

YOUR NAME: \_\_\_\_\_

George Voutsadakis

Read each problem **very carefully** before starting to solve it. Each problem is worth 5 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. This problem will guide you through the steps needed to plot by hand the graph of the function  $f(x) = x^2e^{-x}$ . Please, follow instructions precisely and show your full work.

(a) Find the domain  $\text{Dom}(f)$ .

(b) Find the  $x$ - and the  $y$ - intercepts of  $y = f(x)$ .

(c) Compute

$$\lim_{x \rightarrow -\infty} f(x) =$$

$$\lim_{x \rightarrow +\infty} f(x) =$$

(d) Compute  $f'(x)$  and find the critical points.

(e) Compute  $f''(x)$  and find the critical points.

(f) Using the previous two parts make a sign table for  $f'$  and  $f''$  and draw conclusions about the monotonicity and the concavity of  $f$  together with its local extrema and its inflection points. Show all pertinent information in the last line of your table (referring to  $f$ ).

(g) Use your table and all previously gathered information to roughly plot the graph of  $y = f(x)$ . You **MUST** label your axes at the points of interest.