

# NEGATIVE z Scores

**TABLE A-2** Standard Normal (z) Distribution: Cumulative Area from the LEFT

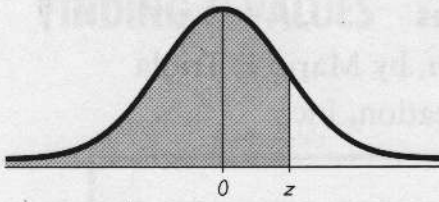
z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.50 and lower	.0001									
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
-3.1	.0010	.0009	.0009	.0009	.0008	.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

NOTE: For values of z below -3.49, use 0.0001 for the area.

\*Use these common values that result from interpolation:

z score	Area
-1.645	0.0500
-2.575	0.0050

# POSITIVE z Scores



**TABLE A-2** (continued) Cumulative Area from the LEFT

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
3.50 and up	.9999									

NOTE: For values of z above 3.49, use 0.9999 for the area.

\*Use these common values that result from interpolation:

z score	Area
1.645	0.9500 ←
2.575	0.9950 ←

### Common Critical Values

Confidence Level	Critical Value
0.90	1.645
0.95	1.96
0.99	2.575

Table A.3: The "t" distribution

Confidence Interval	99%	98%	95%	90%	80%	50%
Prob. In one tail =	0.005	0.01	0.025	0.05	0.1	0.25
Prob. In two tails =	0.01	0.02	0.05	0.1	0.2	0.5
Degrees of Freedom						
1	63.657	31.821	12.706	6.314	3.078	1.000
2	9.925	6.965	4.303	2.920	1.886	0.816
3	5.841	4.541	3.182	2.353	1.638	0.765
4	4.604	3.747	2.776	2.132	1.533	0.741
5	4.032	3.365	2.571	2.015	1.476	0.727
6	3.707	3.143	2.447	1.943	1.440	0.718
7	3.499	2.998	2.365	1.895	1.415	0.711
8	3.355	2.896	2.306	1.860	1.397	0.706
9	3.250	2.821	2.262	1.833	1.383	0.703
10	3.169	2.764	2.228	1.812	1.372	0.700
11	3.106	2.718	2.201	1.796	1.363	0.697
12	3.055	2.681	2.179	1.782	1.356	0.695
13	3.012	2.650	2.160	1.771	1.350	0.694
14	2.977	2.624	2.145	1.761	1.345	0.692
15	2.947	2.602	2.131	1.753	1.341	0.691
16	2.921	2.583	2.120	1.746	1.337	0.690
17	2.898	2.567	2.110	1.740	1.333	0.689
18	2.878	2.552	2.101	1.734	1.330	0.688
19	2.861	2.539	2.093	1.729	1.328	0.688
20	2.845	2.528	2.086	1.725	1.325	0.687
21	2.831	2.518	2.080	1.721	1.323	0.686
22	2.819	2.508	2.074	1.717	1.321	0.686
23	2.807	2.500	2.069	1.714	1.319	0.685
24	2.797	2.492	2.064	1.711	1.318	0.685
25	2.787	2.485	2.060	1.708	1.316	0.684
26	2.779	2.479	2.056	1.706	1.315	0.684
27	2.771	2.473	2.052	1.703	1.314	0.684
28	2.763	2.467	2.048	1.701	1.313	0.683
29	2.756	2.462	2.045	1.699	1.311	0.683
30	2.750	2.457	2.042	1.697	1.310	0.683
31	2.744	2.453	2.040	1.696	1.309	0.682
32	2.738	2.449	2.037	1.694	1.309	0.682
33	2.733	2.445	2.035	1.692	1.308	0.682
34	2.728	2.441	2.032	1.691	1.307	0.682
35	2.724	2.438	2.030	1.690	1.306	0.682
36	2.719	2.434	2.028	1.688	1.306	0.681
37	2.715	2.431	2.026	1.687	1.305	0.681
38	2.712	2.429	2.024	1.686	1.304	0.681
39	2.708	2.426	2.023	1.685	1.304	0.681
40	2.704	2.423	2.021	1.684	1.303	0.681
45	2.690	2.412	2.014	1.679	1.301	0.680
50	2.678	2.403	2.009	1.676	1.299	0.679
55	2.668	2.396	2.004	1.673	1.297	0.679
60	2.660	2.390	2.000	1.671	1.296	0.679
65	2.654	2.385	1.997	1.669	1.295	0.678
70	2.648	2.381	1.994	1.667	1.294	0.678
75	2.643	2.377	1.992	1.665	1.293	0.678
80	2.639	2.374	1.990	1.664	1.292	0.678

Table A.3: The "t" distribution

Confidence Interval	99%	98%	95%	90%	80%	50%
Prob. In one tail =	0.005	0.01	0.025	0.05	0.1	0.25
Prob. In two tails =	0.01	0.02	0.05	0.1	0.2	0.5
Degrees of Freedom						
85	2.635	2.371	1.988	1.663	1.292	0.677
90	2.632	2.368	1.987	1.662	1.291	0.677
95	2.629	2.366	1.985	1.661	1.291	0.677
100	2.626	2.364	1.984	1.660	1.290	0.677
110	2.621	2.361	1.982	1.659	1.289	0.677
120	2.617	2.358	1.980	1.658	1.289	0.677
130	2.614	2.355	1.978	1.657	1.288	0.676
140	2.611	2.353	1.977	1.656	1.288	0.676
150	2.609	2.351	1.976	1.655	1.287	0.676
160	2.607	2.350	1.975	1.654	1.287	0.676
170	2.605	2.348	1.974	1.654	1.287	0.676
180	2.603	2.347	1.973	1.653	1.286	0.676
190	2.602	2.346	1.973	1.653	1.286	0.676
200	2.601	2.345	1.972	1.653	1.286	0.676
210	2.599	2.344	1.971	1.652	1.286	0.676
220	2.598	2.343	1.971	1.652	1.285	0.676
230	2.597	2.343	1.970	1.652	1.285	0.676
240	2.596	2.342	1.970	1.651	1.285	0.676
250	2.596	2.341	1.969	1.651	1.285	0.675
260	2.595	2.341	1.969	1.651	1.285	0.675
270	2.594	2.340	1.969	1.651	1.285	0.675
280	2.594	2.340	1.968	1.650	1.285	0.675
290	2.593	2.339	1.968	1.650	1.284	0.675
300	2.592	2.339	1.968	1.650	1.284	0.675
310	2.592	2.338	1.968	1.650	1.284	0.675
320	2.591	2.338	1.967	1.650	1.284	0.675
330	2.591	2.338	1.967	1.649	1.284	0.675
340	2.590	2.337	1.967	1.649	1.284	0.675
350	2.590	2.337	1.967	1.649	1.284	0.675
360	2.590	2.337	1.967	1.649	1.284	0.675
370	2.589	2.336	1.966	1.649	1.284	0.675
380	2.589	2.336	1.966	1.649	1.284	0.675
390	2.588	2.336	1.966	1.649	1.284	0.675
400	2.588	2.336	1.966	1.649	1.284	0.675
410	2.588	2.335	1.966	1.649	1.284	0.675
420	2.588	2.335	1.966	1.648	1.284	0.675
430	2.587	2.335	1.965	1.648	1.284	0.675
440	2.587	2.335	1.965	1.648	1.283	0.675
450	2.587	2.335	1.965	1.648	1.283	0.675
460	2.587	2.334	1.965	1.648	1.283	0.675
470	2.586	2.334	1.965	1.648	1.283	0.675
480	2.586	2.334	1.965	1.648	1.283	0.675
490	2.586	2.334	1.965	1.648	1.283	0.675
500	2.586	2.334	1.965	1.648	1.283	0.675
10000	2.576	2.327	1.960	1.645	1.282	0.675

Table A.4. The "Chi-Square" distribution

Confidence Intervals	99%	98%	95%	90%	80%	80%	90%	95%	98%	99%
Prob. In Left tail =	0.005	0.010	0.025	0.050	0.100	0.900	0.950	0.975	0.990	0.995
Prob. In Right tail =	0.995	0.990	0.975	0.950	0.900	0.100	0.050	0.025	0.010	0.005
Degrees of Freedom	Values for Chi-Square "Left"					Values for Chi-Square "Right"				
1	0.000	0.000	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.070	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.300
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.195	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.953	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
31	14.458	15.655	17.539	19.281	21.434	41.422	44.985	48.232	52.191	55.003
32	15.134	16.362	18.291	20.072	22.271	42.585	46.194	49.480	53.486	56.328
33	15.815	17.074	19.047	20.867	23.110	43.745	47.400	50.725	54.776	57.648
34	16.501	17.789	19.806	21.664	23.952	44.903	48.602	51.966	56.061	58.964
35	17.192	18.509	20.569	22.465	24.797	46.059	49.802	53.203	57.342	60.275
36	17.887	19.233	21.336	23.269	25.643	47.212	50.998	54.437	58.619	61.581
37	18.586	19.960	22.106	24.075	26.492	48.363	52.192	55.668	59.893	62.883
38	19.289	20.691	22.878	24.884	27.343	49.513	53.384	56.896	61.162	64.181
39	19.996	21.426	23.654	25.695	28.196	50.660	54.572	58.120	62.428	65.476
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
42	22.138	23.650	25.999	28.144	30.765	54.090	58.124	61.777	66.206	69.336
44	23.584	25.148	27.575	29.787	32.487	56.369	60.481	64.201	68.710	71.893
46	25.041	26.657	29.160	31.439	34.215	58.641	62.830	66.617	71.201	74.437
48	26.511	28.177	30.755	33.098	35.949	60.907	65.171	69.023	73.683	76.969
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
52	29.481	31.246	33.968	36.437	39.433	65.422	69.832	73.810	78.616	82.001
54	30.981	32.793	35.586	38.116	41.183	67.673	72.153	76.192	81.069	84.502
56	32.490	34.350	37.212	39.801	42.937	69.919	74.468	78.567	83.513	86.994
58	34.008	35.913	38.844	41.492	44.696	72.160	76.778	80.936	85.950	89.477
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
62	37.068	39.063	42.126	44.889	48.226	76.630	81.381	85.654	90.802	94.419
64	38.610	40.649	43.776	46.595	49.996	78.860	83.675	88.004	93.217	96.878
66	40.158	42.240	45.431	48.305	51.770	81.085	85.965	90.349	95.626	99.330

Table A.4. The "Chi-Square" distribution

Confidence Intervals	99%	98%	95%	90%	80%	80%	90%	95%	98%	99%
Prob. In Left tail =	0.005	0.010	0.025	0.050	0.100	0.900	0.950	0.975	0.990	0.995
Prob. In Right tail =	0.995	0.990	0.975	0.950	0.900	0.100	0.050	0.025	0.010	0.005
Degrees of Freedom	Values for Chi-Square "Left"					Values for Chi-Square "Right"				
68	41.713	43.838	47.092	50.020	53.548	83.308	88.250	92.689	98.028	101.776
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
72	44.843	47.051	50.428	53.462	57.113	87.743	92.808	97.353	102.816	106.648
74	46.417	48.666	52.103	55.189	58.900	89.956	95.081	99.678	105.202	109.074
76	47.997	50.286	53.782	56.920	60.690	92.166	97.351	101.999	107.583	111.495
78	49.582	51.910	55.466	58.654	62.483	94.374	99.617	104.316	109.958	113.911
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
82	52.767	55.174	58.845	62.132	66.076	98.780	104.139	108.937	114.695	118.726
84	54.368	56.813	60.540	63.876	67.876	100.980	106.395	111.242	117.057	121.126
86	55.973	58.456	62.239	65.623	69.679	103.177	108.648	113.544	119.414	123.522
88	57.582	60.103	63.941	67.373	71.484	105.372	110.898	115.841	121.767	125.913
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
92	60.815	63.409	67.356	70.882	75.100	109.756	115.390	120.427	126.462	130.681
94	62.437	65.068	69.068	72.640	76.912	111.944	117.632	122.715	128.803	133.059
96	64.063	66.730	70.783	74.401	78.725	114.131	119.871	125.000	131.141	135.433
98	65.694	68.396	72.501	76.164	80.541	116.315	122.108	127.282	133.476	137.803
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169
105	71.428	74.252	78.536	82.354	86.909	123.947	129.918	135.247	141.620	146.070
110	75.550	78.458	82.867	86.792	91.471	129.385	135.480	140.917	147.414	151.948
115	79.692	82.682	87.213	91.242	96.043	134.813	141.030	146.571	153.191	157.808
120	83.852	86.923	91.573	95.705	100.624	140.233	146.567	152.211	158.950	163.648
125	88.029	91.180	95.946	100.178	105.213	145.643	152.094	157.839	164.694	169.471
130	92.222	95.451	100.331	104.662	109.811	151.045	157.610	163.453	170.423	175.278
135	96.431	99.736	104.729	109.156	114.417	156.440	163.116	169.056	176.138	181.070
140	100.655	104.034	109.137	113.659	119.029	161.827	168.613	174.648	181.840	186.847
145	104.892	108.345	113.556	118.171	123.649	167.207	174.101	180.229	187.530	192.610
150	109.142	112.668	117.985	122.692	128.275	172.581	179.581	185.800	193.208	198.360
155	113.405	117.001	122.423	127.220	132.907	177.949	185.052	191.362	198.874	204.098
160	117.679	121.346	126.870	131.756	137.546	183.311	190.516	196.915	204.530	209.824
165	121.965	125.700	131.326	136.299	142.190	188.667	195.973	202.459	210.176	215.539
170	126.261	130.064	135.790	140.849	146.839	194.017	201.423	207.995	215.812	221.242
175	130.568	134.438	140.262	145.406	151.493	199.363	206.867	213.524	221.438	226.936
180	134.884	138.820	144.741	149.969	156.153	204.704	212.304	219.044	227.056	232.620
185	139.210	143.211	149.228	154.538	160.817	210.040	217.735	224.558	232.665	238.294
190	143.545	147.610	153.721	159.113	165.485	215.371	223.160	230.064	238.266	243.959
195	147.889	152.017	158.221	163.693	170.158	220.698	228.580	235.564	243.860	249.616
200	152.241	156.432	162.728	168.279	174.835	226.021	233.994	241.058	249.445	255.264
220	169.727	174.160	180.813	186.671	193.582	247.274	255.602	262.973	271.717	277.779
240	187.324	191.990	198.984	205.135	212.386	268.471	277.138	284.802	293.888	300.182
260	205.020	209.908	217.229	223.663	231.238	289.619	298.611	306.557	315.970	322.487
280	222.803	227.905	235.541	242.245	250.133	310.723	320.028	328.246	337.974	344.705
300	240.663	245.972	253.912	260.878	269.068	331.789	341.395	349.874	359.906	366.844
320	258.594	264.103	272.337	279.556	288.037	352.819	362.718	371.450	381.776	388.914
340	276.589	282.292	290.810	298.274	307.039	373.818	383.999	392.977	403.588	410.920
360	294.641	300.533	309.328	317.030	326.069	394.787	405.244	414.459	425.347	432.867
380	312.747	318.822	327.886	335.820	345.126	415.730	426.454	435.901	447.058	454.761
400	330.903	337.155	346.482	354.641	364.207	436.649	447.632	457.305	468.724	476.606
420	349.104	355.530	365.112	373.491	383.312	457.545	468.782	478.675	490.350	498.406
440	367.347	373.943	383.775	392.369	402.437	478.419	489.905	500.012	511.937	520.163
460	385.629	392.392	402.468	411.272	421.582	499.274	511.002	521.320	533.488	541.880
480	403.949	410.874	421.189	430.198	440.745	520.111	532.075	542.599	555.006	563.561
500	422.303	429.388	439.936	449.147	459.926	540.930	553.127	563.852	576.493	585.207



## F Distribution

Alpha = 0.01 in right tail

Denom. D.F.	Numerator Degrees of Freedom									
	1	2	3	4	5	6	7	8	9	10
2	98.5	99	99.17	99.25	99.3	99.33	99.36	99.37	99.39	99.4
3	34.12	30.82	29.46	28.71	28.24	27.91	27.67	27.49	27.35	27.23
4	21.2	18	16.69	15.98	15.52	15.21	14.98	14.8	14.66	14.55
5	16.26	13.27	12.06	11.39	10.97	10.67	10.46	10.29	10.16	10.05
6	13.75	10.92	9.78	9.15	8.75	8.47	8.26	8.1	7.98	7.87
7	12.25	9.55	8.45	7.85	7.46	7.19	6.99	6.84	6.72	6.62
8	11.26	8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.91	5.81
9	10.56	8.02	6.99	6.42	6.06	5.8	5.61	5.47	5.35	5.26
10	10.04	7.56	6.55	5.99	5.64	5.39	5.2	5.06	4.94	4.85
11	9.65	7.21	6.22	5.67	5.32	5.07	4.89	4.74	4.63	4.54
12	9.33	6.93	5.95	5.41	5.06	4.82	4.64	4.5	4.39	4.3
13	9.07	6.7	5.74	5.21	4.86	4.62	4.44	4.3	4.19	4.1
14	8.86	6.51	5.56	5.04	4.69	4.46	4.28	4.14	4.03	3.94
15	8.68	6.36	5.42	4.89	4.56	4.32	4.14	4	3.89	3.8
16	8.53	6.23	5.29	4.77	4.44	4.2	4.03	3.89	3.78	3.69
17	8.4	6.11	5.18	4.67	4.34	4.1	3.93	3.79	3.68	3.59
18	8.29	6.01	5.09	4.58	4.25	4.01	3.84	3.71	3.6	3.51
19	8.18	5.93	5.01	4.5	4.17	3.94	3.77	3.63	3.52	3.43
20	8.1	5.85	4.94	4.43	4.1	3.87	3.7	3.56	3.46	3.37
21	8.02	5.78	4.87	4.37	4.04	3.81	3.64	3.51	3.4	3.31
22	7.95	5.72	4.82	4.31	3.99	3.76	3.59	3.45	3.35	3.26
23	7.88	5.66	4.76	4.26	3.94	3.71	3.54	3.41	3.3	3.21
24	7.82	5.61	4.72	4.22	3.9	3.67	3.5	3.36	3.26	3.17
25	7.77	5.57	4.68	4.18	3.85	3.63	3.46	3.32	3.22	3.13
26	7.72	5.53	4.64	4.14	3.82	3.59	3.42	3.29	3.18	3.09
27	7.68	5.49	4.6	4.11	3.78	3.56	3.39	3.26	3.15	3.06
28	7.64	5.45	4.57	4.07	3.75	3.53	3.36	3.23	3.12	3.03
29	7.6	5.42	4.54	4.04	3.73	3.5	3.33	3.2	3.09	3
30	7.56	5.39	4.51	4.02	3.7	3.47	3.3	3.17	3.07	2.98
31	7.53	5.36	4.48	3.99	3.67	3.45	3.28	3.15	3.04	2.96
32	7.5	5.34	4.46	3.97	3.65	3.43	3.26	3.13	3.02	2.93
33	7.47	5.31	4.44	3.95	3.63	3.41	3.24	3.11	3	2.91
34	7.44	5.29	4.42	3.93	3.61	3.39	3.22	3.09	2.98	2.89
35	7.42	5.27	4.4	3.91	3.59	3.37	3.2	3.07	2.96	2.88
36	7.4	5.25	4.38	3.89	3.57	3.35	3.18	3.05	2.95	2.86
37	7.37	5.23	4.36	3.87	3.56	3.33	3.17	3.04	2.93	2.84
38	7.35	5.21	4.34	3.86	3.54	3.32	3.15	3.02	2.92	2.83
39	7.33	5.19	4.33	3.84	3.53	3.3	3.14	3.01	2.9	2.81
40	7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.89	2.8
41	7.3	5.16	4.3	3.81	3.5	3.28	3.11	2.98	2.87	2.79
42	7.28	5.15	4.29	3.8	3.49	3.27	3.1	2.97	2.86	2.78
43	7.26	5.14	4.27	3.79	3.48	3.25	3.09	2.96	2.85	2.76
44	7.25	5.12	4.26	3.78	3.47	3.24	3.08	2.95	2.84	2.75
45	7.23	5.11	4.25	3.77	3.45	3.23	3.07	2.94	2.83	2.74
46	7.22	5.1	4.24	3.76	3.44	3.22	3.06	2.93	2.82	2.73
47	7.21	5.09	4.23	3.75	3.43	3.21	3.05	2.92	2.81	2.72
48	7.19	5.08	4.22	3.74	3.43	3.2	3.04	2.91	2.8	2.71
49	7.18	5.07	4.21	3.73	3.42	3.19	3.03	2.9	2.79	2.71
50	7.17	5.06	4.2	3.72	3.41	3.19	3.02	2.89	2.78	2.7

## F Distribution

Alpha = 0.01 in right tail

Denom. D.F.	Numerator Degrees of Freedom									
	11	12	13	14	15	16	17	18	19	20
2	99.41	99.42	99.42	99.43	99.43	99.44	99.44	99.44	99.45	99.45
3	27.13	27.05	26.98	26.92	26.87	26.83	26.79	26.75	26.72	26.69
4	14.45	14.37	14.31	14.25	14.2	14.15	14.11	14.08	14.05	14.02
5	9.96	9.89	9.82	9.77	9.72	9.68	9.64	9.61	9.58	9.55
6	7.79	7.72	7.66	7.6	7.56	7.52	7.48	7.45	7.42	7.4
7	6.54	6.47	6.41	6.36	6.31	6.28	6.24	6.21	6.18	6.16
8	5.73	5.67	5.61	5.56	5.52	5.48	5.44	5.41	5.38	5.36
9	5.18	5.11	5.05	5.01	4.96	4.92	4.89	4.86	4.83	4.81
10	4.77	4.71	4.65	4.6	4.56	4.52	4.49	4.46	4.43	4.41
11	4.46	4.4	4.34	4.29	4.25	4.21	4.18	4.15	4.12	4.1
12	4.22	4.16	4.1	4.05	4.01	3.97	3.94	3.91	3.88	3.86
13	4.02	3.96	3.91	3.86	3.82	3.78	3.75	3.72	3.69	3.66
14	3.86	3.8	3.75	3.7	3.66	3.62	3.59	3.56	3.53	3.51
15	3.73	3.67	3.61	3.56	3.52	3.49	3.45	3.42	3.4	3.37
16	3.62	3.55	3.5	3.45	3.41	3.37	3.34	3.31	3.28	3.26
17	3.52	3.46	3.4	3.35	3.31	3.27	3.24	3.21	3.19	3.16
18	3.43	3.37	3.32	3.27	3.23	3.19	3.16	3.13	3.1	3.08
19	3.36	3.3	3.24	3.19	3.15	3.12	3.08	3.05	3.03	3
20	3.29	3.23	3.18	3.13	3.09	3.05	3.02	2.99	2.96	2.94
21	3.24	3.17	3.12	3.07	3.03	2.99	2.96	2.93	2.9	2.88
22	3.18	3.12	3.07	3.02	2.98	2.94	2.91	2.88	2.85	2.83
23	3.14	3.07	3.02	2.97	2.93	2.89	2.86	2.83	2.8	2.78
24	3.09	3.03	2.98	2.93	2.89	2.85	2.82	2.79	2.76	2.74
25	3.06	2.99	2.94	2.89	2.85	2.81	2.78	2.75	2.72	2.7
26	3.02	2.96	2.9	2.86	2.81	2.78	2.75	2.72	2.69	2.66
27	2.99	2.93	2.87	2.82	2.78	2.75	2.71	2.68	2.66	2.63
28	2.96	2.9	2.84	2.79	2.75	2.72	2.68	2.65	2.63	2.6
29	2.93	2.87	2.81	2.77	2.73	2.69	2.66	2.63	2.6	2.57
30	2.91	2.84	2.79	2.74	2.7	2.66	2.63	2.6	2.57	2.55
31	2.88	2.82	2.77	2.72	2.68	2.64	2.61	2.58	2.55	2.52
32	2.86	2.8	2.74	2.7	2.65	2.62	2.58	2.55	2.53	2.5
33	2.84	2.78	2.72	2.68	2.63	2.6	2.56	2.53	2.51	2.48
34	2.82	2.76	2.7	2.66	2.61	2.58	2.54	2.51	2.49	2.46
35	2.8	2.74	2.69	2.64	2.6	2.56	2.53	2.5	2.47	2.44
36	2.79	2.72	2.67	2.62	2.58	2.54	2.51	2.48	2.45	2.43
37	2.77	2.71	2.65	2.61	2.56	2.53	2.49	2.46	2.44	2.41
38	2.75	2.69	2.64	2.59	2.55	2.51	2.48	2.45	2.42	2.4
39	2.74	2.68	2.62	2.58	2.54	2.5	2.46	2.43	2.41	2.38
40	2.73	2.66	2.61	2.56	2.52	2.48	2.45	2.42	2.39	2.37
41	2.71	2.65	2.6	2.55	2.51	2.47	2.44	2.41	2.38	2.36
42	2.7	2.64	2.59	2.54	2.5	2.46	2.43	2.4	2.37	2.34
43	2.69	2.63	2.57	2.53	2.49	2.45	2.41	2.38	2.36	2.33
44	2.68	2.62	2.56	2.52	2.47	2.44	2.4	2.37	2.35	2.32
45	2.67	2.61	2.55	2.51	2.46	2.43	2.39	2.36	2.34	2.31
46	2.66	2.6	2.54	2.5	2.45	2.42	2.38	2.35	2.33	2.3
47	2.65	2.59	2.53	2.49	2.44	2.41	2.37	2.34	2.32	2.29
48	2.64	2.58	2.53	2.48	2.44	2.4	2.37	2.33	2.31	2.28
49	2.63	2.57	2.52	2.47	2.43	2.39	2.36	2.33	2.3	2.27
50	2.63	2.56	2.51	2.46	2.42	2.38	2.35	2.32	2.29	2.27



## F Distribution

Alpha = 0.01 in right tail

Denom. D.F.	Numerator Degrees of Freedom									
	21	23	25	27	29	31	33	35	37	39
2	99.45	99.46	99.46	99.46	99.46	99.47	99.47	99.47	99.47	99.47
3	26.66	26.62	26.58	26.55	26.52	26.49	26.47	26.45	26.43	26.42
4	13.99	13.95	13.91	13.88	13.85	13.83	13.8	13.79	13.77	13.75
5	9.53	9.49	9.45	9.42	9.39	9.37	9.35	9.33	9.31	9.3
6	7.37	7.33	7.3	7.27	7.24	7.22	7.2	7.18	7.16	7.15
7	6.13	6.09	6.06	6.03	6	5.98	5.96	5.94	5.93	5.91
8	5.34	5.3	5.26	5.23	5.21	5.19	5.17	5.15	5.14	5.12
9	4.79	4.75	4.71	4.68	4.66	4.64	4.62	4.6	4.59	4.57
10	4.38	4.34	4.31	4.28	4.26	4.24	4.22	4.2	4.19	4.17
11	4.08	4.04	4.01	3.98	3.95	3.93	3.91	3.89	3.88	3.87
12	3.84	3.8	3.76	3.74	3.71	3.69	3.67	3.65	3.64	3.63
13	3.64	3.6	3.57	3.54	3.52	3.5	3.48	3.46	3.45	3.43
14	3.48	3.44	3.41	3.38	3.36	3.34	3.32	3.3	3.29	3.27
15	3.35	3.31	3.28	3.25	3.23	3.2	3.18	3.17	3.15	3.14
16	3.24	3.2	3.16	3.14	3.11	3.09	3.07	3.05	3.04	3.02
17	3.14	3.1	3.07	3.04	3.01	2.99	2.97	2.96	2.94	2.93
18	3.05	3.02	2.98	2.95	2.93	2.91	2.89	2.87	2.86	2.84
19	2.98	2.94	2.91	2.88	2.86	2.83	2.81	2.8	2.78	2.77
20	2.92	2.88	2.84	2.81	2.79	2.77	2.75	2.73	2.72	2.7
21	2.86	2.82	2.79	2.76	2.73	2.71	2.69	2.67	2.66	2.64
22	2.81	2.77	2.73	2.7	2.68	2.66	2.64	2.62	2.6	2.59
23	2.76	2.72	2.69	2.66	2.63	2.61	2.59	2.57	2.56	2.54
24	2.72	2.68	2.64	2.61	2.59	2.57	2.55	2.53	2.51	2.5
25	2.68	2.64	2.6	2.58	2.55	2.53	2.51	2.49	2.47	2.46
26	2.64	2.6	2.57	2.54	2.51	2.49	2.47	2.45	2.44	2.42
27	2.61	2.57	2.54	2.51	2.48	2.46	2.44	2.42	2.41	2.39
28	2.58	2.54	2.51	2.48	2.45	2.43	2.41	2.39	2.37	2.36
29	2.55	2.51	2.48	2.45	2.42	2.4	2.38	2.36	2.35	2.33
30	2.53	2.49	2.45	2.42	2.4	2.38	2.35	2.34	2.32	2.31
31	2.5	2.46	2.43	2.4	2.37	2.35	2.33	2.31	2.3	2.28
32	2.48	2.44	2.41	2.38	2.35	2.33	2.31	2.29	2.27	2.26
33	2.46	2.42	2.39	2.36	2.33	2.31	2.29	2.27	2.25	2.24
34	2.44	2.4	2.37	2.34	2.31	2.29	2.27	2.25	2.23	2.22
35	2.42	2.38	2.35	2.32	2.29	2.27	2.25	2.23	2.21	2.2
36	2.41	2.37	2.33	2.3	2.28	2.25	2.23	2.21	2.2	2.18
37	2.39	2.35	2.31	2.28	2.26	2.24	2.22	2.2	2.18	2.17
38	2.37	2.33	2.3	2.27	2.24	2.22	2.2	2.18	2.16	2.15
39	2.36	2.32	2.29	2.26	2.23	2.21	2.19	2.17	2.15	2.14
40	2.35	2.31	2.27	2.24	2.22	2.19	2.17	2.15	2.14	2.12
41	2.33	2.29	2.26	2.23	2.2	2.18	2.16	2.14	2.12	2.11
42	2.32	2.28	2.25	2.22	2.19	2.17	2.15	2.13	2.11	2.1
43	2.31	2.27	2.23	2.2	2.18	2.15	2.13	2.12	2.1	2.08
44	2.3	2.26	2.22	2.19	2.17	2.14	2.12	2.1	2.09	2.07
45	2.29	2.25	2.21	2.18	2.16	2.13	2.11	2.09	2.08	2.06
46	2.28	2.24	2.2	2.17	2.15	2.12	2.1	2.08	2.07	2.05
47	2.27	2.23	2.19	2.16	2.14	2.11	2.09	2.07	2.06	2.04
48	2.26	2.22	2.18	2.15	2.13	2.1	2.08	2.06	2.05	2.03
49	2.25	2.21	2.18	2.14	2.12	2.09	2.07	2.05	2.04	2.02
50	2.24	2.2	2.17	2.14	2.11	2.09	2.07	2.05	2.03	2.01

## F Distribution

Alpha = 0.01 in right tail

Denom. D.F.	Numerator Degrees of Freedom									
	41	43	45	47	49	51	53	55	57	59
2	99.47	99.48	99.48	99.48	99.48	99.48	99.48	99.48	99.48	99.48
3	26.4	26.39	26.38	26.37	26.36	26.35	26.34	26.33	26.33	26.32
4	13.74	13.73	13.71	13.7	13.69	13.69	13.68	13.67	13.66	13.66
5	9.28	9.27	9.26	9.25	9.24	9.23	9.23	9.22	9.21	9.21
6	7.14	7.13	7.11	7.1	7.1	7.09	7.08	7.07	7.07	7.06
7	5.9	5.89	5.88	5.87	5.86	5.85	5.85	5.84	5.83	5.83
8	5.11	5.1	5.09	5.08	5.07	5.06	5.05	5.05	5.04	5.03
9	4.56	4.55	4.54	4.53	4.52	4.51	4.51	4.5	4.49	4.49
10	4.16	4.15	4.14	4.13	4.12	4.11	4.1	4.1	4.09	4.08
11	3.85	3.84	3.83	3.82	3.81	3.81	3.8	3.79	3.78	3.78
12	3.61	3.6	3.59	3.58	3.57	3.57	3.56	3.55	3.54	3.54
13	3.42	3.41	3.4	3.39	3.38	3.37	3.36	3.36	3.35	3.34
14	3.26	3.25	3.24	3.23	3.22	3.21	3.2	3.2	3.19	3.18
15	3.13	3.11	3.1	3.09	3.09	3.08	3.07	3.06	3.06	3.05
16	3.01	3	2.99	2.98	2.97	2.96	2.96	2.95	2.94	2.94
17	2.91	2.9	2.89	2.88	2.87	2.87	2.86	2.85	2.84	2.84
18	2.83	2.82	2.81	2.8	2.79	2.78	2.77	2.77	2.76	2.75
19	2.75	2.74	2.73	2.72	2.71	2.71	2.7	2.69	2.68	2.68
20	2.69	2.68	2.67	2.66	2.65	2.64	2.63	2.62	2.62	2.61
21	2.63	2.62	2.61	2.6	2.59	2.58	2.57	2.56	2.56	2.55
22	2.58	2.57	2.55	2.54	2.54	2.53	2.52	2.51	2.5	2.5
23	2.53	2.52	2.51	2.5	2.49	2.48	2.47	2.46	2.46	2.45
24	2.49	2.47	2.46	2.45	2.44	2.44	2.43	2.42	2.41	2.41
25	2.45	2.43	2.42	2.41	2.4	2.4	2.39	2.38	2.37	2.37
26	2.41	2.4	2.39	2.38	2.37	2.36	2.35	2.34	2.34	2.33
27	2.38	2.37	2.35	2.34	2.33	2.33	2.32	2.31	2.3	2.3
28	2.35	2.33	2.32	2.31	2.3	2.3	2.29	2.28	2.27	2.27
29	2.32	2.31	2.3	2.29	2.28	2.27	2.26	2.25	2.24	2.24
30	2.29	2.28	2.27	2.26	2.25	2.24	2.23	2.22	2.22	2.21
31	2.27	2.26	2.24	2.23	2.23	2.22	2.21	2.2	2.19	2.19
32	2.25	2.23	2.22	2.21	2.2	2.19	2.18	2.18	2.17	2.16
33	2.22	2.21	2.2	2.19	2.18	2.17	2.16	2.16	2.15	2.14
34	2.2	2.19	2.18	2.17	2.16	2.15	2.14	2.14	2.13	2.12
35	2.19	2.17	2.16	2.15	2.14	2.13	2.12	2.12	2.11	2.1
36	2.17	2.16	2.14	2.13	2.12	2.12	2.11	2.1	2.09	2.08
37	2.15	2.14	2.13	2.12	2.11	2.1	2.09	2.08	2.07	2.07
38	2.14	2.12	2.11	2.1	2.09	2.08	2.07	2.07	2.06	2.05
39	2.12	2.11	2.1	2.09	2.08	2.07	2.06	2.05	2.04	2.04
40	2.11	2.09	2.08	2.07	2.06	2.05	2.05	2.04	2.03	2.02
41	2.09	2.08	2.07	2.06	2.05	2.04	2.03	2.02	2.02	2.01
42	2.08	2.07	2.06	2.05	2.04	2.03	2.02	2.01	2	2
43	2.07	2.06	2.05	2.03	2.02	2.02	2.01	2	1.99	1.98
44	2.06	2.05	2.03	2.02	2.01	2	2	1.99	1.98	1.97
45	2.05	2.03	2.02	2.01	2	1.99	1.98	1.98	1.97	1.96
46	2.04	2.02	2.01	2	1.99	1.98	1.97	1.97	1.96	1.95
47	2.03	2.01	2	1.99	1.98	1.97	1.96	1.96	1.95	1.94
48	2.02	2	1.99	1.98	1.97	1.96	1.95	1.95	1.94	1.93
49	2.01	2	1.98	1.97	1.96	1.95	1.94	1.94	1.93	1.92
50	2	1.99	1.97	1.96	1.95	1.94	1.94	1.93	1.92	1.91

## F Distribution

Alpha = 0.05 in right tail

Denom. D.F.	Numerator Degrees of Freedom									
	1	2	3	4	5	6	7	8	9	10
2	18.51	19	19.16	19.25	19.3	19.33	19.35	19.37	19.38	19.4
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6	5.96
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.1	4.06
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64
8	5.32	4.46	4.07	3.84	3.69	3.58	3.5	3.44	3.39	3.35
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14
10	4.96	4.1	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98
11	4.84	3.98	3.59	3.36	3.2	3.09	3.01	2.95	2.9	2.85
12	4.75	3.89	3.49	3.26	3.11	3	2.91	2.85	2.8	2.75
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67
14	4.6	3.74	3.34	3.11	2.96	2.85	2.76	2.7	2.65	2.6
15	4.54	3.68	3.29	3.06	2.9	2.79	2.71	2.64	2.59	2.54
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49
17	4.45	3.59	3.2	2.96	2.81	2.7	2.61	2.55	2.49	2.45
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41
19	4.38	3.52	3.13	2.9	2.74	2.63	2.54	2.48	2.42	2.38
20	4.35	3.49	3.1	2.87	2.71	2.6	2.51	2.45	2.39	2.35
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32
22	4.3	3.44	3.05	2.82	2.66	2.55	2.46	2.4	2.34	2.3
23	4.28	3.42	3.03	2.8	2.64	2.53	2.44	2.37	2.32	2.27
24	4.26	3.4	3.01	2.78	2.62	2.51	2.42	2.36	2.3	2.25
25	4.24	3.39	2.99	2.76	2.6	2.49	2.4	2.34	2.28	2.24
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.2
28	4.2	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19
29	4.18	3.33	2.93	2.7	2.55	2.43	2.35	2.28	2.22	2.18
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16
31	4.16	3.3	2.91	2.68	2.52	2.41	2.32	2.25	2.2	2.15
32	4.15	3.29	2.9	2.67	2.51	2.4	2.31	2.24	2.19	2.14
33	4.14	3.28	2.89	2.66	2.5	2.39	2.3	2.23	2.18	2.13
34	4.13	3.28	2.88	2.65	2.49	2.38	2.29	2.23	2.17	2.12
35	4.12	3.27	2.87	2.64	2.49	2.37	2.29	2.22	2.16	2.11
36	4.11	3.26	2.87	2.63	2.48	2.36	2.28	2.21	2.15	2.11
37	4.11	3.25	2.86	2.63	2.47	2.36	2.27	2.2	2.14	2.1
38	4.1	3.24	2.85	2.62	2.46	2.35	2.26	2.19	2.14	2.09
39	4.09	3.24	2.85	2.61	2.46	2.34	2.26	2.19	2.13	2.08
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08
41	4.08	3.23	2.83	2.6	2.44	2.33	2.24	2.17	2.12	2.07
42	4.07	3.22	2.83	2.59	2.44	2.32	2.24	2.17	2.11	2.06
43	4.07	3.21	2.82	2.59	2.43	2.32	2.23	2.16	2.11	2.06
44	4.06	3.21	2.82	2.58	2.43	2.31	2.23	2.16	2.1	2.05
45	4.06	3.2	2.81	2.58	2.42	2.31	2.22	2.15	2.1	2.05
46	4.05	3.2	2.81	2.57	2.42	2.3	2.22	2.15	2.09	2.04
47	4.05	3.2	2.8	2.57	2.41	2.3	2.21	2.14	2.09	2.04
48	4.04	3.19	2.8	2.57	2.41	2.29	2.21	2.14	2.08	2.03
49	4.04	3.19	2.79	2.56	2.4	2.29	2.2	2.13	2.08	2.03
50	4.03	3.18	2.79	2.56	2.4	2.29	2.2	2.13	2.07	2.03

## F Distribution

Alpha = 0.05 in right tail

Denom. D.F.	Numerator Degrees of Freedom									
	11	12	13	14	15	16	17	18	19	20
2	19.4	19.41	19.42	19.42	19.43	19.43	19.44	19.44	19.44	19.45
3	8.76	8.74	8.73	8.71	8.7	8.69	8.68	8.67	8.67	8.66
4	5.94	5.91	5.89	5.87	5.86	5.84	5.83	5.82	5.81	5.8
5	4.7	4.68	4.66	4.64	4.62	4.6	4.59	4.58	4.57	4.56
6	4.03	4	3.98	3.96	3.94	3.92	3.91	3.9	3.88	3.87
7	3.6	3.57	3.55	3.53	3.51	3.49	3.48	3.47	3.46	3.44
8	3.31	3.28	3.26	3.24	3.22	3.2	3.19	3.17	3.16	3.15
9	3.1	3.07	3.05	3.03	3.01	2.99	2.97	2.96	2.95	2.94
10	2.94	2.91	2.89	2.86	2.85	2.83	2.81	2.8	2.79	2.77
11	2.82	2.79	2.76	2.74	2.72	2.7	2.69	2.67	2.66	2.65
12	2.72	2.69	2.66	2.64	2.62	2.6	2.58	2.57	2.56	2.54
13	2.63	2.6	2.58	2.55	2.53	2.51	2.5	2.48	2.47	2.46
14	2.57	2.53	2.51	2.48	2.46	2.44	2.43	2.41	2.4	2.39
15	2.51	2.48	2.45	2.42	2.4	2.38	2.37	2.35	2.34	2.33
16	2.46	2.42	2.4	2.37	2.35	2.33	2.32	2.3	2.29	2.28
17	2.41	2.38	2.35	2.33	2.31	2.29	2.27	2.26	2.24	2.23
18	2.37	2.34	2.31	2.29	2.27	2.25	2.23	2.22	2.2	2.19
19	2.34	2.31	2.28	2.26	2.23	2.21	2.2	2.18	2.17	2.16
20	2.31	2.28	2.25	2.22	2.2	2.18	2.17	2.15	2.14	2.12
21	2.28	2.25	2.22	2.2	2.18	2.16	2.14	2.12	2.11	2.1
22	2.26	2.23	2.2	2.17	2.15	2.13	2.11	2.1	2.08	2.07
23	2.24	2.2	2.18	2.15	2.13	2.11	2.09	2.08	2.06	2.05
24	2.22	2.18	2.15	2.13	2.11	2.09	2.07	2.05	2.04	2.03
25	2.2	2.16	2.14	2.11	2.09	2.07	2.05	2.04	2.02	2.01
26	2.18	2.15	2.12	2.09	2.07	2.05	2.03	2.02	2	1.99
27	2.17	2.13	2.1	2.08	2.06	2.04	2.02	2	1.99	1.97
28	2.15	2.12	2.09	2.06	2.04	2.02	2	1.99	1.97	1.96
29	2.14	2.1	2.08	2.05	2.03	2.01	1.99	1.97	1.96	1.94
30	2.13	2.09	2.06	2.04	2.01	1.99	1.98	1.96	1.95	1.93
31	2.11	2.08	2.05	2.03	2	1.98	1.96	1.95	1.93	1.92
32	2.1	2.07	2.04	2.01	1.99	1.97	1.95	1.94	1.92	1.91
33	2.09	2.06	2.03	2	1.98	1.96	1.94	1.93	1.91	1.9
34	2.08	2.05	2.02	1.99	1.97	1.95	1.93	1.92	1.9	1.89
35	2.07	2.04	2.01	1.99	1.96	1.94	1.92	1.91	1.89	1.88
36	2.07	2.03	2	1.98	1.95	1.93	1.92	1.9	1.88	1.87
37	2.06	2.02	2	1.97	1.95	1.93	1.91	1.89	1.88	1.86
38	2.05	2.02	1.99	1.96	1.94	1.92	1.9	1.88	1.87	1.85
39	2.04	2.01	1.98	1.95	1.93	1.91	1.89	1.88	1.86	1.85
40	2.04	2	1.97	1.95	1.92	1.9	1.89	1.87	1.85	1.84
41	2.03	2	1.97	1.94	1.92	1.9	1.88	1.86	1.85	1.83
42	2.03	1.99	1.96	1.94	1.91	1.89	1.87	1.86	1.84	1.83
43	2.02	1.99	1.96	1.93	1.91	1.89	1.87	1.85	1.83	1.82
44	2.01	1.98	1.95	1.92	1.9	1.88	1.86	1.84	1.83	1.81
45	2.01	1.97	1.94	1.92	1.89	1.87	1.86	1.84	1.82	1.81
46	2	1.97	1.94	1.91	1.89	1.87	1.85	1.83	1.82	1.8
47	2	1.96	1.93	1.91	1.88	1.86	1.84	1.83	1.81	1.8
48	1.99	1.96	1.93	1.9	1.88	1.86	1.84	1.82	1.81	1.79
49	1.99	1.96	1.93	1.9	1.88	1.85	1.84	1.82	1.8	1.79
50	1.99	1.95	1.92	1.89	1.87	1.85	1.83	1.81	1.8	1.78

## F Distribution

Alpha = 0.05 in right tail

Denom. D.F.	Numerator Degrees of Freedom									
	21	23	25	27	29	31	33	35	37	39
2	19.45	19.45	19.46	19.46	19.46	19.46	19.47	19.47	19.47	19.47
3	8.65	8.64	8.63	8.63	8.62	8.61	8.61	8.6	8.6	8.6
4	5.79	5.78	5.77	5.76	5.75	5.74	5.74	5.73	5.72	5.72
5	4.55	4.53	4.52	4.51	4.5	4.49	4.48	4.48	4.47	4.47
6	3.86	3.85	3.83	3.82	3.81	3.8	3.8	3.79	3.78	3.78
7	3.43	3.42	3.4	3.39	3.38	3.37	3.36	3.36	3.35	3.34
8	3.14	3.12	3.11	3.1	3.08	3.07	3.07	3.06	3.05	3.05
9	2.93	2.91	2.89	2.88	2.87	2.86	2.85	2.84	2.84	2.83
10	2.76	2.75	2.73	2.72	2.7	2.69	2.69	2.68	2.67	2.66
11	2.64	2.62	2.6	2.59	2.58	2.57	2.56	2.55	2.54	2.53
12	2.53	2.51	2.5	2.48	2.47	2.46	2.45	2.44	2.44	2.43
13	2.45	2.43	2.41	2.4	2.39	2.38	2.37	2.36	2.35	2.34
14	2.38	2.36	2.34	2.33	2.31	2.3	2.29	2.28	2.28	2.27
15	2.32	2.3	2.28	2.27	2.25	2.24	2.23	2.22	2.21	2.21
16	2.26	2.24	2.23	2.21	2.2	2.19	2.18	2.17	2.16	2.15
17	2.22	2.2	2.18	2.17	2.15	2.14	2.13	2.12	2.11	2.11
18	2.18	2.16	2.14	2.13	2.11	2.1	2.09	2.08	2.07	2.07
19	2.14	2.12	2.11	2.09	2.08	2.07	2.06	2.05	2.04	2.03
20	2.11	2.09	2.07	2.06	2.05	2.03	2.02	2.01	2.01	2
21	2.08	2.06	2.05	2.03	2.02	2	1.99	1.98	1.98	1.97
22	2.06	2.04	2.02	2	1.99	1.98	1.97	1.96	1.95	1.94
23	2.04	2.01	2	1.98	1.97	1.95	1.94	1.93	1.93	1.92
24	2.01	1.99	1.97	1.96	1.95	1.93	1.92	1.91	1.9	1.9
25	2	1.97	1.96	1.94	1.93	1.91	1.9	1.89	1.88	1.88
26	1.98	1.96	1.94	1.92	1.91	1.89	1.88	1.87	1.87	1.86
27	1.96	1.94	1.92	1.9	1.89	1.88	1.87	1.86	1.85	1.84
28	1.95	1.92	1.91	1.89	1.88	1.86	1.85	1.84	1.83	1.82
29	1.93	1.91	1.89	1.88	1.86	1.85	1.84	1.83	1.82	1.81
30	1.92	1.9	1.88	1.86	1.85	1.83	1.82	1.81	1.8	1.8
31	1.91	1.88	1.87	1.85	1.83	1.82	1.81	1.8	1.79	1.78
32	1.9	1.87	1.85	1.84	1.82	1.81	1.8	1.79	1.78	1.77
33	1.89	1.86	1.84	1.83	1.81	1.8	1.79	1.78	1.77	1.76
34	1.88	1.85	1.83	1.82	1.8	1.79	1.78	1.77	1.76	1.75
35	1.87	1.84	1.82	1.81	1.79	1.78	1.77	1.76	1.75	1.74
36	1.86	1.83	1.81	1.8	1.78	1.77	1.76	1.75	1.74	1.73
37	1.85	1.83	1.81	1.79	1.77	1.76	1.75	1.74	1.73	1.72
38	1.84	1.82	1.8	1.78	1.77	1.75	1.74	1.73	1.72	1.71
39	1.83	1.81	1.79	1.77	1.76	1.75	1.73	1.72	1.71	1.7
40	1.83	1.8	1.78	1.77	1.75	1.74	1.73	1.72	1.71	1.7
41	1.82	1.8	1.78	1.76	1.74	1.73	1.72	1.71	1.7	1.69
42	1.81	1.79	1.77	1.75	1.74	1.72	1.71	1.7	1.69	1.68
43	1.81	1.78	1.76	1.75	1.73	1.72	1.71	1.7	1.69	1.68
44	1.8	1.78	1.76	1.74	1.73	1.71	1.7	1.69	1.68	1.67
45	1.8	1.77	1.75	1.73	1.72	1.71	1.69	1.68	1.67	1.66
46	1.79	1.77	1.75	1.73	1.71	1.7	1.69	1.68	1.67	1.66
47	1.78	1.76	1.74	1.72	1.71	1.7	1.68	1.67	1.66	1.65
48	1.78	1.76	1.74	1.72	1.7	1.69	1.68	1.67	1.66	1.65
49	1.78	1.75	1.73	1.71	1.7	1.69	1.67	1.66	1.65	1.64
50	1.77	1.75	1.73	1.71	1.69	1.68	1.67	1.66	1.65	1.64

## F Distribution

Alpha = 0.05 in right tail

Denom. D.F.	Numerator Degrees of Freedom									
	41	43	45	47	49	51	53	55	57	59
2	19.47	19.47	19.47	19.47	19.48	19.48	19.48	19.48	19.48	19.48
3	8.59	8.59	8.59	8.58	8.58	8.58	8.58	8.58	8.57	8.57
4	5.71	5.71	5.71	5.7	5.7	5.7	5.7	5.69	5.69	5.69
5	4.46	4.46	4.45	4.45	4.45	4.44	4.44	4.44	4.43	4.43
6	3.77	3.77	3.76	3.76	3.76	3.75	3.75	3.75	3.74	3.74
7	3.34	3.33	3.33	3.32	3.32	3.32	3.31	3.31	3.31	3.31
8	3.04	3.04	3.03	3.03	3.02	3.02	3.02	3.01	3.01	3.01
9	2.82	2.82	2.81	2.81	2.8	2.8	2.8	2.79	2.79	2.79
10	2.66	2.65	2.65	2.64	2.64	2.64	2.63	2.63	2.63	2.62
11	2.53	2.52	2.52	2.51	2.51	2.5	2.5	2.5	2.49	2.49
12	2.42	2.42	2.41	2.41	2.4	2.4	2.4	2.39	2.39	2.39
13	2.34	2.33	2.33	2.32	2.32	2.31	2.31	2.3	2.3	2.3
14	2.26	2.26	2.25	2.25	2.24	2.24	2.23	2.23	2.23	2.22
15	2.2	2.2	2.19	2.18	2.18	2.18	2.17	2.17	2.16	2.16
16	2.15	2.14	2.14	2.13	2.13	2.12	2.12	2.11	2.11	2.11
17	2.1	2.09	2.09	2.08	2.08	2.07	2.07	2.07	2.06	2.06
18	2.06	2.05	2.05	2.04	2.04	2.03	2.03	2.03	2.02	2.02
19	2.02	2.02	2.01	2.01	2	2	1.99	1.99	1.98	1.98
20	1.99	1.98	1.98	1.97	1.97	1.96	1.96	1.96	1.95	1.95
21	1.96	1.95	1.95	1.94	1.94	1.93	1.93	1.93	1.92	1.92
22	1.93	1.93	1.92	1.92	1.91	1.91	1.9	1.9	1.89	1.89
23	1.91	1.9	1.9	1.89	1.89	1.88	1.88	1.87	1.87	1.87
24	1.89	1.88	1.88	1.87	1.86	1.86	1.86	1.85	1.85	1.84
25	1.87	1.86	1.86	1.85	1.84	1.84	1.84	1.83	1.83	1.82
26	1.85	1.84	1.84	1.83	1.83	1.82	1.82	1.81	1.81	1.8
27	1.83	1.83	1.82	1.81	1.81	1.8	1.8	1.79	1.79	1.79
28	1.82	1.81	1.8	1.8	1.79	1.79	1.78	1.78	1.77	1.77
29	1.8	1.79	1.79	1.78	1.78	1.77	1.77	1.76	1.76	1.76
30	1.79	1.78	1.77	1.77	1.76	1.76	1.75	1.75	1.75	1.74
31	1.78	1.77	1.76	1.76	1.75	1.75	1.74	1.74	1.73	1.73
32	1.76	1.76	1.75	1.74	1.74	1.73	1.73	1.72	1.72	1.72
33	1.75	1.74	1.74	1.73	1.73	1.72	1.72	1.71	1.71	1.7
34	1.74	1.73	1.73	1.72	1.72	1.71	1.71	1.7	1.7	1.69
35	1.73	1.72	1.72	1.71	1.71	1.7	1.7	1.69	1.69	1.68
36	1.72	1.71	1.71	1.7	1.7	1.69	1.69	1.68	1.68	1.67
37	1.71	1.71	1.7	1.69	1.69	1.68	1.68	1.67	1.67	1.66
38	1.7	1.7	1.69	1.68	1.68	1.67	1.67	1.66	1.66	1.66
39	1.7	1.69	1.68	1.68	1.67	1.67	1.66	1.66	1.65	1.65
40	1.69	1.68	1.67	1.67	1.66	1.66	1.65	1.65	1.64	1.64
41	1.68	1.67	1.67	1.66	1.66	1.65	1.64	1.64	1.64	1.63
42	1.67	1.67	1.66	1.65	1.65	1.64	1.64	1.63	1.63	1.62
43	1.67	1.66	1.65	1.65	1.64	1.64	1.63	1.63	1.62	1.62
44	1.66	1.65	1.65	1.64	1.64	1.63	1.62	1.62	1.62	1.61
45	1.66	1.65	1.64	1.64	1.63	1.62	1.62	1.61	1.61	1.61
46	1.65	1.64	1.64	1.63	1.62	1.62	1.61	1.61	1.6	1.6
47	1.64	1.64	1.63	1.62	1.62	1.61	1.61	1.6	1.6	1.59
48	1.64	1.63	1.62	1.62	1.61	1.61	1.6	1.6	1.59	1.59
49	1.63	1.63	1.62	1.61	1.61	1.6	1.6	1.59	1.59	1.58
50	1.63	1.62	1.61	1.61	1.6	1.6	1.59	1.59	1.58	1.58