$$\chi^2 = \sum (y - yfit)^2$$

$$= \sum_i (yfit_i - y_i)^2$$

$$= \sum_i (m x_i + b - y_i)^2$$

take first deriv, set = 0!
w.r.t. m, then c

$$\cancel{2}\sum (\qquad)^2 (x_i) = 0/_2$$

$$\cancel{2}\sum_i (m x_i^2 + b x_i - y_i x_i) = 0$$

$$m\sum_i x_i^2 + b\sum_i x_i - \sum_i x_i y_i = 0$$

and

$$2\sum_i (\qquad) = 0$$

$$\sum (m x_i + b\sum_i (1) - y_i) = 0$$

$$m\sum_i x_i + bN - \sum y_i = 0$$

Define $c_x = \frac{1}{N}\sum_i x_i$

$$c_{xx} = \frac{1}{N}\sum_i x_i^2$$

$$c_{xy} = \frac{1}{N}\sum_i x_i y_i$$

$$c_y = \frac{1}{N}\sum_i y_i$$

$$m c_{xx} + b c_x - c_{xy} = 0$$

$$m c_x + b - c_y = 0$$

$$b = c_y - m c_x$$

$$\cancel{m c_{x^2}} + (c_y \cancel{- m c_x}) c_x - c_{xy} = 0$$

$$m\left[c_{x^2} - c_x c_x\right] = c_{xy} - c_y c_x$$

$$\boxed{m = \frac{c_{xy} - c_y c_x}{c_{x^2} - c_x c_x}}$$

$$b = C_y - C_x \left[\frac{C_{xy} - C_y C_x}{C_{xx} - C_x C_x} \right]$$

$$= C_y - \frac{C_x (C_{xy} - C_y C_x)}{C_{xx} - C_x C_x}$$

$$= \frac{C_y (C_{xx} - \cancel{C_x C_x}) - C_x C_{xy} + \cancel{C_x C_x C_y}}{C_{xx} - C_x C_x}$$

$$= \frac{C_{xx} C_y - C_x C_{xy}}{C_{xx} - C_x C_x}$$