We acknowledge that we are meeting on the unceded ancestral lands of the Akimel O'odham nation, and before that the Hohokam people. This place has been and continues to be the home of indigenous peoples, who preserved it since time immemorial. We have much to learn from them.
Structural racism affects us all. There are structural systems in place that hinder the educational and economic success of people of color. Too few people of color are attempting and completing STEM degrees that can help them raise their standard of living.

The Math Division at West Los Angeles College is dedicated to confronting these structural inequities. We work to provide the support students need to realize their potential to succeed. We will continue and increase our efforts to promote STEM degrees, to raise awareness of the achievements of BIPOC in the sciences, and to implement social justice curriculum in our math courses.

We will all benefit from increased diversity in the scientific community.
Who Attends West LA College?

- First-generation college students: 40%
- No HS diploma or GED: 4%
- Math 230 students: Disproportionately fearful of math and/or have had bad experiences with it
Math 230: Math for Liberal Arts

Required Topics
- Sets and logic
- Probability & statistics
- Abstract Algebra
- Geometry (topics)
- Math modeling

Instructor Options
- Numeration systems
- Election Theory & Fair Division
- Financial & Consumer Math
- Graph Theory
- Sequences & Series
- Number Theory
College-Level Math Appreciation

- Three units
- No prerequisites
- Course Student Learning Outcomes:
  1. Use symbolic logic to analyze an argument and determine whether it is valid
  2. Interpret statistical measures and inferences
  3. Use mathematics to analyze social issues or personal finance
You count!

- “Counting Around the World” Activity
  - Numbers and culture
  - Abstract and concrete
- Introduction to numeration systems
  - Base 10 number-words
  - Computation in Mayan math
- Counting in mathematics: Probability, election theory, sets, symmetry
- Assignment: Math and cultures
Who does math?
(from Statistics for Social Justice)

- A Message from Dr. AnnMaria De Mars
- Florence Nightingale as a Statistician
- Nate Silver: Statistics, Baseball and Politics
- Prof. David Blackwell, Black Pioneer in Statistics
- Prof. Kimberly S. Weems, “Math Girl”

“I became knowledgeable of multiple African Americans that contributed a great deal to the history of mathematics.” – DD, Summer 2021
Killed by Police: Absolute numbers versus percents/proportions

- “The most informative mathematical lesson was proportions. It helped me understand how elections work and how to use it in real world situations like the discussion we had on police shootings.” - LG

- “Could [it] be possible that they may kill more whites than blacks? But there were more white people than black people. People from other races would want to come together and [unite] simply just because they [police] are killing them just to kill them the majority of the time.” - TJ

- “An antiracist movement that unites people of different racial and ethnic groups is a great concept! However, based upon the statistics that people use as factual data, some have not even acknowledged the fact that there is a racism issue.” - DD
Statistics: Assessing a legacy of racism

- **Research design:** USPHS syphilis study at Tuskegee
- **The “Bell Curve”**
  - What is intelligence?
  - Galton: statistics and eugenics
  - Scientific racism and anti-racism today
  - Bias in schools and classrooms
- **Discussion: Statistics, Eugenics and Racism:**
  - Did it surprise you to read about Eugenics and the origins of modern statistical theory? Given this history, can statistical analysis still help expose and oppose racism today?

  As a tool to oppress is incredibly shocking. I do not think it’s contradictory to use the system to unravel the institutionalized racism of our country. I find irony that the system that was created to back up racism is now playing a huge role in its potential undoing. — AJ, Winter 2021
Discussion: Statistics, Eugenics and Racism

“The knowledge that mathematics were used as a tool to oppress is incredibly shocking. I do not think it's contradictory to use the system to unravel the institutionalized racism of our country. ...[cites “killed by police”]... I find irony that the system that was created to back up racism is now playing a huge role in its potential undoing.”

--AJ, Winter 2021
Fair division

Big "fair division" questions-- sharing society's wealth or the work involved in creating it, or access to Covid-19 vaccine -- are beyond the scope of our algorithms. Post about something that you think is NOT fairly divided, and what would be fairer.

- "Health insurance" (HF) and "Health care" (MH)
- "Resources allocated to making the world accessible" (AP)
- "Needing a degree to be able to do a certain job." (TJ)
- "Education" (ML) and "College education...Just have free education, or affordable education at least." (LG)
- "Owner corporate business opportunities for minorities" (SM)
- "Gender equality. Minority or people of color equality. Equality is absolutely not fairly divided in the US and the world today." (DD)
Election theory

- **Apportionment controversies**
- **Voting methods**
  - Example: Social Justice Club choosing theme issue for semester
  - Instant run-off in US cities; coalitions (weighted voting) in Israel, Canada, Italy, Scotland
- **Insincere voting and minor-party candidates:**
  - US Presidential elections 2016 (Michigan); 2020 (Arizona)
- **Arrow’s Theorem:** Why should tallying individual preferences result in best group decision? Why not consider what’s best for the group?
- **Consensus** (usually omitted): When there are no fundamental disagreements or serious conflicts of interest within group
After midterm: Required unit on sets and logic

- **Sets**: Relate back to probability and voting coalitions
- **Formal logic**: Students find this difficult
- **Illogical thinking**: Emphasize more examples beyond formal logical fallacies.
- **Examples of poor reasoning encountered on social media or elsewhere** - Did not work as well as hoped.
- **Conclusion**: This unit needs more work to frame it more effectively in terms of equity and social justice.
Geometry: Theory, practice & class society

Axiomatic approach to geometry is not the only one.
Geometry: Proof, Symmetry, Rigid Transformations

Proof #9

Another proof stems from a rearrangement of rigid pieces, much like proof #2. It makes the algebraic part of proof #4 completely redundant. There is nothing much one can add to the two pictures.

(My sincere thanks go to Monty Phister for the kind permission to use the graphics.)
Algebra…. Introducing Group Theory

• Clock arithmetic
• Modular arithmetic
• Cayley tables mod 4
• What is an algebraic “group”
• Symmetries of an equilateral triangle
A Group of Animals

<table>
<thead>
<tr>
<th></th>
<th>Gorilla</th>
<th>Zebra</th>
<th>Hamster</th>
<th>Penguin</th>
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<tr>
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<td>![Hamster]</td>
<td>![Penguin]</td>
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</tr>
</tbody>
</table>

Set $G = \{\text{Gorilla}, \text{Zebra}, \text{Hamster}, \text{Penguin}\}$

Operator: $\text{Hearts}$

Example: $\text{Gorilla} \text{Hearts} \text{Hamster} = \text{Gorilla}$
The **Santa Susana nuclear meltdown (1959)** was possibly the worst nuclear accident in US history. It has been compared to Chernobyl, but for many years people in Los Angeles, including the west San Fernando Valley (where the secret Santa Susana labs were located) were kept in the dark and lied to about it.

**How much radiation is still around?**
PEDAGOGY for Social Justice?

- Winter and Summer 2021
  - Synchronous online (Zoom) in Canvas
  - OER textbooks
    - Lippman, Math in Society
    - Inigo, et al, College Math for Everyday Life
- Summer 2021: Spec grading replacing “points”
  - Assignments
  - Discussions
  - Projects
  - Homework from texts
  - De-emphasizing exams
Questions and Discussion
(to be continued on Whova)

Bonnie Blustein  blustebe@laccd.edu

Thanks to
- AMATYC Equity Committee
- ASCCC OER Initiative (support for Statistics for Social Justice)
- WLAC Math 230 Students (winter and summer 2021)
T3F Math for Liberal Arts: A Social Justice Focus
AMATYC Presentation October 28, 2021
Additional Resources

Bonnie Ellen Blustein, Ph.D.
West Los Angeles College

  o Historical Counting Systems
  o Probability and Statistics
  o Fair Division
  o Apportionment
  o Voting Systems
  o Sets and Logic
  o Fractal Geometry (I might skip this next time)
  o Public-key Cryptography (application of modular arithmetic)
  o Mathematical Models
  o Probability and Statistics
  o Fair Division
  o Apportionment
  o Voting Systems
  o Geometric Symmetry
  o Mathematical Models
• Blustein et al., ASCCC OERI Statistics for Social Justice
  https://lor.instructure.com/resources/883f9616cc614634a0230eb094d7922b?shared

Counting Around the World


Arika Okrent, “12 Mind Blowing Number Systems from Other Languages”
https://www.mentalfloss.com/article/31879/12-mind-blowing-number-systems-other-languages accessed 10/24/2021
https://www.lathisms.org/ (Latinx and Hispanics in the Mathematical Sciences)

Racism and Statistics


Neurodivergent Rebel, “The Problem With IQ” https://www.youtube.com/watch?v=o0GTxrv32Z8
Math and Politics (Fair Division, Apportionment, Decision-making)


“Apportionment Timeline.” http://www.personal.psu.edu/pls5/ApportionHistory.html


Wikipedia is a good source for current information on parliamentary parties and blocs.

Sets and Logic

Not much to share here, but a Canvas discussion “Things People Say” opened a window students’ thinking:

*Everybody has been in a conversation (in person or online) where you think that someone else has said or posted something that is completely illogical or doesn't make sense. We’re not talking about when you simply disagree with an opinion. We’re talking about things that are contradictory or "don't follow." Like: "all dogs are animals, and my cat is an animal, so my cat is a dog." Your experiences would probably not be that obvious, but it's an example. Please post at least one example in the discussion: what someone said AND why you find it illogical.*

Geometry and Algebra Revisited

https://www.cut-the-knot.org/pythagoras/ (Over 100 proofs of the Pythagorean Theorem)

http://www.math.ucdenver.edu/~wcherowi/clockar.html (Clock Arithmetic)

https://en.wikiversity.org/wiki/Introduction_to_group_theory#:~:text=Group%20theory%20is%20the%20study,and%20complex%20numbers%20as%20well. (Group Theory)

https://www.geneseo.edu/~heap/courses/330/trianglesymmetry.pdf (Symmetry group for an equilateral triangle)

https://en.wikipedia.org/wiki/Cayley_table (Cayley tables)

https://www.math.drexel.edu/~dp399/musicmath/assets/Symmetry.pdf (symmetry groups in music)

Mathematical Models

“Coronavirus: What is the R number and how is it calculated?” https://www.bbc.com/news/health-52473523
Critical and Historical Views


Lancelot Hogben, Mathematics for the Million (1937)

Math 230 Syllabus Excerpts

Welcome to Math 230! This class is designed as a fun introduction to quantitative reasoning as used in real-world situations. It fulfills a GE requirement for the AA degree and transfer.

Special topics will include numbers and counting around the world, election math and fair-division problems.

The Statistics unit will focus on Social Justice and anti-racism.

Catalog Description: An introduction to the spirit and style of mathematics and its pursuit as a human endeavor. Topics include logical reasoning and set theory, algebraic and geometric systems, probability and statistics, mathematical modeling, and two or more of the following: numeration systems, financial math, graph theory, election theory, fair-division algorithms, number theory, sequences and series.

Course Student Learning Outcomes (from Course Outline of Record)

1. Use symbolic logic to analyze an argument and determine whether it is valid
2. Interpret statistical measures and inferences
3. Use mathematics to analyze social issues or personal finance

Class Schedule (Six-week summer class)

<table>
<thead>
<tr>
<th>Week</th>
<th>Theme</th>
<th>Mon</th>
<th>Tu</th>
<th>We</th>
<th>Th</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>June 14-17 Multicultural Math Intro: Counting around the world Mathematics and cultures Basic Statistics for Social Justice (1) Basic Statistics for Social Justice (2)</td>
<td></td>
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<tr>
<td>3</td>
<td>June-July 1 Fair Division &amp; Election Theory Voting Methods More on Voting Methods &amp; Paradoxes Coalitions and Power Midterm Exam</td>
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<tr>
<td>4</td>
<td>July 5-8 Sets and Logic COLLEGE CLOSED Sets, subsets &amp; Venn Diagrams Formal Logic &amp; Representation Logical Arguments and Fallacies</td>
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<tr>
<td>5</td>
<td>July 12-15 Geometry and Algebra revisited “Pythagorean” Theorem: Many forms of proof Transformations, Symmetry, Fractals Clock and Modular Arithmetic Group Theory for Beginners</td>
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</tr>
</tbody>
</table>
Instead of the usual “points” system, this class will use a variation of “contract grading.” Classwork, homework, discussions and projects will be assessed as “complete” (meaning mostly correct) or “incomplete” (meaning that a significant part is undone or incorrect). A checklist is included on the next page.

The midterm and final will be assessed as “Outstanding,” “Satisfactory,” or “Unsatisfactory.”

The table below shows what you need to do to achieve the grade you want.

<table>
<thead>
<tr>
<th>For this grade:</th>
<th>You must receive completion credit for ALL of the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>• At least 22 classwork assignments</td>
</tr>
<tr>
<td></td>
<td>• At least 20 homework assignments</td>
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<tr>
<td></td>
<td>• At least 6 projects</td>
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<tr>
<td></td>
<td>• At least 9 discussions</td>
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<tr>
<td></td>
<td>• Both exams at least “satisfactory” with at least one “outstanding”</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>• At least 20 classwork assignments</td>
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<tr>
<td></td>
<td>• At least 17 homework assignments</td>
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<tr>
<td></td>
<td>• At least 5 projects</td>
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<tr>
<td></td>
<td>• At least 8 discussions</td>
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<tr>
<td></td>
<td>• Both exams at least “satisfactory”</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>• At least 16 classwork assignments</td>
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<tr>
<td></td>
<td>• At least 14 homework assignments</td>
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<td></td>
<td>• At least 3 projects</td>
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<td></td>
<td>• At least 6 discussions</td>
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<td></td>
<td>• Both exams, at least one at a “satisfactory” level</td>
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<tr>
<td><strong>D</strong></td>
<td>• At least 12 classwork assignments</td>
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<tr>
<td></td>
<td>• At least 12 homework assignments</td>
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<td></td>
<td>• At least 2 projects</td>
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<td></td>
<td>• At least 5 discussions</td>
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<tr>
<td></td>
<td>• Both exams submitted</td>
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<tr>
<td><strong>F</strong></td>
<td>A grade of F will be assigned if the minimum requirements for a D have not been satisfied.</td>
</tr>
</tbody>
</table>

Instead of the usual “points” system, this class will use a variation of “contract grading.” Classwork, homework, discussions and projects will be assessed as “complete” (meaning mostly correct) or “incomplete” (meaning that a significant part is undone or incorrect). A checklist is included on the next page.

The midterm and final will be assessed as “Outstanding,” “Satisfactory,” or “Unsatisfactory.”

The table below shows what you need to do to achieve the grade you want.
REMEMBER THAT YOU ARE NOT EXPECTED TO DO ALL OF THIS. THINK OF IT AS A MENU FROM WHICH TO CHOOSE!

<table>
<thead>
<tr>
<th>Classwork</th>
<th>Homework</th>
<th>Projects</th>
<th>Discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mon June 14 CW Introductions (discussion)</td>
<td>HW Base 10 and Other Bases</td>
<td>Project: You Count</td>
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</tr>
<tr>
<td>Wed June 16 CW Populations &amp; Samples</td>
<td>Project: Representing Data</td>
<td></td>
<td>Discussion: Covid-19 data controversies</td>
</tr>
<tr>
<td>Thur June 17 CW: Children’s Dental Health</td>
<td>HW: Atlantic Hurricanes</td>
<td>Project: &quot;Flattening the Curve&quot; of COVID-19</td>
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</tr>
<tr>
<td>Mon June 21 CW: Probability (Covid-19)</td>
<td>HW Probability and Diabetes</td>
<td></td>
<td>Discussion: Social capital and health</td>
</tr>
<tr>
<td>Mon June 21 CW: More on Probability; Intimate Partner Violence</td>
<td></td>
<td></td>
<td>Discussion: Hurricanes and Climate Change</td>
</tr>
<tr>
<td>Tues June 22 HW: Normal Distribution</td>
<td>HW: Interpreting Poll Results</td>
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<tr>
<td>Wed June 23 CW How We Can Share</td>
<td>HW: Fair Division</td>
<td></td>
<td>Discussion: Fair Division</td>
</tr>
<tr>
<td>Thurs June 24 CW Apportionment</td>
<td>Project: Apportionment Controversies</td>
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<tr>
<td>Mon June 28 CW Discussion: Democracy</td>
<td>HW Apportionment</td>
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<tr>
<td>Mon June 28 CW Introduction to Election Theory</td>
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<tr>
<td>Tues June 29 CW Discussion: Voting and</td>
<td>HW Voting Methods</td>
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<tr>
<td>Tues June 29 Decision-Making</td>
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<tr>
<td>Wed June 30 CW: Weighted Voting</td>
<td>HW More on Voting Systems</td>
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<tr>
<td>Thurs July 1 MIDTERM EXAM (REQUIRED)</td>
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<tr>
<td>Tues July 6 CW: Sets</td>
<td>HW Sets</td>
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<td>Discussion: Things People Say</td>
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<tr>
<td>Wed July 7 CW: DeMorgan’s Laws</td>
<td>HW Boolean Logic</td>
<td>Project: Logic Puzzles</td>
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<tr>
<td>Thurs July 8 CW: Disjunctive Syllogisms</td>
<td>HW Logical Arguments</td>
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<tr>
<td>Mon July 12 CW: Visual Proofs</td>
<td>HW Axiomatic Geometry</td>
<td>Project: Pythagorean Theorem</td>
<td>Discussion: Learning about Geometry</td>
</tr>
<tr>
<td>Mon July 13 CW: Symmetries</td>
<td>HW Homework: Fractals</td>
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<tr>
<td>Mon July 13 CW: Fractals</td>
<td>HW Homework: Symmetry</td>
<td>Project: Geometry and Art</td>
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<tr>
<td>Mon July 13 HW Homework: Fractals</td>
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<tr>
<td>Mon July 19 CW: Linear Models</td>
<td>HW: Linear Models</td>
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<tr>
<td>Tues July 20 CW: Exponential and Logistic</td>
<td>HW: Exponential Models</td>
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<tr>
<td>Growth</td>
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<tr>
<td>Wed July 21 CW: Exponential Decay</td>
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<td>Discussion: Course Reflection</td>
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<tr>
<td>Thurs July 22 FINAL EXAM (REQUIRED)</td>
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<tr>
<td>TOTAL ITEMS IN EACH CATEGORY</td>
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<td>Projects: 8</td>
<td>Discussions: 10</td>
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<td>Needed for B: 5</td>
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<tr>
<td>Needed for C: 14</td>
<td>Needed for C: 12</td>
<td>Needed for C: 3</td>
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