Simple Linear Regression

Model conditions

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Topics

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- List the conditions for simple linear regression

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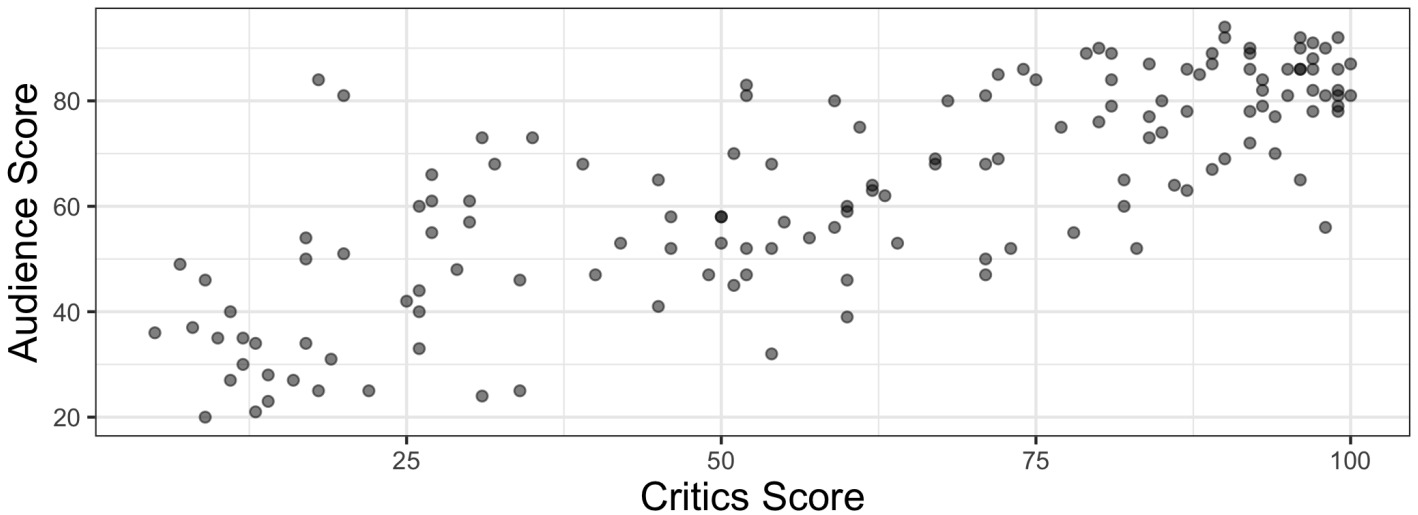
- Use plots of the residuals to check the conditions

Movie ratings data

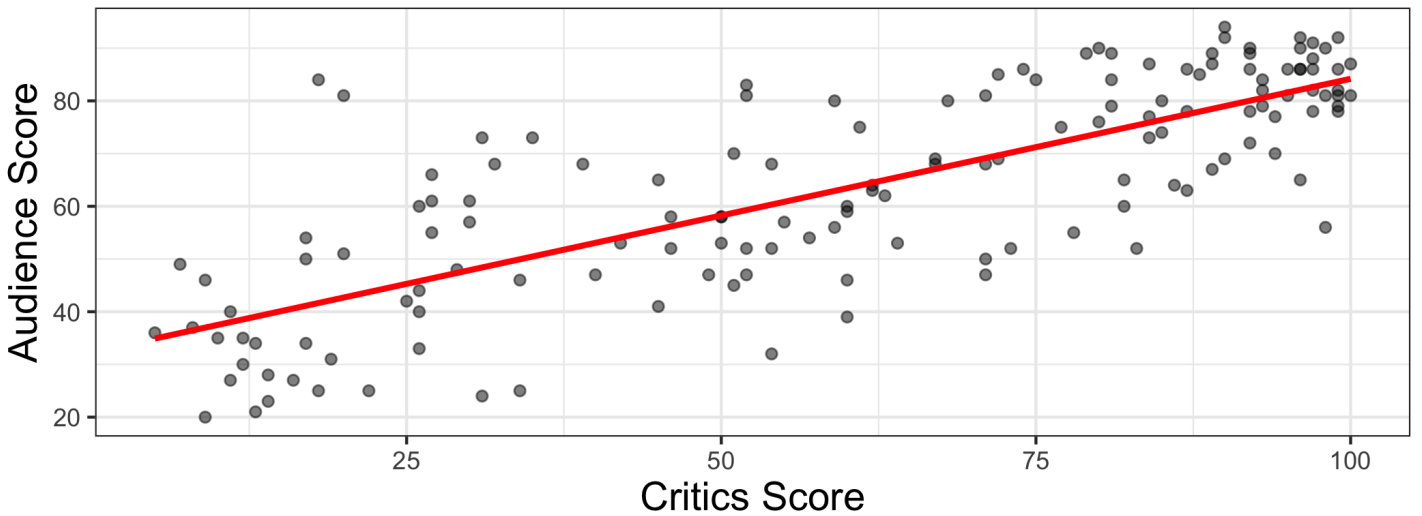
The data set contains the "Tomatometer" score (**`critics`**) and audience score (**`audience`**) for 146 movies rated on rottentomatoes.com.



The model

$$\hat{\text{audience}} = 32.316 + 0.519 \times \text{critics}$$

term	estimate	std.error	statistic	p.value
(Intercept)	32.316	2.343	13.795	0
critics	0.519	0.035	15.028	0



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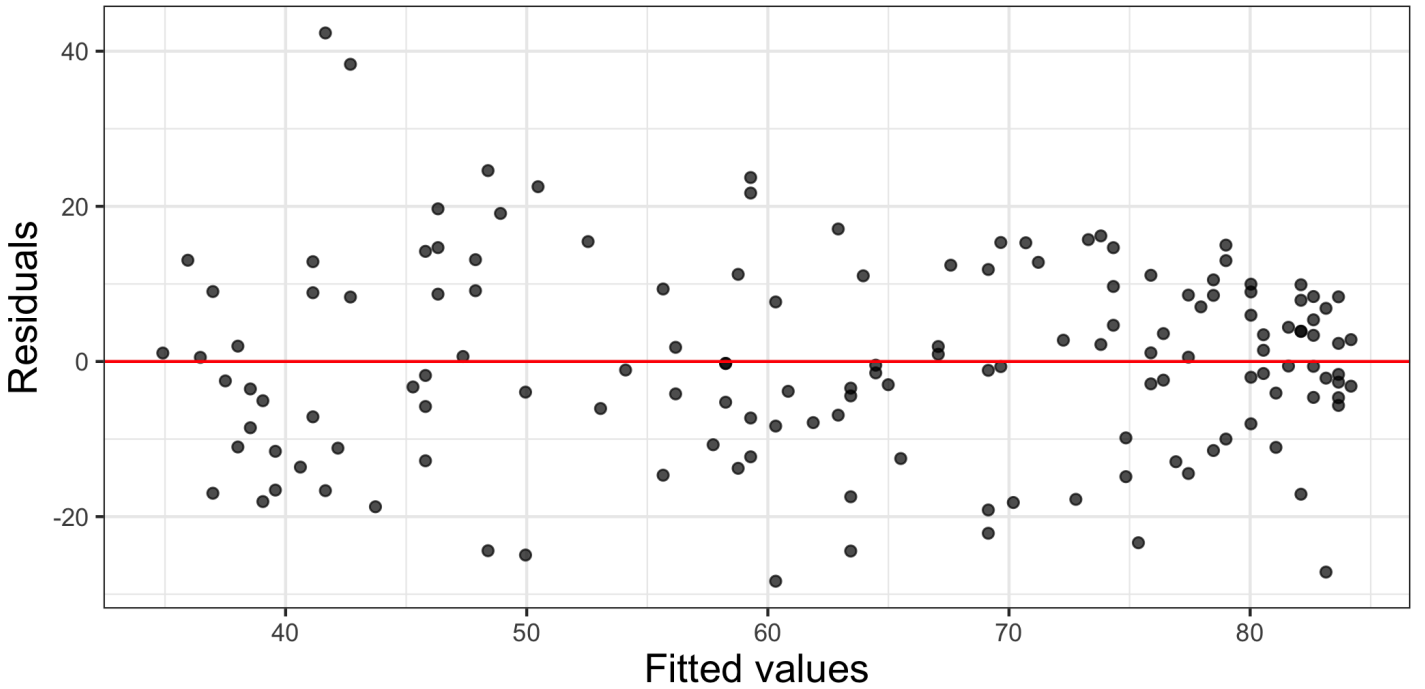
3. **Normality:** The errors follow a normal distribution.

4. **Independence:** The errors are independent from each other.

$$\text{residual} = y - \hat{y}$$

Residuals vs. fitted values



Checking linearity

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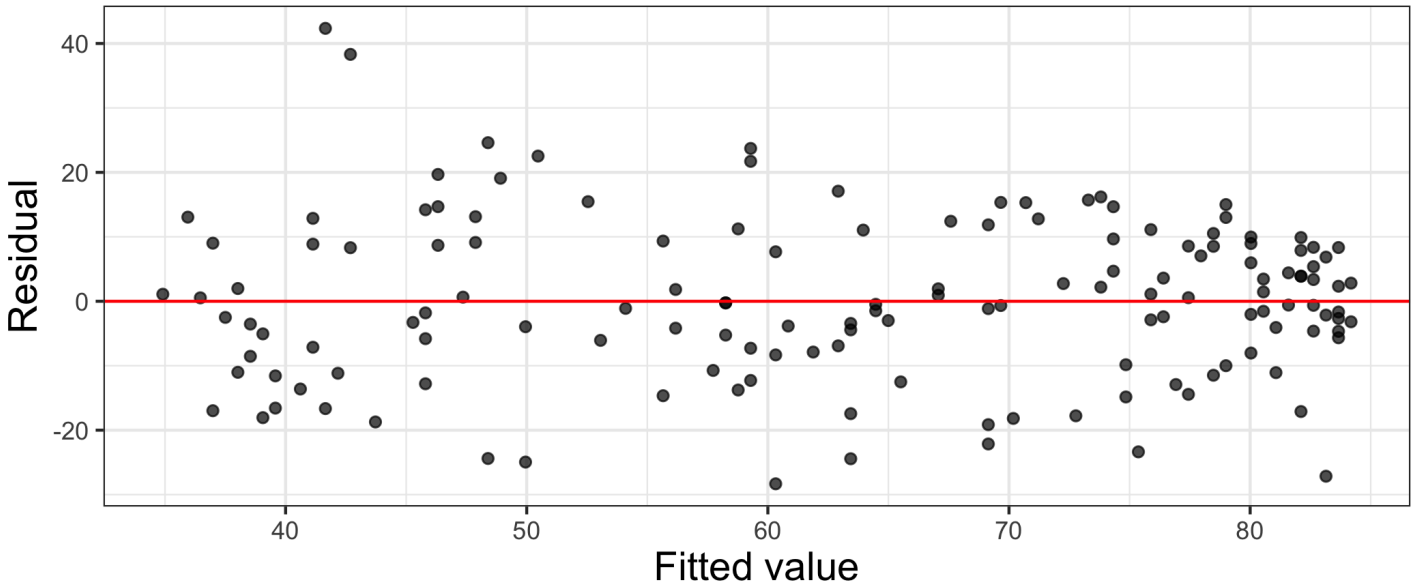

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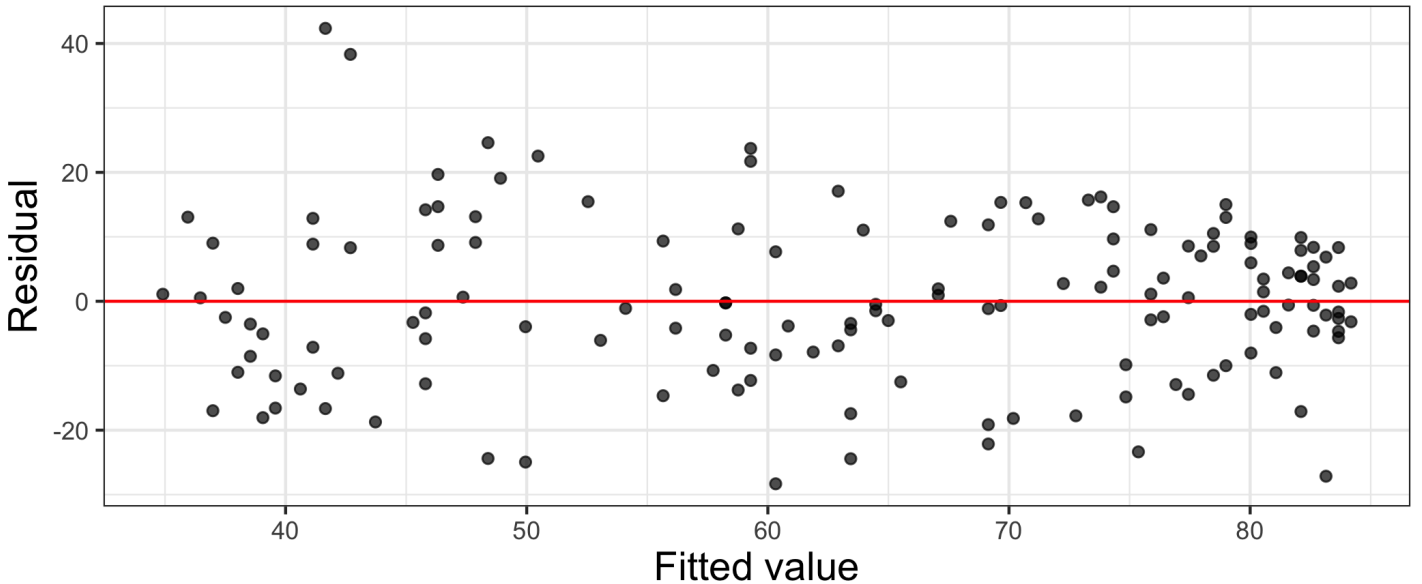

✅ There is no distinguishable pattern or structure. The residuals are randomly scattered.

Checking constant variance

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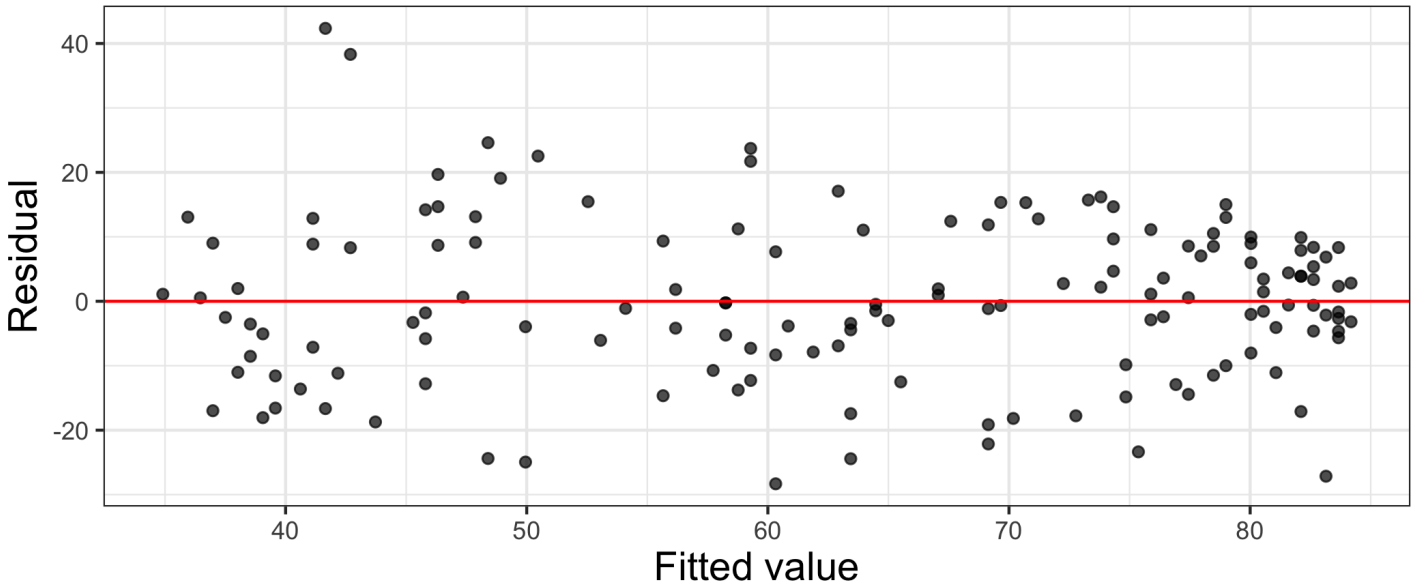

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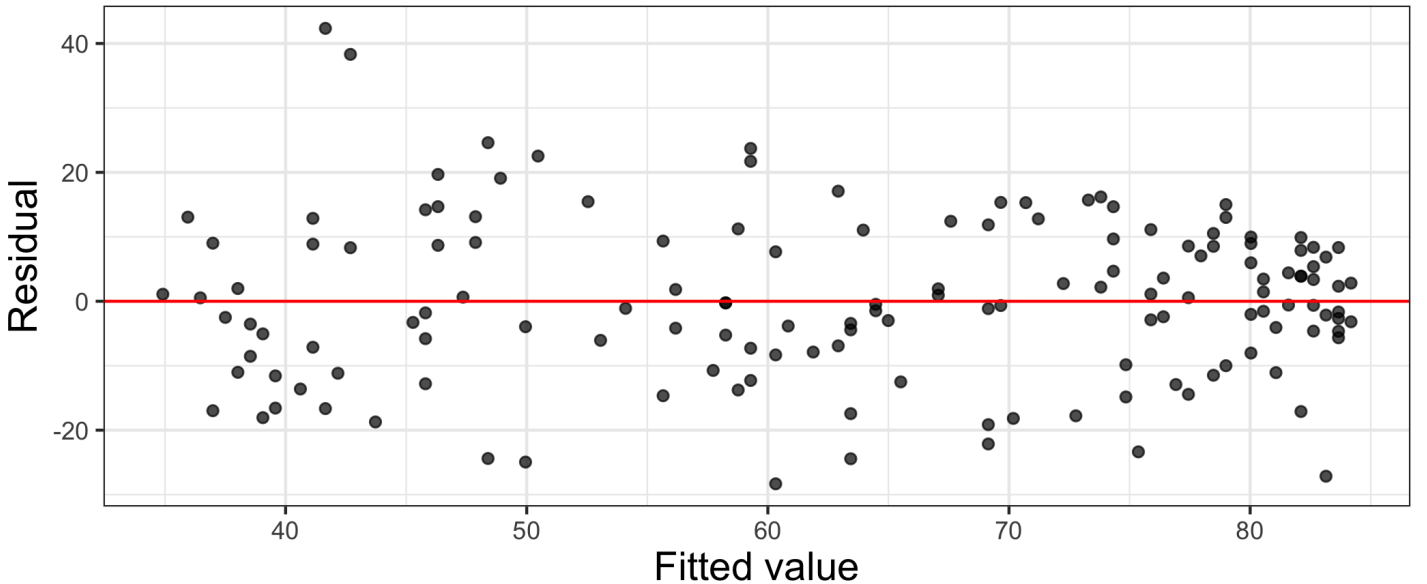
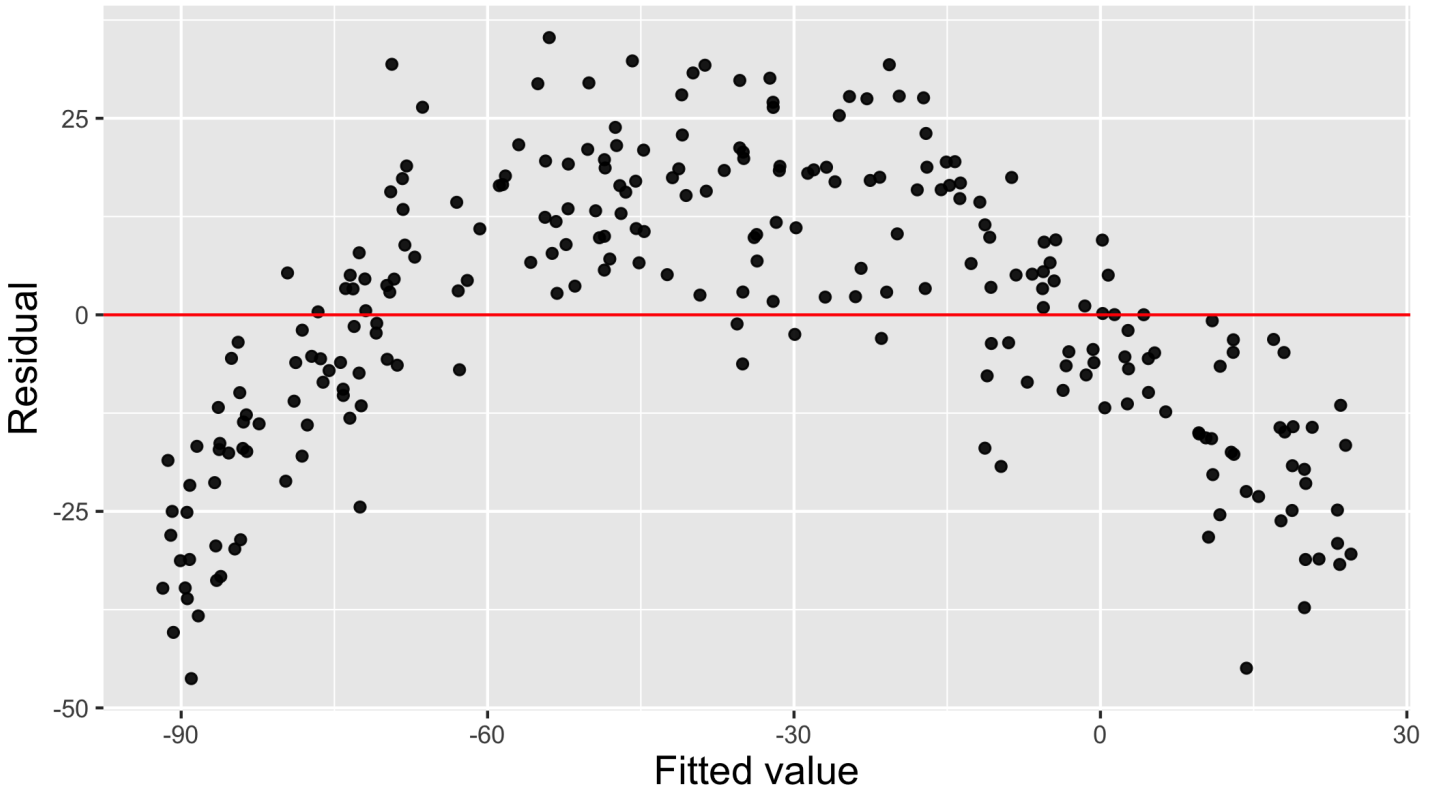
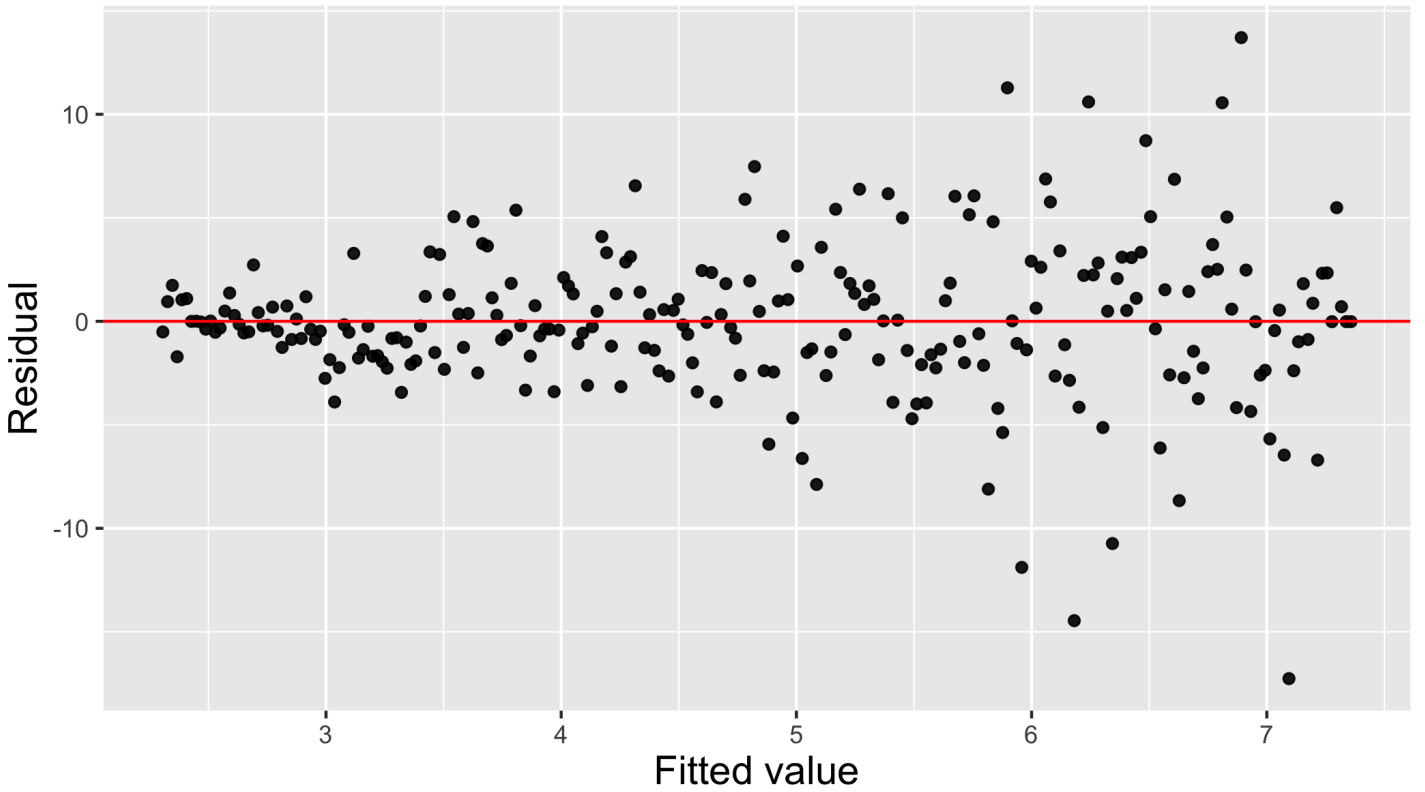


✅ The vertical spread of the residuals is relatively constant across the plot.

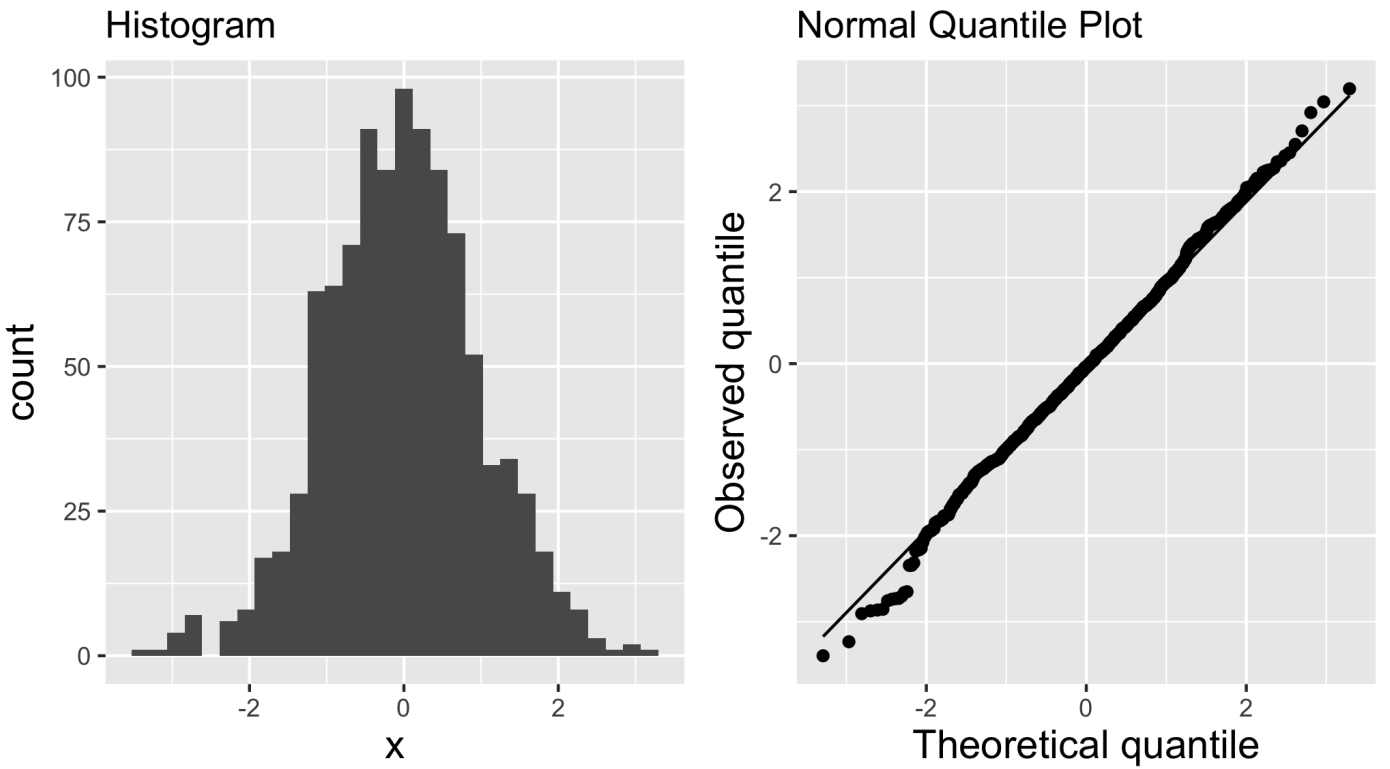
Violation: distinguishable pattern



Violation: non-constant variance



Normal quantile plot



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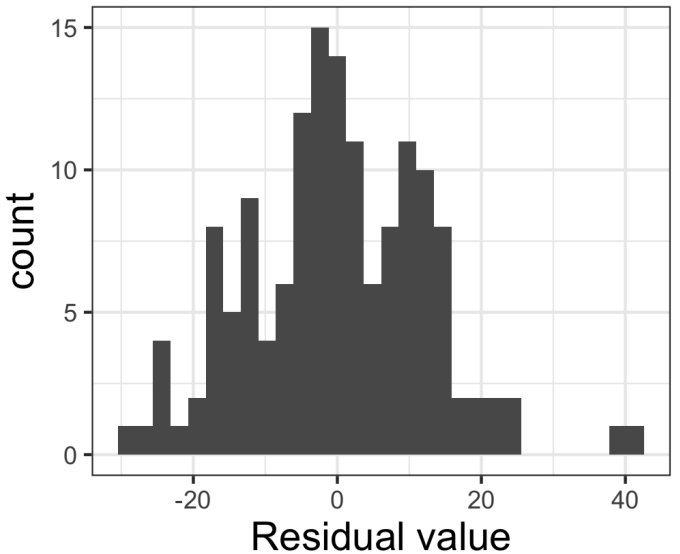

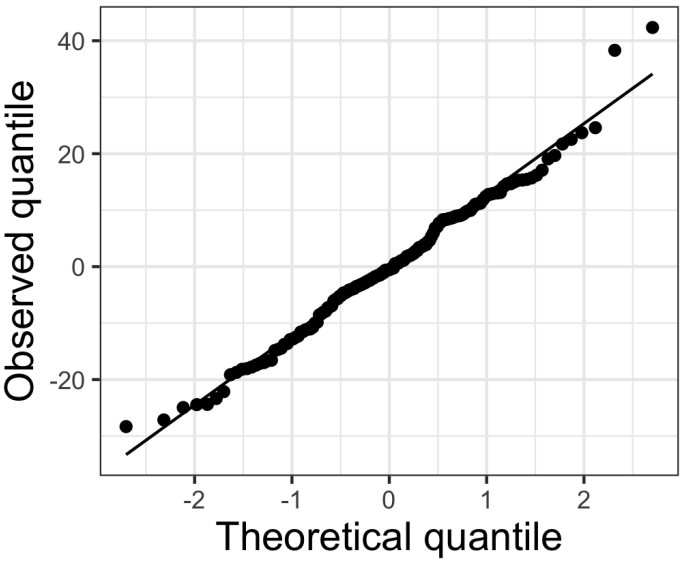

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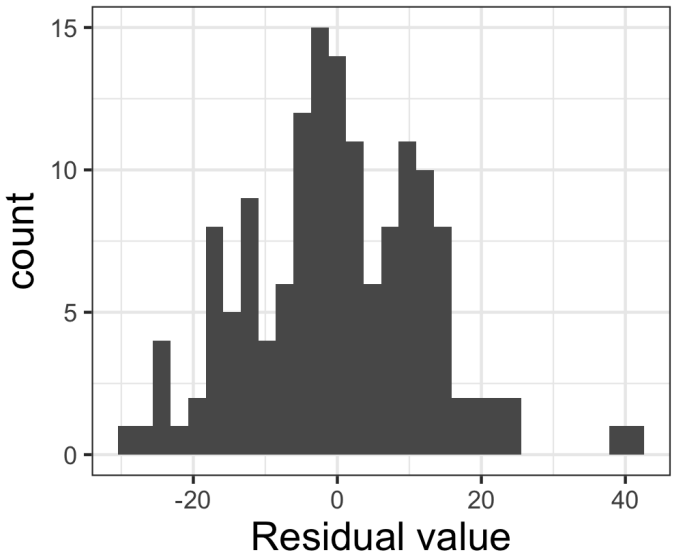

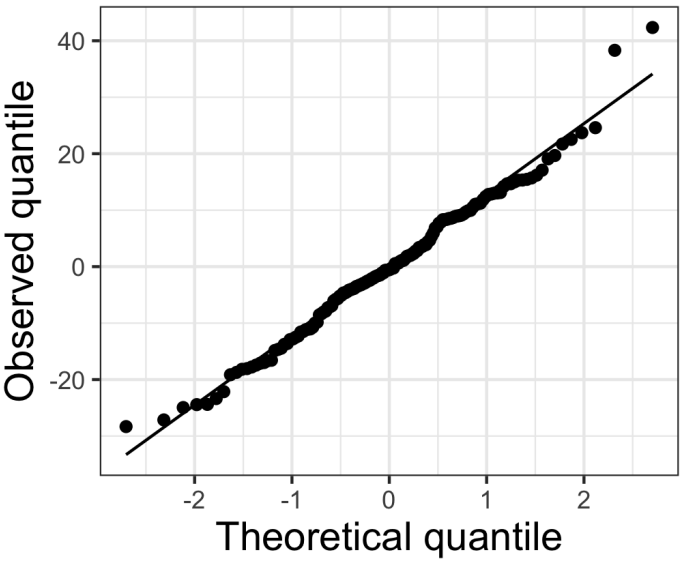

✅ Points follow a straight diagonal line on the normal quantile plot.

Checking independence

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- If the data were collected in a particular order, examine a scatterplot of the residuals versus order in which the data were collected.

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✅ If not, the conditions are sufficiently met and we can proceed with the current model.

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  - Constant Variance
  - Normality
  - Independence

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- Used plots of the residuals to check the conditions