1. When we use Principal Components Regression we need to use all Principal Components of design matrix X .

   ( ) True (X) False

   Justification: In PCR, it is not necessary to use all the principal components of the design matrix. We either use a screeplot or the percent of variation explained by the PCs to decide how many we want to keep.

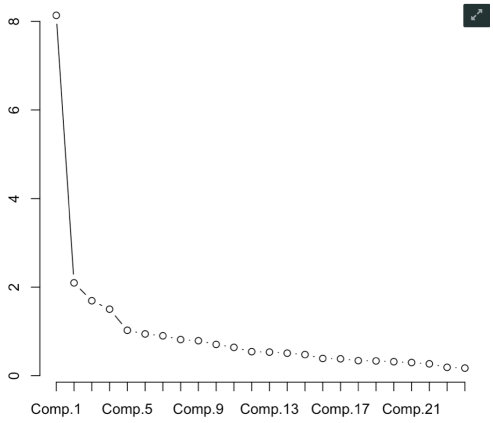
2. The following output is obtained after calculating the principal components of the circumference measurements of the fat data set from the faraway library:

```
## Importance of components:
##                           PC1     PC2     PC3     PC4     PC5     PC6     PC7
## Standard deviation     15.990 4.06584 2.96596 2.00044 1.69408 1.49881 1.30322
## Proportion of Variance  0.867 0.05605 0.02983 0.01357 0.00973 0.00762 0.00576
## Cumulative Proportion   0.867 0.92304 0.95287 0.96644 0.97617 0.98378 0.98954
##                           PC8     PC9    PC10
## Standard deviation     1.25478 1.10955 0.52737
## Proportion of Variance 0.00534 0.00417 0.00094
## Cumulative Proportion  0.99488 0.99906 1.00000
```

   According to this output the first 3 Principal Components explain 95.287 % of the total data variation (use 3 decimal places for your response).

   Justification: We look at the cumulative proportion.

3. Based on the scree plot below, how many components would you choose?



   We choose 4 components.

   Justification: From the 5th component and on the scree plot begins to flatter. So, we choose 4 components, which is where we have the "elbow"

4. In Lasso regression, the value of t in the constraint $\sum_j |\beta_j| \leq t$ can be found using one of the following methods:

   ( ) Maximum Likelihood
   ( ) Least-Squares
   ( ) Weighted Least-Squares
   (X) Cross-Validation

   Justification: t is a tuning parameter, and its value is obtained using Cross-Validation.

5. Shall we re-scale the original variables $X_1, \ldots, X_p$ before performing Principal Component Analysis?

   (X) Yes ( ) No

   Justification: We prefer to re-scale the original variables, specially when the magnitude of the different variables in the model is very different.

6. What will happen when you apply very large penalty in case of Lasso?

   (X) Some of the coefficient will become zero.
   ( ) Some of the coefficient will be approaching to zero but not absolute zero
   ( ) Both A and B depending on the situation
   ( ) None of these

   Justification: If the penalty is very high, then we choose models with less parameters which in other words mean that we force more coefficients to become zero.