EXPLAIN EVERY ANSWER!

1. Use the different functions $f(x) = 3^{(x^2)}$ and $g(x) = (3^x)^2$ for all parts of this quiz.

a. *(4 points)*. Write $f(x)$ and $g(x)$ as the composition of two functions of your choosing, p and q, such that $f = p \circ q$ and $g = q \circ p$. **Confirm** that your choice for p and q satisfy the confition that $q(p(x)) = g(x)$ and $p(q(x)) = f(x)$.

$f(x) = 3^{(x^2)} = p(q(x))$ where $p(u) = 3^u$, $u = x^2 = q(x)$

$(p \circ q)(x) = 3^{q(x)} = 3^{(x^2)}$

$g(x) = (3^x)^2 = q(p(x)) = q(3^x) = (3^x)^2$

b. *(4 points)*. **Find** the derivatives $f'(x)$ and $g'(x)$.

$[3^{(x^2)}]' = f'(x) = 3^{x^2} \cdot \ln 3 \cdot 2x = p'(q(x)) \cdot q'(x)$

$[(3^x)^2]' = g'(x) = 2 \cdot 3^x \cdot \ln 3 \cdot 3^x = q'(p(x)) \cdot p'(x)$

$p'(\heartsuit) = 3^{\heartsuit} \ln 3.$

$q'(\square) = 2\square$

c. *(2 points)*. **Evaluate** $f'(1)$ and $g'(1)$.

$f'(1) = 3^1 \cdot \ln 3 \cdot 2 = 6 \ln 3$

$g'(1) = 2 \cdot 3^1 \cdot \ln 3 \cdot 3 = 18 \ln 3$

$f'(1) \neq g'(1)$