$$egin{aligned} D &= 2[\ell(\hat{oldsymbol{eta}}_{max}) - \ell(\hat{oldsymbol{eta}})] \ &= 2\left[-rac{1}{2}N\log(2\pi\sigma^2) + rac{1}{2\sigma^2}(\mathbf{y} - \mathbf{X}\hat{oldsymbol{eta}})^ op(\mathbf{y} - \mathbf{X}\hat{oldsymbol{eta}}) + rac{1}{2}N\log(2\pi\sigma^2)
ight] \ &= rac{1}{\sigma^2}(\mathbf{y}^ op\mathbf{y} - 2\hat{oldsymbol{eta}}^ op\mathbf{X}^ op\mathbf{y} + \hat{oldsymbol{eta}}^ op\mathbf{X}^ op\mathbf{X}\hat{oldsymbol{eta}}) \ &= rac{1}{\sigma^2}(\mathbf{y}^ op\mathbf{y} - \hat{oldsymbol{eta}}^ op\mathbf{X}^ op\mathbf{X}^ op\mathbf{y}) \end{aligned}$$

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