PRODUCT RULE AND QUOTIENT RULE

Differentiate. Use proper notation and simplify your final answers. In some cases it might be advantageous to simplify/rewrite first. Do not use rules found in later sections.

1. \( f(x) = (1 + \sqrt{x})(x^3) \)  
2. \( g(t) = \left( \frac{2}{t} + t^5 \right) (t^3 + 1) \)

3. \( h(y) = \frac{1}{y^3 + 2y + 1} \)  
4. \( y = \frac{1}{x + \sqrt{x}} \)

5. \( y = 2^x e^x \)  
6. \( g(z) = \frac{z^2 + 1}{z^3 - 5} \)

7. \( y = \frac{\sqrt{x}}{x^3 + 1} \)  
8. \( z = \frac{t^2}{(t-4)(2-t^3)} \)
9. \[ h(x) = \frac{(x^3 + 1)\sqrt{x}}{x^2} \]

10. \[ y(m) = \frac{(e^m)(\sqrt[3]{m})}{m^2 + 3} \]

11. \[ g(x) = (x + \sqrt{x})(3^x) \]

12. Let \( f(x) = g(x)h(x) \), \( g(10) = -4 \), \( h(10) = 560 \), \( g'(10) = 0 \), and \( h'(10) = 35 \). Find \( f'(10) \).

13. Let \( y(x) = \frac{z(x)}{1 + x^2} \), \( z(-3) = 6 \), and \( z'(-3) = 15 \). Find \( y'(-3) \).