Test for Slope of Regression Lines

- We can also test hypotheses about the value of the slope, β .
- The most common hypothesis is that the slope is zero.
- In other words, that is there is no true linear relationship between x and y.
- This means that y does not change at all when x changes.

- When testing on whether or not a linear relationship exists, the null and alternate hypotheses are:

  H_0: $\beta = 0$ and H_a: $\beta \neq 0$

- If we wish to know if there is a positive linear relationship we will use:

  H_0: $\beta = 0$ and H_a: $\beta > 0$

- And for a negative linear relationship:

  H_0: $\beta = 0$ and H_a: $\beta < 0$

- The test statistic is the *t*-statistic: $t = \dfrac{b}{SE_b}$

Example:

1. How well do golfers' scores on the first round of a two-round tournament predict their scores for a second round? Twelve golfers recorded scores for each round of a two-round tournament. Test how well golfers' scores on the first round of a two-round tournament predict their scores for a second round.

$\alpha = .05$

Golfer	1	2	3	4	5	6	7	8	9	10	11	12
Round 1	89	90	87	95	86	81	102	105	83	88	91	79
Round 2	94	85	89	89	81	76	107	89	87	91	88	80

$\hat{y} = 24.332 + .6877x$

$SE_b = .23$

$t = \frac{b}{SE_b} = \frac{.6877}{.23} = 2.99$

$H_0: \beta = 0$

$H_a: \beta \neq 0$

$df = 12 - 2 = 10$

$p\text{value} = 2p(t > 2.99) = .0136 < \alpha$

Reject H_0

Example:

2. The following partial computer output is from data relating the number of pages contained in a magazine to the number of full-page ads for a two-year period ($n = 24$). $df = 22$

Predictor	Coef	StDev	t	p > t
Constant	26.240	8.439	?	?
→Pages	0.25986	0.08615	?	?

S = 11.64 R-Sq = 29.3% R-Sq (adj) = 26.0%

Determine if there is strong evidence to conclude that a large number of pages in the two magazines will also have a large number of ads.

$H_0: \beta = 0$

$H_a: \beta > 0$

$$t = \frac{b}{SE_b} = \frac{.25986}{.08615} = 3.01637$$

pvalue: $p(t > 3.01637) = .00317 < .05$