

## Prediction Equations

# Mean Prediction Standard Error

The diagram illustrates the formula for the Mean Prediction Standard Error,  $s_{\bar{y}_p}$ . The formula is presented as  $s_{\bar{y}_p} = \sqrt{s^2 \left[ \frac{1}{n} + \frac{(x_p - \bar{X})^2}{SS_X} \right]}$ . The components are color-coded and labeled with arrows:

- Standard error of intercept:** A blue label with an arrow pointing to the  $\frac{1}{n}$  term inside the brackets.
- Standard error of slope:** A red label with an arrow pointing to the  $\frac{(x_p - \bar{X})^2}{SS_X}$  term inside the brackets.
- Residual standard deviation:** A green label with an arrow pointing to the  $s^2$  term outside the brackets.

$s_{\bar{y}_p} = \sqrt{s^2 \left[ \frac{1}{n} + \frac{(x_p - \bar{X})^2}{SS_X} \right]}$

# Individual Prediction Standard Error

The diagram illustrates the formula for the Individual Prediction Standard Error,  $s_{\hat{y}_p}$ . The formula is presented as  $s_{\hat{y}_p} = \sqrt{s^2 \left[ \frac{1}{n} + \frac{(x_p - \bar{X})^2}{SS_X} + 1 \right]}$ . The components are color-coded and labeled with arrows:

- Standard error of intercept:** A blue arrow points from this label to the  $\frac{1}{n}$  term inside the brackets.
- Standard error of slope:** A red arrow points from this label to the  $\frac{(x_p - \bar{X})^2}{SS_X}$  term inside the brackets.
- Residual standard deviation:** A green arrow points from this label to the  $s^2$  term outside the brackets.
- Standard deviation around the regression line:** A red arrow points from this label to the constant  $1$  term inside the brackets.

The formula is displayed as:

$$s_{\hat{y}_p} = \sqrt{s^2 \left[ \frac{1}{n} + \frac{(x_p - \bar{X})^2}{SS_X} + 1 \right]}$$

## Cook's distance

- ▶  $s^2$  – residual standard deviation
- ▶  $p$  – number of predictors
- ▶  $\widehat{y}_j$  – predicted value for Observation  $j$
- ▶  $\widehat{y_{j(i)}}$  – predicted value for Observation  $j$  when Observation  $i$  is left out.

$$D_i = \frac{\sum_{j \neq i} (\widehat{y}_j - \widehat{y_{j(i)}})^2}{ps^2}$$