1. Sketch the graph of the function in the provided grid and from its graph, determine at what \( x \) values is the function discontinuous, and what are the types of discontinuity?

\[
f(x) = \begin{cases} 
2, & x < 0 \\
2 - x, & 0 < x < 1 \\
x, & 1 \leq x \leq 2 \\
3, & 2 < x 
\end{cases}
\]

Removable discontinuity at \( x = 0 \).
Jump discontinuity at \( x = 2 \).
(Continuous everywhere else.)

2. Where is the function \( f(x) = \frac{\sin(x)}{x-3} + \frac{x-1}{x^2+9} \) continuous?

A combination of elementary functions, so is continuous on its domain. Domain is \( x \neq 3 \).
So \( f \) is continuous for all \( x \neq 3 \).
3. Using the definition of a derivative, for \( f(x) = x^2 \), find \( f'(3) \).

\[
\begin{align*}
f'(3) &= \lim_{h \to 0} \frac{f(3+h) - f(3)}{h} \\
&= \lim_{h \to 0} \frac{(3+h)^2 - 3^2}{h} \\
&= \lim_{h \to 0} \frac{9 + 6h + h^2 - 9}{h} \\
&= \lim_{h \to 0} \frac{6h + h^2}{h} \\
&= \lim_{h \to 0} \frac{h(6 + h)}{h} \\
&= \lim_{h \to 0} (6 + h) = 6 + 0 = 6
\end{align*}
\]

4. Using the definition of a derivative, for \( y = \frac{1}{x+2} \), find \( \frac{dy}{dx} \). \( f(x) = \frac{1}{x+2} \)

\[
\begin{align*}
\frac{dy}{dx} &= f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} \\
&= \lim_{h \to 0} \frac{1}{h} \left( \frac{1}{(x+h)+2} - \frac{1}{x+2} \right) \\
&= \lim_{h \to 0} \frac{\frac{x+2}{(x+h+2)(x+2)} - \frac{x+h+2}{(x+h+2)(x+2)}}{h} \\
&= \lim_{h \to 0} \frac{-(x+h+2)(x+2) - (x+2)(x+h+2)}{h(x+h+2)(x+2)} \\
&= \lim_{h \to 0} \frac{-1}{(x+h+2)(x+2)} \cdot \frac{1}{h} \\
&= \lim_{h \to 0} \frac{-1}{(x+0+2)(x+2)} = \frac{-1}{(x+2)^2}
\end{align*}
\]