

Math 120A  
August 9, 2023

**Question 1** Stereographic projection is a one-to-one correspondence between

- A.  $\mathbb{C}$ , the complex plane and  $S \setminus \{(0, 0, 1)\}$ , the unit sphere minus the north pole.
- B.  $\mathbb{C}^* = \mathbb{C} \cup \{\infty\}$ , the extended complex plane and  $S$ , the unit sphere.
- C.  $\mathbb{R}^3$ , 3-dimensional space and  $\mathbb{C}^2 = \{(z, w) \mid z, w \in \mathbb{C}\}$ , the set of ordered pairs of complex numbers.
- \*D. **A and B**
- E. **A, B, and C**

**Question 2** Given  $z \in \mathbb{C}$ , it's argument  $\arg(z)$  is

- A. the angle it makes with the positive real axis, with counterclockwise the positive orientation.
- B. the set of real numbers  $t$  for which  $z = |z|e^{it}$ .
- C. the imaginary part of  $\log(z)$ , the logarithm of  $z$ .
- \*D. **B** and **C**.
- E. **A**, **B**, and **C**.

**Question 3**  $\text{Log}(z)$  is

- A. the principal branch of  $\log(z)$ .
- B. equal to  $\log |z| + i\text{Arg}(z)$ , where  $\text{Arg}(z)$  is the principal branch of  $\arg(z)$ .
- C. a set-valued (multivalued) function because  $\text{Arg}(z)$  is a set-valued (multivalued) function.
- \*D. **A** and **B**
- E. **A**, **B**, and **C**.

**Question 4** Why does  $\log(z)$  have branches?

- A.  $e^z$  is periodic.
- B. You have to restrict the domain of  $e^z$  to obtain an invertible function.
- C. There are many choices for a restricted domain on which  $e^z$  is invertible.
- D. Because logs come from trees and trees have branches.
- \*E. **A, B, and C.**

**Question 5** Given  $z \in \mathbb{C}$  with  $|z| = 1$ . Then,

- A.  $z = e^{i\phi}$  for some real number  $\phi$ .
- B.  $\frac{1}{z} = \bar{z}$
- C.  $|\operatorname{Re}(z) + \operatorname{Im}(z)| \leq 1$ .
- \*D. **A** and **B**.
- E. **B** and **C**.