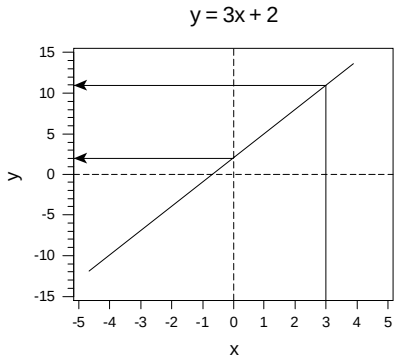
Stat 104 – Lecture 9

Review

- The equation of a straight line
- $y = mx + b$
  - m is the slope – the change in y over the change in x – or rise over run.
  - b is the y-intercept – the value where the line cuts the y axis.

1



Review

- $y = 3x + 2$
  - $x = 0$ ⇒ $y = 2$ (y-intercept)
  - $x = 3$ ⇒ $y = 11$
  - Change in y (+9) divided by the change in x (+3) gives the slope, 3.

3

Stat 104 – Lecture 9

Linear Regression

- Example: Body mass (kg) and Bite force (N) for *Canidae*.
  - y, Response: Bite force (N)
  - x, Explanatory: Body mass (kg)
  - Cases: 28 species of *Canidae*.

4

Correlation Coefficient

- Body mass and Bite force

$$r = \frac{\sum z_x z_y}{n-1} = \frac{\mathbf{26.4796}}{\mathbf{27}}$$

- r = 0.9807

5

Correlation Coefficient

- There is a strong correlation, linear association, between the body mass and bite force for the various species of *Canidae*.

6

Stat 104 – Lecture 9

Linear Model

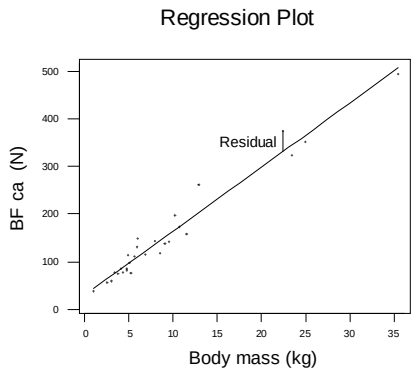
- The linear model is the equation of a straight line through the data.
- A point on the straight line through the data gives a predicted value of y, denoted $\hat{y}$.

7

Residual

- The difference between the observed value of y and the predicted value of y, $\hat{y}$, is called the residual.
- Residual = $y - \hat{y}$

8



Stat 104 – Lecture 9

Line of "Best Fit"

- There are lots of straight lines that go through the data.
- The line of "best fit" is the line for which the sum of squared residuals is the smallest – the least squares line.

10

Line of "Best Fit"

$$\hat{y} = b_0 + b_1 x$$

Least squares slope: $b_1 = r\frac{s_y}{s_x}$

intercept: $b_0 = \bar{y} - b_1\bar{x}$

11

Least Squares Estimates

Body mass, x	Bite Force, y
$\bar{x} = 9.207$ kg	$\bar{y} = 154.029$ N
$s_x = 8.016$ kg	$s_y = 109.760$ N
$r = 0.9807$	

12