$$T = \frac{\hat{Y}_h - \overset{EY_h}{E[\hat{Y}_h]}}{\hat{\sigma}_{\hat{Y}_h}} = \frac{\hat{\beta}_0 + \hat{\beta}_1 x_h - (\beta_0 + \beta_1 x_h)}{\sqrt{MSE\left(\frac{1}{n} + \frac{(x_h - \bar{x})^2}{S_{xx}}\right)}}$$

$$T \sim t(df = n-2)$$

$$.95 = P(-t_{.025,n-2} \le T \le t_{.025,n-2})$$

$$= P\left(-t_{.025,n-2} \le \frac{\hat{Y}_h - EY_h}{\hat{\sigma}_{\hat{Y}_h}} \le t_{.025,n-2}\right)$$

$$= P(-t_{.025,n-2} \cdot \hat{\sigma}_{\hat{Y}_h} \le \hat{Y}_h - EY_h \le t_{.025,n-2} \cdot \hat{\sigma}_{\hat{Y}_h})$$

$$= P(-\hat{Y}_h - t_{.025,n-2}\,\hat{\sigma}_{\hat{Y}_h} \le -\underbrace{EY_h}_{\mu} \le -\hat{Y}_h + t_{.025,n-2}\,\hat{\sigma}_{\hat{Y}_h})$$

$$= P(\hat{Y}_h - t_{.025,n-2}\,\hat{\sigma}_{\hat{Y}_h} \le EY_h \le \hat{Y}_h + t_{.025,n-2}\,\hat{\sigma}_{\hat{Y}_h})$$

Prediction error $W = Y_{h(new)} - \hat{Y}_h$

$Z \sim N(0,1)$ $$Z = \frac{W - EW}{\sigma_W} = \frac{Y_{h(new)} - \hat{Y}_h - 0}{\sqrt{\sigma^2\left(1 + \frac{1}{n} + \frac{(x_h - \bar{x})^2}{Sxx}\right)}}$$

$T \sim t(df = n-2)$ $$T = \frac{Y_{h(new)} - \hat{Y}_h}{\sqrt{MSE\left(1 + \frac{1}{n} + \frac{(x_h - \bar{x})^2}{Sxx}\right)}}$$

$$.95 = P\left(-t_{.025, n-2} \le \frac{Y_{h(new)} - \hat{Y}_h}{\sqrt{MSE\left(1 + \frac{1}{n} + \frac{(x_h - \bar{x})^2}{Sxx}\right)}} \le t_{.025, n-2}\right)$$