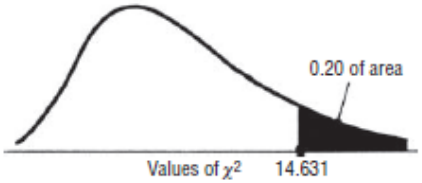
**EXAMPLE:** IN A CHI-SQUARE DISTRIBUTION WITH 11 DEGREES OF FREEDOM, TO FIND THE CHI-SQUARE VALUE FOR 0.20 OF THE AREA UNDER THE CURVE (THE COLORED AREA IN THE RIGHT TAIL) LOOK UNDER THE 0.20 COLUMN IN THE TABLE AND THE 11 DEGREES OF FREEDOM ROW; THE APPROPRIATE CHI-SQUARE VALUE IS 14.631.




**APPENDIX TABLE 5** AREA IN THE RIGHT TAIL OF A CHI-SQUARE ($\chi^2$) DISTRIBUTION

| Degrees of Freedom | Area in Right Tail | | | | |
|---|---|---|---|---|---|
| | 0.99 | 0.975 | 0.95 | 0.90 | 0.800 |
| 1 | 0.00016 | 0.00098 | 0.00398 | 0.0158 | 0.0642 |
| 2 | 0.0201 | 0.0506 | 0.103 | 0.211 | 0.446 |
| 3 | 0.115 | 0.216 | 0.352 | 0.584 | 1.005 |
| 4 | 0.297 | 0.484 | 0.711 | 1.064 | 1.649 |
| 5 | 0.554 | 0.831 | 1.145 | 1.610 | 2.343 |
| 6 | 0.872 | 1.237 | 1.685 | 2.204 | 3.070 |
| 7 | 1.239 | 1.690 | 2.167 | 2.833 | 3.822 |
| 8 | 1.646 | 2.180 | 2.733 | 3.490 | 4.594 |
| 9 | 2.088 | 2.700 | 3.325 | 4.168 | 5.380 |
| 10 | 2.558 | 3.247 | 3.940 | 4.865 | 6.179 |
| 11 | 3.053 | 3.816 | 4.575 | 5.578 | 6.989 |
| 12 | 3.571 | 4.404 | 5.226 | 6.304 | 7.807 |
| 13 | 4.107 | 5.009 | 5.892 | 7.042 | 8.634 |
| 14 | 4.660 | 5.629 | 6.571 | 7.790 | 9.467 |
| 15 | 5.229 | 6.262 | 7.261 | 8.547 | 10.307 |
| 16 | 5.812 | 6.908 | 7.962 | 9.312 | 11.152 |
| 17 | 6.408 | 7.564 | 8.672 | 10.085 | 12.002 |
| 18 | 7.015 | 8.231 | 9.390 | 10.865 | 12.857 |
| 19 | 7.633 | 8.907 | 10.117 | 11.651 | 13.716 |
| 20 | 8.260 | 9.591 | 10.851 | 12.443 | 14.578 |
| 21 | 8.897 | 10.283 | 11.591 | 13.240 | 15.445 |
| 22 | 9.542 | 10.982 | 12.338 | 14.041 | 16.314 |
| 23 | 10.196 | 11.689 | 13.091 | 14.848 | 17.187 |
| 24 | 10.856 | 12.401 | 13.848 | 15.658 | 18.062 |
| 25 | 11.524 | 13.120 | 14.611 | 16.473 | 18.940 |
| 26 | 12.198 | 13.844 | 15.379 | 17.292 | 19.820 |
| 27 | 12.879 | 14.573 | 16.151 | 18.114 | 20.703 |
| 28 | 13.565 | 15.308 | 16.928 | 18.939 | 21.588 |
| 29 | 14.256 | 16.047 | 17.708 | 19.768 | 22.475 |
| 30 | 14.953 | 16.791 | 18.493 | 20.599 | 23.364 |

**Note:** If $v$, the number of degrees of freedom, is greater than 30, we can approximate $\chi^2_\alpha$, the chi-square value leaving $\alpha$ of the area the right tail, by

$$\chi^2_\alpha = v\left(1-\frac{2}{9v}+z_\alpha\sqrt{\frac{2}{9v}}\right)^3$$

where $z_\alpha$ is the standard normal value (from Appendix Table 1) that leaves $\alpha$ of the area in the right tail.

| Area in Right Tail | | | | | Degrees of Freedom |
|---|---|---|---|---|---|
| 0.20 | 0.10 | 0.05 | 0.025 | 0.01 | |
| 1.642 | 2.706 | 3.841 | 5.024 | 6.635 | 1 |
| 3.219 | 4.605 | 5.991 | 7.378 | 9.210 | 2 |
| 4.642 | 6.251 | 7.815 | 9.348 | 11.345 | 3 |
| 5.989 | 7.779 | 9.488 | 11.143 | 13.277 | 4 |
| 7.289 | 9.236 | 11.070 | 12.833 | 15.086 | 5 |
| 8.558 | 10.645 | 12.592 | 14.449 | 16.812 | 6 |
| 9.803 | 12.017 | 14.067 | 16.013 | 18.475 | 7 |
| 11.030 | 13.362 | 15.507 | 17.535 | 20.090 | 8 |
| 12.242 | 14.684 | 16.919 | 19.023 | 21.666 | 9 |
| 13.442 | 15.987 | 18.307 | 20.483 | 23.209 | 10 |
| 14.631 | 17.275 | 19.675 | 21.920 | 24.725 | 11 |
| 15.812 | 18.549 | 21.026 | 23.337 | 26.217 | 12 |
| 16.985 | 19.812 | 22.362 | 24.736 | 27.688 | 13 |
| 18.151 | 21.064 | 23.685 | 26.119 | 29.141 | 14 |
| 19.311 | 22.307 | 24.996 | 27.488 | 30.578 | 15 |
| 20.465 | 23.542 | 26.296 | 28.845 | 32.000 | 16 |
| 21.615 | 24.769 | 27.587 | 30.191 | 33.409 | 17 |
| 22.760 | 25.989 | 28.869 | 31.526 | 34.805 | 18 |
| 23.900 | 27.204 | 30.144 | 32.852 | 36.191 | 19 |
| 25.038 | 28.412 | 31.410 | 34.170 | 37.566 | 20 |
| 26.171 | 29.615 | 32.671 | 35.479 | 38.932 | 21 |
| 27.301 | 30.813 | 33.924 | 36.781 | 40.289 | 22 |
| 28.429 | 32.007 | 35.172 | 38.076 | 41.638 | 23 |
| 29.553 | 33.196 | 36.415 | 39.364 | 42.980 | 24 |
| 30.675 | 34.382 | 37.652 | 40.647 | 44.314 | 25 |
| 31.795 | 35.563 | 38.885 | 41.923 | 45.642 | 26 |
| 32.912 | 36.741 | 40.113 | 43.194 | 46.963 | 27 |
| 34.027 | 37.916 | 41.337 | 44.461 | 48.278 | 28 |
| 35.139 | 39.087 | 42.557 | 45.722 | 49.588 | 29 |
| 36.250 | 40.256 | 43.773 | 46.979 | 50.892 | 30 |