Formulas

Sample Mean/Standard Deviation

$$\bar{x} = \frac{\sum x}{n}, \text{ and } s = \sqrt{\frac{\sum x^2 - \frac{1}{n}\cdot\left(\sum x\right)^2}{n-1}}$$

Sample Mean/Standard Deviation From a Frequency Table

$$\bar{x} \approx \frac{\sum f \cdot x}{n}, \text{ where } n = \sum f,$$

$$s = \sqrt{\frac{\sum f \cdot x^2 - \frac{1}{n}\cdot\left(\sum f \cdot x\right)^2}{n-1}}$$

Percentiles

$$\textit{Percentile for } x = \frac{\textit{values less than } x}{n}\cdot 100$$

Transforming *x* to and from *z*

$$z = \frac{x-\mu}{\sigma}, \text{ and } x = z\,\sigma + \mu$$

Basic Probability Rules

$P(S) \approx x/n$

If *A* and *B* are not mutually exclusive,
$P(A \text{ or } B) = P(A) + P(B) - P(A \,\&\, B)$

If *A* and *B* are mutually exclusive,
$P(A \text{ or } B) = P(A) + P(B)$

$$P(S) = 1 - P(\bar{S})$$

If *A* and *B* are independent, $P(A \,\&\, B) = P(A)\cdot P(B)$

If *A* and *B* are dependent, $P(A \,\&\, B) = P(A)\cdot P(B|A)$

Mean and Standard Deviation of a Discrete Probability Distribution

$$\mu = E(x) = \sum x \cdot P(x),\ \sigma = \sqrt{\sum x^2 \cdot P(x) - \mu^2}$$

The Binomial Probability Distribution

$$P(x) = {}_n C_x\, p^x\, q^{n-x} = \frac{n!}{x!(n-x)!}\, p^x\, q^{n-x}$$

Mean and Standard Deviation of Binomial Distribution

$$\mu = n\,p \text{ and } \sigma = \sqrt{n\,p\,q}$$

Confidence Interval for a Population Proportion

$$E = z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}},\ \hat{p} - E < p < \hat{p} + E$$

Confidence Interval for a Population Mean (σ Known)

$$E = z_{\alpha/2}\frac{\sigma}{\sqrt{n}},\ \bar{x} - E < \mu < \bar{x} + E$$

Confidence Interval for a Population Mean (σ Unknown)

$$E = t_{\alpha/2}\frac{s}{\sqrt{n}},\ \bar{x} - E < \mu < \bar{x} + E$$

Sample Size

Estimating p $\hat{p}$ known	Estimating p $\hat{p}$ unknown	Estimating μ
$n = \frac{z_{\alpha/2}^2 \hat{p}\hat{q}}{E^2}$	$n = \frac{z_{\alpha/2}^2 (0.25)}{E^2}$	$n = \left(\frac{z_{\alpha/2}\cdot\sigma}{E}\right)^2$

Test Statistics

One Proportion	One Mean σ known	One Mean σ unknown
$z = \frac{\hat{p} - p}{\sqrt{pq/n}}$	$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$	$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$

Paired Samples *t* test: $t = \dfrac{\bar{d} - \mu_d}{s_d/\sqrt{n}}$

Two Proportions Test

$$z = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\frac{\bar{p}\bar{q}}{n_1} + \frac{\bar{p}\bar{q}}{n_2}}}, \text{ where } \bar{p} = \frac{x_1 + x_2}{n_1 + n_2}$$

Two Means from Independent Samples *t* Test

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}},\ df = \frac{(V_1 + V_2)^2}{\frac{V_1^2}{n_1 - 1} + \frac{V_2^2}{n_2 - 1}}$$

where $V_1 = \dfrac{s_1^2}{n_1}$ and $V_2 = \dfrac{s_2^2}{n_2}$

Correlation and Regression

$$r = \frac{\sum xy - \frac{1}{n}\left(\sum x\right)\left(\sum y\right)}{\sqrt{\sum x^2 - \frac{1}{n}\left(\sum x\right)^2}\sqrt{\sum y^2 - \frac{1}{n}\left(\sum y\right)^2}}$$

Test for correlation: T.S.: $t = \dfrac{r}{\sqrt{\frac{1-r^2}{n-2}}}$, $df = n - 2$

$$a = \frac{\sum xy - \frac{1}{n}\left(\sum x\right)\left(\sum y\right)}{\sum x^2 - \frac{1}{n}\left(\sum x\right)^2},\ b = \bar{y} - a\cdot\bar{x}$$

Goodness of Fit

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

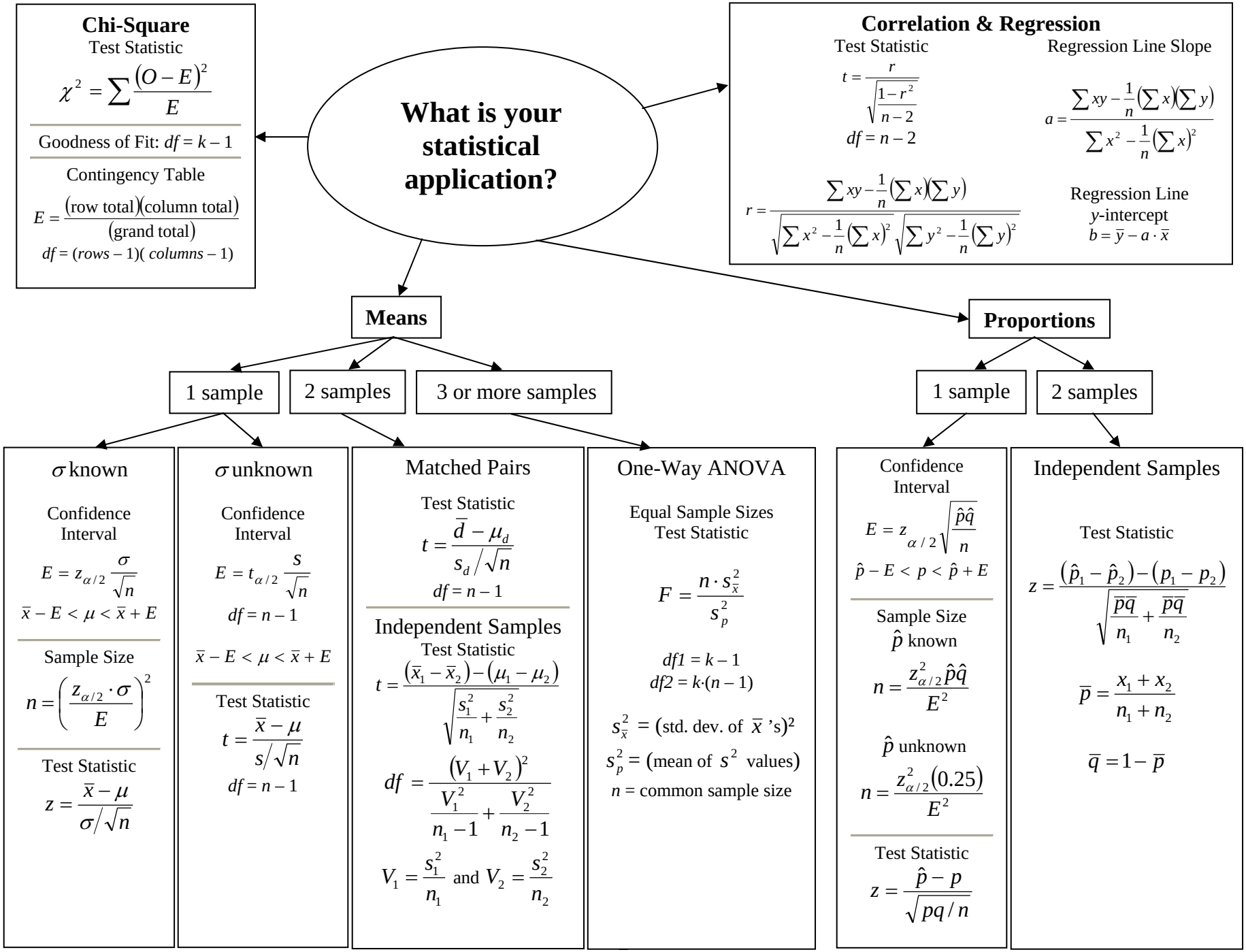
Multinomial Experiment:
$df = k - 1$

Contingency Table:
$df = (\textit{rows} - 1)(\textit{columns} - 1)$

Analysis of Variance

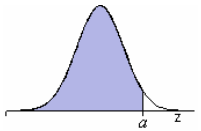
$$F = \frac{n\cdot s_{\bar{x}}^2}{s_p^2}$$

$df1 = k - 1$
$df2 = k(n - 1)$


Chi-Square
Test Statistic
$\chi^2 = \sum \frac{(O-E)^2}{E}$
Goodness of Fit: $df = k - 1$
Contingency Table
$E = \frac{(\text{row total})(\text{column total})}{(\text{grand total})}$
$df = (rows - 1)(columns - 1)$
What is your statistical application?
Correlation & Regression
Test Statistic
$t = \frac{r}{\sqrt{\frac{1-r^2}{n-2}}}$
$df = n - 2$
$r = \frac{\sum xy - \frac{1}{n}(\sum x)(\sum y)}{\sqrt{\sum x^2 - \frac{1}{n}(\sum x)^2}\sqrt{\sum y^2 - \frac{1}{n}(\sum y)^2}}$
Regression Line Slope
$a = \frac{\sum xy - \frac{1}{n}(\sum x)(\sum y)}{\sum x^2 - \frac{1}{n}(\sum x)^2}$
Regression Line
y-intercept
$b = \bar{y} - a \cdot \bar{x}$
Means
Proportions
1 sample
2 samples
3 or more samples
1 sample
2 samples
σ known
Confidence Interval
$E = z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$
$\bar{x} - E < \mu < \bar{x} + E$
Sample Size
$n = \left(\frac{z_{\alpha/2} \cdot \sigma}{E}\right)^2$
Test Statistic
$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$
σ unknown
Confidence Interval
$E = t_{\alpha/2}\frac{s}{\sqrt{n}}$
$df = n - 1$
$\bar{x} - E < \mu < \bar{x} + E$
Test Statistic
$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$
$df = n - 1$
Matched Pairs
Test Statistic
$t = \frac{\bar{d} - \mu_d}{s_d/\sqrt{n}}$
$df = n - 1$
Independent Samples
Test Statistic
$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$
$df = \frac{(V_1 + V_2)^2}{\frac{V_1^2}{n_1 - 1} + \frac{V_2^2}{n_2 - 1}}$
$V_1 = \frac{s_1^2}{n_1}$ and $V_2 = \frac{s_2^2}{n_2}$
One-Way ANOVA
Equal Sample Sizes
Test Statistic
$F = \frac{n \cdot s_{\bar{x}}^2}{s_p^2}$
$df1 = k - 1$
$df2 = k \cdot (n - 1)$
$s_{\bar{x}}^2$ = (std. dev. of $\bar{x}$'s)²
s_p^2 = (mean of s^2 values)
n = common sample size
Confidence Interval
$E = z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$
$\hat{p} - E < p < \hat{p} + E$
Sample Size
$\hat{p}$ known
$n = \frac{z_{\alpha/2}^2 \hat{p}\hat{q}}{E^2}$
$\hat{p}$ unknown
$n = \frac{z_{\alpha/2}^2 (0.25)}{E^2}$
Test Statistic
$z = \frac{\hat{p} - p}{\sqrt{pq/n}}$
Independent Samples
Test Statistic
$z = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\frac{\overline{pq}}{n_1} + \frac{\overline{pq}}{n_2}}}$
$\bar{p} = \frac{x_1 + x_2}{n_1 + n_2}$
$\bar{q} = 1 - \bar{p}$

Negative *z*-Scores

Table A1
The Cumulative Normal Distribution



Positive *z*-Scores

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-4.0	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-3.9	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-3.8	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-3.7	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-3.6	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-3.5	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051 ✻	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505 ✻	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
-0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

For *z* less than -4.09, use 0.0001 for the area

✻ Use these common values from interpolation:	**z**	**Area**
	-1.645	0.0500
	-2.576	0.0050

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495 ✻	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949 ✻	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998
3.5	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998
3.6	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
3.7	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
3.8	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
3.9	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
4.0	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999

For *z* greater than 4.09, use 0.9999 for the area

✻ Use these common values from interpolation:	**z**	**Area**
	1.645	0.9500
	2.576	0.9950

Conf. Level	Critical Value
0.90	1.645
0.95	1.960
0.99	2.576

Table A2 – Critical Values for Student's t and Normal Distributions										
	α									
	One Tail Applications									
	$\alpha = 0.005$	$\alpha = 0.01$	$\alpha = 0.02$	$\alpha = 0.025$	$\alpha = 0.03$	$\alpha = 0.04$	$\alpha = 0.05$	$\alpha = 0.06$	$\alpha = 0.08$	$\alpha = 0.10$
	Two Tail Applications									
df	$\alpha = 0.01$	$\alpha = 0.02$	$\alpha = 0.04$	$\alpha = 0.05$	$\alpha = 0.06$	α=0.08	$\alpha = 0.10$	$\alpha = 0.12$	$\alpha = 0.16$	$\alpha = 0.20$
1	63.657	31.821	15.895	12.706	10.579	7.916	6.314	5.242	3.895	3.078
2	9.925	6.965	4.849	4.303	3.896	3.320	2.920	2.620	2.189	1.886
3	5.841	4.541	3.482	3.182	2.951	2.605	2.353	2.156	1.859	1.638
4	4.604	3.747	2.999	2.776	2.601	2.333	2.132	1.971	1.723	1.533
5	4.032	3.365	2.757	2.571	2.422	2.191	2.015	1.873	1.649	1.476
6	3.707	3.143	2.612	2.447	2.313	2.104	1.943	1.812	1.603	1.440
7	3.499	2.998	2.517	2.365	2.241	2.046	1.895	1.770	1.572	1.415
8	3.355	2.896	2.449	2.306	2.189	2.004	1.860	1.740	1.549	1.397
9	3.250	2.821	2.398	2.262	2.150	1.973	1.833	1.718	1.532	1.383
10	3.169	2.764	2.359	2.228	2.120	1.948	1.812	1.700	1.518	1.372
11	3.106	2.718	2.328	2.201	2.096	1.928	1.796	1.686	1.507	1.363
12	3.055	2.681	2.303	2.179	2.076	1.912	1.782	1.674	1.498	1.356
13	3.012	2.650	2.282	2.160	2.060	1.899	1.771	1.664	1.490	1.350
14	2.977	2.624	2.264	2.145	2.046	1.887	1.761	1.656	1.484	1.345
15	2.947	2.602	2.249	2.131	2.034	1.878	1.753	1.649	1.478	1.341
16	2.921	2.583	2.235	2.120	2.024	1.869	1.746	1.642	1.474	1.337
17	2.898	2.567	2.224	2.110	2.015	1.862	1.740	1.637	1.469	1.333
18	2.878	2.552	2.214	2.101	2.007	1.855	1.734	1.632	1.466	1.330
19	2.861	2.539	2.205	2.093	2.000	1.850	1.729	1.628	1.462	1.328
20	2.845	2.528	2.197	2.086	1.994	1.844	1.725	1.624	1.459	1.325
21	2.831	2.518	2.189	2.080	1.988	1.840	1.721	1.621	1.457	1.323
22	2.819	2.508	2.183	2.074	1.983	1.835	1.717	1.618	1.454	1.321
23	2.807	2.500	2.177	2.069	1.978	1.832	1.714	1.615	1.452	1.319
24	2.797	2.492	2.172	2.064	1.974	1.828	1.711	1.612	1.450	1.318
25	2.787	2.485	2.167	2.060	1.970	1.825	1.708	1.610	1.448	1.316
26	2.779	2.479	2.162	2.056	1.967	1.822	1.706	1.608	1.446	1.315
27	2.771	2.473	2.158	2.052	1.963	1.819	1.703	1.606	1.445	1.314
28	2.763	2.467	2.154	2.048	1.960	1.817	1.701	1.604	1.443	1.313
29	2.756	2.462	2.150	2.045	1.957	1.814	1.699	1.602	1.442	1.311
30	2.750	2.457	2.147	2.042	1.955	1.812	1.697	1.600	1.441	1.310
31	2.744	2.453	2.144	2.040	1.952	1.810	1.696	1.599	1.440	1.309
32	2.738	2.449	2.141	2.037	1.950	1.808	1.694	1.597	1.439	1.309
33	2.733	2.445	2.138	2.035	1.948	1.806	1.692	1.596	1.437	1.308
34	2.728	2.441	2.136	2.032	1.946	1.805	1.691	1.595	1.436	1.307
35	2.724	2.438	2.133	2.030	1.944	1.803	1.690	1.594	1.436	1.306
36	2.719	2.434	2.131	2.028	1.942	1.802	1.688	1.593	1.435	1.306
37	2.715	2.431	2.129	2.026	1.940	1.800	1.687	1.592	1.434	1.305
38	2.712	2.429	2.127	2.024	1.939	1.799	1.686	1.591	1.433	1.304
39	2.708	2.426	2.125	2.023	1.937	1.798	1.685	1.590	1.432	1.304
40	2.704	2.423	2.123	2.021	1.936	1.796	1.684	1.589	1.432	1.303
41	2.701	2.421	2.121	2.020	1.934	1.795	1.683	1.588	1.431	1.303
42	2.698	2.418	2.120	2.018	1.933	1.794	1.682	1.587	1.430	1.302
43	2.695	2.416	2.118	2.017	1.932	1.793	1.681	1.586	1.430	1.302
44	2.692	2.414	2.116	2.015	1.931	1.792	1.680	1.586	1.429	1.301
45	2.690	2.412	2.115	2.014	1.929	1.791	1.679	1.585	1.429	1.301
46	2.687	2.410	2.114	2.013	1.928	1.790	1.679	1.584	1.428	1.300
47	2.685	2.408	2.112	2.012	1.927	1.789	1.678	1.584	1.428	1.300
48	2.682	2.407	2.111	2.011	1.926	1.789	1.677	1.583	1.427	1.299
49	2.680	2.405	2.110	2.010	1.925	1.788	1.677	1.582	1.427	1.299
50	2.678	2.403	2.109	2.009	1.924	1.787	1.676	1.582	1.426	1.299
75	2.643	2.377	2.090	1.992	1.910	1.775	1.665	1.573	1.419	1.293
100	2.626	2.364	2.081	1.984	1.902	1.769	1.660	1.568	1.416	1.290
250	2.596	2.341	2.065	1.969	1.889	1.758	1.651	1.560	1.409	1.285
500	2.586	2.334	2.059	1.965	1.885	1.754	1.648	1.557	1.407	1.283
1000	2.581	2.330	2.056	1.962	1.883	1.752	1.646	1.556	1.406	1.282
Large (z)	2.576	2.326	2.054	1.960	1.881	1.751	1.645	1.555	1.405	1.282

Table A3 *t*-Distribution *p*-Values

Areas to left of T.S. are given. For right tail test subtract 1-(*given area*). For 2-tail tests look up the T.S. absolute value, and *p*-value=2*(1-*area given*)

Degrees of Freedom

Positive *t*-Test Statistic	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	40	50	60	70	80	90	100	∞
0.0	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000
0.1	.5317	.5353	.5367	.5374	.5379	.5382	.5384	.5386	.5387	.5388	.5389	.5390	.5391	.5391	.5392	.5392	.5392	.5393	.5393	.5393	.5394	.5394	.5394	.5394	.5394	.5394	.5395	.5395	.5395	.5396	.5396	.5397	.5397	.5397	.5397	.5397	.5398	.5398
0.2	.5628	.5700	.5729	.5744	.5753	.5760	.5764	.5768	.5770	.5773	.5774	.5776	.5777	.5778	.5779	.5780	.5781	.5781	.5782	.5782	.5783	.5783	.5784	.5784	.5785	.5785	.5785	.5785	.5786	.5786	.5788	.5789	.5789	.5790	.5790	.5790	.5791	.5793
0.3	.5928	.6038	.6081	.6104	.6119	.6129	.6136	.6141	.6145	.6148	.6151	.6153	.6155	.6157	.6159	.6160	.6161	.6162	.6163	.6164	.6164	.6165	.6166	.6166	.6167	.6167	.6168	.6168	.6168	.6169	.6171	.6173	.6174	.6175	.6175	.6176	.6176	.6179
0.4	.6211	.6361	.6420	.6452	.6472	.6485	.6495	.6502	.6508	.6512	.6516	.6519	.6522	.6524	.6526	.6528	.6529	.6531	.6532	.6533	.6534	.6535	.6536	.6537	.6537	.6538	.6538	.6539	.6540	.6540	.6544	.6546	.6547	.6548	.6549	.6549	.6550	.6554
0.5	.6476	.6667	.6743	.6783	.6809	.6826	.6838	.6847	.6855	.6861	.6865	.6869	.6873	.6876	.6878	.6881	.6883	.6884	.6886	.6887	.6889	.6890	.6891	.6892	.6893	.6894	.6894	.6895	.6896	.6896	.6901	.6904	.6905	.6907	.6908	.6909	.6909	.6915
0.6	.6720	.6953	.7046	.7096	.7127	.7148	.7163	.7174	.7183	.7191	.7197	.7202	.7206	.7210	.7213	.7215	.7218	.7220	.7222	.7224	.7225	.7227	.7228	.7229	.7230	.7231	.7232	.7233	.7234	.7235	.7241	.7244	.7246	.7248	.7249	.7250	.7251	.7257
0.7	.6944	.7218	.7328	.7387	.7424	.7449	.7467	.7481	.7492	.7501	.7508	.7514	.7519	.7523	.7527	.7530	.7533	.7536	.7538	.7540	.7542	.7544	.7545	.7547	.7548	.7549	.7550	.7551	.7552	.7553	.7560	.7564	.7567	.7569	.7570	.7571	.7572	.7580
0.8	.7148	.7462	.7589	.7657	.7700	.7729	.7750	.7766	.7778	.7788	.7797	.7804	.7810	.7815	.7819	.7823	.7826	.7829	.7832	.7834	.7837	.7839	.7841	.7842	.7844	.7845	.7847	.7848	.7849	.7850	.7858	.7863	.7866	.7868	.7870	.7871	.7872	.7881
0.9	.7333	.7684	.7828	.7905	.7953	.7986	.8010	.8028	.8042	.8054	.8063	.8071	.8078	.8083	.8088	.8093	.8097	.8100	.8103	.8106	.8108	.8111	.8113	.8115	.8116	.8118	.8120	.8121	.8122	.8124	.8132	.8138	.8141	.8144	.8146	.8147	.8149	.8159
1.0	.7500	.7887	.8045	.8130	.8184	.8220	.8247	.8267	.8283	.8296	.8306	.8315	.8322	.8329	.8334	.8339	.8343	.8347	.8351	.8354	.8357	.8359	.8361	.8364	.8366	.8367	.8369	.8371	.8372	.8373	.8383	.8389	.8393	.8396	.8398	.8400	.8401	.8413
1.1	.7651	.8070	.8242	.8335	.8393	.8433	.8461	.8483	.8501	.8514	.8526	.8535	.8544	.8551	.8557	.8562	.8567	.8571	.8575	.8578	.8581	.8584	.8586	.8589	.8591	.8593	.8595	.8597	.8598	.8600	.8610	.8617	.8621	.8624	.8627	.8629	.8630	.8643
1.2	.7789	.8235	.8419	.8518	.8581	.8623	.8654	.8678	.8696	.8711	.8723	.8734	.8742	.8750	.8756	.8762	.8767	.8772	.8776	.8779	.8782	.8785	.8788	.8791	.8793	.8795	.8797	.8799	.8801	.8802	.8814	.8821	.8826	.8829	.8832	.8834	.8835	.8849
1.3	.7913	.8384	.8578	.8683	.8748	.8793	.8826	.8851	.8870	.8886	.8899	.8910	.8919	.8927	.8934	.8940	.8945	.8950	.8954	.8958	.8962	.8965	.8968	.8970	.8973	.8975	.8977	.8979	.8981	.8982	.8995	.9002	.9007	.9011	.9013	.9015	.9017	.9032
1.4	.8026	.8518	.8720	.8829	.8898	.8945	.8979	.9005	.9025	.9041	.9055	.9066	.9075	.9084	.9091	.9097	.9103	.9107	.9112	.9116	.9119	.9123	.9126	.9128	.9131	.9133	.9136	.9138	.9139	.9141	.9154	.9162	.9167	.9170	.9173	.9175	.9177	.9192
1.5	.8128	.8638	.8847	.8960	.9030	.9079	.9114	.9140	.9161	.9177	.9191	.9203	.9212	.9221	.9228	.9235	.9240	.9245	.9250	.9254	.9258	.9261	.9264	.9267	.9269	.9272	.9274	.9276	.9278	.9280	.9293	.9300	.9306	.9309	.9312	.9314	.9316	.9332
1.6	.8222	.8746	.8960	.9076	.9148	.9196	.9232	.9259	.9280	.9297	.9310	.9322	.9332	.9340	.9348	.9354	.9360	.9365	.9370	.9374	.9377	.9381	.9384	.9387	.9389	.9392	.9394	.9396	.9398	.9400	.9413	.9421	.9426	.9429	.9432	.9434	.9436	.9452
1.7	.8307	.8844	.9062	.9178	.9251	.9300	.9335	.9362	.9383	.9400	.9414	.9426	.9435	.9444	.9451	.9458	.9463	.9468	.9473	.9477	.9481	.9484	.9487	.9490	.9492	.9495	.9497	.9499	.9501	.9503	.9516	.9523	.9528	.9532	.9535	.9537	.9539	.9554
1.8	.8386	.8932	.9152	.9269	.9341	.9390	.9426	.9452	.9473	.9490	.9503	.9515	.9525	.9533	.9540	.9546	.9552	.9557	.9561	.9565	.9569	.9572	.9575	.9578	.9580	.9583	.9585	.9587	.9589	.9590	.9603	.9611	.9616	.9619	.9622	.9624	.9626	.9641
1.9	.8458	.9011	.9232	.9349	.9421	.9469	.9504	.9530	.9551	.9567	.9580	.9591	.9601	.9609	.9616	.9622	.9627	.9632	.9636	.9640	.9644	.9647	.9650	.9652	.9655	.9657	.9659	.9661	.9663	.9665	.9677	.9684	.9689	.9692	.9695	.9697	.9698	.9713
2.0	.8524	.9082	.9303	.9419	.9490	.9538	.9572	.9597	.9617	.9633	.9646	.9657	.9666	.9674	.9680	.9686	.9691	.9696	.9700	.9704	.9707	.9710	.9713	.9715	.9718	.9720	.9722	.9724	.9725	.9727	.9738	.9745	.9750	.9753	.9756	.9757	.9759	.9772
2.1	.8585	.9147	.9367	.9482	.9551	.9598	.9631	.9655	.9674	.9690	.9702	.9712	.9721	.9728	.9735	.9740	.9745	.9750	.9753	.9757	.9760	.9763	.9766	.9768	.9770	.9772	.9774	.9776	.9777	.9779	.9790	.9796	.9800	.9803	.9806	.9807	.9809	.9821
2.2	.8642	.9206	.9424	.9537	.9605	.9649	.9681	.9705	.9723	.9738	.9750	.9759	.9768	.9774	.9781	.9786	.9790	.9794	.9798	.9801	.9804	.9807	.9809	.9812	.9814	.9816	.9817	.9819	.9820	.9822	.9832	.9838	.9842	.9844	.9847	.9848	.9849	.9861
2.3	.8695	.9259	.9475	.9585	.9651	.9694	.9725	.9748	.9765	.9779	.9790	.9799	.9807	.9813	.9819	.9824	.9828	.9832	.9835	.9838	.9841	.9843	.9846	.9848	.9850	.9851	.9853	.9854	.9856	.9857	.9866	.9872	.9875	.9878	.9880	.9881	.9882	.9893
2.4	.8743	.9308	.9521	.9628	.9692	.9734	.9763	.9784	.9801	.9813	.9824	.9832	.9840	.9846	.9851	.9855	.9859	.9863	.9866	.9869	.9871	.9874	.9876	.9877	.9879	.9881	.9882	.9884	.9885	.9886	.9894	.9899	.9902	.9905	.9906	.9908	.9909	.9918
2.5	.8789	.9352	.9561	.9666	.9728	.9767	.9795	.9815	.9831	.9843	.9852	.9860	.9867	.9873	.9877	.9882	.9885	.9888	.9891	.9894	.9896	.9898	.9900	.9902	.9903	.9905	.9906	.9907	.9908	.9909	.9917	.9921	.9924	.9926	.9928	.9929	.9930	.9938
2.6	.8831	.9392	.9598	.9700	.9759	.9797	.9823	.9842	.9856	.9868	.9877	.9884	.9890	.9895	.9900	.9903	.9907	.9910	.9912	.9914	.9916	.9918	.9920	.9921	.9923	.9924	.9925	.9926	.9927	.9928	.9935	.9939	.9941	.9943	.9945	.9946	.9946	.9953
2.7	.8871	.9429	.9631	.9730	.9786	.9822	.9847	.9865	.9878	.9888	.9897	.9903	.9909	.9914	.9918	.9921	.9924	.9927	.9929	.9931	.9933	.9935	.9936	.9937	.9939	.9940	.9941	.9942	.9943	.9944	.9949	.9953	.9955	.9957	.9958	.9959	.9959	.9965
2.8	.8908	.9463	.9661	.9756	.9810	.9844	.9867	.9884	.9896	.9906	.9914	.9920	.9925	.9929	.9933	.9936	.9938	.9941	.9943	.9945	.9946	.9948	.9949	.9950	.9951	.9952	.9953	.9954	.9955	.9956	.9961	.9964	.9966	.9967	.9968	.9969	.9969	.9974
2.9	.8943	.9494	.9687	.9779	.9831	.9863	.9885	.9901	.9912	.9921	.9928	.9933	.9938	.9942	.9945	.9948	.9950	.9952	.9954	.9956	.9957	.9958	.9960	.9961	.9962	.9963	.9963	.9964	.9965	.9965	.9970	.9972	.9974	.9975	.9976	.9977	.9977	.9981
3.0	.8976	.9523	.9712	.9800	.9850	.9880	.9900	.9915	.9925	.9933	.9940	.9945	.9949	.9952	.9955	.9958	.9960	.9962	.9963	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9971	.9972	.9973	.9973	.9977	.9979	.9980	.9981	.9982	.9983	.9983	.9987
3.1	.9007	.9549	.9734	.9819	.9866	.9894	.9913	.9927	.9936	.9944	.9949	.9954	.9958	.9961	.9963	.9966	.9967	.9969	.9971	.9972	.9973	.9974	.9975	.9976	.9976	.9977	.9978	.9978	.9979	.9979	.9982	.9984	.9985	.9986	.9987	.9987	.9987	.9990
3.2	.9036	.9573	.9753	.9835	.9880	.9907	.9925	.9937	.9946	.9953	.9958	.9962	.9965	.9968	.9970	.9972	.9974	.9975	.9976	.9978	.9978	.9979	.9980	.9981	.9981	.9982	.9983	.9983	.9983	.9984	.9987	.9988	.9989	.9990	.9990	.9991	.9991	.9993
3.3	.9063	.9596	.9771	.9850	.9893	.9918	.9934	.9946	.9954	.9960	.9965	.9968	.9971	.9974	.9976	.9977	.9979	.9980	.9981	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986	.9987	.9987	.9988	.9990	.9991	.9992	.9992	.9993	.9993	.9993	.9995
3.4	.9089	.9617	.9788	.9864	.9904	.9928	.9943	.9953	.9961	.9966	.9970	.9974	.9976	.9978	.9980	.9982	.9983	.9984	.9985	.9986	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990	.9990	.9992	.9993	.9994	.9994	.9995	.9995	.9995	.9997
3.5	.9114	.9636	.9803	.9876	.9914	.9936	.9950	.9960	.9966	.9971	.9975	.9978	.9980	.9982	.9984	.9985	.9986	.9987	.9988	.9989	.9989	.9990	.9990	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9994	.9995	.9996	.9996	.9996	.9996	.9997	.9998
3.6	.9138	.9654	.9816	.9886	.9922	.9943	.9956	.9965	.9971	.9976	.9979	.9982	.9984	.9986	.9987	.9988	.9989	.9990	.9990	.9991	.9992	.9992	.9992	.9993	.9993	.9993	.9994	.9994	.9994	.9994	.9996	.9996	.9997	.9997	.9997	.9997	.9998	.9998
3.7	.9160	.9670	.9829	.9896	.9930	.9950	.9962	.9970	.9975	.9979	.9982	.9985	.9987	.9988	.9989	.9990	.9991	.9992	.9992	.9993	.9993	.9994	.9994	.9994	.9995	.9995	.9995	.9995	.9996	.9996	.9997	.9997	.9998	.9998	.9998	.9998	.9998	.9999
3.8	.9181	.9686	.9840	.9904	.9937	.9955	.9966	.9974	.9979	.9983	.9985	.9987	.9989	.9990	.9991	.9992	.9993	.9993	.9994	.9994	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9997	.9997	.9998	.9998	.9998	.9998	.9999	.9999	.9999	.9999
3.9	.9201	.9701	.9850	.9912	.9943	.9960	.9971	.9977	.9982	.9985	.9988	.9989	.9991	.9992	.9993	.9994	.9994	.9995	.9995	.9996	.9996	.9996	.9996	.9997	.9997	.9997	.9997	.9997	.9997	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
4.0	.9220	.9714	.9860	.9919	.9948	.9964	.9974	.9980	.9984	.9987	.9990	.9991	.9992	.9993	.9994	.9995	.9995	.9996	.9996	.9996	.9997	.9997	.9997	.9997	.9998	.9998	.9998	.9998	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
4.1	.9239	.9727	.9869	.9926	.9953	.9968	.9977	.9983	.9987	.9989	.9991	.9993	.9994	.9995	.9995	.9996	.9996	.9997	.9997	.9997	.9997	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
4.2	.9256	.9739	.9877	.9932	.9958	.9972	.9980	.9985	.9988	.9991	.9993	.9994	.9995	.9996	.9996	.9997	.9997	.9997	.9998	.9998	.9998	.9998	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
4.3	.9273	.9750	.9884	.9937	.9961	.9975	.9982	.9987	.9990	.9992	.9994	.9995	.9996	.9996	.9997	.9997	.9998	.9998	.9998	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
4.4	.9289	.9760	.9891	.9942	.9965	.9977	.9984	.9989	.9991	.9993	.9995	.9996	.9996	.9997	.9997	.9998	.9998	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
4.5	.9304	.9770	.9898	.9946	.9968	.9979	.9986	.9990	.9993	.9994	.9995	.9996	.9997	.9998	.9998	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
4.6	.9319	.9779	.9903	.9950	.9971	.9982	.9988	.9991	.9994	.9995	.9996	.9997	.9998	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
4.7	.9333	.9788	.9909	.9953	.9973	.9983	.9989	.9992	.9994	.9996	.9997	.9997	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
4.8	.9346	.9796	.9914	.9957	.9976	.9985	.9990	.9993	.9995	.9996	.9997	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
4.9	.9359	.9804	.9919	.9960	.9978	.9986	.9991	.9994	.9996	.9997	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999
5.0	.9372	.9811	.9923	.9963	.9979	.9988	.9992	.9995	.9996	.9997	.9998	.9998	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999	.9999

Note: Any value which would normally round to 1 is recorded as .9999. For values of *t* greater than 5.0, use 0.9999 for the area.

Table A3 *t*-Distribution *p*-Values

Areas to left of T.S. are given. For right tail test subtract 1-(*given area*). For 2-tail tests look up the T.S. absolute value, and *p*-value=2*(1-*area given*)

Degrees of Freedom

Negative *t*-Test Statistic	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	40	50	60	70	80	90	100	∞
0.0	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000
-0.1	.4683	.4647	.4633	.4626	.4621	.4618	.4616	.4614	.4613	.4612	.4611	.4610	.4609	.4609	.4608	.4608	.4608	.4607	.4607	.4607	.4606	.4606	.4606	.4606	.4606	.4606	.4605	.4605	.4605	.4605	.4604	.4604	.4603	.4603	.4603	.4603	.4603	.4602
-0.2	.4372	.4300	.4271	.4256	.4247	.4240	.4236	.4232	.4230	.4227	.4226	.4224	.4223	.4222	.4221	.4220	.4219	.4219	.4218	.4218	.4217	.4217	.4216	.4216	.4215	.4215	.4215	.4215	.4214	.4214	.4212	.4211	.4211	.4210	.4210	.4210	.4209	.4207
-0.3	.4072	.3962	.3919	.3896	.3881	.3871	.3864	.3859	.3855	.3852	.3849	.3847	.3845	.3843	.3841	.3840	.3839	.3838	.3837	.3836	.3836	.3835	.3834	.3834	.3833	.3833	.3832	.3832	.3832	.3831	.3829	.3827	.3826	.3825	.3825	.3824	.3824	.3821
-0.4	.3789	.3639	.3580	.3548	.3528	.3515	.3505	.3498	.3492	.3488	.3484	.3481	.3478	.3476	.3474	.3472	.3471	.3469	.3468	.3467	.3466	.3465	.3464	.3463	.3463	.3462	.3462	.3461	.3460	.3460	.3456	.3454	.3453	.3452	.3451	.3451	.3450	.3446
-0.5	.3524	.3333	.3257	.3217	.3191	.3174	.3162	.3153	.3145	.3139	.3135	.3131	.3127	.3124	.3122	.3119	.3117	.3116	.3114	.3113	.3111	.3110	.3109	.3108	.3107	.3106	.3106	.3105	.3104	.3104	.3099	.3096	.3095	.3093	.3092	.3091	.3091	.3085
-0.6	.3280	.3047	.2954	.2904	.2873	.2852	.2837	.2826	.2817	.2809	.2803	.2798	.2794	.2790	.2787	.2785	.2782	.2780	.2778	.2776	.2775	.2773	.2772	.2771	.2770	.2769	.2768	.2767	.2766	.2765	.2759	.2756	.2754	.2752	.2751	.2750	.2749	.2743
-0.7	.3056	.2782	.2672	.2613	.2576	.2551	.2533	.2519	.2508	.2499	.2492	.2486	.2481	.2477	.2473	.2470	.2467	.2464	.2462	.2460	.2458	.2456	.2455	.2453	.2452	.2451	.2450	.2449	.2448	.2447	.2440	.2436	.2433	.2431	.2430	.2429	.2428	.2420
-0.8	.2852	.2538	.2411	.2343	.2300	.2271	.2250	.2234	.2222	.2212	.2203	.2196	.2190	.2185	.2181	.2177	.2174	.2171	.2168	.2166	.2163	.2161	.2159	.2158	.2156	.2155	.2153	.2152	.2151	.2150	.2142	.2137	.2134	.2132	.2130	.2129	.2128	.2119
-0.9	.2667	.2316	.2172	.2095	.2047	.2014	.1990	.1972	.1958	.1946	.1937	.1929	.1922	.1917	.1912	.1907	.1903	.1900	.1897	.1894	.1892	.1889	.1887	.1885	.1884	.1882	.1880	.1879	.1878	.1876	.1868	.1862	.1859	.1856	.1854	.1853	.1851	.1841
-1.0	.2500	.2113	.1955	.1870	.1816	.1780	.1753	.1733	.1717	.1704	.1694	.1685	.1678	.1671	.1666	.1661	.1657	.1653	.1649	.1646	.1643	.1641	.1639	.1636	.1634	.1633	.1631	.1629	.1628	.1627	.1617	.1611	.1607	.1604	.1602	.1600	.1599	.1587
-1.1	.2349	.1930	.1758	.1665	.1607	.1567	.1539	.1517	.1499	.1486	.1474	.1465	.1456	.1449	.1443	.1438	.1433	.1429	.1425	.1422	.1419	.1416	.1414	.1411	.1409	.1407	.1405	.1403	.1402	.1400	.1390	.1383	.1379	.1376	.1373	.1371	.1370	.1357
-1.2	.2211	.1765	.1581	.1482	.1419	.1377	.1346	.1322	.1304	.1289	.1277	.1266	.1258	.1250	.1244	.1238	.1233	.1228	.1224	.1221	.1218	.1215	.1212	.1209	.1207	.1205	.1203	.1201	.1199	.1198	.1186	.1179	.1174	.1171	.1168	.1166	.1165	.1151
-1.3	.2087	.1616	.1422	.1317	.1252	.1207	.1174	.1149	.1130	.1114	.1101	.1090	.1081	.1073	.1066	.1060	.1055	.1050	.1046	.1042	.1038	.1035	.1032	.1030	.1027	.1025	.1023	.1021	.1019	.1018	.1005	.0998	.0993	.0989	.0987	.0985	.0983	.0968
-1.4	.1974	.1482	.1280	.1171	.1102	.1055	.1021	.0995	.0975	.0959	.0945	.0934	.0925	.0916	.0909	.0903	.0897	.0893	.0888	.0884	.0881	.0877	.0874	.0872	.0869	.0867	.0864	.0862	.0861	.0859	.0846	.0838	.0833	.0830	.0827	.0825	.0823	.0808
-1.5	.1872	.1362	.1153	.1040	.0970	.0921	.0886	.0860	.0839	.0823	.0809	.0797	.0788	.0779	.0772	.0765	.0760	.0755	.0750	.0746	.0742	.0739	.0736	.0733	.0731	.0728	.0726	.0724	.0722	.0720	.0707	.0700	.0694	.0691	.0688	.0686	.0684	.0668
-1.6	.1778	.1254	.1040	.0924	.0852	.0804	.0768	.0741	.0720	.0703	.0690	.0678	.0668	.0660	.0652	.0646	.0640	.0635	.0630	.0626	.0623	.0619	.0616	.0613	.0611	.0608	.0606	.0604	.0602	.0600	.0587	.0579	.0574	.0571	.0568	.0566	.0564	.0548
-1.7	.1693	.1156	.0938	.0822	.0749	.0700	.0665	.0638	.0617	.0600	.0586	.0574	.0565	.0556	.0549	.0542	.0537	.0532	.0527	.0523	.0519	.0516	.0513	.0510	.0508	.0505	.0503	.0501	.0499	.0497	.0484	.0477	.0472	.0468	.0465	.0463	.0461	.0446
-1.8	.1614	.1068	.0848	.0731	.0659	.0610	.0574	.0548	.0527	.0510	.0497	.0485	.0475	.0467	.0460	.0454	.0448	.0443	.0439	.0435	.0431	.0428	.0425	.0422	.0420	.0417	.0415	.0413	.0411	.0410	.0397	.0389	.0384	.0381	.0378	.0376	.0374	.0359
-1.9	.1542	.0989	.0768	.0651	.0579	.0531	.0496	.0470	.0449	.0433	.0420	.0409	.0399	.0391	.0384	.0378	.0373	.0368	.0364	.0360	.0356	.0353	.0350	.0348	.0345	.0343	.0341	.0339	.0337	.0335	.0323	.0316	.0311	.0308	.0305	.0303	.0302	.0287
-2.0	.1476	.0918	.0697	.0581	.0510	.0462	.0428	.0403	.0383	.0367	.0354	.0343	.0334	.0326	.0320	.0314	.0309	.0304	.0300	.0296	.0293	.0290	.0287	.0285	.0282	.0280	.0278	.0276	.0275	.0273	.0262	.0255	.0250	.0247	.0244	.0243	.0241	.0228
-2.1	.1415	.0853	.0633	.0518	.0449	.0402	.0369	.0345	.0326	.0310	.0298	.0288	.0279	.0272	.0265	.0260	.0255	.0250	.0247	.0243	.0240	.0237	.0234	.0232	.0230	.0228	.0226	.0224	.0223	.0221	.0210	.0204	.0200	.0197	.0194	.0193	.0191	.0179
-2.2	.1358	.0794	.0576	.0463	.0395	.0351	.0319	.0295	.0277	.0262	.0250	.0241	.0232	.0226	.0219	.0214	.0210	.0206	.0202	.0199	.0196	.0193	.0191	.0188	.0186	.0184	.0183	.0181	.0180	.0178	.0168	.0162	.0158	.0156	.0153	.0152	.0151	.0139
-2.3	.1305	.0741	.0525	.0415	.0349	.0306	.0275	.0252	.0235	.0221	.0210	.0201	.0193	.0187	.0181	.0176	.0172	.0168	.0165	.0162	.0159	.0157	.0154	.0152	.0150	.0149	.0147	.0146	.0144	.0143	.0134	.0128	.0125	.0122	.0120	.0119	.0118	.0107
-2.4	.1257	.0692	.0479	.0372	.0308	.0266	.0237	.0216	.0199	.0187	.0176	.0168	.0160	.0154	.0149	.0145	.0141	.0137	.0134	.0131	.0129	.0126	.0124	.0123	.0121	.0119	.0118	.0116	.0115	.0114	.0106	.0101	.0098	.0095	.0094	.0092	.0091	.0082
-2.5	.1211	.0648	.0439	.0334	.0272	.0233	.0205	.0185	.0169	.0157	.0148	.0140	.0133	.0127	.0123	.0118	.0115	.0112	.0109	.0106	.0104	.0102	.0100	.0098	.0097	.0095	.0094	.0093	.0092	.0091	.0083	.0079	.0076	.0074	.0072	.0071	.0070	.0062
-2.6	.1169	.0608	.0402	.0300	.0241	.0203	.0177	.0158	.0144	.0132	.0123	.0116	.0110	.0105	.0100	.0097	.0093	.0090	.0088	.0086	.0084	.0082	.0080	.0079	.0077	.0076	.0075	.0074	.0073	.0072	.0065	.0061	.0059	.0057	.0055	.0054	.0054	.0047
-2.7	.1129	.0571	.0369	.0270	.0214	.0178	.0153	.0135	.0122	.0112	.0103	.0097	.0091	.0086	.0082	.0079	.0076	.0073	.0071	.0069	.0067	.0065	.0064	.0063	.0061	.0060	.0059	.0058	.0057	.0056	.0051	.0047	.0045	.0043	.0042	.0041	.0041	.0035
-2.8	.1092	.0537	.0339	.0244	.0190	.0156	.0133	.0116	.0104	.0094	.0086	.0080	.0075	.0071	.0067	.0064	.0062	.0059	.0057	.0055	.0054	.0052	.0051	.0050	.0049	.0048	.0047	.0046	.0045	.0044	.0039	.0036	.0034	.0033	.0032	.0031	.0031	.0026
-2.9	.1057	.0506	.0313	.0221	.0169	.0137	.0115	.0099	.0088	.0079	.0072	.0067	.0062	.0058	.0055	.0052	.0050	.0048	.0046	.0044	.0043	.0042	.0040	.0039	.0038	.0037	.0037	.0036	.0035	.0035	.0030	.0028	.0026	.0025	.0024	.0023	.0023	.0019
-3.0	.1024	.0477	.0288	.0200	.0150	.0120	.0100	.0085	.0075	.0067	.0060	.0055	.0051	.0048	.0045	.0042	.0040	.0038	.0037	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0029	.0028	.0027	.0027	.0023	.0021	.0020	.0019	.0018	.0017	.0017	.0013
-3.1	.0993	.0451	.0266	.0181	.0134	.0106	.0087	.0073	.0064	.0056	.0051	.0046	.0042	.0039	.0037	.0034	.0033	.0031	.0029	.0028	.0027	.0026	.0025	.0024	.0024	.0023	.0022	.0022	.0021	.0021	.0018	.0016	.0015	.0014	.0013	.0013	.0013	.0010
-3.2	.0964	.0427	.0247	.0165	.0120	.0093	.0075	.0063	.0054	.0047	.0042	.0038	.0035	.0032	.0030	.0028	.0026	.0025	.0024	.0022	.0022	.0021	.0020	.0019	.0019	.0018	.0017	.0017	.0017	.0016	.0013	.0012	.0011	.0010	.0010	.0009	.0009	.0007
-3.3	.0937	.0404	.0229	.0150	.0107	.0082	.0066	.0054	.0046	.0040	.0035	.0032	.0029	.0026	.0024	.0023	.0021	.0020	.0019	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014	.0013	.0013	.0012	.0010	.0009	.0008	.0008	.0007	.0007	.0007	.0005
-3.4	.0911	.0383	.0212	.0136	.0096	.0072	.0057	.0047	.0039	.0034	.0030	.0026	.0024	.0022	.0020	.0018	.0017	.0016	.0015	.0014	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010	.0010	.0008	.0007	.0006	.0006	.0005	.0005	.0005	.0003
-3.5	.0886	.0364	.0197	.0124	.0086	.0064	.0050	.0040	.0034	.0029	.0025	.0022	.0020	.0018	.0016	.0015	.0014	.0013	.0012	.0011	.0011	.0010	.0010	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0006	.0005	.0004	.0004	.0004	.0004	.0003	.0002
-3.6	.0862	.0346	.0184	.0114	.0078	.0057	.0044	.0035	.0029	.0024	.0021	.0018	.0016	.0014	.0013	.0012	.0011	.0010	.0010	.0009	.0008	.0008	.0008	.0007	.0007	.0007	.0006	.0006	.0006	.0006	.0004	.0004	.0003	.0003	.0003	.0003	.0002	.0002
-3.7	.0840	.0330	.0171	.0104	.0070	.0050	.0038	.0030	.0025	.0021	.0018	.0015	.0013	.0012	.0011	.0010	.0009	.0008	.0008	.0007	.0007	.0006	.0006	.0006	.0005	.0005	.0005	.0005	.0004	.0004	.0003	.0003	.0002	.0002	.0002	.0002	.0002	.0001
-3.8	.0819	.0314	.0160	.0096	.0063	.0045	.0034	.0026	.0021	.0017	.0015	.0013	.0011	.0010	.0009	.0008	.0007	.0007	.0006	.0006	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0003	.0003	.0002	.0002	.0002	.0002	.0001	.0001	.0001	.0001
-3.9	.0799	.0299	.0150	.0088	.0057	.0040	.0029	.0023	.0018	.0015	.0012	.0011	.0009	.0008	.0007	.0006	.0006	.0005	.0005	.0004	.0004	.0004	.0004	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-4.0	.0780	.0286	.0140	.0081	.0052	.0036	.0026	.0020	.0016	.0013	.0010	.0009	.0008	.0007	.0006	.0005	.0005	.0004	.0004	.0004	.0003	.0003	.0003	.0003	.0002	.0002	.0002	.0002	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-4.1	.0761	.0273	.0131	.0074	.0047	.0032	.0023	.0017	.0013	.0011	.0009	.0007	.0006	.0005	.0005	.0004	.0004	.0003	.0003	.0003	.0003	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-4.2	.0744	.0261	.0123	.0068	.0042	.0028	.0020	.0015	.0012	.0009	.0007	.0006	.0005	.0004	.0004	.0003	.0003	.0003	.0002	.0002	.0002	.0002	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-4.3	.0727	.0250	.0116	.0063	.0039	.0025	.0018	.0013	.0010	.0008	.0006	.0005	.0004	.0004	.0003	.0003	.0002	.0002	.0002	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-4.4	.0711	.0240	.0109	.0058	.0035	.0023	.0016	.0011	.0009	.0007	.0005	.0004	.0004	.0003	.0003	.0002	.0002	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-4.5	.0696	.0230	.0102	.0054	.0032	.0021	.0014	.0010	.0007	.0006	.0005	.0004	.0003	.0002	.0002	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-4.6	.0681	.0221	.0097	.0050	.0029	.0018	.0012	.0009	.0006	.0005	.0004	.0003	.0002	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-4.7	.0667	.0212	.0091	.0047	.0027	.0017	.0011	.0008	.0006	.0004	.0003	.0003	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-4.8	.0654	.0204	.0086	.0043	.0024	.0015	.0010	.0007	.0005	.0004	.0003	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-4.9	.0641	.0196	.0081	.0040	.0022	.0014	.0009	.0006	.0004	.0003	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
-5.0	.0628	.0189	.0077	.0037	.0021	.0012	.0008	.0005	.0004	.0003	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001

Note: Any value which would normally round to 0 is recorded as .0001. For values of *t* less than -5.0, use 0.0001 for the area.

Table A4 -- Chi-Square Distribution Critical Values

	Area to the Right of Left -Tail Critical Values					Area to the Right of Right-Tail Critical Values				
df	**0.995**	**0.990**	**0.975**	**0.950**	**0.900**	**0.100**	**0.050**	**0.025**	**0.010**	**0.005**
1	0.0000	0.0002	0.0010	0.0039	0.0158	2.7055	3.8415	5.0239	6.6349	7.8794
2	0.0100	0.0201	0.0506	0.1026	0.2107	4.6052	5.9915	7.3778	9.2103	10.5966
3	0.0717	0.1148	0.2158	0.3518	0.5844	6.2514	7.8147	9.3484	11.3449	12.8382
4	0.2070	0.2971	0.4844	0.7107	1.0636	7.7794	9.4877	11.1433	13.2767	14.8603
5	0.4117	0.5543	0.8312	1.1455	1.6103	9.2364	11.0705	12.8325	15.0863	16.7496
6	0.6757	0.8721	1.2373	1.6354	2.2041	10.6446	12.5916	14.4494	16.8119	18.5476
7	0.9893	1.2390	1.6899	2.1673	2.8331	12.0170	14.0671	16.0128	18.4753	20.2777
8	1.3444	1.6465	2.1797	2.7326	3.4895	13.3616	15.5073	17.5345	20.0902	21.9550
9	1.7349	2.0879	2.7004	3.3251	4.1682	14.6837	16.9190	19.0228	21.6660	23.5894
10	2.1559	2.5582	3.2470	3.9403	4.8652	15.9872	18.3070	20.4832	23.2093	25.1882
11	2.6032	3.0535	3.8157	4.5748	5.5778	17.2750	19.6751	21.9200	24.7250	26.7568
12	3.0738	3.5706	4.4038	5.2260	6.3038	18.5493	21.0261	23.3367	26.2170	28.2995
13	3.5650	4.1069	5.0088	5.8919	7.0415	19.8119	22.3620	24.7356	27.6882	29.8195
14	4.0747	4.6604	5.6287	6.5706	7.7895	21.0641	23.6848	26.1189	29.1412	31.3193
15	4.6009	5.2293	6.2621	7.2609	8.5468	22.3071	24.9958	27.4884	30.5779	32.8013
16	5.1422	5.8122	6.9077	7.9616	9.3122	23.5418	26.2962	28.8454	31.9999	34.2672
17	5.6972	6.4078	7.5642	8.6718	10.0852	24.7690	27.5871	30.1910	33.4087	35.7185
18	6.2648	7.0149	8.2307	9.3905	10.8649	25.9894	28.8693	31.5264	34.8053	37.1565
19	6.8440	7.6327	8.9065	10.1170	11.6509	27.2036	30.1435	32.8523	36.1909	38.5823
20	7.4338	8.2604	9.5908	10.8508	12.4426	28.4120	31.4104	34.1696	37.5662	39.9968
21	8.0337	8.8972	10.2829	11.5913	13.2396	29.6151	32.6706	35.4789	38.9322	41.4011
22	8.6427	9.5425	10.9823	12.3380	14.0415	30.8133	33.9244	36.7807	40.2894	42.7957
23	9.2604	10.1957	11.6886	13.0905	14.8480	32.0069	35.1725	38.0756	41.6384	44.1813
24	9.8862	10.8564	12.4012	13.8484	15.6587	33.1962	36.4150	39.3641	42.9798	45.5585
25	10.5197	11.5240	13.1197	14.6114	16.4734	34.3816	37.6525	40.6465	44.3141	46.9279
26	11.1602	12.1981	13.8439	15.3792	17.2919	35.5632	38.8851	41.9232	45.6417	48.2899
27	11.8076	12.8785	14.5734	16.1514	18.1139	36.7412	40.1133	43.1945	46.9629	49.6449
28	12.4613	13.5647	15.3079	16.9279	18.9392	37.9159	41.3371	44.4608	48.2782	50.9934
29	13.1211	14.2565	16.0471	17.7084	19.7677	39.0875	42.5570	45.7223	49.5879	52.3356
30	13.7867	14.9535	16.7908	18.4927	20.5992	40.2560	43.7730	46.9792	50.8922	53.6720
31	14.4578	15.6555	17.5387	19.2806	21.4336	41.4217	44.9853	48.2319	52.1914	55.0027
32	15.1340	16.3622	18.2908	20.0719	22.2706	42.5847	46.1943	49.4804	53.4858	56.3281
33	15.8153	17.0735	19.0467	20.8665	23.1102	43.7452	47.3999	50.7251	54.7755	57.6484
34	16.5013	17.7891	19.8063	21.6643	23.9523	44.9032	48.6024	51.9660	56.0609	58.9639
35	17.1918	18.5089	20.5694	22.4650	24.7967	46.0588	49.8018	53.2033	57.3421	60.2748
36	17.8867	19.2327	21.3359	23.2686	25.6433	47.2122	50.9985	54.4373	58.6192	61.5812
37	18.5858	19.9602	22.1056	24.0749	26.4921	48.3634	52.1923	55.6680	59.8925	62.8833
38	19.2889	20.6914	22.8785	24.8839	27.3430	49.5126	53.3835	56.8955	61.1621	64.1814
39	19.9959	21.4262	23.6543	25.6954	28.1958	50.6598	54.5722	58.1201	62.4281	65.4756
40	20.7065	22.1643	24.4330	26.5093	29.0505	51.8051	55.7585	59.3417	63.6907	66.7660
41	21.4208	22.9056	25.2145	27.3256	29.9071	52.9485	56.9424	60.5606	64.9501	68.0527
42	22.1385	23.6501	25.9987	28.1440	30.7654	54.0902	58.1240	61.7768	66.2062	69.3360
43	22.8595	24.3976	26.7854	28.9647	31.6255	55.2302	59.3035	62.9904	67.4593	70.6159
44	23.5837	25.1480	27.5746	29.7875	32.4871	56.3685	60.4809	64.2015	68.7095	71.8926
45	24.3110	25.9013	28.3662	30.6123	33.3504	57.5053	61.6562	65.4102	69.9568	73.1661
46	25.0413	26.6572	29.1601	31.4390	34.2152	58.6405	62.8296	66.6165	71.2014	74.4365
47	25.7746	27.4158	29.9562	32.2676	35.0814	59.7743	64.0011	67.8206	72.4433	75.7041
48	26.5106	28.1770	30.7545	33.0981	35.9491	60.9066	65.1708	69.0226	73.6826	76.9688
49	27.2493	28.9406	31.5549	33.9303	36.8182	62.0375	66.3386	70.2224	74.9195	78.2307
50	27.9907	29.7067	32.3574	34.7643	37.6886	63.1671	67.5048	71.4202	76.1539	79.4900
55	31.7348	33.5705	36.3981	38.9580	42.0596	68.7962	73.3115	77.3805	82.2921	85.7490
60	35.5345	37.4849	40.4817	43.1880	46.4589	74.3970	79.0819	83.2977	88.3794	91.9517
65	39.3831	41.4436	44.6030	47.4496	50.8829	79.9730	84.8206	89.1771	94.4221	98.1051
70	43.2752	45.4417	48.7576	51.7393	55.3289	85.5270	90.5312	95.0232	100.4252	104.2149
75	47.2060	49.4750	52.9419	56.0541	59.7946	91.0615	96.2167	100.8393	106.3929	110.2856
80	51.1719	53.5401	57.1532	60.3915	64.2778	96.5782	101.8795	106.6286	112.3288	116.3211
85	55.1696	57.6339	61.3888	64.7494	68.7772	102.0789	107.5217	112.3934	118.2357	122.3246
90	59.1963	61.7541	65.6466	69.1260	73.2911	107.5650	113.1453	118.1359	124.1163	128.2989
95	63.2496	65.8984	69.9249	73.5198	77.8184	113.0377	118.7516	123.8580	129.9727	134.2465
100	67.3276	70.0649	74.2219	77.9295	82.3581	118.4980	124.3421	129.5612	135.8067	140.1695
150	109.1422	112.6676	117.9845	122.6918	128.2751	172.5812	179.5806	185.8004	193.2077	198.3602
200	152.2410	156.4320	162.7280	168.2786	174.8353	226.0210	233.9943	241.0579	249.4451	255.2642
250	196.1606	200.9386	208.0978	214.3916	221.8059	279.0504	287.8815	295.6886	304.9396	311.3462
300	240.6634	245.9725	253.9123	260.8781	269.0679	331.7885	341.3951	349.8745	359.9064	366.8444

Table A5 – F Distribution Right Tail Critical Values

Right Tail Area=.01

Numerator Degrees of Freedom (*df1*)

Denominator Degrees of Freedom (*df2*)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	4052.180	4999.500	5403.3520	5624.583	5763.650	5858.9861	5928.356	5981.070	6022.473	6055.8467	6083.316	6106.320	6125.864	6142.674	6157.284	6170.101	6181.434	6191.528
2	98.5025	99.0000	99.1662	99.2494	99.2993	99.3326	99.3564	99.3742	99.3881	99.3992	99.4083	99.4159	99.4223	99.4278	99.4325	99.4367	99.4404	99.4436
3	34.1162	30.8165	29.4567	28.7099	28.2371	27.9107	27.6717	27.4892	27.3452	27.2287	27.1326	27.0518	26.9831	26.9238	26.8722	26.8269	26.7867	26.7509
4	21.1977	18.0000	16.6944	15.9770	15.5219	15.2069	14.9758	14.7989	14.6591	14.5459	14.4523	14.3736	14.3065	14.2486	14.1982	14.1539	14.1146	14.0795
5	16.2582	13.2739	12.0600	11.3919	10.9670	10.6723	10.4555	10.2893	10.1578	10.0510	9.9626	9.8883	9.8248	9.7700	9.7222	9.6802	9.6429	9.6096
6	13.7450	10.9248	9.7795	9.1483	8.7459	8.4661	8.2600	8.1017	7.9761	7.8741	7.7896	7.7183	7.6575	7.6049	7.5590	7.5186	7.4827	7.4507
7	12.2464	9.5466	8.4513	7.8466	7.4604	7.1914	6.9928	6.8400	6.7188	6.6201	6.5382	6.4691	6.4100	6.3590	6.3143	6.2750	6.2401	6.2089
8	11.2586	8.6491	7.5910	7.0061	6.6318	6.3707	6.1776	6.0289	5.9106	5.8143	5.7343	5.6667	5.6089	5.5589	5.5151	5.4766	5.4423	5.4116
9	10.5614	8.0215	6.9919	6.4221	6.0569	5.8018	5.6129	5.4671	5.3511	5.2565	5.1779	5.1114	5.0545	5.0052	4.9621	4.9240	4.8902	4.8599
10	10.0443	7.5594	6.5523	5.9943	5.6363	5.3858	5.2001	5.0567	4.9424	4.8491	4.7715	4.7059	4.6496	4.6008	4.5581	4.5204	4.4869	4.4569
11	9.6460	7.2057	6.2167	5.6683	5.3160	5.0692	4.8861	4.7445	4.6315	4.5393	4.4624	4.3974	4.3416	4.2932	4.2509	4.2134	4.1801	4.1503
12	9.3302	6.9266	5.9525	5.4120	5.0643	4.8206	4.6395	4.4994	4.3875	4.2961	4.2198	4.1553	4.0999	4.0518	4.0096	3.9724	3.9392	3.9095
13	9.0738	6.7010	5.7394	5.2053	4.8616	4.6204	4.4410	4.3021	4.1911	4.1003	4.0245	3.9603	3.9052	3.8573	3.8154	3.7783	3.7452	3.7156
14	8.8616	6.5149	5.5639	5.0354	4.6950	4.4558	4.2779	4.1399	4.0297	3.9394	3.8640	3.8001	3.7452	3.6975	3.6557	3.6187	3.5857	3.5561
15	8.6831	6.3589	5.4170	4.8932	4.5556	4.3183	4.1415	4.0045	3.8948	3.8049	3.7299	3.6662	3.6115	3.5639	3.5222	3.4852	3.4523	3.4228
16	8.5310	6.2262	5.2922	4.7726	4.4374	4.2016	4.0259	3.8896	3.7804	3.6909	3.6162	3.5527	3.4981	3.4506	3.4089	3.3720	3.3391	3.3096
17	8.3997	6.1121	5.1850	4.6690	4.3359	4.1015	3.9267	3.7910	3.6822	3.5931	3.5185	3.4552	3.4007	3.3533	3.3117	3.2748	3.2419	3.2124
18	8.2854	6.0129	5.0919	4.5790	4.2479	4.0146	3.8406	3.7054	3.5971	3.5082	3.4338	3.3706	3.3162	3.2689	3.2273	3.1904	3.1575	3.1280
19	8.1849	5.9259	5.0103	4.5003	4.1708	3.9386	3.7653	3.6305	3.5225	3.4338	3.3596	3.2965	3.2422	3.1949	3.1533	3.1165	3.0836	3.0541
20	8.0960	5.8489	4.9382	4.4307	4.1027	3.8714	3.6987	3.5644	3.4567	3.3682	3.2941	3.2311	3.1769	3.1296	3.0880	3.0512	3.0183	2.9887
21	8.0166	5.7804	4.8740	4.3688	4.0421	3.8117	3.6396	3.5056	3.3981	3.3098	3.2359	3.1730	3.1187	3.0715	3.0300	2.9931	2.9602	2.9306
22	7.9454	5.7190	4.8166	4.3134	3.9880	3.7583	3.5867	3.4530	3.3458	3.2576	3.1837	3.1209	3.0667	3.0195	2.9779	2.9411	2.9082	2.8786
23	7.8811	5.6637	4.7649	4.2636	3.9392	3.7102	3.5390	3.4057	3.2986	3.2106	3.1368	3.0740	3.0199	2.9727	2.9311	2.8943	2.8613	2.8317
24	7.8229	5.6136	4.7181	4.2184	3.8951	3.6667	3.4959	3.3629	3.2560	3.1681	3.0944	3.0316	2.9775	2.9303	2.8887	2.8519	2.8189	2.7892
25	7.7698	5.5680	4.6755	4.1774	3.8550	3.6272	3.4568	3.3239	3.2172	3.1294	3.0558	2.9931	2.9389	2.8917	2.8502	2.8133	2.7803	2.7506
26	7.7213	5.5263	4.6366	4.1400	3.8183	3.5911	3.4210	3.2884	3.1818	3.0941	3.0205	2.9578	2.9038	2.8566	2.8150	2.7781	2.7451	2.7153
27	7.6767	5.4881	4.6009	4.1056	3.7848	3.5580	3.3882	3.2558	3.1494	3.0618	2.9882	2.9256	2.8715	2.8243	2.7827	2.7458	2.7127	2.6830
28	7.6356	5.4529	4.5681	4.0740	3.7539	3.5276	3.3581	3.2259	3.1195	3.0320	2.9585	2.8959	2.8418	2.7946	2.7530	2.7160	2.6830	2.6532
29	7.5977	5.4204	4.5378	4.0449	3.7254	3.4995	3.3303	3.1982	3.0920	3.0045	2.9311	2.8685	2.8144	2.7672	2.7256	2.6886	2.6555	2.6257
30	7.5625	5.3903	4.5097	4.0179	3.6990	3.4735	3.3045	3.1726	3.0665	2.9791	2.9057	2.8431	2.7890	2.7418	2.7002	2.6632	2.6301	2.6003
40	7.3141	5.1785	4.3126	3.8283	3.5138	3.2910	3.1238	2.9930	2.8876	2.8005	2.7274	2.6648	2.6107	2.5634	2.5216	2.4844	2.4511	2.4210
50	7.1706	5.0566	4.1993	3.7195	3.4077	3.1864	3.0202	2.8900	2.7850	2.6981	2.6250	2.5625	2.5083	2.4609	2.4190	2.3816	2.3481	2.3178
100	6.8953	4.8239	3.9837	3.5127	3.2059	2.9877	2.8233	2.6943	2.5898	2.5033	2.4302	2.3676	2.3132	2.2654	2.2230	2.1852	2.1511	2.1203
200	6.7633	4.7129	3.8810	3.4143	3.1100	2.8933	2.7298	2.6012	2.4971	2.4106	2.3375	2.2747	2.2201	2.1721	2.1294	2.0913	2.0569	2.0257
250	6.7373	4.6911	3.8609	3.3950	3.0912	2.8748	2.7114	2.5830	2.4789	2.3925	2.3193	2.2565	2.2018	2.1537	2.1110	2.0728	2.0384	2.0071
500	6.6858	4.6478	3.8210	3.3569	3.0540	2.8381	2.6751	2.5469	2.4429	2.3565	2.2833	2.2204	2.1656	2.1174	2.0746	2.0362	2.0016	1.9702
1000	6.6603	4.6264	3.8012	3.3380	3.0355	2.8200	2.6572	2.5290	2.4250	2.3386	2.2655	2.2025	2.1477	2.0994	2.0565	2.0180	1.9834	1.9519

Table A5 – F Distribution Right Tail Critical Values

Right Tail Area=.01

Numerator Degrees of Freedom (*df1*)

Denominator Degrees of Freedom (*df2*)	19	20	21	22	23	24	25	26	27	28	29	30	40	50	100	250	500	1000
1	6200.576	6208.730	6216.118	6222.843	6228.990	6234.631	6239.825	6244.6239	6249.071	6253.203	6257.053	6260.649	6286.782	6302.517	6334.110	6353.143	6359.500	6362.681
2	99.4465	99.4492	99.4516	99.4537	99.4557	99.4575	99.4592	99.4607	99.4621	99.4635	99.4647	99.4658	99.4742	99.4792	99.4892	99.4952	99.4972	99.4982
3	26.7188	26.6898	26.6635	26.6396	26.6176	26.5975	26.5790	26.5618	26.5460	26.5312	26.5174	26.5045	26.4108	26.3542	26.2402	26.1713	26.1483	26.1367
4	14.0480	14.0196	13.9938	13.9703	13.9488	13.9291	13.9109	13.8940	13.8784	13.8639	13.8503	13.8377	13.7454	13.6896	13.5770	13.5088	13.4859	13.4745
5	9.5797	9.5526	9.5281	9.5058	9.4853	9.4665	9.4491	9.4331	9.4182	9.4043	9.3914	9.3793	9.2912	9.2378	9.1299	9.0644	9.0424	9.0314
6	7.4219	7.3958	7.3722	7.3506	7.3309	7.3127	7.2960	7.2805	7.2661	7.2527	7.2402	7.2285	7.1432	7.0915	6.9867	6.9229	6.9015	6.8908
7	6.1808	6.1554	6.1324	6.1113	6.0921	6.0743	6.0580	6.0428	6.0287	6.0157	6.0034	5.9920	5.9084	5.8577	5.7547	5.6918	5.6707	5.6601
8	5.3840	5.3591	5.3364	5.3157	5.2967	5.2793	5.2631	5.2482	5.2344	5.2214	5.2094	5.1981	5.1156	5.0654	4.9633	4.9009	4.8799	4.8694
9	4.8327	4.8080	4.7856	4.7651	4.7463	4.7290	4.7130	4.6982	4.6845	4.6717	4.6598	4.6486	4.5666	4.5167	4.4150	4.3527	4.3317	4.3211
10	4.4299	4.4054	4.3831	4.3628	4.3441	4.3269	4.3111	4.2963	4.2827	4.2700	4.2581	4.2469	4.1653	4.1155	4.0137	3.9513	3.9302	3.9196
11	4.1234	4.0990	4.0769	4.0566	4.0380	4.0209	4.0051	3.9904	3.9768	3.9641	3.9522	3.9411	3.8596	3.8097	3.7077	3.6450	3.6238	3.6131
12	3.8827	3.8584	3.8363	3.8161	3.7976	3.7805	3.7647	3.7500	3.7364	3.7237	3.7119	3.7008	3.6192	3.5692	3.4668	3.4037	3.3823	3.3716
13	3.6888	3.6646	3.6425	3.6224	3.6038	3.5868	3.5710	3.5563	3.5427	3.5300	3.5182	3.5070	3.4253	3.3752	3.2723	3.2087	3.1871	3.1763
14	3.5294	3.5052	3.4832	3.4630	3.4445	3.4274	3.4116	3.3969	3.3833	3.3706	3.3587	3.3476	3.2656	3.2153	3.1118	3.0477	3.0260	3.0150
15	3.3961	3.3719	3.3498	3.3297	3.3111	3.2940	3.2782	3.2635	3.2499	3.2372	3.2253	3.2141	3.1319	3.0814	2.9772	2.9126	2.8906	2.8795
16	3.2829	3.2587	3.2367	3.2165	3.1979	3.1808	3.1650	3.1503	3.1366	3.1238	3.1119	3.1007	3.0182	2.9675	2.8627	2.7974	2.7752	2.7641
17	3.1857	3.1615	3.1394	3.1192	3.1006	3.0835	3.0676	3.0529	3.0392	3.0264	3.0145	3.0032	2.9205	2.8694	2.7639	2.6981	2.6757	2.6644
18	3.1013	3.0771	3.0550	3.0348	3.0161	2.9990	2.9831	2.9683	2.9546	2.9418	2.9298	2.9185	2.8354	2.7841	2.6779	2.6115	2.5889	2.5775
19	3.0274	3.0031	2.9810	2.9607	2.9421	2.9249	2.9089	2.8941	2.8804	2.8675	2.8555	2.8442	2.7608	2.7093	2.6023	2.5353	2.5124	2.5009
20	2.9620	2.9377	2.9156	2.8953	2.8766	2.8594	2.8434	2.8286	2.8148	2.8019	2.7898	2.7785	2.6947	2.6430	2.5353	2.4677	2.4446	2.4329
21	2.9039	2.8796	2.8574	2.8370	2.8183	2.8010	2.7850	2.7702	2.7563	2.7434	2.7313	2.7200	2.6359	2.5838	2.4755	2.4073	2.3840	2.3722
22	2.8518	2.8274	2.8052	2.7849	2.7661	2.7488	2.7328	2.7179	2.7040	2.6910	2.6789	2.6675	2.5831	2.5308	2.4217	2.3530	2.3294	2.3175
23	2.8049	2.7805	2.7583	2.7378	2.7191	2.7017	2.6856	2.6707	2.6568	2.6438	2.6316	2.6202	2.5355	2.4829	2.3732	2.3038	2.2800	2.2680
24	2.7624	2.7380	2.7157	2.6953	2.6765	2.6591	2.6430	2.6280	2.6140	2.6010	2.5888	2.5773	2.4923	2.4395	2.3291	2.2591	2.2351	2.2230
25	2.7238	2.6993	2.6770	2.6565	2.6377	2.6203	2.6041	2.5891	2.5751	2.5620	2.5498	2.5383	2.4530	2.3999	2.2888	2.2183	2.1941	2.1818
26	2.6885	2.6640	2.6416	2.6211	2.6022	2.5848	2.5686	2.5536	2.5395	2.5264	2.5141	2.5026	2.4170	2.3637	2.2519	2.1809	2.1564	2.1440
27	2.6561	2.6316	2.6092	2.5887	2.5697	2.5522	2.5360	2.5209	2.5069	2.4937	2.4814	2.4699	2.3840	2.3304	2.2180	2.1464	2.1217	2.1092
28	2.6263	2.6017	2.5793	2.5587	2.5398	2.5223	2.5060	2.4909	2.4768	2.4636	2.4513	2.4397	2.3535	2.2997	2.1867	2.1145	2.0896	2.0769
29	2.5987	2.5742	2.5517	2.5311	2.5121	2.4946	2.4783	2.4631	2.4490	2.4358	2.4234	2.4118	2.3253	2.2714	2.1577	2.0850	2.0598	2.0471
30	2.5732	2.5487	2.5262	2.5055	2.4865	2.4689	2.4526	2.4374	2.4233	2.4100	2.3976	2.3860	2.2992	2.2450	2.1307	2.0575	2.0321	2.0192
40	2.3937	2.3689	2.3461	2.3252	2.3059	2.2880	2.2714	2.2559	2.2415	2.2280	2.2153	2.2034	2.1142	2.0581	1.9383	1.8602	1.8329	1.8189
50	2.2903	2.2652	2.2423	2.2211	2.2016	2.1835	2.1667	2.1510	2.1363	2.1226	2.1097	2.0976	2.0066	1.9490	1.8248	1.7425	1.7133	1.6984
100	2.0923	2.0666	2.0431	2.0214	2.0012	1.9826	1.9652	1.9489	1.9337	1.9194	1.9059	1.8933	1.7972	1.7353	1.5977	1.5013	1.4656	1.4468
200	1.9973	1.9713	1.9474	1.9252	1.9047	1.8857	1.8679	1.8512	1.8356	1.8210	1.8071	1.7941	1.6945	1.6295	1.4811	1.3711	1.3277	1.3040
250	1.9786	1.9525	1.9285	1.9063	1.8857	1.8665	1.8487	1.8319	1.8163	1.8015	1.7876	1.7744	1.6740	1.6083	1.4571	1.3432	1.2974	1.2720
500	1.9415	1.9152	1.8910	1.8686	1.8479	1.8285	1.8105	1.7936	1.7777	1.7627	1.7486	1.7353	1.6332	1.5658	1.4084	1.2846	1.2317	1.2007
1000	1.9231	1.8967	1.8724	1.8500	1.8291	1.8096	1.7915	1.7745	1.7585	1.7435	1.7293	1.7158	1.6127	1.5445	1.3835	1.2532	1.1947	1.1586

Table A5 – F Distribution Right Tail Critical Values

Right Tail Area=.05

Numerator Degrees of Freedom (*df1*)

Denominator Degrees of Freedom (*df2*)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	161.4476	199.5000	215.7073	224.5832	230.1619	233.9860	236.7684	238.8827	240.5433	241.8817	242.9835	243.9060	244.6898	245.3640	245.9499	246.4639	246.9184	247.3232
2	18.5128	19.0000	19.1643	19.2468	19.2964	19.3295	19.3532	19.3710	19.3848	19.3959	19.4050	19.4125	19.4189	19.4244	19.4291	19.4333	19.4370	19.4402
3	10.1280	9.5521	9.2766	9.1172	9.0135	8.9406	8.8867	8.8452	8.8123	8.7855	8.7633	8.7446	8.7287	8.7149	8.7029	8.6923	8.6829	8.6745
4	7.7086	6.9443	6.5914	6.3882	6.2561	6.1631	6.0942	6.0410	5.9988	5.9644	5.9358	5.9117	5.8911	5.8733	5.8578	5.8441	5.8320	5.8211
5	6.6079	5.7861	5.4095	5.1922	5.0503	4.9503	4.8759	4.8183	4.7725	4.7351	4.7040	4.6777	4.6552	4.6358	4.6188	4.6038	4.5904	4.5785
6	5.9874	5.1433	4.7571	4.5337	4.3874	4.2839	4.2067	4.1468	4.0990	4.0600	4.0274	3.9999	3.9764	3.9559	3.9381	3.9223	3.9083	3.8957
7	5.5914	4.7374	4.3468	4.1203	3.9715	3.8660	3.7870	3.7257	3.6767	3.6365	3.6030	3.5747	3.5503	3.5292	3.5107	3.4944	3.4799	3.4669
8	5.3177	4.4590	4.0662	3.8379	3.6875	3.5806	3.5005	3.4381	3.3881	3.3472	3.3130	3.2839	3.2590	3.2374	3.2184	3.2016	3.1867	3.1733
9	5.1174	4.2565	3.8625	3.6331	3.4817	3.3738	3.2927	3.2296	3.1789	3.1373	3.1025	3.0729	3.0475	3.0255	3.0061	2.9890	2.9737	2.9600
10	4.9646	4.1028	3.7083	3.4780	3.3258	3.2172	3.1355	3.0717	3.0204	2.9782	2.9430	2.9130	2.8872	2.8647	2.8450	2.8276	2.8120	2.7980
11	4.8443	3.9823	3.5874	3.3567	3.2039	3.0946	3.0123	2.9480	2.8962	2.8536	2.8179	2.7876	2.7614	2.7386	2.7186	2.7009	2.6851	2.6709
12	4.7472	3.8853	3.4903	3.2592	3.1059	2.9961	2.9134	2.8486	2.7964	2.7534	2.7173	2.6866	2.6602	2.6371	2.6169	2.5989	2.5828	2.5684
13	4.6672	3.8056	3.4105	3.1791	3.0254	2.9153	2.8321	2.7669	2.7144	2.6710	2.6347	2.6037	2.5769	2.5536	2.5331	2.5149	2.4987	2.4841
14	4.6001	3.7389	3.3439	3.1122	2.9582	2.8477	2.7642	2.6987	2.6458	2.6022	2.5655	2.5342	2.5073	2.4837	2.4630	2.4446	2.4282	2.4134
15	4.5431	3.6823	3.2874	3.0556	2.9013	2.7905	2.7066	2.6408	2.5876	2.5437	2.5068	2.4753	2.4481	2.4244	2.4034	2.3849	2.3683	2.3533
16	4.4940	3.6337	3.2389	3.0069	2.8524	2.7413	2.6572	2.5911	2.5377	2.4935	2.4564	2.4247	2.3973	2.3733	2.3522	2.3335	2.3167	2.3016
17	4.4513	3.5915	3.1968	2.9647	2.8100	2.6987	2.6143	2.5480	2.4943	2.4499	2.4126	2.3807	2.3531	2.3290	2.3077	2.2888	2.2719	2.2567
18	4.4139	3.5546	3.1599	2.9277	2.7729	2.6613	2.5767	2.5102	2.4563	2.4117	2.3742	2.3421	2.3143	2.2900	2.2686	2.2496	2.2325	2.2172
19	4.3807	3.5219	3.1274	2.8951	2.7401	2.6283	2.5435	2.4768	2.4227	2.3779	2.3402	2.3080	2.2800	2.2556	2.2341	2.2149	2.1977	2.1823
20	4.3512	3.4928	3.0984	2.8661	2.7109	2.5990	2.5140	2.4471	2.3928	2.3479	2.3100	2.2776	2.2495	2.2250	2.2033	2.1840	2.1667	2.1511
21	4.3248	3.4668	3.0725	2.8401	2.6848	2.5727	2.4876	2.4205	2.3660	2.3210	2.2829	2.2504	2.2222	2.1975	2.1757	2.1563	2.1389	2.1232
22	4.3009	3.4434	3.0491	2.8167	2.6613	2.5491	2.4638	2.3965	2.3419	2.2967	2.2585	2.2258	2.1975	2.1727	2.1508	2.1313	2.1138	2.0980
23	4.2793	3.4221	3.0280	2.7955	2.6400	2.5277	2.4422	2.3748	2.3201	2.2747	2.2364	2.2036	2.1752	2.1502	2.1282	2.1086	2.0910	2.0751
24	4.2597	3.4028	3.0088	2.7763	2.6207	2.5082	2.4226	2.3551	2.3002	2.2547	2.2163	2.1834	2.1548	2.1298	2.1077	2.0880	2.0703	2.0543
25	4.2417	3.3852	2.9912	2.7587	2.6030	2.4904	2.4047	2.3371	2.2821	2.2365	2.1979	2.1649	2.1362	2.1111	2.0889	2.0691	2.0513	2.0353
26	4.2252	3.3690	2.9752	2.7426	2.5868	2.4741	2.3883	2.3205	2.2655	2.2197	2.1811	2.1479	2.1192	2.0939	2.0716	2.0518	2.0339	2.0178
27	4.2100	3.3541	2.9604	2.7278	2.5719	2.4591	2.3732	2.3053	2.2501	2.2043	2.1655	2.1323	2.1035	2.0781	2.0558	2.0358	2.0179	2.0017
28	4.1960	3.3404	2.9467	2.7141	2.5581	2.4453	2.3593	2.2913	2.2360	2.1900	2.1512	2.1179	2.0889	2.0635	2.0411	2.0210	2.0030	1.9868
29	4.1830	3.3277	2.9340	2.7014	2.5454	2.4324	2.3463	2.2783	2.2229	2.1768	2.1379	2.1045	2.0755	2.0500	2.0275	2.0073	1.9893	1.9730
30	4.1709	3.3158	2.9223	2.6896	2.5336	2.4205	2.3343	2.2662	2.2107	2.1646	2.1256	2.0921	2.0630	2.0374	2.0148	1.9946	1.9765	1.9601
40	4.0847	3.2317	2.8387	2.6060	2.4495	2.3359	2.2490	2.1802	2.1240	2.0772	2.0376	2.0035	1.9738	1.9476	1.9245	1.9037	1.8851	1.8682
50	4.0343	3.1826	2.7900	2.5572	2.4004	2.2864	2.1992	2.1299	2.0734	2.0261	1.9861	1.9515	1.9214	1.8949	1.8714	1.8503	1.8313	1.8141
100	3.9361	3.0873	2.6955	2.4626	2.3053	2.1906	2.1025	2.0323	1.9748	1.9267	1.8857	1.8503	1.8193	1.7919	1.7675	1.7456	1.7259	1.7079
200	3.8884	3.0411	2.6498	2.4168	2.2592	2.1441	2.0556	1.9849	1.9269	1.8783	1.8368	1.8008	1.7694	1.7415	1.7166	1.6943	1.6741	1.6556
250	3.8789	3.0319	2.6407	2.4078	2.2501	2.1350	2.0463	1.9756	1.9174	1.8687	1.8271	1.7910	1.7595	1.7315	1.7065	1.6841	1.6638	1.6453
500	3.8601	3.0138	2.6227	2.3898	2.2320	2.1167	2.0279	1.9569	1.8986	1.8496	1.8078	1.7715	1.7398	1.7116	1.6864	1.6638	1.6432	1.6245
1000	3.8508	3.0047	2.6138	2.3808	2.2231	2.1076	2.0187	1.9476	1.8892	1.8402	1.7982	1.7618	1.7299	1.7017	1.6764	1.6536	1.6330	1.6142

Table A5 – F Distribution Right Tail Critical Values

Right Tail Area=.05

Numerator Degrees of Freedom (*df1*)

Denominator Degrees of Freedom (*df2*)	19	20	21	22	23	24	25	26	27	28	29	30	40	50	100	250	500	1000
1	247.6861	248.0131	248.3094	248.5791	248.8256	249.0518	249.2601	249.4525	249.6309	249.7966	249.9510	250.0951	251.1432	251.7742	253.0411	253.8043	254.0593	254.1868
2	19.4431	19.4458	19.4481	19.4503	19.4523	19.4541	19.4558	19.4573	19.4587	19.4600	19.4613	19.4624	19.4707	19.4757	19.4857	19.4917	19.4937	19.4947
3	8.6670	8.6602	8.6540	8.6484	8.6432	8.6385	8.6341	8.6301	8.6263	8.6229	8.6196	8.6166	8.5944	8.5810	8.5539	8.5375	8.5320	8.5292
4	5.8114	5.8025	5.7945	5.7872	5.7805	5.7744	5.7687	5.7635	5.7586	5.7541	5.7498	5.7459	5.7170	5.6995	5.6641	5.6425	5.6353	5.6317
5	4.5678	4.5581	4.5493	4.5413	4.5339	4.5272	4.5209	4.5151	4.5097	4.5047	4.5001	4.4957	4.4638	4.4444	4.4051	4.3811	4.3731	4.3690
6	3.8844	3.8742	3.8649	3.8564	3.8486	3.8415	3.8348	3.8287	3.8230	3.8177	3.8128	3.8082	3.7743	3.7537	3.7117	3.6861	3.6775	3.6732
7	3.4551	3.4445	3.4349	3.4260	3.4179	3.4105	3.4036	3.3972	3.3913	3.3858	3.3806	3.3758	3.3404	3.3189	3.2749	3.2479	3.2389	3.2343
8	3.1613	3.1503	3.1404	3.1313	3.1229	3.1152	3.1081	3.1015	3.0954	3.0897	3.0844	3.0794	3.0428	3.0204	2.9747	2.9466	2.9371	2.9324
9	2.9477	2.9365	2.9263	2.9169	2.9084	2.9005	2.8932	2.8864	2.8801	2.8743	2.8688	2.8637	2.8259	2.8028	2.7556	2.7264	2.7166	2.7116
10	2.7854	2.7740	2.7636	2.7541	2.7453	2.7372	2.7298	2.7229	2.7164	2.7104	2.7048	2.6996	2.6609	2.6371	2.5884	2.5583	2.5481	2.5430
11	2.6581	2.6464	2.6358	2.6261	2.6172	2.6090	2.6014	2.5943	2.5877	2.5816	2.5759	2.5705	2.5309	2.5066	2.4566	2.4256	2.4151	2.4098
12	2.5554	2.5436	2.5328	2.5229	2.5139	2.5055	2.4977	2.4905	2.4838	2.4776	2.4718	2.4663	2.4259	2.4010	2.3498	2.3179	2.3071	2.3017
13	2.4709	2.4589	2.4479	2.4379	2.4287	2.4202	2.4123	2.4050	2.3982	2.3918	2.3859	2.3803	2.3392	2.3138	2.2614	2.2287	2.2176	2.2121
14	2.4000	2.3879	2.3768	2.3667	2.3573	2.3487	2.3407	2.3333	2.3264	2.3199	2.3139	2.3082	2.2664	2.2405	2.1870	2.1536	2.1422	2.1365
15	2.3398	2.3275	2.3163	2.3060	2.2966	2.2878	2.2797	2.2722	2.2652	2.2587	2.2525	2.2468	2.2043	2.1780	2.1234	2.0893	2.0776	2.0718
16	2.2880	2.2756	2.2642	2.2538	2.2443	2.2354	2.2272	2.2196	2.2125	2.2059	2.1997	2.1938	2.1507	2.1240	2.0685	2.0336	2.0217	2.0157
17	2.2429	2.2304	2.2189	2.2084	2.1987	2.1898	2.1815	2.1738	2.1666	2.1599	2.1536	2.1477	2.1040	2.0769	2.0204	1.9849	1.9727	1.9666
18	2.2033	2.1906	2.1791	2.1685	2.1587	2.1497	2.1413	2.1335	2.1262	2.1195	2.1131	2.1071	2.0629	2.0354	1.9780	1.9418	1.9294	1.9232
19	2.1683	2.1555	2.1438	2.1331	2.1233	2.1141	2.1057	2.0978	2.0905	2.0836	2.0772	2.0712	2.0264	1.9986	1.9403	1.9035	1.8909	1.8845
20	2.1370	2.1242	2.1124	2.1016	2.0917	2.0825	2.0739	2.0660	2.0586	2.0517	2.0452	2.0391	1.9938	1.9656	1.9066	1.8691	1.8562	1.8497
21	2.1090	2.0960	2.0842	2.0733	2.0633	2.0540	2.0454	2.0374	2.0299	2.0229	2.0164	2.0102	1.9645	1.9360	1.8761	1.8381	1.8250	1.8184
22	2.0837	2.0707	2.0587	2.0478	2.0377	2.0283	2.0196	2.0116	2.0040	1.9970	1.9904	1.9842	1.9380	1.9092	1.8486	1.8099	1.7966	1.7899
23	2.0608	2.0476	2.0356	2.0246	2.0144	2.0050	1.9963	1.9881	1.9805	1.9734	1.9668	1.9605	1.9139	1.8848	1.8234	1.7843	1.7708	1.7639
24	2.0399	2.0267	2.0146	2.0035	1.9932	1.9838	1.9750	1.9668	1.9591	1.9520	1.9453	1.9390	1.8920	1.8625	1.8005	1.7608	1.7470	1.7401
25	2.0207	2.0075	1.9953	1.9842	1.9738	1.9643	1.9554	1.9472	1.9395	1.9323	1.9255	1.9192	1.8718	1.8421	1.7794	1.7391	1.7252	1.7181
26	2.0032	1.9898	1.9776	1.9664	1.9560	1.9464	1.9375	1.9292	1.9215	1.9142	1.9074	1.9010	1.8533	1.8233	1.7599	1.7191	1.7050	1.6978
27	1.9870	1.9736	1.9613	1.9500	1.9396	1.9299	1.9210	1.9126	1.9048	1.8975	1.8907	1.8842	1.8361	1.8059	1.7419	1.7006	1.6863	1.6790
28	1.9720	1.9586	1.9462	1.9349	1.9244	1.9147	1.9057	1.8973	1.8894	1.8821	1.8752	1.8687	1.8203	1.7898	1.7251	1.6834	1.6689	1.6615
29	1.9581	1.9446	1.9322	1.9208	1.9103	1.9005	1.8915	1.8830	1.8751	1.8677	1.8608	1.8543	1.8055	1.7748	1.7096	1.6674	1.6527	1.6452
30	1.9452	1.9317	1.9192	1.9077	1.8972	1.8874	1.8782	1.8698	1.8618	1.8544	1.8474	1.8409	1.7918	1.7609	1.6950	1.6524	1.6375	1.6299
40	1.8529	1.8389	1.8260	1.8141	1.8031	1.7929	1.7835	1.7746	1.7663	1.7586	1.7513	1.7444	1.6928	1.6600	1.5892	1.5425	1.5260	1.5175
50	1.7985	1.7841	1.7709	1.7588	1.7475	1.7371	1.7273	1.7183	1.7097	1.7017	1.6942	1.6872	1.6337	1.5995	1.5249	1.4748	1.4569	1.4477
100	1.6915	1.6764	1.6626	1.6497	1.6378	1.6267	1.6163	1.6067	1.5976	1.5890	1.5809	1.5733	1.5151	1.4772	1.3917	1.3308	1.3079	1.2958
200	1.6388	1.6233	1.6090	1.5958	1.5834	1.5720	1.5612	1.5511	1.5417	1.5328	1.5243	1.5164	1.4551	1.4146	1.3206	1.2495	1.2211	1.2054
250	1.6283	1.6127	1.5983	1.5850	1.5726	1.5610	1.5502	1.5400	1.5305	1.5215	1.5130	1.5049	1.4430	1.4019	1.3058	1.2318	1.2015	1.1847
500	1.6074	1.5916	1.5770	1.5635	1.5509	1.5392	1.5282	1.5178	1.5081	1.4989	1.4903	1.4821	1.4186	1.3762	1.2753	1.1940	1.1587	1.1378
1000	1.5969	1.5811	1.5664	1.5528	1.5401	1.5282	1.5171	1.5067	1.4969	1.4876	1.4789	1.4706	1.4063	1.3632	1.2596	1.1735	1.1342	1.1097

Table A6 – Critical *r* Values for Normal Quantile Correlation Coefficient

n	$\alpha = .01$	$\alpha = .05$	$\alpha = .10$
5	0.832	0.880	0.903
6	0.841	0.889	0.911
7	0.852	0.898	0.919
8	0.862	0.905	0.925
9	0.872	0.912	0.930
10	0.880	0.918	0.935
11	0.888	0.923	0.939
12	0.895	0.928	0.942
13	0.901	0.932	0.945
14	0.906	0.935	0.948
15	0.911	0.938	0.951
16	0.915	0.941	0.953
17	0.919	0.944	0.955
18	0.923	0.946	0.957
19	0.926	0.948	0.958
20	0.929	0.950	0.960
21	0.932	0.952	0.961
22	0.934	0.954	0.963
23	0.937	0.955	0.964
24	0.939	0.957	0.965
25	0.941	0.958	0.966
26	0.943	0.960	0.967
27	0.944	0.961	0.968
28	0.946	0.962	0.969
29	0.948	0.963	0.970
30	0.949	0.964	0.971
31	0.950	0.965	0.971
32	0.952	0.966	0.972
33	0.953	0.967	0.973
34	0.954	0.967	0.973
35	0.955	0.968	0.974
36	0.956	0.969	0.975
37	0.957	0.970	0.975
38	0.958	0.970	0.976
39	0.959	0.971	0.976
40	0.960	0.971	0.977
41	0.960	0.972	0.977
42	0.961	0.973	0.978
43	0.962	0.973	0.978
44	0.963	0.974	0.978
45	0.963	0.974	0.979
46	0.964	0.975	0.979
47	0.965	0.975	0.980
48	0.965	0.976	0.980
49	0.966	0.976	0.980
50	0.966	0.976	0.981
60	0.971	0.980	0.983
70	0.974	0.982	0.986
80	0.977	0.984	0.987
90	0.979	0.986	0.989
100	0.980	0.987	0.990
150	0.985	0.992	0.993
200	0.988	0.994	0.996
250	0.989	0.996	0.997