Staple!

Ord: ___ ___

Plex
MAA4402 2838

Class-A

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Notation. All sets are subsets of $\mathbb{C}$.
For sets B and E, the difference set is

$$B \setminus E \quad := \quad \left\{ x \in B \;\middle|\; x \notin E \right\}.$$

The complement of E is $E^c := \mathbb{C} \setminus E$.

A1: Short answer. Show no work.
Write **DNE** in a blank if the described object does not exist or if the indicated operation cannot be performed.

___ a Prof. King wears bifocals, and cannot read small handwriting. Circle one: **True!** **Yes!** ***Who??***

___ b A subset $S \subset \mathbb{C}$ is ***path-connected*** if

.....

.....

.....

___ c Complex number $[x + \boldsymbol{i}y]^2 = -9\boldsymbol{i}$, for *real numbers*

$x=$ ..... and $y=$ ..... .

___ d Note $[1+\boldsymbol{i}]^{166} =$ [.....] $+ \boldsymbol{i}\cdot$ [.....].

[*Hint: Multiplying complexes multiplies their moduli, and adds their angles.*]

___ e All these sets are non-empty: Sets U and V are open. Sets K, E and E_n are closed. Sets S and T are each connected, i.e path-connected.

Set $U \setminus K$ is open:	*AT*	*AF*	*Nei*
Set $U \cup K$ is open:	*AT*	*AF*	*Nei*
Set $E \cap K$ is closed:	*AT*	*AF*	*Nei*
Union $\bigcup_{n=1}^{\infty} E_n$ is closed:	*AT*	*AF*	*Nei*
$\exists q \in [S \cap T]$; so $S \cup T$ is connected:	*AT*	*AF*	*Nei*

___ f

The empty-set is connected:	*T*	*F*
Punctured ball $\mathrm{PBal}_2(3\boldsymbol{i})$ *is connected:*	*T*	*F*
$\mathrm{Sph}_2(5\boldsymbol{i}) \cap \mathrm{Sph}_2(\boldsymbol{i})$ *is connected:*	*T*	*F*
$\mathrm{Sph}_2(4\boldsymbol{i}) \cup \mathrm{Sph}_2(-\boldsymbol{i})$ *is connected:*	*T*	*F*
$\mathrm{Sph}_2(5\boldsymbol{i}) \cup \mathrm{CldBal}_2(\boldsymbol{i})$ *is closed:*	*T*	*F*

g Let $S := \mathrm{PBal}_2(3\boldsymbol{i})$.
Its boundary
is $\partial(S) =$ ..... .
[You may use our ball/sphere notation as well as $\cup$, $\cap$, complement and set-braces, to describe your answer.]

A2: We've written $h(x+\boldsymbol{i}y) = u(x,y) + \boldsymbol{i}v(x,y)$, giving names to the real and imaginary parts of h.

i Suppose h is differentiable at the point $3+2\boldsymbol{i}$. Carefully *state* the Cauchy-Riemann eqns for h at $3+2\boldsymbol{i}$.

ii Suppose h is differentiable at a point $z \in \mathbb{C}$. Carefully *derive* the Cauchy-Riemann eqns, directly from the defn of "differentiable".

A1:	___ ___ ___	185pts
A2:	___ ___	50pts
Total:	___ ___ ___	235pts