

**Objectives:**

- Use calculus to ensure we have accurate graphs when we use computers for assistance.

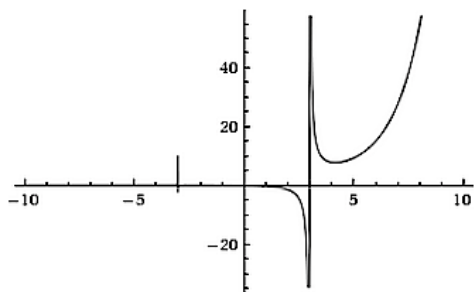
**Example:** Consider the function  $f(x) = \frac{e^x}{x^2 - 9}$ . We want to produce a graph of  $f$  that shows all interesting characteristics of  $f$ . So we want to capture all intervals of increase and decrease, extreme values, intervals of concavity, and inflection points.

First, let's try graphing  $f$  online with WolframAlpha:

Input interpretation:

plot	$\frac{e^x}{x^2 - 9}$	$x = -10$ to $10$
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Plot:



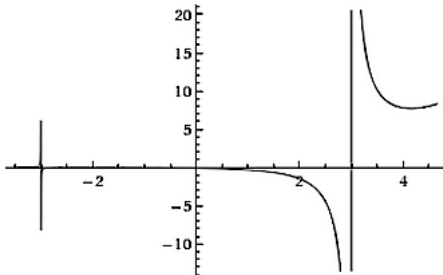
Let's use calculus to do better:

Now what? To find intervals of concavity and inflection points, we need the second derivative.

Input interpretation:

plot	$\frac{e^x}{x^2 - 9}$	$x = -3.5$ to $1.5 + \sqrt{10}$
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Plot:

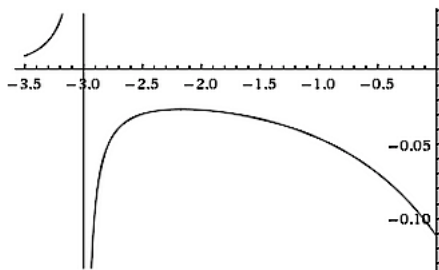


So this is better but not great. It is still hard to see what's going on on the negative axis but we could make multiple graphs to get a better idea:

Input interpretation:

plot	$\frac{e^x}{x^2 - 9}$	$x = -3.5$ to $0$
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Plot:



Input interpretation:

plot	$\frac{e^x}{x^2 - 9}$	$x = 0$ to $1.5 + \sqrt{10}$
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Plot:

