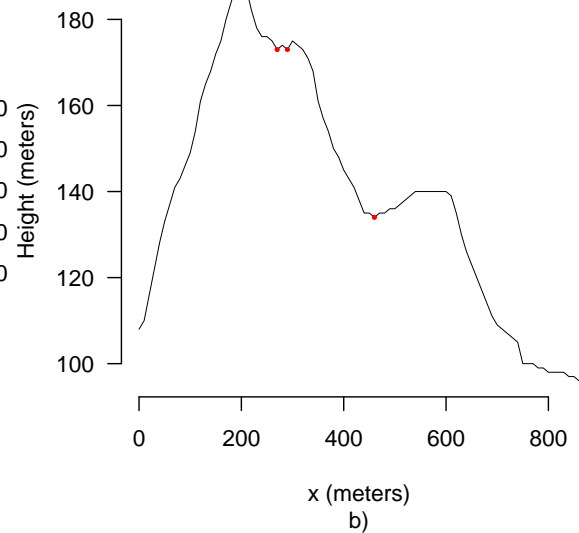
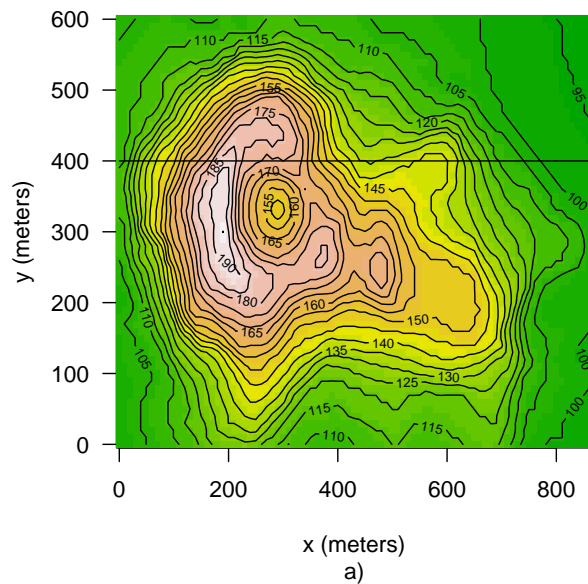


## Homework #3

Maunga Whau (Mt Eden) is one of about 50 volcanos in the Auckland volcanic field. This data set (`?volcano`) gives topographic information for Maunga Whau on a 10m by 10m grid. *Figure a)* shows contour plot of the volcano Maunga Whau. *Figure b)* shows the cross-section of the volcano at  $y = 400\text{m}$ . Answer the following questions in the light of this information.

```
z <- volcano # Store volcano data in z
x <- (0:(nrow(z) - 1)) * 10 # x-values
y <- (0:(ncol(z) - 1)) * 10 # y-values
y400 <- z[,41] # heights at y = 400m
```



**Q1:(10pts)** Answer the questions below using R;

1. What is the *maximum height* of the volcano?
2. What is the  $[x, y]$  coordinate of maximum height?
3. What is the *minimum height* of the volcano?
4. What is the  $[x, y]$  coordinate of minimum height?

**Q2:(30pts)** Data at 6 cells in the matrix (`z`) was removed because of quality assurance (*run the command below*).

```
z <- volcano # Store volcano data in z
set.seed(1)
indices <- round(runif(6, 1, length(z))) # indices to set NA
z[indices] <- NA # set to NA in purpose
```

1. Find the  $x$  and  $y$  coordinates of NAs.
2. Fill the NAs by mean of the 8 values surrounding NA cell.

**Q3:(30pts)** *Figure b)* shows the cross-section of the volcano at  $y = 400\text{m}$  and local minimum heights on the volcano (*red points*). Write an R expression to detect/find the local minimums in the `y400` vector. How far the local minimums are away from the left (zero)? Discuss your results with the *figure b)* (**Hint:** `?diff`, `?sign`, `?which`)

**Q4:(30pts)** Find slopes at the locations  $y = 400$  and  $x = \text{seq}(5, 855, 10)$  meters. What are the location and value of steepest slope (*negative or positive*)? What would be the best place for a climber needs a rest?