

Table A.3 Normal Probability Table

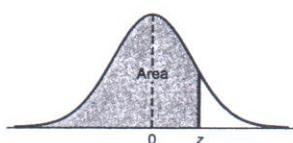
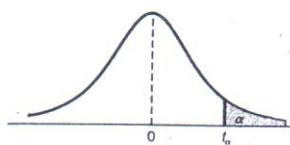


Table A.3 Areas under the Normal Curve

| <i>z</i> | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .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 |

Table A.3 (continued) Areas under the Normal Curve

Table A.4 Student *t*-Distribution Probability TableTable A.4 Critical Values of the *t*-Distribution

| <i>v</i> | α | | | | | | |
|----------|----------|-------|-------|-------|-------|-------|--------|
| | 0.40 | 0.30 | 0.20 | 0.15 | 0.10 | 0.05 | 0.025 |
| 1 | 0.325 | 0.727 | 1.376 | 1.963 | 3.078 | 6.314 | 12.706 |
| 2 | 0.289 | 0.617 | 1.061 | 1.386 | 1.886 | 2.920 | 4.303 |
| 3 | 0.277 | 0.584 | 0.978 | 1.250 | 1.638 | 2.353 | 3.182 |
| 4 | 0.271 | 0.569 | 0.941 | 1.190 | 1.533 | 2.132 | 2.776 |
| 5 | 0.267 | 0.559 | 0.920 | 1.156 | 1.476 | 2.015 | 2.571 |
| 6 | 0.265 | 0.553 | 0.906 | 1.134 | 1.440 | 1.943 | 2.447 |
| 7 | 0.263 | 0.549 | 0.896 | 1.119 | 1.415 | 1.895 | 2.365 |
| 8 | 0.262 | 0.546 | 0.889 | 1.108 | 1.397 | 1.860 | 2.306 |
| 9 | 0.261 | 0.543 | 0.883 | 1.100 | 1.383 | 1.833 | 2.262 |
| 10 | 0.260 | 0.542 | 0.879 | 1.093 | 1.372 | 1.812 | 2.228 |
| 11 | 0.260 | 0.540 | 0.876 | 1.088 | 1.363 | 1.796 | 2.201 |
| 12 | 0.259 | 0.539 | 0.873 | 1.083 | 1.356 | 1.782 | 2.179 |
| 13 | 0.259 | 0.538 | 0.870 | 1.079 | 1.350 | 1.771 | 2.160 |
| 14 | 0.258 | 0.537 | 0.868 | 1.076 | 1.345 | 1.761 | 2.145 |
| 15 | 0.258 | 0.536 | 0.866 | 1.074 | 1.341 | 1.753 | 2.131 |
| 16 | 0.258 | 0.535 | 0.865 | 1.071 | 1.337 | 1.746 | 2.120 |
| 17 | 0.257 | 0.534 | 0.863 | 1.069 | 1.333 | 1.740 | 2.110 |
| 18 | 0.257 | 0.534 | 0.862 | 1.067 | 1.330 | 1.734 | 2.101 |
| 19 | 0.257 | 0.533 | 0.861 | 1.066 | 1.328 | 1.729 | 2.093 |
| 20 | 0.257 | 0.533 | 0.860 | 1.064 | 1.325 | 1.725 | 2.086 |
| 21 | 0.257 | 0.532 | 0.859 | 1.063 | 1.323 | 1.721 | 2.080 |
| 22 | 0.256 | 0.532 | 0.858 | 1.061 | 1.321 | 1.717 | 2.074 |
| 23 | 0.256 | 0.532 | 0.858 | 1.060 | 1.319 | 1.714 | 2.069 |
| 24 | 0.256 | 0.531 | 0.857 | 1.059 | 1.318 | 1.711 | 2.064 |
| 25 | 0.256 | 0.531 | 0.856 | 1.058 | 1.316 | 1.708 | 2.060 |
| 26 | 0.256 | 0.531 | 0.856 | 1.058 | 1.315 | 1.706 | 2.056 |
| 27 | 0.256 | 0.531 | 0.855 | 1.057 | 1.314 | 1.703 | 2.052 |
| 28 | 0.256 | 0.530 | 0.855 | 1.056 | 1.313 | 1.701 | 2.048 |
| 29 | 0.256 | 0.530 | 0.854 | 1.055 | 1.311 | 1.699 | 2.045 |
| 30 | 0.256 | 0.530 | 0.854 | 1.055 | 1.310 | 1.697 | 2.042 |
| 40 | 0.255 | 0.529 | 0.851 | 1.050 | 1.303 | 1.684 | 2.021 |
| 60 | 0.254 | 0.527 | 0.848 | 1.045 | 1.296 | 1.671 | 2.000 |
| 120 | 0.254 | 0.526 | 0.845 | 1.041 | 1.289 | 1.658 | 1.980 |
| ∞ | 0.253 | 0.524 | 0.842 | 1.036 | 1.282 | 1.645 | 1.960 |

Table A.4 (continued) Critical Values of the *t*-Distribution

| <i>v</i> | α | | | | | | |
|----------|----------|--------|--------|--------|--------|---------|---------|
| | 0.02 | 0.015 | 0.01 | 0.0075 | 0.005 | 0.0025 | 0.0005 |
| 1 | 15.894 | 21.205 | 31.821 | 42.433 | 63.656 | 127.321 | 636.578 |
| 2 | 4.849 | 5.643 | 6.965 | 8.073 | 9.925 | 14.089 | 31.600 |
| 3 | 3.482 | 3.896 | 4.541 | 5.047 | 5.841 | 7.453 | 12.924 |
| 4 | 2.999 | 3.298 | 3.747 | 4.088 | 4.604 | 5.598 | 8.610 |
| 5 | 2.757 | 3.003 | 3.365 | 3.634 | 4.032 | 4.773 | 6.869 |
| 6 | 2.612 | 2.829 | 3.143 | 3.372 | 3.707 | 4.317 | 5.959 |
| 7 | 2.517 | 2.715 | 2.998 | 3.203 | 3.499 | 4.029 | 5.408 |
| 8 | 2.449 | 2.634 | 2.896 | 3.085 | 3.355 | 3.833 | 5.041 |
| 9 | 2.398 | 2.574 | 2.821 | 2.998 | 3.250 | 3.690 | 4.781 |
| 10 | 2.359 | 2.527 | 2.764 | 2.932 | 3.169 | 3.581 | 4.587 |
| 11 | 2.328 | 2.491 | 2.718 | 2.879 | 3.106 | 3.497 | 4.437 |
| 12 | 2.303 | 2.461 | 2.681 | 2.836 | 3.055 | 3.428 | 4.318 |
| 13 | 2.282 | 2.436 | 2.650 | 2.801 | 3.012 | 3.372 | 4.221 |
| 14 | 2.264 | 2.415 | 2.624 | 2.771 | 2.977 | 3.326 | 4.140 |
| 15 | 2.249 | 2.397 | 2.602 | 2.746 | 2.947 | 3.286 | 4.073 |
| 16 | 2.235 | 2.382 | 2.583 | 2.724 | 2.921 | 3.252 | 4.015 |
| 17 | 2.224 | 2.368 | 2.567 | 2.706 | 2.898 | 3.222 | 3.965 |
| 18 | 2.214 | 2.356 | 2.552 | 2.689 | 2.878 | 3.197 | 3.922 |
| 19 | 2.205 | 2.346 | 2.539 | 2.674 | 2.861 | 3.174 | 3.883 |
| 20 | 2.197 | 2.336 | 2.528 | 2.661 | 2.845 | 3.153 | 3.850 |
| 21 | 2.189 | 2.328 | 2.518 | 2.649 | 2.831 | 3.135 | 3.819 |
| 22 | 2.183 | 2.320 | 2.508 | 2.639 | 2.819 | 3.119 | 3.792 |
| 23 | 2.177 | 2.313 | 2.500 | 2.629 | 2.807 | 3.104 | 3.768 |
| 24 | 2.172 | 2.307 | 2.492 | 2.620 | 2.797 | 3.091 | 3.745 |
| 25 | 2.167 | 2.301 | 2.485 | 2.612 | 2.787 | 3.078 | 3.725 |
| 26 | 2.162 | 2.296 | 2.479 | 2.605 | 2.779 | 3.067 | 3.707 |
| 27 | 2.158 | 2.291 | 2.473 | 2.598 | 2.771 | 3.057 | 3.689 |
| 28 | 2.154 | 2.286 | 2.467 | 2.592 | 2.763 | 3.047 | 3.674 |
| 29 | 2.150 | 2.282 | 2.462 | 2.586 | 2.756 | 3.038 | 3.660 |
| 30 | 2.147 | 2.278 | 2.457 | 2.581 | 2.750 | 3.030 | 3.646 |
| 40 | 2.123 | 2.250 | 2.423 | 2.542 | 2.704 | 2.971 | 3.551 |
| 60 | 2.099 | 2.223 | 2.390 | 2.504 | 2.660 | 2.915 | 3.460 |
| 120 | 2.076 | 2.196 | 2.358 | 2.468 | 2.617 | 2.860 | 3.373 |
| ∞ | 2.054 | 2.170 | 2.326 | 2.432 | 2.576 | 2.807 | 3.290 |

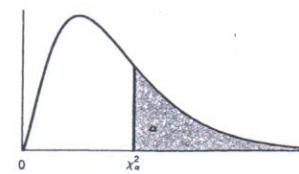


Table A.5 Critical Values of the Chi-Squared Distribution

| v | α | | | | | | | | | |
|-----|----------------------|----------------------|----------------------|----------------------|---------|--------|--------|--------|--------|--------|
| | 0.995 | 0.99 | 0.98 | 0.975 | 0.95 | 0.90 | 0.80 | 0.75 | 0.70 | 0.50 |
| 1 | 0.0 ⁴ 393 | 0.0 ³ 157 | 0.0 ³ 628 | 0.0 ³ 982 | 0.00393 | 0.0158 | 0.0642 | 0.102 | 0.148 | 0.455 |
| 2 | 0.0100 | 0.0201 | 0.0404 | 0.0506 | 0.103 | 0.211 | 0.446 | 0.575 | 0.713 | 1.386 |
| 3 | 0.0717 | 0.115 | 0.185 | 0.216 | 0.352 | 0.584 | 1.005 | 1.213 | 1.424 | 2.366 |
| 4 | 0.207 | 0.297 | 0.429 | 0.484 | 0.711 | 1.064 | 1.649 | 1.923 | 2.195 | 3.357 |
| 5 | 0.412 | 0.554 | 0.752 | 0.831 | 1.145 | 1.610 | 2.343 | 2.675 | 3.000 | 4.351 |
| 6 | 0.676 | 0.872 | 1.134 | 1.237 | 1.635 | 2.204 | 3.070 | 3.455 | 3.828 | 5.348 |
| 7 | 0.989 | 1.239 | 1.564 | 1.690 | 2.167 | 2.833 | 3.822 | 4.255 | 4.671 | 6.346 |
| 8 | 1.344 | 1.647 | 2.032 | 2.180 | 2.733 | 3.490 | 4.594 | 5.071 | 5.527 | 7.344 |
| 9 | 1.735 | 2.088 | 2.532 | 2.700 | 3.325 | 4.168 | 5.380 | 5.899 | 6.393 | 8.343 |
| 10 | 2.156 | 2.558 | 3.059 | 3.247 | 3.940 | 4.865 | 6.179 | 6.737 | 7.267 | 9.342 |
| 11 | 2.603 | 3.053 | 3.609 | 3.816 | 4.575 | 5.578 | 6.989 | 7.584 | 8.148 | 10.341 |
| 12 | 3.074 | 3.571 | 4.178 | 4.404 | 5.226 | 6.304 | 7.807 | 8.438 | 9.034 | 11.340 |
| 13 | 3.565 | 4.107 | 4.765 | 5.009 | 5.892 | 7.041 | 8.634 | 9.299 | 9.926 | 12.340 |
| 14 | 4.075 | 4.660 | 5.368 | 5.629 | 6.571 | 7.790 | 9.467 | 10.165 | 10.821 | 13.339 |
| 15 | 4.601 | 5.229 | 5.985 | 6.262 | 7.261 | 8.547 | 10.307 | 11.037 | 11.721 | 14.339 |
| 16 | 5.142 | 5.812 | 6.614 | 6.908 | 7.962 | 9.312 | 11.152 | 11.912 | 12.624 | 15.338 |
| 17 | 5.697 | 6.408 | 7.255 | 7.564 | 8.672 | 10.085 | 12.002 | 12.792 | 13.531 | 16.338 |
| 18 | 6.265 | 7.015 | 7.906 | 8.231 | 9.390 | 10.865 | 12.857 | 13.675 | 14.440 | 17.338 |
| 19 | 6.844 | 7.633 | 8.567 | 8.907 | 10.117 | 11.651 | 13.716 | 14.562 | 15.352 | 18.338 |
| 20 | 7.434 | 8.260 | 9.237 | 9.591 | 10.851 | 12.443 | 14.578 | 15.452 | 16.266 | 19.337 |
| 21 | 8.034 | 8.897 | 9.915 | 10.283 | 11.591 | 13.240 | 15.445 | 16.344 | 17.182 | 20.337 |
| 22 | 8.643 | 9.542 | 10.600 | 10.982 | 12.338 | 14.041 | 16.314 | 17.240 | 18.101 | 21.337 |
| 23 | 9.260 | 10.196 | 11.293 | 11.689 | 13.091 | 14.848 | 17.187 | 18.137 | 19.021 | 22.337 |
| 24 | 9.886 | 10.856 | 11.992 | 12.401 | 13.848 | 15.659 | 18.062 | 19.037 | 19.943 | 23.337 |
| 25 | 10.520 | 11.524 | 12.697 | 13.120 | 14.611 | 16.473 | 18.940 | 19.939 | 20.867 | 24.337 |
| 26 | 11.160 | 12.198 | 13.409 | 13.844 | 15.379 | 17.292 | 19.820 | 20.843 | 21.792 | 25.336 |
| 27 | 11.808 | 12.878 | 14.125 | 14.573 | 16.151 | 18.114 | 20.703 | 21.749 | 22.719 | 26.336 |
| 28 | 12.461 | 13.565 | 14.847 | 15.308 | 16.928 | 18.939 | 21.588 | 22.657 | 23.647 | 27.336 |
| 29 | 13.121 | 14.256 | 15.574 | 16.047 | 17.708 | 19.768 | 22.475 | 23.567 | 24.577 | 28.336 |
| 30 | 13.787 | 14.953 | 16.306 | 16.791 | 18.493 | 20.599 | 23.364 | 24.478 | 25.508 | 29.336 |
| 40 | 20.707 | 22.164 | 23.838 | 24.433 | 26.509 | 29.051 | 32.345 | 33.66 | 34.872 | 39.335 |
| 50 | 27.991 | 29.707 | 31.664 | 32.357 | 34.764 | 37.689 | 41.449 | 42.942 | 44.313 | 49.335 |
| 60 | 35.534 | 37.485 | 39.699 | 40.482 | 43.188 | 46.459 | 50.641 | 52.294 | 53.809 | 59.335 |

Table A.5 (continued) Critical Values of the Chi-Squared Distribution

| v | α | | | | | | | | | |
|-----|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | 0.30 | 0.25 | 0.20 | 0.10 | 0.05 | 0.025 | 0.02 | 0.01 | 0.005 | 0.001 |
| 1 | 1.074 | 1.323 | 1.642 | 2.706 | 3.841 | 5.024 | 5.412 | 6.635 | 7.879 | 10.827 |
| 2 | 2.408 | 2.773 | 3.219 | 4.605 | 5.991 | 7.378 | 7.824 | 9.210 | 10.597 | 13.815 |
| 3 | 3.665 | 4.108 | 4.642 | 6.251 | 7.815 | 9.348 | 9.837 | 11.345 | 12.838 | 16.266 |
| 4 | 4.878 | 5.385 | 5.989 | 7.779 | 9.488 | 11.143 | 11.668 | 13.277 | 14.860 | 18.466 |
| 5 | 6.064 | 6.626 | 7.289 | 9.236 | 11.070 | 12.832 | 13.388 | 15.086 | 16.750 | 20.515 |
| 6 | 7.231 | 7.841 | 8.558 | 10.645 | 12.592 | 14.449 | 15.033 | 16.812 | 18.548 | 22.457 |
| 7 | 8.383 | 9.037 | 9.803 | 12.017 | 14.067 | 16.013 | 16.622 | 18.475 | 20.278 | 24.321 |
| 8 | 9.524 | 10.219 | 11.030 | 13.362 | 15.507 | 17.535 | 18.168 | 20.090 | 21.955 | 26.124 |
| 9 | 10.656 | 11.389 | 12.242 | 14.684 | 16.919 | 19.023 | 19.679 | 21.666 | 23.589 | 27.877 |
| 10 | 11.781 | 12.549 | 13.442 | 15.987 | 18.307 | 20.483 | 21.161 | 23.209 | 25.188 | 29.588 |
| 11 | 12.899 | 13.701 | 14.631 | 17.275 | 19.675 | 21.920 | 22.618 | 24.725 | 26.757 | 31.264 |
| 12 | 14.011 | 14.845 | 15.812 | 18.549 | 21.026 | 23.337 | 24.054 | 26.217 | 28.300 | 32.909 |
| 13 | 15.119 | 15.984 | 16.985 | 19.812 | 22.362 | 24.736 | 25.471 | 27.688 | 29.819 | 34.527 |
| 14 | 16.222 | 17.117 | 18.151 | 21.064 | 23.685 | 26.119 | 26.873 | 29.141 | 31.319 | 36.124 |
| 15 | 17.322 | 18.245 | 19.311 | 22.307 | 24.996 | 27.488 | 28.259 | 30.578 | 32.801 | 37.698 |
| 16 | 18.418 | 19.369 | 20.465 | 23.542 | 26.296 | 28.845 | 29.633 | 32.000 | 34.267 | 39.252 |
| 17 | 19.511 | 20.489 | 21.615 | 24.769 | 27.587 | 30.191 | 30.995 | 33.409 | 35.718 | 40.791 |
| 18 | 20.601 | 21.605 | 22.760 | 25.989 | 28.869 | 31.526 | 32.346 | 34.805 | 37.156 | 42.312 |
| 19 | 21.689 | 22.718 | 23.900 | 27.204 | 30.144 | 32.852 | 33.687 | 36.191 | 38.582 | 43.819 |
| 20 | 22.775 | 23.828 | 25.038 | 28.412 | 31.410 | 34.170 | 35.020 | 37.566 | 39.997 | 45.314 |
| 21 | 23.858 | 24.935 | 26.171 | 29.615 | 32.671 | 35.479 | 36.343 | 38.932 | 41.401 | 46.796 |
| 22 | 24.939 | 26.039 | 27.301 | 30.813 | 33.924 | 36.781 | 37.659 | 40.289 | 42.796 | 48.268 |
| 23 | 26.018 | 27.141 | 28.429 | 32.007 | 35.172 | 38.076 | 38.968 | 41.638 | 44.181 | 49.728 |
| 24 | 27.096 | 28.241 | 29.553 | 33.196 | 36.415 | 39.364 | 40.270 | 42.980 | 45.558 | 51.179 |
| 25 | 28.172 | 29.339 | 30.675 | 34.382 | 37.652 | 40.646 | 41.566 | 44.314 | 46.928 | 52.619 |
| 26 | 29.246 | 30.435 | 31.795 | 35.563 | 38.885 | 41.923 | 42.856 | 45.642 | 48.290 | 54.051 |
| 27 | 30.319 | 31.528 | 32.912 | 36.741 | 40.113 | 43.195 | 44.140 | 46.963 | 49.645 | 55.475 |
| 28 | 31.391 | 32.620 | 34.027 | 37.916 | 41.337 | 44.461 | 45.419 | 48.278 | 50.994 | 56.892 |
| 29 | 32.461 | 33.711 | 35.139 | 39.087 | 42.557 | 45.722 | 46.693 | 49.588 | 52.335 | 58.301 |
| 30 | 33.530 | 34.800 | 36.250 | 40.256 | 43.773 | 46.979 | 47.962 | 50.892 | 53.672 | 59.702 |
| 40 | 44.165 | 45.616 | 47.269 | 51.805 | 55.758 | 59.342 | 60.436 | 63.691 | 66.766 | 73.403 |
| 50 | 54.723 | 56.334 | 58.164 | 63.167 | 67.505 | 71.420 | 72.613 | 76.154 | 79.490 | 86.660 |
| 60 | 65.226 | 66.981 | 68.972 | 74.397 | 79.082 | 83.298 | 84.58 | 88.379 | 91.952 | 99.608 |

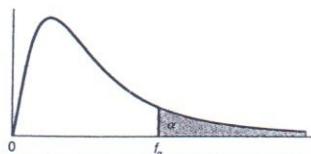


Table A.6* Critical Values of the F-Distribution

| v_2 | $f_{0.05}(v_1, v_2)$ | | | | | | | | |
|----------|----------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | 161.45 | 199.50 | 215.71 | 224.58 | 230.16 | 233.99 | 236.77 | 238.88 | 240.54 |
| 2 | 18.51 | 19.00 | 19.16 | 19.25 | 19.30 | 19.33 | 19.35 | 19.37 | 19.38 |
| 3 | 10.13 | 9.55 | 9.28 | 9.12 | 9.01 | 8.94 | 8.89 | 8.85 | 8.81 |
| 4 | 7.71 | 6.94 | 6.59 | 6.39 | 6.26 | 6.16 | 6.09 | 6.04 | 6.00 |
| 5 | 6.61 | 5.79 | 5.41 | 5.19 | 5.05 | 4.95 | 4.88 | 4.82 | 4.77 |
| 6 | 5.99 | 5.14 | 4.76 | 4.53 | 4.39 | 4.28 | 4.21 | 4.15 | 4.10 |
| 7 | 5.59 | 4.74 | 4.35 | 4.12 | 3.97 | 3.87 | 3.79 | 3.73 | 3.68 |
| 8 | 5.32 | 4.46 | 4.07 | 3.84 | 3.69 | 3.58 | 3.50 | 3.44 | 3.39 |
| 9 | 5.12 | 4.26 | 3.86 | 3.63 | 3.48 | 3.37 | 3.29 | 3.23 | 3.18 |
| 10 | 4.96 | 4.10 | 3.71 | 3.48 | 3.33 | 3.22 | 3.14 | 3.07 | 3.02 |
| 11 | 4.84 | 3.98 | 3.59 | 3.36 | 3.20 | 3.09 | 3.01 | 2.95 | 2.90 |
| 12 | 4.75 | 3.89 | 3.49 | 3.26 | 3.11 | 3.00 | 2.91 | 2.85 | 2.80 |
| 13 | 4.67 | 3.81 | 3.41 | 3.18 | 3.03 | 2.92 | 2.83 | 2.77 | 2.71 |
| 14 | 4.60 | 3.74 | 3.34 | 3.11 | 2.96 | 2.85 | 2.76 | 2.70 | 2.65 |
| 15 | 4.54 | 3.68 | 3.29 | 3.06 | 2.90 | 2.79 | 2.71 | 2.64 | 2.59 |
| 16 | 4.49 | 3.63 | 3.24 | 3.01 | 2.85 | 2.74 | 2.66 | 2.59 | 2.54 |
| 17 | 4.45 | 3.59 | 3.20 | 2.96 | 2.81 | 2.70 | 2.61 | 2.55 | 2.49 |
| 18 | 4.41 | 3.55 | 3.16 | 2.93 | 2.77 | 2.66 | 2.58 | 2.51 | 2.46 |
| 19 | 4.38 | 3.52 | 3.13 | 2.90 | 2.74 | 2.63 | 2.54 | 2.48 | 2.42 |
| 20 | 4.35 | 3.49 | 3.10 | 2.87 | 2.71 | 2.60 | 2.51 | 2.45 | 2.39 |
| 21 | 4.32 | 3.47 | 3.07 | 2.84 | 2.68 | 2.57 | 2.49 | 2.42 | 2.37 |
| 22 | 4.30 | 3.44 | 3.05 | 2.82 | 2.66 | 2.55 | 2.46 | 2.40 | 2.34 |
| 23 | 4.28 | 3.42 | 3.03 | 2.80 | 2.64 | 2.53 | 2.44 | 2.37 | 2.32 |
| 24 | 4.26 | 3.40 | 3.01 | 2.78 | 2.62 | 2.51 | 2.42 | 2.36 | 2.30 |
| 25 | 4.24 | 3.39 | 2.99 | 2.76 | 2.60 | 2.49 | 2.40 | 2.34 | 2.28 |
| 26 | 4.23 | 3.37 | 2.98 | 2.74 | 2.59 | 2.47 | 2.39 | 2.32 | 2.27 |
| 27 | 4.21 | 3.35 | 2.96 | 2.73 | 2.57 | 2.46 | 2.37 | 2.31 | 2.25 |
| 28 | 4.20 | 3.34 | 2.95 | 2.71 | 2.56 | 2.45 | 2.36 | 2.29 | 2.24 |
| 29 | 4.18 | 3.33 | 2.93 | 2.70 | 2.55 | 2.43 | 2.35 | 2.28 | 2.22 |
| 30 | 4.17 | 3.32 | 2.92 | 2.69 | 2.53 | 2.42 | 2.33 | 2.27 | 2.21 |
| 40 | 4.08 | 3.23 | 2.84 | 2.61 | 2.45 | 2.34 | 2.25 | 2.18 | 2.12 |
| 60 | 4.00 | 3.15 | 2.76 | 2.53 | 2.37 | 2.25 | 2.17 | 2.10 | 2.04 |
| 120 | 3.92 | 3.07 | 2.68 | 2.45 | 2.29 | 2.18 | 2.09 | 2.02 | 1.96 |
| ∞ | 3.84 | 3.00 | 2.60 | 2.37 | 2.21 | 2.10 | 2.01 | 1.94 | 1.88 |

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Table A.6 (continued) Critical Values of the *F*-Distribution

| v_2 | $f_{0.05}(v_1, v_2)$ | | | | | | | | | |
|----------|----------------------|--------|--------|--------|--------|--------|--------|--------|--------|----------|
| | 10 | 12 | 15 | 20 | 24 | 30 | 40 | 60 | 120 | ∞ |
| 1 | 241.88 | 243.91 | 245.95 | 248.01 | 249.05 | 250.10 | 251.14 | 252.20 | 253.25 | 254.31 |
| 2 | 19.40 | 19.41 | 19.43 | 19.45 | 19.45 | 19.46 | 19.47 | 19.48 | 19.49 | 19.50 |
| 3 | 8.79 | 8.74 | 8.70 | 8.66 | 8.64 | 8.62 | 8.59 | 8.57 | 8.55 | 8.53 |
| 4 | 5.96 | 5.91 | 5.86 | 5.80 | 5.77 | 5.75 | 5.72 | 5.69 | 5.66 | 5.63 |
| 5 | 4.74 | 4.68 | 4.62 | 4.56 | 4.53 | 4.50 | 4.46 | 4.43 | 4.40 | 4.36 |
| 6 | 4.06 | 4.00 | 3.94 | 3.87 | 3.84 | 3.81 | 3.77 | 3.74 | 3.70 | 3.67 |
| 7 | 3.64 | 3.57 | 3.51 | 3.44 | 3.41 | 3.38 | 3.34 | 3.30 | 3.27 | 3.23 |
| 8 | 3.35 | 3.28 | 3.22 | 3.15 | 3.12 | 3.08 | 3.04 | 3.01 | 2.97 | 2.93 |
| 9 | 3.14 | 3.07 | 3.01 | 2.94 | 2.90 | 2.86 | 2.83 | 2.79 | 2.75 | 2.71 |
| 10 | 2.98 | 2.91 | 2.85 | 2.77 | 2.74 | 2.70 | 2.66 | 2.62 | 2.58 | 2.54 |
| 11 | 2.85 | 2.79 | 2.72 | 2.65 | 2.61 | 2.57 | 2.53 | 2.49 | 2.45 | 2.40 |
| 12 | 2.75 | 2.69 | 2.62 | 2.54 | 2.51 | 2.47 | 2.43 | 2.38 | 2.34 | 2.30 |
| 13 | 2.67 | 2.60 | 2.53 | 2.46 | 2.42 | 2.38 | 2.34 | 2.30 | 2.25 | 2.21 |
| 14 | 2.60 | 2.53 | 2.46 | 2.39 | 2.35 | 2.31 | 2.27 | 2.22 | 2.18 | 2.13 |
| 15 | 2.54 | 2.48 | 2.40 | 2.33 | 2.29 | 2.25 | 2.20 | 2.16 | 2.11 | 2.07 |
| 16 | 2.49 | 2.42 | 2.35 | 2.28 | 2.24 | 2.19 | 2.15 | 2.11 | 2.06 | 2.01 |
| 17 | 2.45 | 2.38 | 2.31 | 2.23 | 2.19 | 2.15 | 2.10 | 2.06 | 2.01 | 1.96 |
| 18 | 2.41 | 2.34 | 2.27 | 2.19 | 2.15 | 2.11 | 2.06 | 2.02 | 1.97 | 1.92 |
| 19 | 2.38 | 2.31 | 2.23 | 2.16 | 2.11 | 2.07 | 2.03 | 1.98 | 1.93 | 1.88 |
| 20 | 2.35 | 2.28 | 2.20 | 2.12 | 2.08 | 2.04 | 1.99 | 1.95 | 1.90 | 1.84 |
| 21 | 2.32 | 2.25 | 2.18 | 2.10 | 2.05 | 2.01 | 1.96 | 1.92 | 1.87 | 1.81 |
| 22 | 2.30 | 2.23 | 2.15 | 2.07 | 2.03 | 1.98 | 1.94 | 1.89 | 1.84 | 1.78 |
| 23 | 2.27 | 2.20 | 2.13 | 2.05 | 2.01 | 1.96 | 1.91 | 1.86 | 1.81 | 1.76 |
| 24 | 2.25 | 2.18 | 2.11 | 2.03 | 1.98 | 1.94 | 1.89 | 1.84 | 1.79 | 1.73 |
| 25 | 2.24 | 2.16 | 2.09 | 2.01 | 1.96 | 1.92 | 1.87 | 1.82 | 1.77 | 1.71 |
| 26 | 2.22 | 2.15 | 2.07 | 1.99 | 1.95 | 1.90 | 1.85 | 1.80 | 1.75 | 1.69 |
| 27 | 2.20 | 2.13 | 2.06 | 1.97 | 1.93 | 1.88 | 1.84 | 1.79 | 1.73 | 1.67 |
| 28 | 2.19 | 2.12 | 2.04 | 1.96 | 1.91 | 1.87 | 1.82 | 1.77 | 1.71 | 1.65 |
| 29 | 2.18 | 2.10 | 2.03 | 1.94 | 1.90 | 1.85 | 1.81 | 1.75 | 1.70 | 1.64 |
| 30 | 2.16 | 2.09 | 2.01 | 1.93 | 1.89 | 1.84 | 1.79 | 1.74 | 1.68 | 1.62 |
| 40 | 2.08 | 2.00 | 1.92 | 1.84 | 1.79 | 1.74 | 1.69 | 1.64 | 1.58 | 1.51 |
| 60 | 1.99 | 1.92 | 1.84 | 1.75 | 1.70 | 1.65 | 1.59 | 1.53 | 1.47 | 1.39 |
| 120 | 1.91 | 1.83 | 1.75 | 1.66 | 1.61 | 1.55 | 1.50 | 1.43 | 1.35 | 1.25 |
| ∞ | 1.83 | 1.75 | 1.67 | 1.57 | 1.52 | 1.46 | 1.39 | 1.32 | 1.22 | 1.00 |

Table A.6 (continued) Critical Values of the F-Distribution

| v_2 | $f_{0.01}(v_1, v_2)$ | | | | | | | | |
|----------|----------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | 4052.18 | 4999.50 | 5403.35 | 5624.58 | 5763.65 | 5858.99 | 5928.36 | 5981.07 | 6022.47 |
| 2 | 98.50 | 99.00 | 99.17 | 99.25 | 99.30 | 99.33 | 99.36 | 99.37 | 99.39 |
| 3 | 34.12 | 30.82 | 29.46 | 28.71 | 28.24 | 27.91 | 27.67 | 27.49 | 27.35 |
| 4 | 21.20 | 18.00 | 16.69 | 15.98 | 15.52 | 15.21 | 14.98 | 14.80 | 14.66 |
| 5 | 16.26 | 13.27 | 12.06 | 11.39 | 10.97 | 10.67 | 10.46 | 10.29 | 10.16 |
| 6 | 13.75 | 10.92 | 9.78 | 9.15 | 8.75 | 8.47 | 8.26 | 8.10 | 7.98 |
| 7 | 12.25 | 9.55 | 8.45 | 7.85 | 7.46 | 7.19 | 6.99 | 6.84 | 6.72 |
| 8 | 11.26 | 8.65 | 7.59 | 7.01 | 6.63 | 6.37 | 6.18 | 6.03 | 5.91 |
| 9 | 10.56 | 8.02 | 6.99 | 6.42 | 6.06 | 5.80 | 5.61 | 5.47 | 5.35 |
| 10 | 10.04 | 7.56 | 6.55 | 5.99 | 5.64 | 5.39 | 5.20 | 5.06 | 4.94 |
| 11 | 9.65 | 7.21 | 6.22 | 5.67 | 5.32 | 5.07 | 4.89 | 4.74 | 4.63 |
| 12 | 9.33 | 6.93 | 5.95 | 5.41 | 5.06 | 4.82 | 4.64 | 4.50 | 4.39 |
| 13 | 9.07 | 6.70 | 5.74 | 5.21 | 4.86 | 4.62 | 4.44 | 4.30 | 4.19 |
| 14 | 8.86 | 6.51 | 5.56 | 5.04 | 4.69 | 4.46 | 4.28 | 4.14 | 4.03 |
| 15 | 8.68 | 6.36 | 5.42 | 4.89 | 4.56 | 4.32 | 4.14 | 4.00 | 3.89 |
| 16 | 8.53 | 6.23 | 5.29 | 4.77 | 4.44 | 4.20 | 4.03 | 3.89 | 3.78 |
| 17 | 8.40 | 6.11 | 5.18 | 4.67 | 4.34 | 4.10 | 3.93 | 3.79 | 3.68 |
| 18 | 8.29 | 6.01 | 5.09 | 4.58 | 4.25 | 4.01 | 3.84 | 3.71 | 3.60 |
| 19 | 8.18 | 5.93 | 5.01 | 4.50 | 4.17 | 3.94 | 3.77 | 3.63 | 3.52 |
| 20 | 8.10 | 5.85 | 4.94 | 4.43 | 4.10 | 3.87 | 3.70 | 3.56 | 3.46 |
| 21 | 8.02 | 5.78 | 4.87 | 4.37 | 4.04 | 3.81 | 3.64 | 3.51 | 3.40 |
| 22 | 7.95 | 5.72 | 4.82 | 4.31 | 3.99 | 3.76 | 3.59 | 3.45 | 3.35 |
| 23 | 7.88 | 5.66 | 4.76 | 4.26 | 3.94 | 3.71 | 3.54 | 3.41 | 3.30 |
| 24 | 7.82 | 5.61 | 4.72 | 4.22 | 3.90 | 3.67 | 3.50 | 3.36 | 3.26 |
| 25 | 7.77 | 5.57 | 4.68 | 4.18 | 3.85 | 3.63 | 3.46 | 3.32 | 3.22 |
| 26 | 7.72 | 5.53 | 4.64 | 4.14 | 3.82 | 3.59 | 3.42 | 3.29 | 3.18 |
| 27 | 7.68 | 5.49 | 4.60 | 4.11 | 3.78 | 3.56 | 3.39 | 3.26 | 3.15 |
| 28 | 7.64 | 5.45 | 4.57 | 4.07 | 3.75 | 3.53 | 3.36 | 3.23 | 3.12 |
| 29 | 7.60 | 5.42 | 4.54 | 4.04 | 3.73 | 3.50 | 3.33 | 3.20 | 3.09 |
| 30 | 7.56 | 5.39 | 4.51 | 4.02 | 3.70 | 3.47 | 3.30 | 3.17 | 3.07 |
| 40 | 7.31 | 5.18 | 4.31 | 3.83 | 3.51 | 3.29 | 3.12 | 2.99 | 2.89 |
| 60 | 7.08 | 4.98 | 4.13 | 3.65 | 3.34 | 3.12 | 2.95 | 2.82 | 2.72 |
| 120 | 6.85 | 4.79 | 3.95 | 3.48 | 3.17 | 2.96 | 2.79 | 2.66 | 2.56 |
| ∞ | 6.63 | 4.61 | 3.78 | 3.32 | 3.02 | 2.80 | 2.64 | 2.51 | 2.41 |

Table A.6 (continued) Critical Values of the *F*-Distribution

| <i>v</i> ₂ | <i>f</i> _{0.01} (<i>v</i> ₁ , <i>v</i> ₂) | | | | | | | | | |
|-----------------------|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 10 | 12 | 15 | 20 | 24 | 30 | 40 | 60 | 120 | ∞ |
| 1 | 6055.85 | 6106.32 | 6157.28 | 6208.73 | 6234.63 | 6260.65 | 6286.78 | 6313.03 | 6339.39 | 6365.86 |
| 2 | 99.40 | 99.42 | 99.43 | 99.45 | 99.46 | 99.47 | 99.47 | 99.48 | 99.49 | 99.50 |
| 3 | 27.23 | 27.05 | 26.87 | 26.69 | 26.60 | 26.50 | 26.41 | 26.32 | 26.22 | 26.13 |
| 4 | 14.55 | 14.37 | 14.20 | 14.02 | 13.93 | 13.84 | 13.75 | 13.65 | 13.56 | 13.46 |
| 5 | 10.05 | 9.89 | 9.72 | 9.55 | 9.47 | 9.38 | 9.29 | 9.20 | 9.11 | 9.02 |
| 6 | 7.87 | 7.72 | 7.56 | 7.40 | 7.31 | 7.23 | 7.14 | 7.06 | 6.97 | 6.88 |
| 7 | 6.62 | 6.47 | 6.31 | 6.16 | 6.07 | 5.99 | 5.91 | 5.82 | 5.74 | 5.65 |
| 8 | 5.81 | 5.67 | 5.52 | 5.36 | 5.28 | 5.20 | 5.12 | 5.03 | 4.95 | 4.86 |
| 9 | 5.26 | 5.11 | 4.96 | 4.81 | 4.73 | 4.65 | 4.57 | 4.48 | 4.40 | 4.31 |
| 10 | 4.85 | 4.71 | 4.56 | 4.41 | 4.33 | 4.25 | 4.17 | 4.08 | 4.00 | 3.91 |
| 11 | 4.54 | 4.40 | 4.25 | 4.10 | 4.02 | 3.94 | 3.86 | 3.78 | 3.69 | 3.60 |
| 12 | 4.30 | 4.16 | 4.01 | 3.86 | 3.78 | 3.70 | 3.62 | 3.54 | 3.45 | 3.36 |
| 13 | 4.10 | 3.96 | 3.82 | 3.66 | 3.59 | 3.51 | 3.43 | 3.34 | 3.25 | 3.17 |
| 14 | 3.94 | 3.80 | 3.66 | 3.51 | 3.43 | 3.35 | 3.27 | 3.18 | 3.09 | 3.00 |
| 15 | 3.80 | 3.67 | 3.52 | 3.37 | 3.29 | 3.21 | 3.13 | 3.05 | 2.96 | 2.87 |
| 16 | 3.69 | 3.55 | 3.41 | 3.26 | 3.18 | 3.10 | 3.02 | 2.93 | 2.84 | 2.75 |
| 17 | 3.59 | 3.46 | 3.31 | 3.16 | 3.08 | 3.00 | 2.92 | 2.83 | 2.75 | 2.65 |
| 18 | 3.51 | 3.37 | 3.23 | 3.08 | 3.00 | 2.92 | 2.84 | 2.75 | 2.66 | 2.57 |
| 19 | 3.43 | 3.30 | 3.15 | 3.00 | 2.92 | 2.84 | 2.76 | 2.67 | 2.58 | 2.49 |
| 20 | 3.37 | 3.23 | 3.09 | 2.94 | 2.86 | 2.78 | 2.69 | 2.61 | 2.52 | 2.42 |
| 21 | 3.31 | 3.17 | 3.03 | 2.88 | 2.80 | 2.72 | 2.64 | 2.55 | 2.46 | 2.36 |
| 22 | 3.26 | 3.12 | 2.98 | 2.83 | 2.75 | 2.67 | 2.58 | 2.50 | 2.40 | 2.31 |
| 23 | 3.21 | 3.07 | 2.93 | 2.78 | 2.70 | 2.62 | 2.54 | 2.45 | 2.35 | 2.26 |
| 24 | 3.17 | 3.03 | 2.89 | 2.74 | 2.66 | 2.58 | 2.49 | 2.40 | 2.31 | 2.21 |
| 25 | 3.13 | 2.99 | 2.85 | 2.70 | 2.62 | 2.54 | 2.45 | 2.36 | 2.27 | 2.17 |
| 26 | 3.09 | 2.96 | 2.81 | 2.66 | 2.58 | 2.50 | 2.42 | 2.33 | 2.23 | 2.13 |
| 27 | 3.06 | 2.93 | 2.78 | 2.63 | 2.55 | 2.47 | 2.38 | 2.29 | 2.20 | 2.10 |
| 28 | 3.03 | 2.90 | 2.75 | 2.60 | 2.52 | 2.44 | 2.35 | 2.26 | 2.17 | 2.06 |
| 29 | 3.00 | 2.87 | 2.73 | 2.57 | 2.49 | 2.41 | 2.33 | 2.23 | 2.14 | 2.03 |
| 30 | 2.98 | 2.84 | 2.70 | 2.55 | 2.47 | 2.39 | 2.30 | 2.21 | 2.11 | 2.01 |
| 40 | 2.80 | 2.66 | 2.52 | 2.37 | 2.29 | 2.20 | 2.11 | 2.02 | 1.92 | 1.80 |
| 60 | 2.63 | 2.50 | 2.35 | 2.20 | 2.12 | 2.03 | 1.94 | 1.84 | 1.73 | 1.60 |
| 120 | 2.47 | 2.34 | 2.19 | 2.03 | 1.95 | 1.86 | 1.76 | 1.66 | 1.53 | 1.38 |
| ∞ | 2.32 | 2.18 | 2.04 | 1.88 | 1.79 | 1.70 | 1.59 | 1.47 | 1.32 | 1.00 |

Table of Critical Values for Pearson's r

| Level of Significance for a One-Tailed Test | | | | | | |
|---|---|-------|-------|--------|--------|---------|
| | .10 | .05 | .025 | .01 | .005 | .0005 |
| <i>df</i> | Level of Significance for a Two-Tailed Test | | | | | |
| | .20 | .10 | .05 | .02 | .01 | .001 |
| 1 | 0.951 | 0.988 | 0.997 | 0.9995 | 0.9999 | 0.99999 |
| 2 | 0.800 | 0.900 | 0.950 | 0.980 | 0.990 | 0.999 |
| 3 | 0.687 | 0.805 | 0.878 | 0.934 | 0.959 | 0.991 |
| 4 | 0.608 | 0.729 | 0.811 | 0.882 | 0.917 | 0.974 |
| 5 | 0.551 | 0.669 | 0.755 | 0.833 | 0.875 | 0.951 |
| 6 | 0.507 | 0.621 | 0.707 | 0.789 | 0.834 | 0.925 |
| 7 | 0.472 | 0.582 | 0.666 | 0.750 | 0.798 | 0.898 |
| 8 | 0.443 | 0.549 | 0.632 | 0.715 | 0.765 | 0.872 |
| 9 | 0.419 | 0.521 | 0.602 | 0.685 | 0.735 | 0.847 |
| 10 | 0.398 | 0.497 | 0.576 | 0.658 | 0.708 | 0.823 |
| 11 | 0.380 | 0.476 | 0.553 | 0.634 | 0.684 | 0.801 |
| 12 | 0.365 | 0.457 | 0.532 | 0.612 | 0.661 | 0.780 |
| 13 | 0.351 | 0.441 | 0.514 | 0.592 | 0.641 | 0.760 |
| 14 | 0.338 | 0.426 | 0.497 | 0.574 | 0.623 | 0.742 |
| 15 | 0.327 | 0.412 | 0.482 | 0.558 | 0.606 | 0.725 |
| 16 | 0.317 | 0.400 | 0.468 | 0.542 | 0.590 | 0.708 |
| 17 | 0.308 | 0.389 | 0.456 | 0.529 | 0.575 | 0.693 |
| 18 | 0.299 | 0.378 | 0.444 | 0.515 | 0.561 | 0.679 |
| 19 | 0.291 | 0.369 | 0.433 | 0.503 | 0.549 | 0.665 |
| 20 | 0.284 | 0.360 | 0.423 | 0.492 | 0.537 | 0.652 |
| 21 | 0.277 | 0.352 | 0.413 | 0.482 | 0.526 | 0.640 |
| 22 | 0.271 | 0.344 | 0.404 | 0.472 | 0.515 | 0.629 |
| 23 | 0.265 | 0.337 | 0.396 | 0.462 | 0.505 | 0.618 |
| 24 | 0.260 | 0.330 | 0.388 | 0.453 | 0.496 | 0.607 |
| 25 | 0.255 | 0.323 | 0.381 | 0.445 | 0.487 | 0.597 |
| 26 | 0.250 | 0.317 | 0.374 | 0.437 | 0.479 | 0.588 |
| 27 | 0.245 | 0.311 | 0.367 | 0.430 | 0.471 | 0.579 |
| 28 | 0.241 | 0.306 | 0.361 | 0.423 | 0.463 | 0.570 |
| 29 | 0.237 | 0.301 | 0.355 | 0.416 | 0.456 | 0.562 |
| 30 | 0.233 | 0.296 | 0.349 | 0.409 | 0.449 | 0.554 |
| 40 | 0.202 | 0.257 | 0.304 | 0.358 | 0.393 | 0.490 |
| 60 | 0.165 | 0.211 | 0.250 | 0.295 | 0.325 | 0.408 |
| 12 | 0 | 0.117 | 0.150 | 0.178 | 0.210 | 0.294 |
| | ∞ | 0.057 | 0.073 | 0.087 | 0.103 | 0.114 |
| | | | | | | 0.146 |

Adapted from Appendix 2 (Critical Values of t) using the square root of $[t^2/(t^2 + df)]$ Note: Critical values for Infinite df actually calculated for $df= 500$.

Critical Values of the Spearman's Ranked Correlation Coefficient (r_s)

Taken from Zar, 1984 Table B.19

| $\alpha(2):$ | 0.50 | 0.20 | 0.10 | 0.05 | 0.02 | 0.01 | 0.005 | 0.0025 | 0.001 | 0.0005 |
|--------------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|
| $\alpha(1):$ | 0.25 | 0.10 | 0.05 | 0.025 | 0.01 | 0.005 | 0.0025 | 0.001 | 0.0005 | |
| n | | | | | | | | | | |
| 4 | 0.600 | 1.000 | 1.000 | | | | | | | |
| 5 | 0.500 | 0.800 | 0.900 | 1.000 | 1.000 | | | | | |
| 6 | 0.371 | 0.657 | 0.829 | 0.886 | 0.943 | 1.000 | 1.000 | | | |
| 7 | 0.321 | 0.571 | 0.714 | 0.786 | 0.893 | 0.929 | 0.964 | 1.000 | 1.000 | |
| 8 | 0.310 | 0.524 | 0.643 | 0.738 | 0.833 | 0.881 | 0.905 | 0.952 | 0.976 | |
| 9 | 0.267 | 0.483 | 0.600 | 0.700 | 0.783 | 0.833 | 0.867 | 0.917 | 0.933 | |
| 10 | 0.248 | 0.455 | 0.564 | 0.648 | 0.745 | 0.794 | 0.830 | 0.879 | 0.903 | |
| 11 | 0.236 | 0.427 | 0.536 | 0.618 | 0.709 | 0.755 | 0.800 | 0.845 | 0.873 | |
| 12 | 0.217 | 0.406 | 0.503 | 0.587 | 0.678 | 0.727 | 0.769 | 0.818 | 0.846 | |
| 13 | 0.209 | 0.385 | 0.484 | 0.560 | 0.648 | 0.703 | 0.747 | 0.791 | 0.824 | |
| 14 | 0.200 | 0.367 | 0.464 | 0.538 | 0.626 | 0.679 | 0.723 | 0.771 | 0.802 | |
| 15 | 0.189 | 0.354 | 0.446 | 0.521 | 0.604 | 0.654 | 0.700 | 0.750 | 0.779 | |
| 16 | 0.182 | 0.341 | 0.429 | 0.503 | 0.582 | 0.635 | 0.679 | 0.729 | 0.762 | |
| 17 | 0.176 | 0.328 | 0.414 | 0.485 | 0.566 | 0.615 | 0.662 | 0.713 | 0.748 | |
| 18 | 0.170 | 0.317 | 0.401 | 0.472 | 0.550 | 0.600 | 0.643 | 0.695 | 0.728 | |
| 19 | 0.165 | 0.309 | 0.391 | 0.460 | 0.535 | 0.584 | 0.628 | 0.677 | 0.712 | |
| 20 | 0.161 | 0.299 | 0.380 | 0.447 | 0.520 | 0.570 | 0.612 | 0.662 | 0.696 | |
| 21 | 0.156 | 0.292 | 0.370 | 0.435 | 0.508 | 0.556 | 0.599 | 0.648 | 0.681 | |
| 22 | 0.152 | 0.284 | 0.361 | 0.425 | 0.496 | 0.544 | 0.586 | 0.634 | 0.667 | |
| 23 | 0.148 | 0.278 | 0.353 | 0.415 | 0.486 | 0.532 | 0.573 | 0.622 | 0.654 | |
| 24 | 0.144 | 0.271 | 0.344 | 0.406 | 0.476 | 0.521 | 0.562 | 0.610 | 0.642 | |
| 25 | 0.142 | 0.265 | 0.337 | 0.398 | 0.466 | 0.511 | 0.551 | 0.598 | 0.630 | |
| 26 | 0.138 | 0.259 | 0.331 | 0.390 | 0.457 | 0.501 | 0.541 | 0.587 | 0.619 | |
| 27 | 0.136 | 0.255 | 0.324 | 0.382 | 0.448 | 0.491 | 0.531 | 0.577 | 0.608 | |
| 28 | 0.133 | 0.250 | 0.317 | 0.375 | 0.440 | 0.483 | 0.522 | 0.567 | 0.598 | |
| 29 | 0.130 | 0.245 | 0.312 | 0.368 | 0.433 | 0.475 | 0.513 | 0.558 | 0.589 | |
| 30 | 0.128 | 0.240 | 0.306 | 0.362 | 0.425 | 0.467 | 0.504 | 0.549 | 0.580 | |
| 31 | 0.126 | 0.236 | 0.301 | 0.356 | 0.418 | 0.459 | 0.496 | 0.541 | 0.571 | |
| 32 | 0.124 | 0.232 | 0.296 | 0.350 | 0.412 | 0.452 | 0.489 | 0.533 | 0.563 | |
| 33 | 0.121 | 0.229 | 0.291 | 0.345 | 0.405 | 0.446 | 0.482 | 0.525 | 0.554 | |
| 34 | 0.120 | 0.225 | 0.287 | 0.340 | 0.399 | 0.439 | 0.475 | 0.517 | 0.547 | |
| 35 | 0.118 | 0.222 | 0.283 | 0.335 | 0.394 | 0.433 | 0.468 | 0.510 | 0.539 | |
| 36 | 0.116 | 0.219 | 0.279 | 0.330 | 0.388 | 0.427 | 0.462 | 0.504 | 0.533 | |
| 37 | 0.114 | 0.216 | 0.275 | 0.325 | 0.383 | 0.421 | 0.456 | 0.497 | 0.526 | |
| 38 | 0.113 | 0.212 | 0.271 | 0.321 | 0.378 | 0.415 | 0.450 | 0.491 | 0.519 | |
| 39 | 0.111 | 0.210 | 0.267 | 0.317 | 0.373 | 0.410 | 0.444 | 0.485 | 0.513 | |
| 40 | 0.110 | 0.207 | 0.264 | 0.313 | 0.368 | 0.405 | 0.439 | 0.479 | 0.507 | |
| 41 | 0.108 | 0.204 | 0.261 | 0.309 | 0.364 | 0.400 | 0.433 | 0.473 | 0.501 | |
| 42 | 0.107 | 0.202 | 0.257 | 0.305 | 0.359 | 0.395 | 0.428 | 0.468 | 0.495 | |
| 43 | 0.105 | 0.199 | 0.254 | 0.301 | 0.355 | 0.391 | 0.423 | 0.463 | 0.490 | |
| 44 | 0.104 | 0.197 | 0.251 | 0.298 | 0.351 | 0.386 | 0.419 | 0.458 | 0.484 | |
| 45 | 0.103 | 0.194 | 0.248 | 0.294 | 0.347 | 0.382 | 0.414 | 0.453 | 0.479 | |
| 46 | 0.102 | 0.192 | 0.246 | 0.291 | 0.343 | 0.378 | 0.410 | 0.448 | 0.474 | |
| 47 | 0.101 | 0.190 | 0.243 | 0.288 | 0.340 | 0.374 | 0.405 | 0.443 | 0.469 | |
| 48 | 0.100 | 0.188 | 0.240 | 0.285 | 0.336 | 0.370 | 0.401 | 0.439 | 0.465 | |
| 49 | 0.098 | 0.186 | 0.238 | 0.282 | 0.333 | 0.366 | 0.397 | 0.434 | 0.460 | |
| 50 | 0.097 | 0.184 | 0.235 | 0.279 | 0.329 | 0.363 | 0.393 | 0.430 | 0.456 | |

| $\alpha(2):$ | 0.50 | 0.20 | 0.10 | 0.05 | 0.02 | 0.01 | 0.005 | 0.002 | 0.001 | 0.0005 |
|--------------|-------|-------|-------|-----------|-------|-------|--------|-------|--------|--------|
| $\alpha(1):$ | 0.25 | 0.10 | 0.05 | 0.025 | 0.01 | 0.005 | 0.0025 | 0.001 | 0.0005 | |
| n | | | | | | | | | | |
| 51 | 0.096 | 0.182 | 0.233 | 0.276 | 0.326 | 0.359 | 0.390 | 0.426 | 0.451 | |
| 52 | 0.095 | 0.180 | 0.231 | 0.274 | 0.323 | 0.356 | 0.386 | 0.422 | 0.447 | |
| 53 | 0.095 | 0.179 | 0.228 | 0.271 | 0.320 | 0.352 | 0.382 | 0.418 | 0.443 | |
| 54 | 0.094 | 0.177 | 0.226 | 0.268 | 0.317 | 0.349 | 0.379 | 0.414 | 0.439 | |
| 55 | 0.093 | 0.175 | 0.224 | 0.266 | 0.314 | 0.346 | 0.375 | 0.411 | 0.435 | |
| 56 | 0.092 | 0.174 | 0.222 | 0.264 | 0.311 | 0.343 | 0.372 | 0.407 | 0.432 | |
| 57 | 0.091 | 0.172 | 0.220 | 0.261 | 0.308 | 0.340 | 0.369 | 0.404 | 0.428 | |
| 58 | 0.090 | 0.171 | 0.218 | 0.259 | 0.306 | 0.337 | 0.366 | 0.400 | 0.424 | |
| 59 | 0.089 | 0.169 | 0.216 | 0.257 | 0.303 | 0.334 | 0.363 | 0.397 | 0.421 | |
| 60 | 0.089 | 0.168 | 0.214 | 0.255 | 0.300 | 0.331 | 0.360 | 0.394 | 0.418 | |
| 61 | 0.088 | 0.166 | 0.213 | 0.252 | 0.298 | 0.329 | 0.357 | 0.391 | 0.414 | |
| 62 | 0.087 | 0.165 | 0.211 | 0.250 | 0.296 | 0.326 | 0.354 | 0.388 | 0.411 | |
| 63 | 0.086 | 0.163 | 0.209 | 0.248 | 0.293 | 0.323 | 0.351 | 0.385 | 0.408 | |
| 64 | 0.086 | 0.162 | 0.207 | 0.246 | 0.291 | 0.321 | 0.348 | 0.382 | 0.405 | |
| 65 | 0.085 | 0.161 | 0.206 | 0.244 | 0.289 | 0.318 | 0.346 | 0.379 | 0.402 | |
| 66 | 0.084 | 0.160 | 0.204 | 0.243 | 0.287 | 0.316 | 0.343 | 0.376 | 0.399 | |
| 67 | 0.084 | 0.158 | 0.203 | 0.241 | 0.284 | 0.314 | 0.341 | 0.373 | 0.396 | |
| 68 | 0.083 | 0.157 | 0.201 | 0.239 | 0.282 | 0.311 | 0.338 | 0.370 | 0.393 | |
| 69 | 0.082 | 0.156 | 0.200 | 0.237 | 0.280 | 0.309 | 0.336 | 0.368 | 0.390 | |
| 70 | 0.082 | 0.155 | 0.198 | 0.235 | 0.278 | 0.307 | 0.333 | 0.365 | 0.388 | |
| 71 | 0.081 | 0.154 | 0.197 | 0.234 | 0.276 | 0.305 | 0.331 | 0.363 | 0.385 | |
| 72 | 0.081 | 0.153 | 0.195 | 0.232 | 0.274 | 0.303 | 0.329 | 0.360 | 0.382 | |
| 73 | 0.080 | 0.152 | 0.194 | 0.230 | 0.272 | 0.301 | 0.327 | 0.358 | 0.380 | |
| 74 | 0.080 | 0.151 | 0.193 | 0.229 | 0.271 | 0.299 | 0.324 | 0.355 | 0.377 | |
| 75 | 0.079 | 0.150 | 0.191 | 0.227 | 0.269 | 0.297 | 0.322 | 0.353 | 0.375 | |
| 76 | 0.078 | 0.149 | 0.190 | 0.226 | 0.267 | 0.295 | 0.320 | 0.351 | 0.372 | |
| 77 | 0.078 | 0.148 | 0.189 | 0.224 | 0.265 | 0.293 | 0.318 | 0.349 | 0.370 | |
| 78 | 0.077 | 0.147 | 0.188 | 0.223 | 0.264 | 0.291 | 0.316 | 0.346 | 0.368 | |
| 79 | 0.077 | 0.146 | 0.186 | 0.221 | 0.262 | 0.289 | 0.314 | 0.344 | 0.365 | |
| 80 | 0.076 | 0.145 | 0.185 | 0.220 | 0.260 | 0.287 | 0.312 | 0.342 | 0.363 | |
| 81 | 0.076 | 0.144 | 0.184 | 0.219 | 0.259 | 0.285 | 0.310 | 0.340 | 0.361 | |
| 82 | 0.075 | 0.143 | 0.183 | 0.217 | 0.257 | 0.284 | 0.308 | 0.338 | 0.359 | |
| 83 | 0.075 | 0.142 | 0.182 | 0.216 | 0.255 | 0.282 | 0.306 | 0.336 | 0.357 | |
| 84 | 0.074 | 0.141 | 0.181 | 0.215 | 0.254 | 0.280 | 0.305 | 0.334 | 0.355 | |
| 85 | 0.074 | 0.140 | 0.180 | 0.213 | 0.252 | 0.279 | 0.303 | 0.332 | 0.353 | |
| 86 | 0.074 | 0.139 | 0.179 | 0.212 | 0.251 | 0.277 | 0.301 | 0.330 | 0.351 | |
| 87 | 0.073 | 0.139 | 0.177 | 0.211 | 0.250 | 0.276 | 0.299 | 0.328 | 0.349 | |
| 88 | 0.073 | 0.138 | 0.176 | 0.210 | 0.248 | 0.274 | 0.298 | 0.327 | 0.347 | |
| 89 | 0.072 | 0.137 | 0.175 | 0.209 | 0.247 | 0.272 | 0.296 | 0.325 | 0.345 | |
| 90 | 0.072 | 0.136 | 0.174 | 0.207 | 0.245 | 0.271 | 0.294 | 0.323 | 0.343 | |
| 91 | 0.072 | 0.135 | 0.173 | 0.206 | 0.244 | 0.269 | 0.293 | 0.321 | 0.341 | |
| 92 | 0.071 | 0.135 | 0.173 | 0.205 | 0.243 | 0.268 | 0.291 | 0.319 | 0.339 | |
| 93 | 0.071 | 0.134 | 0.172 | 0.204 | 0.241 | 0.267 | 0.290 | 0.318 | 0.338 | |
| 94 | 0.070 | 0.133 | 0.171 | 0.203 | 0.240 | 0.265 | 0.288 | 0.316 | 0.336 | |
| 95 | 0.070 | 0.133 | 0.170 | 0.202 | 0.239 | 0.264 | 0.287 | 0.314 | 0.334 | |
| 96 | 0.070 | 0.132 | 0.169 | 0.201 | 0.238 | 0.262 | 0.285 | 0.313 | 0.332 | |
| 97 | 0.069 | 0.131 | 0.168 | 0.200</td | | | | | | |