Physics 213 **Problem 6** **Week 1**

Function with a Maximum

Later in the course we will encounter functions like the following:

$$\boxed{f(x) = x^2 e^{-x/a}}$$

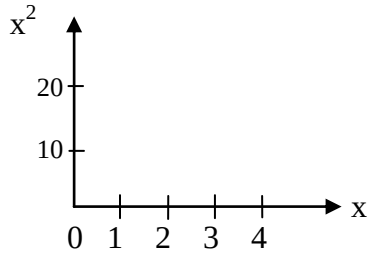
where a is a constant. This function is positive and equals zero at x = 0 and ∞. Notice also that:

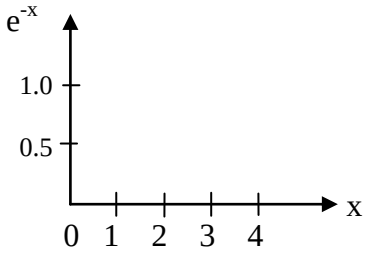
x^2 is an *increasing* function of x, and $e^{-x/a}$ is a *decreasing* function of x.

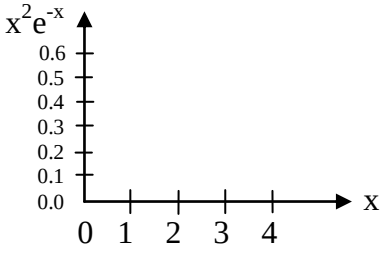
$f(x) = x^2 e^{-x/a}$ has a maximum (a peak).

a) By taking the derivative of f(x), find the value of x at which f(x) is a maximum. Your answer should be in terms of the constant a.

b) To gain some insights, set a = 1 and plot the following for x = 0,1,2,3,4. Draw smooth curves through the points:







c) By taking its derivative, show that ln(f(x)) has a maximum at the same x that f(x) does.