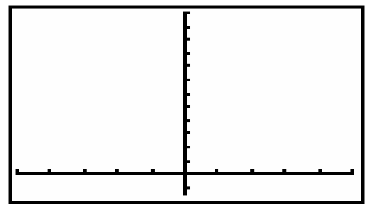
**Assignment 11: Curve Sketching (3.6)** **Name____________________**
**Please provide a handwritten response.**

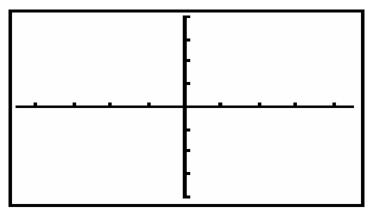
**1a.** The TI calculators can be used to apply curve-sketching techniques to complicated functions such as $\boldsymbol{f(x) = (5 - 2x^3)\sin x + 5^{-x^2}}$. Graph this function over the interval $\boldsymbol{-5 \le x \le 5}$ and sketch the results below. You will be restricted to this interval although this function displays interesting behavior throughout the ***xy***-plane.



$\boldsymbol{-5 \le x \le 5, -30 \le y \le 240}$

**1b.** Based on this graph, tell how many local maxima, local minima and inflection points $\boldsymbol{f}$ appears to have over $\boldsymbol{-5 \le x \le 5}$.

**2a.** It is not possible to solve the equation $\boldsymbol{f'(x) = 0}$ for $\boldsymbol{x}$ algebraically. However, you can use a graph of $\boldsymbol{f'}$ together with numerical equation solving to find the zeros of $\boldsymbol{f'}$. Sketch the graph of $\boldsymbol{f'(x)}$ below.



$\boldsymbol{-4.5 \le x \le 4.5, -80 \le y \le 80}$

**2b.** According to this graph, how many zeros does $\boldsymbol{f'}$ have? Is this consistent with the number of local extrema you found in question **1b?** Select ***f*** and deselect $\boldsymbol{f'}$. Locate the local extrema.

| | **TI-83 Plus/TI-84 Plus** | **TI-86** |
|---|---|---|
| **FINDING EXTREMA ON YOUR CALCULATOR** | **2ND TRACE (CALC)**<br>**3 minimum**<br>**4 maximum** | **GRAPH MORE F1 (MATH)**<br>**F4 fMIN**<br>**F5 fMAX** |

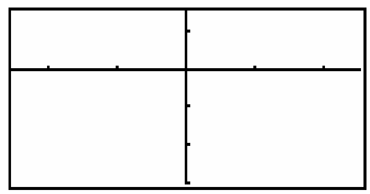
For each local maximum or minimum you must specify a left bound, a right bound and a guess from the graph by tracing. Record these values below. Record the approximate values of the zeros of $\boldsymbol{f'}$.

**2c.** Now use the **SOLVER** to find the exact value of the zero of $\boldsymbol{f'}$ near $\boldsymbol{x = -2.1}$ and record the result below. Repeat using each of your approximate values in part **b** as starting values for the **SOLVER**.

**2d.** Using these results, record below the complete set of intervals on which $\boldsymbol{f}$ is increasing and decreasing. (Remember that you are only considering $\boldsymbol{-5 \le x \le 5}$.)

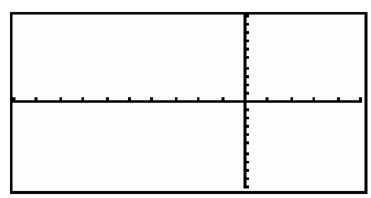
**3a.** You can study the concavity of the graph of $\boldsymbol{f}$ in the same way. Graph $\boldsymbol{f''}$ on the axes below where $\boldsymbol{y1 = f(x)}$, $\boldsymbol{y2 = f'(x)}$. Also graph $\boldsymbol{y3 = f''(x)}$ as described below.

| | **TI-83 Plus/TI-84 Plus** | **TI-86** |
|---|---|---|
| **GRAPHING THE SECOND DERIVATIVE** | **MATH 8)** <br> **nDeriv(**$\boldsymbol{Y_2, X, X}$ **)** | **2ND ÷ (CALC) F4** <br> **der2(** $\boldsymbol{y1, x, x}$ **)** |



$\boldsymbol{-5 \le x \le 5,\ -300 \le y \le 150}$

**3b.** Is it clear from this graph how many zeros $\boldsymbol{f''}$ has? Now graph the second derivative on $\boldsymbol{-2 \le x \le 1}$ to get a closer look at the graph of $\boldsymbol{f''}$ near the origin. Sketch the results below.



$\boldsymbol{-2 \le x \le 1,\ -20 \le y \le 20}$

**3c.** Altogether, how many zeros does $\boldsymbol{f''}$ seem to have over $\boldsymbol{-5 \le x \le 5}$? Tell roughly where they are.

**3d.** Use the **SOLVER** to find the exact value of the zero of $\boldsymbol{f''}$ near $\boldsymbol{x = -4.2}$. Repeat for the other values you listed in part **c** and record the results below.

**3e.** Using these results, record below the complete set of intervals on which the graph of $\boldsymbol{f}$ is concave up or concave down over $\boldsymbol{-5 \le x \le 5}$.