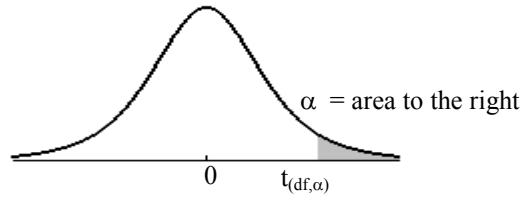
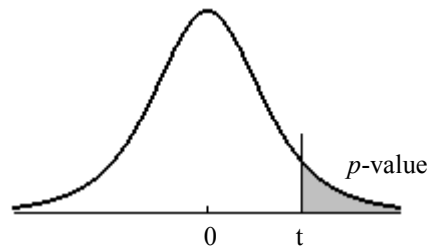


# Critical Values of Student's $t$ -Distribution



| df       | $\alpha$ = area to the right |       |       |       |       |        |        |        |
|----------|------------------------------|-------|-------|-------|-------|--------|--------|--------|
|          | 0.25                         | 0.20  | 0.15  | 0.10  | 0.05  | 0.025  | 0.01   | 0.005  |
| 1        | 1.000                        | 1.376 | 1.963 | 3.078 | 6.314 | 12.706 | 31.821 | 63.656 |
| 2        | 0.816                        | 1.061 | 1.386 | 1.886 | 2.920 | 4.303  | 6.965  | 9.925  |
| 3        | 0.765                        | 0.978 | 1.250 | 1.638 | 2.353 | 3.182  | 4.541  | 5.841  |
| 4        | 0.741                        | 0.941 | 1.190 | 1.533 | 2.132 | 2.776  | 3.747  | 4.604  |
| 5        | 0.727                        | 0.920 | 1.156 | 1.476 | 2.015 | 2.571  | 3.365  | 4.032  |
| 6        | 0.718                        | 0.906 | 1.134 | 1.440 | 1.943 | 2.447  | 3.143  | 3.707  |
| 7        | 0.711                        | 0.896 | 1.119 | 1.415 | 1.895 | 2.365  | 2.998  | 3.499  |
| 8        | 0.706                        | 0.889 | 1.108 | 1.397 | 1.860 | 2.306  | 2.896  | 3.355  |
| 9        | 0.703                        | 0.883 | 1.100 | 1.383 | 1.833 | 2.262  | 2.821  | 3.250  |
| 10       | 0.700                        | 0.879 | 1.093 | 1.372 | 1.812 | 2.228  | 2.764  | 3.169  |
| 11       | 0.697                        | 0.876 | 1.088 | 1.363 | 1.796 | 2.201  | 2.718  | 3.106  |
| 12       | 0.695                        | 0.873 | 1.083 | 1.356 | 1.782 | 2.179  | 2.681  | 3.055  |
| 13       | 0.694                        | 0.870 | 1.079 | 1.350 | 1.771 | 2.160  | 2.650  | 3.012  |
| 14       | 0.692                        | 0.868 | 1.076 | 1.345 | 1.761 | 2.145  | 2.624  | 2.977  |
| 15       | 0.691                        | 0.866 | 1.074 | 1.341 | 1.753 | 2.131  | 2.602  | 2.947  |
| 16       | 0.690                        | 0.865 | 1.071 | 1.337 | 1.746 | 2.120  | 2.583  | 2.921  |
| 17       | 0.689                        | 0.863 | 1.069 | 1.333 | 1.740 | 2.110  | 2.567  | 2.898  |
| 18       | 0.688                        | 0.862 | 1.067 | 1.330 | 1.734 | 2.101  | 2.552  | 2.878  |
| 19       | 0.688                        | 0.861 | 1.066 | 1.328 | 1.729 | 2.093  | 2.539  | 2.861  |
| 20       | 0.687                        | 0.860 | 1.064 | 1.325 | 1.725 | 2.086  | 2.528  | 2.845  |
| 21       | 0.686                        | 0.859 | 1.063 | 1.323 | 1.721 | 2.080  | 2.518  | 2.831  |
| 22       | 0.686                        | 0.858 | 1.061 | 1.321 | 1.717 | 2.074  | 2.508  | 2.819  |
| 23       | 0.685                        | 0.858 | 1.060 | 1.319 | 1.714 | 2.069  | 2.500  | 2.807  |
| 24       | 0.685                        | 0.857 | 1.059 | 1.318 | 1.711 | 2.064  | 2.492  | 2.797  |
| 25       | 0.684                        | 0.856 | 1.058 | 1.316 | 1.708 | 2.060  | 2.485  | 2.787  |
| 26       | 0.684                        | 0.856 | 1.058 | 1.315 | 1.706 | 2.056  | 2.479  | 2.779  |
| 27       | 0.684                        | 0.855 | 1.057 | 1.314 | 1.703 | 2.052  | 2.473  | 2.771  |
| 28       | 0.683                        | 0.855 | 1.056 | 1.313 | 1.701 | 2.048  | 2.467  | 2.763  |
| 29       | 0.683                        | 0.854 | 1.055 | 1.311 | 1.699 | 2.045  | 2.462  | 2.756  |
| 30       | 0.683                        | 0.854 | 1.055 | 1.310 | 1.697 | 2.042  | 2.457  | 2.750  |
| 35       | 0.682                        | 0.852 | 1.052 | 1.306 | 1.690 | 2.030  | 2.438  | 2.724  |
| 40       | 0.681                        | 0.851 | 1.050 | 1.303 | 1.684 | 2.021  | 2.423  | 2.704  |
| 45       | 0.680                        | 0.850 | 1.049 | 1.301 | 1.679 | 2.014  | 2.412  | 2.690  |
| 50       | 0.679                        | 0.849 | 1.047 | 1.299 | 1.676 | 2.009  | 2.403  | 2.678  |
| 55       | 0.679                        | 0.848 | 1.046 | 1.297 | 1.673 | 2.004  | 2.396  | 2.668  |
| 60       | 0.679                        | 0.848 | 1.045 | 1.296 | 1.671 | 2.000  | 2.390  | 2.660  |
| 90       | 0.677                        | 0.846 | 1.042 | 1.291 | 1.662 | 1.987  | 2.368  | 2.632  |
| 120      | 0.677                        | 0.845 | 1.041 | 1.289 | 1.658 | 1.980  | 2.358  | 2.617  |
| $\infty$ | 0.67                         | 0.84  | 1.04  | 1.28  | 1.64  | 1.96   | 2.33   | 2.58   |

# P-Values for Student's *t*-Distribution



|     |       | Degrees of Freedom |       |       |       |       |       |       |       |       |       |       |       |       |       |
|-----|-------|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| t   | 3     | 4                  | 5     | 6     | 7     | 8     | 10    | 12    | 15    | 18    | 21    | 25    | 29    | 35    | df>45 |
| 0.0 | 0.500 | 0.500              | 0.500 | 0.500 | 0.500 | 0.500 | 0.500 | 0.500 | 0.500 | 0.500 | 0.500 | 0.500 | 0.500 | 0.500 | 0.500 |
| 0.1 | 0.463 | 0.463              | 0.462 | 0.462 | 0.462 | 0.461 | 0.461 | 0.461 | 0.461 | 0.461 | 0.461 | 0.461 | 0.461 | 0.460 | 0.460 |
| 0.2 | 0.427 | 0.426              | 0.425 | 0.424 | 0.424 | 0.423 | 0.423 | 0.422 | 0.422 | 0.422 | 0.422 | 0.422 | 0.421 | 0.421 | 0.421 |
| 0.3 | 0.392 | 0.390              | 0.388 | 0.387 | 0.386 | 0.386 | 0.385 | 0.385 | 0.384 | 0.384 | 0.384 | 0.383 | 0.383 | 0.383 | 0.383 |
| 0.4 | 0.358 | 0.355              | 0.353 | 0.352 | 0.351 | 0.350 | 0.349 | 0.348 | 0.347 | 0.347 | 0.347 | 0.346 | 0.346 | 0.346 | 0.346 |
| 0.5 | 0.326 | 0.322              | 0.319 | 0.317 | 0.316 | 0.315 | 0.314 | 0.313 | 0.312 | 0.312 | 0.311 | 0.311 | 0.310 | 0.310 | 0.310 |
| 0.6 | 0.295 | 0.290              | 0.287 | 0.285 | 0.284 | 0.283 | 0.281 | 0.280 | 0.279 | 0.278 | 0.277 | 0.277 | 0.277 | 0.276 | 0.276 |
| 0.7 | 0.267 | 0.261              | 0.258 | 0.255 | 0.253 | 0.252 | 0.250 | 0.249 | 0.247 | 0.246 | 0.246 | 0.245 | 0.245 | 0.244 | 0.244 |
| 0.8 | 0.241 | 0.234              | 0.230 | 0.227 | 0.225 | 0.223 | 0.221 | 0.220 | 0.218 | 0.217 | 0.216 | 0.216 | 0.215 | 0.215 | 0.214 |
| 0.9 | 0.217 | 0.210              | 0.205 | 0.201 | 0.199 | 0.197 | 0.195 | 0.193 | 0.191 | 0.190 | 0.189 | 0.188 | 0.188 | 0.187 | 0.186 |
| 1.0 | 0.196 | 0.187              | 0.182 | 0.178 | 0.175 | 0.173 | 0.170 | 0.169 | 0.167 | 0.165 | 0.164 | 0.163 | 0.163 | 0.162 | 0.161 |
| 1.1 | 0.176 | 0.167              | 0.161 | 0.157 | 0.154 | 0.152 | 0.149 | 0.146 | 0.144 | 0.143 | 0.142 | 0.141 | 0.140 | 0.139 | 0.139 |
| 1.2 | 0.158 | 0.148              | 0.142 | 0.138 | 0.135 | 0.132 | 0.129 | 0.127 | 0.124 | 0.123 | 0.122 | 0.121 | 0.120 | 0.119 | 0.118 |
| 1.3 | 0.142 | 0.132              | 0.125 | 0.121 | 0.117 | 0.115 | 0.111 | 0.109 | 0.107 | 0.105 | 0.104 | 0.103 | 0.102 | 0.101 | 0.100 |
| 1.4 | 0.128 | 0.117              | 0.110 | 0.106 | 0.102 | 0.100 | 0.096 | 0.093 | 0.091 | 0.089 | 0.088 | 0.087 | 0.086 | 0.085 | 0.084 |
| 1.5 | 0.115 | 0.104              | 0.097 | 0.092 | 0.089 | 0.086 | 0.082 | 0.080 | 0.077 | 0.075 | 0.074 | 0.073 | 0.072 | 0.071 | 0.070 |
| 1.6 | 0.104 | 0.092              | 0.085 | 0.080 | 0.077 | 0.074 | 0.070 | 0.068 | 0.065 | 0.064 | 0.062 | 0.061 | 0.060 | 0.059 | 0.058 |
| 1.7 | 0.094 | 0.082              | 0.075 | 0.070 | 0.066 | 0.064 | 0.060 | 0.057 | 0.055 | 0.053 | 0.052 | 0.051 | 0.050 | 0.049 | 0.048 |
| 1.8 | 0.085 | 0.073              | 0.066 | 0.061 | 0.057 | 0.055 | 0.051 | 0.049 | 0.046 | 0.044 | 0.043 | 0.042 | 0.041 | 0.040 | 0.039 |
| 1.9 | 0.077 | 0.065              | 0.058 | 0.053 | 0.050 | 0.047 | 0.043 | 0.041 | 0.038 | 0.037 | 0.036 | 0.035 | 0.034 | 0.033 | 0.032 |
| 2.0 | 0.070 | 0.058              | 0.051 | 0.046 | 0.043 | 0.040 | 0.037 | 0.034 | 0.032 | 0.030 | 0.029 | 0.028 | 0.027 | 0.027 | 0.026 |
| 2.1 | 0.063 | 0.052              | 0.045 | 0.040 | 0.037 | 0.034 | 0.031 | 0.029 | 0.027 | 0.025 | 0.024 | 0.023 | 0.022 | 0.022 | 0.021 |
| 2.2 | 0.058 | 0.046              | 0.040 | 0.035 | 0.032 | 0.029 | 0.026 | 0.024 | 0.022 | 0.021 | 0.020 | 0.019 | 0.018 | 0.017 | 0.016 |
| 2.3 | 0.052 | 0.041              | 0.035 | 0.031 | 0.027 | 0.025 | 0.022 | 0.020 | 0.018 | 0.017 | 0.016 | 0.015 | 0.014 | 0.014 | 0.013 |
| 2.4 | 0.048 | 0.037              | 0.031 | 0.027 | 0.024 | 0.022 | 0.019 | 0.017 | 0.015 | 0.014 | 0.013 | 0.012 | 0.012 | 0.011 | 0.010 |
| 2.5 | 0.044 | 0.033              | 0.027 | 0.023 | 0.020 | 0.018 | 0.016 | 0.014 | 0.012 | 0.011 | 0.010 | 0.010 | 0.009 | 0.009 | 0.008 |
| 2.6 | 0.040 | 0.030              | 0.024 | 0.020 | 0.018 | 0.016 | 0.013 | 0.012 | 0.010 | 0.009 | 0.008 | 0.008 | 0.007 | 0.007 | 0.006 |
| 2.7 | 0.037 | 0.027              | 0.021 | 0.018 | 0.015 | 0.014 | 0.011 | 0.010 | 0.008 | 0.007 | 0.007 | 0.006 | 0.006 | 0.005 | 0.005 |
| 2.8 | 0.034 | 0.024              | 0.019 | 0.016 | 0.013 | 0.012 | 0.009 | 0.008 | 0.007 | 0.006 | 0.005 | 0.005 | 0.004 | 0.004 | 0.004 |
| 2.9 | 0.031 | 0.022              | 0.017 | 0.014 | 0.011 | 0.010 | 0.008 | 0.007 | 0.005 | 0.005 | 0.004 | 0.004 | 0.004 | 0.003 | 0.003 |
| 3.0 | 0.029 | 0.020              | 0.015 | 0.012 | 0.010 | 0.009 | 0.007 | 0.006 | 0.004 | 0.004 | 0.003 | 0.003 | 0.003 | 0.002 | 0.002 |
| 3.1 | 0.027 | 0.018              | 0.013 | 0.011 | 0.009 | 0.007 | 0.006 | 0.005 | 0.004 | 0.003 | 0.003 | 0.002 | 0.002 | 0.002 | 0.002 |
| 3.2 | 0.025 | 0.016              | 0.012 | 0.009 | 0.008 | 0.006 | 0.005 | 0.004 | 0.003 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 |
| 3.3 | 0.023 | 0.015              | 0.011 | 0.008 | 0.007 | 0.005 | 0.004 | 0.003 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 |
| 3.4 | 0.021 | 0.014              | 0.010 | 0.007 | 0.006 | 0.005 | 0.003 | 0.003 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| 3.5 | 0.020 | 0.012              | 0.009 | 0.006 | 0.005 | 0.004 | 0.003 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| 3.6 | 0.018 | 0.011              | 0.008 | 0.006 | 0.004 | 0.003 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0+    | 0+    |
| 3.7 | 0.017 | 0.010              | 0.007 | 0.005 | 0.004 | 0.003 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0+    | 0+    | 0+    |
| 3.8 | 0.016 | 0.010              | 0.006 | 0.004 | 0.003 | 0.003 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0+    | 0+    | 0+    | 0+    |
| 3.9 | 0.015 | 0.009              | 0.006 | 0.004 | 0.003 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0+    | 0+    | 0+    | 0+    | 0+    |
| 4.0 | 0.014 | 0.008              | 0.005 | 0.004 | 0.003 | 0.002 | 0.001 | 0.001 | 0.001 | 0+    | 0+    | 0+    | 0+    | 0+    | 0+    |