\begin{align*}
\int \frac{dx}{x^2 - 1} &= \int \left( \frac{1}{2(x-1)} - \frac{1}{2(x+1)} \right) dx \\
&= \frac{1}{2} \ln |x-1| - \frac{1}{2} \ln |x+1| + C \\
&= \frac{1}{2} \ln \left| \frac{x-1}{x+1} \right| + C
\end{align*}
By the Bell test, the state remains.

有一定数列和数列1，其和数列3。
3. Find the Taylor series for $f(x) = x^3$ about $x = 1$. Determine the interval of convergence.

$$f(x) = x^3$$

$$f'(x) = 3x^2$$

$$f''(x) = 6x$$

$$f'''(x) = 6$$

The Taylor series converges for $|x-1| < 1$.

4. Find the following limits if they exist.

$$\lim_{x \to 0} \frac{\sin(x)}{x}$$

$$\lim_{x \to 0} \frac{e^x - 1}{x}$$

Evaluate both limits.
6. The position of an object is a function of time in space by
\[
\begin{align*}
\frac{\partial x}{\partial s} &= f(t) \\
\frac{\partial y}{\partial s} &= g(t) \\
\frac{\partial z}{\partial s} &= h(t)
\end{align*}
\]
Find the values and units of the slopes at \( t = 2 \).
\[
\begin{align*}
\frac{\partial x}{\partial s} &= f(t) = 2t + 1 \\
\frac{\partial y}{\partial s} &= g(t) = 3t - 4 \\
\frac{\partial z}{\partial s} &= h(t) = 5t + 0
\end{align*}
\]
Slope at \( t = 2 \):
\[
\begin{align*}
\frac{\partial x}{\partial s} &= 2(2) + 1 = 5 \\
\frac{\partial y}{\partial s} &= 3(2) - 4 = 2 \\
\frac{\partial z}{\partial s} &= 5(2) + 0 = 10
\end{align*}
\]

7. Find the shape of the tangent line to the polar coordinate curve \( r = \theta \) at
\[
\begin{align*}
\theta &= \frac{\pi}{4} \\
\frac{\partial r}{\partial \theta} &= 1 \\
\frac{\partial \theta}{\partial r} &= 0
\end{align*}
\]
At \( \theta = \frac{\pi}{4} \):
\[
\begin{align*}
r &= \frac{\pi}{4} \\
\frac{dr}{d\theta} &= 1 \\
\frac{d\theta}{dr} &= 0
\end{align*}
\]
The image area bounded by the lines \( y = x, \), \( y = x - 2, \) and \( x = 1 \) is revolved around the x-axis. Find the volume of the resulted solid of revolution.

\[
V = \pi \int_{1}^{3} (x^2 - (x - 2)^2) \, dx
\]

\[
= \pi \left[ \frac{1}{3} x^3 - \frac{1}{4} x^4 \right]_{1}^{3}
\]

\[
= \frac{2 \pi}{3}
\]
10. Find the inverse of the following functions. Simplify your results.

\[ f(x) = \frac{1}{x^2 + 2x + 1} \]

\[ g(x) = \frac{1}{x^2 - x + 1} \]

\[ h(x) = \frac{1}{x^2 - 4} \]