```
> summary(carpet.mod1)
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -335.225     27.983  -11.98 7.51e-11 ***
cys_acid_f   467.310      8.801   53.09  < 2e-16 ***
Residual standard error: 55.45 on 21 degrees of freedom
Multiple R-squared:  0.9926,    Adjusted R-squared:  0.9923
F-statistic:  2819 on 1 and 21 DF,  p-value: < 2.2e-16

> anova(carpet.mod1)
Analysis of Variance Table
Response: age_f
           Df  Sum Sq Mean Sq F value    Pr(>F)
cys_acid_f  1 8668970 8668970  2819.1 < 2.2e-16 ***
Residuals  21   64577    3075
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> confint(carpet.mod1)
                2.5 %    97.5 %
(Intercept) -393.4178 -277.0318
cys_acid_f   449.0065  485.6134
> predict(carpet.mod1,list(cys_acid_f=cys_acid_m),int="p")
       fit      lwr      upr
1 562.0103 442.8635 681.1572
2 337.7015 216.9257 458.4774
>
> plot(cys_acid_f, age_f)
> abline(carpet.mod1)
>
> cor.test(cys_acid_f, age_f)
        Pearson's product-moment correlation
data:  cys_acid_f and age_f
t = 53.0951, df = 21, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.9911243 0.9984567
sample estimates:
      cor
0.9962961
>
> ############ Scalar Form - Direct Calculations
> (n <- length(age_f))
[1] 23
> (ybar <- mean(age_f))
[1] 1017.739
> (xbar <- mean(cys_acid_f))
[1] 2.895217
> (SS_XX <- sum((cys_acid_f - xbar)^2))
[1] 39.69697
> (SS_XY <- sum((cys_acid_f - xbar) * (age_f - ybar)))
[1] 18550.79
> (SS_YY <- sum((age_f - ybar)^2))
[1] 8733546
>
> (beta1_hat <- SS_XY / SS_XX)
[1] 467.31
> (beta0_hat <- ybar - beta1_hat * xbar)
[1] -335.2248
> Y_hat <- beta0_hat + beta1_hat * cys_acid_f
>
> (SS_ERR <- sum((age_f - Y_hat)^2));  (df_ERR <- n-2); (MS_ERR <- SS_ERR/df_ERR)
[1] 64576.89
[1] 21
[1] 3075.09
> (SS_REG <- sum((Y_hat - ybar)^2)); (df_REG <- 1); (MS_REG <- SS_REG/df_REG)
[1] 8668970
[1] 1
[1] 8668970
>
```

```
> (SE_beta1_hat <- sqrt(MS_ERR / SS_XX))
[1] 8.801368
> (SE_beta0_hat <- sqrt(MS_ERR * ((1/n) + xbar^2/SS_XX)))
[1] 27.98259
>
> (t_beta1 <- beta1_hat / SE_beta1_hat)
[1] 53.09515
> (t_beta0 <- beta0_hat / SE_beta0_hat)
[1] -11.97976
>
> (t_crit <- qt(.975,n-2))
[1] 2.079614
>
> (P_beta1 <- 2*(1-pt(abs(t_beta1),n-2)))
[1] 0
> (P_beta0 <- 2*(1-pt(abs(t_beta0),n-2)))
[1] 7.511813e-11
>
> (CI95_beta1 <- beta1_hat + qt(c(.025,.975),n-2) * SE_beta1_hat)
[1] 449.0065 485.6134
> (CI95_beta0 <- beta0_hat + qt(c(.025,.975),n-2) * SE_beta0_hat)
[1] -393.4178 -277.0318
>
> X_s <- seq(0,5,0.01)
> yhat_h <- beta0_hat + beta1_hat * X_s
> CI_LO <- yhat_h + qt(.025,n-2) * sqrt(MS_ERR*((1/n)+(X_s-xbar)^2/SS_XX))
> CI_HI <- yhat_h + qt(.975,n-2) * sqrt(MS_ERR*((1/n)+(X_s-xbar)^2/SS_XX))
> PI_LO <- yhat_h + qt(.025,n-2) * sqrt(MS_ERR*(1 + (1/n)+(X_s-xbar)^2/SS_XX))
> PI_HI <- yhat_h + qt(.975,n-2) * sqrt(MS_ERR*(1 + (1/n)+(X_s-xbar)^2/SS_XX))
>
> plot(cys_acid_f,age_f,xlim=c(0,5),ylim=c(-500,2500))
> lines(X_s,yhat_h,lty=1)
> lines(X_s,CI_LO,lty=2)
> lines(X_s,CI_HI,lty=2)
> lines(X_s,PI_LO,lty=5)
> lines(X_s,PI_HI,lty=5)

> (yhat_miss <- beta0_hat + beta1_hat * cys_acid_m)
[1] 562.0103 337.7015
> (PE_miss <- sqrt(MS_ERR * (1 + (1/n) + (cys_acid_m - xbar)^2/SS_XX)))
[1] 57.29277 58.07609
> (PI_age_24 <- yhat_miss[1] + qt(c(.025,.975),n-2) * PE_miss[1])
[1] 442.8635 681.1572
> (PI_age_25 <- yhat_miss[2] + qt(c(.025,.975),n-2) * PE_miss[2])
[1] 216.9257 458.4774
> (F_obs <- MS_REG / MS_ERR)
[1] 2819.095
> (F_crit <- qf(.95,1,n-2))
[1] 4.324794
> (P_F <- 1 - pf(F_obs,1,n-2))
[1] 0
> (r_square <- SS_REG / SS_YY)
[1] 0.9926059
>
> ### Correlation Test/CI
> (r <- SS_XY / sqrt(SS_XX * SS_YY))
[1] 0.9962961
> (t_r <- sqrt(n-2) * (r / sqrt(1 - r^2)))
[1] 53.09515
> (t_r_crit <- qt(.975,n-2))
[1] 2.079614
> (P_r <- 2*(1 - pt(abs(t_r),n-2)))
[1] 0
> (z_r <- 0.5 * log((1+r) / (1-r)))
[1] 3.144829
> (CI_z_rho <- z_r + qnorm(c(.025,.975),0,1) * sqrt(1 / (n-3)))
[1] 2.706567 3.583090
> (CI_rho <- (exp(2*CI_z_rho) - 1) / (exp(2*CI_z_rho) + 1))
[1] 0.9911243 0.9984567
```