Grant Funding Amount: \*

This is the total (in a dollar amount) of funding you are requesting for the mini-grant. There is a maximum of \$4800, with a maximum of \$2000 per team member and \$800 for project expenses.

\$4800

## Currently-Existing Resource(s) to be Revised / Ancillaries Created \*

Please provide a title and web address (URL) to each of the currently-existing resources that you are either revising or creating new ancillary materials for below.

LibGuide will be updated (<https://getlibraryhelp.highlands.edu/MATH1401>)

Homework and Practice Problems in Desire-to-Learn

PowerPoints, extra notes and videos in Desire-to-Learn and on the LibGuide  
(<https://getlibraryhelp.highlands.edu/MATH1401>)

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# MATH 0996 Activities (2021)

L. Ralston, C. Pace, T. Suswal  
(Georgia Highlands College)

Type of resource:	MATH 0996 discussion activities, assignments
Scope of coverage:	Partial
ALG repository:	<a href="#">Elementary Statistics Activities</a>
Discussion topics:	<a href="#">Link to assignments</a>



License

High Impact Discussions including Growth Mindset and Metacognition

*Discussion #1*

Students are asked to answer the following questions: what techniques have you found successful in learning the statistics vocabulary and other introductory content? With what have you struggled—time management, learning/applying vocabulary, or other content issues? Additionally, students must reply to at least two classmates' initial posts.

*Discussion #2*

Students are asked to answer the following questions: As the course introduces concepts you may not have seen before, consider how has this course is different from other Math courses you have taken in high school or college? Have you developed new ways to understand the concepts? Additionally, students must reply to at least two classmates' initial posts.

*Discussion #3*

Students are asked to answer the following: the topic of Hypothesis Testing, is often a challenging, yet important, concept in Statistics. Hypothesis Testing is the ultimate procedure used to verify your proposed answer to a research question, much like an experiment in a Chemistry class. Using the problem assigned based on the first letter of your last name, demonstrate how you would dissect the problem. What roadblocks or issues do you encounter? Think about which test you should conduct, the necessary information, stating the hypothesis, making a decision, and the final conclusion. Additionally, students must reply to at least two classmates' initial posts.

*Discussion #4*

Students are asked to answer the following: You are in the homestretch of the course, please reflect on and describe what strategies or activities have helped you learn the vocabulary, concepts, and/or procedures. What would you do differently? Additionally, students must reply to at least two classmates' initial posts.

Learning or Study Skill Strategy Assignments including Growth Mindset and Metacognition

*Learning or Study Skill Strategy Assignment #1*

Students are asked to create a vocabulary study plan using the following guidelines: Your vocabulary study plan should be for a 4-5 day period (Monday through Thursday, Tuesday through Saturday). Think about what days are best for you. Please use complete sentences to describe what you plan to do each day. Be as detailed as

possible. The plan should be at most 1 page in length. Please use at least size 11 font. (I am old and have bad eyes) Consider the following as you make your plan:

1. What strategies have you used in the past to learn vocabulary? Did those strategies work well for you?
2. What strategy or strategies are you going to try this time?
3. How much time will you devote to studying vocabulary before the first test? Keep in mind that there's a lot of vocabulary in Module 1.
4. Make time in your study plan to complete the Practice Problems for MATH 0996 and Homework for MATH 1401

*Learning or Study Skill Strategy Assignment #2*

Students are asked to watch a short 2-minute video on [Growth Mindset](#), and then create their own personal mantra using Padlet. [This is the Padlet link for Spring 2021.](#)

*Learning or Study Skill Strategy Assignment #3*

Students are asked to watch a short video on [Note-Taking Strategies and Techniques](#). Examples of some of the techniques created Mrs. Ralston are provided: Guided Notes, Mind Maps-Graphic Organizer, Outlining, and Mind Maps-Flowcharts. A second video that discusses [scientific study tips](#) is included. Students are required to complete a midterm exam practice that is formatted with questions similar to those on the MATH 1401, Elementary Statistics, midterm exam.

*Learning or Study Skill Strategy Assignment #4*

focuses on reading comprehension skills as we begin the discussion of one of the main statistical concepts: Hypothesis Testing. Students are provided with a variety of strategies and asked to complete a Key Words Quiz. Students struggle with translating words to the appropriate mathematical symbols.

*Learning or Study Skill Strategy Assignment #5*

Students are provided with some advice and information from Dr. Sandra McGuire's Metacognition Presentation at Georgia Highlands College in Fall 2020 and from Dr. McGuire's books, "Teach Students How to Learn" and "Teach Yourself How to Learn." Students are asked to reflect on their experience in MATH 0996 by answering the following two questions:

1. Which of the students' actions have been YOUR actions throughout the semester—students who did not do well or students who made an A?
2. What learning or study skill strategy (discussed throughout this course) do you plan to use in other courses to help you be successful?

Time Management

[Time Management Video and PowerPoint](#)

# Calculus 1

# Calculus 1

## MATH 2211

### Summary of available resources:

		textbook?	homework?	more?
Calculus 1	La Corte	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Chapman and Royal	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Pinzon and Roberts	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Marion and Kunwar	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

# “Calculus I Workbook & Applets” (2021)

J. La Corte

it's lonesome not collaborating

(Georgia State University, Dunwoody Campus)

Type of resource:  
Scope of coverage:  
ALG repository:  
Author(s) presentation:

Textbook (draft PDF); Applets; iCollege module

Complete course

[Calculus I Workbook & Applets](#)

[ALG Featured Speaker Series, Nov. 2021](#)



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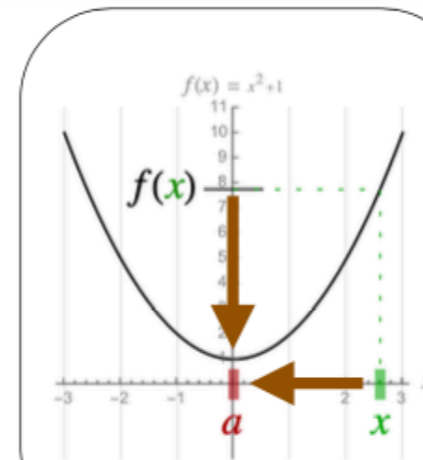
## Course materials

### Brightspace/iCollege Module

Links to applets I wrote appear in iCollege alongside links to applets hosted outside USG.

## Project narrative

### Skills for exercises in problem areas



Part of my job as a teacher is to get my students to see the pictures I have in my head.

These pictures often have moving parts.





# “WeBWoRk Problems for OpenStax Calculus 1” (2019)

K. Chapman, J. Royal  
(Georgia Gwinnett College)

Type of resource:	Online problem sets
Scope of coverage:	Complete course
ALG repository:	<a href="#">WeBWoRk Problems for OpenStax Calculus 1</a>
Format:	MS Word



License

All sections of Calculus I used the OpenStax-compatible WeBWoRk sets in Fall 2019 and in Spring 2020.

## Materials Description

We created a database of WeBWoRk problems, sectioned to align with the OpenStax calculus 1 textbook.

### Timeline

March 2019: Evaluate current Calculus I materials on Galileo to determine aspects most in need of editing or expanding to coincide with UGA intentions.

March-April 2019: Creation of draft of WebWork problem set structure for Calculus II OpenStax textbook using problems from UGA WebWork database and other WebWork databases as needed.

May 2019: Editing of WebWork databases for both courses to ensure consistency with both textbook and departmental goals. Post materials to the Galileo repository. Compile final report

Dr. Chapman will be responsible for creating databases, while Dr. Royal will be responsible for reviewing the materials and determining necessary adjustments. Dr. Chapman will also post materials after completion and write final reports, while Dr. Royal will ensure proper incorporation of the new materials into the pilot program.

# “OpenStax Calculus I Ancillary Materials”

K. Pinzon, J. Roberts  
(Georgia Gwinnett College)

Type of resource:	Edfinity homework (low cost); Guided notes
Scope of coverage:	Complete course
ALG repository:	<a href="#">OpenStax Calculus I Ancillary Materials</a>
Format:	MS Word



License

**Section 2.3: The Limit Laws**

**Evaluating Limits with the Limit Laws**

In the previous section we estimated limits using a table and graph. In addition to estimating, we look at some properties of limits that will allow us to evaluate limits of many types of algebraic functions.

**Basic Limits**

For any real number  $a$  and any constant  $c$ ,

$$\lim_{x \rightarrow a} x = a$$
$$\lim_{x \rightarrow a} c = c$$

**Examples:** Evaluate each of the following limits using the Basic Limits.

1)  $\lim_{x \rightarrow 2} x$     2)  $\lim_{x \rightarrow 2} 5$

We now look at the limit laws, the individual properties of limits, and practice using them.

**Limit Laws**

Let  $f(x)$  and  $g(x)$  be defined for all  $x \neq a$  over some open interval containing  $a$ . Assume that  $L$  and  $M$  are real numbers such that

$$\lim_{x \rightarrow a} f(x) = L \text{ and } \lim_{x \rightarrow a} g(x) = M.$$

Let  $c$  be a constant. Then, the following statements hold:

**Sum law for limits:**  $\lim_{x \rightarrow a} (f(x) + g(x)) = \lim_{x \rightarrow a} f(x) + \lim_{x \rightarrow a} g(x) = L + M$

**Difference law for limits:**  $\lim_{x \rightarrow a} (f(x) - g(x)) = \lim_{x \rightarrow a} f(x) - \lim_{x \rightarrow a} g(x) = L - M$

**Constant multiple law for limits:**  $\lim_{x \rightarrow a} c f(x) = c \cdot \lim_{x \rightarrow a} f(x) = cL$

**Product law for limits:**  $\lim_{x \rightarrow a} (f(x) \cdot g(x)) = \lim_{x \rightarrow a} f(x) \cdot \lim_{x \rightarrow a} g(x) = L \cdot M$

**Quotient law for limits:**  $\lim_{x \rightarrow a} \frac{f(x)}{g(x)} = \frac{\lim_{x \rightarrow a} f(x)}{\lim_{x \rightarrow a} g(x)} = \frac{L}{M}$  for  $M \neq 0$

**Power law for limits:**  $\lim_{x \rightarrow a} (f(x))^n = \left(\lim_{x \rightarrow a} f(x)\right)^n = L^n$  for every integer  $n > 0$

**Root law for limits:**  $\lim_{x \rightarrow a} \sqrt[n]{f(x)} = \sqrt[n]{\lim_{x \rightarrow a} f(x)} = \sqrt[n]{L}$  for all  $L$  if  $n$  is odd and for  $L \geq 0$  if  $n$  is even and  $f(x) \geq 0$

**Media:** Watch this [video](#) example on determining a limit analytically.

**Media:** Watch this [video](#) example on using the limit laws.

**Examples**

1) Use limit laws to evaluate each of the following. In each step, indicate the limit law applied.

a.  $\lim_{x \rightarrow -3} (4x + 2)$     c.  $\lim_{x \rightarrow 6} (2x - 1)\sqrt{x + 4}$

b.  $\lim_{x \rightarrow 2} \frac{2x^2 - 3x + 1}{x^3 + 4}$

2) For each of the following, assume that  $\lim_{x \rightarrow 6} f(x) = 4$ ,  $\lim_{x \rightarrow 6} g(x) = 9$ , and  $\lim_{x \rightarrow 6} h(x) = 6$ . Use these three facts and the limit laws to evaluate each limit.

a.  $\lim_{x \rightarrow 6} \frac{g(x) - 1}{f(x)}$     c.  $\lim_{x \rightarrow 6} (f(x) \cdot g(x) - h(x))$

b.  $\lim_{x \rightarrow 6} [(x + 1) \cdot f(x)]$

# “Calculus Ancillary Videos” (2020)

P. Marion, I. Kunwar  
(Fort Valley State University)

Type of resource:	Videos
Scope of coverage:	Partial
ALG repository:	<a href="#">Calculus Ancillary Videos</a>
Author(s) presentation:	<a href="#">ALG Featured Speaker Series, May 2021</a>



License

## Derivatives of Inverse Functions

[https://www.youtube.com/watch?v=20SJE\\_rwaG0#action=share](https://www.youtube.com/watch?v=20SJE_rwaG0#action=share)

## Derivatives of Exponential Functions

<https://youtu.be/tZc51GMOCOE>

<https://youtu.be/3YnwN1HeXIQ>

<https://youtu.be/LdcBo3hno6Q>

## Integration of Exponential Functions

<https://youtu.be/NwP7Is0WIN0>

# Calculus 2 & 3

# Calculus 2 & 3

## MATH 2212

### Summary of available resources:

		textbook?	homework?	more?
Calculus 2 and 3	Tiemeyer and Schlieper	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

# “Armstrong Calculus”

M. Tiemeyer, J. Schlieper  
(Georgia Southern University, Armstrong Campus)

Type of resource:	Textbook
Scope of coverage:	Complete course
Link to textbook:	<a href="#">Armstrong Calculus</a>



License

Our goal was to adopt an open-source textbook and online homework system for calculus 1, 2, & 3 to bring down the cost of higher education while maintaining academic integrity and success in those courses. While we accomplished this goal by using Active Calculus and Apex Calculus as the text and using WebWork for the homework system, we also decided to adapt the two referenced texts into our own open source textbook in the Calculus sequence. We have finished Calculus 1, and we are in the process of completing the chapters covered in Calculus 2, which will have the remaining chapters completed before fall semester begins in August 2015.

alg.manifoldapp.org/projects/armstrong-calculus

OpenALG Affordable Learning Georgia

Home Projects

## Armstrong Calculus

*A Remix of Active Calculus and APEX Calculus*

by Michael Tiemeyer, Jared Schlieper

This text is an adaptation of two very excellent open-source textbooks: Active Calculus by Dr. Matt Boelkins and APEX Calculus by Drs. Gregory Hartman, Brian Heinold, Troy Siemers, Dimplekumar Chalihajar, and Jennifer Bowen. Topics include integrals, volume, arcs, density, physics applications, differential equations, and hyperbolic functions.

START READING

GITHUB EPUB VERSION WORD VERSION ACCESSIBLE PDF

GRANT DOCS

Open Textbooks

# Discrete Math

# Discrete Math

## MATH 2420

### Summary of available resources:

		textbook?	homework?	more?
Discrete Math	Jamaloodeen et al.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Levin	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>



# “Discrete Math” (2019)

M. Jamalodeen, K. Pinzon, D. Prigel, J. Roberts, S. Siva  
(Georgia Gwinnett College)

Type of resource:	Textbook
Scope of coverage:	Complete course
ALG repository:	<a href="#">Discrete Math</a>
Link to textbook:	<a href="#">Discrete Math</a> (hosted on GitHub)

## Project Goals

[...]

One drastic consideration that has been a reality at several institutions is that information technology (IT)/computer science (CS) programs are increasingly displeased with the discrete mathematics courses that math departments are servicing their majors with and have, in some cases, taken back these courses into their own departments in order to service their IT and CS majors better.

B) Encourage the wider use of free online textbooks within the GGC math program. Currently, the GGC math program subscribes to several very expensive commercial vendor textbooks and platforms, in their multiple section courses. A major project goal, then would be to use the success in transforming the textbook in a multiple section course like MATH 2300, discrete math, as a pilot to stimulate conversations about low/no cost options in multiple section math courses, such as MATH 2450 linear algebra, MATH 2220 multivariable calculus, and potentially even high student enrollment courses like MATH 1113 precalculus. Particularly in MATH 2300, students often do not buy the textbook or wait until very late in the semester to purchase. At times, they download pirated versions of the textbook. This is true in other courses as well.

# “Discrete Math Edfinity Homework Course”

M. Jamalodeen, K. Pinzon, D. Prigel, J. Roberts, S. Siva  
(Georgia Gwinnett College)

Type of resource:	Edfinity homework for GGC’s Discrete Math textbook
Scope of coverage:	Complete course
ALG repository:	<a href="#">Discrete Math</a>
Link to textbook:	<a href="#">Discrete Math</a> (hosted on GitHub)



Home Projects

← BACK TO PROJECT RESOURCES DISCRETE MATH

## Discrete Math Edfinity Homework Course

*Resource added March, 2021*

### FULL DESCRIPTION

This is a low-cost online homework companion mapped to the OER Discrete Math textbook authored by faculty by Georgia Gwinnett College. It is comprised of algorithmic problems carefully organized into problem sets mapped to textbook sections. Edfinity is WeBWorK-compatible - existing WeBWorK courses can be automatically imported, and you can author new WeBWorK problems using the problem authoring tool.

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TYPE:  
LINK

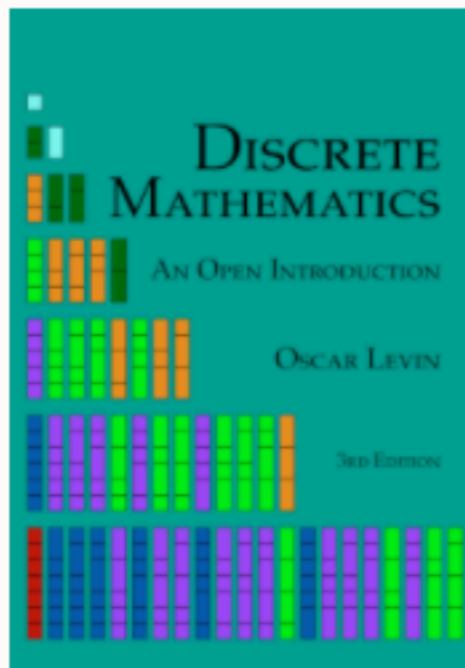
CREATED ON:  
MARCH 11, 2021

# “Discrete Mathematics: An Open Introduction” (2020)

O. Levin

(University of Northern Colorado)

Type of resource:	Textbook; Edfinity/WeBWorK homework
Scope of coverage:	Complete course
ALG repository:	<a href="#">Discrete Math</a>
Link to textbook:	<a href="#">Discrete Math</a> (hosted on GitHub)



 Read online

 Download PDF

 Buy paperback

This is the new 3rd edition of the book. The previous version is available at the [2nd edition's site](#).

*Discrete Mathematics: An Open Introduction* is a free, open source textbook appropriate for a first or second year undergraduate course for math majors, especially those who will go on to teach. Since Spring 2013, the book has been used as the primary textbook or a supplemental resource at more than 75 colleges and universities around the world (see the partial [adoptions list](#)). The text is endorsed by the [American Institute of Mathematics' Open Textbook Initiative](#) and is well reviewed on the [Open Textbook Library](#).

This 3rd edition brings many improvements, including nearly 100 new exercises, a new section on trees in the graph theory chapter, and improved exposition throughout. Previous editions will continue to be available indefinitely. A few times a year, the text is updated with a new "printing" to correct errors. See the [errata list](#) for more information.

**New for Fall 2019:** Online homework sets are available through [Edfinity](#) or as WeBWorK sets from the author. Additional exercises have been added since Spring 2020.

**Linear Algebra,  
Differential Equations,**

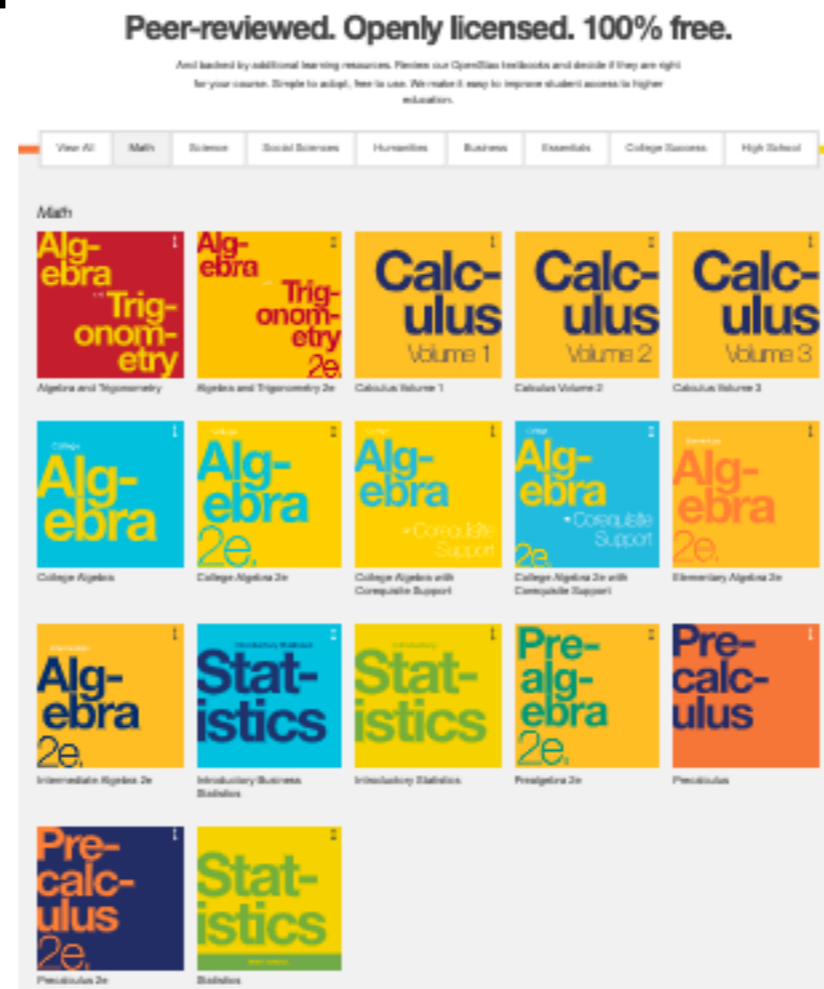
**...**

# Linear Algebra, Differential Equations, ...

MATH 2469, MATH 2653, ...

## Summary of available resources:

- none on OpenALG
- no OpenStax textbook at this time
- others exist though



## Math 1410 Elementary Linear Algebra

Spring 2020 Edition, University of Lethbridge  
(This edition is essentially unchanged from the Spring 2018 edition.)

Editor: Sean Fitzpatrick  
Department of Mathematics and Computer Science  
University of Lethbridge

### Contributing Textbooks

*Precalculus*  
Version  $[\pi] = 3$   
Carl Stitz and Jeff Zeager  
[www.stitz-zeager.com](http://www.stitz-zeager.com)

*Fundamentals of Matrix Algebra*  
Third Edition, Version 3.1110  
Gregory Hartman  
[www.vmi.edu](http://www.vmi.edu)

*APEX Calculus*  
Version 3.0  
Gregory Hartman et al  
[apexcalculus.com](http://apexcalculus.com)

**Some links to free and open  
source textbooks outside of  
USG**

# Lists of links to free and open-source textbooks

## [Dana C. Ernst's list:](#)

- Calculus, Diff Eq, Discrete Math, Intro Proof, Lin Alg, Combinatorics, Abstract Alg, Real An, Computational Math

## [American Institute of Mathematics's list:](#)

### Approved Textbooks

The list below groups open textbooks by course title. All the books have been judged to meet the [evaluation criteria](#) set by the AIM [editorial board](#).

- |                                       |                                    |                         |
|---------------------------------------|------------------------------------|-------------------------|
| ▼ Liberal Arts Math                   | ▼ Introduction to Proofs           | ▼ Real Analysis         |
| ▼ Elementary and Intermediate Algebra | ▼ Discrete Math                    | ▼ Complex Analysis      |
| ▼ College Algebra and Precalculus     | ▼ Combinatorics                    | ▼ Geometry and Topology |
| ▼ <u>Trigonometry</u>                 | ▼ Computing and Numerical Analysis | ▼ Probability           |
| ▼ Calculus                            | ▼ Number Theory                    | ▼ Statistics            |
| ▼ Differential Equations              | ▼ Abstract Algebra                 | ▼ Logic                 |
| ▼ Linear Algebra                      |                                    |                         |

# American Institute of Mathematics's list

## ^ Liberal Arts Math

*Math in Society*

David Lippman

*Mathematical Discovery*

Andrew M. Bruckner, Brian S. Thomson, Judith B. Bruckner

## ^ Elementary and Intermediate Algebra

*ORCCA: Open Resources for Community College Algebra*

Portland Community College

*Elementary Algebra*

Katherine Yoshiwara

*Intermediate Algebra: Functions and Graphs*

Katherine Yoshiwara

*OpenStax Intermediate Algebra*

Lynn Maracek, Senior Contributing Author

## ^ College Algebra and Precalculus

*Modeling, Functions, and Graphs: Algebra for College Students*

Katherine Yoshiwara

*Precalculus*

David H. Collingwood, K. David Prince, Matthew M. Conroy

*Precalculus / College Algebra / Trigonometry*

Carl Stitz and Jeff Zeager

## ^ Trigonometry

*Trigonometry*

Katherine Yoshiwara

*College Trigonometry*

Carl Stitz and Jeff Zeager

## ^ Calculus

*Calculus*

David Guichard

*Active Calculus*

Matt Boelkins

*APEX Calculus*

Gregory Hartman, Brian Heinold, Troy Siemers, Dimplekumar Chalishajar

*CLP Calculus*

Joel Feldman, Andrew Rechnitzer, Elyse Yeager

*Calculus in Context*

James Callahan, lead author

*Calculus I, II, III*

Jerrold E. Marsden and Alan Weinstein

*Calculus*

Gilbert Strang

*OpenStax Calculus*

Gilbert Strang and Edwin Herman, lead authors

*Elementary Calculus*

*Vector Calculus*

Michael Corral



# American Institute of Mathematics's list

## ^ Probability

*Introduction to Probability*

Charles M. Grinstead and J.  
Laurie Snell

*Probability: Lectures and Labs*

Mark Huber

## ^ Statistics

*OpenIntro Statistics*

David M. Diez, Christopher D.  
Barr, Mine Çetinkaya-Rundel

*Introduction to Modern Statistics*

Mine Çetinkaya-Rundel and  
Johanna Hardin

*Introductory Statistics for the Life  
and Biomedical Sciences*

Julie Vu and David Harrington

*SticiGui*

Philip Stark

*Online Statistics Education*

David Lane, lead author

## ^ Differential Equations

*Notes on Diffy Qs*

Jiří Lebl

*Elementary Differential Equations  
(with Boundary Value Problems)*

William F. Trench

## ^ Linear Algebra

*A First Course in Linear Algebra*

Rob Beezer

*Introduction to Applied Linear  
Algebra*

Stephen Boyd and Lieven  
Vandenberghe

*Linear Algebra*

Jim Hefferon

*Linear Algebra Done Wrong*

Sergei Treil

## ^ Discrete Math

*Applied Discrete Structures*

Alan Doerr and Kenneth  
Levasseur

*Discrete Mathematics: An Open  
Introduction*

Oscar Levin

*Discrete Mathematics: First and  
Second Course*

Edward A. Bender and S. Gill  
Williamson