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> # Prof. Dr. Serkan Dağ
# ME 310 Numerical Methods
# File 2.1
# Taylor series expansion of cos(x)

> restart :
unprotect(sum) :
Digits := 16 :

> # Highest order of Taylor series expansion
> N := 6 :

> # True value
>  $t_v := \cos\left(\frac{\text{Pi}}{3.}\right) :$ 

> # Step size
>  $h := \frac{\text{Pi}}{3.} - \frac{\text{Pi}}{4.} :$ 

> sum := 0 :

> # Taylor series approximation
> for n from 0 by 1 to N
while true do
if n = 0 then
     $sum := sum + \cos\left(\frac{\text{Pi}}{4.}\right) :$ 
     $eps_t := \frac{(t_v - sum)}{t_v} \cdot 100 :$ 
    printf("\n %5.1f %15.10f %15.3f ", n, sum, eps_t) :

else
     $sum := sum + \frac{\text{subs}\left(x = \frac{\pi}{4.}, \text{diff}(\cos(x), x\$n)\right)}{n!} \cdot h^n :$ 
     $eps_t := \frac{(t_v - sum)}{t_v} \cdot 100 :$ 

    printf("\n %5.1f %15.10f %15.2e", n, sum, eps_t) :
end if:
end do:

0.0      0.7071067812      -41.421
1.0      0.5219866588      -4.40e+00
2.0      0.4977544914      4.49e-01
3.0      0.4998691469      2.62e-02
4.0      0.5000075508      -1.51e-03
5.0      0.5000003040      -6.08e-05
6.0      0.4999999878      2.44e-06

```