MAT 136 (Calculus I) Prof. Swift

In-class worksheet: The shape of graphs

As a reminder, please do not *think, say or write* "it's positive so it's increasing" when you mean "f' is positive so f is increasing".

Let the function f be defined by $f(x) = e^{-x^2/2}$ for this entire worksheet.

0. Does the graph of f have any x-intercepts?

1. Compute $f'(x)$ and find the largest interval(s) on which f is increasing, and on which f is decreasing.

2. Compute $f''(x)$ and simplify your result. Find the largest interval(s) on which f is concave up, and on which f is concave down.

3. Evaluate f at all the numbers that are endpoints of the intervals you found in questions 1 and 2. This will give you three points on the graph $y = f(x)$. Give exact answers, and decimal approximations using a calculator or your phone.

4. Write four sentences following the pattern below. In each sentence, fill in the first blank with an interval, fill in the second blank with "increasing" or "decreasing", and fill in the third blank with "concave up" or "concave down".

On the interval   , the function f is   and   .

5. Evaluate these two limits using your intuition and knowledge of the graph $y = e^x$.
$\lim_{x\to\infty} f(x) =$ and $\lim_{x\to-\infty} f(x) =$. (No need to show work.)

6. Sketch the graph $y = f(x)$, using everything you have learned, but without plotting any more points than the 3 points you found in question 3.