1)

```
> foward<-function(x,error)
+ {
+   n=2
+   b=x
+   a=n-1
+   A11=1
+   A12=0
+   B11=1
+   B12=1
+   c1=A11*b+A12*a
+   c2=B11*b+B12*a
+   C=c1/c2
+   aproxnorm=1- C* dnorm(x, mean = 0, sd = 1, log=FALSE)
+   while(abs(realnorm(x)-aproxnorm)>error)
+   {
+     n=n+1
+     A12=A11
+     B12=B11
+     A11=c1
+     B11=c2
+     a=n-1
+     c1=A11*b+A12*a
+     c2=B11*b+B12*a
+     C=c1/c2
+     aproxnorm=1- c1/c2* dnorm(x, mean = 0, sd = 1, log=FALSE)
+   }
+   return(C)
+ }
>
> foward(4.7,0.00001)* dnorm(4.7, mean = 0, sd = 1, log=FALSE)
[1] 5.252312e-06
```

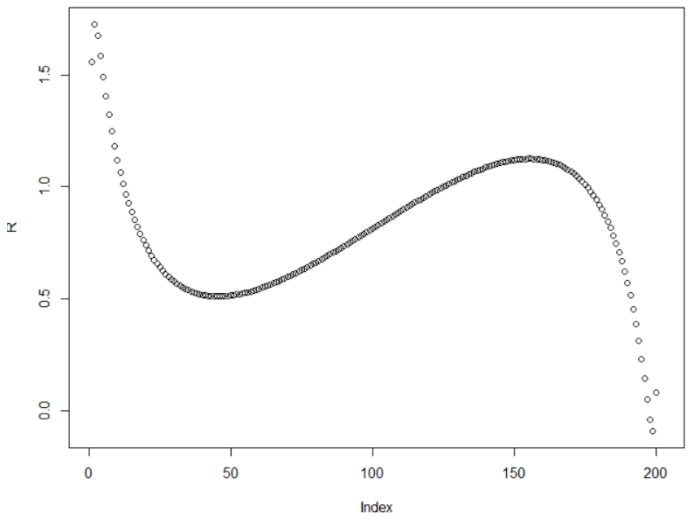
2)

```
> func2<-function(x,n)
+ {
+   a=vector(length=n)
+   a[1]=1
+   c=seq(1,100,by=2)
+   for(i in 2:n){
+     a[i]=cumprod(c[1:(i-1)])[i-1]*(-1)**(i-1)/x**(2*(i-1))
+   }
+   p=exp(-x**2/2)/sqrt(2*pi)/x*sum(a)
+   return(p)
+ }
>
> func2(4.7,12)
[1] 1.300792e-06
```

Not very similar with 1)

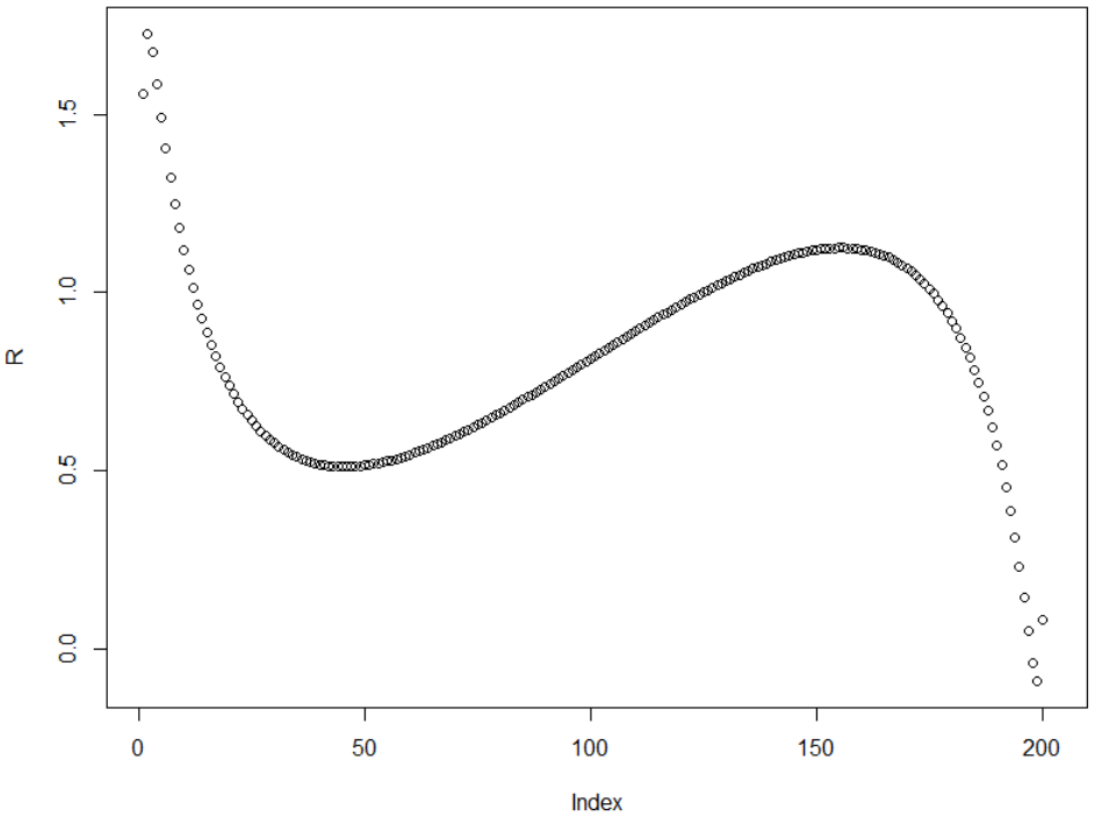
3)

```
> R=numeric(202)
> for(i in 0:202)
+ {
+   R[i]=funcr(x[i])
+ }
> plot(R)
> x=qnorm(seq(0,1,length.out=202))[2:201]
> R=numeric(202)
> for(i in 0:202)
+ {
+   R[i]=funcr(x[i])
+ }
> plot(R)
> plot(R)
> qqnorm(R)
> qqnorm(R)
> x=qnorm(seq(0,1,length.out=202))[2:201]
> R=numeric(202)
> for(i in 0:202)
+ {
+   R[i]=funcr(x[i])
+ }
> plot(R)
```



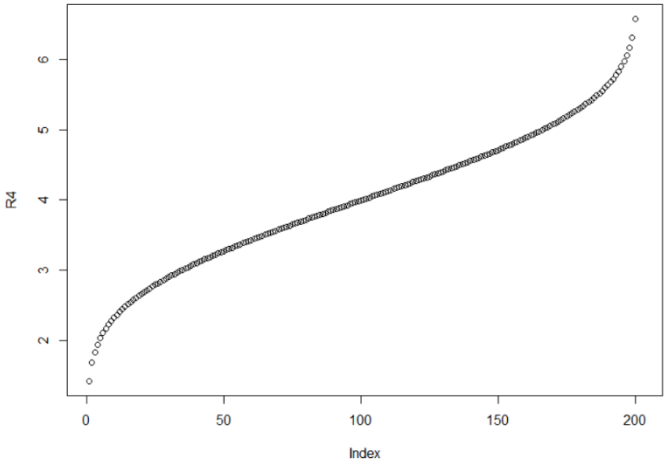
4)

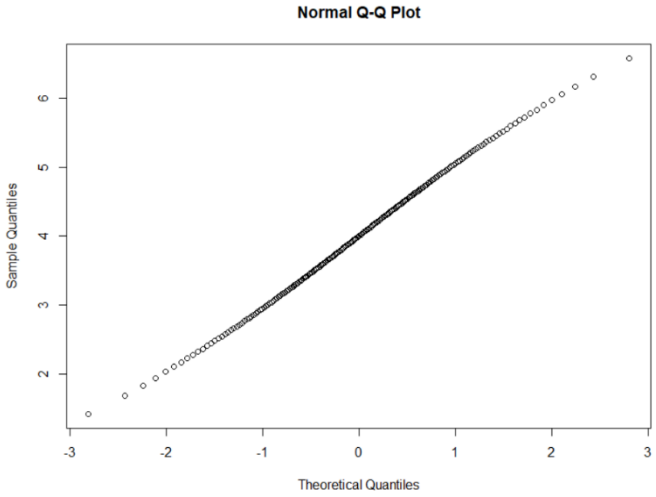
```
> funcr<-function(x)
+ {
+ m2=3/242
+ m3=-21/17303
+ m4=5.6067*0.0001
+ m5=-1.4329*0.0001
+ m6=5.4559*10**-5
+
+ k2=m2
+ k3=m3
+ k4=m4-3*m2**2
+ k6=m6-15*m2*m4-10*m3**2+30*m2**2
+
+ g2=k4/k2**2
+ g4=k6/k2**3
+
+ he1=x
+ he2=x**2-1
+ he3=x**3-3*x
+ he4=x**4-6*x**2+3
+ he5=x**5-10*x**3+15*x
+
+ h2=he3/24
+ h4=he5/720
+ h22=-(3*he5+6*he3+2*he1)/384
+
+ w=x+g2*h2+g4*h4+g2**2*h22
+
+ r=9/11+3/242*w
+ return(r)
+ }
> x=qnorm(seq(0,1,length.out=202))[2:201]
> R=numeric(202)
> for(i in 0:202)
+ {
+   R[i]=funcr(x[i])
+ }
> plot(R)
```



4

```
> n=12
> m2=4/45
> m3=16/945
> m4=16/945
> m5=128/18711
> m6=4.648*10**-3
>
> k2=m2
> k3=m3
> k4=m4-3*m2**2
> k6=m6-15*m2*m4-10*m3**2+30*m2**2
>
> g2=k4/(n*k2**2)
> g4=k6/(n**2*k2**3)
>
> func4<-function(x)
+ {
+   he1=x
+   he2=x**2-1
+   he3=x**3-3*x
+   he4=x**4-6*x**2+3
+   he5=x**5-10*x**3+15*x
+
+   h2=he3/24
+   h4=he5/720
+   h22=-(3*he5+6*he3+2*he1)/384
+
+   w=x+g2*h2+g4*h4+g2**2*h22
+
+   r=n/3+2*sqrt(5*n)/15*w
+   return(r)
+ }
`
> x=qnorm(seq(0,1,length.out=202))[2:201]
>
> R4=numeric(202)
> for(i in 0:202)
+ {
+   R4[i]=func4(x[i])
+ }
> plot(R4)
> qqnorm(R4)
```




5)

```
library(pbivnorm)
rho = 0.5
Hermite_Gauss_inte = function(lambda, y){
  HG = lambda * pnorm((1.6+sqrt(2*rho)*y)/sqrt(1-rho)) *  pnorm((2+sqrt(2*rho)*y)/sqrt(1-rho))
  return(HG)
}
I = (Hermite_Gauss_inte(0.94520872, 0) + Hermite_Gauss_inte(0.39361932, 0.9585725) +
  Hermite_Gauss_inte(0.39361932, -0.9585725) + Hermite_Gauss_inte(0.019953242, 2.0201829) +
    Hermite_Gauss_inte(0.019953242, -2.0201829))/sqrt(pi)
```

```
> pbivnorm(1.6, 2, rho = 0.5, recycle = TRUE)
[1] 0.9297111
```