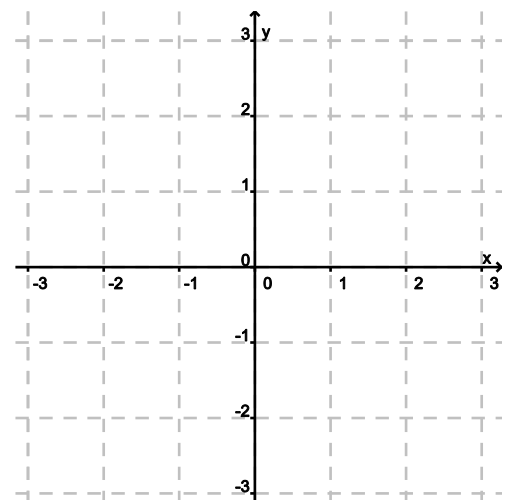


## Applications; Exponential Models

**Ex 1.**

Sketch  $f(x) = e^{-x^2/2}$



We can model exponential behavior with the following exponential function:

$$Q(t) = Q_0 e^{kt} \quad (\text{where } k > 0)$$

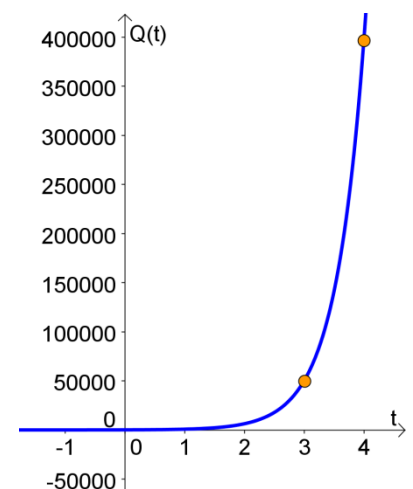
Here,  $Q(t)$  represents quantity after time  $t$ .

$Q_0$  represents the initial quantity.

$k$  is a relative growth rate (ex: 0.02 would represent 2% of the population at time  $t$ ).

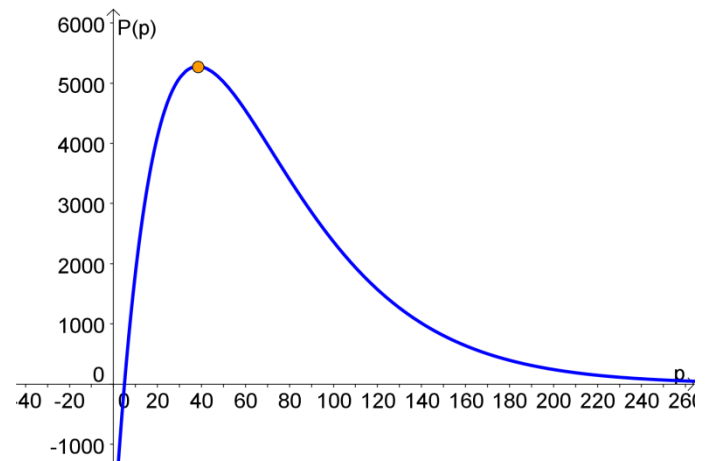
### Ex 2.

Suppose Professor Awesome's "Learn How to Differentiate" video goes viral on YouTube. On the first day it is posted, the video gets 100 hits. Three days later, the video has 50,000 hits. Assuming the number of hits grows exponentially, how many hits will the video have 4 days after being posted?



**Ex 3.**

A company can make backpacks at a cost of \$5 each. The boss estimates that if they are sold for  $p$  dollars each, then consumers will buy  $500e^{-0.03p}$  backpacks each month. What selling price will maximize profit?

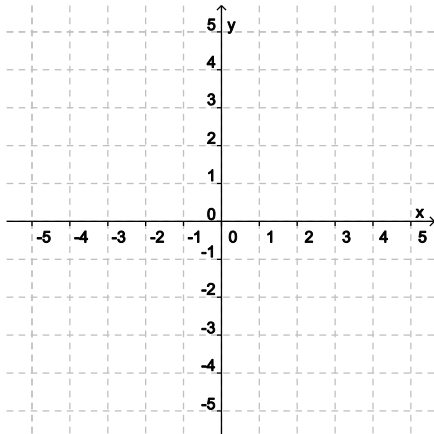


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**Practice**

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1. Sketch  $f(x) = xe^{-x}$ . (Hint:  $\lim_{x \rightarrow +\infty} \frac{x}{e^x} = 0$ )



Q: What three letter word can prefix the following three words to make three new words?  
Ache, Nest, and Drum.