Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Create the combined sign table for the first and second derivatives (clearly indicating intervals of monotonicity and concavity, relative extrema and inflection points in the last line) and, then, sketch the graph of $f(x) = 3x^2 - 2x^3$.

2. Find the following limits (explaining all of your steps):

    (a) $\lim\limits_{x \to +\infty} xe^{-x^2} =$

    (b) $\lim\limits_{x \to +\infty} x^{1/x^2} =$

3. Find the domain, the asymptotes, create the combined sign table for the first and second derivatives of $f(x) = \dfrac{x}{1 - x^2}$ (please, include all info required in Problem 1) and sketch its graph.

4. Find the dimensions of a right triangle of fixed area A that has a hypotenuse of minimum possible length.

5. Compute the following integrals:

(a) $\int \dfrac{x^5 + 3x - \sqrt{x}}{x^2} dx =$

(b) $\int (21 \cos (7x - 5) - 8e^{5-2x}) dx =$