NONLINEAR
LINEAR
REGRESSION

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Transforming covariates

- **Linear** regression is linear in the parameters

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_p x_p + \epsilon$$

- Can have non-linear functions of the covariates

$$y = \beta_0 + \beta_1 f(x_1) + \beta_2 g(x_2) + \cdots + \beta_p h(x_p) + \epsilon$$

and still be linear regression!

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Common transformations of X

- Consider just one covariate, x:
  - $y = \beta_0 + \beta_1 x + \epsilon$
- Polynomials of x:
  - $y = \beta_0 + \beta_1 x + \beta_2 x^2 + \cdots \beta_p x^p + \epsilon$
- Log of x:
  - $y = \beta_0 + \beta_1 \log(x) \ + \epsilon$
- Log of y and x:
  - $\log y = \beta_0 + \beta_1 \log(x) \ + \epsilon$

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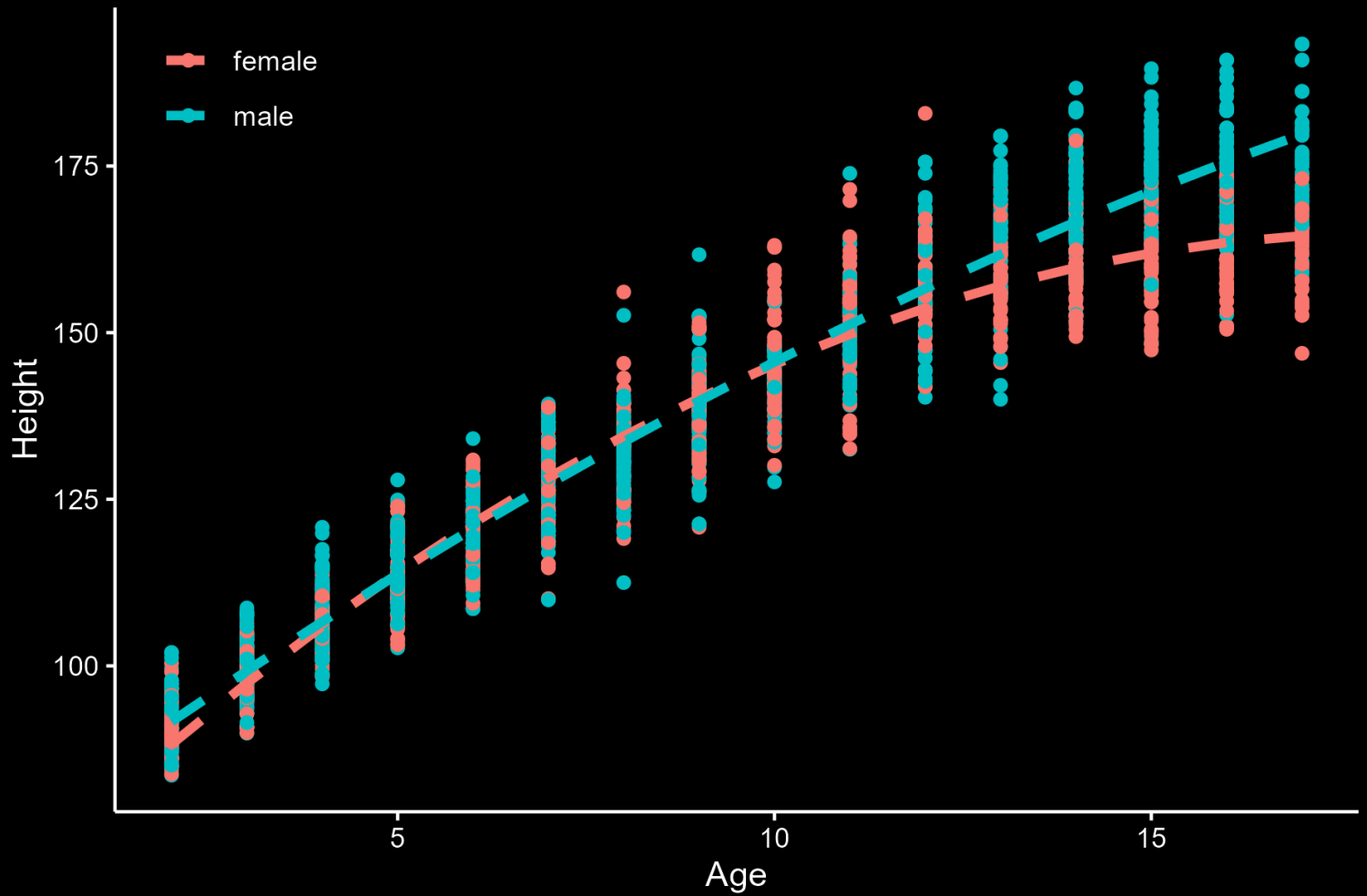
$$height_i = \beta_0 + \beta_m male_i + (\beta_{a_1} + \beta_{a_1 \times m} male_i) age_i + (\beta_{a_2} + \beta_{a_2 \times m} male_i) age_i^2$$



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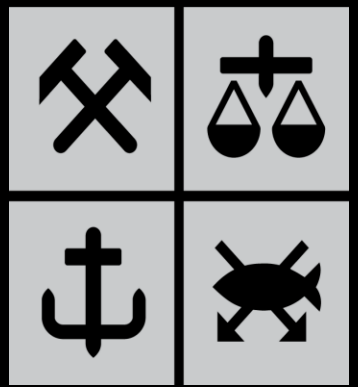

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