



Ohio Math Initiative, Subgroup 5

High School Transition Course

Ohio Mathematics Chairs Network Meeting

November 2, 2018

Bradford Findell, Ohio State University

Andrew Tonge, Kent State University

Serita McGuina, Cuyahoga Community College

Brenda Haas, Ohio Department of Higher Education

Anna Cannelongo, Ohio Department of Education



Advisory Committee

- *Gwen Bergman-High School Teacher at Miami East Local Schools*
- *Brett Doudican-High School Teacher at Green County Career Center*
- *Brad Findell-Higher Education Faculty at Ohio State University*
- *Greg Foley-Higher Education Faculty at Ohio University*
- *Serita McGunia-Higher Education Faculty at Cuyahoga Community College*
- *Andrew Tonge-Higher Education Faculty at Kent State University*
- *Sandra Wilder-District Instructional Specialist at Akron Public Schools*

Facilitator:

- *Stephen Miller-Summit County ESC; former OCTM president*



Planning Committee

- Deidra Davis-*Higher Education Faculty at Cuyahoga Community College*
- Rachel Gorsuch-*High School Teacher at Columbus Academy*
- Jessie-Jones Carter-*High School Teacher at Hubbard High School and Higher Education Faculty at Youngstown State*
- Endora Kight-Neal-*Higher Education Faculty at Cuyahoga Community College and Curriculum and Instruction Specialist at Cleveland Public Schools*
- Michael Mack-*High School Teacher at Hillsdale High School*
- Emily Meister-*High School Teacher at Grandview Heights City School District*
- Robert Mendenhall-*Curriculum Director at Toledo Public Schools*
- Rodney Null-*Higher Education Faculty at Rhodes State College*
- Beverly Reed-*Higher Education Faculty at Kent State University*
- Julie Seitz-*Higher Education Faculty at Youngstown State University*
- Jenny Walls-*High School Teacher at Akron City Schools*



Timeline

- Spring/summer 2018
 - *Begin development of the course*
- 2018-2019 school year
 - *Implement developmental pre-pilot where the pre-pilot teacher provides feedback and creates materials to help flesh out and refine the course.*
- 2019-2020 school year
 - *Implement full pilot*
- 2020-2021 school year
 - *Launch course*



Target Audience

- High school students who
 - have completed three years of high school mathematics
 - Algebra 1, Geometry, Algebra 2
 - are college intending
 - are not yet college ready
- Pre-pilot class in Akron
 - Mostly seniors, some juniors
 - Some have completed Precalculus
 - ACT score between 17 and 21



Sample Problem

Suppose the number of bacteria in a Petri dish doubles every 3 min. There were 4 bacteria when the experiment started.

- How many bacteria would there be after
 - a) 6 min?
 - b) 9 min?
 - c) 15 min?
 - d) 1 hr?
 - e) 1 day?
- After how many minutes would there be
 - f) 16 bacteria?
 - g) 64 bacteria?
 - h) 200 bacteria?



Making Sense

magnitude scale = 3^{60}
 4.2×10^{24}

x	y
0	1
1	3
2	9
3	27
60	

log = undoing exponents

x	y
1	3
2	6
3	9
6	18

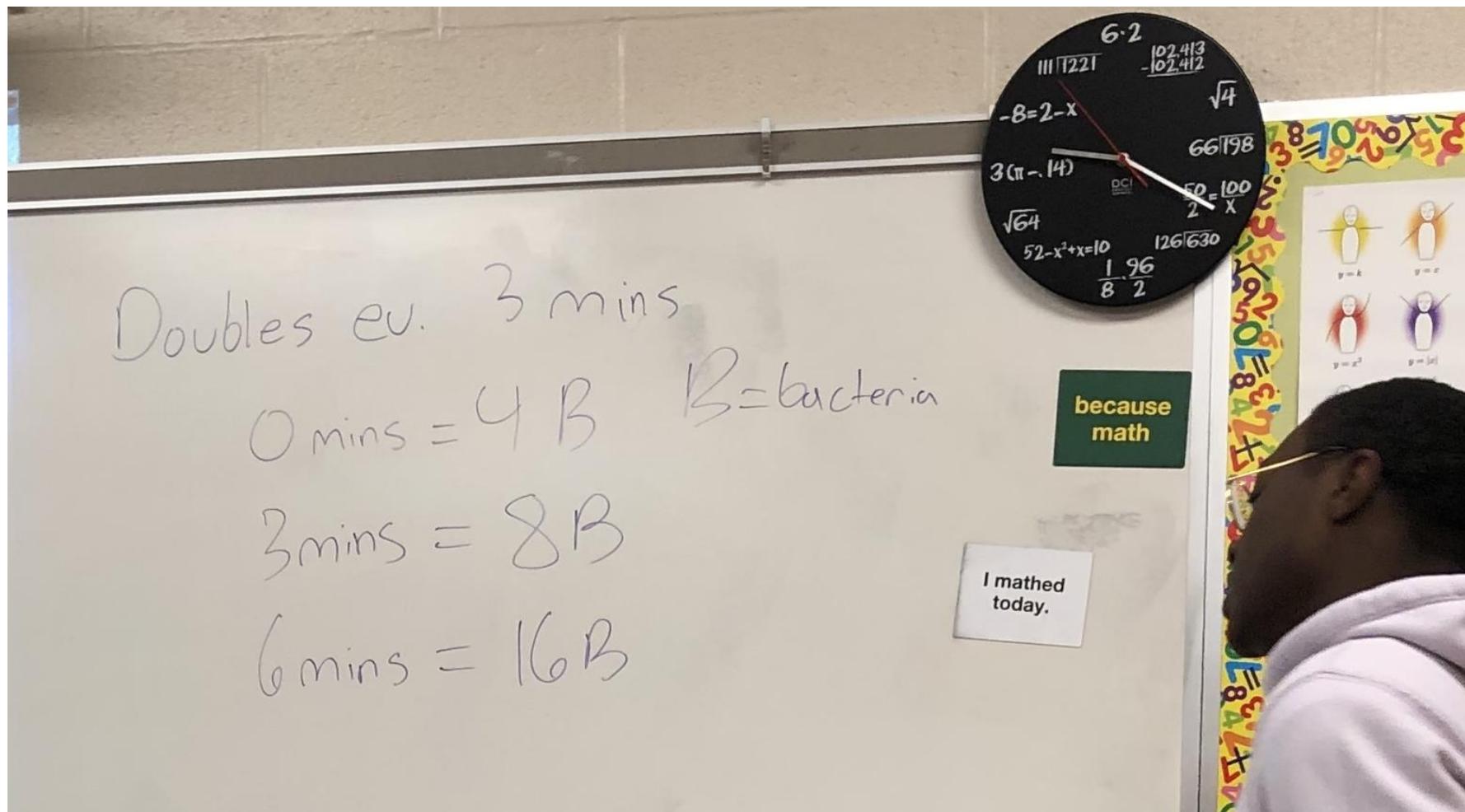
\log_{10}^3 $\frac{\log 4.2}{\log 3}$
 $= 60$
 a) $y = 3(6) = 18$
 b) $y = 9(3) = 27$

x	y
---	---

# Bacteria	Time (mins)
4	0
8	3
16	6
32	9
64	12
128	15



Sharing Sense





Making Use of Yesterday's Mathematics

0	1	0	1
1	2	1	3
2	4	2	9
3	8	3	27
4	16		
.	.	3^{60}	?

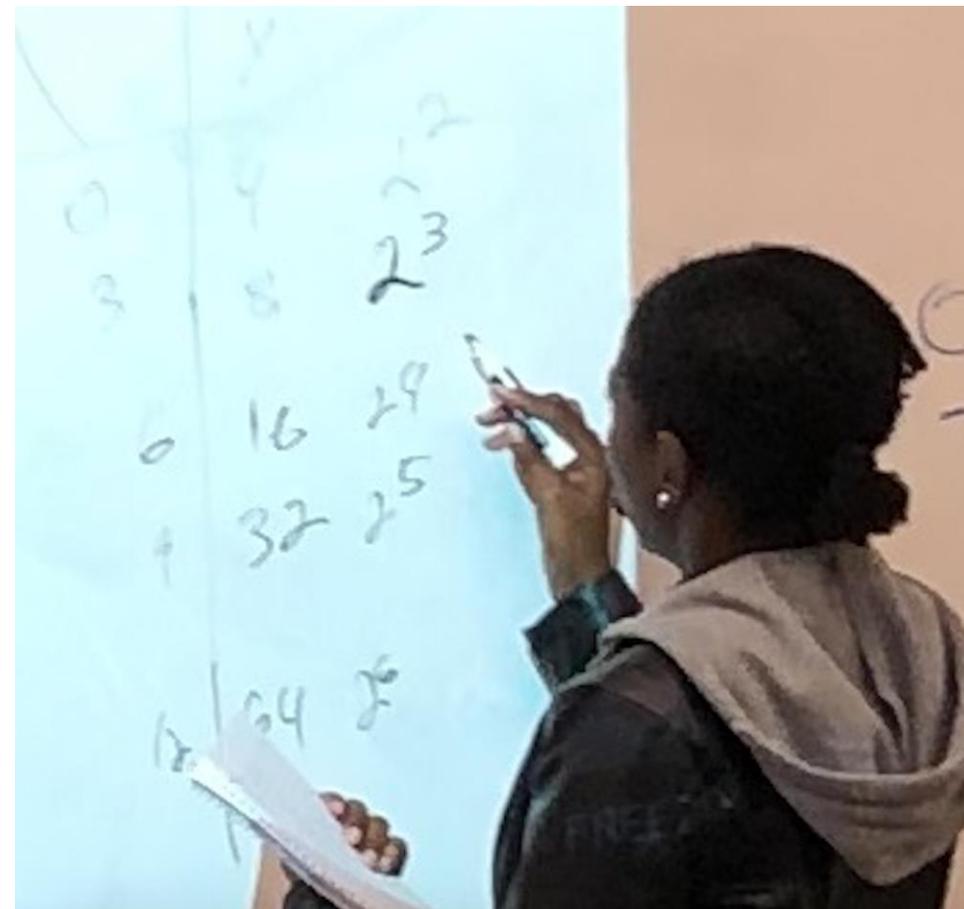
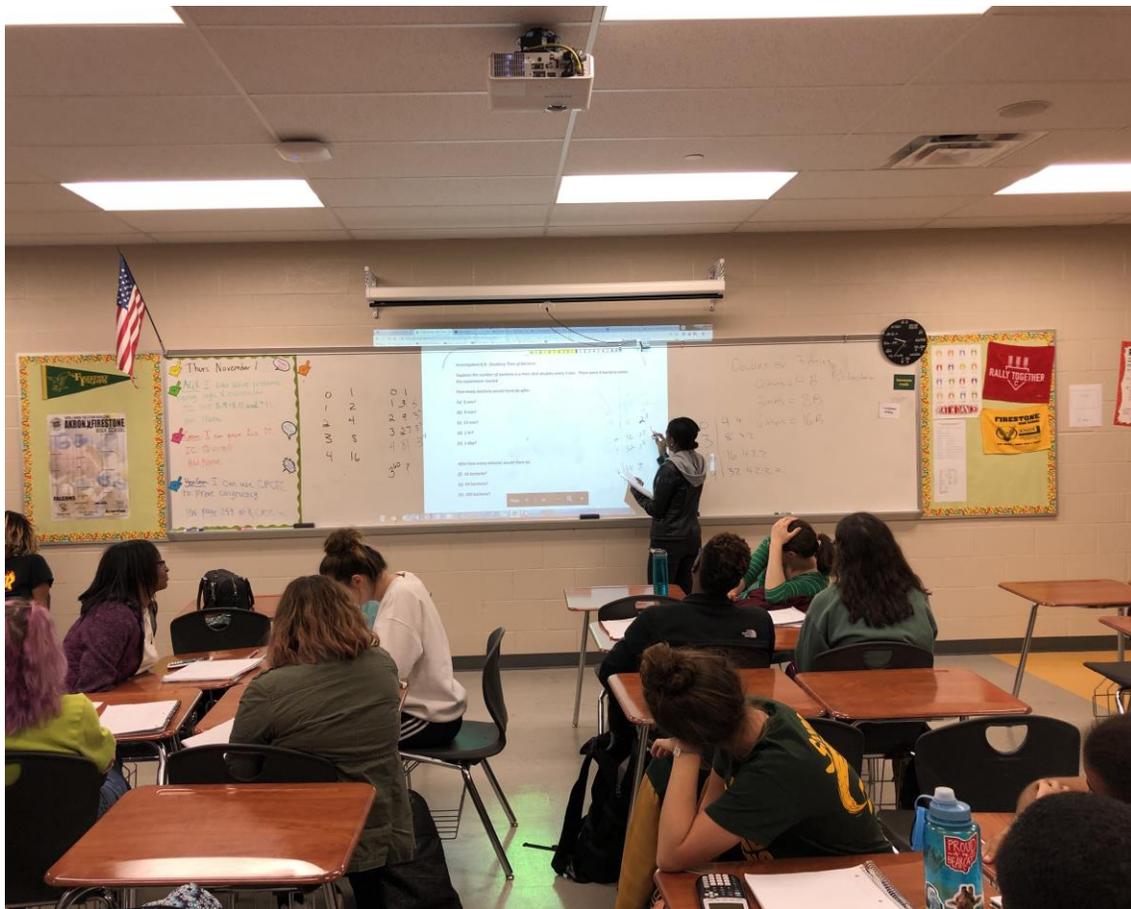


Looking for Patterns

0	4 4	6 mins = 16B
3	8 4·2	
6	16 4·2·2	
9	32 4·2·2·2	



Looking for Patterns





Describing Patterns

x	y	pattern
0	4	4
3	8	4 · 2
6	16	4 · 2 · 2
9	32	4 · 2 · 2 · 2

$a = 16$
 $b = 32$
 $c = 128$
 $d =$

$a = 256$
 $B = 6,5536$
 $C = 3.6 \times 10^{14}$
 $d =$

$4 \cdot 2^x$

x	y	2^x
3	8	2^3
6	16	2^4
9	32	2^5
12	64	2^6
15	128	2^7
18	256	2^8
21	512	2^9
24	1024	2^{10}
27	2048	2^{11}
30	4096	2^{12}
33	8192	2^{13}
36	16384	2^{14}
39	32768	2^{15}
42	65536	2^{16}
45	131072	2^{17}
48	262144	2^{18}
51	524288	2^{19}
54	1048576	2^{20}
57	2097152	2^{21}
60	4194304	2^{22}



A Solution for Bacteria after 1 Hour

Investigation 8.9: Doubling Time of Bacteria

Suppose the number of bacteria in a Petri dish doubles every 3 min. There were 4 bacteria when the experiment started.

How many bacteria would there be after

- (a) 6 min?
- (b) 9 min?
- (c) 15 min?
- (d) 1 hr?**
- (e) 1 day?

After how many minutes would there be

- (f) 16 bacteria?
- (g) 64 bacteria?
- (h) 200 bacteria?

Handwritten notes on the whiteboard:

Time (min)	Number of Bacteria
0	4
3	8
6	16
9	32
12	64

$\frac{60}{3} = 20$

$4 \cdot 2^{20} = 4194304$

Page 11 / 14



Generalizing

Investigation 8.9: Doubling Time of Bacteria

Suppose the number of bacteria in a Petri dish doubles every 3 min. There were 4 bacteria when the experiment started.

How many bacteria would there be after

- (a) 6 min?
- (b) 9 min?
- (c) 15 min?
- (d) 1 hr?
- (e) 1 day?

After t hours, how many minutes would there be

- (f) 1 hour?
- (g) 1 day?
- (h) 1 year?

Handwritten notes on the screen:

- $\frac{X}{3} = 20$
- $4 \cdot 2^{20} = 4194304$

Handwritten notes on the whiteboard to the left:

0	1
1	3
2	9
3	27
4	81

Page 11 / 14



Generalizing

(c) 15 min?

(d) 1 hr?

(e) 1 day?

After how many minutes would there be

(f) 16 bacteria?

(g) 64 bacteria?

(h) 200 bacteria?

$$\frac{\text{times}}{3} = 20$$

$$4 \cdot 2^{20} = 4194304$$

Starting with 4. Dab [^] Time Divided 3

$$4 \cdot 2^{\frac{\text{time}}{3}}$$



Teacher Observations

- At first, students still wanted to know the formula
- Several weeks before students were willing to focus on one problem per day
- Problems are open ended
- Problem contexts are key
- Instruction is a balance between
 - Letting the students go where they go
 - Knowing where you want to go
- “I don’t know how [absent] students could make this up.”
 - Class participation is critical to changing student dispositions
- Attendance is not an issue for this group of students
- Akron administrators want to spread this throughout the district



Student Observations

- Teacher and student teacher reported students saying,
- “This is the first time
 - ... math isn’t my problem class.”
 - ... I understand.”
 - ... math makes sense.”
 - ... I like math.”



Questions

- How to fund another ACT for participating students
- How to design and provide professional development for the pilot teachers next year and following
- How to take advantage of the learning among piloting teachers
 - Based on this course, teachers are reconsidering earlier courses