Math 120A
August 4, 2022

Question 1 Let z be a complex number. Then,

A. $\mathrm{Re}(z) = \dfrac{z + \bar{z}}{2}$, which is a real number.

B. $\mathrm{Im}(z) = \dfrac{z - \bar{z}}{2}$, which is a purely imaginary number.

C. $\mathrm{Im}(z) = \dfrac{z - \bar{z}}{2i}$, which is a real number.

D. **A** and **B**

*E. **A** and **C**

Question 2 Let n be a positive integer. An n^{th} root of unity is a complex number z with the property that $z^n = 1$. Thus,

A. 1 is an n^{th} root of unity, and there are $n-1$ additional distinct n^{th} roots of unity.

B. if w is an n^{th} root of unity, then $w = e^{\frac{2\pi i k}{n}}$ for some integer $k \in \{0, 1, \ldots, n-1\}$.

C. i is an n^{th} root of unity for all even integers n. For example, $i^4 = 1$ so i is a 4^{th} root of unity.

D. **B** and **C**

*E. **A** and **B**

Question 3 Let n be a positive integer with $n \geq 2$, and let z be a nonzero complex number. Then,

*A. $z^{\frac{1}{n}}$ has n distinct values.

B. $z^{\frac{1}{n}}$ is single-valued.

C. $z^{\frac{1}{n}} \cdot z^{-\frac{1}{n}} = 1$.

D. **A** and **C**

E. **B** and **C**

Question 4 The real-valued hyperbolic functions $\cosh(x)$ and $\sinh(x)$ are not periodic but satisfy the hyperbolic identity $\cosh^2(x) - \sinh^2(x) = 1$. When extended to the complex numbers, $\cosh(z)$ and $\sinh(z)$

A. satisfy the hyperbolic identity $\cosh^2(z) - \sinh^2(z) = 1$.

B. are still not periodic; after all, they're still hyperbolic.

C. are periodic with period $2\pi i$, just like the exponential function.

D. **A** and **B**

*E. **A** and **C**