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

1a. The TI-89 and Voyage 200 calculators can be used to apply curve-sketching techniques to complicated functions such as $f(x) = (5 - 2x^3)\sin x + 5^{-x^2}$. Graph this function over the interval $-5 \le x \le 5$ and sketch the results below. You will be restricted to this interval although this function displays interesting behavior throughout the xy-plane.
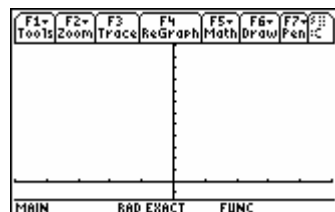
$$-5 \le x \le 5, -30 \le y \le 240$$

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

2a. It is not possible to solve the equation $f'(x) = 0$ for x algebraically. However, you can use a graph of f' together with numerical equation solving to find the zeros of f'. Sketch the graph of $f'(x)$ below.
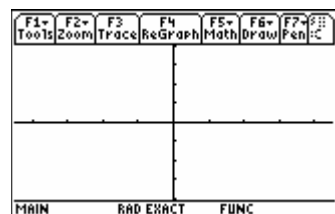
$$-4.5 \le x \le 4.5, -80 \le y \le 80$$

2b. According to this graph, how many zeros does f' have? Record the approximate values of the zeros of f' below. Is this consistent with the number of local extrema you found in question **1b**? Select f and deselect f'. Locate the local extrema. From the graph of f select **F5 (Math)** and then select either **3 Minimum** or **4 Maximum.** For each local maximum or minimum you must specify a left bound and a right bound from the graph by tracing. The calculator will calculate the extreme value. Record these values below.

2c. Now use the **solve** command to find the zeros of f' and record the result below. Use $solve(y2(x) = 0, x)$. What is the value of the zero near $x = -2.1$?
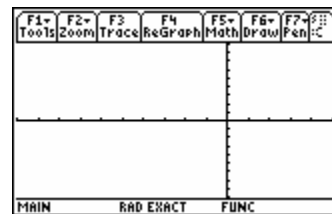
2d. Using these results, record below the complete set of intervals on which f is increasing and decreasing. (Remember that you are only considering $-5 \le x \le 5$.)

3a. You can study the concavity of the graph of f in the same way. Graph f'' on the axes below where $y1 = f(x)$, $y2 = f'(x)$ and $y3 = d\left(y1(x), x, 2\right)$
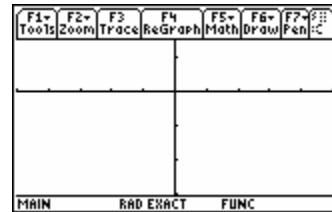
$$-5 \le x \le 5, -300 \le y \le 150$$

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

$$-2 \le x \le 1, -20 \le y \le 20$$

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

3d. Use the **solve** command to find the zeros of f''. What is the value of the zero near $x = -4.2$?

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