Plex
MAA4402 **Quizzes P** Tuesday 03Jan2017
MAA5404

Number Sets. An expression such as $k \in \mathbb{N}$ (read as "k is an element of $\mathbb{N}$" or "k in $\mathbb{N}$") means that k is a natural number; a ***natnum***.

$\mathbb{N}$ = 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 ***ratnums*** and $\mathbb{Q}_-$ for the negative ratnums.

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

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

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

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

Mathematical objects. Seq: '*sequence*'. poly(s): '*polynomial(s)*'. irred: '*irreducible*'. Coeff: '*coefficient*' and var(s): '*variable(s)*' and parm(s): '*parameter(s)*'. Expr.: '*expression*'. CoI: '*Constant of Integration*'. LoI: '*Limit(s) of Integration*'.

Fnc: '*function*' (so ratfnc: means rational function, a ratio of polynomials). cty: '*continuity*'. cts: '*continuous*'. diff'able: '*differentiable*'.

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*'. CoV: '*Change-of-Variable*'.

Phrases. WLOG: '*Without loss of generality*'. TFAE: '*The following are equivalent*'. ITOf: '*In Terms Of*'. OTForm: '*of the form*'. FTSOC: '*For the sake of contradiction*'. Use iff: '*if and only if*'.

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*'. QED: *quod erat demonstrandum*, meaning "end of proof".

Plex notation. Let **SCC** mean "positively oriented simple-closed-contour". For a SCC C, have $\mathring{C}$ be the (open) region C encloses, and let $\widehat{C}$ mean C together with $\mathring{C}$. So $\widehat{C}$ is $C \cup \mathring{C}$; it is automatically simply-connected and is a closed bounded set.

Plex [2017g] quizzes so far...

P1: Wed. 11 Jan Blanks$\in\mathbb{R}$. So $\frac{1}{2+3i} =$ ______ $+ i \cdot$ [______].

Thus $\dfrac{5 - i}{2 + 3i} =$ ______ $+ i \cdot$ [______].

For z complex, $\mathrm{Im}(z) = \mathrm{Formula}(z, \overline{z}) =$ ______.

P2: Wed. 18 Jan Suppose $[C + Di]^2 = -4i$, where $C, D \in \mathbb{R}$. Then

$C =$ ______ and $D =$ ______.

On a set Ω, a ***metric*** is a map $\mathsf{d}: \Omega \to [0, \infty)$ such that $\forall\, w, x, y, z \in \Omega$:

MS1: ______.

MS2: ______.

MS3: ______.

P3: Fri. 03 Feb Blanks$\in\mathbb{R}$. So $\frac{1}{4-3i} =$ ______ $+ i \cdot$ [______].

P4: Fri. 17 Feb Consider fnc $u: \mathbb{R}\times\mathbb{R} \to \mathbb{R}$ by $u(x, y) := 8x + \cos(y \cdot x)$. Its Laplacian is $[\Delta(u)](x, y) =$ ______.

There exists function $v: \mathbb{R}\times\mathbb{R} \to \mathbb{R}$ such that $f(x + iy) := u(x, y) + iv(x, y)$ is holomorphic. *T F*

PBonus: Fri. 03 Mar Let C be SCC $\mathrm{Sph}_7(0)$, a circle of radius 7. Then

$$\oint_C \frac{\cos(2z)}{[z-5]^4}\,dz = \underline{\hspace{6cm}}$$

[Ans may be written as a product, using powers and factorials.]

P5: Mon. 13 Mar Writing $x + \boldsymbol{i}y :=$ [P.V of $\boldsymbol{i}^{[1+\boldsymbol{i}]}$] with $x,y \in \mathbb{R}$, then $x=$ ________ and $y=$ ________.

P6: Fri. 14 Apr For a SCC C, suppose fncs analytic on $\widehat{\mathsf{C}}$ satisfy that $|f(z)| \geqslant |g(z)|$ for every $z \in \mathsf{C}$. If $f+g$ has fewer zeros in $\mathring{\mathsf{C}}$ than f does, then there must exist a point $w \in \mathsf{C}$ such that ________________.

P7: Mon. 17 Apr Let $f(z) := z^5 + 3z^4 + 6$, and $\mathsf{C}_r := \mathrm{Sph}_r(0)$. Our f

has ________ zeros inside C_1, and ________ zeros inside C_2.

Games Party!