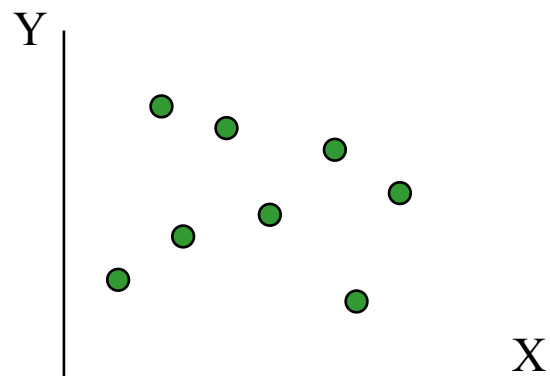
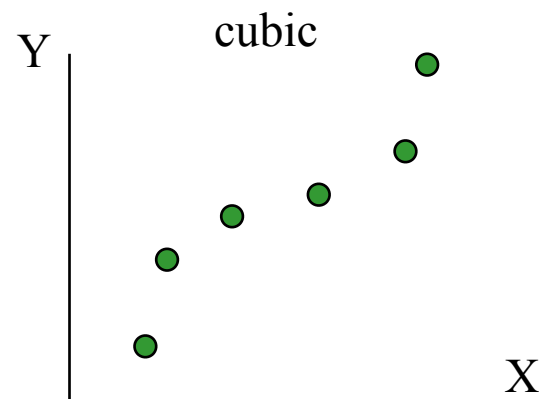
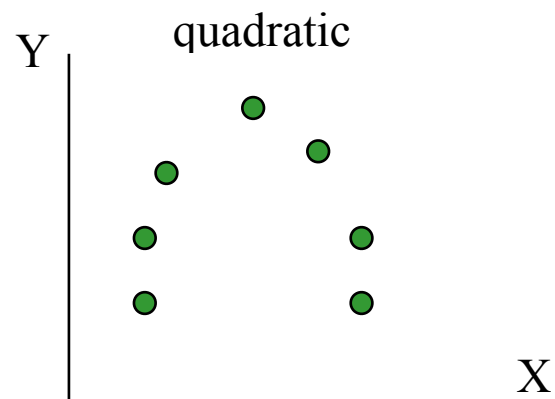
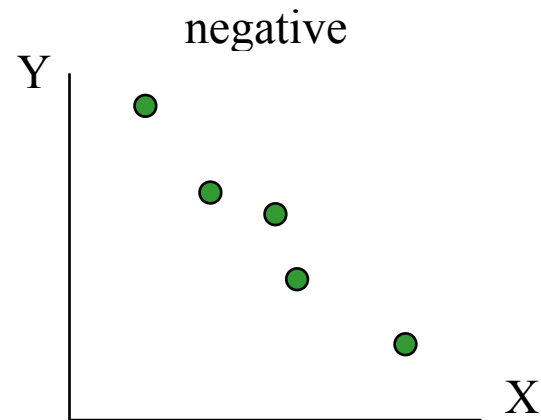
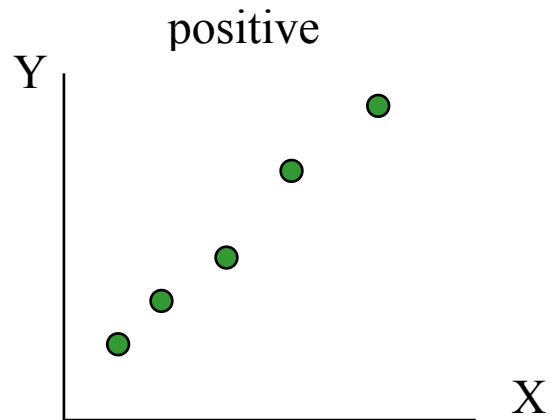


# Linear models

Katie Pollard

BMI 206

# Relating Continuous Variables

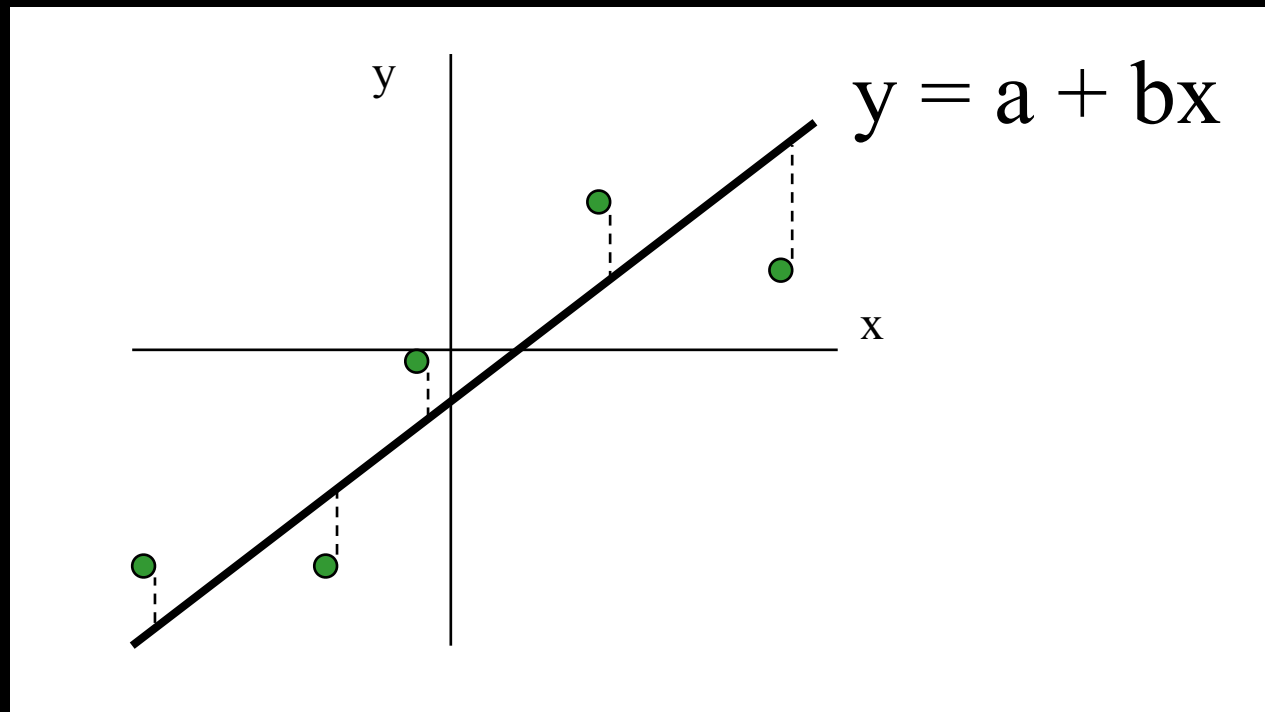


Linear relationship

Non-linear relationship

No relationship

# Linear Model



a is the intercept  
b is the slope

Seek the line that minimizes sum of squared residuals.

The solution to the least squares problem is:

$$a = \bar{y} - b\bar{x} \quad b = \frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{\sum_i (x_i - \bar{x})^2}$$

- Substituting estimates of (a,b) provides predictions.
- Residual is observed minus predicted value for each x.

# Multiple Regression

- One outcome variable, 2+ covariates
  - Covariates can be continuous or categorical
  - May include powers or other transformations of covariates
  - May include interactions between covariates
- Coefficients represent expected change in Y per unit increase in that covariate, while holding the other covariates constant (i.e., adjusted for them).
- X and Y can be conditionally associated, but marginally independent. Or the opposite.
- Coefficient estimates and their standard errors can be used to test for association with Y.
- Predicted values can be computed for different covariate combinations.

# Code Examples & Board Work