(1) (30 Points) Compute the following:
(a) Arg(11 − 11i)
(b) Log(11 − 11i)
(c) The principle branch of $i^i$
(d) $\int_C z^7 \, dx$ where $C$ is the curve $z(t) = 1 + ti$ with $0 \leq t \leq 1$ and simplify your answer.
(e) $\int_{|z|=3} \frac{e^z \cos(z)}{z} \, dz$
(f) $\int_{|z|=7} \frac{z^3 e^z}{z + 1} \, dz$
(g) \[ \int_{|z-i|=1/2} \frac{z^3}{z^2 + 1} \, dz \]

(h) \[ \int_{|z|=2} (-y \, dx + x \, dy) \]

(2) (10 points) Define the following

(a) \( D \) is a domain.

(b) \( D \) is a simply connected domain.

(c) \( C \) is a closed curve.

(d) \( C \) is a simple closed curve.

(e) \( \text{Arg}(z) \) where \( z \neq 0 \).
(3) (15 points)
(a) State Green’s theorem.

(b) State the Cauchy-Riemann equations.

(c) Use Green’s Theorem and the Cauchy-Riemann equations to show that if $D$ is a bounded domain with nice boundary, and $f(z)$ is a function analytic in $D$ and continuous on $D \cup \partial D$ that

$$\int_{\partial D} f(z) \, dz = 0.$$
(4) (15 points)
(a) State the Cauchy Integral Formula.

(b) Prove the Cauchy Integral Formula.
(5) (10 Points)
(a) Define antiderivative.

(b) Let $D$ be the disk $\{ z : |z - 3| < 4 \}$. Explain why the function $f(z) = e^{z^2} \cos(z^3)$ has an antiderivative in $D$. (This should not involved much more than quoting a theorem and saying why its hypothesis hold.)
(6) (10 points) Let $D$ be the disk $\{z : |z| < 1\}$. Explain why there is an analytic function $h(z)$ with $h(z)^2 = 6 + z^3$.

(7) (10 points) Explain why the function analytic function $f(z) = \frac{1}{z - 1}$ does not have an antiderivative in the domain $D = \{z : 1/3 < |z - 1| < 4\}$. (This should involve using some English.)