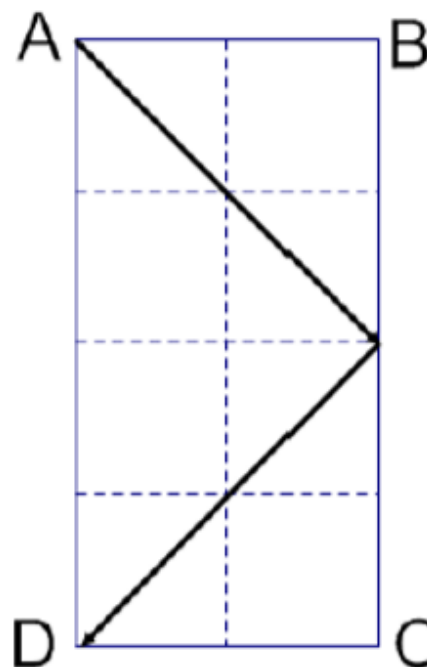
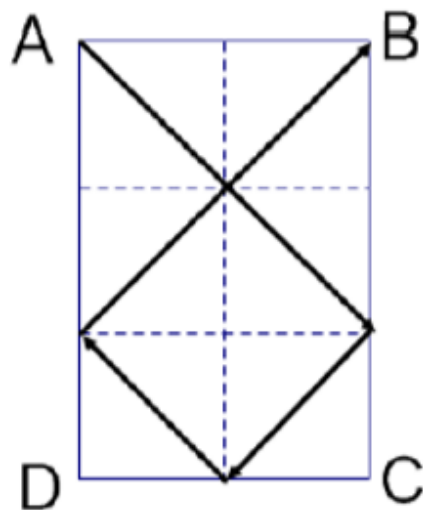


Question # 1

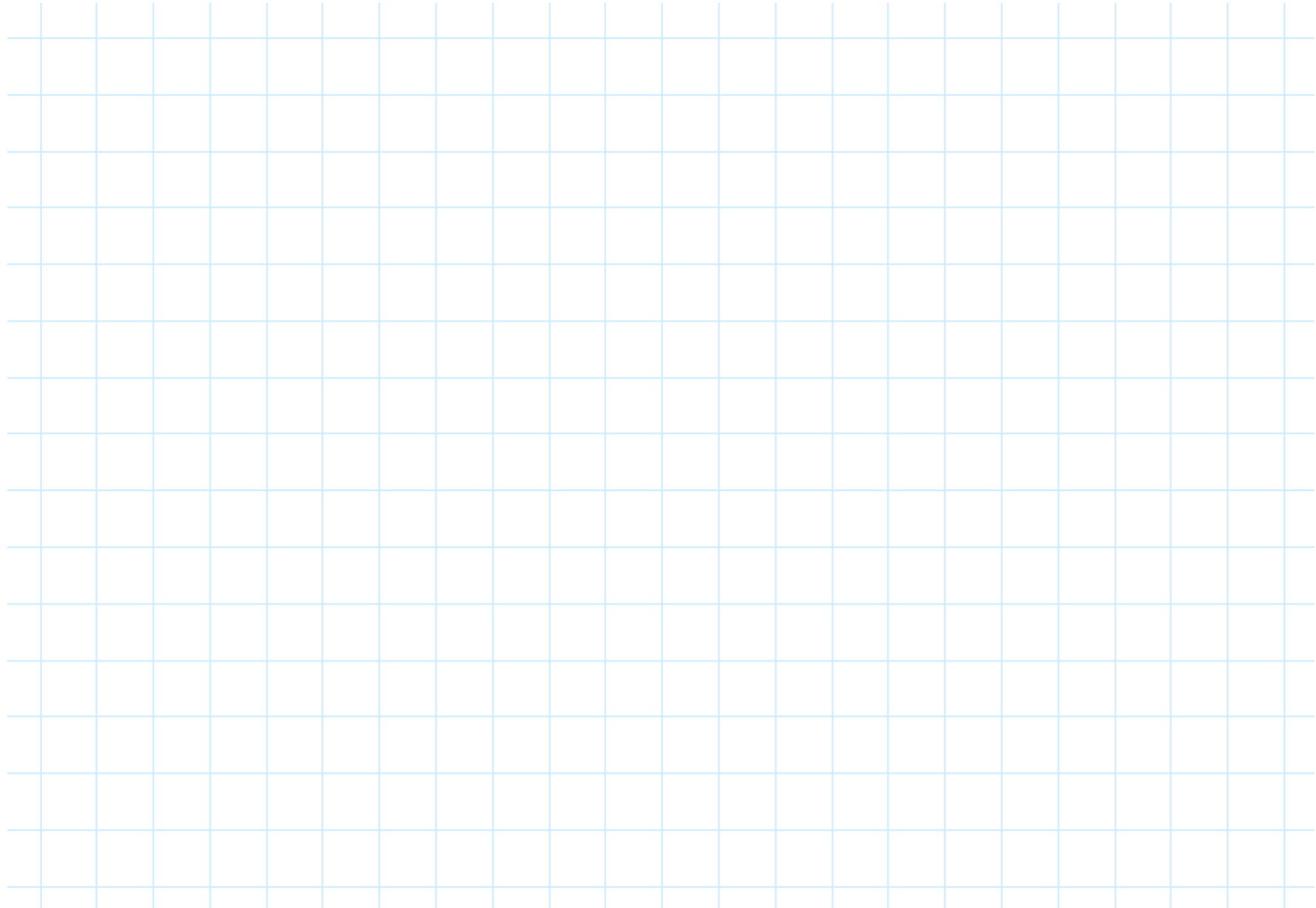
A light beam is fired through the top left corner (A) of a 2 by 3 rectangular prism block at a 45° angle towards the opposite wall. As shown in the diagram below, it will emerge from the block at the top right corner (B).



If a light beam is fired into a 2 by 4 rectangular prism block (above) from the top left corner, it will emerge from the bottom left corner (D).

If a light beam is fired into a 2 by 50 rectangular prism block from the top left corner, which corner will it emerge from?

Integrating Problem Solving 2020



Return to Question #1

What kind of extensions could you do with this question?

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Head of Mathematics at White Oaks Secondary School in Oakville, Ontario

GVMA Councilor

Organize, plan and write the Halton Math Contest - team competition

- spend up to two months looking for good problems

Teach IB Higher and Standard Level, Ontario Mathematics Curriculum and Computer Science

Problem Solving with Exploration Tasks

It should have one or more of the following:

- the route to the solution is initially unclear
- the task is accessible to students with a wide range of abilities
- students can pose problems as well as solve them, or make conjectures
- extend knowledge or apply knowledge in different situations
- more than one way to solve the problem
- connections between different areas of mathematics

Question #2

Farey sequences are sequences of fractions in order of size.
For example, F_3 represents the following Farey sequence.

$$\frac{0}{1}, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}, \frac{1}{1}$$

Find F_4 , F_5 and F_6 .

Fibonacci Type Questions

In sheep talk, the only letters used are A and B.

Sequences of words are formed as follows:

The first word only contains the single letter A.

To get the next word in the sequence, change each A in the previous word into B and each B in the previous word into AB.

How many letters are there in the 15th word of sheep talk?

In a Fibonacci Word, letters consist only of a 1 or a 0.

The rules are as follows: $f_1 = 1, f_2 = 0, f_n = f_{n-1}f_{n-2}$ (words are concatenated)

For example:

$$f_3 = 01, f_4 = 010, f_5 = 01001, f_6 = 01001010$$

Find each of the following Fibonacci Words:

$$f_7 = \underline{\hspace{10em}}$$

$$f_8 = \underline{\hspace{10em}}$$

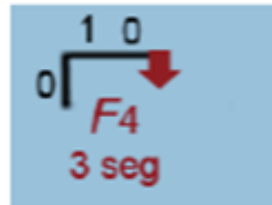
How to draw a Fibonacci Fractal:

We start with the left most digit of the word and follow the following rules, where n is the n th digit in the sequence. Also, when $n = 1$, direction forward is vertical (up).

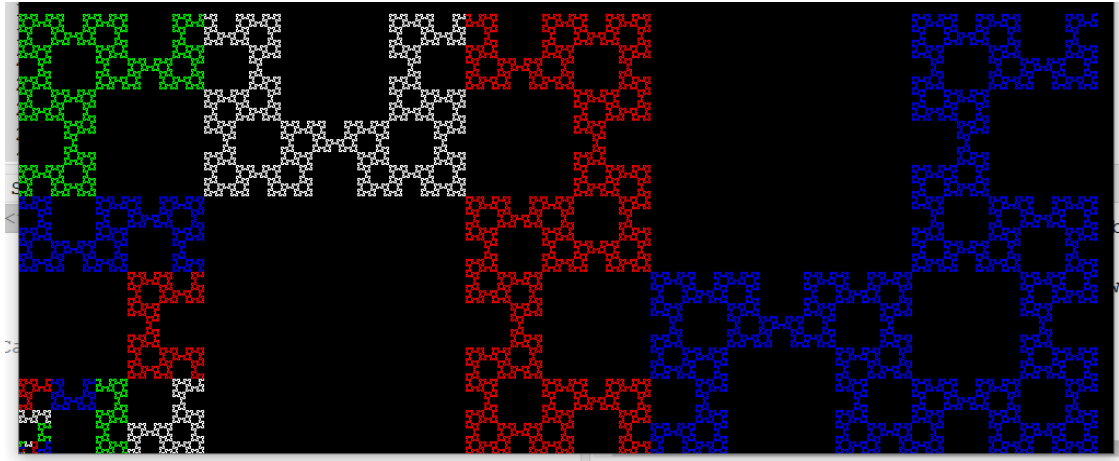
Take the n th digit of a Fibonacci Word,

- i) Draw a line segment forward in the current direction.
- ii) If the digit is a '0' then:
 - turn left of the current direction if the value of n is even
 - turn right of the current direction if the value of n is odd

For example:



Integrating Problem Solving 2020



The New Reality

What does your return to school look like?

A) Face-to-face

B) Online only

C) Hybrid Model

D) No idea - I'm so confused

How to have students collaborate with social distancing?

- Depends on how many students and how big the classroom
- Can groups be spaced out away from each other enough?
- Can students in groups be six feet apart and still focus on the task?
- Use of whiteboards with sanitizers? (Thinking classroom)
- Online versions even when in class? (the online whiteboard and they can still physically talk?)


WE HAVE TO FIND WAYS AND THE TIME!!!

Videos - the Flipped Classroom

Videos work for problem solving as well as for lessons.

Watch the video for homework, try and solve on your own, discuss with others at the next class.

Online or face-to face.

 <https://youtu.be/0tkICNSdwV4?t=12>

Proofs are Problem Solving!!

Not enough proof in our curriculum but should always show a proof when you can!!

Students should not believe everything you or any teacher writes!!!

Critical Thinking!

Student should always be asking:
"How do we know it is true?"

Find the roots of the quadratic equations $ax^2 + bx + c = 0$

Logic Problems

There are 3 black hats and 2 white hats in a box.

Three men (we will call them A, B, & C) each reach into the box and place one of the hats on his own head.

They cannot see what color hat they have chosen.

The men are situated in a way that A can see the hats on B & C's heads, B can only see the hat on C's head and C cannot see any hats.

When A is asked if he knows the color of the hat he is wearing, he says no.

When B is asked if he knows the color of the hat he is wearing he says no.

When C is asked if he knows the color of the hat he is wearing he says yes and he is correct.

What color hat is C wearing and how can this be?

Two players play the following game:

The goal of the game is to be the first to reach exactly 23 points.

The game starts with 0 points and each turn, the player can add from 1 to 4 points.

The players alternate.

For example, the game is currently at 18 points and it is player 1's turn.

Player 1 chooses to add 4 points, putting the score at 22 points.

Player 2's turn is next and they choose to add 1 point, thus winning the game at 23 points.

Find a partner and play this game. Try to win!!!!

Puzzles - Sudoku Variants

Binairos

A binairo is much like a Sudoku except you can only fill in 1's or 0's.

The grid made be odd (11 by 11, for example) or even (12 by 12, also for example).

If it is even, then each row and column contains the same number of ones and zeroes.

If it is odd, then there is one more one than zeroes in each row and column.

No more than two of the same number can be next to or under each other.

For example,

0	0	0
----------	----------	----------

is not allowed.

- Also try Slitherlinks, Str8ts, Nonograms

Transference Problems

A camel must travel 1000 kilometres across a desert to the nearest city.

The camel has 3000 bananas but can only carry 1000 at a time.

For every kilometre the camel walks, it needs to eat a banana.

The camel does not eat partial bananas.

What is the maximum number of bananas the camel can transport to the city?

Thank you!

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