Problem 1. Section 3.9 #332

This is the quotient rule and exponential differentiation: $f'(x) = \frac{x\frac{\mathrm{d}}{\mathrm{dx}}e^{-x} - e^{-x}\frac{\mathrm{d}}{\mathrm{dx}}x}{x^2} = \frac{-xe^{-x} - e^{-x}}{x^2}$.

Problem 2. Section 3.9 #336

This is the constant multiple rule and equation 3.34 in the book: $f'(x) = \frac{1}{\ln 10}\frac{\mathrm{d}}{\mathrm{dx}}10^x = \frac{1}{\ln 10}10^x \ln 10 = 10^x$.

Problem 3. Section 3.9 #338

This is just Equation 3.35 in the book: $f'(x) = 3^{\sin(3x)}(\ln 3)\frac{d^2}{dx^2}(\sin(3x))$. So we need to compute the second derivative of $\sin(3x)$ using the chain rule. The first derivative is $3\cos(3x)$, so the second derivative is $-9\sin(3x)$. Thus we have $f'(x) = 3^{\sin(3x)}(\ln 3)(-9\sin(3x))$.

Problem 4. Section 3.9 #340

This is the chain rule, to get that $f'(x) = \frac{1}{4x^3+x}(12x^2+1)$.

Problem 5. Section 3.9 #344

A log property tells us that $f(x) = 5\log_7(6x^4+3)$. Chain rule then gives us that $f'(x) = 5(\frac{24x^3}{(6x^4+3)\ln 7})$.