L3–STATMF

*See back cover for an English translation of this cover*

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MANA TOHU MĀTAURANGA O AOTEAROA

993308

# Te Pāngarau me te Tauanga (Tauanga), Kaupae 3, 2014

9.30 i te ata Rāpare 20 Whiringa-ā-rangi 2014

## TE PUKAITI O NGĀ TIKANGA TĀTAI ME NGĀ TŪTOHI

## mō 91584M, 91585M me 91586M

Tirohia tēnei pepa hei whakautu i ngā pātai o ō pukapuka Pātai, Whakautu hoki.

Tirohia mehemea kei roto nei ngā whārangi 2–7 e raupapa tika ana, ā, kāore hoki he whārangi wātea.

**KA TAEA TĒNEI PUKAITI TE PUPURI HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.**

# TE PĀNGARAU ME TE TAUANGA (TAUANGA) – ĒTAHI TIKANGA TĀTAI ME ĒTAHI TŪTOHI WHAITAKE

**Ngā Whiriwhiringa Raupapa me ngā Whiriwhiringa Raupapa Kore**

$$^{n}P_{r} = \frac{n!}{(n-r)!}$$

$$\binom{n}{r} = {}^{n}C_{r} = \frac{n!}{(n-r)!r!}$$

**Taurangi Whakapae**

$$\mathrm{E}[aX + b] = a\mathrm{E}[X] + b$$

$$\mathrm{Var}[aX + b] = a^2\mathrm{Var}[X]$$

$$\mathrm{E}[aX + bY] = a\mathrm{E}[X] + b\mathrm{E}[Y]$$

$$\mathrm{Var}[aX + bY] = a^2\mathrm{Var}[X] + b^2\mathrm{Var}[Y]$$

mēnā he wehe kē te $X$ me te $Y$

**Tūponotanga**

$$\mathrm{P}(A \cup B) = \mathrm{P}(A) + \mathrm{P}(B) - \mathrm{P}(A \cap B)$$

$$\mathrm{P}(A|B) = \frac{\mathrm{P}(A \cap B)}{\mathrm{P}(B)}$$

**Te Tau Toharite me te Taurangitanga o tētahi Taurangi Matapōkere**

$$\mu = \mathrm{E}(X) \qquad \sigma^2 = \mathrm{Var}(X)$$

$$= \Sigma x.\mathrm{P}(X = x) \qquad \sigma = \mathrm{SD}(X)$$

$$= \sqrt{\Sigma(x-\mu)^2.\mathrm{P}(X = x)}$$

$$= \sqrt{\mathrm{E}(X^2) - [\mathrm{E}(X)]^2}$$

**Tuaritanga Ōrite Motukore**

Ko te pānga kiato tūponotanga, $f(x)$, mō tētahi tuaritanga ōrite motukore, ko:

$$f(x) = \begin{cases} \dfrac{1}{b-a} & \text{ina } a \le x \le b \\ 0 & \text{i wāhi kē} \end{cases}$$

# MATHEMATICS AND STATISTICS (STATISTICS) – USEFUL FORMULAE AND TABLES

## Permutations and Combinations

$$^{n}P_{r} = \frac{n!}{(n-r)!}$$

$$\binom{n}{r} = {}^{n}C_{r} = \frac{n!}{(n-r)!r!}$$

## Expectation Algebra

$$\mathrm{E}[aX + b] = a\mathrm{E}[X] + b$$

$$\mathrm{Var}[aX + b] = a^2\mathrm{Var}[X]$$

$$\mathrm{E}[aX + bY] = a\mathrm{E}[X] + b\mathrm{E}[Y]$$

$$\mathrm{Var}[aX + bY] = a^2\mathrm{Var}[X] + b^2\mathrm{Var}[Y]$$

if $X$, $Y$ are independent

## Probability

$$\mathrm{P}(A \cup B) = \mathrm{P}(A) + \mathrm{P}(B) - \mathrm{P}(A \cap B)$$

$$\mathrm{P}(A|B) = \frac{\mathrm{P}(A \cap B)}{\mathrm{P}(B)}$$

## Mean and Variance of a Discrete Random Variable

$$\mu = \mathrm{E}(X) = \Sigma x.\mathrm{P}(X = x)$$

$$\sigma^2 = \mathrm{Var}(X)$$

$$\sigma = \mathrm{SD}(X) = \sqrt{\Sigma(x-\mu)^2.\mathrm{P}(X = x)} = \sqrt{\mathrm{E}(X^2) - [\mathrm{E}(X)]^2}$$

## Continuous Uniform Distribution

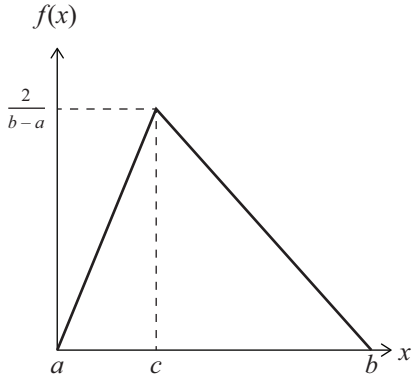
The probability density function, $f(x)$, for a continuous uniform distribution is defined as:

$$f(x) = \begin{cases} \dfrac{1}{b-a} & \text{for } a \le x \le b \\ 0 & \text{elsewhere} \end{cases}$$

## Tuaritanga Tapatoru

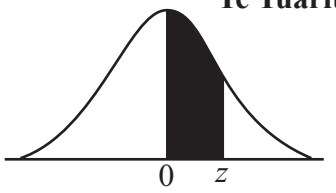
Ko te pānga kiato tūponotanga, $f(x)$, mō tētahi tuaritanga tapatoru, ko:

$$f(x) = \begin{cases} 0 & x < a \\ \dfrac{2(x-a)}{(b-a)(c-a)} & a \le x \le c \\ \dfrac{2(b-x)}{(b-a)(b-c)} & c \le x \le b \\ 0 & x > b \end{cases}$$




Horahanga o te tapatoru = $\frac{1}{2}$ pūtake × teitei

## Te Tuaritanga Māori Aro Whānui




$$\left( z = \frac{x - \mu}{\sigma} \right)$$

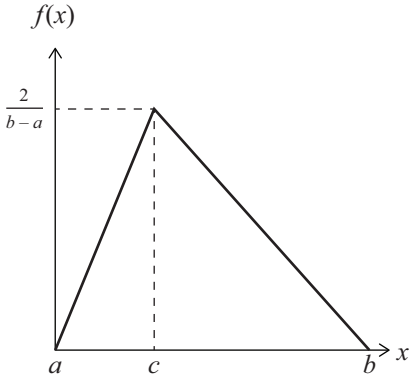
Ko ia tau e whakaatu ana i te tūponotanga ka noho mai te taurangi māori aro whānui o te $Z$ ki waenganui i te 0 me te $z$.

| $z$ | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Huatango 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | .0000 | .0040 | .0080 | .0120 | .0160 | .0199 | .0239 | .0279 | .0319 | .0359 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 |
| 0.1 | .0398 | .0438 | .0478 | .0517 | .0557 | .0596 | .0636 | .0675 | .0714 | .0754 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 |
| 0.2 | .0793 | .0832 | .0871 | .0910 | .0948 | .0987 | .1026 | .1064 | .1103 | .1141 | 4 | 8 | 12 | 15 | 19 | 22 | 27 | 31 | 35 |
| 0.3 | .1179 | .1217 | .1255 | .1293 | .1331 | .1368 | .1406 | .1443 | .1480 | .1517 | 4 | 8 | 11 | 15 | 19 | 22 | 26 | 30 | 34 |
| 0.4 | .1554 | .1591 | .1628 | .1664 | .1700 | .1736 | .1772 | .1808 | .1844 | .1879 | 4 | 7 | 11 | 14 | 18 | 22 | 25 | 29 | 32 |
| 0.5 | .1915 | .1950 | .1985 | .2019 | .2054 | .2088 | .2123 | .2157 | .2190 | .2224 | 3 | 7 | 10 | 14 | 17 | 21 | 24 | 27 | 31 |
| 0.6 | .2258 | .2291 | .2324 | .2357 | .2389 | .2422 | .2454 | .2486 | .2518 | .2549 | 3 | 6 | 10 | 13 | 16 | 19 | 23 | 26 | 29 |
| 0.7 | .2580 | .2612 | .2642 | .2673 | .2704 | .2734 | .2764 | .2794 | .2823 | .2852 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 |
| 0.8 | .2881 | .2910 | .2939 | .2967 | .2996 | .3023 | .3051 | .3078 | .3106 | .3133 | 3 | 6 | 8 | 11 | 14 | 17 | 19 | 22 | 25 |
| 0.9 | .3159 | .3186 | .3212 | .3238 | .3264 | .3289 | .3315 | .3340 | .3365 | .3389 | 3 | 5 | 8 | 10 | 13 | 15 | 18 | 20 | 23 |
| 1.0 | .3413 | .3438 | .3461 | .3485 | .3508 | .3531 | .3554 | .3577 | .3599 | .3621 | 2 | 5 | 7 | 9 | 12 | 14 | 16 | 18 | 21 |
| 1.1 | .3643 | .3665 | .3686 | .3708 | .3729 | .3749 | .3770 | .3790 | .3810 | .3830 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 19 |
| 1.2 | .3849 | .3869 | .3888 | .3907 | .3925 | .3944 | .3962 | .3980 | .3997 | .4015 | 2 | 4 | 5 | 7 | 9 | 11 | 13 | 15 | 16 |
| 1.3 | .4032 | .4049 | .4066 | .4082 | .4099 | .4115 | .4131 | .4147 | .4162 | .4177 | 2 | 3 | 5 | 6 | 8 | 10 | 11 | 13 | 14 |
| 1.4 | .4192 | .4207 | .4222 | .4236 | .4251 | .4265 | .4279 | .4292 | .4306 | .4319 | 1 | 3 | 4 | 6 | 7 | 8 | 10 | 11 | 13 |
| 1.5 | .4332 | .4345 | .4357 | .4370 | .4382 | .4394 | .4406 | .4418 | .4429 | .4441 | 1 | 2 | 4 | 5 | 6 | 7 | 8 | 10 | 11 |
| 1.6 | .4452 | .4463 | .4474 | .4484 | .4495 | .4505 | .4515 | .4525 | .4535 | .4545 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1.7 | .4554 | .4564 | .4573 | .4582 | .4591 | .4599 | .4608 | .4616 | .4625 | .4633 | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1.8 | .4641 | .4649 | .4656 | .4664 | .4671 | .4678 | .4686 | .4693 | .4699 | .4706 | 1 | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 6 |
| 1.9 | .4713 | .4719 | .4726 | .4732 | .4738 | .4744 | .4750 | .4756 | .4761 | .4767 | 1 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| 2.0 | .4772 | .4778 | .4783 | .4788 | .4793 | .4798 | .4803 | .4808 | .4812 | .4817 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 2.1 | .4821 | .4826 | .4830 | .4834 | .4838 | .4842 | .4846 | .4850 | .4854 | .4857 | 0 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 |
| 2.2 | .4861 | .4864 | .4868 | .4871 | .4875 | .4878 | .4881 | .4884 | .4887 | .4890 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| 2.3 | .4893 | .4896 | .4898 | .4901 | .4904 | .4906 | .4909 | .4911 | .4913 | .4916 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 2.4 | .4918 | .4920 | .4922 | .4925 | .4927 | .4929 | .4931 | .4932 | .4934 | .4936 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 2.5 | .4938 | .4940 | .4941 | .4943 | .4945 | .4946 | .4948 | .4949 | .4951 | .4952 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2.6 | .4953 | .4955 | .4956 | .4957 | .4959 | .4960 | .4961 | .4962 | .4963 | .4964 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 2.7 | .4965 | .4966 | .4967 | .4968 | .4969 | .4970 | .4971 | .4972 | .4973 | .4974 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 2.8 | .4974 | .4975 | .4976 | .4977 | .4977 | .4978 | .4979 | .4979 | .4980 | .4981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2.9 | .4981 | .4982 | .4982 | .4983 | .4984 | .4984 | .4985 | .4985 | .4986 | .4986 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 3.0 | .4987 | .4987 | .4987 | .4988 | .4988 | .4989 | .4989 | .4989 | .4990 | .4990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.1 | .4990 | .4991 | .4991 | .4991 | .4992 | .4992 | .4992 | .4992 | .4993 | .4993 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.2 | .4993 | .4993 | .4994 | .4994 | .4994 | .4994 | .4994 | .4995 | .4995 | .4995 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.3 | .4995 | .4995 | .4995 | .4996 | .4996 | .4996 | .4996 | .4996 | .4996 | .4997 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.4 | .4997 | .4997 | .4997 | .4997 | .4997 | .4997 | .4997 | .4997 | .4998 | .4998 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.5 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.6 | .4998 | .4998 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.7 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.8 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .5000 | .5000 | .5000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.9 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## Triangular Distribution

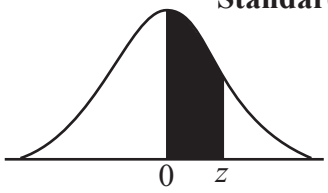
The probability density function, $f(x)$, for a triangular distribution is defined as:

$$f(x) = \begin{cases} 0 & x < a \\ \dfrac{2(x-a)}{(b-a)(c-a)} & a \le x \le c \\ \dfrac{2(b-x)}{(b-a)(b-c)} & c \le x \le b \\ 0 & x > b \end{cases}$$




$$\text{Area of a triangle} = \frac{1}{2}\text{base} \times \text{height}$$

## Standard Normal Distribution




$$\left( z = \frac{x - \mu}{\sigma} \right)$$

Each entry gives the probability that the standardised normal random variable $Z$ lies between 0 and $z$.

| $z$ | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Differences 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | .0000 | .0040 | .0080 | .0120 | .0160 | .0199 | .0239 | .0279 | .0319 | .0359 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 |
| 0.1 | .0398 | .0438 | .0478 | .0517 | .0557 | .0596 | .0636 | .0675 | .0714 | .0754 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 |
| 0.2 | .0793 | .0832 | .0871 | .0910 | .0948 | .0987 | .1026 | .1064 | .1103 | .1141 | 4 | 8 | 12 | 15 | 19 | 22 | 27 | 31 | 35 |
| 0.3 | .1179 | .1217 | .1255 | .1293 | .1331 | .1368 | .1406 | .1443 | .1480 | .1517 | 4 | 8 | 11 | 15 | 19 | 22 | 26 | 30 | 34 |
| 0.4 | .1554 | .1591 | .1628 | .1664 | .1700 | .1736 | .1772 | .1808 | .1844 | .1879 | 4 | 7 | 11 | 14 | 18 | 22 | 25 | 29 | 32 |
| 0.5 | .1915 | .1950 | .1985 | .2019 | .2054 | .2088 | .2123 | .2157 | .2190 | .2224 | 3 | 7 | 10 | 14 | 17 | 21 | 24 | 27 | 31 |
| 0.6 | .2258 | .2291 | .2324 | .2357 | .2389 | .2422 | .2454 | .2486 | .2518 | .2549 | 3 | 6 | 10 | 13 | 16 | 19 | 23 | 26 | 29 |
| 0.7 | .2580 | .2612 | .2642 | .2673 | .2704 | .2734 | .2764 | .2794 | .2823 | .2852 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 |
| 0.8 | .2881 | .2910 | .2939 | .2967 | .2996 | .3023 | .3051 | .3078 | .3106 | .3133 | 3 | 6 | 8 | 11 | 14 | 17 | 19 | 22 | 25 |
| 0.9 | .3159 | .3186 | .3212 | .3238 | .3264 | .3289 | .3315 | .3340 | .3365 | .3389 | 3 | 5 | 8 | 10 | 13 | 15 | 18 | 20 | 23 |
| 1.0 | .3413 | .3438 | .3461 | .3485 | .3508 | .3531 | .3554 | .3577 | .3599 | .3621 | 2 | 5 | 7 | 9 | 12 | 14 | 16 | 18 | 21 |
| 1.1 | .3643 | .3665 | .3686 | .3708 | .3729 | .3749 | .3770 | .3790 | .3810 | .3830 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 19 |
| 1.2 | .3849 | .3869 | .3888 | .3907 | .3925 | .3944 | .3962 | .3980 | .3997 | .4015 | 2 | 4 | 5 | 7 | 9 | 11 | 13 | 15 | 16 |
| 1.3 | .4032 | .4049 | .4066 | .4082 | .4099 | .4115 | .4131 | .4147 | .4162 | .4177 | 2 | 3 | 5 | 6 | 8 | 10 | 11 | 13 | 14 |
| 1.4 | .4192 | .4207 | .4222 | .4236 | .4251 | .4265 | .4279 | .4292 | .4306 | .4319 | 1 | 3 | 4 | 6 | 7 | 8 | 10 | 11 | 13 |
| 1.5 | .4332 | .4345 | .4357 | .4370 | .4382 | .4394 | .4406 | .4418 | .4429 | .4441 | 1 | 2 | 4 | 5 | 6 | 7 | 8 | 10 | 11 |
| 1.6 | .4452 | .4463 | .4474 | .4484 | .4495 | .4505 | .4515 | .4525 | .4535 | .4545 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1.7 | .4554 | .4564 | .4573 | .4582 | .4591 | .4599 | .4608 | .4616 | .4625 | .4633 | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1.8 | .4641 | .4649 | .4656 | .4664 | .4671 | .4678 | .4686 | .4693 | .4699 | .4706 | 1 | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 6 |
| 1.9 | .4713 | .4719 | .4726 | .4732 | .4738 | .4744 | .4750 | .4756 | .4761 | .4767 | 1 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| 2.0 | .4772 | .4778 | .4783 | .4788 | .4793 | .4798 | .4803 | .4808 | .4812 | .4817 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 2.1 | .4821 | .4826 | .4830 | .4834 | .4838 | .4842 | .4846 | .4850 | .4854 | .4857 | 0 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 |
| 2.2 | .4861 | .4864 | .4868 | .4871 | .4875 | .4878 | .4881 | .4884 | .4887 | .4890 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| 2.3 | .4893 | .4896 | .4898 | .4901 | .4904 | .4906 | .4909 | .4911 | .4913 | .4916 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 2.4 | .4918 | .4920 | .4922 | .4925 | .4927 | .4929 | .4931 | .4932 | .4934 | .4936 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 2.5 | .4938 | .4940 | .4941 | .4943 | .4945 | .4946 | .4948 | .4949 | .4951 | .4952 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2.6 | .4953 | .4955 | .4956 | .4957 | .4959 | .4960 | .4961 | .4962 | .4963 | .4964 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 2.7 | .4965 | .4966 | .4967 | .4968 | .4969 | .4970 | .4971 | .4972 | .4973 | .4974 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 2.8 | .4974 | .4975 | .4976 | .4977 | .4977 | .4978 | .4979 | .4979 | .4980 | .4981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2.9 | .4981 | .4982 | .4982 | .4983 | .4984 | .4984 | .4985 | .4985 | .4986 | .4986 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 3.0 | .4987 | .4987 | .4987 | .4988 | .4988 | .4989 | .4989 | .4989 | .4990 | .4990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.1 | .4990 | .4991 | .4991 | .4991 | .4992 | .4992 | .4992 | .4992 | .4993 | .4993 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.2 | .4993 | .4993 | .4994 | .4994 | .4994 | .4994 | .4994 | .4995 | .4995 | .4995 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.3 | .4995 | .4995 | .4995 | .4996 | .4996 | .4996 | .4996 | .4996 | .4996 | .4997 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.4 | .4997 | .4997 | .4997 | .4997 | .4997 | .4997 | .4997 | .4997 | .4998 | .4998 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.5 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | .4998 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.6 | .4998 | .4998 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.7 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.8 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .4999 | .5000 | .5000 | .5000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3.9 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | .5000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## Tuaritanga Huarua

Ko ia tau e whakaatu ana i te tūponotanga ka noho mai tētahi taurangi matapōkere huarua $X$, ki te uara $x$, ko $n$ me $\pi$ hei tawhā.

$$\left(\begin{array}{l} \mathrm{P}(X=x)=\binom{n}{x}\pi^{x}\left(1-\pi\right)^{n-x} \\ \mu=n\pi, \qquad \sigma=\sqrt{n\pi\left(1-\pi\right)} \end{array}\right)$$

| $n$ | $x$ \ $\pi$ | 0.05 | 0.1 | 0.15 | 1/6 | 0.2 | 0.25 | 0.3 | 1/3 | 0.35 | 0.4 | 0.45 | 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 0 | 0.8145 | 0.6561 | 0.5220 | 0.4823 | 0.4096 | 0.3164 | 0.2401 | 0.1975 | 0.1785 | 0.1296 | 0.0915 | 0.0625 |
| | 1 | 0.1715 | 0.2916 | 0.3685 | 0.3858 | 0.4096 | 0.4219 | 0.4116 | 0.3951 | 0.3845 | 0.3456 | 0.2995 | 0.2500 |
| | 2 | 0.0135 | 0.0486 | 0.0975 | 0.1157 | 0.1536 | 0.2109 | 0.2646 | 0.2963 | 0.3105 | 0.3456 | 0.3675 | 0.3750 |
| | 3 | 0.0005 | 0.0036 | 0.0115 | 0.0154 | 0.0256 | 0.0469 | 0.0756 | 0.0988 | 0.1115 | 0.1536 | 0.2005 | 0.2500 |
| | 4 | | 0.0001 | 0.0005 | 0.0008 | 0.0016 | 0.0039 | 0.0081 | 0.0123 | 0.0150 | 0.0256 | 0.0410 | 0.0625 |
| 5 | 0 | 0.7738 | 0.5905 | 0.4437 | 0.4019 | 0.3277 | 0.2373 | 0.1681 | 0.1317 | 0.1160 | 0.0778 | 0.0503 | 0.0313 |
| | 1 | 0.2036 | 0.3281 | 0.3915 | 0.4019 | 0.4096 | 0.3955 | 0.3602 | 0.3292 | 0.3124 | 0.2592 | 0.2059 | 0.1563 |
| | 2 | 0.0214 | 0.0729 | 0.1382 | 0.1608 | 0.2048 | 0.2637 | 0.3087 | 0.3292 | 0.3364 | 0.3456 | 0.3369 | 0.3125 |
| | 3 | 0.0011 | 0.0081 | 0.0244 | 0.0322 | 0.0512 | 0.0879 | 0.1323 | 0.1646 | 0.1811 | 0.2304 | 0.2757 | 0.3125 |
| | 4 | | 0.0005 | 0.0022 | 0.0032 | 0.0064 | 0.0146 | 0.0284 | 0.0412 | 0.0488 | 0.0768 | 0.1128 | 0.1563 |
| | 5 | | | 0.0001 | 0.0001 | 0.0003 | 0.0010 | 0.0024 | 0.0041 | 0.0053 | 0.0102 | 0.0185 | 0.0313 |
| 6 | 0 | 0.7351 | 0.5314 | 0.3771 | 0.3349 | 0.2621 | 0.1780 | 0.1176 | 0.0878 | 0.0754 | 0.0467 | 0.0277 | 0.0156 |
| | 1 | 0.2321 | 0.3543 | 0.3993 | 0.4019 | 0.3932 | 0.3560 | 0.3025 | 0.2634 | 0.2437 | 0.1866 | 0.1359 | 0.0938 |
| | 2 | 0.0305 | 0.0984 | 0.1762 | 0.2009 | 0.2458 | 0.2966 | 0.3241 | 0.3292 | 0.3280 | 0.3110 | 0.2780 | 0.2344 |
| | 3 | 0.0021 | 0.0146 | 0.0415 | 0.0536 | 0.0819 | 0.1318 | 0.1852 | 0.2195 | 0.2355 | 0.2765 | 0.3032 | 0.3125 |
| | 4 | 0.0001 | 0.0012 | 0.0055 | 0.0080 | 0.0154 | 0.0330 | 0.0595 | 0.0823 | 0.0951 | 0.1382 | 0.1861 | 0.2344 |
| | 5 | | 0.0001 | 0.0004 | 0.0006 | 0.0015 | 0.0044 | 0.0102 | 0.0165 | 0.0205 | 0.0369 | 0.0609 | 0.0938 |
| | 6 | | | | | 0.0001 | 0.0002 | 0.0007 | 0.0014 | 0.0018 | 0.0041 | 0.0083 | 0.0156 |
| 7 | 0 | 0.6983 | 0.4783 | 0.3206 | 0.2791 | 0.2097 | 0.1335 | 0.0824 | 0.0585 | 0.0490 | 0.0280 | 0.0152 | 0.0078 |
| | 1 | 0.2573 | 0.3720 | 0.3960 | 0.3907 | 0.3670 | 0.3115 | 0.2471 | 0.2048 | 0.1848 | 0.1306 | 0.0872 | 0.0547 |
| | 2 | 0.0406 | 0.1240 | 0.2097 | 0.2344 | 0.2753 | 0.3115 | 0.3177 | 0.3073 | 0.2985 | 0.2613 | 0.2140 | 0.1641 |
| | 3 | 0.0036 | 0.0230 | 0.0617 | 0.0781 | 0.1147 | 0.1730 | 0.2269 | 0.2561 | 0.2679 | 0.2903 | 0.2918 | 0.2734 |
| | 4 | 0.0002 | 0.0026 | 0.0109 | 0.0156 | 0.0287 | 0.0577 | 0.0972 | 0.1280 | 0.1442 | 0.1935 | 0.2388 | 0.2734 |
| | 5 | | 0.0002 | 0.0012 | 0.0019 | 0.0043 | 0.0115 | 0.0250 | 0.0384 | 0.0466 | 0.0774 | 0.1172 | 0.1641 |
| | 6 | | | 0.0001 | 0.0001 | 0.0004 | 0.0013 | 0.0036 | 0.0064 | 0.0084 | 0.0172 | 0.0320 | 0.0547 |
| | 7 | | | | | | 0.0001 | 0.0002 | 0.0005 | 0.0006 | 0.0016 | 0.0037 | 0.0078 |
| 8 | 0 | 0.6634 | 0.4305 | 0.2725 | 0.2326 | 0.1678 | 0.1001 | 0.0576 | 0.0390 | 0.0319 | 0.0168 | 0.0084 | 0.0039 |
| | 1 | 0.2793 | 0.3826 | 0.3847 | 0.3721 | 0.3355 | 0.2670 | 0.1977 | 0.1561 | 0.1373 | 0.0896 | 0.0548 | 0.0313 |
| | 2 | 0.0515 | 0.1488 | 0.2376 | 0.2605 | 0.2936 | 0.3115 | 0.2965 | 0.2731 | 0.2587 | 0.2090 | 0.1569 | 0.1094 |
| | 3 | 0.0054 | 0.0331 | 0.0839 | 0.1042 | 0.1468 | 0.2076 | 0.2541 | 0.2731 | 0.2786 | 0.2787 | 0.2568 | 0.2188 |
| | 4 | 0.0004 | 0.0046 | 0.0185 | 0.0260 | 0.0459 | 0.0865 | 0.1361 | 0.1707 | 0.1875 | 0.2322 | 0.2627 | 0.2734 |
| | 5 | | 0.0004 | 0.0026 | 0.0042 | 0.0092 | 0.0231 | 0.0467 | 0.0683 | 0.0808 | 0.1239 | 0.1719 | 0.2188 |
| | 6 | | | 0.0002 | 0.0004 | 0.0011 | 0.0038 | 0.0100 | 0.0171 | 0.0217 | 0.0413 | 0.0703 | 0.1094 |
| | 7 | | | | | 0.0001 | 0.0004 | 0.0012 | 0.0024 | 0.0033 | 0.0079 | 0.0164 | 0.0313 |
| | 8 | | | | | | | 0.0001 | 0.0002 | 0.0002 | 0.0007 | 0.0017 | 0.0039 |
| 9 | 0 | 0.6302 | 0.3874 | 0.2316 | 0.1938 | 0.1342 | 0.0751 | 0.0404 | 0.0260 | 0.0207 | 0.0101 | 0.0046 | 0.0020 |
| | 1 | 0.2985 | 0.3874 | 0.3679 | 0.3489 | 0.3020 | 0.2253 | 0.1556 | 0.1171 | 0.1004 | 0.0605 | 0.0339 | 0.0176 |
| | 2 | 0.0629 | 0.1722 | 0.2597 | 0.2791 | 0.3020 | 0.3003 | 0.2668 | 0.2341 | 0.2162 | 0.1612 | 0.1110 | 0.0703 |
| | 3 | 0.0077 | 0.0446 | 0.1069 | 0.1302 | 0.1762 | 0.2336 | 0.2668 | 0.2731 | 0.2716 | 0.2508 | 0.2119 | 0.1641 |
| | 4 | 0.0006 | 0.0074 | 0.0283 | 0.0391 | 0.0661 | 0.1168 | 0.1715 | 0.2048 | 0.2194 | 0.2508 | 0.2600 | 0.2461 |
| | 5 | | 0.0008 | 0.0050 | 0.0078 | 0.0165 | 0.0389 | 0.0735 | 0.1024 | 0.1181 | 0.1672 | 0.2128 | 0.2461 |
| | 6 | | 0.0001 | 0.0006 | 0.0010 | 0.0028 | 0.0087 | 0.0210 | 0.0341 | 0.0424 | 0.0743 | 0.1160 | 0.1641 |
| | 7 | | | | 0.0001 | 0.0003 | 0.0012 | 0.0039 | 0.0073 | 0.0098 | 0.0212 | 0.0407 | 0.0703 |
| | 8 | | | | | | 0.0001 | 0.0004 | 0.0009 | 0.0013 | 0.0035 | 0.0083 | 0.0176 |
| | 9 | | | | | | | | 0.0001 | 0.0001 | 0.0003 | 0.0008 | 0.0020 |
| 10 | 0 | 0.5987 | 0.3487 | 0.1969 | 0.1615 | 0.1074 | 0.0563 | 0.0282 | 0.0173 | 0.0135 | 0.0060 | 0.0025 | 0.0010 |
| | 1 | 0.3151 | 0.3874 | 0.3474 | 0.3230 | 0.2684 | 0.1877 | 0.1211 | 0.0867 | 0.0725 | 0.0403 | 0.0207 | 0.0098 |
| | 2 | 0.0746 | 0.1937 | 0.2759 | 0.2907 | 0.3020 | 0.2816 | 0.2335 | 0.1951 | 0.1757 | 0.1209 | 0.0763 | 0.0439 |
| | 3 | 0.0105 | 0.0574 | 0.1298 | 0.1550 | 0.2013 | 0.2503 | 0.2668 | 0.2601 | 0.2522 | 0.2150 | 0.1665 | 0.1172 |
| | 4 | 0.0010 | 0.0112 | 0.0401 | 0.0543 | 0.0881 | 0.1460 | 0.2001 | 0.2276 | 0.2377 | 0.2508 | 0.2384 | 0.2051 |
| | 5 | 0.0001 | 0.0015 | 0.0085 | 0.0130 | 0.0264 | 0.0584 | 0.1029 | 0.1366 | 0.1536 | 0.2007 | 0.2340 | 0.2461 |
| | 6 | | 0.0001 | 0.0012 | 0.0022 | 0.0055 | 0.0162 | 0.0368 | 0.0569 | 0.0689 | 0.1115 | 0.1596 | 0.2051 |
| | 7 | | | 0.0001 | 0.0002 | 0.0008 | 0.0031 | 0.0090 | 0.0163 | 0.0212 | 0.0425 | 0.0746 | 0.1172 |
| | 8 | | | | | 0.0001 | 0.0004 | 0.0014 | 0.0030 | 0.0043 | 0.0106 | 0.0229 | 0.0439 |
| | 9 | | | | | | | 0.0001 | 0.0003 | 0.0005 | 0.0016 | 0.0042 | 0.0098 |
| | 10 | (ko ērā atu o ngā tau katoa < 0.0001) | | | | | | | | | 0.0001 | 0.0003 | 0.0010 |

## Tuaritanga Poisson

Ko ia tau e whakaatu ana i te tūponotanga ka noho mai tētahi taurangi matapōkere Poisson $X$, ki te uara o $x$, ko te $\lambda$ hei tawhā.

$$\left(\begin{array}{l} \mathrm{P}(X=x)=\dfrac{\lambda^{x}\mathrm{e}^{-\lambda}}{x!} \\ \mu=\lambda, \qquad \sigma=\sqrt{\lambda} \end{array}\right)$$

| $x$ \ $\lambda$ | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.9048 | 0.8187 | 0.7408 | 0.6703 | 0.6065 | 0.5488 | 0.4966 | 0.4493 | 0.4066 | 0.3679 |
| 1 | 0.0905 | 0.1637 | 0.2222 | 0.2681 | 0.3033 | 0.3293 | 0.3476 | 0.3595 | 0.3659 | 0.3679 |
| 2 | 0.0045 | 0.0164 | 0.0333 | 0.0536 | 0.0758 | 0.0988 | 0.1217 | 0.1438 | 0.1647 | 0.1839 |
| 3 | 0.0002 | 0.0011 | 0.0033 | 0.0072 | 0.0126 | 0.0198 | 0.0284 | 0.0383 | 0.0494 | 0.0613 |
| 4 | | 0.0001 | 0.0003 | 0.0007 | 0.0016 | 0.0030 | 0.0050 | 0.0077 | 0.0111 | 0.0153 |
| 5 | | | | 0.0001 | 0.0002 | 0.0004 | 0.0007 | 0.0012 | 0.0020 | 0.0031 |
| 6 | | | | | | | 0.0001 | 0.0002 | 0.0003 | 0.0005 |
| 7 | | | | | | | | | | 0.0001 |

| $x$ \ $\lambda$ | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.3329 | 0.3012 | 0.2725 | 0.2466 | 0.2231 | 0.2019 | 0.1827 | 0.1653 | 0.1496 | 0.1353 |
| 1 | 0.3662 | 0.3614 | 0.3543 | 0.3452 | 0.3347 | 0.3230 | 0.3106 | 0.2975 | 0.2842 | 0.2707 |
| 2 | 0.2014 | 0.2169 | 0.2303 | 0.2417 | 0.2510 | 0.2584 | 0.2640 | 0.2678 | 0.2700 | 0.2707 |
| 3 | 0.0738 | 0.0867 | 0.0998 | 0.1128 | 0.1255 | 0.1378 | 0.1496 | 0.1607 | 0.1710 | 0.1804 |
| 4 | 0.0203 | 0.0260 | 0.0324 | 0.0395 | 0.0471 | 0.0551 | 0.0636 | 0.0723 | 0.0812 | 0.0902 |
| 5 | 0.0045 | 0.0062 | 0.0084 | 0.0111 | 0.0141 | 0.0176 | 0.0216 | 0.0260 | 0.0309 | 0.0361 |
| 6 | 0.0008 | 0.0012 | 0.0018 | 0.0026 | 0.0035 | 0.0047 | 0.0061 | 0.0078 | 0.0098 | 0.0120 |
| 7 | 0.0001 | 0.0002 | 0.0003 | 0.0005 | 0.0008 | 0.0011 | 0.0015 | 0.0020 | 0.0027 | 0.0034 |
| 8 | | | 0.0001 | 0.0001 | 0.0001 | 0.0002 | 0.0003 | 0.0005 | 0.0006 | 0.0009 |
| 9 | | | | | | | 0.0001 | 0.0001 | 0.0001 | 0.0002 |

| $x$ \ $\lambda$ | 2.2 | 2.4 | 2.6 | 2.8 | 3.0 | 3.2 | 3.4 | 3.6 | 3.8 | 4.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.1108 | 0.0907 | 0.0743 | 0.0608 | 0.0498 | 0.0408 | 0.0334 | 0.0273 | 0.0224 | 0.0183 |
| 1 | 0.2438 | 0.2177 | 0.1931 | 0.1703 | 0.1494 | 0.1304 | 0.1135 | 0.0984 | 0.0850 | 0.0733 |
| 2 | 0.2681 | 0.2613 | 0.2510 | 0.2384 | 0.2240 | 0.2087 | 0.1929 | 0.1771 | 0.1615 | 0.1465 |
| 3 | 0.1966 | 0.2090 | 0.2176 | 0.2225 | 0.2240 | 0.2226 | 0.2186 | 0.2125 | 0.2046 | 0.1954 |
| 4 | 0.1082 | 0.1254 | 0.1414 | 0.1557 | 0.1680 | 0.1781 | 0.1858 | 0.1912 | 0.1944 | 0.1954 |
| 5 | 0.0476 | 0.0602 | 0.0735 | 0.0872 | 0.1008 | 0.1140 | 0.1264 | 0.1377 | 0.1477 | 0.1563 |
| 6 | 0.0174 | 0.0241 | 0.0319 | 0.0407 | 0.0504 | 0.0608 | 0.0716 | 0.0826 | 0.0936 | 0.1042 |
| 7 | 0.0055 | 0.0083 | 0.0118 | 0.0163 | 0.0216 | 0.0278 | 0.0348 | 0.0425 | 0.0508 | 0.0595 |
| 8 | 0.0015 | 0.0025 | 0.0038 | 0.0057 | 0.0081 | 0.0111 | 0.0148 | 0.0191 | 0.0241 | 0.0298 |
| 9 | 0.0004 | 0.0007 | 0.0011 | 0.0018 | 0.0027 | 0.0040 | 0.0056 | 0.0076 | 0.0102 | 0.0132 |
| 10 | 0.0001 | 0.0002 | 0.0003 | 0.0005 | 0.0008 | 0.0013 | 0.0019 | 0.0028 | 0.0039 | 0.0053 |
| 11 | | | 0.0001 | 0.0001 | 0.0002 | 0.0004 | 0.0006 | 0.0009 | 0.0013 | 0.0019 |
| 12 | | | | | 0.0001 | 0.0001 | 0.0002 | 0.0003 | 0.0004 | 0.0006 |
| 13 | | | | | | | | 0.0001 | 0.0001 | 0.0002 |
| 14 | | | | | | | | | | 0.0001 |

| $x$ \ $\lambda$ | 4.2 | 4.4 | 4.6 | 4.8 | 5.0 | 5.2 | 5.4 | 5.6 | 5.8 | 6.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0150 | 0.0123 | 0.0101 | 0.0082 | 0.0067 | 0.0055 | 0.0045 | 0.0037 | 0.0030 | 0.0025 |
| 1 | 0.0630 | 0.0540 | 0.0462 | 0.0395 | 0.0337 | 0.0287 | 0.0244 | 0.0207 | 0.0176 | 0.0149 |
| 2 | 0.1323 | 0.1188 | 0.1063 | 0.0948 | 0.0842 | 0.0746 | 0.0659 | 0.0580 | 0.0509 | 0.0446 |
| 3 | 0.1852 | 0.1743 | 0.1631 | 0.1517 | 0.1404 | 0.1293 | 0.1185 | 0.1082 | 0.0985 | 0.0892 |
| 4 | 0.1944 | 0.1917 | 0.1875 | 0.1820 | 0.1755 | 0.1681 | 0.1600 | 0.1515 | 0.1428 | 0.1339 |
| 5 | 0.1633 | 0.1687 | 0.1725 | 0.1747 | 0.1755 | 0.1748 | 0.1728 | 0.1697 | 0.1656 | 0.1606 |
| 6 | 0.1143 | 0.1237 | 0.1323 | 0.1398 | 0.1462 | 0.1515 | 0.1555 | 0.1584 | 0.1601 | 0.1606 |
| 7 | 0.0686 | 0.0778 | 0.0869 | 0.0959 | 0.1044 | 0.1125 | 0.1200 | 0.1267 | 0.1326 | 0.1377 |
| 8 | 0.0360 | 0.0428 | 0.0500 | 0.0575 | 0.0653 | 0.0731 | 0.0810 | 0.0887 | 0.0962 | 0.1033 |
| 9 | 0.0168 | 0.0209 | 0.0255 | 0.0307 | 0.0363 | 0.0423 | 0.0486 | 0.0552 | 0.0620 | 0.0688 |
| 10 | 0.0071 | 0.0092 | 0.0118 | 0.0147 | 0.0181 | 0.0220 | 0.0262 | 0.0309 | 0.0359 | 0.0413 |
| 11 | 0.0027 | 0.0037 | 0.0049 | 0.0064 | 0.0082 | 0.0104 | 0.0129 | 0.0157 | 0.0190 | 0.0225 |
| 12 | 0.0009 | 0.0013 | 0.0019 | 0.0026 | 0.0034 | 0.0045 | 0.0058 | 0.0073 | 0.0092 | 0.0113 |
| 13 | 0.0003 | 0.0005 | 0.0007 | 0.0009 | 0.0013 | 0.0018 | 0.0024 | 0.0032 | 0.0041 | 0.0052 |
| 14 | 0.0001 | 0.0001 | 0.0002 | 0.0003 | 0.0005 | 0.0007 | 0.0009 | 0.0013 | 0.0017 | 0.0022 |
| 15 | | | 0.0001 | 0.0001 | 0.0002 | 0.0002 | 0.0003 | 0.0005 | 0.0007 | 0.0009 |
| 16 | | | | | | 0.0001 | 0.0001 | 0.0002 | 0.0002 | 0.0003 |
| 17 | (ko ērā atu o ngā tau katoa < 0.0001) | | | | | | | 0.0001 | 0.0001 | 0.0001 |

## Binomial Distribution

Each entry gives the probability that a binomial random variable $X$, with the parameters $n$ and $\pi$, has the value $x$.

$$\left(\mathrm{P}(X=x)=\binom{n}{x}\pi^{x}\left(1-\pi\right)^{n-x}\right.$$

$$\left.\mu=n\pi, \qquad \sigma=\sqrt{n\pi\left(1-\pi\right)}\right)$$

| $n$ | $x$ \ $\pi$ | 0.05 | 0.1 | 0.15 | 1/6 | 0.2 | 0.25 | 0.3 | 1/3 | 0.35 | 0.4 | 0.45 | 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 0 | 0.8145 | 0.6561 | 0.5220 | 0.4823 | 0.4096 | 0.3164 | 0.2401 | 0.1975 | 0.1785 | 0.1296 | 0.0915 | 0.0625 |
| | 1 | 0.1715 | 0.2916 | 0.3685 | 0.3858 | 0.4096 | 0.4219 | 0.4116 | 0.3951 | 0.3845 | 0.3456 | 0.2995 | 0.2500 |
| | 2 | 0.0135 | 0.0486 | 0.0975 | 0.1157 | 0.1536 | 0.2109 | 0.2646 | 0.2963 | 0.3105 | 0.3456 | 0.3675 | 0.3750 |
| | 3 | 0.0005 | 0.0036 | 0.0115 | 0.0154 | 0.0256 | 0.0469 | 0.0756 | 0.0988 | 0.1115 | 0.1536 | 0.2005 | 0.2500 |
| | 4 | | 0.0001 | 0.0005 | 0.0008 | 0.0016 | 0.0039 | 0.0081 | 0.0123 | 0.0150 | 0.0256 | 0.0410 | 0.0625 |
| 5 | 0 | 0.7738 | 0.5905 | 0.4437 | 0.4019 | 0.3277 | 0.2373 | 0.1681 | 0.1317 | 0.1160 | 0.0778 | 0.0503 | 0.0313 |
| | 1 | 0.2036 | 0.3281 | 0.3915 | 0.4019 | 0.4096 | 0.3955 | 0.3602 | 0.3292 | 0.3124 | 0.2592 | 0.2059 | 0.1563 |
| | 2 | 0.0214 | 0.0729 | 0.1382 | 0.1608 | 0.2048 | 0.2637 | 0.3087 | 0.3292 | 0.3364 | 0.3456 | 0.3369 | 0.3125 |
| | 3 | 0.0011 | 0.0081 | 0.0244 | 0.0322 | 0.0512 | 0.0879 | 0.1323 | 0.1646 | 0.1811 | 0.2304 | 0.2757 | 0.3125 |
| | 4 | | 0.0005 | 0.0022 | 0.0032 | 0.0064 | 0.0146 | 0.0284 | 0.0412 | 0.0488 | 0.0768 | 0.1128 | 0.1563 |
| | 5 | | | 0.0001 | 0.0001 | 0.0003 | 0.0010 | 0.0024 | 0.0041 | 0.0053 | 0.0102 | 0.0185 | 0.0313 |
| 6 | 0 | 0.7351 | 0.5314 | 0.3771 | 0.3349 | 0.2621 | 0.1780 | 0.1176 | 0.0878 | 0.0754 | 0.0467 | 0.0277 | 0.0156 |
| | 1 | 0.2321 | 0.3543 | 0.3993 | 0.4019 | 0.3932 | 0.3560 | 0.3025 | 0.2634 | 0.2437 | 0.1866 | 0.1359 | 0.0938 |
| | 2 | 0.0305 | 0.0984 | 0.1762 | 0.2009 | 0.2458 | 0.2966 | 0.3241 | 0.3292 | 0.3280 | 0.3110 | 0.2780 | 0.2344 |
| | 3 | 0.0021 | 0.0146 | 0.0415 | 0.0536 | 0.0819 | 0.1318 | 0.1852 | 0.2195 | 0.2355 | 0.2765 | 0.3032 | 0.3125 |
| | 4 | 0.0001 | 0.0012 | 0.0055 | 0.0080 | 0.0154 | 0.0330 | 0.0595 | 0.0823 | 0.0951 | 0.1382 | 0.1861 | 0.2344 |
| | 5 | | 0.0001 | 0.0004 | 0.0006 | 0.0015 | 0.0044 | 0.0102 | 0.0165 | 0.0205 | 0.0369 | 0.0609 | 0.0938 |
| | 6 | | | | | 0.0001 | 0.0002 | 0.0007 | 0.0014 | 0.0018 | 0.0041 | 0.0083 | 0.0156 |
| 7 | 0 | 0.6983 | 0.4783 | 0.3206 | 0.2791 | 0.2097 | 0.1335 | 0.0824 | 0.0585 | 0.0490 | 0.0280 | 0.0152 | 0.0078 |
| | 1 | 0.2573 | 0.3720 | 0.3960 | 0.3907 | 0.3670 | 0.3115 | 0.2471 | 0.2048 | 0.1848 | 0.1306 | 0.0872 | 0.0547 |
| | 2 | 0.0406 | 0.1240 | 0.2097 | 0.2344 | 0.2753 | 0.3115 | 0.3177 | 0.3073 | 0.2985 | 0.2613 | 0.2140 | 0.1641 |
| | 3 | 0.0036 | 0.0230 | 0.0617 | 0.0781 | 0.1147 | 0.1730 | 0.2269 | 0.2561 | 0.2679 | 0.2903 | 0.2918 | 0.2734 |
| | 4 | 0.0002 | 0.0026 | 0.0109 | 0.0156 | 0.0287 | 0.0577 | 0.0972 | 0.1280 | 0.1442 | 0.1935 | 0.2388 | 0.2734 |
| | 5 | | 0.0002 | 0.0012 | 0.0019 | 0.0043 | 0.0115 | 0.0250 | 0.0384 | 0.0466 | 0.0774 | 0.1172 | 0.1641 |
| | 6 | | | 0.0001 | 0.0001 | 0.0004 | 0.0013 | 0.0036 | 0.0064 | 0.0084 | 0.0172 | 0.0320 | 0.0547 |
| | 7 | | | | | | 0.0001 | 0.0002 | 0.0005 | 0.0006 | 0.0016 | 0.0037 | 0.0078 |
| 8 | 0 | 0.6634 | 0.4305 | 0.2725 | 0.2326 | 0.1678 | 0.1001 | 0.0576 | 0.0390 | 0.0319 | 0.0168 | 0.0084 | 0.0039 |
| | 1 | 0.2793 | 0.3826 | 0.3847 | 0.3721 | 0.3355 | 0.2670 | 0.1977 | 0.1561 | 0.1373 | 0.0896 | 0.0548 | 0.0313 |
| | 2 | 0.0515 | 0.1488 | 0.2376 | 0.2605 | 0.2936 | 0.3115 | 0.2965 | 0.2731 | 0.2587 | 0.2090 | 0.1569 | 0.1094 |
| | 3 | 0.0054 | 0.0331 | 0.0839 | 0.1042 | 0.1468 | 0.2076 | 0.2541 | 0.2731 | 0.2786 | 0.2787 | 0.2568 | 0.2188 |
| | 4 | 0.0004 | 0.0046 | 0.0185 | 0.0260 | 0.0459 | 0.0865 | 0.1361 | 0.1707 | 0.1875 | 0.2322 | 0.2627 | 0.2734 |
| | 5 | | 0.0004 | 0.0026 | 0.0042 | 0.0092 | 0.0231 | 0.0467 | 0.0683 | 0.0808 | 0.1239 | 0.1719 | 0.2188 |
| | 6 | | | 0.0002 | 0.0004 | 0.0011 | 0.0038 | 0.0100 | 0.0171 | 0.0217 | 0.0413 | 0.0703 | 0.1094 |
| | 7 | | | | | 0.0001 | 0.0004 | 0.0012 | 0.0024 | 0.0033 | 0.0079 | 0.0164 | 0.0313 |
| | 8 | | | | | | | 0.0001 | 0.0002 | 0.0002 | 0.0007 | 0.0017 | 0.0039 |
| 9 | 0 | 0.6302 | 0.3874 | 0.2316 | 0.1938 | 0.1342 | 0.0751 | 0.0404 | 0.0260 | 0.0207 | 0.0101 | 0.0046 | 0.0020 |
| | 1 | 0.2985 | 0.3874 | 0.3679 | 0.3489 | 0.3020 | 0.2253 | 0.1556 | 0.1171 | 0.1004 | 0.0605 | 0.0339 | 0.0176 |
| | 2 | 0.0629 | 0.1722 | 0.2597 | 0.2791 | 0.3020 | 0.3003 | 0.2668 | 0.2341 | 0.2162 | 0.1612 | 0.1110 | 0.0703 |
| | 3 | 0.0077 | 0.0446 | 0.1069 | 0.1302 | 0.1762 | 0.2336 | 0.2668 | 0.2731 | 0.2716 | 0.2508 | 0.2119 | 0.1641 |
| | 4 | 0.0006 | 0.0074 | 0.0283 | 0.0391 | 0.0661 | 0.1168 | 0.1715 | 0.2048 | 0.2194 | 0.2508 | 0.2600 | 0.2461 |
| | 5 | | 0.0008 | 0.0050 | 0.0078 | 0.0165 | 0.0389 | 0.0735 | 0.1024 | 0.1181 | 0.1672 | 0.2128 | 0.2461 |
| | 6 | | 0.0001 | 0.0006 | 0.0010 | 0.0028 | 0.0087 | 0.0210 | 0.0341 | 0.0424 | 0.0743 | 0.1160 | 0.1641 |
| | 7 | | | | 0.0001 | 0.0003 | 0.0012 | 0.0039 | 0.0073 | 0.0098 | 0.0212 | 0.0407 | 0.0703 |
| | 8 | | | | | | 0.0001 | 0.0004 | 0.0009 | 0.0013 | 0.0035 | 0.0083 | 0.0176 |
| | 9 | | | | | | | | 0.0001 | 0.0001 | 0.0003 | 0.0008 | 0.0020 |
| 10 | 0 | 0.5987 | 0.3487 | 0.1969 | 0.1615 | 0.1074 | 0.0563 | 0.0282 | 0.0173 | 0.0135 | 0.0060 | 0.0025 | 0.0010 |
| | 1 | 0.3151 | 0.3874 | 0.3474 | 0.3230 | 0.2684 | 0.1877 | 0.1211 | 0.0867 | 0.0725 | 0.0403 | 0.0207 | 0.0098 |
| | 2 | 0.0746 | 0.1937 | 0.2759 | 0.2907 | 0.3020 | 0.2816 | 0.2335 | 0.1951 | 0.1757 | 0.1209 | 0.0763 | 0.0439 |
| | 3 | 0.0105 | 0.0574 | 0.1298 | 0.1550 | 0.2013 | 0.2503 | 0.2668 | 0.2601 | 0.2522 | 0.2150 | 0.1665 | 0.1172 |
| | 4 | 0.0010 | 0.0112 | 0.0401 | 0.0543 | 0.0881 | 0.1460 | 0.2001 | 0.2276 | 0.2377 | 0.2508 | 0.2384 | 0.2051 |
| | 5 | 0.0001 | 0.0015 | 0.0085 | 0.0130 | 0.0264 | 0.0584 | 0.1029 | 0.1366 | 0.1536 | 0.2007 | 0.2340 | 0.2461 |
| | 6 | | 0.0001 | 0.0012 | 0.0022 | 0.0055 | 0.0162 | 0.0368 | 0.0569 | 0.0689 | 0.1115 | 0.1596 | 0.2051 |
| | 7 | | | 0.0001 | 0.0002 | 0.0008 | 0.0031 | 0.0090 | 0.0163 | 0.0212 | 0.0425 | 0.0746 | 0.1172 |
| | 8 | | | | | 0.0001 | 0.0004 | 0.0014 | 0.0030 | 0.0043 | 0.0106 | 0.0229 | 0.0439 |
| | 9 | | | | | | | 0.0001 | 0.0003 | 0.0005 | 0.0016 | 0.0042 | 0.0098 |
| | 10 | (all other entries < 0.0001) | | | | | | | | | 0.0001 | 0.0003 | 0.0010 |

## Poisson Distribution

Each entry gives the probability that a Poisson random variable $X$, with parameter $\lambda$, has the value $x$.

$$\left(\mathrm{P}(X=x)=\frac{\lambda^{x}\mathrm{e}^{-\lambda}}{x!}\right.$$

$$\left.\mu=\lambda, \qquad \sigma=\sqrt{\lambda}\right)$$

| $x$ \ $\lambda$ | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.9048 | 0.8187 | 0.7408 | 0.6703 | 0.6065 | 0.5488 | 0.4966 | 0.4493 | 0.4066 | 0.3679 |
| 1 | 0.0905 | 0.1637 | 0.2222 | 0.2681 | 0.3033 | 0.3293 | 0.3476 | 0.3595 | 0.3659 | 0.3679 |
| 2 | 0.0045 | 0.0164 | 0.0333 | 0.0536 | 0.0758 | 0.0988 | 0.1217 | 0.1438 | 0.1647 | 0.1839 |
| 3 | 0.0002 | 0.0011 | 0.0033 | 0.0072 | 0.0126 | 0.0198 | 0.0284 | 0.0383 | 0.0494 | 0.0613 |
| 4 | | 0.0001 | 0.0003 | 0.0007 | 0.0016 | 0.0030 | 0.0050 | 0.0077 | 0.0111 | 0.0153 |
| 5 | | | | 0.0001 | 0.0002 | 0.0004 | 0.0007 | 0.0012 | 0.0020 | 0.0031 |
| 6 | | | | | | | 0.0001 | 0.0002 | 0.0003 | 0.0005 |
| 7 | | | | | | | | | | 0.0001 |

| $x$ \ $\lambda$ | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.3329 | 0.3012 | 0.2725 | 0.2466 | 0.2231 | 0.2019 | 0.1827 | 0.1653 | 0.1496 | 0.1353 |
| 1 | 0.3662 | 0.3614 | 0.3543 | 0.3452 | 0.3347 | 0.3230 | 0.3106 | 0.2975 | 0.2842 | 0.2707 |
| 2 | 0.2014 | 0.2169 | 0.2303 | 0.2417 | 0.2510 | 0.2584 | 0.2640 | 0.2678 | 0.2700 | 0.2707 |
| 3 | 0.0738 | 0.0867 | 0.0998 | 0.1128 | 0.1255 | 0.1378 | 0.1496 | 0.1607 | 0.1710 | 0.1804 |
| 4 | 0.0203 | 0.0260 | 0.0324 | 0.0395 | 0.0471 | 0.0551 | 0.0636 | 0.0723 | 0.0812 | 0.0902 |
| 5 | 0.0045 | 0.0062 | 0.0084 | 0.0111 | 0.0141 | 0.0176 | 0.0216 | 0.0260 | 0.0309 | 0.0361 |
| 6 | 0.0008 | 0.0012 | 0.0018 | 0.0026 | 0.0035 | 0.0047 | 0.0061 | 0.0078 | 0.0098 | 0.0120 |
| 7 | 0.0001 | 0.0002 | 0.0003 | 0.0005 | 0.0008 | 0.0011 | 0.0015 | 0.0020 | 0.0027 | 0.0034 |
| 8 | | | 0.0001 | 0.0001 | 0.0001 | 0.0002 | 0.0003 | 0.0005 | 0.0006 | 0.0009 |
| 9 | | | | | | | 0.0001 | 0.0001 | 0.0001 | 0.0002 |

| $x$ \ $\lambda$ | 2.2 | 2.4 | 2.6 | 2.8 | 3.0 | 3.2 | 3.4 | 3.6 | 3.8 | 4.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.1108 | 0.0907 | 0.0743 | 0.0608 | 0.0498 | 0.0408 | 0.0334 | 0.0273 | 0.0224 | 0.0183 |
| 1 | 0.2438 | 0.2177 | 0.1931 | 0.1703 | 0.1494 | 0.1304 | 0.1135 | 0.0984 | 0.0850 | 0.0733 |
| 2 | 0.2681 | 0.2613 | 0.2510 | 0.2384 | 0.2240 | 0.2087 | 0.1929 | 0.1771 | 0.1615 | 0.1465 |
| 3 | 0.1966 | 0.2090 | 0.2176 | 0.2225 | 0.2240 | 0.2226 | 0.2186 | 0.2125 | 0.2046 | 0.1954 |
| 4 | 0.1082 | 0.1254 | 0.1414 | 0.1557 | 0.1680 | 0.1781 | 0.1858 | 0.1912 | 0.1944 | 0.1954 |
| 5 | 0.0476 | 0.0602 | 0.0735 | 0.0872 | 0.1008 | 0.1140 | 0.1264 | 0.1377 | 0.1477 | 0.1563 |
| 6 | 0.0174 | 0.0241 | 0.0319 | 0.0407 | 0.0504 | 0.0608 | 0.0716 | 0.0826 | 0.0936 | 0.1042 |
| 7 | 0.0055 | 0.0083 | 0.0118 | 0.0163 | 0.0216 | 0.0278 | 0.0348 | 0.0425 | 0.0508 | 0.0595 |
| 8 | 0.0015 | 0.0025 | 0.0038 | 0.0057 | 0.0081 | 0.0111 | 0.0148 | 0.0191 | 0.0241 | 0.0298 |
| 9 | 0.0004 | 0.0007 | 0.0011 | 0.0018 | 0.0027 | 0.0040 | 0.0056 | 0.0076 | 0.0102 | 0.0132 |
| 10 | 0.0001 | 0.0002 | 0.0003 | 0.0005 | 0.0008 | 0.0013 | 0.0019 | 0.0028 | 0.0039 | 0.0053 |
| 11 | | | 0.0001 | 0.0001 | 0.0002 | 0.0004 | 0.0006 | 0.0009 | 0.0013 | 0.0019 |
| 12 | | | | | 0.0001 | 0.0001 | 0.0002 | 0.0003 | 0.0004 | 0.0006 |
| 13 | | | | | | | | 0.0001 | 0.0001 | 0.0002 |
| 14 | | | | | | | | | | 0.0001 |

| $x$ \ $\lambda$ | 4.2 | 4.4 | 4.6 | 4.8 | 5.0 | 5.2 | 5.4 | 5.6 | 5.8 | 6.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0150 | 0.0123 | 0.0101 | 0.0082 | 0.0067 | 0.0055 | 0.0045 | 0.0037 | 0.0030 | 0.0025 |
| 1 | 0.0630 | 0.0540 | 0.0462 | 0.0395 | 0.0337 | 0.0287 | 0.0244 | 0.0207 | 0.0176 | 0.0149 |
| 2 | 0.1323 | 0.1188 | 0.1063 | 0.0948 | 0.0842 | 0.0746 | 0.0659 | 0.0580 | 0.0509 | 0.0446 |
| 3 | 0.1852 | 0.1743 | 0.1631 | 0.1517 | 0.1404 | 0.1293 | 0.1185 | 0.1082 | 0.0985 | 0.0892 |
| 4 | 0.1944 | 0.1917 | 0.1875 | 0.1820 | 0.1755 | 0.1681 | 0.1600 | 0.1515 | 0.1428 | 0.1339 |
| 5 | 0.1633 | 0.1687 | 0.1725 | 0.1747 | 0.1755 | 0.1748 | 0.1728 | 0.1697 | 0.1656 | 0.1606 |
| 6 | 0.1143 | 0.1237 | 0.1323 | 0.1398 | 0.1462 | 0.1515 | 0.1555 | 0.1584 | 0.1601 | 0.1606 |
| 7 | 0.0686 | 0.0778 | 0.0869 | 0.0959 | 0.1044 | 0.1125 | 0.1200 | 0.1267 | 0.1326 | 0.1377 |
| 8 | 0.0360 | 0.0428 | 0.0500 | 0.0575 | 0.0653 | 0.0731 | 0.0810 | 0.0887 | 0.0962 | 0.1033 |
| 9 | 0.0168 | 0.0209 | 0.0255 | 0.0307 | 0.0363 | 0.0423 | 0.0486 | 0.0552 | 0.0620 | 0.0688 |
| 10 | 0.0071 | 0.0092 | 0.0118 | 0.0147 | 0.0181 | 0.0220 | 0.0262 | 0.0309 | 0.0359 | 0.0413 |
| 11 | 0.0027 | 0.0037 | 0.0049 | 0.0064 | 0.0082 | 0.0104 | 0.0129 | 0.0157 | 0.0190 | 0.0225 |
| 12 | 0.0009 | 0.0013 | 0.0019 | 0.0026 | 0.0034 | 0.0045 | 0.0058 | 0.0073 | 0.0092 | 0.0113 |
| 13 | 0.0003 | 0.0005 | 0.0007 | 0.0009 | 0.0013 | 0.0018 | 0.0024 | 0.0032 | 0.0041 | 0.0052 |
| 14 | 0.0001 | 0.0001 | 0.0002 | 0.0003 | 0.0005 | 0.0007 | 0.0009 | 0.0013 | 0.0017 | 0.0022 |
| 15 | | | 0.0001 | 0.0001 | 0.0002 | 0.0002 | 0.0003 | 0.0005 | 0.0007 | 0.0009 |
| 16 | | | | | | 0.0001 | 0.0001 | 0.0002 | 0.0002 | 0.0003 |
| 17 | (all other entries < 0.0001) | | | | | | | 0.0001 | 0.0001 | 0.0001 |

*English translation of the wording on the front cover*

# Level 3 Mathematics and Statistics (Statistics), 2014

9.30 am Thursday 20 November 2014

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