Linear Regressions

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1 Review: Slope-intercept Form

Slope-intercept form is the equation of a straight line written as $y = mx + b$ where x represents the line's slope and b represents the y-intercept.

1.1 Examples of Slope-Intercept and Solving for Y

Example 1 (the given equation is already in the correct format):

$$y = 3x + 7$$

$$\text{slope} = 3$$

$$\text{y-intercept} = 7$$

Example 2 (we need to solve for y):

$$\begin{aligned} 3x + 4y &= 5 \\ 4y &= 5 - 3x \\ y &= \frac{5 - 3x}{4} \\ y &= \frac{-3x}{4} + \frac{5}{4} \\ \text{slope} &= \frac{-3}{4} \\ \text{y-intercept} &= \frac{5}{4} \end{aligned}$$

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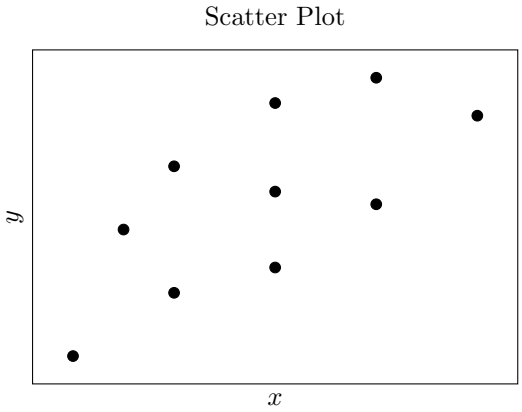
2 Paired Data

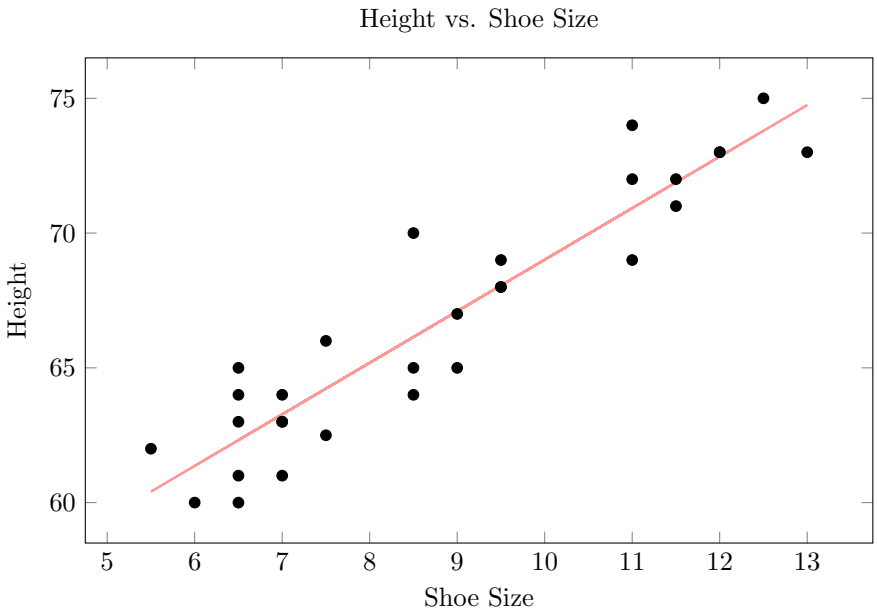
A data set where each inidividual is described by two variables.
You can visualize paired data with a scatter chart.



Scatter plots help us:

- Identify if the data has a trend or pattern
- Identify if two variables are *correlated* or not
- Make predictions

2.1 Strong Correlation Example



When we analyze this scatter plot, we can see:

- There is a *strong correlation* between height and shoe size
- This allows us to make a prediction of somebody's height based on their shoe size

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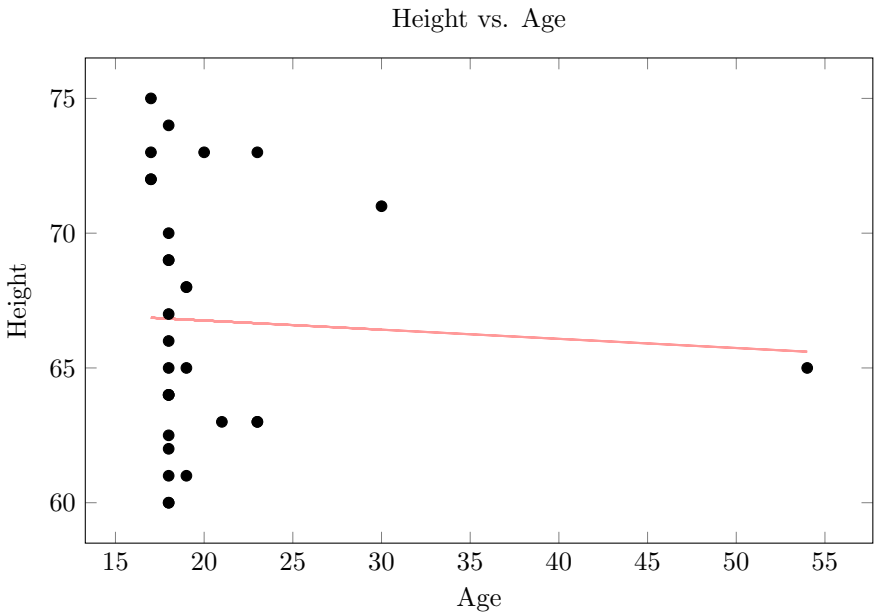
2.2 Weak or No Correlation Example

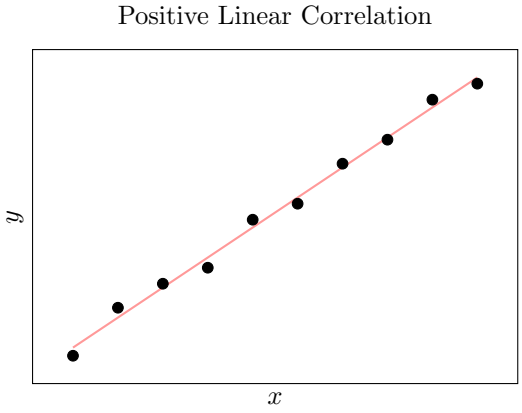


When we analyze this scatter plot, we can see:

- There is either a *weak correlation* or *no correlation* between height and age
- The age variable does not seem to influence the height variable

3 Types of Relationships in Paired Data

3.1 Positive Linear Correlation



When we analyze this scatter plot, we can see:

- The data has a clear linear shape
- The slope of the line is *positive*

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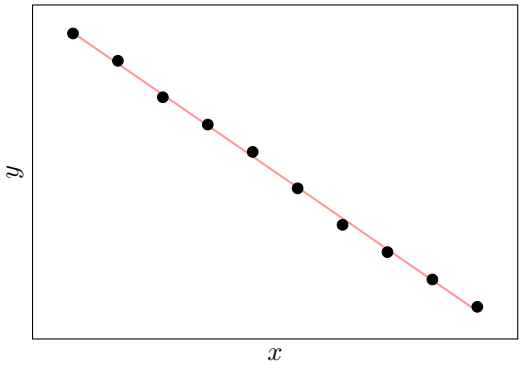
3.2 Negative Linear Correlation

Negative Linear Correlation

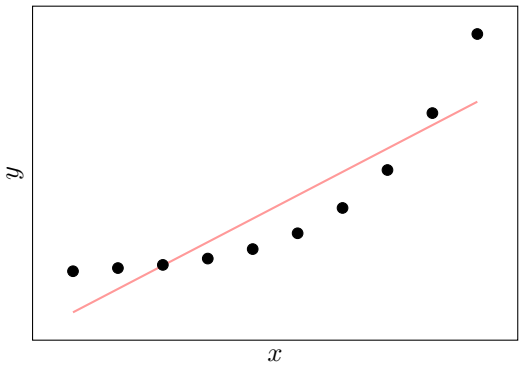


When we analyze this scatter plot, we can see:

- The data has a clear linear shape
- The slope of the line is *negative*

3.3 Non Linear Correlation

Non Linear Correlation



When we analyze this scatter plot, we can see:

- While data is following a pattern (in this case exponential), it is not a straight line

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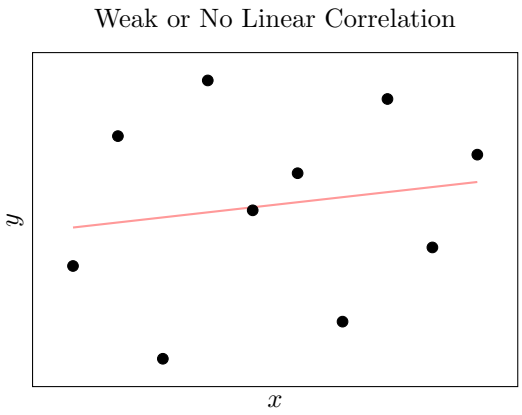
3.4 Weak or No Linear Correlation



When we analyze this scatter plot, we can see:

- The data has no clear pattern (a diffuse cloud)