Pstat 115 HW4

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2.

(a)

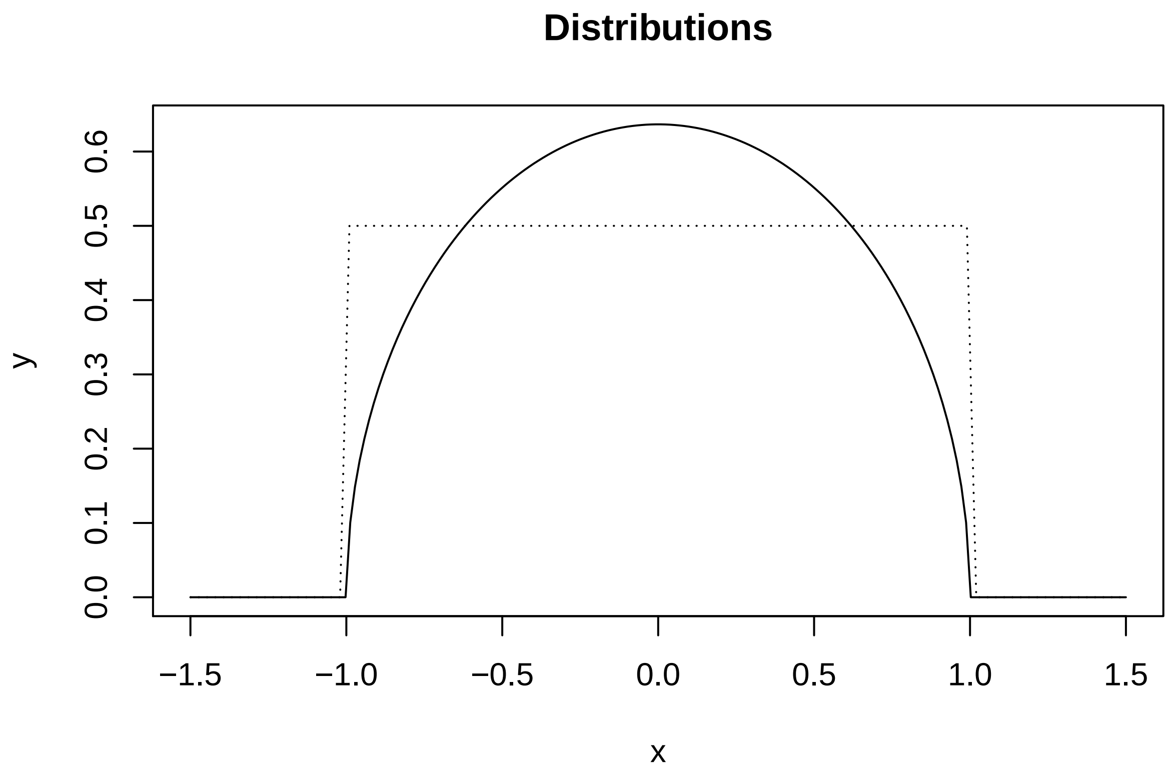
For rejection sampling, let $g(x|R) = \frac{1}{2R}\mathbf{1}_{[-R,R]}$.

We see that, if $M = \frac{4}{\pi}$, then $p(x|R) = \frac{2}{\pi R^2}\sqrt{R^2 - x^2}\mathbf{1}_{[-R,R]} \leq \frac{2}{\pi R}\mathbf{1}_{[-R,R]} = Mg(x|R)$.

(b)

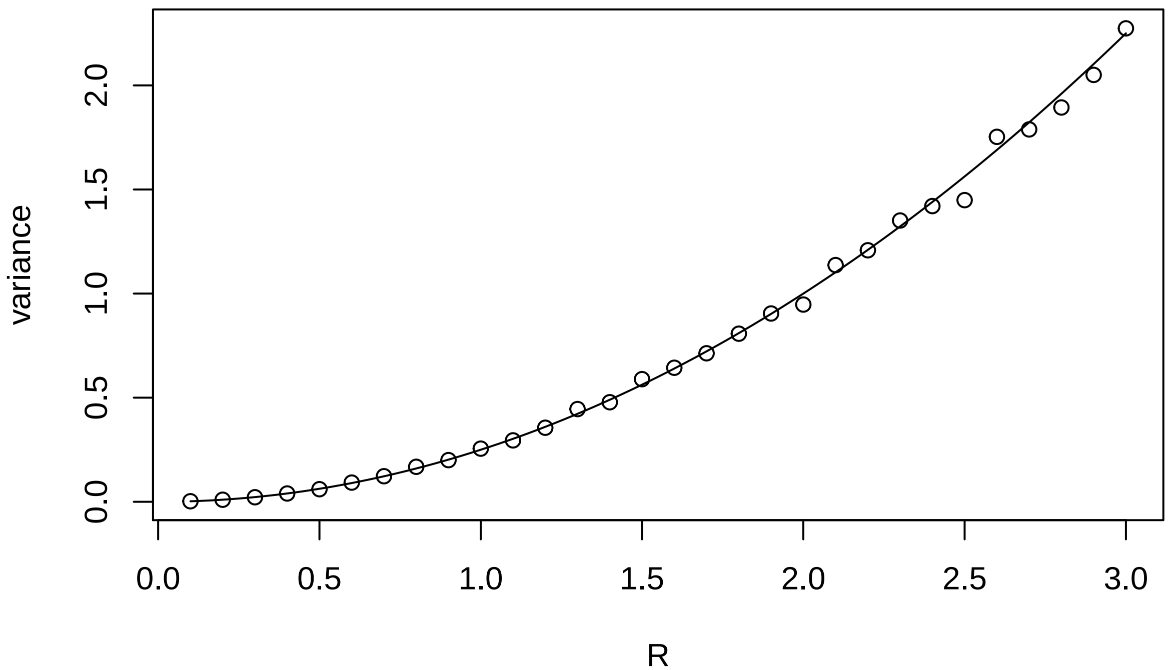
```
p=function(x)
{
  if(x>1 | x< -1)
    return (0)
  return (2/pi*sqrt(1-x^2))
}

g=function(x)
{
  if(x>1 | x< -1)
    return (0)
  return (0.5)
}
h <- Vectorize(p);
k <- Vectorize(g);
curve(h,-1.5,1.5,n=200,xlab='x',ylab='y',main="Distributions")
curve(k,add=TRUE,lty=3)
```



(c)

```
R=seq(0.1,3,0.1)
l=function(x,R)
{
  return(sqrt(R^2-x^2)/R/pi)
}
variances=function(R)
{
  s=5000
  samples=runif(s,-R,R)
  #runif is a uniform distribution
  keep=l(samples,R)>runif(s)
  return(var(samples[keep]))
}
m=function(x)
{
  return (x^2/4)
}
variance=sapply(R,variances)
plot(R,variance)
curve(m,add=TRUE)
```


variance
0.0
0.5
1.0
1.5
2.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
R