*Use for Small Samples*

# STA2023 - Statistics

*Use for Large Samples*

## Student's T-distribution (W. S. Gossett)

Probability Density Function

| | Confidence Intervals | 50% | 80% | 90% | 95% | 98% | 99% |
|---|---|---|---|---|---|---|---|
| | One Tail, $\alpha$ | 0.25 | 0.10 | 0.05 | 0.025 | 0.01 | 0.005 |
| | Two Tails, $\alpha$ | 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 |
| 33 | | 0.682 | 1.308 | 1.692 | 2.035 | 2.445 | 2.733 |
| 34 | | 0.682 | 1.307 | 1.691 | 2.032 | 2.441 | 2.728 |
| 35 | | 0.682 | 1.306 | 1.690 | 2.030 | 2.438 | 2.724 |
| 36 | | 0.681 | 1.306 | 1.688 | 2.028 | 2.434 | 2.719 |
| 37 | | 0.681 | 1.305 | 1.687 | 2.026 | 2.431 | 2.715 |
| 38 | | 0.681 | 1.304 | 1.686 | 2.024 | 2.429 | 2.712 |
| 39 | | 0.681 | 1.304 | 1.685 | 2.023 | 2.426 | 2.708 |
| 40 | | 0.681 | 1.303 | 1.684 | 2.021 | 2.423 | 2.704 |
| 41 | | 0.68052 | 1.30254 | 1.68288 | 2.01954 | 2.42080 | 2.70118 |
| 42 | | 0.68038 | 1.30203 | 1.68195 | 2.01808 | 2.41847 | 2.69807 |
| 43 | | 0.68024 | 1.30155 | 1.68107 | 2.01669 | 2.41625 | 2.69511 |
| 44 | | 0.68011 | 1.30109 | 1.68023 | 2.01537 | 2.41414 | 2.69229 |
| 45 | | 0.67998 | 1.30065 | 1.67943 | 2.01410 | 2.41212 | 2.68959 |
| 46 | | 0.67986 | 1.30023 | 1.67866 | 2.01289 | 2.41019 | 2.68701 |
| 47 | | 0.67975 | 1.29982 | 1.67793 | 2.01174 | 2.40834 | 2.68456 |
| 48 | | 0.67964 | 1.29944 | 1.67722 | 2.01063 | 2.40658 | 2.68221 |
| 49 | | 0.67953 | 1.29907 | 1.67655 | 2.00957 | 2.40489 | 2.67995 |
| 50 | | 0.67943 | 1.29871 | 1.67591 | 2.00856 | 2.40327 | 2.67779 |
| 51 | | 0.67933 | 1.29837 | 1.67528 | 2.00758 | 2.40172 | 2.67573 |
| 52 | | 0.67924 | 1.29804 | 1.67469 | 2.00665 | 2.40023 | 2.67373 |
| 53 | | 0.67915 | 1.29773 | 1.67412 | 2.00575 | 2.39879 | 2.67182 |
| 54 | | 0.67906 | 1.29743 | 1.67357 | 2.00488 | 2.39741 | 2.66999 |
| 55 | | 0.67898 | 1.29713 | 1.67303 | 2.00404 | 2.39608 | 2.66822 |
| 56 | | 0.67890 | 1.29685 | 1.67252 | 2.00324 | 2.39480 | 2.66651 |
| 57 | | 0.67882 | 1.29658 | 1.67203 | 2.00247 | 2.39357 | 2.66487 |
| 58 | | 0.67874 | 1.29632 | 1.67155 | 2.00172 | 2.39238 | 2.66329 |
| 59 | | 0.67867 | 1.29607 | 1.67109 | 2.00100 | 2.39123 | 2.66176 |
| 60 | | 0.67860 | 1.29582 | 1.67065 | 2.00030 | 2.39012 | 2.66027 |
| 61 | | 0.67853 | 1.29558 | 1.67022 | 1.99962 | 2.38904 | 2.65885 |
| 62 | | 0.67847 | 1.29536 | 1.66980 | 1.99897 | 2.38801 | 2.65747 |

## Standard Normal Distribution Table

(Standard Normal Probability Density Function)

| $z$ | 0.00 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.0000 | 0.0040 | 0.0080 | 0.0120 | 0.0160 | 0.0199 | 0.0239 | 0.0279 | 0.0319 | 0.0359 |
| 0.1 | 0.0398 | 0.0438 | 0.0478 | 0.0517 | 0.0557 | 0.0596 | 0.0636 | 0.0675 | 0.0714 | 0.0753 |
| 0.2 | 0.0793 | 0.0832 | 0.0871 | 0.0910 | 0.0948 | 0.0987 | 0.1026 | 0.1064 | 0.1103 | 0.1141 |
| 0.3 | 0.1179 | 0.1217 | 0.1255 | 0.1293 | 0.1331 | 0.1368 | 0.1406 | 0.1443 | 0.1480 | 0.1517 |
| 0.4 | 0.1554 | 0.1591 | 0.1628 | 0.1664 | 0.1700 | 0.1736 | 0.1772 | 0.1808 | 0.1844 | 0.1879 |
| 0.5 | 0.1915 | 0.1950 | 0.1985 | 0.2019 | 0.2054 | 0.2088 | 0.2123 | 0.2157 | 0.2190 | 0.2224 |
| 0.6 | 0.2257 | 0.2291 | 0.2324 | 0.2357 | 0.2389 | 0.2422 | 0.2454 | 0.2486 | 0.2517 | 0.2549 |
| 0.7 | 0.2580 | 0.2611 | 0.2642 | 0.2673 | 0.2704 | 0.2734 | 0.2764 | 0.2794 | 0.2823 | 0.2852 |
| 0.8 | 0.2881 | 0.2910 | 0.2939 | 0.2967 | 0.2995 | 0.3023 | 0.3051 | 0.3078 | 0.3106 | 0.3133 |
| 0.9 | 0.3159 | 0.3186 | 0.3212 | 0.3238 | 0.3264 | 0.3289 | 0.3315 | 0.3340 | 0.3365 | 0.3389 |
| 1.0 | 0.3413 | 0.3438 | 0.3461 | 0.3485 | 0.3508 | 0.3531 | 0.3554 | 0.3577 | 0.3599 | 0.3621 |
| 1.1 | 0.3643 | 0.3665 | 0.3686 | 0.3708 | 0.3729 | 0.3749 | 0.3770 | 0.3790 | 0.3810 | 0.3830 |
| 1.2 | 0.3849 | 0.3869 | 0.3888 | 0.3907 | 0.3925 | 0.3944 | 0.3962 | 0.3980 | 0.3997 | 0.4015 |
| 1.3 | 0.4032 | 0.4049 | 0.4066 | 0.4082 | 0.4099 | 0.4115 | 0.4131 | 0.4147 | 0.4162 | 0.4177 |
| 1.4 | 0.4192 | 0.4207 | 0.4222 | 0.4236 | 0.4251 | 0.4265 | 0.4279 | 0.4292 | 0.4306 | 0.4319 |
| 1.5 | 0.4332 | 0.4345 | 0.4357 | 0.4370 | 0.4382 | 0.4394 | 0.4406 | 0.4418 | 0.4429 | 0.4441 |
| 1.6 | 0.4452 | 0.4463 | 0.4474 | 0.4484 | 0.4495 | 0.4505 | 0.4515 | 0.4525 | 0.4535 | 0.4545 |
| 1.7 | 0.4554 | 0.4564 | 0.4573 | 0.4582 | 0.4591 | 0.4599 | 0.4608 | 0.4616 | 0.4625 | 0.4633 |
| 1.8 | 0.4641 | 0.4649 | 0.4656 | 0.4664 | 0.4671 | 0.4678 | 0.4686 | 0.4693 | 0.4699 | 0.4706 |
| 1.9 | 0.4713 | 0.4719 | 0.4726 | 0.4732 | 0.4738 | 0.4744 | 0.4750 | 0.4756 | 0.4761 | 0.4767 |
| 2.0 | 0.4772 | 0.4778 | 0.4783 | 0.4788 | 0.4793 | 0.4798 | 0.4803 | 0.4808 | 0.4812 | 0.4817 |
| 2.1 | 0.4821 | 0.4826 | 0.4830 | 0.4834 | 0.4838 | 0.4842 | 0.4846 | 0.4850 | 0.4854 | 0.4857 |
| 2.2 | 0.4861 | 0.4864 | 0.4868 | 0.4871 | 0.4875 | 0.4878 | 0.4881 | 0.4884 | 0.4887 | 0.4890 |
| 2.3 | 0.4893 | 0.4896 | 0.4898 | 0.4901 | 0.4904 | 0.4906 | 0.4909 | 0.4911 | 0.4913 | 0.4916 |
| 2.4 | 0.4918 | 0.4920 | 0.4922 | 0.4925 | 0.4927 | 0.4929 | 0.4931 | 0.4932 | 0.4934 | 0.4936 |
| 2.5 | 0.4938 | 0.4940 | 0.4941 | 0.4943 | 0.4945 | 0.4946 | 0.4948 | 0.4949 | 0.4951 | 0.4952 |
| 2.6 | 0.4953 | 0.4955 | 0.4956 | 0.4957 | 0.4959 | 0.4960 | 0.4961 | 0.4962 | 0.4963 | 0.4964 |
| 2.7 | 0.4965 | 0.4966 | 0.4967 | 0.4968 | 0.4969 | 0.4970 | 0.4971 | 0.4972 | 0.4973 | 0.4974 |
| 2.8 | 0.4974 | 0.4975 | 0.4976 | 0.4977 | 0.4977 | 0.4978 | 0.4979 | 0.4979 | 0.4980 | 0.4981 |
| 2.9 | 0.4981 | 0.4982 | 0.4982 | 0.4983 | 0.4984 | 0.4984 | 0.4985 | 0.4985 | 0.4986 | 0.4986 |
| 3.0 | 0.498650 | 0.498694 | 0.498736 | 0.498777 | 0.498817 | 0.498856 | 0.498893 | 0.498930 | 0.498965 | 0.498999 |
| 3.1 | 0.4990323 | 0.4990645 | 0.4990957 | 0.4991259 | 0.4991552 | 0.4991836 | 0.4992111 | 0.4992377 | 0.4992636 | 0.4992886 |
| 3.2 | 0.4993128 | 0.4993363 | 0.4993590 | 0.4993810 | 0.4994023 | 0.4994229 | 0.4994429 | 0.4994622 | 0.4994809 | 0.4994990 |
| 3.3 | 0.4995165 | 0.4995335 | 0.4995499 | 0.4995657 | 0.4995811 | 0.4995959 | 0.4996102 | 0.4996241 | 0.4996375 | 0.4996505 |
| 3.4 | 0.4996630 | 0.4996751 | 0.4996868 | 0.4996982 | 0.4997091 | 0.4997197 | 0.4997299 | 0.4997397 | 0.4997492 | 0.4997584 |
| 3.5 | 0.4997673 | 0.4997759 | 0.4997842 | 0.4997922 | 0.4997999 | 0.4998073 | 0.4998145 | 0.4998215 | 0.4998282 | 0.4998346 |
| 3.6 | 0.4998409 | 0.4998469 | 0.4998527 | 0.4998583 | 0.4998636 | 0.4998688 | 0.4998739 | 0.4998787 | 0.4998834 | 0.4998878 |
| 3.7 | 0.4998922 | 0.4998963 | 0.4999004 | 0.4999042 | 0.4999080 | 0.4999116 | 0.4999150 | 0.4999184 | 0.4999216 | 0.4999247 |
| 3.8 | 0.4999276 | 0.4999305 | 0.4999333 | 0.4999359 | 0.4999385 | 0.4999409 | 0.4999433 | 0.4999456 | 0.4999478 | 0.4999499 |
| 3.9 | 0.4999519 | 0.4999538 | 0.4999557 | 0.4999575 | 0.4999592 | 0.4999609 | 0.4999625 | 0.4999640 | 0.4999655 | 0.4999669 |
| 4.0 | 0.4999683 | 0.4999696 | 0.4999709 | 0.4999721 | 0.4999733 | 0.4999744 | 0.4999755 | 0.4999765 | 0.4999775 | 0.4999784 |

## *Standard Normal Distribution Z's*

*for **confidence intervals & 1 and 2 tail Hypothesis Test***

***Critical Points** (NOT for student t scores)*

| $\alpha$ Sig Lev | $1-\alpha$ Conf Lev | *Conf. Intervals* $\pm z$ 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 |