**Number Sets.** Expression $k \in \mathbb{N}$ [read as "$k$ is an element of $\mathbb{N}$" or "$k$ in $\mathbb{N}$"] means that $k$ is a natural number; a ***natnum***. Expression $\mathbb{N} \ni k$ [read as "$\mathbb{N}$ ***owns*** $k$"] is a synonym for $k \in \mathbb{N}$.

$\mathbb{N}$ = natural numbers = $\{0, 1, 2, \dots\}$.

$\mathbb{Z}$ = integers = $\{\dots, -2, -1, 0, 1, \dots\}$. For the set $\{1, 2, 3, \dots\}$ of positive integers, the ***posints***, use $\mathbb{Z}_+$. Use $\mathbb{Z}_-$ for the negative integers, the ***negints***.

$\mathbb{Q}$ = rational numbers = $\{\frac{p}{q} \mid p \in \mathbb{Z} \text{ and } q \in \mathbb{Z}_+\}$. Use $\mathbb{Q}_+$ for the positive rationals and $\mathbb{Q}_-$ for the negative rationals.

$\mathbb{R}$ = reals. The ***posreals*** $\mathbb{R}_+$ and the ***negreals*** $\mathbb{R}_-$.

$\mathbb{C}$ = complex numbers, also called the ***complexes***.

For $\omega \in \mathbb{C}$, let "$\omega > 5$" mean "*$\omega$ is **real** <u>and</u> $\omega > 5$*". [Use the same convention for $\geq, <, \leq$, and also if 5 is replaced by any real number.]

Use $\overline{\mathbb{R}} = [-\infty, +\infty] := \{-\infty\} \cup \mathbb{R} \cup \{+\infty\}$, the ***extended reals***.

An "***interval of integers***" $[b \,..\, c)$ means the intersection $[b, c) \cap \mathbb{Z}$; ditto for open and closed intervals. So $[e \,..\, 2\pi] = \{3, 4, 5, 6\} = [3 \,..\, 6] = (2 \,..\, 6]$. We allow $b$ and $c$ to be $\pm\infty$; so $(-\infty \,..\, -1]$ is $\mathbb{Z}_-$. And $[-\infty \,..\, -1]$, is $\{-\infty\} \cup \mathbb{Z}_-$.

Floor function: $\lfloor \boldsymbol{\pi} \rfloor = 3$, $\lfloor -\boldsymbol{\pi} \rfloor = -4$. Ceiling fnc: $\lceil \boldsymbol{\pi} \rceil = 4$. Absolute value: $|-6| = 6 = |6|$ and $|-5 + 2\mathbf{i}| = \sqrt{29}$.

**Mathematical objects.** Seq: '*sequence*'. poly(s): '*polynomial(s)*'. irred: '*irreducible*'. Coeff: '*coefficient*' and var(s): '*variable(s)*' and parm(s): '*parameter(s)*'. Expr.: '*expression*'. Fnc: '*function*' (so ratfnc: means rational function, a ratio of polynomials). trnfn: '*transformation*'. cty: '*continuity*'. cts: '*continuous*'. diff'able: '*differentiable*'. CoV: '*Change-of-Variable*'. CoI: '*Constant of Integration*'. LoI: '*Limit(s) of Integration*'. RoC: '*Radius of Convergence*'.

Soln: '*Solution*'. Thm: '*Theorem*'. Prop'n: '*Proposition*'. CEX: '*Counterexample*'. eqn: '*equation*'. RhS: '*RightHand side*' of an eqn or inequality. LhS: '*lefthand side*'. Sqrt or Sqroot: '*square-root*', e.g, "the sqroot of 16 is 4". Ptn: '*partition*', <u>*but*</u> pt: '*point*' as in "a fixed-pt of a map".

FTC: '*Fund. Thm of Calculus*'. IVT: '*intermediate-Value Thm*'. MVT: '*Mean-Value Thm*'.

The ***logarithm*** fnc, defined for $x>0$, is $\log(x) := \int_1^x \frac{dv}{v}$. Its inverse-fnc is $\exp()$. For $x>0$, then, $\exp(\log(x)) = x = e^{\log(x)}$. For real $t$, naturally, $\log(\exp(t)) = t = \log(e^t)$.

PolyExp: '*Polynomial-times-exponential*', e.g, $[3 + t^2] \cdot e^{4t}$. PolyExp-sum: '*Sum of polyexps*'. E.g, $f(t) := 3te^{2t} + [t^2] \cdot e^t$ is a polyexp-sum.

**Phrases.** WLOG: '*Without loss of generality*'. IFF: '*if and only if*'. TFAE: '*The following are equivalent*'. ITOf: '*In Terms Of*'. OTForm: '*of the form*'. FTSOC: '*For the sake of contradiction*'. And ※ = "Contradiction".

IST: '*It Suffices To*', as in ISTShow, ISTExhibit.

Use w.r.t: '*with respect to*' and s.t: '*such that*'.

**Latin:** e.g: *exempli gratia*, '*for example*'. i.e: *id est*, '*that is*'. N.B: *Nota bene*, '*Note well*'. inter alia: '*among other things*'. QED: *quod erat demonstrandum*, meaning "end of proof".

**Sequence notation.** A *sequence* $\vec{\mathbf{x}}$ abbreviates $(x_0, x_1, x_2, x_3, \dots)$. For a set $\Omega$, expression "$\vec{\mathbf{x}} \subset \Omega$" means $[\forall n\colon x_n \in \Omega]$. Use $\text{Tail}_N(\vec{\mathbf{x}})$ for the subsequence

$$(x_N,\ x_{N+1},\ x_{N+2}, \dots)$$

of $\vec{\mathbf{x}}$. Given a fnc $f\colon \Omega \to \Lambda$ and an $\Omega$-sequence $\vec{\mathbf{x}}$, let $f(\vec{\mathbf{x}})$ be the $\Lambda$-sequence $(f(x_1), f(x_2), f(x_2), \dots)$.

Suppose $\Omega$ has an addition and multiplication. For $\Omega$-seqs $\vec{\mathbf{x}}$ and $\vec{\mathbf{y}}$, then, let $\vec{\mathbf{x}} + \vec{\mathbf{y}}$ be the sequence whose $n^{\text{th}}$ member is $x_n + y_n$. I.e

$$\vec{\mathbf{x}} + \vec{\mathbf{y}} \quad = \quad [n \mapsto [x_n + y_n]] \,.$$

Similarly, $\vec{\mathbf{x}} \cdot \vec{\mathbf{y}}$ denotes seq $[n \mapsto [x_n \cdot y_n]]$.

## SeLo quizzes during Add/Drop

*These do not count for a grade.*

**DNC1:** Fri. 02 Jan $\left[\left[\sqrt{5}\right]^{\sqrt{2}}\right]^{\sqrt{8}}=$ ______ . $\log_8(4)=$ ______ .

**DNC2:** Mon. 10 Jan Line $y = Mx + B$ is orthogonal to $y = \frac{1}{5}x + 2$ and owns $(4, 10)$. So $M=$ ____ and $B=$ ____ .

Quadratic $15x^2 + 23x + 6 = [Ax - \alpha] \cdot [Bx - \beta]$, for numbers $A=$ ____ , $\alpha=$ ____ ; $B=$ ____ , $\beta=$ ____ .

## SeLo [2022g] quizzes

*These count!*

(Recall, the lowest MQ score is dropped. Consequently, there is no make-up for the first missed MQ.)

**P1:** Wed. 12 Jan The four solutions to $[y-2] \cdot y \cdot [y+2] = -1/y$ are $y =$ ______________________________

[*Hint:* Apply the Quadratic Formula to $y^2$.]

**P2:** Fri. 14 Jan Multinomial coefficient $\binom{9}{4,2,3}=$ ______ $=$ ______ .

[*Note:* Write your ans. ITOf factorials, then **also** write it as a single integer, or product of two, **without** factorials.]

**P3:** Fri. 21 Jan The coeff of $x^7 y^{12}$ in $[5x + y^3 + 1]^{30}$ is ______________________ .

[Write your answer as a product of powers and a multinomial. Optionally, you can expand the multinomial as a product of binomials.]

**P4:** ?? Wed. 09 Jan LBolt gives $G := \text{GCD}(23, 413) =$ ___ . And $23S + 413T = G$, where $S=$ ___ & $T=$ ___ are integers.

**P5:** Fri. 11 Feb LBolt gives $G := \text{GCD}(413, 294) =$ ___ . And $413S + 294T = G$, where $S=$ ___ & $T=$ ___ are integers.

**P6:** Fri. 18 Feb On a $K$-element set $\Omega$, the number , $\#_K$ , of **reflexive symmetric** binrels is ___ .

Hence: $\#_5 = 2^{\binom{5}{2}} = 2^{10} = 1024$.

**P7:** Fri. 04 Mar Pr.K thinks *Spring Break* is an opportunity to start a Robert Long essay. Circle **True*Darn tootin'!***

$\mathbf{Q} \coloneqq \Big\{(6,2), (2,7), (5,2), (7,3), (7,5), (3,4), (1,3), (1,5)\Big\}$ is a binrel on $[1..7]$, with transitive closure $\mathbf{R}$. Then:

$2\mathbf{R}2$ is *T F*. $4\mathbf{R}6$ is *T F*. $7\mathbf{R}7$ is *T F*.

**P8:** Mon. 18 Mar With $N := 85$, then $\varphi(N) =$ ⌊......⌋. Thus EFT (Euler-Fermat) says that $3^{901} \equiv_N$ ⌊..............⌋ $\in [0 .. N)$.