Problem 1. Find the derivative $\left(ie\ \dfrac{df}{dx}\right)$ for the following:

(1) $f(x) = 2x^5 + 3\sqrt[3]{x^{10}} + 6e^x - 7^x - 5\ln(x) + \log_3(x) + 4\pi x + 3e$

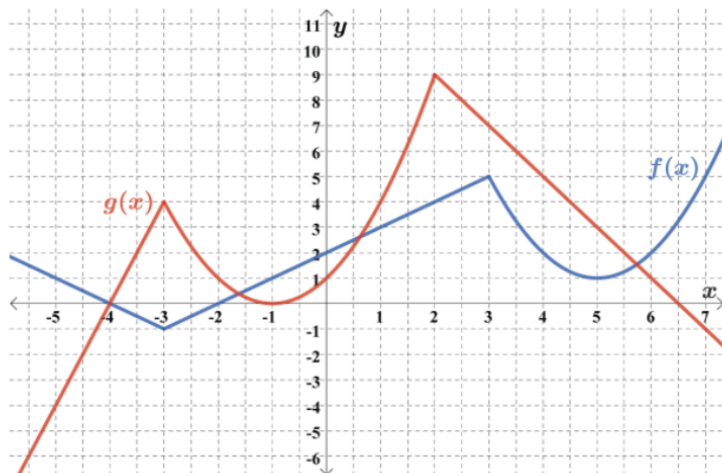(2) $f(x) = \left(\dfrac{7}{x^2} - 4x^3\right)(3x^2 - 5x)$

(3) $f(x) = \dfrac{x^3 + 5x^2 + 7x + \sqrt[5]{x^2}}{3x}$

Problem 2. Find the derivative of $f(x) = (2x^2 + 4x + 11)(2^x + 7 - 3x^7)$. Do not simplify your answer.

Problem 3. Find the derivative of $f(x) = \dfrac{10x^5 - 3x^2 + 4e^x}{4x^4 - \sqrt{x^3} - 2\ln x}$. Do not simplify your answer.

Problem 4. The graphs of f and g are given below. Use the graphs to answer the following:

(1) If $h(x) = 3e^x(f(x) - 4x^2)$, find $h'(5)$.

(2) If $k(x) = \dfrac{x^2 - \sqrt{x}}{2f(x) - g(x)}$ find $k'(-1)$.

Problem 5. Given that $f(3) = 2$, $g(3) = -5$, $f'(3) = 7$, $g'(3) = 9$, find $h'(3)$ for the following:

(1) $h(x) = 7f(x) - 3g(x)$

(2) $h(x) = 2f(x)g(x)$

(3) $h(x) = \dfrac{f(x)}{4 + g(x)}$

(4) $h(x) = \dfrac{3x^2 g(x)}{f(x)}$

Problem 6. Given $f(x) = \dfrac{x^2 + x - 4}{x - 3}$,

(1) For what value(s) of x does the graph of $f(x)$ have a horizontal tangent line?

(2) Find the equation of the tangent line to $f(x)$ at $x = 0$.

Problem 7. The monthly price demand equation for a set of high quality knives is given by $p = 876(0.9985)^x$ dollars, where x is the number of knife sets bought each month.

(1) Find the marginal revenue function.

(2) Find the marginal revenue at a production level of 800 kinfe sets. Interpret your answer.

(3) Approximate the revenue from selling the 500th knife set.

(4) Find the exact revenue from selling the 500th knife set.

Problem 8. Find the equation of the tangent line to the curve $y = e^x - x^2$ at $x = 1$.

Problem 9. Find the value(s) of x where the tangent line to the graph of $f(x) = 2x^5 - 30x^3 + e^2$ is horizontal.