Math 120A
August 12, 2019
**Question 1**  Let $f(z) = e^z$ and $g(z) = z^{\frac{1}{4}}$.

A. $f(z)$ is single-valued, but $g(z)$ is multiple-valued.

B. $f\left(\frac{1}{4}\right) = g(e)$ since they are both equal to $e^{\frac{1}{4}}$.

C. $g(e) = \left\{ e^{\frac{1}{4}+i\frac{\pi}{2}k}, \; k = 0, 1, 2, 3 \right\}$.

D. B and C

*E. A and C
Question 2  A function $f(x, y) = (u(x, y), v(x, y))$ is complex differentiable at $z_0 = (x_0, y_0)$ if and only if

A. $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$ and $\frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$ at $(x_0, y_0)$.

B. $\frac{\partial}{\partial x} (u + iv) = \frac{1}{i} \frac{\partial}{\partial y} (u + iv)$ at $(x_0, y_0)$.

C. $\lim_{\Delta z \to 0} \frac{f(z_0 + \Delta z) - f(z)}{\Delta z}$ converges.

D. A and C.

*E. A, B, and C.

Note: B follows from A.
Question 3  The power function $z^\alpha$ is single-valued

A. for every real number $\alpha$.

B. for every rational number $\alpha$.

*C. for every integer $\alpha$.

D. All of the above; after all, every rational number is a real number and every integer is a rational number.

E. None of the above; $z^\alpha$ is always multiple-valued.