

PROBABILITY INTEGRAL OF χ^2 -DISTRIBUTION, INCOMPLETE GAMMA FUNCTION Table 26.7
CUMULATIVE SUMS OF THE POISSON DISTRIBUTION

ν	$\chi^2=42$ $m=21$	44 22	46 23	48 24	50 25	52 26	54 27	56 28	58 29	60 30
10	0.00001									
11	0.00002	0.00001								
12	0.00003	0.00002	0.00001							
13	0.00006	0.00003	0.00001	0.00001						
14	0.00012	0.00006	0.00003	0.00001	0.00001					
15	0.00023	0.00011	0.00005	0.00003	0.00001	0.00001				
16	0.00040	0.00020	0.00010	0.00005	0.00002	0.00001	0.00001			
17	0.00067	0.00034	0.00017	0.00009	0.00004	0.00002	0.00001	0.00001		
18	0.00111	0.00058	0.00030	0.00015	0.00008	0.00004	0.00002	0.00001		
19	0.00177	0.00094	0.00050	0.00026	0.00013	0.00007	0.00003	0.00002	0.00001	
20	0.00277	0.00151	0.00081	0.00043	0.00022	0.00011	0.00006	0.00003	0.00001	0.00001
21	0.00421	0.00234	0.00128	0.00069	0.00036	0.00019	0.00010	0.00005	0.00003	0.00001
22	0.00625	0.00355	0.00198	0.00109	0.00059	0.00031	0.00016	0.00009	0.00004	0.00002
23	0.00908	0.00526	0.00299	0.00167	0.00092	0.00050	0.00027	0.00014	0.00007	0.00004
24	0.01291	0.00763	0.00443	0.00252	0.00142	0.00078	0.00043	0.00023	0.00012	0.00006
25	0.01797	0.01085	0.00642	0.00373	0.00213	0.00120	0.00066	0.00036	0.00020	0.00011
26	0.02455	0.01512	0.00912	0.00540	0.00314	0.00180	0.00102	0.00056	0.00031	0.00017
27	0.03292	0.02068	0.01272	0.00768	0.00455	0.00265	0.00152	0.00086	0.00048	0.00026
28	0.04336	0.02779	0.01743	0.01072	0.00647	0.00384	0.00224	0.00129	0.00073	0.00041
29	0.05616	0.03670	0.02346	0.01470	0.00903	0.00545	0.00324	0.00189	0.00109	0.00062
30	0.07157	0.04769	0.03107	0.01983	0.01240	0.00762	0.00460	0.00273	0.00160	0.00092
ν	$\chi^2=62$ $m=31$	64 32	66 33	68 34	70 35	72 36	74 37	76 38		
21	0.00001									
22	0.00001	0.00001								
23	0.00002	0.00001	0.00001							
24	0.00003	0.00002	0.00001							
25	0.00006	0.00003	0.00002	0.00001						
26	0.00009	0.00005	0.00003	0.00001	0.00001					
27	0.00014	0.00008	0.00004	0.00002	0.00001	0.00001				
28	0.00023	0.00012	0.00007	0.00004	0.00002	0.00001	0.00001			
29	0.00035	0.00019	0.00011	0.00006	0.00003	0.00002	0.00001			
30	0.00052	0.00029	0.00016	0.00009	0.00005	0.00003	0.00001	0.00001		

$$Q(\chi^2|\nu) = 1 - P(\chi^2|\nu) = \left[2^{\frac{\nu}{2}} \Gamma\left(\frac{\nu}{2}\right) \right]^{-1} \int_{\chi^2}^{\infty} e^{-\frac{t}{2}} t^{\frac{\nu}{2}-1} dt = \left[\Gamma\left(\frac{\nu}{2}\right) \right]^{-1} \int_{\frac{1}{2}\chi^2}^{\infty} e^{-t} t^{\frac{\nu}{2}-1} dt = \sum_{j=0}^{c-1} e^{-m} m^j / j! \quad (\nu \text{ even, } c = \frac{1}{2}\nu, m = \frac{1}{2}\chi^2)$$

$$\phi = \frac{1}{2}(\chi^2 - \chi_0^2) \quad w = \nu - \nu_0 > 0$$

Interpolation on χ^2

$$Q(\chi^2|\nu) = Q(\chi_0^2|\nu_0 - 4) \left[\frac{1}{2} \phi^2 \right] + Q(\chi_0^2|\nu_0 - 2) [\phi - \phi^2] + Q(\chi_0^2|\nu_0) \left[1 - \phi + \frac{1}{2} \phi^2 \right]$$

Double Entry Interpolation

$$Q(\chi^2|\nu) = Q(\chi_0^2|\nu_0 - 4) \left[\frac{1}{2} \phi^2 \right] + Q(\chi_0^2|\nu_0 - 2) [\phi - \phi^2 - w\phi] + Q(\chi_0^2|\nu_0 - 1) \left[\frac{1}{2} w^2 - \frac{1}{2} w + w\phi \right]$$

$$+ Q(\chi_0^2|\nu_0) \left[1 - w^2 - \phi + \frac{1}{2} \phi^2 + w\phi \right] + Q(\chi_0^2|\nu_0 + 1) \left[\frac{1}{2} w^2 + \frac{1}{2} w - w\phi \right]$$