(Poisson) probabilities of observing y events if "expected" or average number is μ

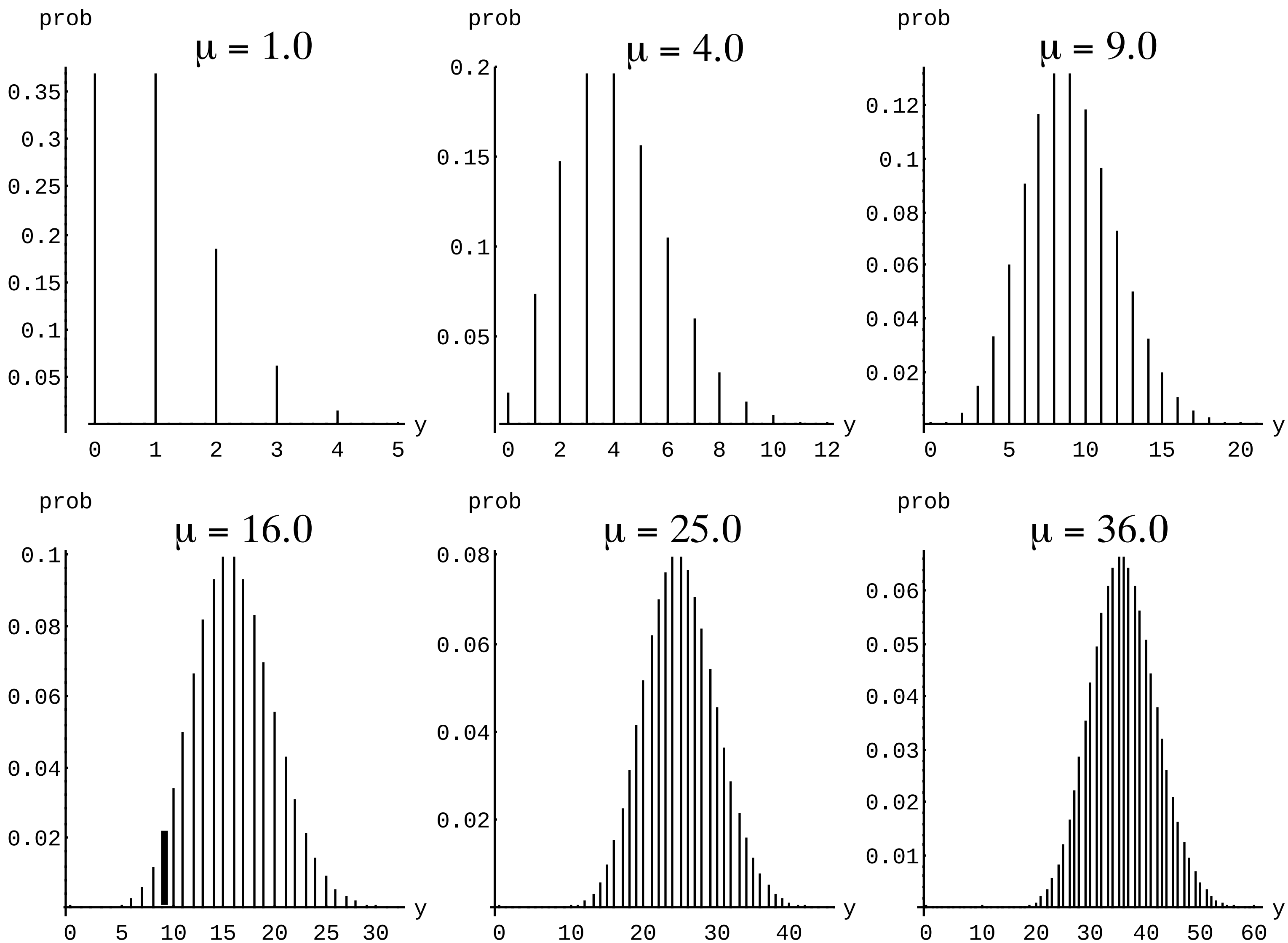
Probabilities are expressed "per 1000" i.e. 905 is 905/1000 or 0.905 or 90.5% The formula is Prob(y) = [exp(-μ)] • [μ to power y] / y!

E.g.: if μ = 1.5, then Prob(y=3) is exp(-1.5)•1.5 cubed / [1x2x3] = 126/1000 or .126 or 12.6% ... Reminder: 3! = 1x2x3=6]

y \ μ =	.10	.20	.30	.40	.50	.60	.70	.80	.90	1.0	1.5	2	3	4	5	7	10	16	20	25	30	36
0	905	819	741	670	607	549	497	449	407	368	223	135	50	18	7	1	0	0	0	0	0	0
1	90	164	222	268	303	329	348	359	366	368	335	271	149	73	34	6	0	0	0	0	0	0
2	5	16	33	54	76	99	122	144	165	184	251	271	224	147	84	22	2	0	0	0	0	0
3	0	1	3	7	13	20	28	38	49	61	126	180	224	195	140	52	8	0	0	0	0	0
4	0	0	0	1	2	3	5	8	11	15	47	90	168	195	175	91	19	0	0	0	0	0
5	0	0	0	0	0	0	1	1	2	3	14	36	101	156	175	128	38	1	0	0	0	0
6	0	0	0	0	0	0	0	0	0	1	4	12	50	104	146	149	63	3	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	1	3	22	60	104	149	90	6	1	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	1	8	30	65	130	113	12	1	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	3	13	36	101	125	21	3	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	1	5	18	71	125	34	6	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	45	114	50	11	1	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	26	95	66	18	2	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	14	73	81	27	3	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	52	93	39	6	1	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	35	99	52	10	1	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	22	99	65	15	2	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13	93	76	23	3	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	83	84	32	6	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	70	89	42	9	1
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	56	89	52	13	1
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	43	85	62	19	2
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	77	70	26	4
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	67	76	34	6
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	56	80	43	8
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	45	80	51	12
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	34	76	59	17
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	25	71	66	22
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	18	63	70	29
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13	54	73	36
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	45	73	43
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	37	70	50
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	29	66	56
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	22	60	61
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	16	53	64
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	11	45	66
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	38	66
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	31	65
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	24	61
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	19	56

(Poisson) probabilities of observing y events if "expected" or average number is μ= 1, 4, 9, 16, 25, 36

Using μ *and mean interchangeably.* μ *is not usually an integer: it can be any non-negative real number , such as 1.3)*



E.G. Prob(Y=9 | Mean = 16.0) = 0.021

<u>Message</u>: Gaussian approxn. to Poisson distrn. reasonably accurate when μ **is in the double digits'** [cf also Armitage & Berry]

[See frequency distributions on previous page]

The normal distribution is often useful as an approximation to the Poisson distribution. The Poisson distribution with mean μ approaches normality as μ increases indefinitely (see diagram of Poisson distributions as a function of μ). For sufficiently large μ, A Poisson variable y may, therefore, be regarded as "approximately normal" with mean μ and standard deviation $\sqrt{\mu}$

If tables of the normal distribution are to be used to provide approximations to the Poisson distribution, account must be taken of the fact that this distribution is discrete whereas the normal distribution is continuous. It is useful to introduce what is known as a *continuity correction,* whereby the exact probability for, say, the Poisson variable y (taking integral values) is approximated by the probability of a normal variable between y - 0.5 and y + 0.5 *[jh: round the continuous values between y-0.5 and y+0.5 to the nearest integer -- imagine the "spikes" in the distribution on the previous page converted to rectangles with no gaps]*. Thus, the probability that a Poisson variable took values greater than or equal to y when y > μ (or less than or equal to y when y < μ) would be approximated by the normal tail area beyond a standardized normal deviate

$$z = \frac{|\,y - \mu\,| - 0.5}{\sqrt{\mu}} \quad (1)$$

Table 2.7:

Examples of approximation with continuity correction

Mean (μ)	SD ($\mu^{1/2}$)	Values of y	Exact Prob.	Approx Prob*	z
5	2.236	0	*0.0067*	*0.0221*	2.013
		≤2	*0.1246*	*0.1318*	1.118
		≥8	*0.1334*	*0.1318*	1.118
		≥10	*0.0318*	*0.0221*	2.013
20	4.472	≤10	*0.0108*	*0.0168*	2.124
		≤15	*0.1565*	*0.1572*	1.006
		≥25	*0.1568*	*0.1572*	1.006
		≥30	*0.0218*	*0.0168*	2.124
100	10.000	≤80	*0.0226*	*0.0256*	1.950
		≤90	*0.1714*	*0.1711*	0.950
		≥110	*0.1706*	*0.1711*	0.950
		≥120	*0.0282*	*0.0256*	1.950

* Normal approximation with continuity correction, with z as in (1)