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 "ω *is* **real** and $\omega > 5$". [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*', *but* 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 Ω, 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 Ω-sequence $\vec{\mathbf{x}}$, let $f(\vec{\mathbf{x}})$ be the Λ-sequence $(f(x_1), f(x_2), f(x_2), \dots)$.

Suppose Ω has an addition and multiplication. For Ω-seqs $\vec{\mathbf{x}}$ and $\vec{\mathbf{y}}$, then, let $\vec{\mathbf{x}} + \vec{\mathbf{y}}$ be the sequence whose n^{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 $[n \mapsto [x_n \cdot y_n]]$.

LinA quizzes during Add/Drop

These do not count for a grade.

DNC1: Mon. 10 Jan The **slope** of line $3[y-5]=2[x-2]$ is ___.
Point $(-4,y)$ lies on this line, where $y=$ ___.

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

LinA [2022g] quizzes

These count!

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

Q1: Tue. 11 Jan Jake Park's office-hour desk is in

Narnia **Oz** **Lit403(NE)**

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

Q2: 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.]

Q3: Fri. 14 Jan Matrix-product $\begin{bmatrix}2 & -3\\ 4 & 5\end{bmatrix}\cdot\begin{bmatrix}7 & w\\ 2 & 1\end{bmatrix}=$ ___.

Q4: Tue. 18 Jan Blanks$\in\mathbb{R}$. So $\frac{1}{2+3\mathbf{i}}=$ ___ $+\mathbf{i}\cdot$ [___].

Thus $\operatorname{Im}\left(\frac{5-\mathbf{i}}{2+3\mathbf{i}}\right)=$ ___.

By the way, $|5-3\mathbf{i}|=$ ___.

Q5: Tue. 01 Feb Collection $\mathcal{B}:=\{x^3-2x^2+1,\ 4x^2-x+3,\ 3x-2\}$ generates VS $\mathsf{P}_3(\mathbb{R})$. *T* *F*

In VS $\mathbf{V}$, collection $\mathcal{C}:=\{\mathbf{v}_1,\mathbf{v}_2,\ldots,\mathbf{v}_8\}$ is LD. Then each $\mathbf{v}_j$ lies in $\operatorname{Spn}(\mathcal{C}\setminus\{\mathbf{v}_j\})$. *T* *F*

Q6: Fri. 11 Feb VS $\mathbf{V} := \mathrm{MAT}_{4\times 4}(\mathbb{R})$ is a 16-dim'al $\mathbb{R}$-VS. Define lin.trn $D{:}\,\mathbf{V}\to\mathbf{V}$ by $D(\mathsf{M}) := \mathsf{M} + \mathsf{M}^{\mathsf{t}}$. Then Nullity$(D) =$ ________. And Rank$(D) =$ ________.

The trn $U{:}\,\mathbf{V}\to\mathbf{V}$ by $U(\mathsf{M}) := \mathsf{M}^2$ is: Circle best

Linear Affine (but not linear) Not-affine

Q7: Fri. 18 Feb Let $\mathsf{T}{:}\mathbb{R}^2 ⟲$ rotate the plane CCW by 60°, then vertically stretch by a factor of 8. W.r.t the std basis,

$$[\![\mathsf{T}]\!]_{\mathcal{E}}^{\mathcal{E}} = \begin{bmatrix} \quad & \quad \\ \quad & \quad \end{bmatrix}.$$

Q8: Tue. 22 Feb Suppose $\mathsf{T}{:}\,\mathbf{V}\to\mathbf{W}$ is a VS-isomorphism between finite dim'al VSes. Subspace $\mathbf{V}_0 \subset \mathbf{V}$ has dimension m. Then $\mathrm{Dim}\Big(\mathsf{T}(\mathbf{V}_0)\Big) =$ ____________________.

Q9: Fri. 25 Feb Over field $\mathbb{Z}_7$, matrix $\mathsf{M} := \begin{bmatrix} 2 & 0 & 3 \\ 0 & 0 & -1 \\ 0 & -2 & 2 \end{bmatrix}$ has inverse

$$\mathsf{M}^{-1} = \begin{bmatrix} \quad & \quad & \quad \\ \quad & \quad & \quad \\ \quad & \quad & \quad \end{bmatrix}.$$

[Write your answer using *symmetric* residues.]

QA: Tue. 01 Mar $\mathrm{Det}(\mathsf{A})=$ ________ *and* $\mathrm{Det}(\mathsf{B})=$ ________, for $\mathbb{Q}$-matrices

$$\mathsf{A} := \begin{bmatrix} 19 & 22 & 7 \\ 0 & 8 & 0 \\ 0 & 9 & 0 \end{bmatrix} \quad \textit{and} \quad \mathsf{B} := \begin{bmatrix} 0 & 11 & 0 \\ 12 & 2 & 7 \\ 0 & 3 & 0 \end{bmatrix}.$$

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

Over field $\mathbb{Z}_{11}$, matrix $C := \begin{bmatrix} 0 & 0 & \mathbf{-2} \\ 0 & \mathbf{3} & 0 \\ \mathbf{4} & \mathbf{-2} & \mathbf{-3} \end{bmatrix}$ has inverse

$$C^{-1} = \begin{bmatrix} \_\_\_ & \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ & \_\_\_ \end{bmatrix}.$$

[Write your answer using *symmetric* residues.]

QC: Tue. 29 Mar For matrix $A := \begin{bmatrix} -5 & 2 \\ 0 & -4 \end{bmatrix}$, the *e*Val corresponding to $\begin{bmatrix} 2 \\ 1 \end{bmatrix}$ is ....

QD: Tue. 12 Apr Let $A := \begin{bmatrix} 1+\mathbf{i} & 3+4\mathbf{i} & 7 \\ 1+2\mathbf{i} & 5\mathbf{i} & 2+\mathbf{i} \end{bmatrix}$. Then A^* is a ...... × ...... matrix. In order, the entries in the top row of A^* are ....

QE: Tue. 19 Apr Let $A := \begin{bmatrix} \mathbf{i} & \mathbf{i} \\ \mathbf{i} & -\mathbf{i} \end{bmatrix}$. Compute A^*, as well as products AA^* and A^*A, to conclude that A is *normal*, that is, that A commutes with its adjoint.