Algebra 2.0

Maria H. Andersen, Ph.D.
Troublemaker, Edge of Learning

2016
A dive down a rabbit hole ...

ILL.—An equation is aptly compared to a pair of scales with equal arms, balanced by weights in the two pans.

Now, if the weights in the scale pans balance each other, that is, are equal, and we multiply the weights in each pan by 6 (or any other number), the balance (equality) will still be preserved. Or, if we increase or decrease the weights in both pans equally, the balance (equality) will not be destroyed.

2. Clear $\frac{2x}{3} - \frac{5x}{4} + 1 = \frac{11}{2}$ of fractions.

Result, $8x - 15x + 12 = 66$.

3. Clear $10 + \frac{2x - 5}{5} = 1 + \frac{x}{2} - 3x$ of fractions.

Result, $100 + 4x - 10 = 5 + 5x - 30x$.

4. Clear $\frac{x - 1}{2} - \frac{x - 2}{3} + x = \frac{3x - 1}{6} + \frac{4 - x}{3}$ of fractions.
Because it was so fun …

21. At a certain election 943 men voted, and the candidate chosen had a majority of 65 votes. How many voted for each?  
   *Ans.*, 439 and 504.

36. There is a fish whose head is 9 inches long; the tail is as long as the head and half the body, and the body is as long as the head and tail together. What is the length of the fish?  
   *Ans.*, 72 in.

40. In the composition of a quantity of gunpowder the nitre was 10 lbs. more than \(\frac{2}{3}\) of the whole, the sulphur was 4½ lbs. less than \(\frac{1}{6}\) of the whole, and the charcoal 2 lbs. less than \(\frac{1}{7}\) of the nitre. What was the amount of the gunpowder?  
   *Ans.*, 69 lbs.
138 years of progress ...

3. Reduce $\sqrt{-64w^2}$.
4. Reduce $\sqrt{256a^2x^2}$.
5. Reduce $\sqrt{81n^2m^4}$.

Ex. 4. What are the factors of $a^2 - 2am + m^2$?
Ex. 5. What are the factors of $a^3 - c^3$?
Ex. 6. What are the factors of $x^3 - 2x + 1$?
Ex. 7. What are the factors of $9 - x^3$?
Ex. 8. What are the factors of $a^3 + 2a + 1$?

31. Repeat the rules of arithmetic for this purpose.

Ex. 1. Add $\frac{x}{2}$, $\frac{x}{3}$ and $\frac{x}{5}$.
Ex. 2. Add $\frac{2x}{3}$ and $\frac{x + 2}{2}$.
Ex. 3. Add $\frac{2 - x}{5}$, and $\frac{3x}{2} - \frac{1}{2}$.
Ex. 4. Add $\frac{a + b}{a - b}$ and $\frac{a - b}{a + b}$.
Ex. 5. Add $1 - x^2$ and $1 + x^2$.

TO ADD FRACTIONS.

Sum, $\frac{3 + 3 + x}{3}$

Sum, $\frac{7x + 6}{6}$

Sum, $\frac{13x - 10}{10}$

Sum, $\frac{2a^2 + 2b^2}{a^2 - b^2}$

Sum, $\frac{2 + 2}{1 - x^2}$

WolframAlpha® computational knowledge engine

Enter what you want to calculate or know about:

(2-x)/5+(3x-1)/2

Web Apps  Examples  Random

O’REILLY®
Since 1878 we’ve changed a little…
We live in a different world, but the problems haven’t evolved

112. Television Dimensions
Suppose that your friend buys a television with a 55-inch diagonal.
(a) From this information, can you determine how wide the television screen is?
(b) If the height of this screen is 27 inches, approximate the width of the screen to two decimal places.

Google
55 inch diagonal tv dimensions
how wide is a 60 inch tv
dimensions of a 50 inch tv
55 inch tv dimensions in mm
55 inch tv dimensions in cm
About 2,800,000 results (0.51 seconds)
Data is at our fingertips, we would never calculate this stuff anymore.

34. Laura hiked up Lamb’s Canyon in 2 hr and then ran back down in 1 hr. Her speed running downhill was 2.5 mph greater than her speed hiking uphill. How far up the canyon did she hike? Laura hiked 5 mi up the canyon.
But much of the algebra remains the same.

**Factoring Polynomials**

*Exercises 11-48: Factor the polynomial completely.*

11. $5x^2 - 5x - 30$
12. $3x^2 - 15x + 12$
13. $-4y^2 - 32y - 48$
14. $-7y^2 + 14y + 21$
15. $-20z^2 - 110z - 50$
16. $-12z^2 - 54z + 30$
17. $60 - 64t - 28t^2$
18. $18 - 45t - 27t^2$
19. $r^3 - r$
20. $r^3 + 2r^2 - 3r$
21. $3x^3 + 3x^2 - 18x$
22. $6x^3 - 26x^2 - 20x$
23. $72z^3 + 12z^2 - 24z$
24. $6z^3 - 4z^2 - 42z$
25. $x^4 - 4x^2$
26. $4x^4 - 36x^2$
27. $t^4 + t^3 - 2t^2$
28. $t^4 + 5t^3 - 24t^2$
29. $x^4 - 5x^2 + 6$
30. $x^4 - 3x^2 - 10$
31. $2x^4 + 7x^2 + 3$
32. $3x^4 - 8x^2 + 5$
33. $y^4 + 6y^2 + 9$
34. $y^4 - 10y^2 + 25$
35. $x^4 - 9$
36. $x^4 - 25$

*Exercises 73-86: If possible, solve. Check your answer.*

73. \(\frac{1}{5x} + \frac{3}{5x} = \frac{1}{5}\)
74. \(\frac{1}{x - 1} + \frac{2x}{x - 1} = 1\)
75. \(\frac{1}{x} + \frac{2}{3x} = \frac{1}{3}\)
76. \(\frac{1}{x + 3} + \frac{2}{x + 3} = \frac{3}{2}\)
77. \(\frac{5}{x} - \frac{3}{x + 1} = \frac{1}{2}\)
78. \(\frac{1}{x - 1} - \frac{1}{x + 1} = \frac{1}{4}\)
79. \(\frac{4}{p} - \frac{5}{p + 2} = 0\)
80. \(\frac{1}{x - 3} - \frac{1}{x + 3} = \frac{1}{x^2 - 9}\)
81. \(\frac{1}{x + 1} = \frac{-x}{x + 1}\)
82. \(\frac{2}{x} = \frac{2}{x^2 + x} - 4\)
83. \(\frac{2}{x^2 - 2x} + \frac{1}{x^2 - 4} = \frac{1}{x^2 + 2x}\)
84. \(\frac{3}{x^2 - 3x} - \frac{1}{x^2 - 9} = \frac{1}{x^2 + 3x}\)
85. \(\frac{1}{x^2} - \frac{5}{x^2 + 4x} = \frac{1}{x^2 + 4x}\)
What if we just started over?
What kinds of thinking was a course like algebra meant to foster?

- Problem solving
- Abstract thinking
- Process thinking
- Critical thinking
- Proving things
**ERD Notation**

- Relationships illustrate an association between two tables. In the physical data model, relationships are represented by stylized lines.
- Cardinality and ordinality, respectively, refer to the maximum number of times an instance in one entity can be associated with instances in the related entity, and the minimum number of times an instance in one entity can be associated with an instance in the related entity. Cardinality and ordinality are represented by the styling of a line and its endpoint, as denoted by the chosen notation style.

**ERD – Entity Relationship Diagrams**
CREATE TABLE film (
    film_id SMALLINT UNSIGNED NOT NULL AUTO_INCREMENT,
    title VARCHAR(255) NOT NULL,
    description TEXT DEFAULT NULL, -- Up to 64KB
    release_year YEAR DEFAULT NULL, -- 'yyyy'
    language_id TINYINT UNSIGNED NOT NULL, -- 8-bit unsigned int [0, 255]
    original_language_id TINYINT UNSIGNED DEFAULT NULL,
    rental_duration TINYINT UNSIGNED NOT NULL DEFAULT 3,
    rental_rate DECIMAL(4,2) NOT NULL DEFAULT 4.99,
    length SMALLINT UNSIGNED DEFAULT NULL, -- 16-bit unsigned int [0, 65535]
    replacement_cost DECIMAL(5,2) NOT NULL DEFAULT 19.99, -- [999.99], UNSIGNED??
    rating ENUM('G','PG','PG-13','R','NC-17') DEFAULT 'G',
    special_features SET('Trailers','Commentaries','Deleted Scenes','Behind the Scenes') DEFAULT NULL,
    -- Can take zero or more values from a SET
    -- But only one value from ENUM
)

SELECT IFNULL(SUM(film.rental_rate), 0) INTO v_rentfees
FROM film, inventory, rental
WHERE film.film_id = inventory.film_id
    AND inventory.inventory_id = rental.inventory_id
    AND rental.rental_date <= p_effective_date
    AND rental.customer_id = p_customer_id;
<!DOCTYPE html>
<html>
<body>

<svg height="210" width="500">
  <line x1="0" y1="0" x2="200" y2="200"
stroke="rgb(255,0,0);stroke-width:2" />
  Sorry, your browser does not support inline SVG.
</svg>

</body>
</html>
Excel or Google Spreadsheets

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>10 =AND( A1&gt;0, A1&lt;B1 )</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>10 =AND( A2&gt;0, A2&lt;B2, B2&gt;12 )</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>10 =AND( A3&lt;0, A3&gt;B3, B3&gt;12 )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>10 TRUE</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>10 FALSE</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>10 FALSE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5 =IF( A1&gt;=0, A1, -A1 )</td>
<td>- returns the value 5</td>
</tr>
<tr>
<td>2</td>
<td>-5 =IF( A2&gt;=0, A2, -A2 )</td>
<td>- returns the value 5</td>
</tr>
<tr>
<td>3</td>
<td>0 =IF( ISERROR( 1/A3 ), 1, 1/A3 )</td>
<td>- returns the value 1</td>
</tr>
<tr>
<td>4</td>
<td>test =IF( LEN( A4 )&lt;&gt;0, 1, 0 )</td>
<td>- returns the value 1</td>
</tr>
</tbody>
</table>
Python and r

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
</table>
| `
substr(x, start=n1, stop=n2)` | Extract or replace substrings in a character vector.                      |
| x <- "abcdef"    |                                                                             |
| substr(x, 2, 4) is "bcd" |                                                                             |
| substr(x, 2, 4) <- "22222" is "a222ef" |                                                                             |

```r
print(sample(1:3))
print(sample(1:3, size=3, replace=FALSE))  # same as previous line
print(sample(c(2,5,3), size=4, replace=TRUE))
print(sample(1:2, size=10, prob=c(1,3), replace=TRUE))
```

```
[1] 3 1 2
[1] 2 1 3
[1] 2 5 2 2
[1] 2 2 2 1 1 2 2 2 1 2
```
Decision Trees

Ignite AMATYC

Should I Quit?

- Can't decide whether to leave your job? We can help!
  - Yes: Are you sure?
  - No: Do you have a job offer?
- Do you really want it?
  - Yes: Really want to quit with no job. How? Can help!
  - No: Yes, but I like where I work
- Do you want to apply?
  - Yes: Well, something motivated you to apply
  - No: My boss is a nightmare
- Make lists to see if there are...
  - New opportunities
  - New money!
- New opportunities
- New money!

Should I Take a Nap?

- Did you get a good night's sleep?
  - Yes: BUT...
  - No: Why not?
- The kids are asleep
  - I'm bored
  - I'm still tired
  - I'm ill
  - My child kept me awake
  - I was working late
  - Do you have important things to do?
    - No: I don't feel well
    - Yes: Why are you tired?
      - I DON'T KNOW
        - No: Do you have important things to do?
          - No: Do you have a case of the sniffles?
            - No: Is it cold outside?
              - Yes: Why are you tired?
                - No: I don't feel well
                  - Yes: Why are you tired?
                    - No: I don't feel well
                      - Yes: Why are you tired?
                        - No: I don't feel well
                          - Yes: Why are you tired?
                            - No: I don't feel well
                              - Yes: Why are you tired?
                                - No: I don't feel well
                                  - Yes: Why are you tired?
                                    - No: I don't feel well
                                      - Yes: Why are you tired?
                                        - No: I don't feel well
                                          - Yes: Why are you tired?
                                            - No: I don't feel well
                                              - Yes: Why are you tired?
                                                - No: I don't feel well
                                                  - Yes: Why are you tired?
                                                    - No: I don't feel well
                                                      - Yes: Why are you tired?
                                                        - No: I don't feel well
                                                          - Yes: Why are you tired?
                                                            - No: I don't feel well
                                                              - Yes: Why are you tired?
                                                                - No: I don't feel well
                                                                  - Yes: Why are you tired?
                                                                    - No: I don't feel well
                                                                      - Yes: Why are you tired?
                                                                        - No: I don't feel well
                                                                          - Yes: Why are you tired?
                                                                            - No: I don't feel well
                                                                              - Yes: Why are you tired?
                                                                                - No: I don't feel well
                                                                                  - Yes: Why are you tired?
                                                                                    - No: I don't feel well
                                                                                      - Yes: Why are you tired?
                                                                                        - No: I don't feel well
                                                                                          - Yes: Why are you tired?
                                                                                           - No: I don't feel well
                                                                                             - Yes: Why are you tired?
                                                                                              - No: I don't feel well
                                                                                               - Yes: Why are you tired?
                                                                                                 - No: I don't feel well
                                                                                                   - Yes: Why are you tired?
                                                                                                     - No: I don't feel well
                                                                                                       - Yes: Why are you tired?
                                                                                                         - No: I don't feel well
                                                                                                          - Yes: Why are you tired?
                                                                                                            - No: I don't feel well
                                                                                                             - Yes: Why are you tired?
                                                                                                              - No: I don't feel well
                                                                                                               - Yes: Why are you tired?
                                                                                                                 - No: I don't feel well
                                                                                                                  - Yes: Why are you tired?
                                                                                                                    - No: I don't feel well
                                                                                                                     - Yes: Why are you tired?
                                                                                                                      - No: I don't feel well
                                                                                                                       - Yes: Why are you tired?
                                                                                                                        - No: I don't feel well
                                                                                                                         - Yes: Why are you tired?
                                                                                                                          - No: I don't feel well
                                                                                                                           - Yes: Why are you tired?
                                                                                                                            - No: I don't feel well
                                                                                                                             - Yes: Why are you tired?
                                                                                                                              - No: I don't feel well
                                                                                                                               - Yes: Why are you tired?
                                                                                                                                - No: I don't feel well
                                                                                                                                   - Yes: Why are you tired?
                                                                                                                                    - No: I don't feel well
                                                                                                                                     - Yes: Why are you tired?
                                                                                                                                      - No: I don't feel well
                                                                                                                                       - Yes: Why are you tired?
                                                                                                                                        - No: I don't feel well
                                                                                                                                         - Yes: Why are you tired?
                                                                                                                                          - No: I don't feel well
                                                                                                                                           - Yes: Why are you tired?
                                                                                                                                            - No: I don't feel well
                                                                                                                                             - Yes: Why are you tired?
                                                                                                                                              - No: I don't feel well
                                                                                                                                               - Yes: Why are you tired?
                                                                                                                                                - No: I don't feel well
                                                                                                                                                 - Yes: Why are you tired?
                                                                                                                                                   - No: I don't feel well
                                                                                                                                                    - Yes: Why are you tired?
                                                                                                                                                     - No: I don't feel well
                                                                                                                                                       - Yes: Why are you tired?
                                                                                                                                                         - No: I don't feel well
                                                                                                                                   - Yes, but I can't be bothered
                                                                                                                                         - Yes: I've been at work
                                                                                                                                             - No: Are you sure?
                                                                                                                                                - No: I was lying
                                                                                                                                                    - Yes: Have a nap!
Let’s build Algebra 2.0
(note: not a fully inclusive list, just a start)

- Basic algebraic manipulation
- Linear functions
- Systems of equations
- Exponential functions
- Boolean algebra
- Algorithms
- ER Diagrams
- Database queries
- Business Information Graphs
- Information visualization
Want to stay informed?

busynessgirl.com
tinyletter.com/busynessgirl
twitter: @busynessgirl
facebook.com/ibusynessgirl

Want to help or fund it?
email: busynessgirl@gmail.com
Tech what?
Mathematics for the Technologies
Sounds like a math class you took in high school to get out of taking math class!
Is it real?

Absolutely!

And, it’s tough!
We try to put *everything* in it!
Transferable?

Umm

No

Often not.
Who takes it?

Blue Collar
The company builds cars and destroys men.
Students are often ‘underprepared’ for the course.
They can be a tough audience

Best student in the class!
Text Books ??

inadequate

adjective

lacking the quality or quantity required; insufficient for a purpose
What would we want in them, anyway?
Join the Discussion:

- Do you teach this course or know someone who does?
- What’s important?
- Make a list, send it to me.
Get Industry Involved:

- Ask them what they think is important.
- Include that in the list you send to me.
Push for Employment:

- Wah, wah, wah,
- What can we do to get our students employed?
- Blah, blah, blah!
Get them to learn math!!

How many people do you know who are good at math and unemployed?
Standards now!!

- Consistency.
- Transferability.
- Practicality and respect.
- Better textbooks.
Set a stone in a ‘Pathway.’
Contact me now or later:

- Pick up a questionnaire and business reply envelope.
- Send me an email: padgettr@wccc.edu
See you in...
Shake Up the Curriculum

Tammi Marshall
Chair, Math Department
Cuyamaca College
tammi.marshall@gcccd.edu
High School Math

- PreAlgebra → Algebra 1 → Geometry → Algebra 2
- Algebra 1 → Geometry → Algebra 2 → PreCalculus (or Statistics)
Let’s give them a test...

Choose Correct Answer!

7 + 7 ÷ 7 + 7 x 7 - 7

a: 00  b: 08  c: 50  d: 56
They pass...
They fail...
What do you think?
They don’t completely fail...
Does that make it better?
We could give the students a little credit for past experiences
Is that any better?
Sound familiar?

CA Community College Placement Tests

…with Multiple Measures
Instead…

- Honor students’ past work
- Students are more capable
Change Placement Policies

- High School GPA
- Last math class with a grade of C or better
Eliminate…

- Basic Math
- PreAlgebra
- Beginning Algebra
Research...

- Less than 10% from PreAlgebra make it through a Transfer Level Class
- Even worse for students of color and first generation college students
Co-Requisite Support

- Intermediate Algebra + Support
- Statistics + Support
- College Algebra + Support
- PreCalculus + Support
- Business Calculus + Support

2016
Accelerate Remediation

- CAP – PreStatistics
- Carnegie – Statway
- Carnegie – Quantway
Three High-Leverage Strategies

- Change Placement Policies
- Create Co-Requisite Support Courses
- Accelerate Remediation
Cuyamaca College...

- Math Pathways
- Started fall 2016

2016
Delivering Education’s Promise
Fractal Geometry

Mark.Harbison @ LosRios.edu

Sacramento City College, CA
Amatyc V.P., West Region

2016
Fractal (disambiguation)

From Wikipedia, the free encyclopedia

A fractal is a mathematical set that has a fractal dimension that usually exceeds its topological dimension and may fall between the integers. There is also a fractal derivative, defined in fractal spacetime.

Fractal or Fractals may also refer to:

- Fractal (EP), 2009 album by Swedish metal band Skyfire
- Fractal (video game), 2011 puzzle game by Philadelphia-based studio Cipher Prime
- Fractal art, form of algorithmic art
- Fractal Design, US software company
- Fractals (journal), scientific journal published by World Scientific
- Fractal (Producer), an electronic music music producer.
Fractals (journal): Complex Geometry, Patterns, and Scaling in Nature and Society

www.worldscientific.com/worldscinet/fractals since 1993

Current issue: vol. 24, no. 3 (Sept. 2016)

Peer-reviewed Research Articles

by Seema Satin, A. D. Gangal
by Ning Chen, Yuting Zhang
by Hao Li, Jian Huang
by Juan Deng, Lifeng Xi
by MD Akhtar, M. Prasad
by Sun, Meifeng Dai, Yahoiu

* Multiscale Fractal Characterization of Sandstone
* A Model for Gas Diffusion in Dry Porous Media with Converging-Diverging Capillaries
* Gap Sequence of Graph-Directed Sets
* Box Dimensions of $\alpha$-Fractal Functions
Google Earth fractals? "Statistical self-similarity" is only approximate.

An example of this for a river system is illustrated below, clicking on an image will give the high resolution version of the image without the markings. At each scale the branching structures are similar in appearance.
Scale Invariance: levels of magnification exist where the image is exactly self-similar.
\[ N = r^D \]
## Deterministic fractals ($n = 90$)

<table>
<thead>
<tr>
<th>Hausdorff dimension (exact value)</th>
<th>Hausdorff dimension (approx.)</th>
<th>Name</th>
<th>Illustration</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculated</td>
<td></td>
<td>0.538</td>
<td>Feigenbaum attractor</td>
<td>The Feigenbaum attractor is the set of points generated by successive iterations of the logistic function for the critical parameter value $\lambda_\infty = 3.570$, where the period doubling is infinite. This dimension is the same for any differentiable and unimodal function.</td>
</tr>
<tr>
<td>$\log_3(2)$</td>
<td></td>
<td>0.631</td>
<td>Cantor set</td>
<td>Built by removing the central third at each iteration. Nowhere dense and not a countable set.</td>
</tr>
<tr>
<td>$\log_2(\phi) = ...$</td>
<td></td>
<td>0.694</td>
<td>Asymmetric Cantor set</td>
<td>Built by removing the second quarter at each iteration. Nowhere dense and not a countable set. $\phi = \frac{1 + \sqrt{5}}{2}$ (golden cut).</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>1</td>
<td>Smith–Volterra–Cantor set</td>
<td>Built by removing a central interval of length $2^{-2n}$ of each remaining interval at the $n$th iteration. Nowhere dense but has a Lebesgue measure of $\frac{1}{2}$.</td>
</tr>
<tr>
<td>$2 + \log_2\left(\frac{1}{2}\right) = 1$</td>
<td></td>
<td>1</td>
<td>Takagi or Blancmange curve</td>
<td>Defined on the unit interval by $f(x) = \sum_{n=0}^{\infty} 2^{-n} s(2^n x)$, where $s(x)$ is the sawtooth function.</td>
</tr>
<tr>
<td>Solution $s$ of $2</td>
<td>\alpha</td>
<td>^{3s} +</td>
<td>\alpha</td>
<td>^{4s} = 1$</td>
</tr>
<tr>
<td>Fractal Type</td>
<td>Description</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cauliflower</td>
<td>Every branch carries around 13 branches 3 times smaller.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balls of crumpled paper</td>
<td>When crumpling sheets of different sizes but made of the same type of paper and with the same aspect ratio (for example, different sizes in the ISO 216 A series), then the diameter of the balls so obtained elevated to a non-integer exponent between 2 and 3 will be approximately proportional to the area of the sheets from which the balls have been made. Creases will form at all size scales (see Universality (dynamical systems)).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3D DLA Cluster</td>
<td>In 3 dimensions, clusters formed by diffusion-limited aggregation, have a fractal dimension of around 2.50.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lichtenberg figure</td>
<td>Their appearance and growth appear to be related to the process of diffusion-limited aggregation or DLA.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Instead of plugging in each \( x \) once to get out one \( y = f(x) \), a Dynamic System uses a recursive \textit{feedback loop} at each \( x \).

For example, the point \( c = -1.2 + 0.4i \) on the complex plane gets colored \textbf{green} because \( z_{n+1} = z_n^2 + c \) diverges (\( |z| > 2 \)) after \( n = 7 \) iterations. Repeat for other nearby points to get the Mandelbrot set.
1918 Hausdorff introduces non-integer dimensions for sets.

1918 P. Fatou and G. Julia independently invent Julia Sets.

1930s – 40s P. Lévy teaches self-similarity to B. Mandelbrot at École Polytechnique.
Abstract: … Many geographical curves are statistically "selfsimilar," … The degree of complication can be described by a quantity $D$ that has many properties of a "dimension," though it is fractional; that is, it exceeds the value unity associated with the ordinary, rectifiable, curves.
1975
Mandelbrot publishes the word “Fractal” for the first time.

1977
This is translated into English for the first time.
1983 Mandelbrot expands his previous book and uses a new title.
The Fractal Geometry of Mandelbrot

Anthony Barcellos

The College Mathematics Journal
pp. 98-114
pg. 103 revised in 2011

1987 Pulitzer prize runner-up

2016

O'REILLY
CHAOFS/FRACTALS

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Chaos</th>
<th>Fractals</th>
</tr>
</thead>
<tbody>
<tr>
<td>74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NUMBER OF ARTICLES

2016

re: C. Pickover
As of Oct, 2016, at least two major textbook publishers offer nothing for fractals.
1992 was the peak of fractal popularity.
1992 = SDSU M.A. thesis + 1st C.C. classes taught + Wedding day

Summer 1992

Alfonso Flores June 29, 1992

2016
Mark.Harbison @ LosRios.edu
Sacramento City College, CA
Amatyc V.P., West Region
RSI: What Is It? And Why Does the DOE Care About It?

Fred Feldon
Coastline Community College
42nd AMATYC Annual Conference
November 18, 2016, Denver, CO
One Week of a Student’s Electrodermal Activity (EDA)

Poh, Swenson & Picard, 2010
“Some people talk in their sleep. Lecturers talk while other people sleep.” -- Albert Camus, 1913-1960

“There must be far less telling on the part of the teacher, and far more doing on the part of the student.”

-- Jean Piaget, 1896-1980
Instead of giving the answer ...

ask a question!
What a Student Who Resisted Learned:

“Not only *can* you learn on your own, you already *do* learn on your own and you will continue to learn on your own for your whole life!”

Professors Nancy Lape, Karl Haushalter, Rachel Levy and Darryl Yong received an NSF grant to study the effects of the flipped classroom on students’ learning... Results suggest the benefits of flipping a classroom are dubious.

“If you’re not a good instructor, flipping the classroom won’t really ensure better learning. If you aren’t doing something to fill the space, it won’t do you any good.”

Another Caveat...

Modern ‘reform’ is taking place at the wrong end... They put the cart before the horse, lipstick on the pig. Group work! Technology! Inquiry learning! Flipped classroom!

We need to reform mathematical substance, not pedagogy... The question isn’t, “How can we make students understand Concept X?” We must ask, “Should we even teach Concept X in the first place? If so, why?”

Viktor Blåsjö
@viktorblasjo

Historian of mathematics, radical calculus textbook author, mathematical agent infiltrating history and philosophy of science.

“Manifesto on the Teaching of Mathematics”
www.intellectualmathematics.com
What About Online Classes?
The DOE Is Looking for...

RSI

Instructor-initiated, Regular and Substantive Interaction!

Or they want their money back!

2016
**U.S. Department of Education** Code of Federal Regulations, Title 34, Subpart A, Paragraph 602.3 establishes that correspondence courses do not qualify for Title IV federal financial aid, and that Distance Education is distinct from Correspondence Education (2015, p.12).

Similar stipulations exist in the **California Department of Education** California Community Colleges Distance Education California Code of Regulations; and in the **Accrediting Commission for Community and Junior Colleges** (ACCJC) Guide to Evaluating Distance Education and Correspondence Education.
**Define Regular:** Instructors shall interact weekly with online students for a duration equivalent to onsite classes. Interaction and feedback will be personal (as opposed to computer-generated).

**Define Substantive:** Feedback is academic rather than administrative. Instructors shall initiate scholarly dialogue and require student-to-student and student-to-teacher interactions.

**Define Interaction:** Dynamic synchronous or asynchronous academic, timely and reactive announcements; chat rooms with instructor participation; discussion board; e-mails; messaging; phone calls; review sessions; rubrics; social networking; video conferences; webcats; webinars; podcasts; etc.
**Define Non-Interactive:** Announcements, e-mails, messages, etc. that are administrative; course orientations; discussion board messages with non-academic or administrative content such as generic praise or clarification of class policies; Internet resources, links to external sites; computer or publisher-generated or pre-loaded content; webcasts, webinars, podcasts or other audio-video material that are generic, impersonal, passive or non-timely.
How Do You Get It??

- Non-routine problems
- Current events
- Comics, cartoons, movies & videos
- “Hot Tips” for the exams
- Extra Credit
- Group Projects
- Funnel phone calls, e-mails, and *ALL* student questions and concerns to a Discussion Forum
- Require participation as part of their grade
- Model the behavior you are trying to get them to emulate
How Do You Get It??

Thank you to everyone contributing to this...I looked everywhere in the book and watched lectures without much luck, but you all explained everything so clearly as if in a real classroom discussion, this is a big help thanks.

---

Wow! Thank you, Dominic. That is an awesome comment. That’s my goal, as an online instructor, to replicate online the kind of discussion that normally takes place in the classroom. You made my day! -- Fred Feldon
Sources for Non-Routine Problems That Stimulate Discussion

Books
Math Contests Grades 4-6, by Conrad & Flegler, Math League Press
Math Contests Grades 7-8 and Algebra, by Conrad & Flegler, Math League Press
Math Contests High School, by Conrad & Flegler, Math League Press
Principles to Actions: Ensuring Mathematical Success for All, NCTM
The Scientific American Book of Mathematical Puzzles and Diversions, by Martin Gardner,
Empowering Students by Promoting Active Learning in Mathematics, NCTM
What Students Abroad Are Expected To Know About Mathematics: Exams from France, Germany and Japan
Challenging Math Problems, by Terry Stickels (or any of his other books)

Websites
http://mathforum.org/problems_puzzles_landing.html
http://cemc.uwaterloo.ca/resources/potw.php
https://www.mathcounts.org/resources/problem-of-the-week
https://www.math.purdue.edu/pow
http://orion.math.iastate.edu/ehjohnst/PoW/PoW.html
https://www.youtube.com/channel/UC1_uAlS3r8Vu6JjXWvastJg (Mathologer)

Journals
Journal for Research in Mathematics Education, NCTM
Mathematics Teacher, Monthly Calendar Problems, NCTM
Mathematics Teaching in the Middle School, Monthly Palette of Problems, NCTM
Stop wasting time doing things that a computer (or robot) can do better.

-- Maria Andersen, busynessgirl.com
Illustrations by Mat Moore

Good Teachers = Good Coaches!

Communicating
Questioning
Challenging
Accountability
Encouraging
Showing new perspectives
Monitoring
Thank You

ffeldon@coastline.edu

This presentation is available at
http://www.slideshare.net/ffeldon
Open SOURCE textbooks

Mathbook XML and improving the quality of textbooks

Bruce Yoshiwara (retired!)
AIM Open Textbook Initiative

The American Institute of Mathematics (AIM) seeks to encourage the adoption of open source and open access mathematics textbooks…The Editorial Board maintains a list of Approved Textbooks…

http://aimath.org/textbooks
You can be more than a consumer!

- AIM encourages authors to provide not only pdf documents, but also a mechanism for improving the book.
- If authors provide the source files from which the pdf documents are produced, the academic community can directly adapt and improve the textbooks.
Mathbook XML, a.k.a. MBX

- Rob Beezer (U. Puget Sound) has developed (and continues to develop) authoring tools for creating textbooks, specifically open math textbooks.
- These tools can convert your (properly marked-up) source files into pdf’s (via LaTeX), with textbook publisher quality output...
Mathbook XML

- …but MBX can also convert your text into html documents (or even ePUB documents) so that you and your students can view the content on mobile devices.
- The MBX team designs their tools to help authors attend to accessibility issues.
- MathJax displays the math notation…
...and MBX can automatically create bells and whistles such as

- TOC with hyperlinks
- Index with hyperlinks
- A collection of “Answers to selected exercises” in the appendix
- Hints, solutions, etc., hidden in “knowls”
A *knowl* is a link that reveals, by creating space around it, information the author wants easily available but does not want to be initially cluttering the screen.

Possible uses: Hints, solutions, definitions, proofs, ...
Knowls appear in place
Knowls appear in place
Textbook adjusts to display width
You may have heard that mathematics is the language of science. In fact, professionals in nearly every discipline take advantage of mathematical methods to analyze data, identify trends, and predict the effects of change. This process is called mathematical modeling. A model is a simplified representation of reality that helps us understand a process or phenomenon. Because it is a simplification, a model can
You may have heard that mathematics is the language of science. In fact, professionals in nearly every discipline take advantage of mathematical methods to analyze data, identify trends, and predict the effects of change. This process is called *mathematical modeling*. A model is a simplified representation of reality that helps us understand a process or phenomenon. Because it is a simplification, a model can
Undergraduate Teaching in Mathematics with Open Source Software and Textbooks (UTMOST)

The NSF grant-supported UTMOST project supports the Sage Cell server, SageMathCloud, MathBook XML, and AIM Open Textbook Initiative.
Sage cell server
https://cloud.sagemath.com/

Tools for Teaching
Create projects for your students, hand out assignments, then collect and grade them with ease.

Collaboration Made Easy
Edit documents with multiple team members in real time.

All-in-one Programming
Write, compile and run code in nearly any programming language.

Computational Mathematics
Use SageMath, IPython, the entire scientific Python stack, R, Julia, GAP, Octave and much more.

$\chi^2$
LaTeX Editor
Write beautiful documents using LaTeX.

Interactive Worksheets
Course Management
If you have ever owned a drone, you sympathize with this guy. Way funnier than a cat video.

Figure 15.3. First Drone Flight (1:28)
What do you need?

- A computer with internet access
- Time and willingness to learn
What will you use?

- A (plain) text editor to format content
- A command line interface to convert your document into html and/or pdf
- Mathbook XML support
  [Link](https://groups.google.com/forum/#!forum/mathbook-xml-support)
- GitHub to refresh your version of MBX and possibly to collaborate on your textbook

Mathbook XML (a.k.a. MBX) [http://mathbook.pugetsound.edu/](http://mathbook.pugetsound.edu/)

Undergraduate Teaching in Mathematics with Open Source Software and Textbooks (UTMOST) [http://utmost.aimath.org/](http://utmost.aimath.org/)

January 2017 Joint Math Meetings (Atlanta): OER sessions, MBX workshop, Electronic poster session
Thank you!

Bruce Yoshiwara

yoshiwbw@faculty.laccd.edu
Pie vs. Pi
Helping Students Visualize Radians

- Anne Praderas Vance
- Austin Community College
- anne.vance@austincc.edu
I hate it when students...

- ...convert everything into degrees, ‘cuz
  "I get 150º, but $\frac{5}{6}$ is just WEIRD."

- ...have no idea where radian angles terminate:
Like fingernails on a chalkboard

Test grade = 58
Motivation

Ahh, RADIANS! Students...

...can’t see ‘em.

...can’t draw ‘em.

...can’t think ‘em.

Students need a new way to visualize fractions, and thus, understand radians.
What is a radian, anyway?

An angle with its vertex at the center of a circle that intercepts an arc on the circle equal in length to the radius of the circle has a measure of 1 radian.
Let’s play “The Slice Is Right”

When will $m_{\widehat{AB}} = 5$ cm (the radius)?

- $m_{\angle APB} = 0.025$ radians
- $m_{\widehat{AB}}$ on $c_1 = 0.025$ radians

Radius = 5.00 cm

Length $\widehat{AB} = 0.12$ cm
Keep going…

…and going…

…and going…
Ding!

$m_{\angle APB} = 1.000$ radians

$m_{\hat{AB}} \text{ on } c_1 = 1.000$ radians

Radius = 5.00 cm

Length $\hat{AB} = 5.00$ cm
How many radians fill the circle?

$\pi$ radians $= 180^\circ$

$2\pi$ radians $= 360^\circ$
Snowboarders could use radians!

- **Triple Misty:** $1080^\circ 1620^\circ$ means $6\pi$ rotations going up, $9\pi$ rotations to the left

- **Nose Picker:** $1080^\circ 900^\circ$ means $6\pi$ rotations going up, $5\pi$ rotations to the left
Just like (someone else's) Mom used to make

1 Whole Pie:

½ of a pie

¼ of a pie
I like pi

1 Whole Pie

½ of a pie vs. ½ of a pi
More ways to slice our pi

= one-fourth of a $\pi = \frac{1}{4} = \frac{\pi}{4}$ radians

= one-third of a $\pi = \frac{1}{3} = \frac{\pi}{3}$ radians

= one-sixth of a $\pi = \frac{1}{6} = \frac{\pi}{6}$ radians
Counting slices of pi

\[
\begin{align*}
\frac{3}{4} \pi & = 2/4 = 1/2 \pi \\
\frac{1}{4} \pi & = 1/4 pi \\
\frac{4}{4} = 1 \pi & = 4/4 \\
\end{align*}
\]
$3/3 = 1 \pi$

$2/3 \pi$

$1/3 \pi$

$5/6 \pi$

$4/6 = 2/3 \pi$

$3/6 = 1/2 \pi$

$2/6 = 1/3 \pi$

$1/6 \pi$

$6/6 = 1 \pi$

Start Here
Halve you third the latest?

2/2 = 1 pi

3/2 = 1 pi

2/3 pi

1/3 pi

3/3 = 1 pi

4/3 pi

5/3 pi

Start Here

2016
Don’t fourth me to be sixth
Now trig will be easy!

(Assuming students already know about trig ratios & the unit circle)

Find \( \sin \frac{5}{6} \)

Start Here

\[
\begin{align*}
5/6 \pi & \quad 4/6 \pi & \quad 3/6 \pi \\
5/6 \pi & \quad 2/6 \pi & \quad 1/6 \pi
\end{align*}
\]
\[ \sin \frac{5}{6} = \frac{1}{2} \]

Remember from Geometry:

\[ \frac{1}{2}, \frac{\sqrt{3}}{2} \]
Thank you!

Anne Vance
Austin Community College, Highland Campus
512-223-7430
anne.vance@austincc.edu
Visualizing Algebra

by Dr. Natalya Vinogradova

nvinogradova@plymouth.edu
What does the word *algebra* mean?

**al·ge·bra**

Noun: *algebra*

the part of mathematics in which letters and other general symbols are used to represent numbers and quantities in formulae and equations
Is it really all about symbols?

Then Algebra is a mystery cult, where strange symbols are used by those few who belong.

Others are destined to be left forever oblivious of the meaning of those symbols.
What is the meaning of the symbol $x^2$?

Is this $x \cdot x$?

Is this a number multiplied by itself?

Is this the area of a square whose side has length $x$?
Which meaning is more helpful for a learner?

All of them!

To explain any mathematical concept we should combine numbers, words, illustrations, and symbols.
Unfortunately very little attention is given to geometric representations of algebraic formulas in modern algebra textbooks.

Next few slides will ask you to “read pictures” in words and in symbols.
What do you see?

A square with a side \((x + 1)\) or four rectangles

\[(x + 1)^2 = x^2 + 2x + 1\]
What is emphasized by this shading?

The distributive property of multiplication over addition

\[(x + 1)^2 = x \cdot (x + 1) + 1 \cdot (x + 1)\]
What if the same parts are rearranged?

Consider a rectangle that encloses all these parts

\[(x + 1)^2 = x \cdot (x + 3) - 1 \cdot (x - 1)\]
Here is a different arrangement.

What is the area of the large rectangle?

\[ x \cdot 2x \quad \text{or} \quad 2x^2 \]

\[ (x + 1)^2 = 2x^2 - x \cdot (x - 2) + 1 \]
Can you see the difference of two consecutive squares?

\[(x + 1)^2 - x^2 = x + (x + 1) = 2x + 1\]

Does this mean that any odd number is the difference of two consecutive square numbers?

So which two consecutive square numbers have the difference of 27?
These and other ideas on how to make sense of algebraic formulas using illustrations, words and numbers are presented in my book *Make Friends with Algebra One Picture at a Time*. 
Combinations & Permutations: Order Matters, Doesn’t Matter

- Presented by: Wendy Pogoda
- Hillsborough Community College
  wpogoda@hccfl.edu
Typical Combination and Permutation Questions

How many ways can five students be selected out of a class of 20?

How many ways can eight friends sit at a bar with four chairs?

How many ways can 15 make a committee of 10, with one secretary & two co-chairs?
Traditional Method to Solve:

Does Order Matter?
- Yes: Permutations
- No: Combinations
Now We Ask Our Students to Solve a Problem…

Do we use combinations or permutations?

Combinations!

Permutations!
Problem: How many ways can we knock down 8 pins?

- It’s combinations – order does NOT matter.
It’s not our teaching!

- “Order mattering” is confusing!
- Students will ultimately look for key words
  - Sample -> Combinations
  - Racing -> Permutations
  - Committee -> Combinations
Key words are misleading!

How many ways can 20 racers place if:

- Top 3 get gold, silver, and bronze?
  - \( \binom{20}{3} \)

- Top 3 get blue ribbons, everyone else gets participation ribbons?
  - \( \binom{20}{3} \)

- Top 3 get gold, silver, and bronze, next 10 get You Rock! ribbons, everyone else gets Fabulous Effort! ribbons?
  - \( \binom{20}{13} \times \binom{13}{3} \times \binom{10}{3} \)
Number of Distinguishable Permutations

\[ \frac{n!}{n_1!n_2!n_3!...n_k!}, \text{ where } \sum_i^k n_i = n \]

Typically used to rearrange letters of words like MISSISSIPPI

<table>
<thead>
<tr>
<th>Letter</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>1</td>
</tr>
<tr>
<td>I</td>
<td>4</td>
</tr>
<tr>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>P</td>
<td>2</td>
</tr>
</tbody>
</table>

\[ \frac{11!}{1! 4! 4! 2!} = 34,650 \]
Case 1: Combinations

How many ways can 20 racers place if top 3 get blue ribbons?
Make it a Word!

- Line up the 20 racers.
- Assign each a letter representing a prize.
  
  B B B L L L L L L L L L L L L L L L L L L

- How many ways can we rearrange these letters?
Rearrange the letters

- B B B L L L L L L L L L L L L L L L

- How many ways can we rearrange these letters?

<table>
<thead>
<tr>
<th>Letter</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>3</td>
</tr>
<tr>
<td>L</td>
<td>17</td>
</tr>
</tbody>
</table>

\[
\frac{20!}{3! \cdot 17!} = \binom{20}{3} = 1,140
\]
Case 2: Permutations

How many ways can 20 racers place if top 3 get gold, silver, and bronze metals?

G S B L L L L L L L L L L L L L L L L L L L L L L L L L L L L L L
Rearrange the letters

G S B L L L L L L L L L L L L L L L L L L

How many ways can we rearrange these letters?

<table>
<thead>
<tr>
<th>Letter</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>1</td>
</tr>
<tr>
<td>S</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
</tr>
<tr>
<td>L</td>
<td>17</td>
</tr>
</tbody>
</table>

\[
\frac{20!}{1! 1! 1! 1! 17!} = 20P_3 = 6,840
\]
Case 3: Mixture

- How many ways can 20 racers place if top 3 get gold, silver, and bronze, next 10 get You Rock! ribbons, everyone else gets Fabulous Effort! ribbons?

G S B R R R R R R R R R R R F F F F F F F F F
Rearrange the letters!

- G S B R R R R R R R F F F F F F F F

- How many ways can we rearrange these letters?

\[
\frac{20!}{1! \cdot 1! \cdot 1! \cdot 10! \cdot 7!} = 133,024,320
\]

Instead of

\[
\binom{20}{13} \cdot \binom{13}{3} \cdot \binom{3}{3} P_3
\]

\[
\frac{20!}{13! \cdot 3! \cdot 0!} = \frac{7!}{13!} \cdot \frac{10!}{3!} \cdot \frac{3!}{0!}
\]
Harder Question

- You have 20 employees.
- 13 will work on Christmas Eve, but 4 of those will only work a half-day and 2 will only work to stock in the morning.
- Of the remaining employees, 3 will have to work the evening of Thanksgiving. How many ways can this be done?

<table>
<thead>
<tr>
<th>Holiday Assignment</th>
<th>Symbol</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Christmas Eve All Day</td>
<td>C</td>
<td>13 - 6 = 7</td>
</tr>
<tr>
<td>Christmas Eve Half Day</td>
<td>H</td>
<td>4</td>
</tr>
<tr>
<td>Christmas Eve Stock Shelves</td>
<td>S</td>
<td>2</td>
</tr>
<tr>
<td>Thanksgiving</td>
<td>T</td>
<td>3</td>
</tr>
<tr>
<td>No Assignment (Lucky!)</td>
<td>L</td>
<td>20 – 16 = 4</td>
</tr>
</tbody>
</table>
Harder Question (cont.)

Done with distinguishable permutations:

\[
\frac{20!}{7! \cdot 4! \cdot 2! \cdot 3! \cdot 4!} = 69,837,768,000
\]

Done with combinations:

\[
\binom{20}{16} \times \binom{16}{13} \times \binom{13}{6} \times \binom{6}{2} = \frac{20!}{4! \cdot 16!} \cdot \frac{16!}{3! \cdot 13!} \cdot \frac{13!}{13! \cdot 6!} \cdot \frac{6!}{4! \cdot 2!}
\]
Benefits

• One formula explain them all!
• Built in self-check
• Illustrates why $0! = 1$
• Illustrates why $\binom{n}{r} = \binom{n}{n-r}$
• Facilitates the memorization of $\binom{n}{r}$ and $\binom{n}{r}$ formula.
Suggested Strategy

Fundamental Counting Principle

n!

# of Distinguishable Permutations

nCr

nPr
Thank you!

Contact Info:
Wendy Pogoda
wpogoda@hccfl.edu
Storyboarding for Dummies

- Anne Magnuson
- Wake Technical Community College, Raleigh NC
Why am I Storyboarding?

- First Step in Creating instructional videos
- Pre Calculus Redesign Grant
  - Repository of Videos available to ALL students in these courses
- Consult with Instructional designer, Jennifer Stanigar, Ph.D.
**What is Storyboarding?**

<table>
<thead>
<tr>
<th>Audio Narration</th>
<th>Video/Screen/Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>&lt;Music Plays in&gt;</em></td>
<td>![Image]</td>
</tr>
<tr>
<td><em>Narration for Slide 1</em></td>
<td>![Image]</td>
</tr>
<tr>
<td><em>Narration for Slide 2</em></td>
<td>![Image]</td>
</tr>
<tr>
<td><em>Narration for Slide 3</em></td>
<td>![Image]</td>
</tr>
<tr>
<td><em>Narration for Last Slide</em></td>
<td>![Image]</td>
</tr>
<tr>
<td><em>&lt;Music Plays Out&gt;</em></td>
<td>![Image]</td>
</tr>
</tbody>
</table>

- Sketch of how visual elements are displayed in sequence along with narration in an instructional video
- Used power points for existing lectures in storyboard and added narrative script
My First Storyboard

- Narration in left column
- Corresponding slide in right column
- Used to create voice over and transcript for the video
- Jennifer advanced the corresponding slides in right column and recorded my narration…

<table>
<thead>
<tr>
<th>Audio Narration</th>
<th>Video/Screens/Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcome to Wake Tech Pre-Calculus Algebra.</td>
<td></td>
</tr>
<tr>
<td>Hello, I'm Anne Magnuson and this is MAT 171, Module 2 Lesson 1.</td>
<td>MAT 171 Module 1</td>
</tr>
<tr>
<td>In this video you will learn how to find the unknown value given an input or an output from a given function that is described symbolically. We have seen the terms “symbolic function”, “input to a function” and “output from a function” in Module 1, Lesson 1. Basically, a symbolically defined function is a formula, as opposed to a graph or a description in words. The input is the variable or value that the formula acts on and the output is what the formula returns. In this lesson, we will review how to evaluate a symbolic function to get an output value given an input value and we will see how we find the input value given an output value by solving the equation $y = f(x)$. You have seen how to get these values from a graph of a function in Module 1.</td>
<td></td>
</tr>
</tbody>
</table>
Hello, I’m Anne Magnuson..

MAT 171 Redesign
(Module 2 Lesson 1)

Given a function described symbolically, find the unknown value given an input or an output.
Hello, I’m Dr. Sheldon Cooper...
Jennifer’s Guidelines for Narration

- “Using voice to project enthusiasm”
- “Practice narration and then listen to self-evaluate”
- “Appropriate use of pauses for learning to think about questions”

Twinning sign at Dull village, Perth and Kinross, Scotland by Peter Mercator licensed under CC by 3.0
Jennifer's Guidelines for Content

- Driven by Learning objective
- “If wording needs further explanation, restate it in other words”
The Learning Objective

In this video you will learn how to find the unknown value given an input or an output from a given function that is described symbolically.

Anne Magnuson
In other words…

In this video you will learn how to find the unknown value given an input or an output from a given function that is described symbolically.

In other words, you will learn how to evaluate (“plug a value in to”) a function or solve a given equation for the independent variable.

Anne Magnuson
Jennifer's Guidelines for Content

- “Recall student's prior knowledge before introducing new content”
- Tricky for Just-in-time videos
Recall Prior Knowledge

Vocabulary

Symbolic function – A way to define a function using symbols or variables. For example, \( f(x) = x^2 \)

**Input** – the argument to a function “\( x \)” in \( f(x) = x^2 \) or “\( 2 \)” in \( f(2) = 2^2 = 4 \).

**Output** – What a function returns. “\( f \) of \( x \)” in \( f(x) = x^2 \) or “\( 4 \)” in \( f(2) = 2^2 = 4 \).

Anne Magnuson
Visual Representation of Symbolic Function

\[ f(x) = x^2 \]

Input

\[ x = 2 \]
\[ x = 3 \]
\[ x = 4 \]

Output

\[ f(2) = 4 \]
\[ f(3) = 9 \]
\[ f(4) = 16 \]
Jennifer's Guidelines for Content

- Provide 2 or 3 examples step by step, and describe what you want to appear on the screen under the "Video/Screen/Actions" column
Here we have the familiar formula for the area of a circle of radius \( r \). Since the area of a circle changes as we change the radius, we define the area function, \( A(r) \). \( r \) is the input and the area of a circle at any value of \( r \) is the output. When \( r=2 \), the area of the circle is \( A(2) \) or \( 4\pi \).
Finding output...what is missing?

Area of a Circle

What is $A(2)$? $x = 2$ is the input. What is the output?

$$A(2) = \pi 2^2 = 4\pi$$

Anne Magnuson
Visuals were missing, but...

**Area of a Circle**

What is $A(2)$?

$r = 2$ is the input.

The output is $A(2) = \pi \times 2^2 = 4\pi \approx 12.57$ sq units

![Circle of radius 2 has area 12.57 sq units](image1)

**Area of a Circle**

What is $A(3)$?

$r = 3$ is the input.

The output is $A(3) = \pi \times 3^2 = 9\pi \approx 28.2$ sq units

![Circle of radius 3 has area 28.2 square units](image2)
Also added the graph of the area function, $A(r)$.
Area of a Circle

What is \( r \) when \( A = 9\pi \)?

\[ 9\pi = \pi r^2 \]
\[ 9 = r^2 \]
\[ r = \pm 3 \]

Since the radius is a distance, it must be positive

\[ r = 3 \]

Anne Magnuson
Cheatin’ Ain’t Cheap

Scott.McClendon@kctcs.edu
Somerset Community College
Somerset KY
YouTube Channel: mcclendonmath
Here our online class taking experts are taking classes online and getting straight A's for students like you all day, every day.

We have helped many students who were in the exact same situation you are in now, needing someone to be there for you. Be it writing your essay, taking your online class, taking your online test, doing your MyMathLab quizzes, online class discussion boards or helping you with an assignment you can count on NoNeedToStudy's expertly trained academic assistants.

Chat Up A Genius + One to help with online courses? - NoNeedToStudy.Com

Having your essays, research papers and book reports written without you ever having to actually lift a
Here our online class taking experts are taking classes online and getting straight A's for students like you all day, every day.

We have helped many students who were in the exact same situation you are in now: needing someone to be there for you. Be it writing your essay, taking your online class, taking your online test, doing your MyMathLab quizzes, online class discussion boards or helping you with an assignment you can count on NoNeedToStudy's expertly trained academic assistants.
Thanks for your request. How can we help out with your college algebra course?

I have college algebra in the spring. I already failed it once and I’m hopeless. How much would it cost for you guys to take it for me? It's on mylabsplus and all the work is online. Except for the final. It's proctored.

Hi Scott, No problem. Do you have the syllabus?
Thanks for your request. How can we help out with your college algebra course?

I have college algebra in the spring. I already failed it once and I’m hopeless. How much would it cost for you guys to take it for me? It's on mylabsplus and all the work is online. Except for the final. It's proctored.

Hi Scott, No problem. Do you have the syllabus?
Here’s the syllabus. What do you think? There’s a proctored final. How much for an A?!

How many weeks are left in the course? What assignments remain? What is your current grade?

Oh no. I gave up and dropped it. I plan to retake it with the same instructor in the spring.
Here’s the syllabus. What do you think? There’s a proctored final. How much for an A?! 

How many weeks are left in the course? What assignments remain? What is your current grade? 

Oh no. I gave up and dropped it. I plan to retake it with the same instructor in the spring.
I would have to see a course syllabus to give you a definitive price, but the price would be around $699. For an algebra course, we guarantee an A average on all work completed by the tutor.

The class has a proctored final but you take it on a computer. Can the tutor still take that too?
I would have to see a course syllabus to give you a definitive price, but the price would be around $699. For an algebra course, we guarantee an A average on all work completed by the tutor.

The class has a proctored final but you take it on a computer. Can the tutor still take that too?
Is it done through proctor u?

Maybe. It's in MyMathLab. I've never took it.

We can definitely help out with the proctored final, we have a work around that is very successful.
Previously...

We guarantee that it will work or your money back as long as it's done through proctoru.com

I checked with the teacher and they do not use proctoru. They said I will need to schedule a time at the assessment center on campus. I have to take an id.
Previously...

We guarantee that it will work or your money back as long as it's done through proctoru.com

I checked with the teacher and they do not use proctoru. They said I will need to schedule a time at the assessment center on campus. I have to take an id.
Can you find out more about the software they are going to use, if any to prevent cheating? We've had success in testing centers but if it is a one on one thing with you and a proctor, it might be an issue.
We can try to make it happen but in this case there is no guarantee for success.

I know they use something called a lockdown browser. A friend told me that it’s basically a small computer lab they don’t let you bring much in so it isn’t really one on one.
lore & tutoring

search titles only
has image
posted today
reset
search

algebra

list thumb gallery map

- Feb 26 洛Exhausted*with*Accounting?*Disturbed*with*Algebra?* 洛 - (other other other)
- Feb 8 $$$ MATH mathematics Tutor tutoring GED, ALGEBRA, geometry, & MORE - (LEXINGTON, KENTUCKY, KY)
- Jan 26 Statistics, Algebra and Calculus Tutoring - (lexington ky) pic map
- Feb 26 ?Performing*poorly**in*online**exams??We*can**help*a**lot...??♀ - (♀♀ easy♀♀)
- Feb 25 专题Confidential solutions to online Math, Statistics available专题 - (●CALCULUS●)
- Feb 25 专题Boost Your Math Grade专题 - (●CALCULUS●)
- Feb 19 Experienced Math tutor - (Lexington, KY) pic
- Feb 16 math accounting class - (lexington) map
- Feb 16 Your Hunt for the Finest help is Over Here - (lexington) map
- Feb 16 help-in_online_math-and-statistics-class - (lexington) map
**NEED A ALGEBRA 2 / MATH WIZ ASAP WILL PAY NICELY** - $100200 (greenville sc)

Need an algebra 2 math pro by the end of February very urgent will pay very generously...
- do NOT contact me with unsolicited services or offers

**ARE U GOOD AT COLLEGE ALGEBRA?? HELP** - $400 (lexington ky)

Need help with online math class its college algebra. If your good at this or a math person please get in touch we can work a sweet deal.I'll pay you good.

**Help Take My Online Class - Accounting, Finance (California)**

Will pay someone to take my online classes
- Accounting 2
- Business Finance

These classes are required for me to advance in my career at my company. I'd like the assistance of someone to help me take the class online. We can negotiate a fair payment via PayPal.
NEED A ALGEBRA 2 / MATH WIZ ASAP WILL PAY NICELY - $100200 (greenville sc)

Need an algebra 2 math pro by the end of February very urgent will pay very generously…
- do NOT contact me with unsolicited services or offers

ARE U GOOD AT COLLEGE ALGEBRA?? HELP - $400 (lexington ky)

Need help with online math class its college algebra. If your good at this or a math person please get in touch we can work a sweet deal. Ill pay you good.

Help Take My Online Class - Accounting, Finance (California)

Will pay someone to take my online classes
- Accounting 2
- Business Finance

These classes are required for me to advance in my career at my company. I'd like the assistance of someone to help me take the class online. We can negotiate a fair payment via PayPal.
Cheatin’ Ain’t Cheap

- Scott.McClendon@kctcs.edu
- Youtube Channel: mcclendonmath
- Somerset Community College
- Somerset KY
The End...
Thanks to Everyone!

Ignite
AMATYC

enlighten us, but make it quick