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# Prof. Dr. Serkan Dağ
# ME 310 Numerical Methods
# File 4.3
# Newton-Raphson Method
# Solves nonlinear equations of the form f(x) = 0
restart :
Digits := 16 :
# Define the equation
f := sin(sqrt(x)) - x;
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$$f := \sin\left(\sqrt{x}\right) - x \tag{1}$$

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# Find the derivative
fp := diff(f, x);
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$$fp := \frac{1}{2}\,\frac{\cos\left(\sqrt{x}\right)}{\sqrt{x}} - 1 \tag{2}$$

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# Number of significant figures and error criterion
n := 3 :
epss := 0.5·10^(2 - n);
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$$epss := 0.05000000000000000 \tag{3}$$

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# Maximum number of iterations
kmax := 20 :
# Initial guess
xr0 := 3·Pi/16 :
# Unleash the iterations
for k from 1 by 1 to kmax
while true do
if k = 1 then
printf("\n %5.1f %15.10f", k - 1, xr0);
 end if:
 xrn := xr0 - evalf(subs(x = xr0, f))/evalf(subs(x = xr0, fp)) :
 if xrn ≠ 0 then
 epsa := evalf(abs((xrn - xr0)/xrn)·100) :
 end if:
 printf("\n %5.1f %15.10f %15.10f", k, xrn, epsa);
 xr0 := xrn :
 if epsa < epss then
 break:
 end if:
 end do:
```

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  0.0     0.5890486225
  1.0     0.7872647384    25.1778221747
  2.0     0.7687772256     2.4047945462
  3.0     0.7686488631     0.0166997659
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