Initiation à la statistique avec R, code et compléments chapitre 4

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```r
#
#Chapitre 4
#page 207
#Exercice 4.2
#2)
dnorm(0)
```

```
## [1] 0.3989423
```

```r
pnorm(2.58)
```

```
## [1] 0.99506
```

```r
qnorm(0.975)
```

```
## [1] 1.959964
```

```r
rnorm(50)
```

```
##  [1] -0.029850367  0.188102983 -0.297268498  0.872286374  2.043921910
##  [6] -0.409016523 -0.748979795 -0.317899751  0.806876270  1.168067077
## [11] -0.263504762 -0.111546386 -1.291170902  0.913781720 -0.717579669
## [16] -1.642802905  1.890219188  1.969405378  0.026868518  0.042438062
## [21] -1.561457824 -0.996640013 -0.389828820  0.361465613 -0.131164855
## [26] -0.624090874  0.262890447 -2.046372254 -1.201509561  2.496740970
## [31] -1.338938802  2.011163549  0.516801927 -0.358650778 -0.786333477
## [36] -0.721496368  0.193540995  1.116409339  0.121653081  0.007436191
## [41]  0.700285716  1.071549767 -0.516913730 -0.099108667 -0.304877115
## [46]  0.741107936  1.369000712 -0.439834445  0.876331763 -0.146804942
```

```r
rnorm(20,mean=10,sd=2)
```

```
##  [1] 11.712359 12.879182 10.857532 10.150048 11.453982 10.260715 11.215097
##  [8]  9.768084 12.083554 11.354936 10.809671  7.383314  8.803970 14.726468
## [15]  8.200145 11.291321  5.871059  9.735578 13.556514  9.889595
```

```r
x=seq(-5,5,0.1) ;pdf=dnorm(x) ;plot(x,pdf,type="l",main="Densité d'une loi
  normale centrée et réduite")
library(ggplot2)
```

**Densité d'une loi
normale centrée et réduite**
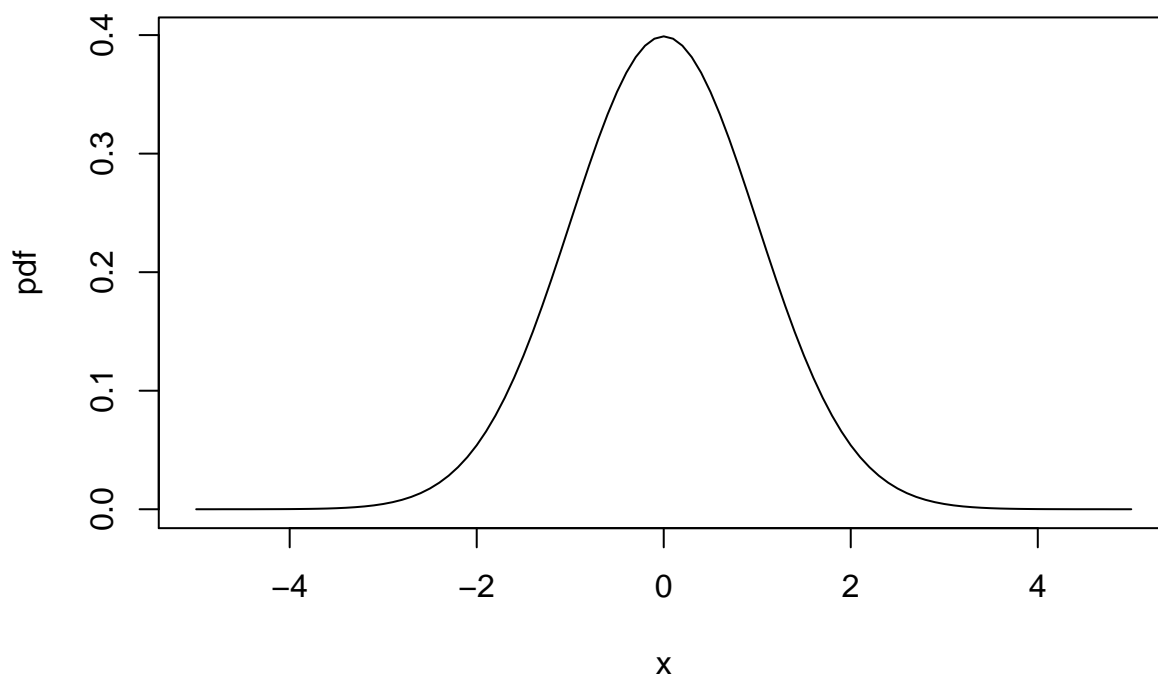

```r
ggplot(data.frame(x=c(-5,5)),aes(x))+stat_function(fun=dnorm)+
  ggtitle("Densité d'une loi normale centrée et réduite")+ylab("Densité")
```

Densité d'une loi normale centrée et réduite
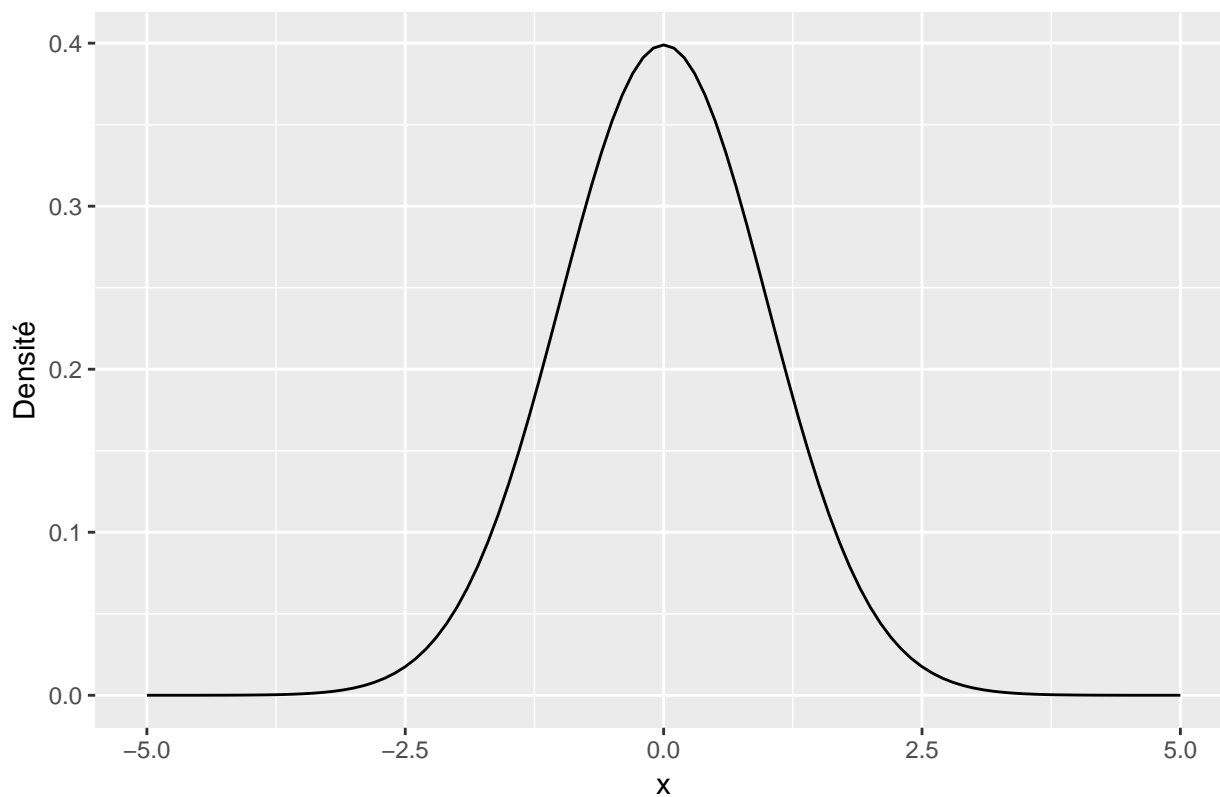
```
runif(10)
```

```
##  [1] 0.4308433 0.2316983 0.7072718 0.9065823 0.3235112 0.2523209 0.5639236
##  [8] 0.7775911 0.3714265 0.4476571
```

```
rt(10,20)
```

```
##  [1] -1.38092808 -0.12152640  0.92489002  0.48974802 -0.50025633
##  [6] -0.84064483 -0.78417036  1.14211647 -0.97604869  0.01800386
```

```
#Exercice 4.1
#page 210
#1)
#couleurs <- gray(c(0,.25,.5,.75)) #En nuances de gris comme dans le livre
couleurs<-c("black","red","green","blue") #En couleurs

fd<-function(x) {dbinom(x,5,0.5)}
plot(cbind(0:5,sapply(0:5,fd)),xlim=c(0,20),ylim=c(0,.40),type="p",ylab="",xlab="",
  pch=15,cex=2,lwd=3,col=couleurs[1],cex.axis=2)
fd<-function(x) {dbinom(x,10,0.5)}
points(cbind(0:10,sapply(0:10,fd)),xlim=c(0,20),ylim=c(0,.40),type="p",ylab="",xlab="",
  pch=16,cex=2,lwd=3,col=couleurs[2])
#L'option new=TRUE n'est pas nécessaire pour que la fonction points ajoute les points
# au graphique déjà existant
fd<-function(x) {dbinom(x,20,0.5)}
points(cbind(0:20,sapply(0:20,fd)),xlim=c(0,20),ylim=c(0,.40),type="p",ylab="",xlab="",
  pch=17,cex=2,lwd=3,col=couleurs[3])
#L'option new=TRUE n'est pas nécessaire pour que la fonction points ajoute les points
# au graphique déjà existant
legtxt<-c(expression(paste(italic(n)," = 5",sep="")),expression(paste(italic(n)," = 10",
  sep="")),expression(paste(italic(n)," = 20",sep="")))
legend("topright",legtxt,title=expression(paste(italic(p)," = 0,5",sep="")),pch=c(15,16,
  17),col=c(couleurs[1],couleurs[2],couleurs[3]),cex=2,bg="white",inset=.075)
```



```
#page 211
#2)
```
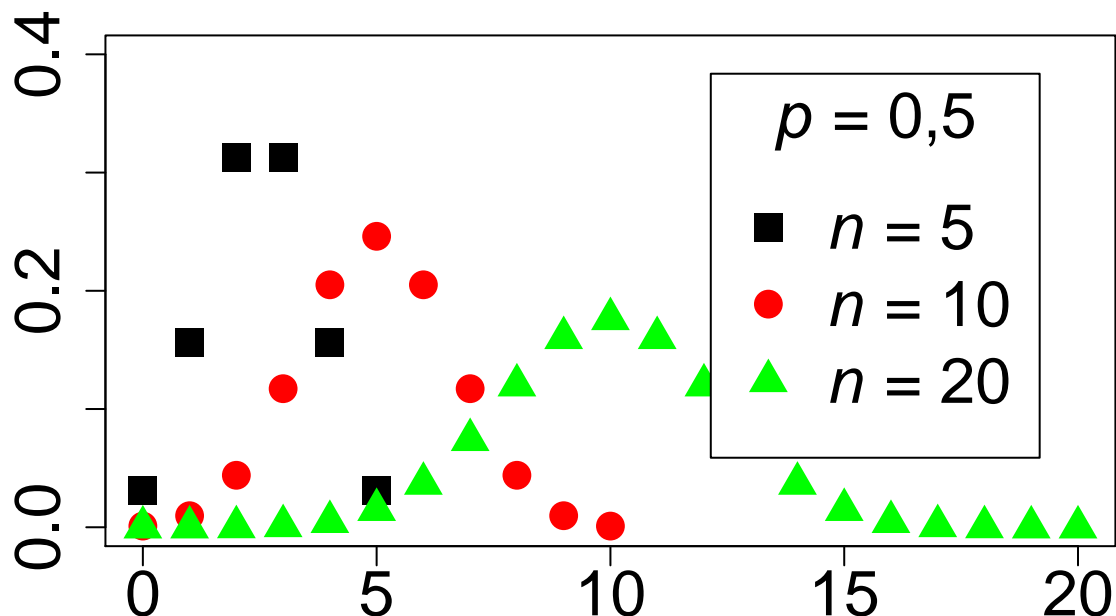
```r
dhypergeom<-function(x,N,n,p) (choose(N*p,x)*choose(N*(1-p),n-x)/choose(N,n))
fd<-function(x) {dhypergeom(x,14,10,0.5)}
plot(cbind(0:10,sapply(0:10,fd)),xlim=c(0,10),ylim=c(0,.5),type="p",ylab="",xlab="",
  pch=15,cex=2,lwd=3,col=couleurs[4],cex.axis=2)
fd<-function(x) {dhypergeom(x,20,10,0.5)}
points(cbind(0:10,sapply(0:10,fd)),xlim=c(0,10),ylim=c(0,.5),type="p",ylab="",xlab="",
  pch=16,cex=2,lwd=3,col=couleurs[3],new=T)
fd<-function(x) {dhypergeom(x,50,10,0.5)}
points(cbind(0:10,sapply(0:10,fd)),xlim=c(0,10),ylim=c(0,.5),type="p",ylab="",xlab="",
  pch=17,cex=2,lwd=3,col=couleurs[2],new=T)
fd<-function(x) {dbinom(x,10,0.5)}
points(cbind(0:10,sapply(0:10,fd)),xlim=c(0,10),ylim=c(0,.5),type="p",ylab="",xlab="",
  pch=18,cex=2,lwd=3,col=couleurs[1],new=T)
legtxt<-c(expression(paste(italic(N)," = 14",sep="")),expression(paste(italic(N)," = 20",
  sep="")),expression(paste(italic(N)," = 50",sep="")),expression(paste(italic(B),
  "(10;0,5)",sep="")))
legend("topright",legtxt,title=expression(paste(italic(n)," = 10 et ",italic(p)," = 0,5",
  sep="")),pch=c(15,16,17,18),col=c(couleurs[4],couleurs[3],couleurs[2],couleurs[1]),
  cex=1.6,bg="white",inset=.0)
```
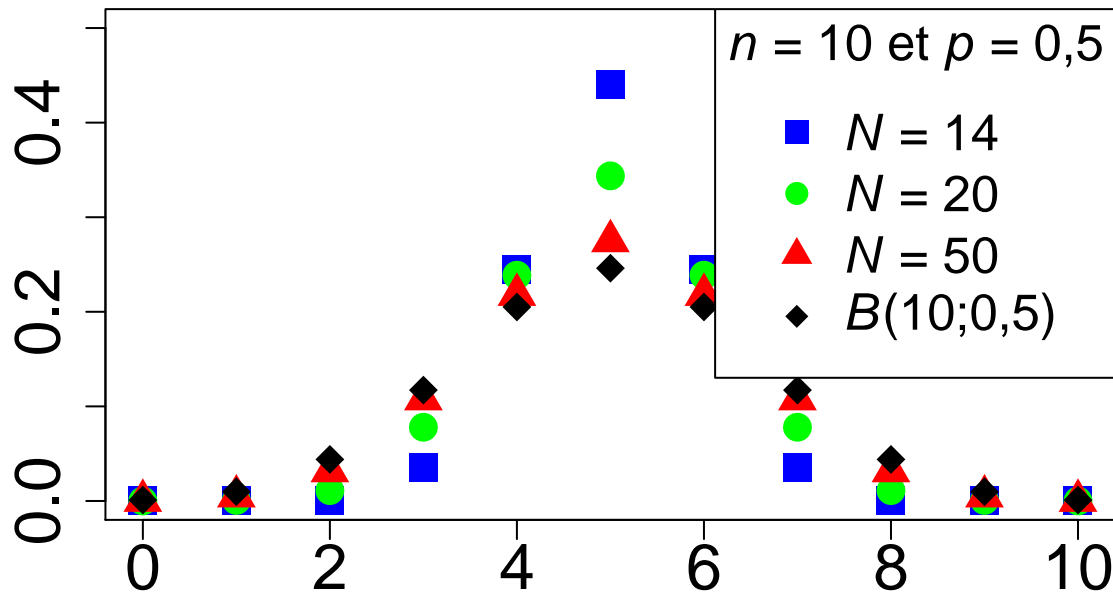


```r
#3)
fr<-function(x) {pchisq(x,1)}
curve(fr,from=-1,to=9,ylab="",xlab="",lty=1,lwd=3,col=couleurs[1],type="n",cex.axis=2)
curve(fr,from=-1,to=-0.000001,ylab="",xlab="",lty=5,lwd=3,add=TRUE,col=couleurs[1])
curve(fr,from=0.000001,to=9,ylab="",xlab="",lty=5,lwd=3,add=TRUE,col=couleurs[1])
fr<-function(x) {pchisq(x,3)}
curve(fr,from=-1,to=-0.000001,ylab="",xlab="",lty=1,lwd=3,col=couleurs[3],add=TRUE)
curve(fr,from=0.000001,to=9,ylab="",xlab="",lty=4,lwd=3,col=couleurs[3],add=TRUE)
fr<-function(x) {pchisq(x,2)}
curve(fr,from=-1,to=-0.000001,ylab="",xlab="",lty=2,lwd=3,add=TRUE,col=couleurs[2])
curve(fr,from=0.000001,to=9,ylab="",xlab="",lty=2,lwd=3,add=TRUE,col=couleurs[2])
fr<-function(x) {pchisq(x,6)}
curve(fr,from=-1,to=-0.000001,ylab="",xlab="",lty=4,lwd=3,add=TRUE,col=couleurs[1])
#la fin de cette instruction est sur la page 212
curve(fr,from=0.000001,to=9,ylab="",xlab="",lty=1,lwd=3,add=TRUE,col=couleurs[4])
```

```
#page 212
legtxt<-c(expression(paste(italic(p)," = 1",sep="")),expression(paste(italic(p)," = 2",
  sep="")),expression(paste(italic(p)," = 3",sep="")),expression(paste(italic(p)," = 6",
  sep="")))
legend("bottomright",legtxt,lty=c(5,2,4,1),lwd=3,col=c(couleurs[1],couleurs[2],
  couleurs[3],couleurs[4]),cex=2,bg="white",inset=.0375)
```
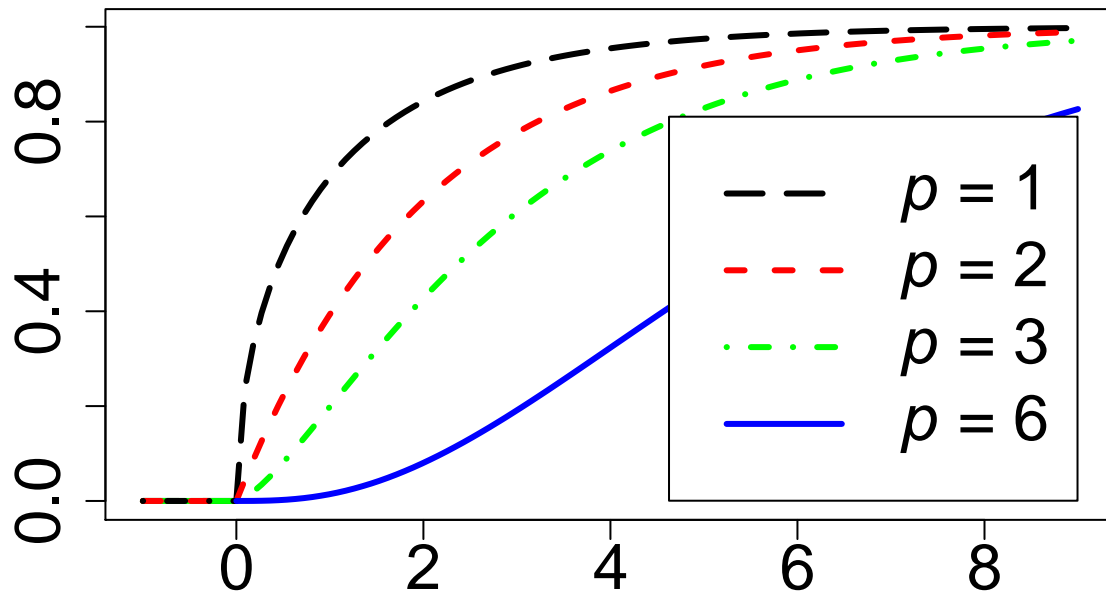


```
#4)
fd<-function(x) {dnorm(x)}
curve(fd,from=-4,to=4,ylab="",xlab="",lty=5,lwd=3,add=FALSE,col=couleurs[1],cex.axis=2)
fd<-function(x) {dt(x,1)}
curve(fd,from=-4,to=4,ylab="",xlab="",lty=1,lwd=3,add=TRUE,col=couleurs[2])
fd<-function(x) {dt(x,2)}
curve(fd,from=-4,to=4,ylab="",xlab="",lty=2,lwd=3,add=TRUE,col=couleurs[3])
fd<-function(x) {dt(x,5)}
curve(fd,from=-4,to=4,ylab="",xlab="",lty=4,lwd=3,add=TRUE,col=couleurs[4])
legtxt<-c(expression(paste(italic(n)," = 1",sep="")),expression(paste(italic(n)," = 2",
  sep="")),expression(paste(italic(n)," = 5",sep="")),expression(paste(italic(N),"(0;1)",
  sep="")))
legend("topleft",legtxt,lty=c(1,2,4,5),lwd=3,col=c(couleurs[2],couleurs[3],couleurs[4],
  couleurs[1]),cex=1.6,bg="white",inset=.0375)
```
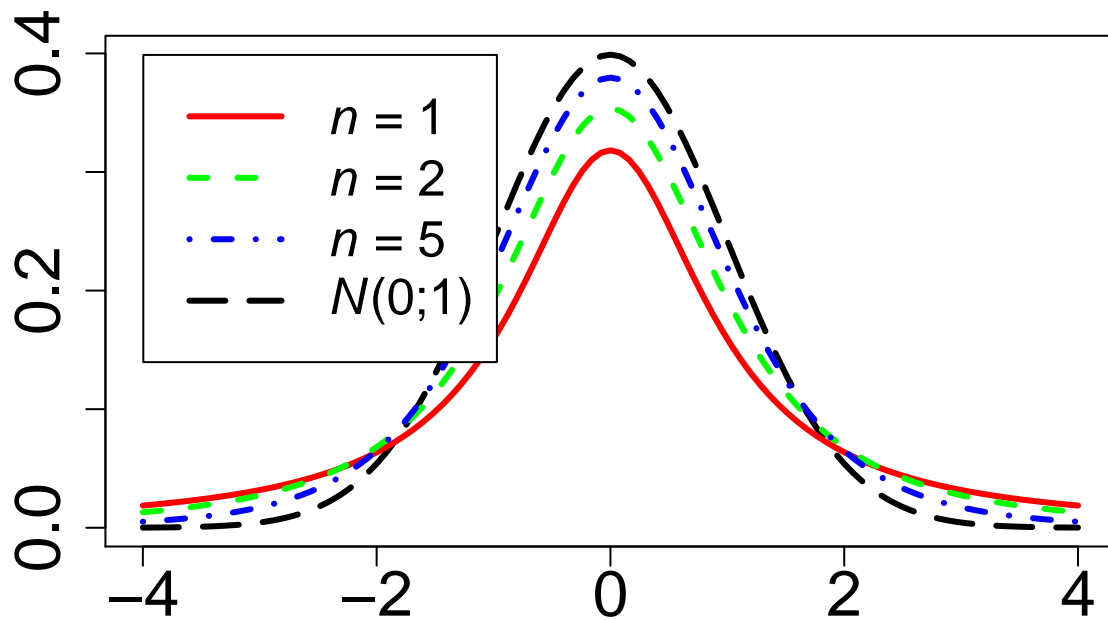
```r
#Exercice 4.2
dnorm(0)
```

```
## [1] 0.3989423
```

```r
#page 213
1/sqrt(2*pi)
```

```
## [1] 0.3989423
```

```r
pnorm(2.58)
```

```
## [1] 0.99506
```

```r
qnorm(0.975)
```

```
## [1] 1.959964
```

```r
rnorm(50)
```

```
##  [1] -1.37393138  0.23166163  1.23274939  0.75906570 -1.74178938
##  [6] -0.02410817 -0.98078728 -0.65116412 -0.35519358 -0.19411449
## [11] -2.15090040 -0.83299442  0.98653363 -0.02107944 -1.02704784
## [16]  0.49095893 -1.45155638  0.75438057 -1.48278817 -0.13968403
## [21] -0.33690607 -1.20259734 -0.10227708  0.30402224 -0.61914231
## [26] -0.44820927  0.08076903  1.86645032  2.61755856  0.15645799
## [31] -0.91541129  0.32098120 -0.22105228  0.74035042 -1.98993404
## [36] -0.37028801  1.40495470  2.66784425 -0.75879558  0.61819651
## [41] -4.17842389 -0.45125138  1.42447933  0.49597238 -0.50803679
## [46]  0.96087528 -0.60777042 -1.64956944 -1.06462931 -1.04565013
```

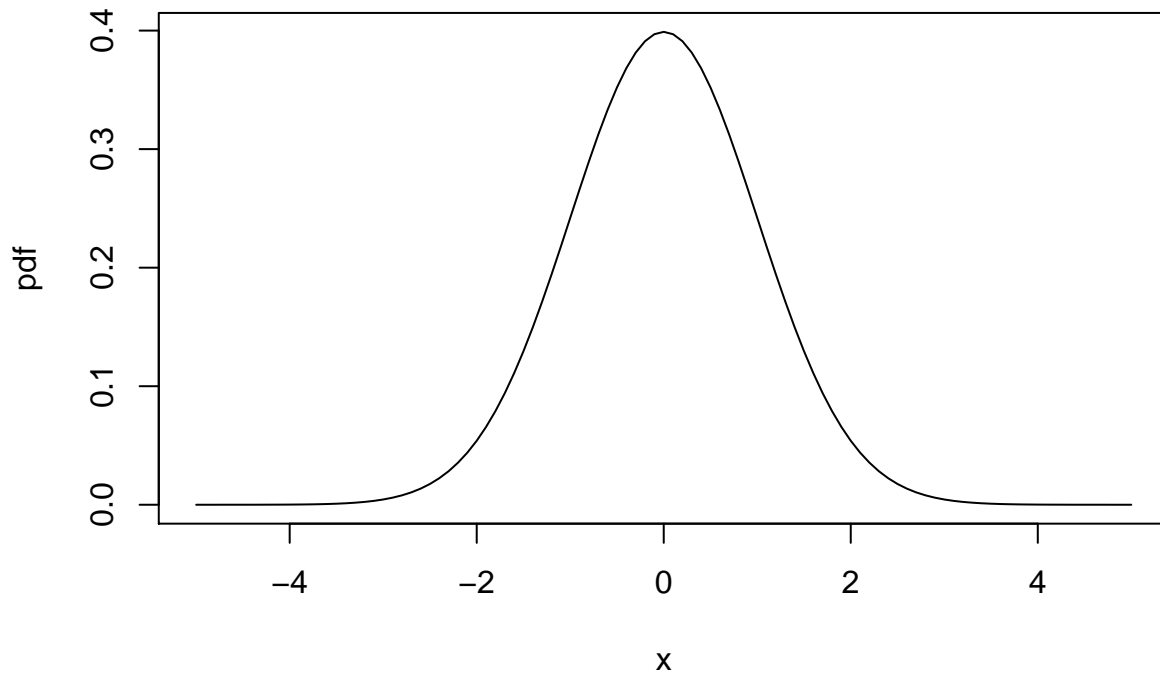```r
rnorm(20,mean=10,sd=2)
```

```
##  [1] 10.030149  9.868882  7.768354 13.033762 11.251472  7.931555 11.852496
##  [8] 10.497427  9.035457  8.104209 15.556011 11.463285 10.440840  9.117876
## [15]  9.114393  8.021647 10.198653  8.241223 12.323582 14.601007
```

```r
#page 214
x=seq(-5,5,0.1) ;pdf=dnorm(x) ;plot(x,pdf,type="l",
```

```
main="Densité de la loi normale centrée et réduite")
```

Densité de la loi normale centrée et réduite


```
runif(10)
```

```
##  [1] 0.3143197 0.7103501 0.9509352 0.7938318 0.2759871 0.7393912 0.1462793
##  [8] 0.9214865 0.5120292 0.7574358
#page 215
rt(10,20)
```

```
##  [1]  0.4403945  1.7825921  1.5628667  1.8335581  0.3224997  0.5825271
##  [7] -1.1854755 -1.7936463  0.2467840  1.6090490
#Exercice 4.3
#1)
dbinom(5,150,0.02)
```

```
## [1] 0.1011484
#page 216
pbinom(3,150,0.02)
```

```
## [1] 0.6472395
qbinom(0.99,150,0.02)
```

```
## [1] 8
#page 217
#Exercice 4.4
#1)
qbinom(0.95,230,0.85,lower.tail = FALSE)
```

```
## [1] 186
```

```r
qbinom(0.95,240,0.85,lower.tail = FALSE)
```

```
## [1] 195
```

```r
qbinom(0.95,246,0.85,lower.tail = FALSE)
```

```
## [1] 200
```

```r
plot(230:250,qbinom(0.95,230:250,0.85,lower.tail = FALSE))
abline(h=200)
abline(v=246)
```
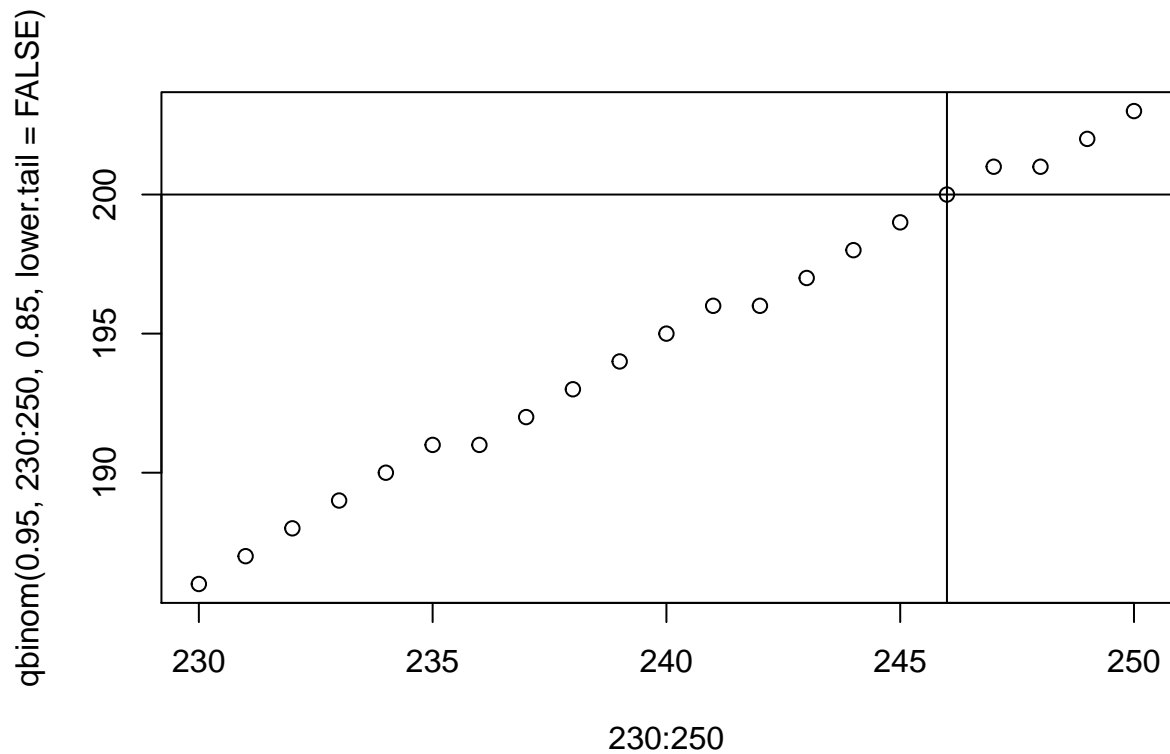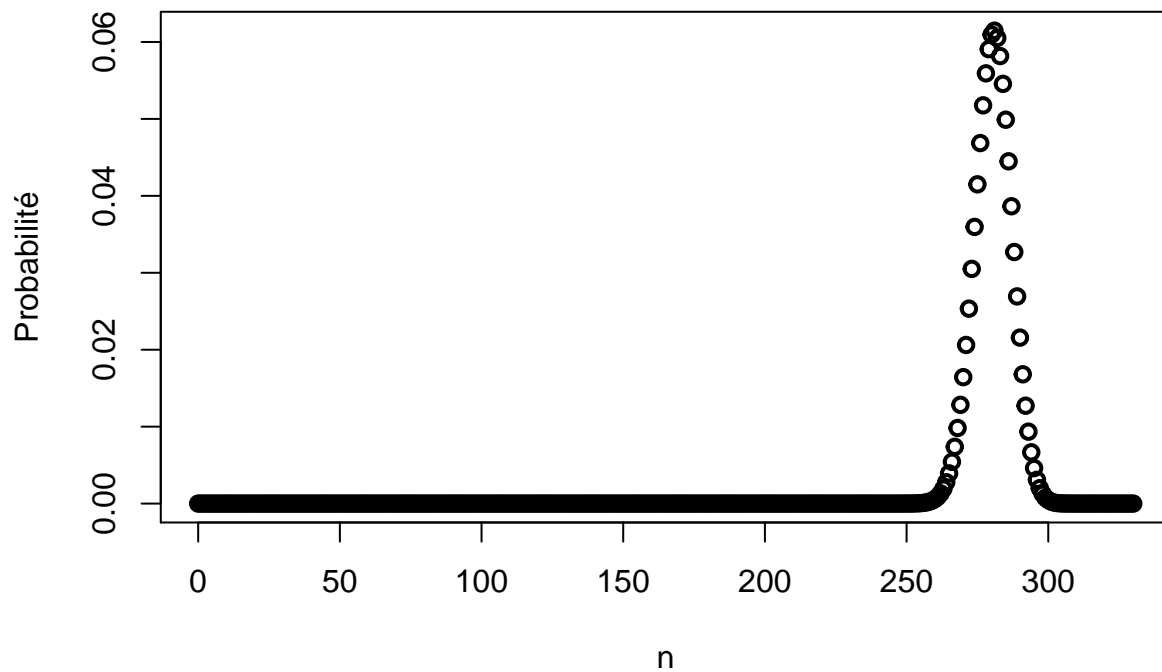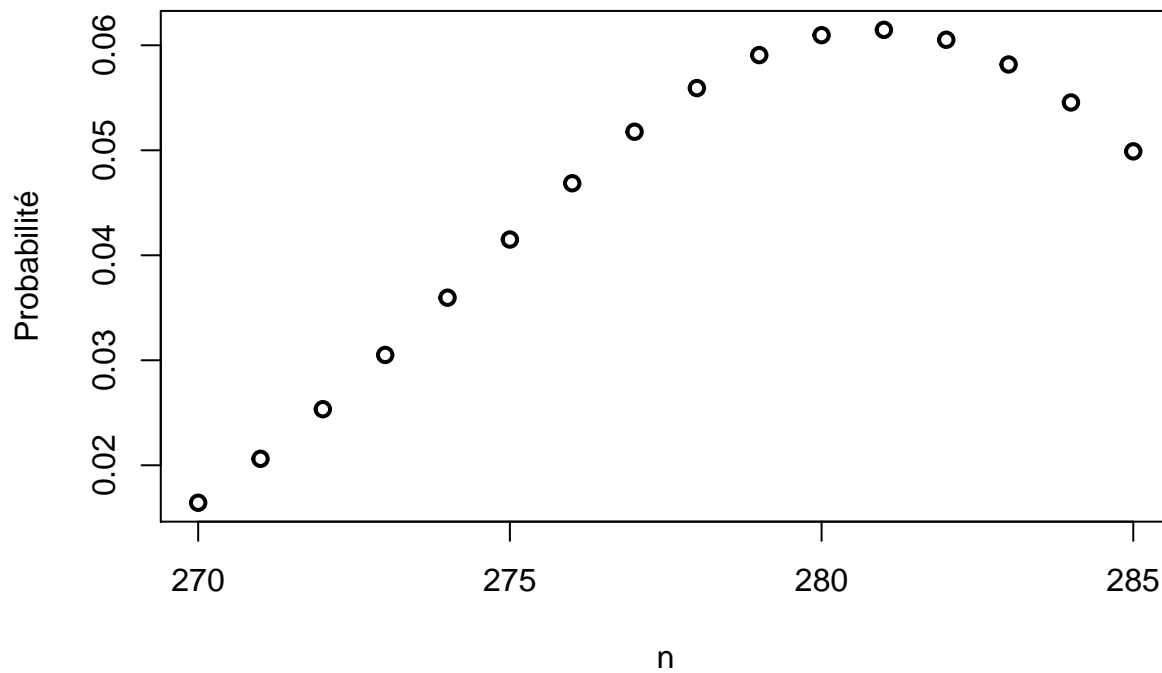


```r
#page 218
#2)
which.max(dbinom(0:330,330,.85))
```
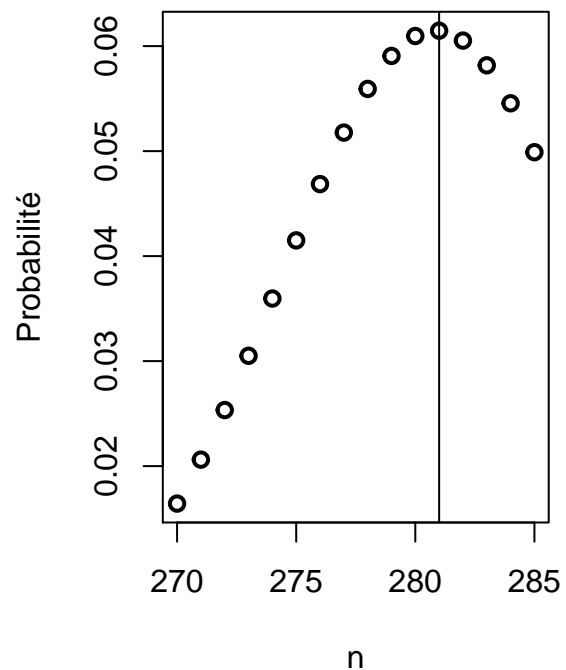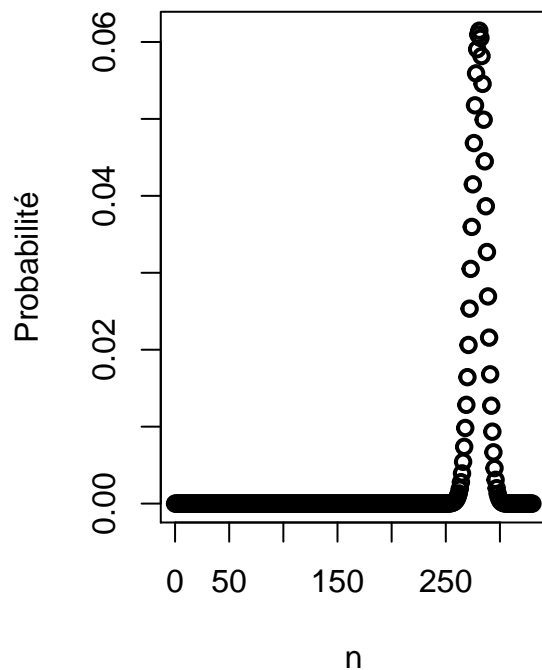
```
## [1] 282
```

```r
plot(0:330,dbinom(0:330,330,.85),xlab="n",ylab="Probabilité",lwd=2)
```

```
plot(270:285,dbinom(270:285,330,.85),xlab="n",ylab="Probabilité",lwd=2)
```



```
#En plus : code figure 424
old.par <- par(no.readonly = TRUE)
layout(t(1:2))
plot(0:330,dbinom(0:330,330,.85),xlab="n",ylab="Probabilité",lwd=2)
plot(270:285,dbinom(270:285,330,.85),xlab="n",ylab="Probabilité",lwd=2)
abline(v=281)
```

```
layout(1)
par(old.par)

old.par <- par(no.readonly = TRUE)
pdf("figure424.pdf",h=6,w=9)
layout(t(1:2))
par(oma=rep(0,4));par(mar=c(4, 4, 2, 2) + 0.1)
plot(0:330,dbinom(0:330,330,.85),xlab="n",ylab="Probabilité",lwd=2)
plot(270:285,dbinom(270:285,330,.85),xlab="n",ylab="Probabilité",lwd=2)
abline(v=281)
layout(1)
dev.off()
```

```
## pdf
##   2
```

```
par(old.par)

#page 219
#Exercice 4.5
#1)
1-pnorm(80,92,8)
```
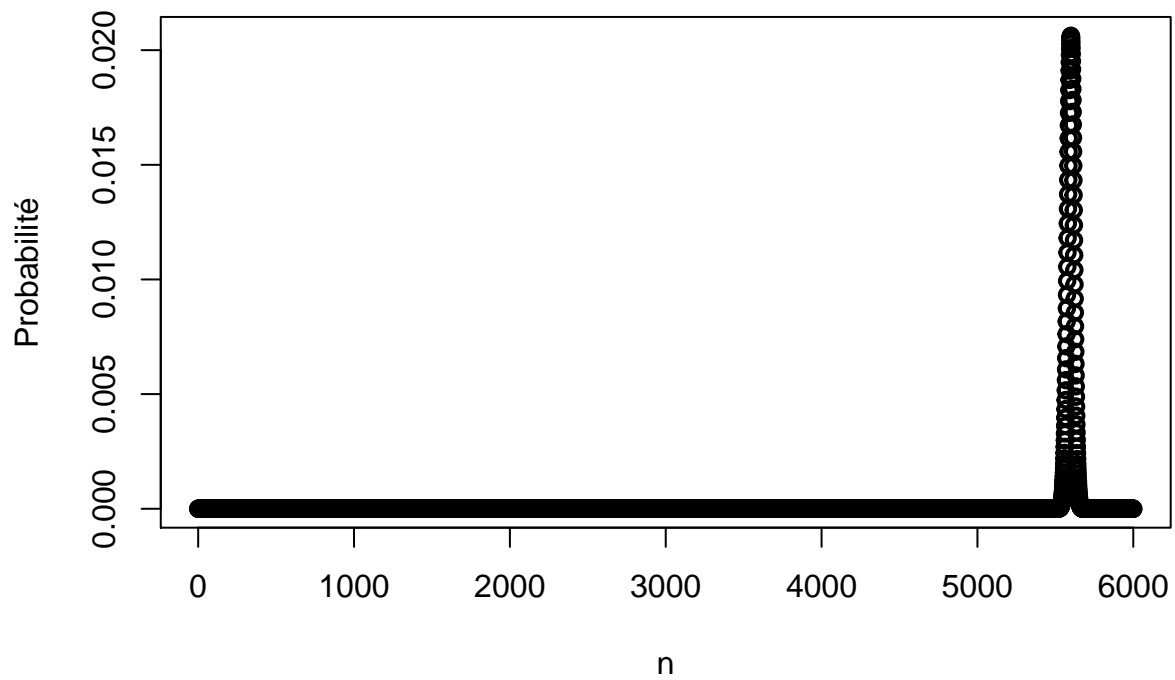
```
## [1] 0.9331928
```

```
#page 220
#2)
(1-pnorm(80,92,8))*6000
```
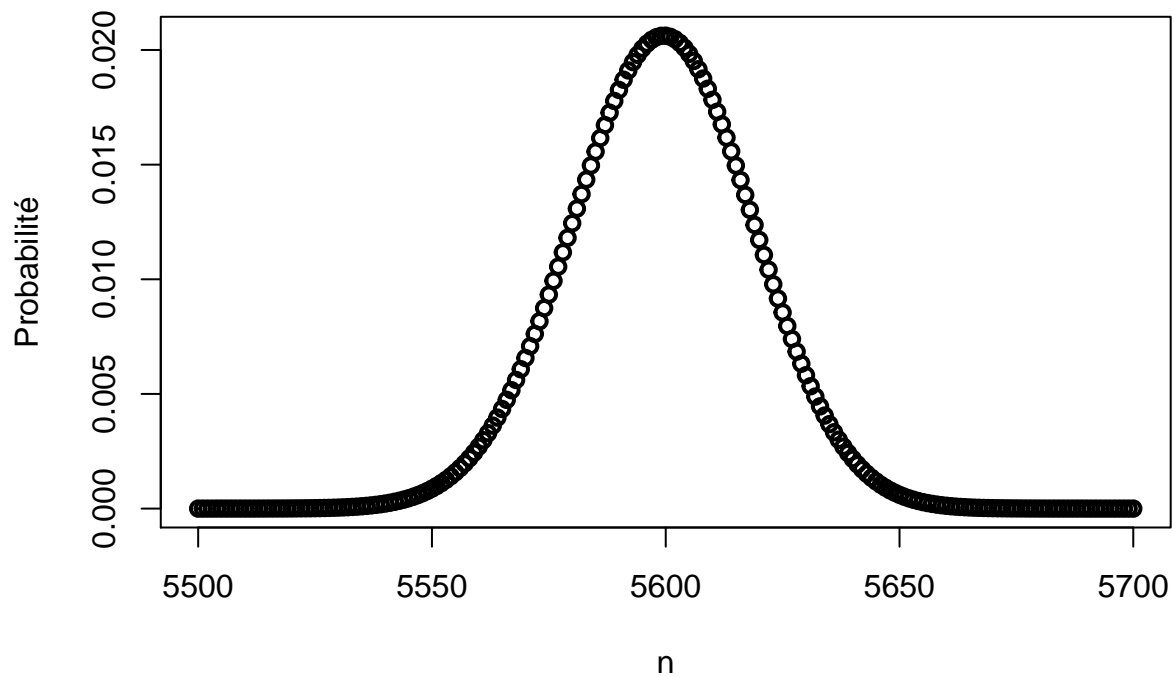
```
## [1] 5599.157
```

```
#3)
which.max(dbinom(0:6000,6000,.9331928))
```
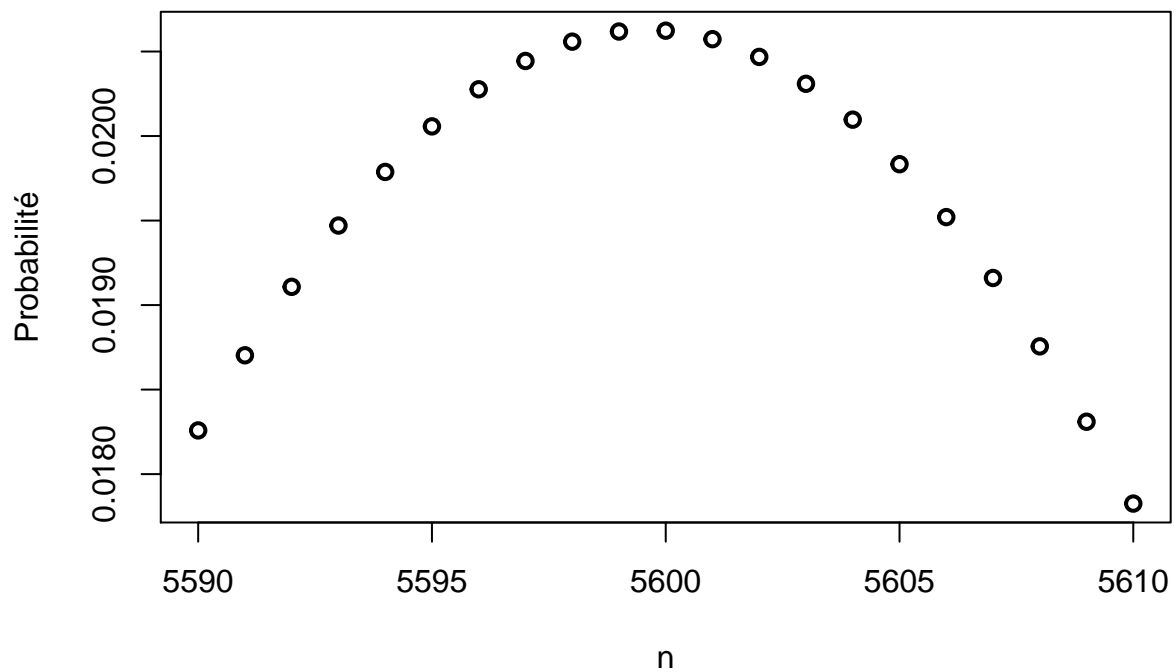
```
## [1] 5601
```

```r
plot(0:6000,dbinom(0:6000,6000,.9331928),xlab="n",ylab="Probabilité",lwd=2)
```



```r
plot(5500:5700,dbinom(5500:5700,6000,.9331928),xlab="n",ylab="Probabilité",lwd=2)
```



```r
plot(5590:5610,dbinom(5590:5610,6000,.9331928),xlab="n",ylab="Probabilité",lwd=2)
```

```r
dbinom(5599,6000,.9331928)
```

```
## [1] 0.02061832
```

```r
#page 221
dbinom(5600,6000,.9331928)
```

```
## [1] 0.02062328
```

```r
#En plus : code figure 425
old.par <- par(no.readonly = TRUE)
layout(matrix(c(1,2,1,3),nrow=2))
par(oma=rep(0,4));par(mar=c(4, 4, 2, 2) + 0.1)
plot(0:6000,dbinom(0:6000,6000,.9331928),xlab="n",ylab="Probabilité",lwd=2)
plot(5500:5700,dbinom(5500:5700,6000,.9331928),xlab="n",ylab="Probabilité",lwd=2)
plot(5590:5610,dbinom(5590:5610,6000,.9331928),xlab="n",ylab="Probabilité",lwd=2)
```
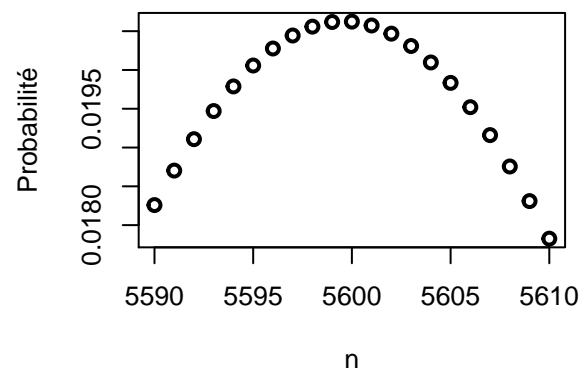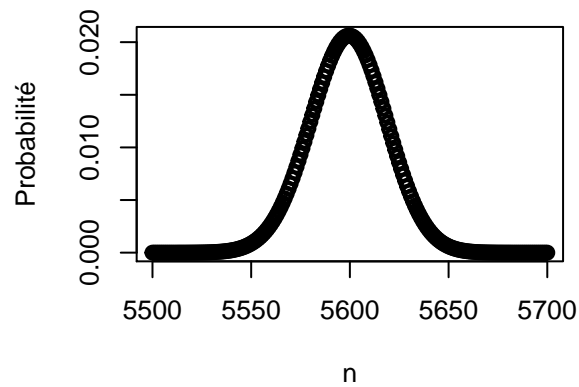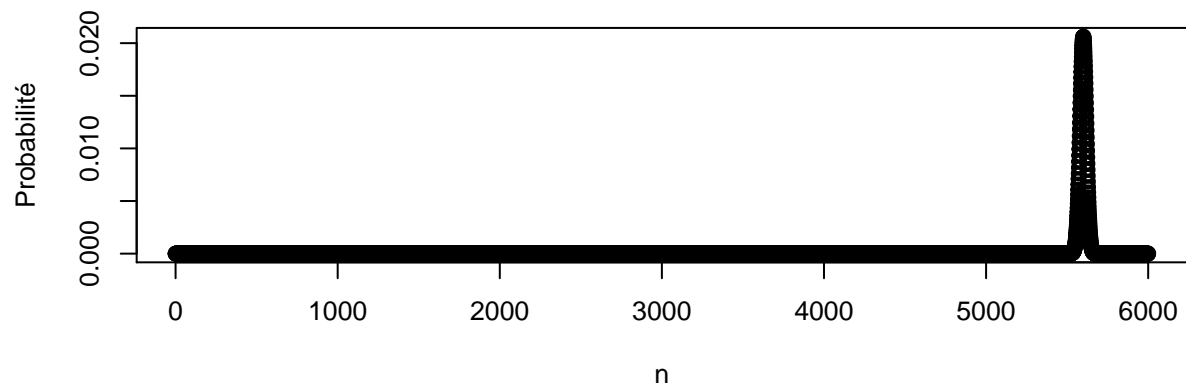
```r
layout(1)
par(old.par)

old.par <- par(no.readonly = TRUE)
pdf("figure425.pdf",h=6,w=9)
layout(matrix(c(1,2,1,3),nrow=2))
par(oma=rep(0,4));par(mar=c(4, 4, 2, 2) + 0.1)
plot(0:6000,dbinom(0:6000,6000,.9331928),xlab="n",ylab="Probabilité",lwd=2)
plot(5500:5700,dbinom(5500:5700,6000,.9331928),xlab="n",ylab="Probabilité",lwd=2)
plot(5590:5610,dbinom(5590:5610,6000,.9331928),xlab="n",ylab="Probabilité",lwd=2)
layout(1)
dev.off()

## pdf
##   2

par(old.par)
```