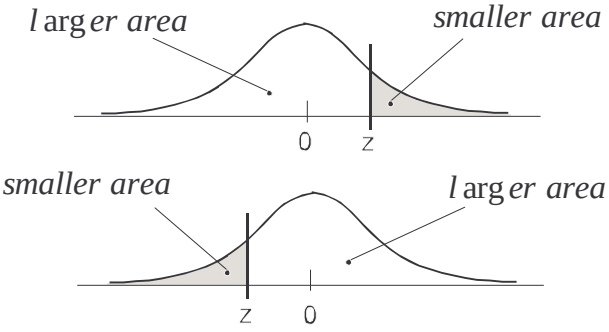
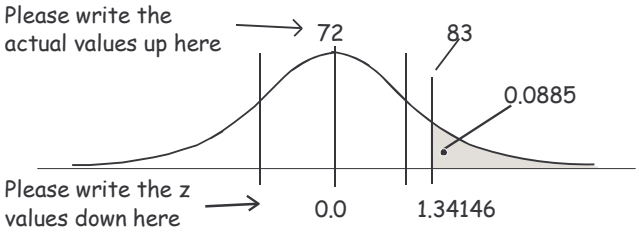
Table 1: Areas under the normal curve

z	z to $\bar{x}$	smaller area	larger area	z	z to $\bar{x}$	smaller area	larger area	z	z to $\bar{x}$	smaller area	larger area
0.000	0.0000	0.5000	0.5000	**1.033**	0.3493	0.1507	0.8493	**2.033**	0.4790	0.0210	0.9790
0.033	0.0133	0.4867	0.5133	**1.067**	0.3569	0.1431	0.8569	**2.067**	0.4806	0.0194	0.9806
0.067	0.0266	0.4734	0.5266	**1.100**	0.3643	0.1357	0.8643	**2.100**	0.4821	0.0179	0.9821
0.100	0.0398	0.4602	0.5398	**1.133**	0.3715	0.1285	0.8715	**2.133**	0.4836	0.0164	0.9836
0.133	0.0530	0.4470	0.5530	**1.167**	0.3783	0.1217	0.8783	**2.167**	0.4849	0.0151	0.9849
0.167	0.0662	0.4338	0.5662	**1.200**	0.3849	0.1151	0.8849	**2.200**	0.4861	0.0139	0.9861
0.200	0.0793	0.4207	0.5793	**1.200**	0.3849	0.1151	0.8849	**2.233**	0.4872	0.0128	0.9872
0.233	0.0922	0.4078	0.5922	**1.233**	0.3913	0.1087	0.8913	**2.267**	0.4883	0.0117	0.9883
0.267	0.1051	0.3949	0.6051	**1.267**	0.3974	0.1026	0.8974	**2.300**	0.4893	0.0107	0.9893
0.300	0.1179	0.3821	0.6179	**1.300**	0.4032	0.0968	0.9032	**2.333**	0.4902	0.0098	0.9902
0.333	0.1306	0.3694	0.6306	**1.333**	0.4088	0.0912	0.9088	**2.367**	0.4910	0.0090	0.9910
0.367	0.1431	0.3569	0.6431	**1.367**	0.4141	0.0859	0.9141	**2.400**	0.4918	0.0082	0.9918
0.400	0.1554	0.3446	0.6554	**1.400**	0.4192	0.0808	0.9192	**2.400**	0.4918	0.0082	0.9918
0.433	0.1676	0.3324	0.6676	**1.433**	0.4241	0.0759	0.9241	**2.433**	0.4925	0.0075	0.9925
0.467	0.1796	0.3204	0.6796	**1.467**	0.4288	0.0712	0.9288	**2.467**	0.4932	0.0068	0.9932
0.500	0.1915	0.3085	0.6915	**1.500**	0.4332	0.0668	0.9332	**2.500**	0.4938	0.0062	0.9938
0.533	0.2031	0.2969	0.7031	**1.533**	0.4374	0.0626	0.9374	**2.533**	0.4944	0.0056	0.9944
0.567	0.2145	0.2855	0.7145	**1.567**	0.4414	0.0586	0.9414	**2.567**	0.4949	0.0051	0.9949
0.600	0.2257	0.2743	0.7257	**1.600**	0.4452	0.0548	0.9452	**2.600**	0.4953	0.0047	0.9953
0.633	0.2367	0.2633	0.7367	**1.633**	0.4488	0.0512	0.9488	**2.633**	0.4958	0.0042	0.9958
0.667	0.2475	0.2525	0.7475	**1.667**	0.4522	0.0478	0.9522	**2.667**	0.4962	0.0038	0.9962
0.700	0.2580	0.2420	0.7580	**1.700**	0.4554	0.0446	0.9554	**2.700**	0.4965	0.0035	0.9965
0.733	0.2683	0.2317	0.7683	**1.733**	0.4585	0.0415	0.9585	**2.733**	0.4969	0.0031	0.9969
0.767	0.2784	0.2216	0.7784	**1.767**	0.4614	0.0386	0.9614	**2.767**	0.4972	0.0028	0.9972
0.800	0.2881	0.2119	0.7881	**1.800**	0.4641	0.0359	0.9641	**2.800**	0.4974	0.0026	0.9974
0.833	0.2977	0.2023	0.7977	**1.833**	0.4666	0.0334	0.9666	**2.833**	0.4977	0.0023	0.9977
0.867	0.3069	0.1931	0.8069	**1.867**	0.4690	0.0310	0.9690	**2.867**	0.4979	0.0021	0.9979
0.900	0.3159	0.1841	0.8159	**1.900**	0.4713	0.0287	0.9713	**2.900**	0.4981	0.0019	0.9981
0.933	0.3247	0.1753	0.8247	**1.933**	0.4734	0.0266	0.9734	**2.933**	0.4983	0.0017	0.9983
0.967	0.3331	0.1669	0.8331	**1.967**	0.4754	0.0246	0.9754	**2.967**	0.4985	0.0015	0.9985
1.000	0.3413	0.1587	0.8413	**2.000**	0.4772	0.0228	0.9772	**3.000**	0.4987	0.0013	0.9987





If the mean is 72, the standard deviation is 8.2 and a person has a grade of 83, what percent have higher grades?

The grade of 83 gives a *z*-score of 1.3414634, closest to 1.333, so use 1.33.

The smaller area for *z* (1.33) is 0.1285 or 12.85%.

$$\bar{x} = \frac{\sum x_i}{n} \qquad z_i = \frac{x_i - \bar{x}}{s} = \frac{d_i}{s} \qquad d_i = x_i - \bar{x}$$

$$s = \sqrt{\frac{\sum d_i^2}{n-1}} = \sqrt{\frac{\sum X_i^2 - \left(\sum X\right)^2 / n}{n-1}}$$

$$z_{obs} = \frac{\bar{x}_1 - \bar{x}_2}{\sigma_{\bar{x}_1 - \bar{x}_2}} \qquad \sigma_{\bar{x}_1 - \bar{x}_2} \approx \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

$$SS = \sum d_i^2 = \sum \left(x_i - \bar{x}\right)^2 \qquad s^2 = \frac{\sum d_i^2}{n-1} = \frac{SS}{n-1} \qquad z_{obs} = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} \qquad \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} \approx \frac{s}{\sqrt{n}}$$

TABLE 3. CRITICAL VALUES OF CHI-SQUARE

df	*.25*	*.10*	*.05*	*.025*	*.01*	*.005*
1	1.323	2.706	3.841	5.024	6.635	7.879
2	2.773	4.605	5.991	7.378	9.210	10.597
3	4.108	6.251	7.815	9.348	11.345	12.838
4	5.385	7.779	9.488	11.143	13.277	14.860
5	6.626	9.236	11.071	12.833	15.086	16.750
6	7.841	10.645	12.592	14.449	16.812	18.548
7	9.037	12.017	14.067	16.013	18.475	20.278
8	10.219	13.362	15.507	17.535	20.090	21.955
9	11.389	14.684	16.919	19.023	21.666	23.589
10	12.549	15.987	18.307	21.483	23.209	25.188
12	14.845	18.549	21.026	23.337	26.217	28.299
14	17.117	21.064	23.685	26.119	29.141	31.319
15	18.245	22.307	24.996	27.488	30.578	32.801
16	19.396	23.542	26.296	28.845	32.000	34.267
18	21.605	25.989	28.869	31.526	34.805	37.156

$$t_{obs} = r\sqrt{(n-2)/(1-r^2)} \qquad df = n-2$$

$$\sigma_{Z_1-Z_2} = \sqrt{\frac{1}{n_1-3}+\frac{1}{n_2-3}} \qquad z_{obs} = \frac{Z_1-Z_2}{\sigma_{Z_1-Z_2}}$$

Table 2: Critical values of *t*

df	Level of significance for one-tailed test				
	0.1	**0.05**	**0.025**	**0.01**	**0.005**
	Level of significance for two-tailed test				
	0.2	**0.1**	**0.05**	**0.02**	**0.01**
10	1.372	1.812	2.228	2.764	3.169
12	1.356	1.782	2.179	2.681	3.055
14	1.345	1.761	2.145	2.624	2.977
16	1.337	1.746	2.120	2.583	2.921
18	1.330	1.734	2.101	2.552	2.878
20	1.325	1.725	2.086	2.528	2.845
22	1.321	1.717	2.074	2.508	2.819
24	1.318	1.711	2.064	2.492	2.797
26	1.315	1.706	2.056	2.479	2.779
28	1.313	1.701	2.048	2.467	2.763
30	1.310	1.697	2.042	2.457	2.75
40	1.303	1.684	2.021	2.423	2.704
60	1.296	1.671	2.000	2.390	2.66
80	1.292	1.664	1.990	2.374	2.639
100	1.290	1.660	1.984	2.364	2.626
120	1.289	1.658	1.980	2.358	2.617
∞	1.282	1.645	1.960	2.327	2.576

$$\mathrm{cov}_{xy} = \frac{\sum d_x d_y}{n} = \frac{\sum xy - \frac{\sum x \sum y}{n}}{n}$$

$$r_{xy} = \frac{\sum z_x z_y}{n} = \frac{n\sum xy - \sum x \sum y}{\sqrt{n\sum x^2 - (\sum x)^2}\sqrt{n\sum y^2 - (\sum y)^2}}$$

Table 5. Fisher's r to Z

r	Z	r	Z	r	Z
0.10	0.100	0.30	0.310	0.60	0.693
0.11	0.110	0.31	0.321	0.61	0.709
0.12	0.121	0.32	0.332	0.62	0.725
0.13	0.131	0.33	0.343	0.63	0.741
0.14	0.141	0.34	0.354	0.64	0.758
0.15	0.151	0.35	0.365	0.65	0.775
0.16	0.161	0.36	0.377	0.66	0.793
0.17	0.172	0.37	0.388	0.67	0.811
0.18	0.182	0.38	0.400	0.68	0.829
0.19	0.192	0.39	0.412	0.69	0.848
0.20	0.203	0.40	0.424	0.70	0.867
0.21	0.213	0.41	0.436	0.71	0.887
0.22	0.224	0.42	0.448	0.72	0.908
0.23	0.234	0.43	0.460	0.73	0.929
0.24	0.245	0.44	0.472	0.74	0.950
0.25	0.255	0.45	0.485	0.75	0.973
0.26	0.266	0.46	0.497	0.76	0.996
0.27	0.277	0.47	0.510	0.77	1.020
0.28	0.288	0.48	0.523	0.78	1.045

$$\chi^2 = \sum \frac{(o-e)^2}{e} \qquad df = (rows-1)\times(cols-1)$$

$$expexted_{i,j} = \frac{rowtotal_i \times coltotal_j}{tabletotal}$$

$$a = \bar{Y} - b\bar{X} \qquad \hat{y} = bx + a \qquad b = \frac{rise}{run} = r_{xy}\frac{s_y}{s_x}$$

$$SE_{\bar{x}_1-\bar{x}_2} = \sqrt{\left(\frac{\sum d_1^2 + \sum d_2^2}{n_1+n_2-2}\right)\left(\frac{n_1+n_2}{n_1 n_2}\right)}$$

$$t_{obs} = \frac{\bar{x}_1 - \bar{x}_2}{SE_{\bar{x}_1-\bar{x}_2}} \qquad df = (n_1-1)+(n_2-1)$$