

**Table Z: Areas under the standard normal curve (negative Z)**

| Second decimal place in z |        |        |        |        |        |        |        |        |          | z    |
|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|------|
| 0.09                      | 0.08   | 0.07   | 0.06   | 0.05   | 0.04   | 0.03   | 0.02   | 0.01   | 0.00     |      |
|                           |        |        |        |        |        |        |        |        | * 0.0000 | -3.9 |
| 0.0001                    | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001   | -3.8 |
| 0.0001                    | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001   | -3.7 |
| 0.0001                    | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0002 | 0.0002   | -3.6 |
| 0.0002                    | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002   | -3.5 |
| 0.0002                    | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003   | -3.4 |
| 0.0003                    | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0005 | 0.0005 | 0.0005   | -3.3 |
| 0.0005                    | 0.0005 | 0.0005 | 0.0006 | 0.0006 | 0.0006 | 0.0006 | 0.0006 | 0.0007 | 0.0007   | -3.2 |
| 0.0007                    | 0.0007 | 0.0008 | 0.0008 | 0.0008 | 0.0008 | 0.0009 | 0.0009 | 0.0009 | 0.0010   | -3.1 |
| 0.0010                    | 0.0010 | 0.0011 | 0.0011 | 0.0011 | 0.0012 | 0.0012 | 0.0013 | 0.0013 | 0.0013   | -3.0 |
| 0.0014                    | 0.0014 | 0.0015 | 0.0015 | 0.0016 | 0.0016 | 0.0017 | 0.0018 | 0.0018 | 0.0019   | -2.9 |
| 0.0019                    | 0.0020 | 0.0021 | 0.0021 | 0.0022 | 0.0023 | 0.0023 | 0.0024 | 0.0025 | 0.0026   | -2.8 |
| 0.0026                    | 0.0027 | 0.0028 | 0.0029 | 0.0030 | 0.0031 | 0.0032 | 0.0033 | 0.0034 | 0.0035   | -2.7 |
| 0.0036                    | 0.0037 | 0.0038 | 0.0039 | 0.0040 | 0.0041 | 0.0043 | 0.0044 | 0.0045 | 0.0047   | -2.6 |
| 0.0048                    | 0.0049 | 0.0051 | 0.0052 | 0.0054 | 0.0055 | 0.0057 | 0.0059 | 0.0060 | 0.0062   | -2.5 |
| 0.0064                    | 0.0066 | 0.0068 | 0.0069 | 0.0071 | 0.0073 | 0.0075 | 0.0078 | 0.0080 | 0.0082   | -2.4 |
| 0.0084                    | 0.0087 | 0.0089 | 0.0091 | 0.0094 | 0.0096 | 0.0099 | 0.0102 | 0.0104 | 0.0107   | -2.3 |
| 0.0110                    | 0.0113 | 0.0116 | 0.0119 | 0.0122 | 0.0125 | 0.0129 | 0.0132 | 0.0136 | 0.0139   | -2.2 |
| 0.0143                    | 0.0146 | 0.0150 | 0.0154 | 0.0158 | 0.0162 | 0.0166 | 0.0170 | 0.0174 | 0.0179   | -2.1 |
| 0.0183                    | 0.0188 | 0.0192 | 0.0197 | 0.0202 | 0.0207 | 0.0212 | 0.0217 | 0.0222 | 0.0228   | -2.0 |
| 0.0233                    | 0.0239 | 0.0244 | 0.0250 | 0.0256 | 0.0262 | 0.0268 | 0.0274 | 0.0281 | 0.0287   | -1.9 |
| 0.0294                    | 0.0301 | 0.0307 | 0.0314 | 0.0322 | 0.0329 | 0.0336 | 0.0344 | 0.0351 | 0.0359   | -1.8 |
| 0.0367                    | 0.0375 | 0.0384 | 0.0392 | 0.0401 | 0.0409 | 0.0418 | 0.0427 | 0.0436 | 0.0446   | -1.7 |
| 0.0455                    | 0.0465 | 0.0475 | 0.0485 | 0.0495 | 0.0505 | 0.0516 | 0.0526 | 0.0537 | 0.0548   | -1.6 |
| 0.0559                    | 0.0571 | 0.0582 | 0.0594 | 0.0606 | 0.0618 | 0.0630 | 0.0643 | 0.0655 | 0.0668   | -1.5 |
| 0.0681                    | 0.0694 | 0.0708 | 0.0721 | 0.0735 | 0.0749 | 0.0764 | 0.0778 | 0.0793 | 0.0808   | -1.4 |
| 0.0823                    | 0.0838 | 0.0853 | 0.0869 | 0.0885 | 0.0901 | 0.0918 | 0.0934 | 0.0951 | 0.0968   | -1.3 |
| 0.0985                    | 0.1003 | 0.1020 | 0.1038 | 0.1056 | 0.1075 | 0.1093 | 0.1112 | 0.1131 | 0.1151   | -1.2 |
| 0.1170                    | 0.1190 | 0.1210 | 0.1230 | 0.1251 | 0.1271 | 0.1292 | 0.1314 | 0.1335 | 0.1357   | -1.1 |
| 0.1379                    | 0.1401 | 0.1423 | 0.1446 | 0.1469 | 0.1492 | 0.1515 | 0.1539 | 0.1562 | 0.1587   | -1.0 |
| 0.1611                    | 0.1635 | 0.1660 | 0.1685 | 0.1711 | 0.1736 | 0.1762 | 0.1788 | 0.1814 | 0.1841   | -0.9 |
| 0.1867                    | 0.1894 | 0.1922 | 0.1949 | 0.1977 | 0.2005 | 0.2033 | 0.2061 | 0.2090 | 0.2119   | -0.8 |
| 0.2148                    | 0.2177 | 0.2206 | 0.2236 | 0.2266 | 0.2296 | 0.2327 | 0.2358 | 0.2389 | 0.2420   | -0.7 |
| 0.2451                    | 0.2483 | 0.2514 | 0.2546 | 0.2578 | 0.2611 | 0.2643 | 0.2676 | 0.2709 | 0.2743   | -0.6 |
| 0.2776                    | 0.2810 | 0.2843 | 0.2877 | 0.2912 | 0.2946 | 0.2981 | 0.3015 | 0.3050 | 0.3085   | -0.5 |
| 0.3121                    | 0.3156 | 0.3192 | 0.3228 | 0.3264 | 0.3300 | 0.3336 | 0.3372 | 0.3409 | 0.3446   | -0.4 |
| 0.3483                    | 0.3520 | 0.3557 | 0.3594 | 0.3632 | 0.3669 | 0.3707 | 0.3745 | 0.3783 | 0.3821   | -0.3 |
| 0.3859                    | 0.3897 | 0.3936 | 0.3974 | 0.4013 | 0.4052 | 0.4090 | 0.4129 | 0.4168 | 0.4207   | -0.2 |
| 0.4247                    | 0.4286 | 0.4325 | 0.4364 | 0.4404 | 0.4443 | 0.4483 | 0.4522 | 0.4562 | 0.4602   | -0.1 |
| 0.4641                    | 0.4681 | 0.4721 | 0.4761 | 0.4801 | 0.4840 | 0.4880 | 0.4920 | 0.4960 | 0.5000   | -0.0 |

\* For values of  $z \leq -3.90$ , the areas are 0.0000 to four decimal places

**Table Z: Areas under the standard normal curve (positive Z)**

| z   | Second decimal place in z |        |        |        |        |        |        |        |        |        |
|-----|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|     | 0.00                      | 0.01   | 0.02   | 0.03   | 0.04   | 0.05   | 0.06   | 0.07   | 0.08   | 0.09   |
| 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 |
| 3.5 | 0.9998                    | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 | 0.9998 |
| 3.6 | 0.9998                    | 0.9998 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 |
| 3.7 | 0.9999                    | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 |
| 3.8 | 0.9999                    | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 | 0.9999 |
| 3.9 | * 1.0000                  |        |        |        |        |        |        |        |        |        |

\* For values of  $z \geq 3.90$ , the areas are 1.0000 to four decimal places

## Table T: Critical values for the Student's T distributions

| two tail probability | 0.20  | 0.10  | 0.05   | 0.02   | 0.01   |              |
|----------------------|-------|-------|--------|--------|--------|--------------|
| one tail probability | 0.10  | 0.05  | 0.025  | 0.01   | 0.005  |              |
| df                   |       |       |        |        |        | df           |
| 1                    | 3.078 | 6.314 | 12.706 | 31.821 | 63.657 | 1            |
| 2                    | 1.886 | 2.920 | 4.303  | 6.965  | 9.925  | 2            |
| 3                    | 1.638 | 2.353 | 3.182  | 4.541  | 5.841  | 3            |
| 4                    | 1.533 | 2.132 | 2.776  | 3.747  | 4.604  | 4            |
| 5                    | 1.476 | 2.015 | 2.571  | 3.365  | 4.032  | 5            |
| 6                    | 1.440 | 1.943 | 2.447  | 3.143  | 3.707  | 6            |
| 7                    | 1.415 | 1.895 | 2.365  | 2.998  | 3.499  | 7            |
| 8                    | 1.397 | 1.860 | 2.306  | 2.896  | 3.355  | 8            |
| 9                    | 1.383 | 1.833 | 2.262  | 2.821  | 3.250  | 9            |
| 10                   | 1.372 | 1.812 | 2.228  | 2.764  | 3.169  | 10           |
| 11                   | 1.363 | 1.796 | 2.201  | 2.718  | 3.106  | 11           |
| 12                   | 1.356 | 1.782 | 2.179  | 2.681  | 3.055  | 12           |
| 13                   | 1.350 | 1.771 | 2.160  | 2.650  | 3.012  | 13           |
| 14                   | 1.345 | 1.761 | 2.145  | 2.624  | 2.977  | 14           |
| 15                   | 1.341 | 1.753 | 2.131  | 2.602  | 2.947  | 15           |
| 16                   | 1.337 | 1.746 | 2.120  | 2.583  | 2.921  | 16           |
| 17                   | 1.333 | 1.740 | 2.110  | 2.567  | 2.898  | 17           |
| 18                   | 1.330 | 1.734 | 2.101  | 2.552  | 2.878  | 18           |
| 19                   | 1.328 | 1.729 | 2.093  | 2.539  | 2.861  | 19           |
| 20                   | 1.325 | 1.725 | 2.086  | 2.528  | 2.845  | 20           |
| 21                   | 1.323 | 1.721 | 2.080  | 2.518  | 2.831  | 21           |
| 22                   | 1.321 | 1.717 | 2.074  | 2.508  | 2.819  | 22           |
| 23                   | 1.319 | 1.714 | 2.069  | 2.500  | 2.807  | 23           |
| 24                   | 1.318 | 1.711 | 2.064  | 2.492  | 2.797  | 24           |
| 25                   | 1.316 | 1.708 | 2.060  | 2.485  | 2.787  | 25           |
| 26                   | 1.315 | 1.706 | 2.056  | 2.479  | 2.779  | 26           |
| 27                   | 1.314 | 1.703 | 2.052  | 2.473  | 2.771  | 27           |
| 28                   | 1.313 | 1.701 | 2.048  | 2.467  | 2.763  | 28           |
| 29                   | 1.311 | 1.699 | 2.045  | 2.462  | 2.756  | 29           |
| 30                   | 1.310 | 1.697 | 2.042  | 2.457  | 2.750  | 30           |
| 32                   | 1.309 | 1.694 | 2.037  | 2.449  | 2.738  | 32           |
| 35                   | 1.306 | 1.690 | 2.030  | 2.438  | 2.724  | 35           |
| 40                   | 1.303 | 1.684 | 2.021  | 2.423  | 2.704  | 40           |
| 45                   | 1.301 | 1.679 | 2.014  | 2.412  | 2.690  | 45           |
| 50                   | 1.299 | 1.676 | 2.009  | 2.403  | 2.678  | 50           |
| 60                   | 1.296 | 1.671 | 2.000  | 2.390  | 2.660  | 60           |
| 75                   | 1.293 | 1.665 | 1.992  | 2.377  | 2.643  | 75           |
| 90                   | 1.291 | 1.662 | 1.987  | 2.368  | 2.632  | 90           |
| 120                  | 1.289 | 1.658 | 1.980  | 2.358  | 2.617  | 120          |
| 150                  | 1.287 | 1.655 | 1.976  | 2.351  | 2.609  | 150          |
| 250                  | 1.285 | 1.651 | 1.969  | 2.341  | 2.596  | 250          |
| 500                  | 1.283 | 1.648 | 1.965  | 2.334  | 2.586  | 500          |
| 750                  | 1.283 | 1.647 | 1.963  | 2.331  | 2.582  | 750          |
| 1000                 | 1.282 | 1.646 | 1.962  | 2.330  | 2.581  | 1000         |
| normal $\infty$ (z)  | 1.282 | 1.645 | 1.960  | 2.326  | 2.576  | (z) $\infty$ |
| confidence levels    | 80%   | 90%   | 95%    | 98%    | 99%    |              |

**Table  $\chi^2$ : Critical values for the Chi-Squared distributions**

| <b>Right tail probability</b> | 0.10    | 0.05    | 0.025   | 0.01    | 0.005   |
|-------------------------------|---------|---------|---------|---------|---------|
| <b>df</b>                     |         |         |         |         |         |
| 1                             | 2.706   | 3.841   | 5.024   | 6.635   | 7.879   |
| 2                             | 4.605   | 5.991   | 7.378   | 9.210   | 10.597  |
| 3                             | 6.251   | 7.815   | 9.348   | 11.345  | 12.838  |
| 4                             | 7.779   | 9.488   | 11.143  | 13.277  | 14.860  |
| 5                             | 9.236   | 11.070  | 12.833  | 15.086  | 16.750  |
| 6                             | 10.645  | 12.592  | 14.449  | 16.812  | 18.548  |
| 7                             | 12.017  | 14.067  | 16.013  | 18.475  | 20.278  |
| 8                             | 13.362  | 15.507  | 17.535  | 20.090  | 21.955  |
| 9                             | 14.684  | 16.919  | 19.023  | 21.666  | 23.589  |
| 10                            | 15.987  | 18.307  | 20.483  | 23.209  | 25.188  |
| 11                            | 17.275  | 19.675  | 21.920  | 24.725  | 26.757  |
| 12                            | 18.549  | 21.026  | 23.337  | 26.217  | 28.300  |
| 13                            | 19.812  | 22.362  | 24.736  | 27.688  | 29.819  |
| 14                            | 21.064  | 23.685  | 26.119  | 29.141  | 31.319  |
| 15                            | 22.307  | 24.996  | 27.488  | 30.578  | 32.801  |
| 16                            | 23.542  | 26.296  | 28.845  | 32.000  | 34.267  |
| 17                            | 24.769  | 27.587  | 30.191  | 33.409  | 35.718  |
| 18                            | 25.989  | 28.869  | 31.526  | 34.805  | 37.156  |
| 19                            | 27.204  | 30.144  | 32.852  | 36.191  | 38.582  |
| 20                            | 28.412  | 31.410  | 34.170  | 37.566  | 39.997  |
| 21                            | 29.615  | 32.671  | 35.479  | 38.932  | 41.401  |
| 22                            | 30.813  | 33.924  | 36.781  | 40.289  | 42.796  |
| 23                            | 32.007  | 35.172  | 38.076  | 41.638  | 44.181  |
| 24                            | 33.196  | 36.415  | 39.364  | 42.980  | 45.559  |
| 25                            | 34.382  | 37.652  | 40.646  | 44.314  | 46.928  |
| 26                            | 35.563  | 38.885  | 41.923  | 45.642  | 48.290  |
| 27                            | 36.741  | 40.113  | 43.195  | 46.963  | 49.645  |
| 28                            | 37.916  | 41.337  | 44.461  | 48.278  | 50.993  |
| 29                            | 39.087  | 42.557  | 45.722  | 49.588  | 52.336  |
| 30                            | 40.256  | 43.773  | 46.979  | 50.892  | 53.672  |
| 40                            | 51.805  | 55.758  | 59.342  | 63.691  | 66.766  |
| 50                            | 63.167  | 67.505  | 71.420  | 76.154  | 79.490  |
| 60                            | 74.397  | 79.082  | 83.298  | 88.379  | 91.952  |
| 70                            | 85.527  | 90.531  | 95.023  | 100.425 | 104.215 |
| 80                            | 96.578  | 101.879 | 106.629 | 112.329 | 116.321 |
| 90                            | 107.565 | 113.145 | 118.136 | 124.116 | 128.299 |
| 100                           | 118.498 | 124.342 | 129.561 | 135.807 | 140.169 |
| 110                           | 129.385 | 135.480 | 140.917 | 147.414 | 151.948 |
| 120                           | 140.233 | 146.567 | 152.211 | 158.950 | 163.648 |