Maths for Funsies (and Learning)

Axel Brandt

NORTHERN KENTUCKY UNIVERSITY

KYMAA Section Meeting
March 29, 2019

When did you know you liked maths/stats?

When did you know you liked maths/stats?

Why did you?

Number Babble

Reciting π

Number Babble

Reciting π Alternatives

2-digit Cubed

Number Babble

Reciting π Alternatives

2-digit Cubed

3-digit Remainder

Number Babble

Reciting π Alternatives

2-digit Cubed

3-digit Remainder

9th Digit

Number Babble

Reciting π Alternatives

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9th Digit

Barcode Scanner

Number Babble

Reciting π Alternatives

2-digit Cubed

3-digit Remainder

9th Digit

Barcode Scanner

The Maths

Prime Factorization of 1001

Distributive Property

Modular Arithmetic

Number Babble

Card 4	Card 3	Card 2	Card 1	Card 0
16 17 18 19	8 9 10 11	4 5 6 7	2 3 6 7	1 3 5 7
20 21 22 23	12 13 14 15	12 13 14 15	10 11 14 15	9 11 13 15
24 25 26 27	24 25 26 27	20 21 22 23	18 19 22 23	17 19 21 23
28 29 30 31	28 29 30 31	28 29 30 31	26 27 30 31	25 27 29 31

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16 17 18 19	8 9 10 11	4 5 6 7	2 3 6 7	1 3 5 7
20 21 22 23	12 13 14 15	12 13 14 15	10 11 14 15	9 11 13 15
24 25 26 27	24 25 26 27	20 21 22 23	18 19 22 23	17 19 21 23
28 29 30 31	28 29 30 31	28 29 30 31	26 27 30 31	25 27 29 31

The Maths

Binary Number System

Maths Mentality

OECD Program for International Student Assessment[1]

U.S. Department of Education[2]

[1] PISA 2012 Results: Ready to Learn (Volume III): Students' Engagement, Drive and Self-Beliefs. Mathematics Self-Beliefs and Participation in Mathematics-Related Activities. OECD publishing. DOI: 10.1787/9789264201170-8-en

[2] U.S. Department of Education. Science, Technology, Engineering and Math: Education for Global Leadership. https://www.ed.gov/stem (Accessed 5/16/2018)

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??   % of who major in STEM and eventually choose STEM career

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50% of who major in STEM and eventually choose STEM career

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Mathematics for Human Flourishing
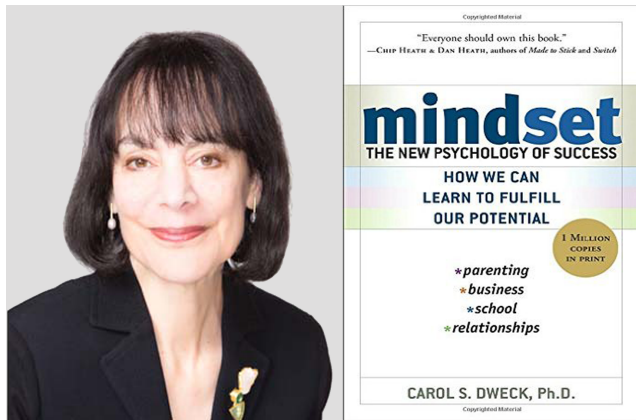
Francis Su

Harvey Mudd College

Former President of MAA

How to achieve human flourishing?

1. Play
   - ▶ Hopefulness
   - ▶ Community
   - ▶ Perseverance
2. Beauty
3. Truth
4. Justice
5. Love

Growth Mindset

Boaler, J. (2013). Ability and Mathematics: the mindset revolution that is reshaping education. *FORUM*, 55, 1, 143-152.

Classroom Activities

Surface Area, Volume, and Mammalian Heart Rates

measure body parts in inches

calculate $120 \times \dfrac{SA}{V}$

compare to resting heart rate

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The Maths

Mathematical Modeling

Classroom Activities

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The Maths

Mathematical Modeling

CCSS.MATH.CONTENT.7.G.B.6

CCSS.MATH.CONTENT.8.G.C.9

CCSS.MATH.CONTENT.HSG.MG.A.1

Classroom Activities

Will the Zombie Virus Get You?

simulate spread of zombie outbreak via linear, exponential, and dice roll models

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The Maths

Mathematical Modeling

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CCSS.MATH.CONTENT.6.EE.C.9

CCSS.MATH.CONTENT.HSA.CED.A.1

CCSS.MATH.CONTENT.HSF.LE.B.5

Classroom Activities

Greedy Pig

dice roll game played in rounds

while standing up, accumulate points unless `bad' number rolled

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The Maths

Game Theory

CCSS.MATH.CONTENT.7.SP.C.5

CCSS.MATH.CONTENT.7.SP.C.7

Classroom Activities

Combinatorial Games

Subtraction Game

Two players alternate turns subtracting 1, 2, or 3.

Leaving 0 $\Rightarrow$ Winner!

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Leaving $0 \Rightarrow$ Winner!

Chomp

Two players alternate turns `eating' rectangle of tokens from square.

Taking last $\Rightarrow$ Loser!

Mastermind

Exploring optimal strategy

Classroom Activities

Towers of Hanoi - determine closed form minimum number moves

Utility Sabotage - draw $K_{3,3}$ in the plane

Knight's Tour - chess knight land all squares once

Number Building - n^{th} digit is # times $n-1$ is used as a digit

Finding Fifteen - two player game building 3-set summing to 15

Coins in the Dark - split pile of n coins with $\frac{n}{2}$ heads into 2 piles with same # heads in each pile

Cryptography - shift and block ciphers

In Progress - SuperPermuations, Voting Methods

MatheMagic

Rope Trick Topology

The Twisted Tailor

The Blind Barkeep

Tic-Tac-Woah

Thank These People!

MathsBusking.com
- ▶ Rope Handcuffs
- ▶ 2-digit Cubes
- ▶ Binary Mindreading
- ▶ Divine Remainder
- ▶ Subtraction Games
- ▶ Emergency Pentagon

Stand Up Maths on YouTube
- ▶ 2-digit Cubes
- ▶ 9-digit Product

ArtOfMathematics.org
- ▶ IBL Activities

CU Denver STEM Clubs
- ▶ Combinatorial Games
- ▶ Greedy Pig
- ▶ Mammalian Heart Rates
- ▶ Zombie Virus

Rope Tricks
- ▶ Allison Henrich @ Seattle Univ
- ▶ Book by Karl Fulves

Tic-Tac-Toe
- ▶ Main St Math @ Davidson Coll

Thank You!

Axel Brandt

brandta2@nku.edu

Slides at

sappho.nku.edu/~brandta2/docs/kymaa2019