Group Member Names:

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In [1]:   from sympy import *
          from sympy.plotting import plot, plot_parametric
```

Lab 6 Template

Each part of each problem should be solved in its own cell.

Question 1

Let $f(x) = -e^{3x} + 7e^{2x} - 15e^x + 9$.

a.) Plot f on the domain $x = [-10, 10]$ and use **ylim = [-10, 10]**. In two separate print statements, indicate first how many local extrema there appear to be, then how many inflection points there appear to be.

b.) Plot f' using $x = [-10, 10]$ and **ylim = [-10, 10]**. Use the solve command to find the critical points of f (just the x coordinate is sufficient). In three separate print statements, give the critical points of f, the intervals where f is increasing, and the intervals where f is decreasing. (The solve command does find all solutions despite how the graph may look)

c.) Plot f'' using $x = [-10, 10]$ and **ylim = [-15, 15]**. In three separate print statements, give the possible inflection points of f (just the x coordinate is sufficient), the intervals where f is concave up, and the intervals where f is concave down. (It may look as though there is an inflection point at $x \approx -5$, but this is just a plotting quirk)

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Question 2

Let $f(x) = \sqrt{|x^2 - 6x + 5|}$. General Note: For this problem, the **diff** command will not work out of the box. You will need to carefully handle the absolute values whenever you need to differentiate. See the note in part b) for details.

a.) Plot f on the domain $x = [-10, 10]$ and use **ylim = [0, 10]**. In two separate print statements, indicate first how many local extrema there appear to be, then how many inflection points there appear to be. (Remember inflection points only occur whenever there is a change in concavity)

b.) Find the zeros of f and put them in a print statement. Then, find and put in a print statement f' on each interval created by the zeros. (Note: it should help to see where the inside of the absolute value is positive and negative. Eventually, you should have three intervals and thus three functions

for f'). Plot all three parts of f' on the same axes using $x = [-10, 10]$ and **ylim = [-10, 10]**, being sure to plot each piece only on the interval where it is defined.

c.) In a print statement, give the critical values for f, and in two separate print statements, give the intervals where f is increasing and decreasing. (Remember that critical values are where $f'(x) = 0$ **or** $f'(x)$ is undefined)

d.) Plot f'' using $x = [-10, 10]$ and **ylim = [-10, 10]**. In three separate print statements, give the possible inflection points of f (just the x coordinate is sufficient), the intervals where f is concave up, and the intervals where f is concave down. (Note: the graph may look like it crosses the x-axis at -1 and -7.5, but it does not)

e.) In separate print statements, put how many local minimums there are, how many local maximums there are, and how many points of inflection there are.

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