1. Determine the values of $x$ for which the following series converge.

Using ratio test:
\[
\frac{a_{n+1}}{a_n} = \frac{(x-2)^{n+1}/(n+1)!}{(x-2)^n/(n)!} = \frac{(x-2)(n+2)}{(n+1)!} \\
\text{Converges for all } x.
\]

For ratio test:
\[
-1 < x < 1 \text{ converges} \\
\text{For } x < -1, x > 1 \text{ diverges} \\
\text{At } x = -1, x = 1 \text{ test fails.}
\]

Testing endpoints $x = 1, \quad \sum_{n=1}^{\infty} \frac{1}{n^2} \text{ converges absolutely.} \\
\text{Also converges.}
\]

Converges for all values of $x$.

2. The series $\sum_{n=0}^{\infty} \frac{x^n}{n!} = f(x)$ converges for all $x$. If we take the derivative of the series by taking the derivative of each term, we have
\[
\text{Differentiate each term to see pattern.}
\]

a) For what $x$'s does the derivative series converge?

\[
\frac{a_{n+1}}{a_n} = \frac{(n+1)x^n/(n+1)!}{x^n/(n)!} = \frac{x}{(n+1)} \lim_{n \to \infty} \frac{x}{n} = 0 \text{ for all } x.
\]

b) What is $f'(0)$? $f(0) = 1 + 0 + 0 + \ldots = 1$