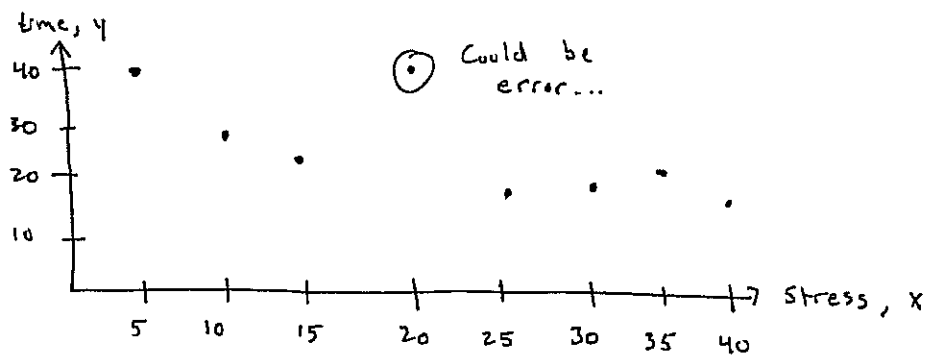


Curve Fitting and Prediction Solution



With all data it looks like a straight line would be best.

$$Y = ZA \quad Y = \begin{bmatrix} y_1 \\ \vdots \\ y_n \end{bmatrix} \quad Z = \begin{bmatrix} 1 & x_1 \\ \vdots & \vdots \\ 1 & x_n \end{bmatrix} \quad A = \begin{bmatrix} a_0 \\ a_1 \end{bmatrix}$$

$$A = [Z^T Z]^{-1} [Z^T Y] \quad A = \begin{bmatrix} 39.75 \\ -0.6 \end{bmatrix} \quad \text{so } \boxed{y = -0.6x + 39.75}$$

$$y(20) = -0.6(20) + 39.75 = \boxed{27.75 \text{ hours}}$$

$$y(30) = -0.6(30) + 39.75 = \boxed{21.75 \text{ hours}}$$

Omitting the data point that looks bad, a 4th order would be best.

$$Y = ZA \quad Y = \begin{bmatrix} y_1 \\ \vdots \\ y_n \end{bmatrix} \quad Z = \begin{bmatrix} 1 & x_1 & x_1^2 & x_1^3 & x_1^4 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 1 & x_n & x_n^2 & x_n^3 & x_n^4 \end{bmatrix} \quad A = \begin{bmatrix} a_0 \\ a_1 \\ a_2 \\ a_3 \\ a_4 \end{bmatrix}$$

$$A = [Z^T Z]^{-1} [Z^T Y] \quad A = \begin{bmatrix} 43.707 \\ 0.0364 \\ -0.2196 \\ 0.0106 \\ -3.395 \times 10^{-4} \end{bmatrix}$$

$$y = a_4 x^4 + a_3 x^3 + a_2 x^2 + a_1 x + a_0$$

$$a_4 = -0.0001395 \quad a_3 = 0.0106 \quad a_2 = -0.2196 \quad a_1 = 0.0364 \quad a_0 = 43.707$$

$$\boxed{y = -0.0001395x^4 + 0.0106x^3 - 0.2196x^2 + 0.0364x + 43.707}$$

$$y(20) = \boxed{19.075 \text{ hours}} \quad \text{Maybe this value is what it should have been}$$

$$y(30) = \boxed{20.364 \text{ hours}} \quad \text{This is much closer to measured data}$$