

Instructions

- Solve the puzzles below (in base 10) by any means
- Convert the answers to base 3
- Write the answers in the boxes to the right, including leading zeroes.
- Colour the squares containing a 1 red; containing a 2 blue; leave 0 unshaded.
- When finished, place your completed entry in the box.

Winner will be selected randomly from correct entries.

Name: _____

Puzzles

- 1) 6!
- 2) Year that mathematician Abraham Wald died.
- 3) MCDLXIV: all standard Roman numeral digits are present.
- 4) The magic constant of a 9x9 magic square.
- 5) How many ways to choose five things from a dozen? $\binom{12}{5}$
- 6) How many 3 digit numbers have at least one digit zero in decimal base? (not counting leading zeros)
- 7) $6^2 + 7^2 + 8^2 + 9^2 + 10^2 + 11^2 + 12^2$
- 8) Five times the 29th triangular number
- 9) Apply $a(n) = 2n * (4n + 5)$ where n is the index of this puzzle
- 10) If $a = 1, b = 2, c = 3$ etc., what is the sum of all the letters of the alphabet?

	729	243	81	27	9	3	1
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Prime Loop Competition

A loop is a sequence of integers that wraps around so that the last is considered adjacent to the first. A tier- n prime loop is a loop of digits 0-9 where every integer composed of n adjacent digits clockwise is a distinct prime, and the same anti-clockwise. Note that a particular prime can feature in both the clockwise and anti-clockwise directions but can't be repeated within a single direction.

If $n > 1$ then all the digits must be odd since each digit must be the last digit in some prime of 2 digits or more. Similarly, if $n > 1$, none of the digits can be 5.

Here is a tier-1 prime loop: 2, 3, 5, 7. Not very interesting!

This is an invalid tier-2 prime loop, since 91 (= 7 x 13) is composite in the anti-clockwise direction: 1, 3, 7, 1, 9, 7, 3.

Here is another that is invalid, since we can't choose any value for x without failing in some way: 1, 3, 7, 3, 1, 7, 1, 1, x .

$x = 1$ would repeat 11

$x = 3$ would repeat 13

$x = 7$ would repeat 17

$x = 9$ would introduce 91.

Here is a valid (but short!) tier-2 prime loop: 1, 3.

Tasks

Warmup: First construct a tier-2 prime loop that is as long as possible. Satisfy yourself that there is no longer one.

Judged: Now construct the longest tier-3 prime loop that you can.

For judging purposes, if submitted loops are equally long, then the sum of the digits in the loop will be used as a tie-breaker.

Bonus: If appropriate, try to prove that there is no longer one.

Primes

For your reference, here are the 3 digit primes using the digits 1, 3, 7 and 9:

113 131 137 139 173 179 191 193 197 199

311 313 317 331 337 373 379 397

719 733 739 773 797

911 919 937 971 977 991 997

Number card game

To enter this competition, design a **Function** card and a **Goal** card using the template below, for a game with the following instructions. You will be judged on interesting game mechanics, creativity and ingenuity / loopholes.

ENTRANT'S NAME:

Game contents (90 cards)

- 30 **Number** cards numbered 1-9 and a wild card in each of three suits; circle, triangle and square.
- 30 each of **Function** cards and **Goal** cards (TBC)

Rules

1. To start, shuffle all cards and deal six to each player. The rest go face-down in a draw pile. Play goes around the table starting left of dealer.
2. A turn consists of playing three cards from your hand; **one each** of a **Goal** card, a **Function** card, and an **Number** card. These can each be played in front of you or another player. *If you can't play one of the card types from your hand, you must instead discard one of that same type from anywhere on the table (not necessarily in front of you), unless none of that type are visible.*
3. At the end of your turn, replenish your hand to six. If there are no more cards available, shuffle the discard pile to replenish the draw pile.
4. If at the end of your turn, some combination of your **Number** and **Function** cards satisfies a **Goal** card that is in front of you, you win.

(Bonus) suggest a name for this game:

<h2>Function</h2>	<h2>Goal</h2>
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Function card examples:

- Concatenate two cards of different suits
- Sum all of your triangle cards
- Consider all of your circles to be squares
- Multiply two cards

Goal card examples:

- Have exactly one number card of each suit (circle, triangle, square) in front of you
- Make the number 24 using only circle cards

Why do you want to win and how genuine is your entry to this competition?

You may use one of these sentences if they resonate with you, or feel free to write your genuine reason. Be your authentic self. You could even write in a number from 0 to 13, where 0 is low (a Trumpian level of genuine) and 8 is the highest (Ted Lasso), then it decreases again toward 13 which is approx. mid-level genuine, the kind of genuine where you go over the top so it seems less genuine.

- A. I have never been more genuine in my life. Right now, in this moment, it's my sole focus.
- B. Very genuine. Winning this would make the highlights reel of my life, should such a reel be produced.
- C. I'd quite like to win. It won't make my week but might make my day.
- D. I just like to win things. This is one of many competitions that I'm trying to win.

Thank you for entering this competition. I genuinely mean that.

Please write your name and your answer in the blank space below this sentence; tell us why you want to win and how genuinely you mean it.

How many sweets in the jar?

The closest entry wins!

Name:

Number of sweets: