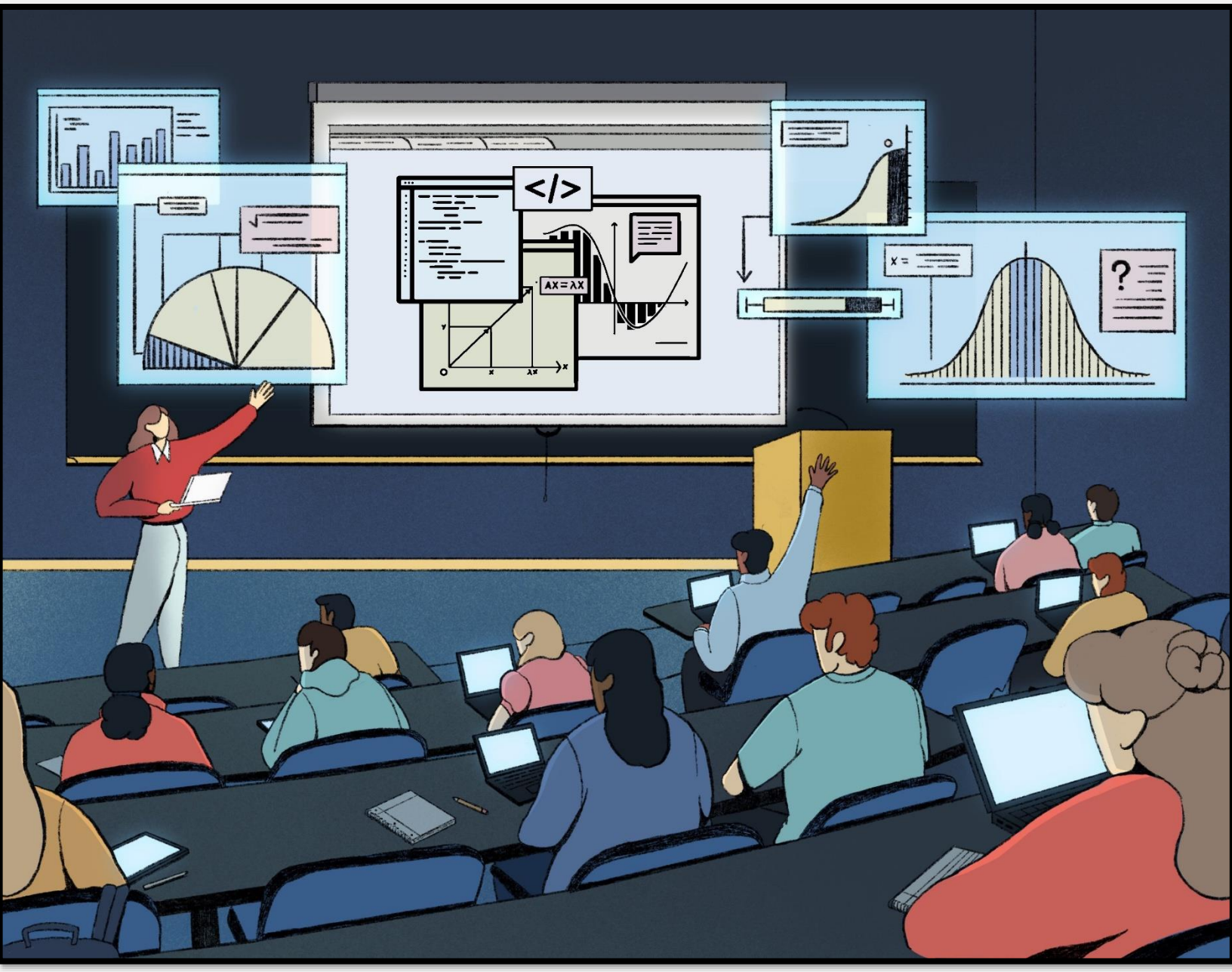
Teaching with Technology in Undergraduate Mathematics

Resource Book Part 1
Tech Tools and Useful Links



Master List of Supplementary Resources

Coding with Python

- Versatile coding language.
- Wikipedia Entry
- Python for beginners https://www.python.org/about/gettingstarted/
- Complete Python tutorial: https://docs.python.org/3/tutorial/
- Learn Python by Example https://www.learnbyexample.org/python
- Download Python and documentation https://www.python.org/doc/
- Python Wiki https://wiki.python.org/moin/BeginnersGuide
- Python community (Stack Overflow) https://stackoverflow.com/questions/tagged/python
- Data Visualization
    - Matplotlib: Visualization with Python https://matplotlib.org/
    - Lightning framework for data visualization in Jupyter https://nbviewer.jupyter.org/github/lightning-viz/lightning-example-notebooks/blob/master/index.ipynb
- Mathematics and Python Resources
    - Calc: Calculus and Algebra in Python (introduction to SageMath) https://medium.com/analytics-vidhya/calculus-and-algebra-in-python-just-became-so-much-easier-8cfaeebb777
    - Calc: Calculus using SymPy. https://docs.sympy.org/latest/tutorial/calculus.html
    - Calc: How to do calculus with python https://hackermoon.com/how-to-do-calculus-with-python-derivatives-cheat-sheet-part-1-zfy3uno
    - Calc: Solving ODEs with Python https://towardsdatascience.com/ordinal-differential-equation-ode-inpython-8dc1de21323b
    - Central Limit Theorem https://serc.carleton.edu/introgeo/teachingwdata/Statcentral.html
    - Central Limit Theorem: Wiki with activities http://wiki.stat.ucla.edu/socr/index.php/SOCR_EduMaterials_Activities_GeneralCentralLimitTheorem
    - Linear Algebra: Linear Algebra with Python http://www.math.umbc.edu/~campbell/Computers/Python/linalg.html
- Manim - making animations with Python https://github.com/3b1b/manim

DGS (Dynamic Geometry Software)

- Desmos
  - Advanced graphing calculator with curricular resources and opportunities to create your own resources.
  - Wikipedia Entry
  - https://www.desmos.com/
- Geogebra
  - Interactive software for geometry, algebra, statistics and calculus.
  - Wikipedia Entry
  - https://www.geogebra.org/
  - Geogebra 3D https://www.geogebra.org/3d?lang=en
  - Geogebra Demo https://drive.google.com/file/d/1ozPNY9wVCJbbXutebmPI7P_xH-fTo3SZ/view?usp=sharing
- Geometer's Sketchpad
  - Interactive software applied to many areas of mathematics.
  - Wikipedia Entry
  - Download the Geometer's Sketchpad for PC and for Mac.
  - Web Sketchpad Tool Library https://geometricfunctions.org/fc/tools/
  - Applets for Calculus
    - WebSketchpad https://www.sfu.ca/geometry4yl/websketchpad.html
    - Calculus http://www.sfu.ca/~jtmulhol/calculus-applets/html/appletsforcalculus.html
    - Pre-Calculus http://www.sfu.ca/people/oilamn/resource-for-teachers.html
    - Calculus in Motion https://calculusinmotion.com/calculus-in-motion/
  - GSP support https://sketchpad.keycurriculum.com/
- Geoservant 3D
  - 3D online drawing program. Available in many different languages.
  - https://www.matheretter.de/geoservant/en
- JSXGraph
  - a cross-browser JavaScript library for interactive geometry, function plotting, charting, and data visualization in the web browser.
  - https://jsxgraph.uni-bayreuth.de/wp/index.html
- Sketchometry
  - Sketchometry converts finger drawings into exact Euclidean Geometry figures.
  - https://sketchometry.org/en/index.html

Dynamic Mathematics Software

- CalcPlot 3D
  - An online 3D visualization tool for multivariable calculus
  - https://c3d.libretexts.org/CalcPlot3D/index.html
- Chartmaker
  - From Bloomberg, web-based tool for creating charts.
  - https://chartmaker.bloomberg.com/login
- E-Proofs
  - online tool that supports the creation of electronic proofs
  - http://e-proof.weebly.com
- Graph.tk
  - Online graph sketching app that can graph functions and numerically solve differential equations.
  - https://graph.tk
- Plotlux
  - Plotter for arbitrary functions
  - https://www.matheretter.de/calc/plotlux
- Wolfram Alpha
  - A computational knowledge application. Students can enter mathematical queries and find answers. There are also dynamic representations of mathematical concepts
  - Wikipedia Entry
  - https://www.wolframalpha.com

Interactive Whiteboards & Screencast Resources

- Interactive Whiteboard Tools
  - Explain Everything https://explaineverything.com/
    - YouTube video exploring the tool https://www.youtube.com/watch?v=FTCxtUyPZHk
    - User manual https://s3.amazonaws.com/ee.marketing/public-resources/explain-everything-resources/Explain-Everything-User-Manual.pdf
    - Review from Review from CommonSense Education https://www.commonsense.org/education/website/explain-everything
  - Jamboard. Google's interactive whiteboard https://jamboard.google.com

- Annotation Tools
  - VideoAnt https://ant.umn.edu
    - A comprehensive guide to using VideoAnt for annotating YouTube videos in the classroom (by Nathan Hall) https://nathanghall.wordpress.com/2018/02/22/a-comprehensive-guide-to-using-videoant-for-annotating-youtube-videos-in-the-classroom/
    - Article discussing the usage and benefits of VideoAnt https://cdn.tc-library.org/Edlab/VideoANT_0.pdf
  - IPEVO Innovator. Annotation tools for your interactive whiteboard. https://www.ipevo.com/software/annotator

Video Podcasts for Undergraduate Mathematics:

- 3Blue1Brown https://www.3blue1brown.com/
  - YouTube channel with interactive videos on various mathematics topics.
- Black pen red pen https://www.youtube.com/channel/UC_SvYP0k05UKiJ_2ndB02IA
  - YouTube channel explaining mathematics topics (mostly calculus).
- Looking Glass Universe https://www.youtube.com/user/LookingGlassUniverse
  - YouTube channel about quantum mechanics integrating mathematics and physics.
- Mathologer https://www.youtube.com/channel/UC1_uAIS3r8Vu6JjXWvastJg
  - YouTube channel with well-explained videos on mathematical concepts.
- Numberfile https://www.youtube.com/user/numberphile
  - YouTube channel featuring various mathematicians explaining mathematical topics.
- Patrick JMT https://www.youtube.com/user/patrickJMT
  - YouTube channel mostly with worked examples for calculus.
- Welch labs https://www.youtube.com/user/Taylorns34
  - YouTube channel featuring videos about math, science and machine learning.

Miscellaneous Teaching Resources

- Course Planning
  - Fact and Formulae Leaflets https://www.mathcentre.ac.uk/types/facts-and-formulae-leaflets/leaflets/
  - MIT openCourseWare http://ocw.mit.edu/courses/#mathematics

- Dealing with Anxiety in the classroom
    - How to talk to your students https://anxietyintheclassroom.org/school-system/resources-for-school-personnel/how-to-talk-to-your-students/
- Example Spaces
    - The power of student-generated examples in mathematics https://rtalbert.org/the-power-of-student-generated-examples-in-mathematics/
    - University of Cambridge Mathematics for the Natural Sciences: Example Sheets http://www.damtp.cam.ac.uk/user/examples/
- Online Teaching
    - Online communication https://www.kings.uwo.ca/current-students/student-support-and-resources/academics/online-course-etiquette-and-effective-communication/
    - Teaching with Zoom https://www.unr.edu/digital-learning/tools-and-technologies/web-conferencing/zoom/best-practices
- Online Discussions
    - 10 tips for effective online discussions https://er.educause.edu/blogs/2018/11/10-tips-for-effective-online-discussions
    - 10 tips for setting up online discussions with your class https://healthsci.queensu.ca/it/services/elearning/10-tips-setting-online-discussions-your-class
    - Leading online discussions https://uwaterloo.ca/centre-for-teaching-excellence/teaching-resources/teaching-tips/alternatives-lecturing/discussions/online-discussions-tips-for-instructors
    - Tips for students from University of Waterloo https://uwaterloo.ca/centre-for-teaching-excellence/teaching-resources/teaching-tips/developing-assignments/blended-learning/online-discussions-tips-students
    - Tips for students from Western University https://www.uwo.ca/sdc/learning/selfhelp/skill_building_handouts/PDFs/Learning%20Online/Online-Discussion.pdf
- Proofs and Proving
    - MAA guidelines for teaching and learning proof: https://www.maa.org/programs/faculty-and-departments/curriculum-department-guidelines-recommendations/teaching-and-learning/research-sampler-8-students-difficulties-with-proof
    - E-Proofs
        - online tool that supports the creation of electronic proofs
        - http://e-proof.weebly.com

    - Hands on tutorial on proofs and proving https://www.birmingham.ac.uk/Documents/college-eps/college/stem/Student-Summer-Education-Internships/Proof-and-Reasoning.pdf
    - Proof comprehension tests developed by PCRG https://sites.google.com/view/pcrg/projects/proof-comprehension-tests?authuser=0
- Scaffolding
    - Prompting and scaffolding student thinking https://gcci.uconn.edu/2019/05/21/prompting-and-scaffolding-student-thinking/
    - Scaffolding help from the University of Buffalo https://www.buffalo.edu/ubcei/enhance/teaching/guiding-students/scaffolding.html
    - Scaffolding learning in the online classroom https://ctl.wiley.com/scaffolding-learning-in-the-online-classroom/
- TA handbook from the Mathematical Association of America: https://www.maa.org/programs/students/student-resources/a-handbook-for-mathematics-teaching-assistants
- Using Group Work in the classroom
    - Energizing your online course with group work from HBPE https://hbsp.harvard.edu/inspiring-minds/energize-your-online-course-with-group-work
    - Facilitating group work online from Niagara College Canada https://www.niagaracollege.ca/cae/eddev/teaching-resources/online-teaching/develop/group-work-online/
    - Setting up group work in Canvas from UCDavis https://canvas.ucdavis.edu/courses/34528/pages/group-work-and-participation
    - Strategies for high quality interactions https://oere.oise.utoronto.ca/wp-content/uploads/2012/08/+WW_InteractionInMathClass.pdf
    - Tips for students from Drexel University https://www.online.drexel.edu/news/group-tips.aspx
    - Tips for students from York University https://learningcommons.yorku.ca/groupwork/

Miscellaneous Technology Resources

- Email Etiquette
  - Email Etiquette https://www.purdue.edu/advisors/students/email.php
  - Practice good email etiquette https://careers.yorku.ca/student_topic/practice-good-email-etiquette
- Internet Connection
  - 7 ways to stop a poor internet connection ruining your online lessons https://community.wacom.com/eu/europe/7-ways-to-stop-a-poor-internet-connection-ruining-your-online-lessons/
  - Check your internet speed at speed test https://www.speedtest.net
  - Coping with unstable internet connection from Cambridge University https://www.cambridge.org/elt/blog/2020/06/18/teaching-adults-unstable-internet-connection/
  - Internet slow? Here are the possible reasons why and how to fix them https://www.zdnet.com/article/why-is-my-internet-so-slow-here-are-reasons-and-how-to-fix-them/
- Zoom Etiquette
  - 14 netiquette rules students should know https://potomac.edu/netiquette-rules-online-students/
  - Etiquette and best practices for Zoom https://www.technology.pitt.edu/blog/zoom-tips
  - Helping students develop net etiquette https://www.pearson.com/ped-blogs/blogs/2020/03/helping-students-develop-proper-internet-etiquette.html
  - Netiquette https://www.ucl.ac.uk/teaching-learning/education-planning-2021-22/online-teaching-guidance-tips-and-platforms/netiquette-good-online
  - Netiquette infographic https://sscm.mcmaster.ca/app/uploads/2020/08/Netiquette-Infographic-Smaller-File-Size.pdf
  - Video meeting etiquette tips from Zoom https://blog.zoom.us/video-meeting-etiquette-tips/
  - Zoom etiquette guidelines https://citl.indiana.edu/teaching-resources/guides/Zoom%20Etiquette.html