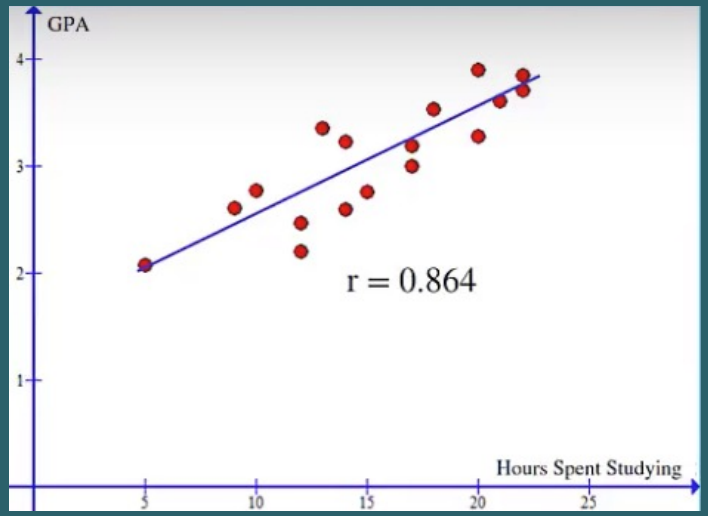
Exercise 7-1
Hypothesis Test of Linear Correlation Coefficient

Table and Graph

Hours spent studying Per Week	GPA
22	3.85
22	3.72
21	3.61
20	3.28
20	3.91
18	3.54
17	3.2
17	3.01
15	2.77
14	2.6
14	3.23
13	3.36
12	2.21
12	2.47
10	2.78
9	2.61
5	2.08

The table shows the relationship for **17 randomly selected students** between the number of hours spent studying per week and the student's GPA.



The graph shows the scatter plot for this correlated data. This graph shows **a positive linear relationship**. It is a positive relationship because as the values of the independent variable increase the values of the dependent variable also increase.

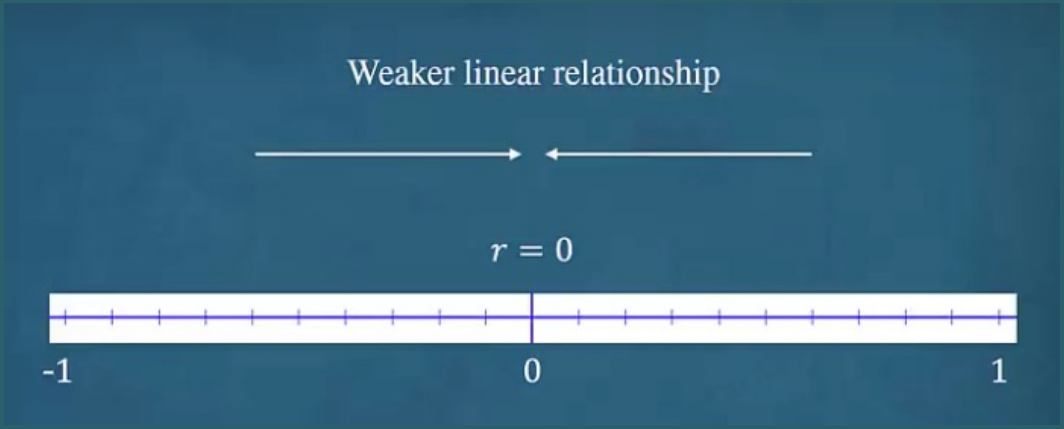
Exercise 7-1

Conduct a hypothesis test about the significance of the linear relationship between two variables (n = 17, r = 0.864) using the P-value method.

Use use $\alpha = 0.05$ for this example.

Correlation Coefficient

For this relationship, the sample correlation coefficient is r equal to **0.864**. Recall that the closer the value of r is to +1 the stronger the positive relationship between the variables. The closer the value of r is to -1 the stronger the negative linear relationship between the variables. The closer the value of r is to 0 the weaker the linear relationship between the variables.



(1) The Hypotheses

State the hypotheses

$$H_0: \rho = 0$$

$$H_1: \rho \neq 0$$

There is no need to place the claim in this type of hypothesis test as this test is always about whether or not there is a linear relationship between the variables.

If we reject the null hypothesis then we will conclude that a significant linear relationship exists between the variables.

(2) The test value

$$t = r\sqrt{\frac{n-2}{1-r^2}}$$

$$t = 0.864\sqrt{\frac{17-2}{1-0.864^2}}$$

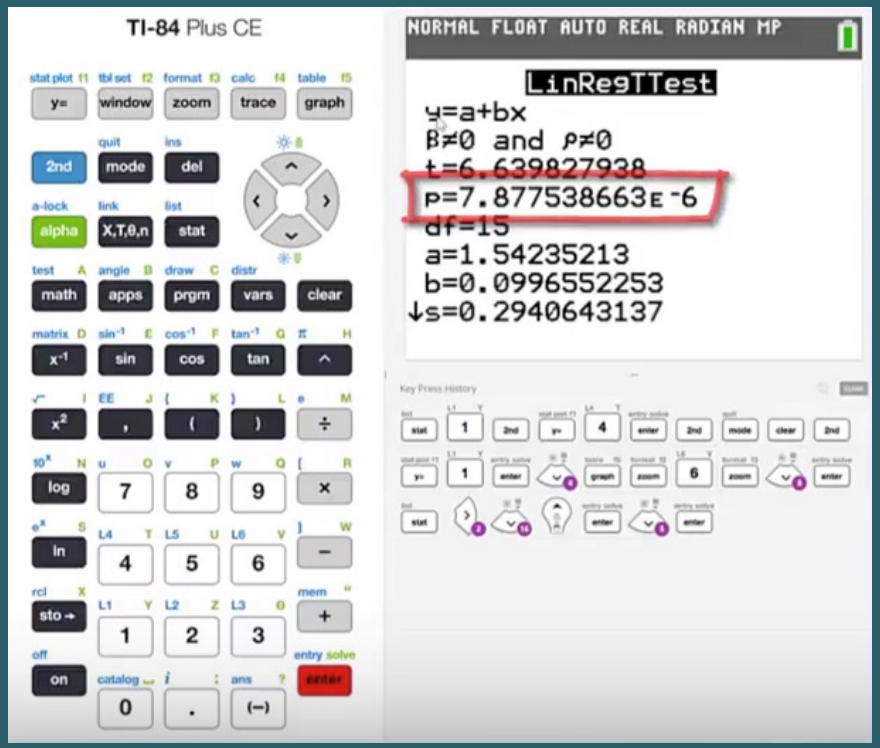
$$t = 6.646$$

(3) P-value from a calculator

The P-value is given as **7.88×10^{-6}**. In decimal form this would be expressed as **0.00000788**

P-values are typically expressed with 4 decimal places.

In this case the P-value has 5 zeros to the right of the decimal place before a non-zero digit is encountered.



(4) Decision and (5) Conclusion

Recall that the decision rule when using a P-value tells us that if the P-value is less than α we should reject the null hypothesis.

P–value = 0.00000788

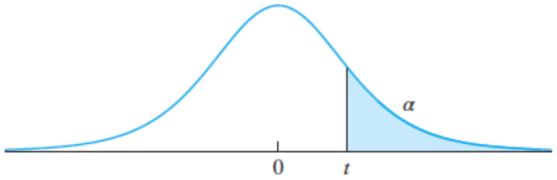
P–value = 0.00000788 < α = 0.05, reject H_0

Since this P-value is less than 0.05 we should reject the null hypothesis that the population correlation coefficient is equal to 0.

We conclude that it is not 0.

We conclude that **there is a significant linear relationship** between hours spent studying and GPA.

TABLE A.3 Upper percentage points for the Student's *t* distribution



	α								
v	**0.40**	**0.25**	**0.10**	**0.05**	**0.025**	**0.01**	**0.005**	**0.001**	**0.0005**
1	0.325	1.000	3.078	6.314	12.706	31.821	63.657	318.309	636.619
2	0.289	0.816	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.277	0.765	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.271	0.741	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.267	0.727	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.265	0.718	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.263	0.711	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.262	0.706	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.261	0.703	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.260	0.700	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.260	0.697	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.259	0.695	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.259	0.694	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.258	0.692	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.258	0.691	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.258	0.690	1.337	1.746	2.120	2.583	2.921	3.686	4.015

P-value from Table A.3

Two-tailed test: P-value < 2*0.0005 = 0.001