1. Consider the following twelve functions:

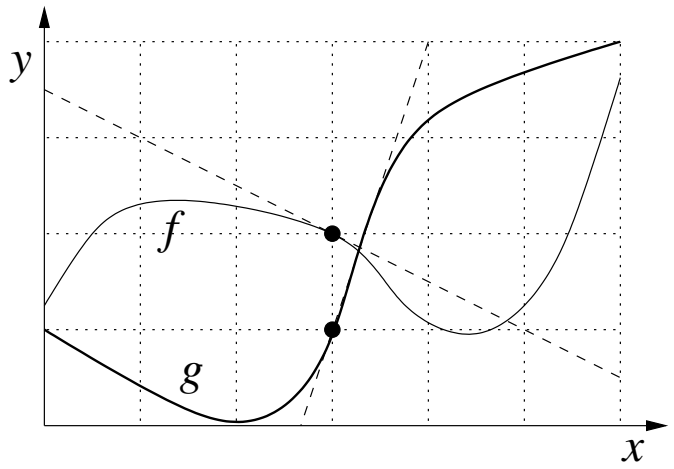
$$f_1(x) = \frac{85}{x^{84} - 7x^{27}} \qquad g_1(x) = \frac{xe^x + 3x}{x^5 - 13}$$
$$f_2(x) = (x^\pi - 17x^3)(18e^x - 23) \qquad g_2(x) = (\sqrt[3]{x} + e^x)(7e^x - 5\sqrt{x})$$
$$f_3(x) = \frac{x^3 + 3x + 7}{e^x - 6} \qquad g_3(x) = x^2 e^x$$
$$f_4(x) = \frac{e^x}{x^3} + \frac{x^3}{e^x} \qquad g_4(x) = x^6 e^{2x}$$
$$f_5(x) = xe^{x^2} \qquad g_5(x) = \frac{5x^2 + 3}{7x^3 - 2}$$
$$f_6(x) = (13\sqrt{x} + 7)^2 \qquad g_6(x) = \sqrt{x^2 + 7}$$

It turns out that you can compute the derivatives of ten of these functions using our rules to date (power, e^x, sum, difference, constant multiple, product, quotient), possibly along with some algebra, and that you can't compute the other two without rules we haven't seen yet.

(a) Identify the two you can't compute yet, and explain why our current list of rules isn't enough to compute them.

(b) Compute the other ten derivatives. **DO NOT SIMPLIFY** your answers.

2. Suppose f and g are functions whose graph is shown below, with the indicated tangent lines at $x = 3$.



(a) Let $h_1(x) = \dfrac{f(x)+7}{g(x)}$. Find $h_1'(x)$.

(b) Let $h_2(x) = (f(x)+7)(g(x)+x)$. Find $h_2'(x)$.

(c) Let $h_3(x) = \dfrac{x^2 f(x)}{g(x)}$. Find $h_3'(x)$.

(d) Let $h_4(x) = \dfrac{7}{2f(x)+5xg(x)}$. Find $h_4'(x)$.