

Q1

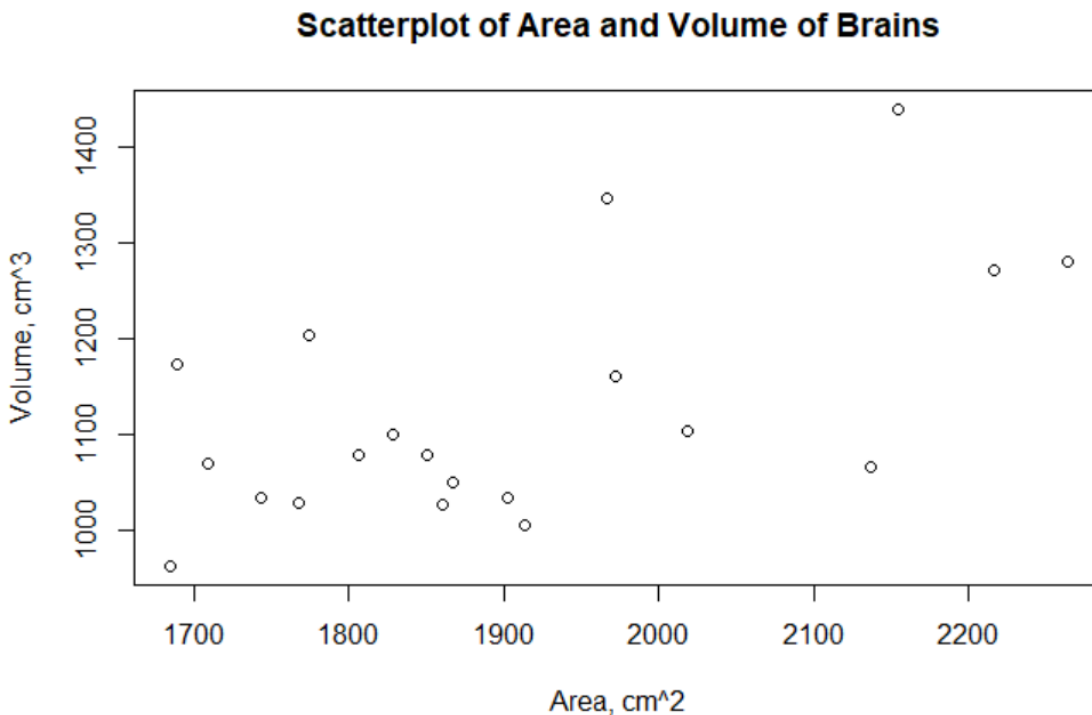
```
dir = "C:\\Users\\...\\Stat3510 - Environmental Risk Analysis\\Assignment 2\\"
```

```
file1 = "IQBRAIN.csv"
```

```
dfBrain = read.table(file=paste(dir,file1, sep=""), header=TRUE, sep=',')
```

a)

```
plot(dfBrain$AREA, dfBrain$VOL, xlab = "Area, cm^2", ylab = "Volume, cm^3", main =  
"Scatterplot of Area and Volume of Brains")
```



The volume of brains and area of brains appear to be somewhat linearly related.

b)

```
model.brain = lm(VOL~AREA, data = dfBrain)
```

```
summary(model.brain)
```

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) 307.2205    257.6590   1.192  0.24861
AREA         0.4295     0.1346    3.190  0.00507 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 102.6 on 18 degrees of freedom
Multiple R-squared:  0.3612,    Adjusted R-squared:  0.3257
F-statistic: 10.18 on 1 and 18 DF,  p-value: 0.00507
```

Ho: $B_1 = 0$, the slope is equal to zero, no linear relationship

Ha: $B_1 \neq 0$, the slope is not equal to zero, significant linear relationship

With a p-value of 0.00507 there is relatively strong evidence to reject the null hypothesis in favour of the alternative, that there is a linear relationship between the area of a brain and the volume of a brain.

c)

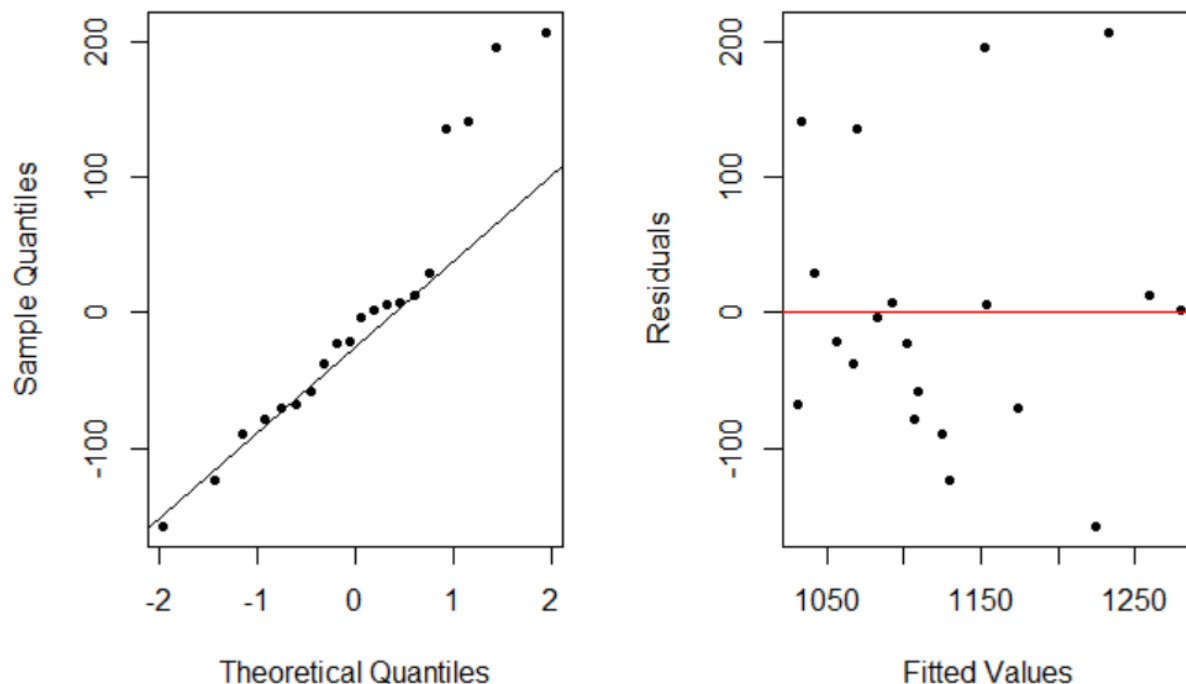
```
par(mfrow=c(1,2))
```

```
qqnorm(model.brain$residuals, pch = 20, main = " ")
```

```
qqline(model.brain$residuals)
```

```
plot(model.brain$fitted.values, model.brain$residuals, pch = 20, xlab = "Fitted Values", ylab = "Residuals")
```

```
abline(h = 0, col = "red")
```



The assumption of linearity appears to hold as the points are randomly distributed in the Residuals plot. The assumption of normality does not appear to hold as there are points quite far away from the straight line in the QQ plot. The assumption of constant variance does not appear to hold as the points are not evenly distributed across the midline in the Residuals plot.

d)

The predicted volume for a brain with an area of 1900cm^2 would be:

$$\begin{aligned}\hat{Y} &= 307.2205 + (0.4295)1900 \\ &= 1123.2705\end{aligned}$$