Problem Solving & Posing [2019-20]
The Hewitt School
Benjamin Dickman [@benjamindickman]

GUIDE[1]**:**
I have omitted the live session portions from this shareable document.
Otherwise, each day is broken into small pieces with 3 items: DO, WATCH, READ.
The assignments are due at the end of the school week at 11:59 pm.
Ideal viewing: Go to the View menu and uncheck Print Layout.

3/30 - 4/5: On (Mathematical) "Genius"

MONDAY 3/30
DO Read back over our course document (and its links!) and all of the problem sets (or any other problem sources) to find some clearly-formulated problems that interest you.
WATCH The World's Best Mathematician (*),
https://www.youtube.com/watch?v=MXJ-zpJeY3E
READ Jim Propp: "The Genius Box" (at least the first half, and maybe the whole thing; feel free to follow some of its links),
https://mathenchant.wordpress.com/2018/03/16/the-genius-box/

Assignments DUE Friday by 11:59 pm:
In about two pages of a google doc to submit directly to me, describe the themes that you see across our three readings this week (Propp, Nguyen, Duchin) along with the clips you've watched, and how you have seen them apply, or not apply, in your own mathematical (or STEM-based) experiences. You may wish to look ahead at the items to read and watch, but there is no need to strain yourself.

TUESDAY
DO Check over the mathematics in the Problem Set 1 Sample Solutions,
https://docs.google.com/document/d/1JQqb8ZD3aaxP8vQjs5K3hPpkymZzGslUjK2Vn4V2T4A/. For 3(c), try to write down a formula for the number of ways that a number N (if you know its prime factorization) can be written as a difference of squares.
WATCH A chess prodigy explains how his mind works,
https://www.youtube.com/watch?v=PZFS0kewLRQ
READ Jim Propp: "The Genius Box" (finish reading this piece; feel free to follow some of its links), https://mathenchant.wordpress.com/2018/03/16/the-genius-box/

[1] This guide links to the Remote Learning Template from The Hewitt School, a girls school in NYC, which includes a *very helpful* worked example from Science Teacher Tegan Morton [@tegan_morton].

Assignments DUE Friday by 11:59 pm:
Using just the numbers 2, 3, and 4, in how many different ways can you add up to 10? In this problem, order matters: so, e.g., 244 is different from 442.

WEDNESDAY
DO Continue to work out the problem from yesterday; if you are stuck, then what are some of the heuristics/strategies that we have used in the past to get started? See where you can get with this problem, whether it is collecting data on certain numbers (arranged by size? arranged by prime factors?) or writing out a full solution with proof.
WATCH Inside The Mind Of Jaxon Cota An 11-Year-Old Kid Genius,
https://www.youtube.com/watch?v=aIYBZIM10DA
READ Viet Thanh Nguyen's "Don't Call Me A Genius" (feel free to look up more about the author),
https://www.nytimes.com/2018/04/14/opinion/sunday/dont-call-me-a-genius.html

THURSDAY
DO Work on the three items that are due tomorrow: (1) the two page essay on genius; (2) figuring out how many ways a natural number can be written as a difference of squares; and (3) figuring out in how many ways 2s, 3s, and 4s can sum to 10.
WATCH Counting from Infinity (the first half, at least),
https://www.youtube.com/watch?v=7Au3cIKb2ZA
READ Moon Duchin's "The sexual politics of genius" (at least the first half, but probably the whole thing),
https://web.archive.org/web/20190618200342/https://mduchin.math.tufts.edu/genius.pdf

FRIDAY
DO Finish the assignments for the week!
WATCH Counting from Infinity (whatever remains),
https://www.youtube.com/watch?v=7Au3cIKb2ZA
READ Moon Duchin's "The sexual politics of genius" (finish reading this piece if necessary),
https://web.archive.org/web/20190618200342/https://mduchin.math.tufts.edu/genius.pdf

Assignments DUE Friday by 11:59 pm:
The assignments due today are the three previously indicated in the week, and they can all be put in the same google doc and shared directly with me: (1) the two page essay on genius; (2) figuring out how many ways a natural number can be written as a difference of squares; and (3) the problem on 2s, 3s, and 4s summing to 10.

WEEKEND
Get fresh air! (You should be doing this all week, too...) Give some thought to what is working and what could work better (or be eliminated) after our first week of Remote Learning. It'll be best to think this over while afoot.

4/6 - 4/12: On (Mathematical) "Creativity"

MONDAY 4/6
DO Read The Riddler on FiveThirtyEight from this past Friday; be sure to note the solution to the previous Riddler Express, and give some thought to the current Riddler Express or Riddler Classic.
WATCH Elizabeth Gilbert, "Your elusive creative genius,"
https://www.youtube.com/watch?v=86x-u-tz0MA
READ Henri Poincare, "Mathematical Creation,"
http://vigeland.caltech.edu/ist4/lectures/Poincare%20Reflections.pdf

Assignments DUE Wednesday by 11:59 pm:
Try to solve the difference of squares problem for last week: Given a natural number n and its prime factorization, can you come up with a method or formula to compute all of the ways in which n can be expressed as the difference of two squares?

TUESDAY 4/7
DO Think about how to approach either the Riddler Express or the Riddler Classic or both. You don't need a full proof; it will suffice to jot down thoughts about how someone might even get started on either or both of these problems, or just to muse on them.
WATCH Dan Dennett, "Dangerous Memes,"
https://www.ted.com/talks/dan_dennett_dangerous_memes
READ Michael Hanchett Hanson, "The Ideology of Creativity and Challenges of Participation," (this is tough reading: read it across Tue/Wed as necessary),
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4873049/

WEDNESDAY 4/8
DO Try to solve the difference of squares problem!
WATCH Sugata Mitra, "The Child-Driven Education,"
https://www.ted.com/talks/sugata_mitra_the_child_driven_education
READ The Ideology of Creativity and Challenges of Participation," (this is tough reading: finish it as possible), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4873049/

Assignments DUE Wednesday by 11:59 pm:

Try to solve the difference of squares problem for last week: Given a natural number n and its prime factorization, can you come up with a method or formula to compute all of the ways in which n can be expressed as the difference of two squares?

LONG WEEKEND
Get fresh air! (You should be doing this all week, too...) Give some thought to what is working and what could work better (or be eliminated) after our second week of Remote Learning. It'll be best to think this over while afoot.

4/13 and Beyond: Math Trails

MONDAY 4/13 to WEDNESDAY 4/15
DO Walk around the spaces that you have been in (this might be your residence or nearby outdoor areas that you can traverse while staying physically distanced responsibly).
WATCH Enough screen time for now; watch the physical world around you, and try thinking about it in new ways. (To be done with care: Sometimes, I try to identify places in my living space where I've never really stood before; for example, I safely climb up on furniture or sit in a place I've never previously sat. Give it a shot!)
READ We'll get back to the Math Trails book (PDF) but for now: please look over the Hewitt Math Trail started by PS&P last year (Slides). In particular, note the goals of accessibility, connections, and joy.

THURSDAY 4/16 and FRIDAY 4/17
There is nothing new due this week; so, refine the previous problems and writings as necessary, and consider creating a shared document (e.g., Slides) that you can begin to populate with Math Trails material. How can we incorporate various items that we have learned across the year, or otherwise stretch ourselves into new mathematical areas? (Once there is a shared Slides document, we will be able to give each other feedback; for example, if you see potential mathematics in an object but are not sure how to explore it, let us know so that we can collaboratively think through how it could fit into a Math Trail.)

WEEKEND
Get fresh air! (You should be doing this all week, too...) Give some thought to potential Math Trail objects in the places and spaces that you are presently inhabiting; this may also include outside areas that you are traversing responsibly.

4/20 - 4/26: Math Trails (continued)

MON

DO Get some material into a Math Trail google slides doc shared with (at least) your live session cohort.
WATCH Overview of Designing Math Trails,
https://www.youtube.com/watch?v=ysWorsOoxrU
READ Check out this 1999 paper on Math Trails (no sign in required, I believe):
https://www.jstor.org/stable/41180762?seq=1#metadata_info_tab_contents

TUE
DO Give feedback to at least one other person about their proposed items. You can use the speaker notes for this; be sure to include your name after your comment!
WATCH Math for America Math Trail at the Rubin Museum,
https://www.youtube.com/watch?v=6KZ8KOWHSWc
READ Same reading assignment as yesterday; finish up as necessary.

WED
DO Revise your Math Trail item based on classmate feedback.
WATCH Math Trail from Germantown Friends School,
https://www.youtube.com/watch?v=j1_xCwAmo0M
READ Check out this 2018 paper on Math Trails (no sign in required, I believe):
https://library.osu.edu/ojs/index.php/OJSM/article/viewFile/6282/5069

THU
DO Continue to give feedback and modify items.
WATCH FASE The National Math Trail (I think this was released in 2001; but, the late 90s vibes feel strong), https://www.youtube.com/watch?v=0ZKp_iolito
READ Same reading assignment as yesterday; finish up as necessary.

FRI
DO Get your Math Trail item (or items) into a place where you feel like they are representative of the quality of work you're up to creating right now.
WATCH Peace for Triple Piano from Vi Hart,
https://www.youtube.com/watch?v=HcRW3FMuttY
READ Find something unrelated to math or COVID! Anything from the ingredients list on a food item to a full length novel. Have you read anything good lately?

4/27 - 5/3: Math Trails Finale

This week, I would like to collect two things:

1) Focused Free Write (aka "Math Libs") before our second, and final, live session;
2) Math Trail items from all students by Friday.

Sections 1 and 3: [REDACTED]
Section 2: [REDACTED]

Please ensure that the second item represents the type of work that you feel capable of doing right now; I would like to have something that we can share with (at least) the larger Hewitt community!

If you are looking for additional resources for the week, here are some readings that I have recently been going through. They range from blog posts to articles written using very tough terminology; there is no need to read them, but if you find yourself looking to be intellectually stretched, then I hope that you will find them of interest. (Send me an email if they spark new thoughts!)

READINGS
Impersonation and personification in mid-twentieth century mathematics by Michael Barany (pre-print)
http://mbarany.com/Impersonation-Barany-preprint.pdf

On the role of anonymity in a site dedicated to research-level mathematics answer by "Lucia" (pseudonym of a male mathematician; identity unknown to most)
https://meta.mathoverflow.net/a/1115

Author, Self, Monster: Using Foucault to Examine Functions of Creativity by Michael Hanchett Hanson
https://sci-hub.tw/10.1037/a0026721%E2%80%8B

Why I'm Not on MathOverflow &
Still not on MathOverflow by Izabella Laba
https://ilaba.wordpress.com/2011/03/28/why-im-not-on-mathoverflow/ &
https://ilaba.wordpress.com/2012/12/16/still-not-on-mathoverflow/

Creativity in Question and Answer Digital Spaces for Mathematics Education: A Case Study of the Water Triangle for Proportional Reasoning by Benjamin Dickman (me!)
https://www.researchgate.net/publication/321683932