3. Commands, Variables and Functions

Task 1

```r
x=1
sin(x)**2+cos(x)**2
```

The result of this command is always 1, irrespective of the numerical value of x.

4. Vectors

Task 1

```r
x=1:3
y=x^2
rep(y,3)
```

Task 2

```r
rep(seq(1,7,3),3)
```

Task 3

```r
sum(seq(1,999,2))
```

Answer: 250,000

There are a few ways to do part 2. One way:

```r
sum((1:500)*2-1)
```

5. Vector Indexing

Task 1

```r
x <- c(7,4,10,3,15,8,1)
y <- c(6,2:4)
x[-y]
```
Task 2
There are a few ways to do this. One way:
\[ x = -5:5 \]
\[ x[1:5] = 0 \]
\[ x[seq(7, 11, 2)] = 1 \]

Task 3
\[ x = 0:1000 \]
\[ x[seq(1, 1001, 2)] = 0 \]
\[ \text{sum}(x) \]
Answer: 250,000

6. Logical Operators and Statements

Task 1
\[ x = 1:10 \]
\[ x[x < 4 | x == 5 | x > 6] \]
\[ x[x != 4 & x != 6] \]
\[ x[!(x == 4 | x == 6)] \]

Task 2
\[ x = -10:10 \]
\[ y = \sqrt{x} \]
\[ z = x[y > 2 & !\text{is.na}(y)] \]

7. Matrices and Arrays

Task 1
\[ x = \text{matrix}(0, 5, 8) \]
\[ x[2:4, c(3, 5, 7)] = 1 \]
\[ \text{sum}(\text{crossprod}(x, x)) \]

Task 2
\[ x = 1:24 \]
\[ \text{dim}(x) = c(4, 6) \]
\[ \text{dim}(x) = c(4, 3, 2) \]
\[ \text{dim}(x) = c(2, 2, 3, 2) \]
\[ x = \text{as.vector}(x) \]
8. Types, Objects, Classes and Character Strings

Task 1

```r
paste("a","b",sep="_")
x <- c("a","b","c")
paste(x,collapse="")
```

9. Reading and Writing Files, and Data Frames

Task 1

```r
data(CO2)
CO2
CO2$uptake
x=CO2$uptake[CO2$Type=="Quebec" & CO2$Treatment=="chilled"]
summary(x)
```

10. Plotting and Graphical Facilities

Task 1

```r
data(Puromycin)
Puromycin
plot(Puromycin$rate~Puromycin$conc)
plot(Puromycin$rate~Puromycin$conc,xlab="Substrate Concentration", ylab="Reaction Rate",main="Reaction Rate vs Substrate Concentration")
plot(Puromycin$rate~Puromycin$conc,xlab="Substrate Concentration", ylab="Reaction Rate",main="Reaction Rate vs Substrate Concentration",pch=19)
points(Puromycin$rate[Puromycin$state=="treated"~x]~Puromycin$conc[x], pch=19,col="red")
```

Task 2

```r
x <- rnorm(1000)
hist(x)
hist(x,breaks=100,col="red")
hist(x,breaks=100,freq=FALSE)
lines(density(x),lwd="2")
```