1. Define the Taylor series of the function $f(x)$ at the point $c$.

   **Proof.** The Taylor series is the following:
   \[
   \sum_{n=0}^{\infty} \frac{f^{(n)}(c)}{n!} (x - c)^n
   \]

2. State the binomial theorem (make sure your definition is precise).

   **Proof.** The binomial theorem is the following:
   \[
   (1 + x)^k = \sum_{n=0}^{\infty} \binom{k}{n} x^n
   \]
   where:
   \[
   \binom{k}{0} = 0 \quad \text{and} \quad \binom{k}{n} = \frac{k(k-1)(k-2)...(k-n+1)}{n!}
   \]

3. Find the McLaurin series of $f(x) = \frac{x^2}{\sqrt{1 + x^3}}$ and use it to find $f^{(14)}(0)$.

   **Proof.** We use the binomial theorem to find the McLaurin series:
   \[
   \frac{x^2}{\sqrt{1 + x^3}} = x^2 \frac{1}{\sqrt{1 + x^3}} = x^2 \sum_{n=0}^{\infty} \binom{\frac{1}{2}}{n} x^{3n+2}
   \]
   Now, we find $f^{(14)}(0)$. Note that the series expands to the following:
   \[
   \left( \frac{1}{2} \right) x^2 + \left( \frac{1}{2} \right) x^5 + \left( \frac{1}{2} \right) x^8 + \left( \frac{1}{2} \right) x^{11} + \left( \frac{3}{4} \right) x^{14} + \left( \frac{1}{2} \right) x^{17} + ...
   \]
   If we take derivative of this function 14 times, the first four terms will become zero and so we get:
   \[
   f^{(14)}(x) = 14! \left( \frac{1}{4} \right) x^3 + ...
   \]
   Finally:
   \[
   f^{(14)}(0) = 14! \left( \frac{1}{4} \right) = 14! \frac{1}{4!} \frac{1}{4!} (\frac{1}{2})(\frac{3}{2})(\frac{5}{2}) = -\frac{14! \cdot 15}{16 \cdot 4!} = -\frac{15!}{16 \cdot 4!}
   \]