Exercise 1: (Taylor's polinome)
Prove that the following equalities hold

1. $\sin^2(x) = x^2 - \frac{x^4}{3} + o(x^5)$ $\quad x \to 0$
2. $\cos^2(x) = 1 - x^2 + \frac{x^4}{3} + o(x^5)$ $\quad x \to 0$
3. $\frac{1}{1+e^x} = \frac{1}{2} - \frac{x}{4} + o(x^2)$ $\quad x \to 0$
4. $\log(\cos x) = -\frac{1}{2}x^2 - \frac{1}{12}x^4 + o(x^4)$ $\quad x \to 0$
5. $e^{\sin(x)} = 1 + x + \frac{x^2}{2} - \frac{1}{8}x^4 + o(x^4)$ $\quad x \to 0$.

Exercise 2: Study and draw the graph of the following functions: (domain of definition, value of the limits at infinity, asymptotes, derivative, interval of monotonicity, second derivative interval of convexities)

1. $f(x) = (x-1)^3(2-x)$
2. $f(x) = \frac{x^2}{\log|x| - 1}$ — **No second derivatives**
3. $f(x) = \log(x) - \operatorname{arctg}(x-1)$ — **No second derivatives**

(4) $f(x) = e^{\frac{x-2}{x}}$

(5) $f(x) = e^{-|x|}\sqrt{x^2-5x+6}$

No second derivatives