1. Find the horizontal and vertical asymptotes of the function, if any.

   \[ f(x) = \frac{x^2 - 4}{x^2 - 9} \]

   There are no horizontal or vertical asymptotes.

2. Find the critical numbers of the function and the intervals where the function increases and decreases.

   \[ f(x) = \frac{x^2 - 4}{x^2 - 9} \]

   The critical numbers are the solutions to the equation:

   \[ x^2 - 4 = 0 \]

   \[ x = \pm 2 \]

   The function increases on the interval \( (-\infty, -2) \) and decreases on the interval \( (2, \infty) \).
14. Find the local extrema of the function. Identify each extrema as a local minimum or local maximum.

By the first derivative test,

\[ f'(x) = \frac{d}{dx} f(x) \]

is a local minimum, and

\[ f'(x) = \frac{d}{dx} f(x) \]

is a local maximum.

15. Find the points of inflection of the function. Identify the intervals where the graph of the function is concave up and concave down.

\[ f''(x) = 60, \quad 0 < x < 5, \quad x > 5. \]

\[ f''(x) = 0 \]

is concave down on \((-\infty, 5)\) and concave up on \((5, \infty)\).
(c) Sketch a graph of the function as shown provided below.
\[ \frac{d}{dx} \ln \left( \frac{a}{x} \right) = 0 \]
6. Evaluate the following definite integrals.

\[ \int_{a}^{b} x^{n} \, dx = \left[ \frac{x^{n+1}}{n+1} \right]_{a}^{b} \]

\[ = \frac{b^{n+1}}{n+1} - \frac{a^{n+1}}{n+1} \]

\[ = \frac{b^{n+1} - a^{n+1}}{n+1} \]

5. Evaluate the following definite integrals.

\[ \int_{0}^{1} \frac{3x^{2}}{x + 1} \, dx \]

\[ = \left[ 3x^{2} \ln |x + 1| \right]_{0}^{1} \]

\[ = 3(1)^{2} \ln |1 + 1| - 3(0)^{2} \ln |0 + 1| \]

\[ = 3 \ln 2 \]

\[ \int_{1}^{2} x^{2} \, dx \]

\[ = \left[ \frac{x^{3}}{3} \right]_{1}^{2} \]

\[ = \frac{2^{3}}{3} - \frac{1^{3}}{3} \]

\[ = \frac{8}{3} - \frac{1}{3} \]

\[ = \frac{7}{3} \]

\[ \int_{0}^{1} e^{x} \, dx \]

\[ = \left[ e^{x} \right]_{0}^{1} \]

\[ = e^{1} - e^{0} \]

\[ = e - 1 \]

\[ \int_{0}^{\pi/2} \cos x \, dx \]

\[ = \left[ \sin x \right]_{0}^{\pi/2} \]

\[ = \sin \left( \frac{\pi}{2} \right) - \sin 0 \]

\[ = 1 - 0 \]

\[ = 1 \]
In the interval $x$ it is true that $f''(x)$ is equal to $e^x$. To determine the maximum or minimum of the function, we evaluate the critical points.

$$f'(x) = xe^{x^2} - 2e^{x^2}$$

At $x = 0$, $f'(x) = 2e^{x^2}(1-x)$.

Critical points:
- At $x = 0$, $x = 1$.

Evaluating $f(x)$ at these points:
- $f(0) = 0$
- $f(1) = e^1 = 0.71828$ (maximum)
- $f(2) = e^4 = 54.598$ (maximum)

The absolute minimum occurs at the endpoints of the interval.