Formative Assessment 8

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Question 1

An analogue signal received at a detector, measured in microvolts, is normally distributed with mean of 200 and variance of 256.

that is, X ~ N(200, 16).

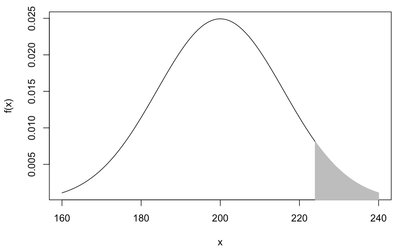
a. What is the probability that the signal will exceed 224 μV?

P(X > 224)

```
1-pnorm(224,200,16)
```

```
## [1] 0.0668072
```

```
curve(dnorm(x, 200, 16), 240, 160, xlab = "x", ylab = "f(x)")
x <- seq(224, 240, 0.01) #values of x in the range 40-50 in intervals of 0.01
lines (x, dnorm(x, mean = 200, sd = 16), type = "h",
col = "grey") #shading
```



b. What is the probability that it will be between 186 and 224 μV?

P(X < 224|X > 186) = $\frac{P((X<224)\cap(X>186))}{P(X>186)} \equiv \frac{P(186<X<224)}{P(X>186)}$

P(186 < X< 224)=

```
a <- pnorm(224,200,16)-pnorm(186,200,16)
a
```

```
## [1] 0.7424058
```

P(X>186) =

```
b <- 1-pnorm(186,200,16)
b
```

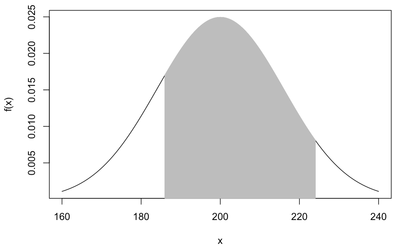
```
## [1] 0.809213
```

$\frac{P(186<X<224)}{P(X>186)}$ =

```
c <- a/b
c
```

```
## [1] 0.9174418
```

```
curve(dnorm(x, 200, 16), 240, 160, xlab = "x", ylab = "f(x)")
x <- seq(186, 224, 0.01) #values of x in the range 40-50 in intervals of 0.01
lines (x, dnorm(x, mean = 200, sd = 16), type = "h",
col = "grey") #shading
```



c. What is the micro voltage below which 25% of the signals will be?

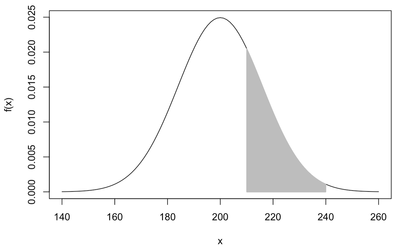
d. What is the probability that the signal will be less than 240 μV, given that it is larger than 210 μV?

P(X < 240|X > 210)

```
pnorm(240,200,16)-pnorm(210,200,16)
```

```
## [1] 0.2597759
```

```
curve(dnorm(x, 200, 16), 260, 140, xlab = "x", ylab = "f(x)")
x <- seq(210, 240, 0.01) #values of x in the range 40-50 in intervals of 0.01
lines (x, dnorm(x, mean = 200, sd = 16), type = "h",
col = "grey") #shading
```



e. Estimate the interquartile range.

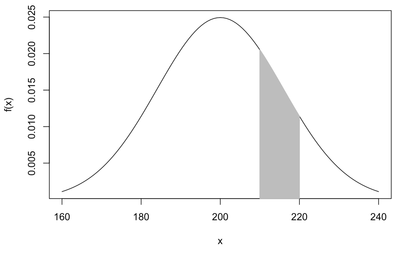
f. What is the probability that the signal will be less than 220 μV, given that it is larger than 210 μV?

P(X < 220|X > 210)

```
pnorm(220,200,16)-pnorm(210,200,16)
```

```
## [1] 0.1603358
```

```
curve(dnorm(x, 200, 16), 240, 160, xlab = "x", ylab = "f(x)")
x <- seq(210, 220, 0.01) #values of x in the range 40-50 in intervals of 0.01
lines (x, dnorm(x, mean = 200, sd = 16), type = "h",
col = "grey") #shading
```



g. If we know that a received signal is greater that 200 μV, what is the probability that is in fact greater than 220 μV?

```
summary(cars)
```

```
##      speed           dist
##  Min.   : 4.0   Min.   :  2.00
##  1st Qu.:12.0   1st Qu.: 26.00
##  Median :15.0   Median : 36.00
##  Mean   :15.4   Mean   : 42.98
##  3rd Qu.:19.0   3rd Qu.: 56.00
##  Max.   :25.0   Max.   :120.00
```

Question 2

A manufacturer of a particular type of computer system is interested in improving its customer support services. As a first step, its marketing department has been charged with the responsibility of summarizing the extent of customer problems in terms of system failures. Over a period of six months, customers were surveyed and the amount of downtime (in minutes) due to system failures they had experienced during the previous month was collected. The average downtime was found to be 25 minutes and a variance of 144. If it can be assumed that downtime is normally distributed:

a. obtain bounds which will include 95% of the downtime of all the customers;

b. obtain the bound above which 10% of the downtime is included.