Polynomial Regression & Degrees of Freedom

$n=2$

$$Y = \beta_0 + \beta_1 X + \varepsilon$$

$k=1$, $p=2$

degree $=2$

$$Y = \beta_0 + \beta_1 X + \beta_2 X^{②} + \varepsilon$$

$n=3$, $k=2$, $p=3$

$$Y = \beta_0 + \beta_1 X + \beta_2 X^2 + \beta_3 X^3 + \varepsilon$$

$n=4$
$k=3$
$p=4$
degree $=3$

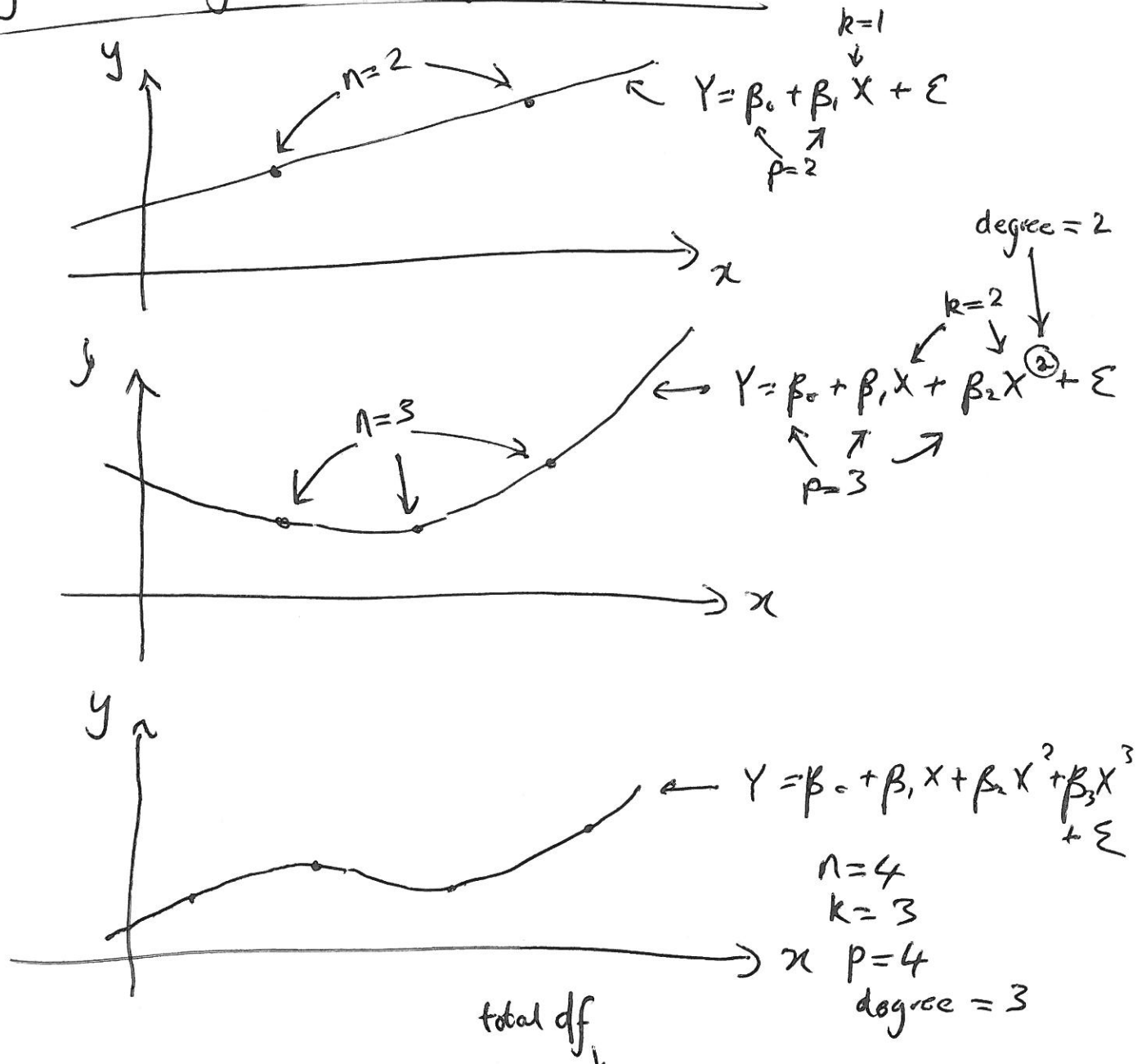total df

A polynomial of degree $(n-1)$ will be a perfect fit for n observations, BUT there are no degrees of freedom left over to estimate σ^2, the variance of the errors, ε.

→ this is an extreme of "over-fitting" a too complicated model

more on this later