

Distribuční funkce Poissonova rozdělení $Po(\lambda)$

$$F(x) = \sum_{k=0}^x \frac{\lambda^k e^{-\lambda}}{k!}$$

$x \cdot \lambda$	0.1	0.2	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
0	0.9048	0.8187	0.6065	0.3679	0.2231	0.1353	0.0821	0.0498	0.0302	0.0183	0.0111	0.0067
1	0.9953	0.9825	0.9098	0.7358	0.5578	0.4060	0.2873	0.1991	0.1359	0.0916	0.0611	0.0404
2	0.9998	0.9989	0.9856	0.9197	0.8088	0.6767	0.5438	0.4232	0.3208	0.2381	0.1736	0.1247
3	1	0.9999	0.9982	0.9810	0.9344	0.8571	0.7576	0.6472	0.5366	0.4335	0.3423	0.2605
4	1	1	0.9998	0.9963	0.9814	0.9473	0.8912	0.8153	0.7254	0.6288	0.5321	0.4405
5	1	1	1	0.9994	0.9955	0.9834	0.9580	0.9161	0.8576	0.7851	0.7029	0.6160
6	1	1	1	0.9999	0.9991	0.9955	0.9858	0.9665	0.9347	0.8893	0.8311	0.7622
7	1	1	1	1	0.9998	0.9989	0.9958	0.9881	0.9733	0.9489	0.9134	0.8666
8	1	1	1	1	1	0.9998	0.9989	0.9962	0.9901	0.9786	0.9597	0.9319
9	1	1	1	1	1	1	0.9997	0.9989	0.9967	0.9919	0.9829	0.9682
10	1	1	1	1	1	1	0.9999	0.9997	0.9990	0.9972	0.9933	0.9863
$x \cdot \lambda$	6	7	8	9	10	11	12	13	14	15	16	17
0	0.0025	0.0009	0.0003	0.0001	0	0	0	0	0	0	0	0
1	0.0174	0.0073	0.0030	0.0012	0.0005	0.0002	0.0001	0	0	0	0	0
2	0.0620	0.0296	0.0138	0.0062	0.0028	0.0012	0.0005	0.0002	0.0001	0	0	0
3	0.1512	0.0818	0.0424	0.0212	0.0103	0.0049	0.0023	0.0011	0.0005	0.0002	0.0001	0
4	0.2851	0.1730	0.0996	0.0550	0.0293	0.0151	0.0076	0.0037	0.0018	0.0009	0.0004	0.0002
5	0.4457	0.3007	0.1912	0.1157	0.0671	0.0375	0.0203	0.0107	0.0055	0.0028	0.0014	0.0007
6	0.6063	0.4497	0.3134	0.2068	0.1301	0.0786	0.0458	0.0259	0.0142	0.0076	0.0040	0.0021
7	0.7440	0.5987	0.4530	0.3239	0.2202	0.1432	0.0895	0.0540	0.0316	0.0180	0.0100	0.0054
8	0.8472	0.7291	0.5925	0.4557	0.3328	0.2320	0.1550	0.0998	0.0621	0.0374	0.0220	0.0126
9	0.9161	0.8305	0.7166	0.5874	0.4579	0.3405	0.2424	0.1658	0.1094	0.0699	0.0433	0.0261
10	0.9574	0.9015	0.8159	0.7060	0.5830	0.4599	0.3472	0.2517	0.1757	0.1185	0.0774	0.0491
11	0.9799	0.9467	0.8881	0.8030	0.6968	0.5793	0.4616	0.3532	0.2600	0.1848	0.1270	0.0847
12	0.9912	0.9730	0.9362	0.8758	0.7916	0.6887	0.5760	0.4631	0.3585	0.2676	0.1931	0.1350
13	0.9964	0.9872	0.9658	0.9261	0.8645	0.7813	0.6815	0.5730	0.4644	0.3632	0.2745	0.2009
14	0.9986	0.9943	0.9827	0.9585	0.9165	0.8540	0.7720	0.6751	0.5704	0.4657	0.3675	0.2808
15	0.9995	0.9976	0.9918	0.9780	0.9513	0.9074	0.8444	0.7636	0.6694	0.5681	0.4667	0.3715
16	0.9998	0.9990	0.9963	0.9889	0.9730	0.9441	0.8987	0.8355	0.7559	0.6641	0.5660	0.4677
17	0.9999	0.9996	0.9984	0.9947	0.9857	0.9678	0.9370	0.8905	0.8272	0.7489	0.6593	0.5640
18	1	0.9999	0.9993	0.9976	0.9928	0.9823	0.9626	0.9302	0.8826	0.8195	0.7423	0.6550
19	1	1	0.9997	0.9989	0.9965	0.9907	0.9787	0.9573	0.9235	0.8752	0.8122	0.7363
20	1	1	0.9999	0.9996	0.9984	0.9953	0.9884	0.9750	0.9521	0.9170	0.8682	0.8055
21	1	1	1	0.9998	0.9993	0.9977	0.9939	0.9859	0.9712	0.9469	0.9108	0.8615
22	1	1	1	0.9999	0.9997	0.9990	0.9970	0.9924	0.9833	0.9673	0.9418	0.9047
23	1	1	1	1	0.9999	0.9995	0.9985	0.9960	0.9907	0.9805	0.9633	0.9367
24	1	1	1	1	1	0.9998	0.9993	0.9980	0.9950	0.9888	0.9777	0.9594
25	1	1	1	1	1	0.9999	0.9997	0.9990	0.9974	0.9938	0.9869	0.9748

Pro $n \geq 30$ a $p \leq 0.1$ platí aproximace $HG(M, N, n) \approx Bi(n, p = \frac{M}{N}) \approx Po(\lambda = n \cdot p)$

Pro velká λ ($\lambda \geq 9$) platí aproximace $Po(\lambda) \approx N(\mu = \lambda, \sigma^2 = \lambda)$

Kvantily χ^2 - rozdělení

$\nu \cdot p$	0.01	0.025	0.05	0.1	0.5	0.9	0.95	0.975	0.99	0.999
1	0.0002	0.001	0.004	0.016	0.455	2.71	3.84	5.02	6.63	10.83
2	0.020	0.051	0.103	0.211	1.39	4.61	5.99	7.38	9.21	13.82
3	0.115	0.216	0.352	0.584	2.37	6.25	7.81	9.35	11.34	16.27
4	0.297	0.484	0.711	1.06	3.36	7.78	9.49	11.14	13.28	18.47
5	0.554	0.831	1.15	1.61	4.35	9.24	11.07	12.83	15.09	20.51
6	0.872	1.24	1.64	2.20	5.35	10.64	12.59	14.45	16.81	22.46
7	1.24	1.69	2.17	2.83	6.35	12.02	14.07	16.01	18.48	24.32
8	1.65	2.18	2.73	3.49	7.34	13.36	15.51	17.53	20.09	26.12
9	2.09	2.70	3.33	4.17	8.34	14.68	16.92	19.02	21.67	27.88
10	2.56	3.25	3.94	4.87	9.34	15.99	18.31	20.48	23.21	29.59
11	3.05	3.82	4.57	5.58	10.34	17.28	19.68	21.92	24.73	31.26
12	3.57	4.40	5.23	6.30	11.34	18.55	21.03	23.34	26.22	32.91
13	4.11	5.01	5.89	7.04	12.34	19.81	22.36	24.74	27.69	34.53
14	4.66	5.63	6.57	7.79	13.34	21.06	23.68	26.12	29.14	36.12
15	5.23	6.26	7.26	8.55	14.34	22.31	25.00	27.49	30.58	37.70
16	5.81	6.91	7.96	9.31	15.34	23.54	26.30	28.85	32.00	39.25
17	6.41	7.56	8.67	10.09	16.34	24.77	27.59	30.19	33.41	40.79
18	7.01	8.23	9.39	10.86	17.34	25.99	28.87	31.53	34.81	42.31
19	7.63	8.91	10.12	11.65	18.34	27.20	30.14	32.85	36.19	43.82
20	8.26	9.59	10.85	12.44	19.34	28.41	31.41	34.17	37.57	45.31
22	9.54	10.98	12.34	14.04	21.34	30.81	33.92	36.78	40.29	48.27
24	10.86	12.40	13.85	15.66	23.34	33.20	36.42	39.36	42.98	51.18
26	12.20	13.84	15.38	17.29	25.34	35.56	38.89	41.92	45.64	54.05
28	13.56	15.31	16.93	18.94	27.34	37.92	41.34	44.46	48.28	56.89
30	14.95	16.79	18.49	20.60	29.34	40.26	43.77	46.98	50.89	59.70
32	16.36	18.29	20.07	22.27	31.34	42.58	46.19	49.48	53.49	62.49
34	17.79	19.81	21.66	23.95	33.34	44.90	48.60	51.97	56.06	65.25
36	19.23	21.34	23.27	25.64	35.34	47.21	51.00	54.44	58.62	67.98
38	20.69	22.88	24.88	27.34	37.34	49.51	53.38	56.90	61.16	70.70
40	22.16	24.43	26.51	29.05	39.34	51.81	55.76	59.34	63.69	73.40
42	23.65	26.00	28.14	30.77	41.34	54.09	58.12	61.78	66.21	76.08
44	25.15	27.57	29.79	32.49	43.34	56.37	60.48	64.20	68.71	78.75
46	26.66	29.16	31.44	34.22	45.34	58.64	62.83	66.62	71.20	81.40
48	28.18	30.75	33.10	35.95	47.34	60.91	65.17	69.02	73.68	84.04
50	29.71	32.36	34.76	37.69	49.33	63.17	67.50	71.42	76.15	86.66
60	37.48	40.48	43.19	46.46	59.33	74.40	79.08	83.30	88.38	99.61
70	45.44	48.76	51.74	55.33	69.33	85.53	90.53	95.02	100.43	112.32
80	53.54	57.15	60.39	64.28	79.33	96.58	101.88	106.63	112.33	124.84
90	61.75	65.65	69.13	73.29	89.33	107.57	113.15	118.14	124.12	137.21
100	70.06	74.22	77.93	82.36	99.33	118.50	124.34	129.56	135.81	149.45

Pro velké ν platí $\chi_p^2 \approx \frac{1}{2}(\sqrt{2\nu - 1} + u_p)^2$, kde u_p jsou kvantily normovaného normálního rozdělení.

Distribuční funkce normálního normovaného rozdělení $N(\mu = 0, \sigma^2 = 1)$

$$\Phi(u) = \int_{-\infty}^u \frac{1}{\sqrt{2\pi}} e^{-\frac{t^2}{2}} dt$$

u	$\Phi(u)$	u	$\Phi(u)$	u	$\Phi(u)$	u	$\Phi(u)$	u	$\Phi(u)$	u	$\Phi(u)$	u	$\Phi(u)$
0.00	0.5000	0.50	0.6915	1.00	0.8413	1.50	0.9332	2.00	0.9772	2.50	0.9938	3.50	0.99977
0.01	0.5040	0.51	0.6950	1.01	0.8438	1.51	0.9345	2.01	0.9778	2.52	0.9941	3.52	0.99978
0.02	0.5080	0.52	0.6985	1.02	0.8461	1.52	0.9357	2.02	0.9783	2.54	0.9945	3.54	0.99980
0.03	0.5120	0.53	0.7019	1.03	0.8485	1.53	0.9370	2.03	0.9788	2.56	0.9948	3.56	0.99981
0.04	0.5160	0.54	0.7054	1.04	0.8508	1.54	0.9382	2.04	0.9793	2.58	0.9951	3.58	0.99983
0.05	0.5199	0.55	0.7088	1.05	0.8531	1.55	0.9394	2.05	0.9798	2.60	0.9953	3.60	0.99984
0.06	0.5239	0.56	0.7123	1.06	0.8554	1.56	0.9406	2.06	0.9803	2.62	0.9956	3.62	0.99985
0.07	0.5279	0.57	0.7157	1.07	0.8577	1.57	0.9418	2.07	0.9808	2.64	0.9959	3.64	0.99986
0.08	0.5319	0.58	0.7190	1.08	0.8599	1.58	0.9429	2.08	0.9812	2.66	0.9961	3.66	0.99987
0.09	0.5359	0.59	0.7224	1.09	0.8621	1.59	0.9441	2.09	0.9817	2.68	0.9963	3.68	0.99988
0.10	0.5398	0.60	0.7257	1.10	0.8643	1.60	0.9452	2.10	0.9821	2.70	0.9965	3.70	0.99989
0.11	0.5438	0.61	0.7291	1.11	0.8665	1.61	0.9463	2.11	0.9826	2.72	0.9967	3.72	0.99990
0.12	0.5478	0.62	0.7324	1.12	0.8686	1.62	0.9474	2.12	0.9830	2.74	0.9969	3.74	0.99991
0.13	0.5517	0.63	0.7357	1.13	0.8708	1.63	0.9484	2.13	0.9834	2.76	0.9971	3.76	0.99992
0.14	0.5557	0.64	0.7389	1.14	0.8729	1.64	0.9495	2.14	0.9838	2.78	0.9973	3.78	0.99992
0.15	0.5596	0.65	0.7422	1.15	0.8749	1.65	0.9505	2.15	0.9842	2.80	0.9974	3.80	0.99993
0.16	0.5636	0.66	0.7454	1.16	0.8770	1.66	0.9515	2.16	0.9846	2.82	0.9976	3.82	0.99993
0.17	0.5675	0.67	0.7486	1.17	0.8790	1.67	0.9525	2.17	0.9850	2.84	0.9977	3.84	0.99994
0.18	0.5714	0.68	0.7517	1.18	0.8810	1.68	0.9535	2.18	0.9854	2.86	0.9979	3.86	0.99994
0.19	0.5753	0.69	0.7549	1.19	0.8830	1.69	0.9545	2.19	0.9857	2.88	0.9980	3.88	0.99995
0.20	0.5793	0.70	0.7580	1.20	0.8849	1.70	0.9554	2.20	0.9861	2.90	0.9981	3.90	0.99995
0.21	0.5832	0.71	0.7611	1.21	0.8869	1.71	0.9564	2.21	0.9864	2.92	0.9982	3.92	0.99996
0.22	0.5871	0.72	0.7642	1.22	0.8888	1.72	0.9573	2.22	0.9868	2.94	0.9984	3.94	0.99996
0.23	0.5910	0.73	0.7673	1.23	0.8907	1.73	0.9582	2.23	0.9871	2.96	0.9985	3.96	0.99996
0.24	0.5948	0.74	0.7704	1.24	0.8925	1.74	0.9591	2.24	0.9875	2.98	0.9986	3.98	0.99997
0.25	0.5987	0.75	0.7734	1.25	0.8944	1.75	0.9599	2.25	0.9878	3.00	0.9987	4.00	0.99997
0.26	0.6026	0.76	0.7764	1.26	0.8962	1.76	0.9608	2.26	0.9881	3.02	0.9987	4.02	0.99997
0.27	0.6064	0.77	0.7794	1.27	0.8980	1.77	0.9616	2.27	0.9884	3.04	0.9988	4.04	0.99997
0.28	0.6103	0.78	0.7823	1.28	0.8997	1.78	0.9625	2.28	0.9887	3.06	0.9989	4.06	0.99998
0.29	0.6141	0.79	0.7852	1.29	0.9015	1.79	0.9633	2.29	0.9890	3.08	0.9990	4.08	0.99998
0.30	0.6179	0.80	0.7881	1.30	0.9032	1.80	0.9641	2.30	0.9893	3.10	0.9990	4.10	0.99998
0.31	0.6217	0.81	0.7910	1.31	0.9049	1.81	0.9649	2.31	0.9896	3.12	0.9991	4.12	0.99998
0.32	0.6255	0.82	0.7939	1.32	0.9066	1.82	0.9656	2.32	0.9898	3.14	0.9992	4.14	0.99998
0.33	0.6293	0.83	0.7967	1.33	0.9082	1.83	0.9664	2.33	0.9901	3.16	0.9992	4.16	0.99998
0.34	0.6331	0.84	0.7995	1.34	0.9099	1.84	0.9671	2.34	0.9904	3.18	0.9993	4.18	0.99999
0.35	0.6368	0.85	0.8023	1.35	0.9115	1.85	0.9678	2.35	0.9906	3.20	0.9993	4.20	0.99999
0.36	0.6406	0.86	0.8051	1.36	0.9131	1.86	0.9686	2.36	0.9909	3.22	0.9994	4.22	0.99999
0.37	0.6443	0.87	0.8078	1.37	0.9147	1.87	0.9693	2.37	0.9911	3.24	0.9994	4.24	0.99999
0.38	0.6480	0.88	0.8106	1.38	0.9162	1.88	0.9699	2.38	0.9913	3.26	0.9994	4.26	0.99999
0.39	0.6517	0.89	0.8133	1.39	0.9177	1.89	0.9706	2.39	0.9916	3.28	0.9995	4.28	0.99999
0.40	0.6554	0.90	0.8159	1.40	0.9192	1.90	0.9713	2.40	0.9918	3.30	0.9995	4.30	0.99999
0.41	0.6591	0.91	0.8186	1.41	0.9207	1.91	0.9719	2.41	0.9920	3.32	0.9995	4.32	0.99999
0.42	0.6628	0.92	0.8212	1.42	0.9222	1.92	0.9726	2.42	0.9922	3.34	0.9996	4.34	0.99999
0.43	0.6664	0.93	0.8238	1.43	0.9236	1.93	0.9732	2.43	0.9925	3.36	0.9996	4.36	0.99999
0.44	0.6700	0.94	0.8264	1.44	0.9251	1.94	0.9738	2.44	0.9927	3.38	0.9996	4.38	0.99999
0.45	0.6736	0.95	0.8289	1.45	0.9265	1.95	0.9744	2.45	0.9929	3.40	0.9997	4.40	0.99999
0.46	0.6772	0.96	0.8315	1.46	0.9279	1.96	0.9750	2.46	0.9931	3.42	0.9997	4.42	1.00000
0.47	0.6808	0.97	0.8340	1.47	0.9292	1.97	0.9756	2.47	0.9932	3.44	0.9997	4.44	1.00000
0.48	0.6844	0.98	0.8365	1.48	0.9306	1.98	0.9761	2.48	0.9934	3.46	0.9997	4.46	1.00000
0.49	0.6879	0.99	0.8389	1.49	0.9319	1.99	0.9767	2.49	0.9936	3.48	0.9997	4.48	1.00000

$$\Phi(-u) = 1 - \Phi(u)$$

Pro distribuční funkci náhodné veličiny $X \approx N(\mu, \sigma^2)$, platí $F(x) = \Phi\left(\frac{x-\mu}{\sigma}\right)$

Kvantily Studentova rozdělení $t_p(\nu)$

$\nu \cdot p$	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.925	0.95	0.975	0.99	0.995
1	0.3249	0.5095	0.7265	1.0000	1.3764	1.9626	3.0777	4.1653	6.3137	12.7062	31.8210	63.6559
2	0.2887	0.4447	0.6172	0.8165	1.0607	1.3862	1.8856	2.2819	2.9200	4.3027	6.9645	9.9250
3	0.2767	0.4242	0.5844	0.7649	0.9785	1.2498	1.6377	1.9243	2.3534	3.1824	4.5407	5.8408
4	0.2707	0.4142	0.5686	0.7407	0.9410	1.1896	1.5332	1.7782	2.1318	2.7765	3.7469	4.6041
5	0.2672	0.4082	0.5594	0.7267	0.9195	1.1558	1.4759	1.6994	2.0150	2.5706	3.3649	4.0321
6	0.2648	0.4043	0.5534	0.7176	0.9057	1.1342	1.4398	1.6502	1.9432	2.4469	3.1427	3.7074
7	0.2632	0.4015	0.5491	0.7111	0.8960	1.1192	1.4149	1.6166	1.8946	2.3646	2.9979	3.4995
8	0.2619	0.3995	0.5459	0.7064	0.8889	1.1081	1.3968	1.5922	1.8595	2.3060	2.8965	3.3554
9	0.2610	0.3979	0.5435	0.7027	0.8834	1.0997	1.3830	1.5737	1.8331	2.2622	2.8214	3.2498
10	0.2602	0.3966	0.5415	0.6998	0.8791	1.0931	1.3722	1.5592	1.8125	2.2281	2.7638	3.1693
11	0.2596	0.3956	0.5399	0.6974	0.8755	1.0877	1.3634	1.5476	1.7959	2.2010	2.7181	3.1058
12	0.2590	0.3947	0.5386	0.6955	0.8726	1.0832	1.3562	1.5380	1.7823	2.1788	2.6810	3.0545
13	0.2586	0.3940	0.5375	0.6938	0.8702	1.0795	1.3502	1.5299	1.7709	2.1604	2.6503	3.0123
14	0.2582	0.3933	0.5366	0.6924	0.8681	1.0763	1.3450	1.5231	1.7613	2.1448	2.6245	2.9768
15	0.2579	0.3928	0.5357	0.6912	0.8662	1.0735	1.3406	1.5172	1.7531	2.1315	2.6025	2.9467
16	0.2576	0.3923	0.5350	0.6901	0.8647	1.0711	1.3368	1.5121	1.7459	2.1199	2.5835	2.9208
17	0.2573	0.3919	0.5344	0.6892	0.8633	1.0690	1.3334	1.5077	1.7396	2.1098	2.5669	2.8982
18	0.2571	0.3915	0.5338	0.6884	0.8620	1.0672	1.3304	1.5037	1.7341	2.1009	2.5524	2.8784
19	0.2569	0.3912	0.5333	0.6876	0.8610	1.0655	1.3277	1.5002	1.7291	2.0930	2.5395	2.8609
20	0.2567	0.3909	0.5329	0.6870	0.8600	1.0640	1.3253	1.4970	1.7247	2.0860	2.5280	2.8453
22	0.2564	0.3904	0.5321	0.6858	0.8583	1.0614	1.3212	1.4916	1.7171	2.0739	2.5083	2.8188
24	0.2562	0.3900	0.5314	0.6848	0.8569	1.0593	1.3178	1.4871	1.7109	2.0639	2.4922	2.7970
26	0.2560	0.3896	0.5309	0.6840	0.8557	1.0575	1.3150	1.4834	1.7056	2.0555	2.4786	2.7787
28	0.2558	0.3893	0.5304	0.6834	0.8546	1.0560	1.3125	1.4801	1.7011	2.0484	2.4671	2.7633
30	0.2556	0.3890	0.5300	0.6828	0.8538	1.0547	1.3104	1.4774	1.6973	2.0423	2.4573	2.7500
35	0.2553	0.3885	0.5292	0.6816	0.8520	1.0520	1.3062	1.4718	1.6896	2.0301	2.4377	2.7238
40	0.2550	0.3881	0.5286	0.6807	0.8507	1.0500	1.3031	1.4677	1.6839	2.0211	2.4233	2.7045
45	0.2549	0.3878	0.5281	0.6800	0.8497	1.0485	1.3007	1.4645	1.6794	2.0141	2.4121	2.6896
50	0.2547	0.3875	0.5278	0.6794	0.8489	1.0473	1.2987	1.4620	1.6759	2.0086	2.4033	2.6778
75	0.2542	0.3868	0.5266	0.6778	0.8464	1.0436	1.2929	1.4544	1.6654	1.9921	2.3771	2.6430
100	0.2540	0.3864	0.5261	0.6770	0.8452	1.0418	1.2901	1.4507	1.6602	1.9840	2.3642	2.6259
500	0.2535	0.3855	0.5247	0.6750	0.8423	1.0375	1.2832	1.4417	1.6479	1.9647	2.3338	2.5857
1000	0.2534	0.3854	0.5246	0.6747	0.8420	1.0370	1.2824	1.4406	1.6464	1.9623	2.3301	2.5807

$$t_p(\nu) = -t_{1-p}(\nu)$$

Kvantily normovaného normálního rozdělení u_p

p	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.925	0.95	0.975	0.99	0.995
u_p	0.2533	0.3853	0.5244	0.6745	0.8416	1.0364	1.2816	1.4395	1.6449	1.9600	2.3263	2.5758

$$u_p = -u_{1-p}$$

Pro velká ν platí $t_p(\nu) = u_p$.

Pro kvantily náhodné veličiny $X \approx N(\mu, \sigma^2)$, platí $x_p = u_p \cdot \sigma + \mu$.

Centrální limitní věta: Nechtě $\{X_i\}_{i=1,2,\dots,n}$ jsou vzájemně nezávislé náhodné veličiny se stejným rozdělením, označme $E(X_i) = \mu_0$ a $D(X_i) = \sigma_0^2$. Pak platí

$$\sum_{i=1}^n X_i \approx N(n \cdot \mu_0, n \cdot \sigma_0^2), \quad \bar{X} \approx N\left(\mu_0, \frac{\sigma_0^2}{n}\right).$$