1. f is not differentiable at $x = -2$ because $f'_-(-2) \nexists$.

   f is not differentiable at $x = 2$ because $f'_-(2) \neq f'_+(2) \therefore f'(2) \nexists$.

   f is not differentiable at $x = 5$ because $f'_-(5) \neq f'_+(5) \therefore f'(5) \nexists$.

   f is not differentiable at $x = 7$ because $f'_-(7) \neq f'_+(7) \therefore f'(7) \nexists$.

2. f is not differentiable at $x = 3$ because f is not continuous at $x = 3$.

   f is not differentiable at $x = 4$ because $f'_-(4) \neq f'_+(4) \therefore f'4) \nexists$.

   f is not differentiable at $x = 6$ because $f'_-(6) \neq f'_+(6) \therefore f'(6) \nexists$.

3. $f(x) = \begin{cases} x-6 & x \geq 6 \\ 6-x & x < 6 \end{cases}$

   $f'(x) = \begin{cases} 1 & x > 6 \\ -1 & x < 6 \end{cases}$

   Since $f'_-(6) = -1$ but $f'_+(6) = 1 \longrightarrow f'(6) \nexists \therefore f$ is not differentiable at $x = 6$.

4. f is not differentiable at any integer because f is not continuous at any integer.

5. <u>Continuity test at $x = 0$</u>

   $f(0) = 0$

   $\lim\limits_{x \to 0} f(x) = \lim\limits_{x \to 0} (x-1) = -1$

   Since $f(0) \neq \lim\limits_{x \to 0} f(x)$, f is not continuous at $x = 0$ and therefore f is not differentiable at $x = 0$.

   <u>Continuity test at $x = 1$</u>

   $f(1) = 0$

   $\lim\limits_{x \to 1^-} f(x) = 0$ and $\lim\limits_{x \to 1} f(x) = 0 \longrightarrow \lim\limits_{x \to 1} f(x) = 0$

   Since $f(1) = \lim\limits_{x \to 1} f(x)$, f is continuous at $x = 1$

   <u>Differentiability at $x = 1$</u>

   $f'(x) = \begin{cases} 1 & x < 1 \text{ and } x \neq 0 \\ 0 & x = 0 \\ -1 & x > 1 \end{cases}$

   Since $f'_-(1) = 1$ but $f'_+(1) = -1 \longrightarrow f'(1) \nexists \therefore f$ is not differentiable at $x = 1$.

6. $f'(x) = \begin{cases} 2x & x < 0 \\ 1 & x > 0 \end{cases}$

Since $f'_-(0) = 0$ but $f'_+(0) = 1 \quad \longrightarrow \quad f'(0) \nexists \; \therefore f$ is not differentiable at $x = 0$.