

t - Table For means, use when σ is NOT known (s is given)
 (See "Choosing z or t" flowchart, below right, for details).
 Also used for other applications.

Student's T-distribution (Probability Density Function)							
Degrees of Freedom <i>df</i>	Confidence Intervals	50%	80%	90%	95%	98%	99%
	One Tail, α	0.25	0.10	0.05	0.025	0.01	0.005
	Two Tails, α	0.50	0.20	0.10	0.05	0.02	0.01
1		1.000	3.078	6.314	12.706	31.821	63.656
2		0.816	1.886	2.920	4.303	6.965	9.925
3		0.765	1.638	2.353	3.182	4.541	5.841
4		0.741	1.533	2.132	2.776	3.747	4.604
5		0.727	1.476	2.015	2.571	3.365	4.032
6		0.718	1.440	1.943	2.447	3.143	3.707
7		0.711	1.415	1.895	2.365	2.998	3.499
8		0.706	1.397	1.860	2.306	2.896	3.355
9		0.703	1.383	1.833	2.262	2.821	3.250
10		0.700	1.372	1.812	2.228	2.764	3.169
11		0.697	1.363	1.796	2.201	2.718	3.106
12		0.695	1.356	1.782	2.179	2.681	3.055
13		0.694	1.350	1.771	2.160	2.650	3.012
14		0.692	1.345	1.761	2.145	2.624	2.977
15		0.691	1.341	1.753	2.131	2.602	2.947
16		0.690	1.337	1.746	2.120	2.583	2.921
17		0.689	1.333	1.740	2.110	2.567	2.898
18		0.688	1.330	1.734	2.101	2.552	2.878
19		0.688	1.328	1.729	2.093	2.539	2.861
20		0.687	1.325	1.725	2.086	2.528	2.845
21		0.686	1.323	1.721	2.080	2.518	2.831
22		0.686	1.321	1.717	2.074	2.508	2.819
23		0.685	1.319	1.714	2.069	2.500	2.807
24		0.685	1.318	1.711	2.064	2.492	2.797
25		0.684	1.316	1.708	2.060	2.485	2.787
26		0.684	1.315	1.706	2.056	2.479	2.779
27		0.684	1.314	1.703	2.052	2.473	2.771
28		0.683	1.313	1.701	2.048	2.467	2.763
29		0.683	1.311	1.699	2.045	2.462	2.756
30		0.683	1.310	1.697	2.042	2.457	2.750
31		0.682	1.309	1.696	2.040	2.453	2.744
32		0.682	1.309	1.694	2.037	2.449	2.738
34		0.682	1.307	1.691	2.032	2.441	2.728
36		0.681	1.306	1.688	2.028	2.434	2.719
38		0.681	1.304	1.686	2.024	2.429	2.712
40		0.681	1.303	1.684	2.021	2.423	2.704
45	use closest,	0.680	1.301	1.679	2.014	2.412	2.690
50	or largest	0.679	1.299	1.676	2.009	2.403	2.678
55	if exactly	0.679	1.297	1.673	2.004	2.396	2.668
60	in-between	0.679	1.296	1.671	2.000	2.390	2.660
65		0.678	1.295	1.669	1.997	2.385	2.654
70		0.678	1.294	1.667	1.994	2.381	2.648
75		0.678	1.293	1.665	1.992	2.377	2.643
80		0.678	1.292	1.664	1.990	2.374	2.639
90		0.677	1.291	1.662	1.987	2.368	2.632
100		0.677	1.290	1.660	1.984	2.364	2.626
200		0.676	1.286	1.653	1.972	2.345	2.601
300		0.675	1.284	1.650	1.968	2.339	2.592
400		0.675	1.284	1.649	1.966	2.336	2.588
500		0.675	1.283	1.648	1.965	2.334	2.586
750		0.675	1.283	1.647	1.963	2.331	2.582
1000		0.675	1.282	1.646	1.962	2.330	2.581
2000		0.675	1.282	1.646	1.961	2.328	2.578
	Large	0.674	1.282	1.645	1.960	2.326	2.576

P-Values:

Left tail: Area to the left of the test statistic

Right tail: Area to the right of the test statistic

Two tail:

Test Stat to left of center: Twice the area to the left of the test statistic.

Test Stat to right of center: Twice the area to the right of the test statistic.

(To find the areas, use the "Strategies to Find Areas"...over)

**Reject H_0 if $\alpha \geq p$ -value or
 Fail to Reject H_0 if $\alpha < p$ -value.**

Hypothesis Test Steps

1) Set up H_0 & H_1

H_0 : Use the "=" or indicate equality, independence, etc.

H_1 : Use the "≠", ">", "<" or indicate inequality, dependence, etc. **Label the Claim**

2) Determine the critical number(s)

When σ is known, refer to the Z-table. Also, use the Z-table for proportions. When σ is NOT known (and s is given), use the t-table. For others (Chi-square, regression, F-dist, ANOVA, etc.) refer to the proper table or method.

3) Draw a curve and plot the critical number(s).

Label the "Fail to Reject H_0 Zone" and, label and shade the "Reject H_0 Zone"

4) Determine the test statistic - see the applicable formula sheet. **and plot it.**

5) Reject H_0 or Fail to Reject H_0 .

1) Reject if the test stat is in the Reject Zone or
 2) If using p-values, Reject if $\alpha \geq p$ -value or Fail to reject if $\alpha < p$ -value.)

6) Write the final conclusion - see the flowchart below

Areas, Confidence Intervals and Hypothesis Tests Package

For a first course in statistics - Generic where possible

H_0 statement of equality **Tail Types, Critical Z Signs for Hypothesis Tests**

The tail type is determined by H_1

H_0	H_1	Type	Critical Value Sign
=	<	left 1-tail	negative (-)
=	>	right 1-tail	positive (+)
=	≠	both 2-tail	pos & neg (±)

Note: All Confidence Intervals are 2-tail

Z-Table For means, use when σ is known
 (See "Choosing z or t" flowchart, below, for details).
 Also used for other applications.

α Sig Lev	$1 - \alpha$ Conf Lev	Conf Int (All) $\pm z$ for 2-Tail	z for 1-Tail
0.10	90%	1.645	1.28
0.09	91%	1.695	1.34
0.08	92%	1.75	1.405
0.07	93%	1.81	1.476
0.06	94%	1.88	1.555
0.05	95%	1.96	1.645
0.045	95.5%	2.005	1.695
0.04	96%	2.054	1.75
0.035	96.5%	2.11	1.81
0.03	97%	2.17	1.88
0.025	97.5%	2.24	1.96
0.02	98%	2.326	2.054
0.015	98.5%	2.43	2.17
0.01	99%	2.576	2.326
0.005	99.5%	2.81	2.576

Confidence Interval Steps:

1) Find the critical z or t

When σ is known, refer to the Z-table. Also, use the Z-table for proportions.

When σ is NOT known (and s is given), use the t-table. For others, refer to the proper table or method.

2) Calculate the Maximum Error (see formulas - reverse page)

3) The Interval is:

Point Est. \pm Max. Error

Discrete Probability Distribution Functions

$$\sum P(x) = 1$$

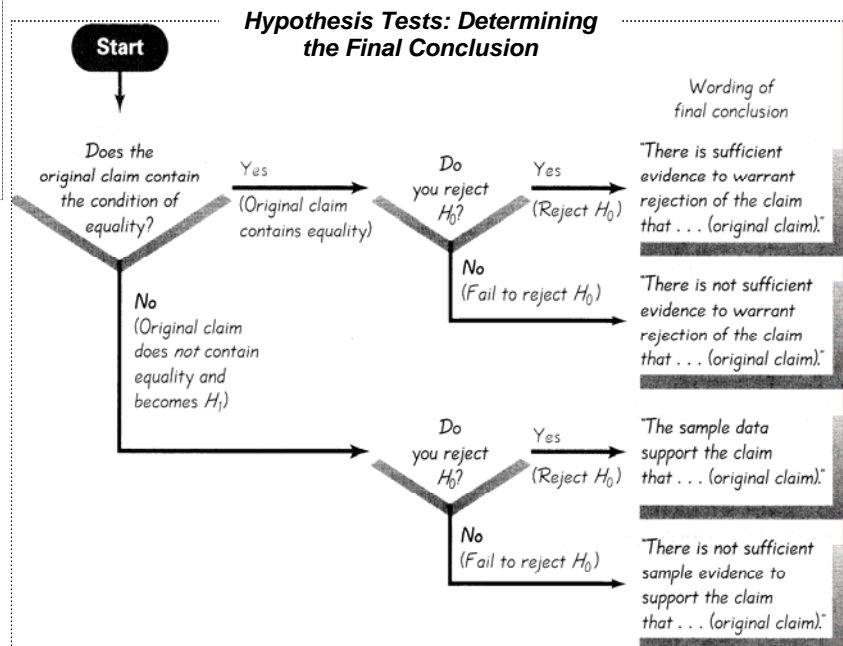
$$0 \leq P(x) \leq 1$$

$$\mu = \sum x \cdot P(x)$$

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

Binomial PDF's

$$\mu = np \quad \sigma = \sqrt{npq}$$

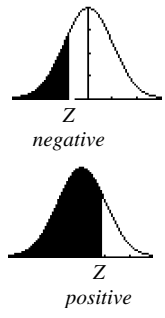


Standard Normal Distribution Z-Table (density function)

-3.5 and lower use 0.0001

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
-0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

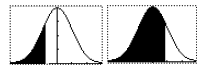
← Z-Table
This table gives areas from $-\infty$ to the z that you provide



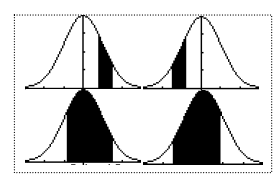
Strategies to find Areas
(and Probabilities, Percents)

Area to Find

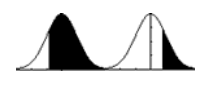
- 1) To the left of the z**
Use the table area "as is".



- 2) Between the z's**
Subtract the smaller table area from the larger table area.



- 3) To the right of the z**
Subtract the table area from 1.0000.



Find Z's

- 1) z's for the Normal Distribution**
$$z = \frac{x - \bar{x}}{s} \qquad z = \frac{x - \mu}{\sigma}$$
Enter on calculator as:
 $(x - \bar{x}) / s$ or $(x - \mu) / \sigma$

- 2) z's for the Sampling Distribution of \bar{x}**
$$z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$
Enter on calculator as:
 $(\bar{x} - \mu) / (\sigma / \sqrt{n})$
Use s if σ is not known.

Find X's

$$x = \mu + z\sigma$$

3.5 and up use .9999