Problem 1: Limits (6P) Determine whether the following limits exists. If a limit exists, determine its value. If you think that a limit does not exist, give a proof for your claim.

1. \( \lim_{x \to 1} \frac{(x-1)^\lambda}{x^2(x+2)} \)
2. \( \lim_{x \to 0} \frac{|\lambda x|}{x/\lambda} \)
3. \( \lim_{x \to \lambda^+} \sqrt{x-\lambda} \cdot e^{\sin(\pi/(x-\lambda))} + 2^\lambda \)

Problem 2: Tangent (6P) Consider the function

\[
f(x) := \left( \frac{1}{x} - 2 \right)^3 + \lambda^2 \cdot x - 2.
\]

Denote by \( P \) the point on the graph of \( f \) with \( x \)-coordinate equal to \( \lambda \). Compute the defining equation of the tangent to \( f \) in the point \( P \).

Problem 3: Continuous functions (4P) Determine all \( x \)-values where the following function is discontinuous:

\[
f(x) = \begin{cases} 
  x + 2 & \text{if } x < 0 \\
  e^x & \text{if } 0 \leq x \leq \lambda \\
  2 - x & \text{if } x > \lambda
\end{cases}
\]

Problem 4: Derivatives (4P) Determine the derivative \( f(x)' \) of the following functions \( f(x) \)—simplify your answer:

1. \( f(x) = \frac{x}{x+\lambda} \)
2. \( f(x) = x^{\lambda/\lambda} \)
3. \( f(x) = (\sin(\sqrt{x+\lambda}) - \cos(x-\lambda))^4 \)

Good luck & have fun!!!