

Formulas and Tables

1. Standard deviation:

$$\sigma = \sqrt{\frac{\sum (X_i - \bar{X})^2}{n - 1}}$$

2. z-score: If X is drawn from a normal distribution, with mean μ , and standard deviation σ , its corresponding z-score is:

$$z = \frac{X - \mu}{\sigma}$$

In reverse (given z , find X):

$$X = z \times \sigma + \mu$$

3. Standard deviation for a proportion, π :

$$\sigma_\pi = \sqrt{\pi(1 - \pi)}$$

4. Sample standard error, SE, depends on sample standard deviation, s , and sample size, n :

$$SE = \frac{s}{\sqrt{n}}$$

5. Confidence interval around point estimate, ϵ , where z is the z-score for the required level of confidence, and SE the standard error (note: z-score may be derived from standard normal distribution or t -distribution, as appropriate):

$$\epsilon \pm z \times SE$$

6. Chi-squared statistic for a table,

$$X^2 = \sum \frac{(O - E)^2}{E}$$

where O is the observed value and E the expected value.

7. Expected value under independence in a table:

$$E = \frac{rc}{T}$$

where r is the row total and c the column total for that cell, and T the grand total for the table.

8. Predicted value from a bi-variate regression, where a is the constant and b the slope coefficient:

$$\hat{Y} = a + bx$$

9. Standard error for comparing means of two sub-samples, whose variance may not be the same:

$$\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

where s_i is the standard deviation for group i , and n_i the number of cases in group i .

Table of the Standard Normal Distribution

Right tail (probability of $X > z$)

	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.00	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641
.10	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
.20	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
.30	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
.40	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
.50	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
.60	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
.70	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
.80	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
.90	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
1.00	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
1.10	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
1.20	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
1.30	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
1.40	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
1.50	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
1.60	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
1.70	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
1.80	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
1.90	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
2.00	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
2.10	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
2.20	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
2.30	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
2.40	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
2.50	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
2.60	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
2.70	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
2.80	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
2.90	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
3.00	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
3.10	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
3.20	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
3.30	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
3.40	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
3.50	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002
3.60	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
3.70	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
3.80	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
3.90	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
4.00	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

Table of Student's *t* Distribution

Two-tailed probability

Degrees of Freedom	Probability level (Area under both tails)				
	0.10	0.05	0.025	0.01	0.005
1	6.314	12.706	25.452	63.657	127.321
2	2.920	4.303	6.205	9.925	14.089
3	2.353	3.182	4.177	5.841	7.453
4	2.132	2.776	3.495	4.604	5.598
5	2.015	2.571	3.163	4.032	4.773
6	1.943	2.447	2.969	3.707	4.317
7	1.895	2.365	2.841	3.499	4.029
8	1.860	2.306	2.752	3.355	3.833
9	1.833	2.262	2.685	3.250	3.690
10	1.812	2.228	2.634	3.169	3.581
11	1.796	2.201	2.593	3.106	3.497
12	1.782	2.179	2.560	3.055	3.428
13	1.771	2.160	2.533	3.012	3.372
14	1.761	2.145	2.510	2.977	3.326
15	1.753	2.131	2.490	2.947	3.286
16	1.746	2.120	2.473	2.921	3.252
17	1.740	2.110	2.458	2.898	3.222
18	1.734	2.101	2.445	2.878	3.197
19	1.729	2.093	2.433	2.861	3.174
20	1.725	2.086	2.423	2.845	3.153
21	1.721	2.080	2.414	2.831	3.135
22	1.717	2.074	2.405	2.819	3.119
23	1.714	2.069	2.398	2.807	3.104
24	1.711	2.064	2.391	2.797	3.091
25	1.708	2.060	2.385	2.787	3.078
26	1.706	2.056	2.379	2.779	3.067
27	1.703	2.052	2.373	2.771	3.057
28	1.701	2.048	2.368	2.763	3.047
29	1.699	2.045	2.364	2.756	3.038
30	1.697	2.042	2.360	2.750	3.030
35	1.690	2.030	2.342	2.724	2.996
40	1.684	2.021	2.329	2.704	2.971
50	1.676	2.009	2.311	2.678	2.937
60	1.671	2.000	2.299	2.660	2.915
75	1.665	1.992	2.287	2.643	2.892
100	1.660	1.984	2.276	2.626	2.871
500	1.648	1.965	2.248	2.586	2.820
1000	1.646	1.962	2.245	2.581	2.813
10000	1.645	1.960	2.241	2.576	2.807

Table of the χ^2 distribution (chi-sq)
 Values of the χ^2 statistic for various degrees
 of freedom and areas under the right tail

Degrees of Freedom	Area under right tail				
	0.100	0.050	0.025	0.010	0.005
1	2.706	3.841	5.024	6.635	7.879
2	4.605	5.991	7.378	9.210	10.597
3	6.251	7.815	9.348	11.345	12.838
4	7.779	9.488	11.143	13.277	14.860
5	9.236	11.070	12.833	15.086	16.750
6	10.645	12.592	14.449	16.812	18.548
7	12.017	14.067	16.013	18.475	20.278
8	13.362	15.507	17.535	20.090	21.955
9	14.684	16.919	19.023	21.666	23.589
10	15.987	18.307	20.483	23.209	25.188
11	17.275	19.675	21.920	24.725	26.757
12	18.549	21.026	23.337	26.217	28.300
13	19.812	22.362	24.736	27.688	29.819
14	21.064	23.685	26.119	29.141	31.319
15	22.307	24.996	27.488	30.578	32.801
16	23.542	26.296	28.845	32.000	34.267
17	24.769	27.587	30.191	33.409	35.718
18	25.989	28.869	31.526	34.805	37.156
19	27.204	30.144	32.852	36.191	38.582
20	28.412	31.410	34.170	37.566	39.997
21	29.615	32.671	35.479	38.932	41.401
22	30.813	33.924	36.781	40.289	42.796
23	32.007	35.172	38.076	41.638	44.181
24	33.196	36.415	39.364	42.980	45.559
25	34.382	37.652	40.646	44.314	46.928