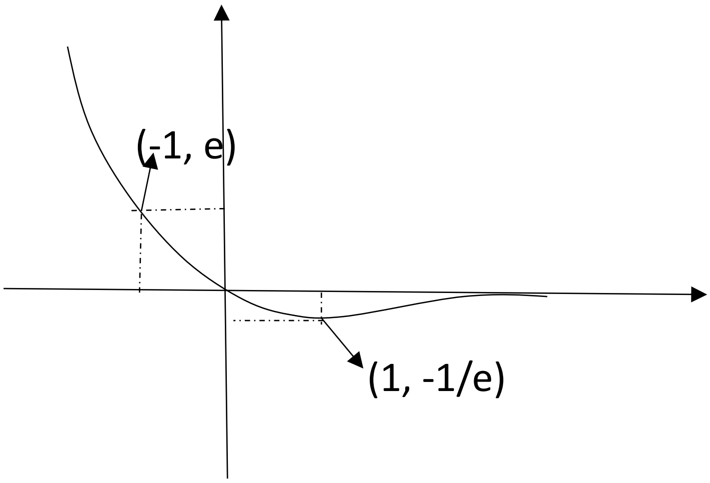
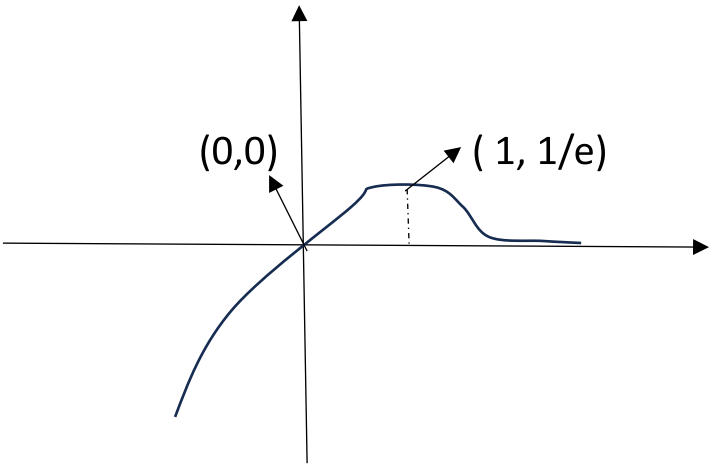
Potential curve:

We can study a function that has a curve similar to the U(r) of a rigid rotor :

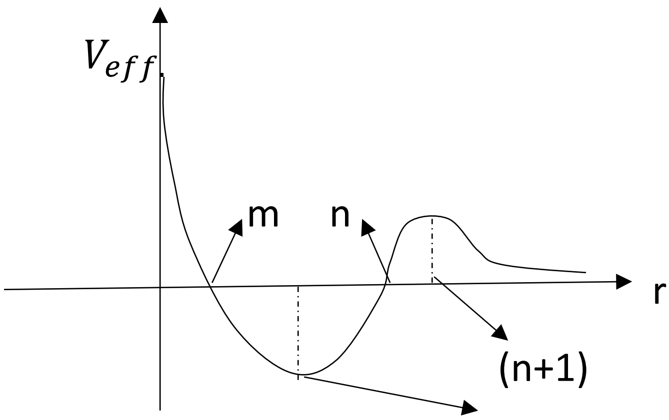
y= -x. e^{-x}:



or y=x.e^{-x}



If we now try to elucidate the following curve:



$V_{eff.} = V(r) + f(r) + g(r)$

V(r) ~a/r , $f(r)$~b.(r-d) ^{2} + p , g(r) ~(r-n).e^{-r}

Suppose that a=b= 1 , d= 5 , p=-3

To isolate m, n we will set f(r) to zero and obtain the intercept points on the r axis :$(r-5)^2-3=0 \quad r^2-10r+25-3=0$

a$r^2-br+c=0$

that applying : r= $\frac{-b\pm\sqrt{b^2-4.a.c}}{2a}$= $\frac{10\pm\sqrt{10^2-4.1.22}}{2.1}$= 5+ $\sqrt{3}$= n= 6'73

5- $\sqrt{3}$= m= 3'27

Applying Barrow we will obtain at what value of r →V(r)= f(r):

r= 0'046→ V(0' 046)= 21'7 f(0' 046)= 21'5

enough limited

now we will expand V_{eff}so that the results conform to the values we have proposed:

1/0'046 ~21'7 , 1/3'27 ~0'33 , 1/6'73 ~0'14 ,

thus : V(r)= [1/r)-21'7].[(1/r)-0'33].[(1/r)-0'14]

i V_{eff}= V(r)+$[(r-5)^2-3]+$

+$[(r-6'73)(r-3{,}27)(r-0'046).e^{-r}]$

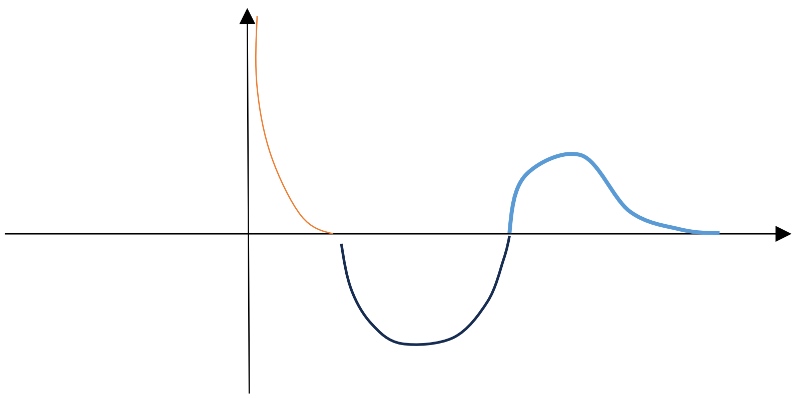
Therefore :

R	V(r)	f(r)	g(r)
0	+∞	…	…
0'046	0	21'5	0
1	(-20'7).(0'7).(0'9)	13	(-5'73).(-2'27).1.e^{-1}
2	(-21'2).(0'1).(0'4)	6	(-4'73).(-1'27).(2). e^{-2}
3'27	0	0	0
5	(-21'2).(-0'1).(0'4)	-3	(-1'73).(-1'73).(5). e^{-5}
6'73	0	0	0
7'73	(0'13-21'7). .(-0'17).(0'01)	4'45	(1).(3'43).(7'73). $e^{-7'73}$
∞	0	+∞	+∞

Them values they are approximate but really they agree with the graphic

V_{eff}vs. r

As a last resort analysis , r ∈(0, ∞) and I have used Barrow's rule to gain accuracy between V(r) and if(r) since if only would look when they are equal to zero , the graph would remain something like this like :



When is it more accurate :