Quiz 1

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1. By a *branch of the argument* we mean
→*A*. specifying a particular range for the angle.
B. allowing the addition of 2π to the angle.
C. allowing any value for the angle.
D. All of the above.
E. None of the above.

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2. If z_1, z_2 are nonzero complex numbers then
A. $\arg(z_1 + z_2) = \arg(z_1) + \arg(z_2)$.
B. $\arg(z_1 z_2) = \arg(z_1)\arg(z_2)$.
C. $\arg(z_1 z_2) = \arg(z_1) + \arg(z_2)$.
D. All of the above.
→*E*. None of the above.

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3. If z_1, z_2 are complex numbers then
A. $\overline{z_1 + z_2} = \overline{z_1} + \overline{z_2}$.
B. $\overline{z_1 z_2} = \overline{z_1} \cdot \overline{z_2}$.
C. $z_1 \overline{z_1} = |z_1|^2$.
→*D*. All of the above.
E. None of the above.

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4. If z_1, z_2 are complex numbers then
A. $|z_1 + z_2| \leq |z_1| + |z_2|$.
B. $|z_1 - z_2| \geq ||z_1| - |z_2||$.
C. $-|z_1| \leq \mathrm{Re}(z_1) \leq |z_1|$.
→*D*. All of the above.
E. None of the above.

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5. De Moivre's Theorem says that if z is a complex number and n is a positive integer then
→*A*. $|z^n| = |z|^n$ and $\arg(z^n) = n\arg(z) \bmod 2\pi$.
B. $|z^n| = n\,|z|$ and $\arg(z^n) = \arg(z)^n \bmod 2\pi$.
C. $|z^n| = |z|$ and $\arg(z^n) = \arg(z) \bmod 2\pi$.
D. All of the above.
E. None of the above.

Quiz 2

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1. A function $f\colon A \to \mathbb{C}$ is *uniformly continuous* on A if

$\rightarrow A$. for every $\epsilon > 0$ there is a $\delta > 0$ such that $|f(s) - f(t)| < \epsilon$ whenever $s, t \in A$ and $|s - t| < \delta$.

B. for every $s \in A$ and $\epsilon > 0$ there is a $\delta > 0$ such that $|f(s) - f(t)| < \epsilon$ whenever $t \in A$ and $|s - t| < \delta$.

C. for every $\epsilon > 0$ there is a $\delta > 0$ such that $|f(s) - f(t)| < \epsilon$ implies $s, t \in A$ and $|s - t| < \delta$.

D. All of the above.

E. None of the above.

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2. If K is compact then

A. every open cover of K has a finite subcover.

B. every sequence in K has a subsequence that converges to a point in K.

C. K is closed and bounded.

$\rightarrow D$. All of the above.

E. None of the above.

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3. If f is continuous on the closed unit disk U then

A. f is uniformly continuous on U.

B. $|f(z)|$ attains a maximum value somewhere on U.

C. the image of U is connected.

$\rightarrow D$. All of the above.

E. None of the above.

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4. If $\gamma\colon [a, b] \to \mathbb{C}$ is a smooth path then $-\gamma$ denotes the path defined by the formula

A. $-\gamma(t)$.

B. $\gamma(-t)$.

C. $-\gamma(-t)$.

D. All of the above.

$\rightarrow E$. None of the above.

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5. If $\gamma(t) = e^{it}$ for $t \in [0, 2\pi]$ then $\int_\gamma |dz|$ equals

A. 1.

$\rightarrow B$. 2π.

C. 0.

D. All of the above.

E. None of the above.

Quiz 3

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1. Suppose f is analytic on a region G, and γ is a piecewise smooth, closed path in G. Under what conditions is $\int_\gamma f = 0$?

A. γ is homotopic to a point in G.
B. f has an antiderivative in G.
C. γ lies in a disk that is contained in G.
$\rightarrow D$. All of the above.
E. None of the above.

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2. Suppose f defined on a disk $D_r(z_0)$ and analytic and on the deleted disk. Under what conditions is f also analytic at z_0?

A. f is bounded on the disk.
B. f is continuous on the disk.
C. $\lim_{z\to z_0} f(z)(z-z_0) = 0$.
$\rightarrow D$. All of the above.
E. None of the above.

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3. Suppose γ is a closed path in some deleted disk around a point z_0. Under what conditions is $I(\gamma, z_0) = 0$?

A. γ is homotopic to a point in the undeleted disk.
$\rightarrow B$. γ is homotopic to a point in the deleted disk.
C. γ is homotopic to a point in $\mathbb{C}$.
D. All of the above.
E. None of the above.

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4. Suppose f is analytic in a region G. Which of the following is true?

A. For every piecewise smooth, closed curve in G, $\int_\gamma f = 0$.
B. f has an antiderivative in G.
$\rightarrow C$. f' is continuous in G.
D. All of the above.
E. None of the above.

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5. Suppose f is continuous in a region G and that $\int_\gamma f = 0$ for every piecewise smooth, closed path in G. Which of the following is true?

A. Path integrals of f in G depend only on the endpoints.
B. f has an antiderivative in G.
C. f is analytic in G.
$\rightarrow D$. All of the above.
E. None of the above.

Quiz 4

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1. If $\sum a_n z^n$ converges at a point z_1 then the series

$\rightarrow A$. converges at every z such that $|z| < |z_1|$.

B. converges uniformly on the closed disk $\{z \mid |z| \leq |z_1|\}$.

C. diverges at every z such that $|z| > |z_1|$.

D. All of the above.

E. None of the above.

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2. If $f_n(z)$ are analytic on a region A and $f_n \to f$ uniformly on every compact K in A then

A. f is uniformly continuous on every compact K in A.

B. f is analytic on A.

C. $f_n' \to f'$ uniformly on every compact K in A.

$\rightarrow D$. All of the above.

E. None of the above.

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3. If the partial sums of $\sum z_n$ form a Cauchy sequence then

A. the partial sums of $\sum |z_n|$ form a Cauchy sequence.

B. $\sum |z_n|$ converges.

$\rightarrow C$. $\sum z_n$ converges.

D. All of the above.

E. None of the above.

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4. If $\sum z_n$ is an absolutely convergent series then

A. the partial sums of $\sum |z_n|$ form a Cauchy sequence.

B. $\sum |z_n|$ converges.

C. $\sum z_n$ converges.

$\rightarrow D$. All of the above.

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5. Which of the following, if it exists, is the radius of convergence for $\sum a_n z^n$?

A. $\lim_{n\to\infty} |a_{n+1}| \,/\, |a_n|$.

$\rightarrow B$. $\lim_{n\to\infty} |a_n| \,/\, |a_{n+1}|$.

C. $\lim_{n\to\infty} \sqrt[n]{|a_n|}$.

D. All of the above.

E. None of the above.

Quiz 5

1. Suppose f is analytic on the disk $D_r(z_0)$. Consider the power series for f at z_0. Which of the following is true?

A. The radius of convergence is exactly r.
B. The radius of convergence is at most r.
$\rightarrow C$. The radius of convergence is at least r.
D. None of the above.

2. Suppose z_0 is an isolated singularity for f, and $\lim_{z\to z_0}(z-z_0)f(z)=0$. Which of the following is true?

$\rightarrow A$. z_0 is a removable singularity.
B. z_0 is a simple pole.
C. z_0 is a pole, but not necessarily simple.
D. None of the above.

3. Suppose z_0 is an isolated singularity for f, and $\lim_{z\to z_0}(z-z_0)f(z)=L\neq 0$. Which of the following is true?

A. z_0 is a removable singularity.
$\rightarrow B$. z_0 is a simple pole, and L is the residue.
C. z_0 is a pole, but not necessarily simple.
D. None of the above.

4. Suppose z_0 is an isolated singularity for f, and $\lim_{z\to z_0} f(z)=\infty$. Which of the following is true?

A. z_0 is an essential singularity.
B. z_0 is a simple pole.
$\rightarrow C$. z_0 is a pole, but not necessarily simple.
D. None of the above.

5. What are we saying about the singularities of f when we say that f is meromorphic in a region A?

A. All are isolated and removable.
B. All are isolated and at worst simple poles.
$\rightarrow C$. All are isolated and none are essential.
D. None of the above.

Quiz 6

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1. If f is a conformal map then
$\rightarrow A$. f preserves (oriented) angles.
B. f maps circles and lines to circles and lines.
C. f preserves cross ratios.
D. All of the above.
E. None of the above.

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2. If f is a linear fractional transformation then
A. f preserves (oriented) angles.
B. f maps circles and lines to circles and lines.
C. f preserves cross ratios.
$\rightarrow D$. All of the above.
E. None of the above.

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3. True or false: If C_1 and C_2 are circles then there is a linear fractional transformation that maps C_1 onto C_2.
$\rightarrow A$. True.
B. False.

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4. True or False: If G is a simply connected region in the plane and $G \neq \mathbb{C}$ then there is a conformal equivalence of G onto the unit disk.
$\rightarrow A$. True.
B. False.

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5. True or False: If T is a bijective analytic map from the unit disk to itself, then T is a linear fractional transformation.
$\rightarrow A$. True.
B. False.

Quiz 7

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1. True or False: If f can be analytically continued in a region A along any two paths from z_0 to z_1 then the radius of convergence of the power series at z_1 is always the same, no matter what continuation is used.

$\rightarrow A$. True.

B. False.

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2. True or False: If f can be analytically continued in a region A along any two paths from z_0 to z_1 then the value of the function so defined at z_1 is always the same, no matter what continuation is used.

A. True.

$\rightarrow B$. False.

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3. True or False: If f and g are analytic on A and B, respectively, and if f and g agree on $A \cap B$, then there is an analytic function on $A \cup B$ which agrees with f on A and g on B.

$\rightarrow A$. True.

B. False.

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4. True or False: If A is simply connected, if f is analytic on a neighborhood of z_0 in A, and if f can be analytically continued to any other point of A, then analytic continuation defines an unambiguous function which is analytic on all of A.

$\rightarrow A$. True.

B. False.

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5. True or False: If a power series based at z_0 has a finite radius of convergence R then there is a point z_1 at distance R from z_0 to which the function defined by the power series cannot be analytically continued.

$\rightarrow A$. True.

B. False.