STUDY FORMULA BOOKLET

# Edexcel IAL Maths Unit S2 (WST02): statistics 2

The booklet prints the binomial and Poisson formulae, the continuous mean, variance and c.d.f., the uniform distribution and tables X2 to X5. Learn first P(a < X <= b), f = dF/dx, the approximations with continuity correction and the test method.

GIVEN printed in the formula booklet LEARN IT not in the booklet: learn it

Built by CuratedPrep from 17 past question papers for Unit S2 in our question bank, January 2021 to January 2026. Given means it is in the Mathematical Formulae and Statistical Tables booklet (Issue 2, 2021) handed out in every unit exam. Learn it means a past question needed it and the exam did not print it.

## Binomial and Poisson distributions

The booklet prints the probability, mean and variance formulae for both distributions, and the cumulative tables X4 and X5 follow this section. The approximations and the rules for converting probabilities are not printed.

### Binomial B(n, p): probability

n is the number of trials and p the probability of success on each. Use the tables X4 when n and p are in them. Used in: Jan 2026 (A) Q2(a), P(X = 3) for B(10, p) in terms of p; Jun 2023 Q1(a)(i), exactly 26 of 50 adults; Jan 2021 Q1(c)(i), exactly 24 of 30 oysters survive.

$$P(X = x) = \binom{n}{x} p^x (1-p)^{n-x}$$

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### Binomial B(n, p): mean

np is the expected number of successes. Used in: Jun 2025 Q3(a), n and p from a mean of 3 and a variance of 2.55; Jun 2025 Q3(b), the expected number of green sweets in 40; Jan 2026 (A) Q2(c), n = 80 from np = 32.

$$np$$

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### Binomial B(n, p): variance

The standard deviation is the square root of np(1 - p). It supplies the second parameter of a normal approximation. Used in: Jan 2025 Q6(a), variance of R in terms of p; Oct 2023 Q7, n and p from a normal approximation; Jan 2026 (A) Q2(c), alpha = 19.2.

$$np(1-p)$$

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### Poisson Po(λ): probability

x is a whole number and λ is the mean for the interval in the question. Used in: Jan 2026 (A) Q2(b), λ when P(Y = 3) is 5 times P(Y = 5); Jan 2025 Q1(e), λ from P(Y = 6) and P(Y = 7); Jun 2022 Q1(c), P(W = 2) for Po(4).

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

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### Poisson Po(λ): mean

The mean is the average rate for the interval asked about, so scale it to that interval first. Used in: Jan 2021 Q3(c), a mean of 7 per 100 ml becomes 0.07n for n ml; Jan 2026 Q6(f), a mean of 5 per 150 $m^2$ becomes 30 per 900 $m^2$; Oct 2025 Q2(a), the sample mean 1.98.

$$\lambda$$

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### Poisson Po(λ): variance

The variance equals the mean, which is how a question tests whether data fit a Poisson model. Used in: Oct 2025 Q2(a), mean 1.98 and variance 1.95; Jun 2022 Q1(a), the variance of W ~ Po(4); Jan 2021 Q3(c), N(0.07n, 0.07n).

$$\lambda$$

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### Cumulative probabilities from the tables

The tables X4 and X5 print P(X <= x) only, so convert 'more than', 'at least' and 'between' first and take care with the end values. Used in: Jan 2026 Q1(d), more than 40% of 50 customers; Jan 2026 (A) Q1(b), at least 3 of 8 rods; Jan 2026 Q3(a)(i), at least 4 detections.

$$P(X \geq k) = 1 - P(X \leq k-1), \qquad P(X = k) = P(X \leq k) - P(X \leq k-1)$$

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### At least one success in n trials

Set it above the target probability and solve for n with logarithms. Dividing by log(1 - p), which is negative, reverses the inequality. Used in: Oct 2025 Q5(b), the least number of tulips for P(at least 1) > 0.95; Jun 2025 Q4(b), the least n for P(Y >= 1) > 0.95.

$$P(X \geq 1) = 1 - (1-p)^n$$

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### Poisson over a different interval

The specification gives Po(λ) per minute becoming Po(5 λ) per 5 minutes. Scale the mean to the interval in the question before you use the tables. Used in: Jan 2026 Q3(a), 2.5 per 15 minutes becomes 5 per 30 minutes; Jan 2026 (A) Q7(b), a rate of 1 per 2 months gives Po(0.5m); Oct 2025 (A) Q5(a), 3 per 5 minutes gives 6 per 10 minutes.

$$\text{rate } \lambda \text{ per unit} \;\Rightarrow\; \text{number in } t \text{ units} \sim \text{Po}(t\lambda)$$

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### Poisson approximation to the binomial

State the conditions: n large and p small, and the schemes allow 'p < 0.1' or 'p close to 0'. Used in: Jan 2026 (A) Q1(c), more than 5 of 60 rods with p = 0.05; Jun 2023 Q4(b), no more than 6 of 125 candles; Jan 2025 Q1(b), P(X = 2) for 100 trials.

$$X \sim \text{B}(n,p) \approx \text{Po}(np) \quad (n \text{ large},\ p \text{ small})$$

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### Percentage error of an approximation

Use the exact binomial probability as the denominator. Used in: Jan 2025 Q1(c), the percentage error of the Poisson approximation.

$$\text{percentage error} = \frac{\text{approximate} - \text{exact}}{\text{exact}} \times 100\%$$

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## Binomial cumulative distribution function

The tabulated value is P(X ≤ x), where X has a binomial distribution with index n and parameter p.

**n = 5**

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.7738 | 0.5905 | 0.4437 | 0.3277 | 0.2373 | 0.1681 | 0.1160 | 0.0778 | 0.0503 | 0.0312 |
| 1 | 0.9774 | 0.9185 | 0.8352 | 0.7373 | 0.6328 | 0.5282 | 0.4284 | 0.3370 | 0.2562 | 0.1875 |
| 2 | 0.9988 | 0.9914 | 0.9734 | 0.9421 | 0.8965 | 0.8369 | 0.7648 | 0.6826 | 0.5931 | 0.5000 |
| 3 | 1.0000 | 0.9995 | 0.9978 | 0.9933 | 0.9844 | 0.9692 | 0.9460 | 0.9130 | 0.8688 | 0.8125 |
| 4 | 1.0000 | 1.0000 | 0.9999 | 0.9997 | 0.9990 | 0.9976 | 0.9947 | 0.9898 | 0.9815 | 0.9688 |

**n = 6**

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.7351 | 0.5314 | 0.3771 | 0.2621 | 0.1780 | 0.1176 | 0.0754 | 0.0467 | 0.0277 | 0.0156 |
| 1 | 0.9672 | 0.8857 | 0.7765 | 0.6554 | 0.5339 | 0.4202 | 0.3191 | 0.2333 | 0.1636 | 0.1094 |
| 2 | 0.9978 | 0.9842 | 0.9527 | 0.9011 | 0.8306 | 0.7443 | 0.6471 | 0.5443 | 0.4415 | 0.3438 |
| 3 | 0.9999 | 0.9987 | 0.9941 | 0.9830 | 0.9624 | 0.9295 | 0.8826 | 0.8208 | 0.7447 | 0.6563 |
| 4 | 1.0000 | 0.9999 | 0.9996 | 0.9984 | 0.9954 | 0.9891 | 0.9777 | 0.9590 | 0.9308 | 0.8906 |
| 5 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9998 | 0.9993 | 0.9982 | 0.9959 | 0.9917 | 0.9844 |

## n = 7

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.6983 | 0.4783 | 0.3206 | 0.2097 | 0.1335 | 0.0824 | 0.0490 | 0.0280 | 0.0152 | 0.0078 |
| 1 | 0.9556 | 0.8503 | 0.7166 | 0.5767 | 0.4449 | 0.3294 | 0.2338 | 0.1586 | 0.1024 | 0.0625 |
| 2 | 0.9962 | 0.9743 | 0.9262 | 0.8520 | 0.7564 | 0.6471 | 0.5323 | 0.4199 | 0.3164 | 0.2266 |
| 3 | 0.9998 | 0.9973 | 0.9879 | 0.9667 | 0.9294 | 0.8740 | 0.8002 | 0.7102 | 0.6083 | 0.5000 |
| 4 | 1.0000 | 0.9998 | 0.9988 | 0.9953 | 0.9871 | 0.9712 | 0.9444 | 0.9037 | 0.8471 | 0.7734 |
| 5 | 1.0000 | 1.0000 | 0.9999 | 0.9996 | 0.9987 | 0.9962 | 0.9910 | 0.9812 | 0.9643 | 0.9375 |
| 6 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9998 | 0.9994 | 0.9984 | 0.9963 | 0.9922 |

## n = 8

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.6634 | 0.4305 | 0.2725 | 0.1678 | 0.1001 | 0.0576 | 0.0319 | 0.0168 | 0.0084 | 0.0039 |
| 1 | 0.9428 | 0.8131 | 0.6572 | 0.5033 | 0.3671 | 0.2553 | 0.1691 | 0.1064 | 0.0632 | 0.0352 |
| 2 | 0.9942 | 0.9619 | 0.8948 | 0.7969 | 0.6785 | 0.5518 | 0.4278 | 0.3154 | 0.2201 | 0.1445 |
| 3 | 0.9996 | 0.9950 | 0.9786 | 0.9437 | 0.8862 | 0.8059 | 0.7064 | 0.5941 | 0.4770 | 0.3633 |
| 4 | 1.0000 | 0.9996 | 0.9971 | 0.9896 | 0.9727 | 0.9420 | 0.8939 | 0.8263 | 0.7396 | 0.6367 |
| 5 | 1.0000 | 1.0000 | 0.9998 | 0.9988 | 0.9958 | 0.9887 | 0.9747 | 0.9502 | 0.9115 | 0.8555 |
| 6 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9996 | 0.9987 | 0.9964 | 0.9915 | 0.9819 | 0.9648 |
| 7 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9998 | 0.9993 | 0.9983 | 0.9961 |

## n = 9

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.6302 | 0.3874 | 0.2316 | 0.1342 | 0.0751 | 0.0404 | 0.0207 | 0.0101 | 0.0046 | 0.0020 |
| 1 | 0.9288 | 0.7748 | 0.5995 | 0.4362 | 0.3003 | 0.1960 | 0.1211 | 0.0705 | 0.0385 | 0.0195 |
| 2 | 0.9916 | 0.9470 | 0.8591 | 0.7382 | 0.6007 | 0.4628 | 0.3373 | 0.2318 | 0.1495 | 0.0898 |
| 3 | 0.9994 | 0.9917 | 0.9661 | 0.9144 | 0.8343 | 0.7297 | 0.6089 | 0.4826 | 0.3614 | 0.2539 |
| 4 | 1.0000 | 0.9991 | 0.9944 | 0.9804 | 0.9511 | 0.9012 | 0.8283 | 0.7334 | 0.6214 | 0.5000 |
| 5 | 1.0000 | 0.9999 | 0.9994 | 0.9969 | 0.9900 | 0.9747 | 0.9464 | 0.9006 | 0.8342 | 0.7461 |
| 6 | 1.0000 | 1.0000 | 1.0000 | 0.9997 | 0.9987 | 0.9957 | 0.9888 | 0.9750 | 0.9502 | 0.9102 |
| 7 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9996 | 0.9986 | 0.9962 | 0.9909 | 0.9805 |
| 8 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9997 | 0.9992 | 0.9980 |

## n = 10

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.5987 | 0.3487 | 0.1969 | 0.1074 | 0.0563 | 0.0282 | 0.0135 | 0.0060 | 0.0025 | 0.0010 |
| 1 | 0.9139 | 0.7361 | 0.5443 | 0.3758 | 0.2440 | 0.1493 | 0.0860 | 0.0464 | 0.0233 | 0.0107 |
| 2 | 0.9885 | 0.9298 | 0.8202 | 0.6778 | 0.5256 | 0.3828 | 0.2616 | 0.1673 | 0.0996 | 0.0547 |
| 3 | 0.9990 | 0.9872 | 0.9500 | 0.8791 | 0.7759 | 0.6496 | 0.5138 | 0.3823 | 0.2660 | 0.1719 |
| 4 | 0.9999 | 0.9984 | 0.9901 | 0.9672 | 0.9219 | 0.8497 | 0.7515 | 0.6331 | 0.5044 | 0.3770 |
| 5 | 1.0000 | 0.9999 | 0.9986 | 0.9936 | 0.9803 | 0.9527 | 0.9051 | 0.8338 | 0.7384 | 0.6230 |
| 6 | 1.0000 | 1.0000 | 0.9999 | 0.9991 | 0.9965 | 0.9894 | 0.9740 | 0.9452 | 0.8980 | 0.8281 |
| 7 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9996 | 0.9984 | 0.9952 | 0.9877 | 0.9726 | 0.9453 |
| 8 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9995 | 0.9983 | 0.9955 | 0.9893 |
| 9 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9997 | 0.9990 |

## n = 12

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.5404 | 0.2824 | 0.1422 | 0.0687 | 0.0317 | 0.0138 | 0.0057 | 0.0022 | 0.0008 | 0.0002 |
| 1 | 0.8816 | 0.6590 | 0.4435 | 0.2749 | 0.1584 | 0.0850 | 0.0424 | 0.0196 | 0.0083 | 0.0032 |
| 2 | 0.9804 | 0.8891 | 0.7358 | 0.5583 | 0.3907 | 0.2528 | 0.1513 | 0.0834 | 0.0421 | 0.0193 |
| 3 | 0.9978 | 0.9744 | 0.9078 | 0.7946 | 0.6488 | 0.4925 | 0.3467 | 0.2253 | 0.1345 | 0.0730 |
| 4 | 0.9998 | 0.9957 | 0.9761 | 0.9274 | 0.8424 | 0.7237 | 0.5833 | 0.4382 | 0.3044 | 0.1938 |
| 5 | 1.0000 | 0.9995 | 0.9954 | 0.9806 | 0.9456 | 0.8822 | 0.7873 | 0.6652 | 0.5269 | 0.3872 |
| 6 | 1.0000 | 0.9999 | 0.9993 | 0.9961 | 0.9857 | 0.9614 | 0.9154 | 0.8418 | 0.7393 | 0.6128 |
| 7 | 1.0000 | 1.0000 | 0.9999 | 0.9994 | 0.9972 | 0.9905 | 0.9745 | 0.9427 | 0.8883 | 0.8062 |
| 8 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9996 | 0.9983 | 0.9944 | 0.9847 | 0.9644 | 0.9270 |

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9998 | 0.9992 | 0.9972 | 0.9921 | 0.9807 |
| 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9997 | 0.9989 | 0.9968 |
| 11 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9998 |

## n = 15

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.4633 | 0.2059 | 0.0874 | 0.0352 | 0.0134 | 0.0047 | 0.0016 | 0.0005 | 0.0001 | 0.0000 |
| 1 | 0.8290 | 0.5490 | 0.3186 | 0.1671 | 0.0802 | 0.0353 | 0.0142 | 0.0052 | 0.0017 | 0.0005 |
| 2 | 0.9638 | 0.8159 | 0.6042 | 0.3980 | 0.2361 | 0.1268 | 0.0617 | 0.0271 | 0.0107 | 0.0037 |
| 3 | 0.9945 | 0.9444 | 0.8227 | 0.6482 | 0.4613 | 0.2969 | 0.1727 | 0.0905 | 0.0424 | 0.0176 |
| 4 | 0.9994 | 0.9873 | 0.9383 | 0.8358 | 0.6865 | 0.5155 | 0.3519 | 0.2173 | 0.1204 | 0.0592 |
| 5 | 0.9999 | 0.9978 | 0.9832 | 0.9389 | 0.8516 | 0.7216 | 0.5643 | 0.4032 | 0.2608 | 0.1509 |
| 6 | 1.0000 | 0.9997 | 0.9964 | 0.9819 | 0.9434 | 0.8689 | 0.7548 | 0.6098 | 0.4522 | 0.3036 |
| 7 | 1.0000 | 1.0000 | 0.9994 | 0.9958 | 0.9827 | 0.9500 | 0.8868 | 0.7869 | 0.6535 | 0.5000 |
| 8 | 1.0000 | 1.0000 | 0.9999 | 0.9992 | 0.9958 | 0.9848 | 0.9578 | 0.9050 | 0.8182 | 0.6964 |
| 9 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9992 | 0.9963 | 0.9876 | 0.9662 | 0.9231 | 0.8491 |
| 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9993 | 0.9972 | 0.9907 | 0.9745 | 0.9408 |
| 11 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9995 | 0.9981 | 0.9937 | 0.9824 |
| 12 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9997 | 0.9989 | 0.9963 |
| 13 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9995 |
| 14 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

## n = 20

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.3585 | 0.1216 | 0.0388 | 0.0115 | 0.0032 | 0.0008 | 0.0002 | 0.0000 | 0.0000 | 0.0000 |
| 1 | 0.7358 | 0.3917 | 0.1756 | 0.0692 | 0.0243 | 0.0076 | 0.0021 | 0.0005 | 0.0001 | 0.0000 |
| 2 | 0.9245 | 0.6769 | 0.4049 | 0.2061 | 0.0913 | 0.0355 | 0.0121 | 0.0036 | 0.0009 | 0.0002 |
| 3 | 0.9841 | 0.8670 | 0.6477 | 0.4114 | 0.2252 | 0.1071 | 0.0444 | 0.0160 | 0.0049 | 0.0013 |
| 4 | 0.9974 | 0.9568 | 0.8298 | 0.6296 | 0.4148 | 0.2375 | 0.1182 | 0.0510 | 0.0189 | 0.0059 |
| 5 | 0.9997 | 0.9887 | 0.9327 | 0.8042 | 0.6172 | 0.4164 | 0.2454 | 0.1256 | 0.0553 | 0.0207 |
| 6 | 1.0000 | 0.9976 | 0.9781 | 0.9133 | 0.7858 | 0.6080 | 0.4166 | 0.2500 | 0.1299 | 0.0577 |
| 7 | 1.0000 | 0.9996 | 0.9941 | 0.9679 | 0.8982 | 0.7723 | 0.6010 | 0.4159 | 0.2520 | 0.1316 |
| 8 | 1.0000 | 0.9999 | 0.9987 | 0.9900 | 0.9591 | 0.8867 | 0.7624 | 0.5956 | 0.4143 | 0.2517 |
| 9 | 1.0000 | 1.0000 | 0.9998 | 0.9974 | 0.9861 | 0.9520 | 0.8782 | 0.7553 | 0.5914 | 0.4119 |
| 10 | 1.0000 | 1.0000 | 1.0000 | 0.9994 | 0.9961 | 0.9829 | 0.9468 | 0.8725 | 0.7507 | 0.5881 |
| 11 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9991 | 0.9949 | 0.9804 | 0.9435 | 0.8692 | 0.7483 |
| 12 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9998 | 0.9987 | 0.9940 | 0.9790 | 0.9420 | 0.8684 |
| 13 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9997 | 0.9985 | 0.9935 | 0.9786 | 0.9423 |
| 14 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9997 | 0.9984 | 0.9936 | 0.9793 |
| 15 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9997 | 0.9985 | 0.9941 |
| 16 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9997 | 0.9987 |
| 17 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9998 |
| 18 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

## n = 25

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.2774 | 0.0718 | 0.0172 | 0.0038 | 0.0008 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 1 | 0.6424 | 0.2712 | 0.0931 | 0.0274 | 0.0070 | 0.0016 | 0.0003 | 0.0001 | 0.0000 | 0.0000 |
| 2 | 0.8729 | 0.5371 | 0.2537 | 0.0982 | 0.0321 | 0.0090 | 0.0021 | 0.0004 | 0.0001 | 0.0000 |
| 3 | 0.9659 | 0.7636 | 0.4711 | 0.2340 | 0.0962 | 0.0332 | 0.0097 | 0.0024 | 0.0005 | 0.0001 |
| 4 | 0.9928 | 0.9020 | 0.6821 | 0.4207 | 0.2137 | 0.0905 | 0.0320 | 0.0095 | 0.0023 | 0.0005 |
| 5 | 0.9988 | 0.9666 | 0.8385 | 0.6167 | 0.3783 | 0.1935 | 0.0826 | 0.0294 | 0.0086 | 0.0020 |
| 6 | 0.9998 | 0.9905 | 0.9305 | 0.7800 | 0.5611 | 0.3407 | 0.1734 | 0.0736 | 0.0258 | 0.0073 |
| 7 | 1.0000 | 0.9977 | 0.9745 | 0.8909 | 0.7265 | 0.5118 | 0.3061 | 0.1536 | 0.0639 | 0.0216 |
| 8 | 1.0000 | 0.9995 | 0.9920 | 0.9532 | 0.8506 | 0.6769 | 0.4668 | 0.2735 | 0.1340 | 0.0539 |

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 1.0000 | 0.9999 | 0.9979 | 0.9827 | 0.9287 | 0.8106 | 0.6303 | 0.4246 | 0.2424 | 0.1148 |
| 10 | 1.0000 | 1.0000 | 0.9995 | 0.9944 | 0.9703 | 0.9022 | 0.7712 | 0.5858 | 0.3843 | 0.2122 |
| 11 | 1.0000 | 1.0000 | 0.9999 | 0.9985 | 0.9893 | 0.9558 | 0.8746 | 0.7323 | 0.5426 | 0.3450 |
| 12 | 1.0000 | 1.0000 | 1.0000 | 0.9996 | 0.9966 | 0.9825 | 0.9396 | 0.8462 | 0.6937 | 0.5000 |
| 13 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9991 | 0.9940 | 0.9745 | 0.9222 | 0.8173 | 0.6550 |
| 14 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9998 | 0.9982 | 0.9907 | 0.9656 | 0.9040 | 0.7878 |
| 15 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9995 | 0.9971 | 0.9868 | 0.9560 | 0.8852 |
| 16 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9992 | 0.9957 | 0.9826 | 0.9461 |
| 17 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9998 | 0.9988 | 0.9942 | 0.9784 |
| 18 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9997 | 0.9984 | 0.9927 |
| 19 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9996 | 0.9980 |
| 20 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9995 |
| 21 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 |
| 22 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

## n = 30

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.2146 | 0.0424 | 0.0076 | 0.0012 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 1 | 0.5535 | 0.1837 | 0.0480 | 0.0105 | 0.0020 | 0.0003 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 2 | 0.8122 | 0.4114 | 0.1514 | 0.0442 | 0.0106 | 0.0021 | 0.0003 | 0.0000 | 0.0000 | 0.0000 |
| 3 | 0.9392 | 0.6474 | 0.3217 | 0.1227 | 0.0374 | 0.0093 | 0.0019 | 0.0003 | 0.0000 | 0.0000 |
| 4 | 0.9844 | 0.8245 | 0.5245 | 0.2552 | 0.0979 | 0.0302 | 0.0075 | 0.0015 | 0.0002 | 0.0000 |
| 5 | 0.9967 | 0.9268 | 0.7106 | 0.4275 | 0.2026 | 0.0766 | 0.0233 | 0.0057 | 0.0011 | 0.0002 |
| 6 | 0.9994 | 0.9742 | 0.8474 | 0.6070 | 0.3481 | 0.1595 | 0.0586 | 0.0172 | 0.0040 | 0.0007 |
| 7 | 0.9999 | 0.9922 | 0.9302 | 0.7608 | 0.5143 | 0.2814 | 0.1238 | 0.0435 | 0.0121 | 0.0026 |
| 8 | 1.0000 | 0.9980 | 0.9722 | 0.8713 | 0.6736 | 0.4315 | 0.2247 | 0.0940 | 0.0312 | 0.0081 |
| 9 | 1.0000 | 0.9995 | 0.9903 | 0.9389 | 0.8034 | 0.5888 | 0.3575 | 0.1763 | 0.0694 | 0.0214 |
| 10 | 1.0000 | 0.9999 | 0.9971 | 0.9744 | 0.8943 | 0.7304 | 0.5078 | 0.2915 | 0.1350 | 0.0494 |
| 11 | 1.0000 | 1.0000 | 0.9992 | 0.9905 | 0.9493 | 0.8407 | 0.6548 | 0.4311 | 0.2327 | 0.1002 |
| 12 | 1.0000 | 1.0000 | 0.9998 | 0.9969 | 0.9784 | 0.9155 | 0.7802 | 0.5785 | 0.3592 | 0.1808 |
| 13 | 1.0000 | 1.0000 | 1.0000 | 0.9991 | 0.9918 | 0.9599 | 0.8737 | 0.7145 | 0.5025 | 0.2923 |
| 14 | 1.0000 | 1.0000 | 1.0000 | 0.9998 | 0.9973 | 0.9831 | 0.9348 | 0.8246 | 0.6448 | 0.4278 |
| 15 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9992 | 0.9936 | 0.9699 | 0.9029 | 0.7691 | 0.5722 |
| 16 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9998 | 0.9979 | 0.9876 | 0.9519 | 0.8644 | 0.7077 |
| 17 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9994 | 0.9955 | 0.9788 | 0.9286 | 0.8192 |
| 18 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9998 | 0.9986 | 0.9917 | 0.9666 | 0.8998 |
| 19 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9996 | 0.9971 | 0.9862 | 0.9506 |
| 20 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9991 | 0.9950 | 0.9786 |
| 21 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9998 | 0.9984 | 0.9919 |
| 22 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9996 | 0.9974 |
| 23 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9993 |
| 24 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9998 |
| 25 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

## n = 40

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.1285 | 0.0148 | 0.0015 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 1 | 0.3991 | 0.0805 | 0.0121 | 0.0015 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 2 | 0.6767 | 0.2228 | 0.0486 | 0.0079 | 0.0010 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 3 | 0.8619 | 0.4231 | 0.1302 | 0.0285 | 0.0047 | 0.0006 | 0.0001 | 0.0000 | 0.0000 | 0.0000 |
| 4 | 0.9520 | 0.6290 | 0.2633 | 0.0759 | 0.0160 | 0.0026 | 0.0003 | 0.0000 | 0.0000 | 0.0000 |
| 5 | 0.9861 | 0.7937 | 0.4325 | 0.1613 | 0.0433 | 0.0086 | 0.0013 | 0.0001 | 0.0000 | 0.0000 |
| 6 | 0.9966 | 0.9005 | 0.6067 | 0.2859 | 0.0962 | 0.0238 | 0.0044 | 0.0006 | 0.0001 | 0.0000 |
| 7 | 0.9993 | 0.9581 | 0.7559 | 0.4371 | 0.1820 | 0.0553 | 0.0124 | 0.0021 | 0.0002 | 0.0000 |

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 8 | 0.9999 | 0.9845 | 0.8646 | 0.5931 | 0.2998 | 0.1110 | 0.0303 | 0.0061 | 0.0009 | 0.0001 |
| 9 | 1.0000 | 0.9949 | 0.9328 | 0.7318 | 0.4395 | 0.1959 | 0.0644 | 0.0156 | 0.0027 | 0.0003 |
| 10 | 1.0000 | 0.9985 | 0.9701 | 0.8392 | 0.5839 | 0.3087 | 0.1215 | 0.0352 | 0.0074 | 0.0011 |
| 11 | 1.0000 | 0.9996 | 0.9880 | 0.9125 | 0.7151 | 0.4406 | 0.2053 | 0.0709 | 0.0179 | 0.0032 |
| 12 | 1.0000 | 0.9999 | 0.9957 | 0.9568 | 0.8209 | 0.5772 | 0.3143 | 0.1285 | 0.0386 | 0.0083 |
| 13 | 1.0000 | 1.0000 | 0.9986 | 0.9806 | 0.8968 | 0.7032 | 0.4408 | 0.2112 | 0.0751 | 0.0192 |
| 14 | 1.0000 | 1.0000 | 0.9996 | 0.9921 | 0.9456 | 0.8074 | 0.5721 | 0.3174 | 0.1326 | 0.0403 |
| 15 | 1.0000 | 1.0000 | 0.9999 | 0.9971 | 0.9738 | 0.8849 | 0.6946 | 0.4402 | 0.2142 | 0.0769 |
| 16 | 1.0000 | 1.0000 | 1.0000 | 0.9990 | 0.9884 | 0.9367 | 0.7978 | 0.5681 | 0.3185 | 0.1341 |
| 17 | 1.0000 | 1.0000 | 1.0000 | 0.9997 | 0.9953 | 0.9680 | 0.8761 | 0.6885 | 0.4391 | 0.2148 |
| 18 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9983 | 0.9852 | 0.9301 | 0.7911 | 0.5651 | 0.3179 |
| 19 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9994 | 0.9937 | 0.9637 | 0.8702 | 0.6844 | 0.4373 |
| 20 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9998 | 0.9976 | 0.9827 | 0.9256 | 0.7870 | 0.5627 |
| 21 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9991 | 0.9925 | 0.9608 | 0.8669 | 0.6821 |
| 22 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9997 | 0.9970 | 0.9811 | 0.9233 | 0.7852 |
| 23 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9989 | 0.9917 | 0.9595 | 0.8659 |
| 24 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9996 | 0.9966 | 0.9804 | 0.9231 |
| 25 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9988 | 0.9914 | 0.9597 |
| 26 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9996 | 0.9966 | 0.9808 |
| 27 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9988 | 0.9917 |
| 28 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9996 | 0.9968 |
| 29 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9989 |
| 30 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9997 |
| 31 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 |
| 32 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

n = 50

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.0769 | 0.0052 | 0.0003 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 1 | 0.2794 | 0.0338 | 0.0029 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 2 | 0.5405 | 0.1117 | 0.0142 | 0.0013 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 3 | 0.7604 | 0.2503 | 0.0460 | 0.0057 | 0.0005 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 4 | 0.8964 | 0.4312 | 0.1121 | 0.0185 | 0.0021 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 5 | 0.9622 | 0.6161 | 0.2194 | 0.0480 | 0.0070 | 0.0007 | 0.0001 | 0.0000 | 0.0000 | 0.0000 |
| 6 | 0.9882 | 0.7702 | 0.3613 | 0.1034 | 0.0194 | 0.0025 | 0.0002 | 0.0000 | 0.0000 | 0.0000 |
| 7 | 0.9968 | 0.8779 | 0.5188 | 0.1904 | 0.0453 | 0.0073 | 0.0008 | 0.0001 | 0.0000 | 0.0000 |
| 8 | 0.9992 | 0.9421 | 0.6681 | 0.3073 | 0.0916 | 0.0183 | 0.0025 | 0.0002 | 0.0000 | 0.0000 |
| 9 | 0.9998 | 0.9755 | 0.7911 | 0.4437 | 0.1637 | 0.0402 | 0.0067 | 0.0008 | 0.0001 | 0.0000 |
| 10 | 1.0000 | 0.9906 | 0.8801 | 0.5836 | 0.2622 | 0.0789 | 0.0160 | 0.0022 | 0.0002 | 0.0000 |
| 11 | 1.0000 | 0.9968 | 0.9372 | 0.7107 | 0.3816 | 0.1390 | 0.0342 | 0.0057 | 0.0006 | 0.0000 |
| 12 | 1.0000 | 0.9990 | 0.9699 | 0.8139 | 0.5110 | 0.2229 | 0.0661 | 0.0133 | 0.0018 | 0.0002 |
| 13 | 1.0000 | 0.9997 | 0.9868 | 0.8894 | 0.6370 | 0.3279 | 0.1163 | 0.0280 | 0.0045 | 0.0005 |
| 14 | 1.0000 | 0.9999 | 0.9947 | 0.9393 | 0.7481 | 0.4468 | 0.1878 | 0.0540 | 0.0104 | 0.0013 |
| 15 | 1.0000 | 1.0000 | 0.9981 | 0.9692 | 0.8369 | 0.5692 | 0.2801 | 0.0955 | 0.0220 | 0.0033 |
| 16 | 1.0000 | 1.0000 | 0.9993 | 0.9856 | 0.9017 | 0.6839 | 0.3889 | 0.1561 | 0.0427 | 0.0077 |
| 17 | 1.0000 | 1.0000 | 0.9998 | 0.9937 | 0.9449 | 0.7822 | 0.5060 | 0.2369 | 0.0765 | 0.0164 |
| 18 | 1.0000 | 1.0000 | 0.9999 | 0.9975 | 0.9713 | 0.8594 | 0.6216 | 0.3356 | 0.1273 | 0.0325 |
| 19 | 1.0000 | 1.0000 | 1.0000 | 0.9991 | 0.9861 | 0.9152 | 0.7264 | 0.4465 | 0.1974 | 0.0595 |
| 20 | 1.0000 | 1.0000 | 1.0000 | 0.9997 | 0.9937 | 0.9522 | 0.8139 | 0.5610 | 0.2862 | 0.1013 |
| 21 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9974 | 0.9749 | 0.8813 | 0.6701 | 0.3900 | 0.1611 |
| 22 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9990 | 0.9877 | 0.9290 | 0.7660 | 0.5019 | 0.2399 |
| 23 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9996 | 0.9944 | 0.9604 | 0.8438 | 0.6134 | 0.3359 |
| 24 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9976 | 0.9793 | 0.9022 | 0.7160 | 0.4439 |
| 25 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9991 | 0.9900 | 0.9427 | 0.8034 | 0.5561 |

| x | p = 0.05 | p = 0.1 | p = 0.15 | p = 0.2 | p = 0.25 | p = 0.3 | p = 0.35 | p = 0.4 | p = 0.45 | p = 0.5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 26 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9997 | 0.9955 | 0.9686 | 0.8721 | 0.6641 |
| 27 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9981 | 0.9840 | 0.9220 | 0.7601 |
| 28 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9993 | 0.9924 | 0.9556 | 0.8389 |
| 29 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9997 | 0.9966 | 0.9765 | 0.8987 |
| 30 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9986 | 0.9884 | 0.9405 |
| 31 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9995 | 0.9947 | 0.9675 |
| 32 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9998 | 0.9978 | 0.9836 |
| 33 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9991 | 0.9923 |
| 34 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9997 | 0.9967 |
| 35 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9987 |
| 36 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9995 |
| 37 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9998 |
| 38 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

## Poisson cumulative distribution function

The tabulated value is $P(X \leq x)$, where X has a Poisson distribution with parameter $\lambda$.

| x | λ = 0.5 | λ = 1 | λ = 1.5 | λ = 2 | λ = 2.5 | λ = 3 | λ = 3.5 | λ = 4 | λ = 4.5 | λ = 5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.6065 | 0.3679 | 0.2231 | 0.1353 | 0.0821 | 0.0498 | 0.0302 | 0.0183 | 0.0111 | 0.0067 |
| 1 | 0.9098 | 0.7358 | 0.5578 | 0.4060 | 0.2873 | 0.1991 | 0.1359 | 0.0916 | 0.0611 | 0.0404 |
| 2 | 0.9856 | 0.9197 | 0.8088 | 0.6767 | 0.5438 | 0.4232 | 0.3208 | 0.2381 | 0.1736 | 0.1247 |
| 3 | 0.9982 | 0.9810 | 0.9344 | 0.8571 | 0.7576 | 0.6472 | 0.5366 | 0.4335 | 0.3423 | 0.2650 |
| 4 | 0.9998 | 0.9963 | 0.9814 | 0.9473 | 0.8912 | 0.8153 | 0.7254 | 0.6288 | 0.5321 | 0.4405 |
| 5 | 1.0000 | 0.9994 | 0.9955 | 0.9834 | 0.9580 | 0.9161 | 0.8576 | 0.7851 | 0.7029 | 0.6160 |
| 6 | 1.0000 | 0.9999 | 0.9991 | 0.9955 | 0.9858 | 0.9665 | 0.9347 | 0.8893 | 0.8311 | 0.7622 |
| 7 | 1.0000 | 1.0000 | 0.9998 | 0.9989 | 0.9958 | 0.9881 | 0.9733 | 0.9489 | 0.9134 | 0.8666 |
| 8 | 1.0000 | 1.0000 | 1.0000 | 0.9998 | 0.9989 | 0.9962 | 0.9901 | 0.9786 | 0.9597 | 0.9319 |
| 9 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9997 | 0.9989 | 0.9967 | 0.9919 | 0.9829 | 0.9682 |
| 10 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9997 | 0.9990 | 0.9972 | 0.9933 | 0.9863 |
| 11 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9997 | 0.9991 | 0.9976 | 0.9945 |
| 12 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9997 | 0.9992 | 0.9980 |
| 13 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9997 | 0.9993 |
| 14 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9998 |
| 15 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 |
| 16 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 17 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 18 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| 19 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| x | λ = 5.5 | λ = 6 | λ = 6.5 | λ = 7 | λ = 7.5 | λ = 8 | λ = 8.5 | λ = 9 | λ = 9.5 | λ = 10 |
| 0 | 0.0041 | 0.0025 | 0.0015 | 0.0009 | 0.0006 | 0.0003 | 0.0002 | 0.0001 | 0.0001 | 0.0000 |
| 1 | 0.0266 | 0.0174 | 0.0113 | 0.0073 | 0.0047 | 0.0030 | 0.0019 | 0.0012 | 0.0008 | 0.0005 |
| 2 | 0.0884 | 0.0620 | 0.0430 | 0.0296 | 0.0203 | 0.0138 | 0.0093 | 0.0062 | 0.0042 | 0.0028 |
| 3 | 0.2017 | 0.1512 | 0.1118 | 0.0818 | 0.0591 | 0.0424 | 0.0301 | 0.0212 | 0.0149 | 0.0103 |
| 4 | 0.3575 | 0.2851 | 0.2237 | 0.1730 | 0.1321 | 0.0996 | 0.0744 | 0.0550 | 0.0403 | 0.0293 |
| 5 | 0.5289 | 0.4457 | 0.3690 | 0.3007 | 0.2414 | 0.1912 | 0.1496 | 0.1157 | 0.0885 | 0.0671 |
| 6 | 0.6860 | 0.6063 | 0.5265 | 0.4497 | 0.3782 | 0.3134 | 0.2562 | 0.2068 | 0.1649 | 0.1301 |
| 7 | 0.8095 | 0.7440 | 0.6728 | 0.5987 | 0.5246 | 0.4530 | 0.3856 | 0.3239 | 0.2687 | 0.2202 |
| 8 | 0.8944 | 0.8472 | 0.7916 | 0.7291 | 0.6620 | 0.5925 | 0.5231 | 0.4557 | 0.3918 | 0.3328 |
| 9 | 0.9462 | 0.9161 | 0.8774 | 0.8305 | 0.7764 | 0.7166 | 0.6530 | 0.5874 | 0.5218 | 0.4579 |
| 10 | 0.9747 | 0.9574 | 0.9332 | 0.9015 | 0.8622 | 0.8159 | 0.7634 | 0.7060 | 0.6453 | 0.5830 |
| 11 | 0.9890 | 0.9799 | 0.9661 | 0.9467 | 0.9208 | 0.8881 | 0.8487 | 0.8030 | 0.7520 | 0.6968 |
| 12 | 0.9955 | 0.9912 | 0.9840 | 0.9730 | 0.9573 | 0.9362 | 0.9091 | 0.8758 | 0.8364 | 0.7916 |
| 13 | 0.9983 | 0.9964 | 0.9929 | 0.9872 | 0.9784 | 0.9658 | 0.9486 | 0.9261 | 0.8981 | 0.8645 |
| 14 | 0.9994 | 0.9986 | 0.9970 | 0.9943 | 0.9897 | 0.9827 | 0.9726 | 0.9585 | 0.9400 | 0.9165 |

| x | λ = 5.5 | λ = 6 | λ = 6.5 | λ = 7 | λ = 7.5 | λ = 8 | λ = 8.5 | λ = 9 | λ = 9.5 | λ = 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 0.9998 | 0.9995 | 0.9988 | 0.9976 | 0.9954 | 0.9918 | 0.9862 | 0.9780 | 0.9665 | 0.9513 |
| 16 | 0.9999 | 0.9998 | 0.9996 | 0.9990 | 0.9980 | 0.9963 | 0.9934 | 0.9889 | 0.9823 | 0.9730 |
| 17 | 1.0000 | 0.9999 | 0.9998 | 0.9996 | 0.9992 | 0.9984 | 0.9970 | 0.9947 | 0.9911 | 0.9857 |
| 18 | 1.0000 | 1.0000 | 0.9999 | 0.9999 | 0.9997 | 0.9993 | 0.9987 | 0.9976 | 0.9957 | 0.9928 |
| 19 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9997 | 0.9995 | 0.9989 | 0.9980 | 0.9965 |
| 20 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9998 | 0.9996 | 0.9991 | 0.9984 |
| 21 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9998 | 0.9996 | 0.9993 |
| 22 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 0.9999 | 0.9999 | 0.9997 |

## Continuous random variables

The specification lists P(a < X <= b) and f = dF/dx as formulae that will not appear in the booklet. The booklet prints the mean, variance, E(g(X)) and F(x) in integral form.

### Probability from a p.d.f.

The specification lists it as a formula you are expected to know. A single value of a continuous variable has probability 0, so < and <= give the same answer. Used in: Jan 2026 (A) Q6(c), show that P(X > 2) = 0.8; Jun 2023 Q3(b), P(2 < X < 3); Jan 2026 Q2(b), P(X = 5) = 0.

$$P(a < X \leq b) = \int_a^b f(x)\,dx$$

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### P.d.f. from the c.d.f.

The specification lists it as a formula you are expected to know. Differentiate each piece of F separately and keep the same intervals, with f(x) = 0 elsewhere. Used in: Jan 2026 Q2(d), specify the p.d.f.; Oct 2025 Q4(d), r(x) and s(x); Oct 2025 (A) Q1(c).

$$f(x) = \frac{dF(x)}{dx}$$

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### Probability from the c.d.f.

Read the correct piece of F for each value. Used in: Jan 2026 Q2(c), P(5 < X < 7); Oct 2025 Q4(c); Oct 2025 (A) Q1(a), P(X > 4).

$$P(a < X < b) = F(b) - F(a), \qquad P(X > a) = 1 - F(a)$$

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### Total probability and constants

Use it to find constants: put F at the top of the range equal to 1 and make the pieces of a c.d.f. equal where they join. Used in: Jan 2026 Q2(a), show that k = 1; Oct 2025 Q4(a), show that k = 1/48; Jun 2023 Q5(a)(b), a, b and c in a c.d.f.

$$\int_{-\infty}^{\infty} f(x)\,dx = 1, \qquad F(\text{lowest}) = 0, \quad F(\text{highest}) = 1$$

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### Expectation (mean)

Differentiate F to get f first when the c.d.f. is given, then integrate x f(x) over the range. Used in: Jan 2026 (A) Q3(b)(i), E(X) by calculus; Jan 2026 Q6(c), the mean weight of watermelons; Jan 2021 Q4(b), use algebraic integration to show a = 6.

$$E(X) = \mu = \int x\, f(x)\,dx$$

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### Variance

Integrate $x^2$ f(x), then subtract $\mu^2$. Some questions give E(X), so Var(X) = $E(X^2 - E(X)^2$ needs only $E(X^2$. Used in: Jan 2026 (A) Q3(b)(ii); Oct 2025 Q7(b), show Var(Y) = 66/7225; Jan 2021 Q2(c), algebraic integration with E(W) = 1.6.

$$\text{Var}(X) = \sigma^2 = \int (x-\mu)^2 f(x)\,dx = \int x^2 f(x)\,dx - \mu^2$$

GIVEN

### Expectation of a function

Rearranged, $E(X^2 = Var(X) + [E(X)]^2$ gives $E(X^2$ when the variance is known. Used in: Jan 2026 Q2(g), $E(2X^2 - 1)$ using Var(X) = 3 and E(X) = 7; Jun 2023 Q5(e), E(6Y - 5); Jan 2021 Q5(c), $E(X^2$ for a hypotenuse.

$$E(g(X)) = \int g(x)\, f(x)\, dx$$

GIVEN

### Cumulative distribution function

Integrate f(t) piece by piece and fix each constant with F(lowest) = 0 or F(highest) = 1, then write F in every interval. Used in: Jan 2026 (A) Q6(d), define F(x) fully; Jan 2022 Q4(c); Oct 2021 Q6(d).

$$F(x_0) = P(X \leqslant x_0) = \int_{-\infty}^{x_0} f(t)\, dt$$

GIVEN

### Linear change of a variable

From Statistics 1, which the specification says is assumed. The constant drops out of the variance and a is squared. Used in: Oct 2025 (A) Q7(a), E(3 - 2X); Oct 2021 Q6(b), Var(2Y - 3); Oct 2025 Q7(c).

$$E(aX + b) = aE(X) + b, \qquad \mathrm{Var}(aX + b) = a^2\,\mathrm{Var}(X)$$

LEARN IT

### Median and quartiles

The specification includes the median and quartiles of a continuous variable. Set the right piece of F equal to the value and solve, checking the answer lies in that interval. Used in: Oct 2025 Q7(a), show that the median is 2.165; Jan 2026 Q6(e), the median lies between 3.7 and 3.8; Oct 2025 (A) Q4(d).

$$F(m) = \tfrac{1}{2}, \qquad F(Q_1) = \tfrac{1}{4}, \qquad F(Q_3) = \tfrac{3}{4}$$

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### Mode of a continuous variable

Differentiate f and set it to 0, or take an end of the interval if f is greatest there. If the derivative gives a minimum or a value outside the interval, the mode is at an end point. Used in: Jan 2026 Q6(b), mode of a quadratic p.d.f.; Jun 2023 Q3(d)(e), why Kei's method fails; Oct 2025 (A) Q4(b), use calculus.

$$\text{mode: } f'(x) = 0 \text{ (a maximum of } f)$$

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### Derivative of a power

The specification says differentiation of polynomials is assumed. You need it to turn F into f. Used in: Jan 2026 Q2(d); Oct 2025 Q4(d); Jan 2026 (A) Q3(b).

$$\frac{d}{dx}\left(x^n\right) = nx^{n-1}$$

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### Integral of a power

The specification says integration of polynomials is assumed. Questions often say that calculator technology is not acceptable, so show the integral with limits. Used in: Jan 2026 (A) Q3(b), E(X) and $E(X^2$; Jun 2023 Q5(e); Oct 2025 Q7(b).

$$\int x^n\, dx = \frac{x^{n+1}}{n+1} + c, \quad n \neq -1$$

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### Quadratic formula

From Pure Mathematics 1. Setting F(a) to a probability often gives a quadratic, and you must reject a root outside the range of X. Used in: Jan 2026 (A) Q6(f), a to 3 significant figures; Jan 2026 (A) Q3(a), F(a) = 0.6.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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## Continuous uniform distribution

The booklet prints the p.d.f., mean and variance. The specification also asks for the derivation of the mean, variance and c.d.f. Questions often put a uniform length into a shape.

**Uniform (rectangular) on [a, b]: p.d.f.**

The p.d.f. is constant on [a, b] and 0 outside it, and the rectangle under it has area 1. Used in: Jan 2026 (A) Q5(a), L ~ U[20, 40]; Jan 2025 Q3(a), the p.d.f. on [-k, 5k]; Oct 2025 Q6(a), X uniform on [0, 20].

$$f(x) = \frac{1}{b-a}$$

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**Uniform (rectangular) on [a, b]: mean**

The midpoint of the interval. Used in: Oct 2025 (A) Q7(a), E(3 - 2X) in terms of a and b; Jan 2025 Q3(c), the mean on [-k, 5k]; Jun 2025 Q6(a), a and b from a mean of 6.

$$\tfrac{1}{2}(a+b)$$

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**Uniform (rectangular) on [a, b]: variance**

The range is b - a, so a range of 18 gives variance $18^2$ / 12. Used in: Jun 2023 Q6(b)(i), a and b from Var(W) = 75; Jun 2025 Q6(c), the exact value of Var(X); Oct 2025 (A) Q7(d).

$$\tfrac{1}{12}(b-a)^2$$

GIVEN

**Uniform probabilities and c.d.f.**

The probability is the length of the interval over the total length. Used in: Jan 2026 (A) Q5(b), a longer piece of 28 cm to the nearest cm; Jan 2025 Q3(d), the c.d.f. on [-k, 5k]; Oct 2025 Q6(b).

$$P(c < X < d) = \frac{d-c}{b-a}, \qquad F(x) = \frac{x-a}{b-a} \ \ (a \le x \le b)$$

LEARN IT

**Perimeter and area of a rectangle or square**

Used to turn a uniform length into an area, then solve the inequality for X. Used in: Oct 2025 Q6(a), the area X(20 - X) of a rectangle with perimeter 40 cm; Jan 2026 (A) Q5(c), the area of the larger square made from a string.

$$P = 2(l+w), \quad A = lw; \qquad \text{square: } P = 4s,\ A = s^2$$

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**Pythagoras' theorem**

c is the hypotenuse. Used in: Jan 2021 Q5(b), show that $X^2 = 2W^2 - 6W + 9$ for the longest side of a right-angled triangle.

$$a^2 + b^2 = c^2$$

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## Normal approximations

The tables X2 and X3 follow this section. The booklet prints neither the approximations nor the continuity correction, so learn all three.

**Normal approximation to the binomial**

Say which distribution you use. The schemes want n large and p close to 0.5 as the condition, and the standard deviation is the square root of np(1 - p). Used in: Oct 2025 Q5(c), N(25, 18.75); Jun 2023 Q1(b)(i), N(240, 144); Jan 2026 Q7(b), N(81, 44.55).

$$X \sim \mathrm{B}(n,p) \approx Y \sim N\big(np,\ np(1-p)\big)$$

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### Normal approximation to the Poisson

For a large mean, after scaling λ to the interval asked about. Used in: Jan 2026 Q6(f), N(30, 30); Jan 2021 Q3(c), N(0.07n, 0.07n); Jan 2022 Q1(b), six weeks gives N(36, 36).

$$X \sim \mathrm{Po}(\lambda) \approx Y \sim N(\lambda,\ \lambda)$$

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### Continuity correction

Add or subtract 0.5 on the boundary so that the whole integer is included. Used in: Jan 2026 Q7(b), more than k becomes k + 0.5; Oct 2022 Q4(b), fewer than n becomes n - 0.5; Oct 2025 Q5(c), more than 21 but no more than 30 uses 21.5 and 30.5.

$$P(X \leq k) \to P(Y < k + 0.5), \quad P(X < k) \to P(Y < k - 0.5), \quad P(X \geq k) \to P(Y > k - 0.5), \quad P(X > k) \to P(Y > k + 0.5)$$

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### Standardising a Normal variable

From Statistics 1, which the specification says is assumed. Use the mean and standard deviation of the approximating normal, and show the standardisation with numbers. Used in: Jan 2026 Q7(b); Oct 2025 Q5(c); Jun 2023 Q1(b)(i).

$$Z = \frac{Y - \mu}{\sigma}$$

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### Symmetry of the standard Normal

The table X2 starts at z = 0.00, so for a negative z read the positive value and subtract from 1. Used in: Jun 2023 Q1(b)(i), P(Z < -1.46) = 1 - 0.9279; Jan 2022 Q1(b), P(Z < -0.75); Oct 2025 Q5(c).

$$P(Z < -z) = 1 - P(Z < z)$$

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## The normal distribution function

The tabulated function is Φ(z), defined as the area under the standard normal curve to the left of z. Printed in five column pairs, in step 0.01 up to 2.00, 0.02 up to 2.50, 0.05 up to 3.40, then 3.50 to 4.00 in steps of 0.10. The last row repeats the first value of the next column.

| z | Φ(z) | z | Φ(z) | z | Φ(z) | z | Φ(z) | z | Φ(z) |
|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.5000 | 0.50 | 0.6915 | 1.00 | 0.8413 | 1.50 | 0.9332 | 2.00 | 0.9772 |
| 0.01 | 0.5040 | 0.51 | 0.6950 | 1.01 | 0.8438 | 1.51 | 0.9345 | 2.02 | 0.9783 |
| 0.02 | 0.5080 | 0.52 | 0.6985 | 1.02 | 0.8461 | 1.52 | 0.9357 | 2.04 | 0.9793 |
| 0.03 | 0.5120 | 0.53 | 0.7019 | 1.03 | 0.8485 | 1.53 | 0.9370 | 2.06 | 0.9803 |
| 0.04 | 0.5160 | 0.54 | 0.7054 | 1.04 | 0.8508 | 1.54 | 0.9382 | 2.08 | 0.9812 |
| 0.05 | 0.5199 | 0.55 | 0.7088 | 1.05 | 0.8531 | 1.55 | 0.9394 | 2.10 | 0.9821 |
| 0.06 | 0.5239 | 0.56 | 0.7123 | 1.06 | 0.8554 | 1.56 | 0.9406 | 2.12 | 0.9830 |
| 0.07 | 0.5279 | 0.57 | 0.7157 | 1.07 | 0.8577 | 1.57 | 0.9418 | 2.14 | 0.9838 |
| 0.08 | 0.5319 | 0.58 | 0.7190 | 1.08 | 0.8599 | 1.58 | 0.9429 | 2.16 | 0.9846 |
| 0.09 | 0.5359 | 0.59 | 0.7224 | 1.09 | 0.8621 | 1.59 | 0.9441 | 2.18 | 0.9854 |
| 0.10 | 0.5398 | 0.60 | 0.7257 | 1.10 | 0.8643 | 1.60 | 0.9452 | 2.20 | 0.9861 |
| 0.11 | 0.5438 | 0.61 | 0.7291 | 1.11 | 0.8665 | 1.61 | 0.9463 | 2.22 | 0.9868 |
| 0.12 | 0.5478 | 0.62 | 0.7324 | 1.12 | 0.8686 | 1.62 | 0.9474 | 2.24 | 0.9875 |
| 0.13 | 0.5517 | 0.63 | 0.7357 | 1.13 | 0.8708 | 1.63 | 0.9484 | 2.26 | 0.9881 |
| 0.14 | 0.5557 | 0.64 | 0.7389 | 1.14 | 0.8729 | 1.64 | 0.9495 | 2.28 | 0.9887 |
| 0.15 | 0.5596 | 0.65 | 0.7422 | 1.15 | 0.8749 | 1.65 | 0.9505 | 2.30 | 0.9893 |
| 0.16 | 0.5636 | 0.66 | 0.7454 | 1.16 | 0.8770 | 1.66 | 0.9515 | 2.32 | 0.9898 |
| 0.17 | 0.5675 | 0.67 | 0.7486 | 1.17 | 0.8790 | 1.67 | 0.9525 | 2.34 | 0.9904 |
| 0.18 | 0.5714 | 0.68 | 0.7517 | 1.18 | 0.8810 | 1.68 | 0.9535 | 2.36 | 0.9909 |

| z | Φ(z) | z | Φ(z) | z | Φ(z) | z | Φ(z) | z | Φ(z) |
|---|---|---|---|---|---|---|---|---|---|
| 0.19 | 0.5753 | 0.69 | 0.7549 | 1.19 | 0.8830 | 1.69 | 0.9545 | 2.38 | 0.9913 |
| 0.20 | 0.5793 | 0.70 | 0.7580 | 1.20 | 0.8849 | 1.70 | 0.9554 | 2.40 | 0.9918 |
| 0.21 | 0.5832 | 0.71 | 0.7611 | 1.21 | 0.8869 | 1.71 | 0.9564 | 2.42 | 0.9922 |
| 0.22 | 0.5871 | 0.72 | 0.7642 | 1.22 | 0.8888 | 1.72 | 0.9573 | 2.44 | 0.9927 |
| 0.23 | 0.5910 | 0.73 | 0.7673 | 1.23 | 0.8907 | 1.73 | 0.9582 | 2.46 | 0.9931 |
| 0.24 | 0.5948 | 0.74 | 0.7704 | 1.24 | 0.8925 | 1.74 | 0.9591 | 2.48 | 0.9934 |
| 0.25 | 0.5987 | 0.75 | 0.7734 | 1.25 | 0.8944 | 1.75 | 0.9599 | 2.50 | 0.9938 |
| 0.26 | 0.6026 | 0.76 | 0.7764 | 1.26 | 0.8962 | 1.76 | 0.9608 | 2.55 | 0.9946 |
| 0.27 | 0.6064 | 0.77 | 0.7794 | 1.27 | 0.8980 | 1.77 | 0.9616 | 2.60 | 0.9953 |
| 0.28 | 0.6103 | 0.78 | 0.7823 | 1.28 | 0.8997 | 1.78 | 0.9625 | 2.65 | 0.9960 |
| 0.29 | 0.6141 | 0.79 | 0.7852 | 1.29 | 0.9015 | 1.79 | 0.9633 | 2.70 | 0.9965 |
| 0.30 | 0.6179 | 0.80 | 0.7881 | 1.30 | 0.9032 | 1.80 | 0.9641 | 2.75 | 0.9970 |
| 0.31 | 0.6217 | 0.81 | 0.7910 | 1.31 | 0.9049 | 1.81 | 0.9649 | 2.80 | 0.9974 |
| 0.32 | 0.6255 | 0.82 | 0.7939 | 1.32 | 0.9066 | 1.82 | 0.9656 | 2.85 | 0.9978 |
| 0.33 | 0.6293 | 0.83 | 0.7967 | 1.33 | 0.9082 | 1.83 | 0.9664 | 2.90 | 0.9981 |
| 0.34 | 0.6331 | 0.84 | 0.7995 | 1.34 | 0.9099 | 1.84 | 0.9671 | 2.95 | 0.9984 |
| 0.35 | 0.6368 | 0.85 | 0.8023 | 1.35 | 0.9115 | 1.85 | 0.9678 | 3.00 | 0.9987 |
| 0.36 | 0.6406 | 0.86 | 0.8051 | 1.36 | 0.9131 | 1.86 | 0.9686 | 3.05 | 0.9989 |
| 0.37 | 0.6443 | 0.87 | 0.8078 | 1.37 | 0.9147 | 1.87 | 0.9693 | 3.10 | 0.9990 |
| 0.38 | 0.6480 | 0.88 | 0.8106 | 1.38 | 0.9162 | 1.88 | 0.9699 | 3.15 | 0.9992 |
| 0.39 | 0.6517 | 0.89 | 0.8133 | 1.39 | 0.9177 | 1.89 | 0.9706 | 3.20 | 0.9993 |
| 0.40 | 0.6554 | 0.90 | 0.8159 | 1.40 | 0.9192 | 1.90 | 0.9713 | 3.25 | 0.9994 |
| 0.41 | 0.6591 | 0.91 | 0.8186 | 1.41 | 0.9207 | 1.91 | 0.9719 | 3.30 | 0.9995 |
| 0.42 | 0.6628 | 0.92 | 0.8212 | 1.42 | 0.9222 | 1.92 | 0.9726 | 3.35 | 0.9996 |
| 0.43 | 0.6664 | 0.93 | 0.8238 | 1.43 | 0.9236 | 1.93 | 0.9732 | 3.40 | 0.9997 |
| 0.44 | 0.6700 | 0.94 | 0.8264 | 1.44 | 0.9251 | 1.94 | 0.9738 | 3.50 | 0.9998 |
| 0.45 | 0.6736 | 0.95 | 0.8289 | 1.45 | 0.9265 | 1.95 | 0.9744 | 3.60 | 0.9998 |
| 0.46 | 0.6772 | 0.96 | 0.8315 | 1.46 | 0.9279 | 1.96 | 0.9750 | 3.70 | 0.9999 |
| 0.47 | 0.6808 | 0.97 | 0.8340 | 1.47 | 0.9292 | 1.97 | 0.9756 | 3.80 | 0.9999 |
| 0.48 | 0.6844 | 0.98 | 0.8365 | 1.48 | 0.9306 | 1.98 | 0.9761 | 3.90 | 1.0000 |
| 0.49 | 0.6879 | 0.99 | 0.8389 | 1.49 | 0.9319 | 1.99 | 0.9767 | 4.00 | 1.0000 |
| 0.50 | 0.6915 | 1.00 | 0.8413 | 1.50 | 0.9332 | 2.00 | 0.9772 | | |

## Percentage points of the normal distribution

The values z are those which a random variable Z ~ N(0, 1) exceeds with probability p; that is, P(Z > z) = 1 - Φ(z) = p.

| p | z | p | z |
|---|---|---|---|
| 0.5000 | 0.0000 | 0.0500 | 1.6449 |
| 0.4000 | 0.2533 | 0.0250 | 1.9600 |
| 0.3000 | 0.5244 | 0.0100 | 2.3263 |
| 0.2000 | 0.8416 | 0.0050 | 2.5758 |
| 0.1500 | 1.0364 | 0.0010 | 3.0902 |

| p | z | p | z |
|---|---|---|---|
| 0.1000 | 1.2816 | 0.0005 | 3.2905 |

## Sampling distributions and tests

These rows come from Statistics 1 and are assumed in S2. The method of a test is in the Also learn list below.

### Expectation (mean)

Multiply each value of the statistic by its probability and add. Used in: Jan 2022 Q6(c), E(T) for a total of breakfast items; Oct 2023 Q4(a), the mean value of the t-shirts.

$$E(X) = \mu = \sum x_i \, P(X = x_i)$$

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### Independent events

From Statistics 1, which the specification says is assumed. Use it for independent periods, observations or samples. Used in: Jan 2026 Q3(a)(ii), 3 independent 30-minute periods; Jun 2022 Q1(c), P(W = 2 and X = 2); Jan 2025 Q2(ii), two independent observations of Y.

$$P(A \cap B) = P(A) \, P(B)$$

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### Mean and variance of data

From Statistics 1. Sxx in the booklet is the top line of the variance. Used in: Oct 2025 Q2(a), show that daily complaints fit a Poisson model.

$$\bar{x} = \frac{\sum x}{n}, \qquad \sigma^2 = \frac{\sum (x - \bar{x})^2}{n}$$

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## Also learn these

### Sampling terms

A census asks the whole population, a sample only part of it. A sampling frame is a list of all the population, and a sampling unit is one member of it. Advantages of a sample: cheaper, quicker; a disadvantage: it may not be representative. Used in: Jan 2026 Q1(a)(b); Oct 2025 Q1; Jun 2023 Q2(a)(b).

### Statistic and parameter

A statistic is calculated only from sample values and has no unknown parameters; μ is an unknown population parameter and the sample mean is a statistic. Used in: Jun 2023 Q2(c); Jan 2025 Q2(i).

### Sampling distribution of a statistic

It is all the values a statistic can take with their probabilities when every possible sample is considered. Used in: Oct 2025 Q3(a); Jan 2022 Q6, the total of breakfast items for 2 customers; Jan 2026 Q5(c).

### Building a sampling distribution

List the possible samples, find the probability of each (multiply, and count the arrangements, for example $3p^2 q$), group the samples giving the same value of the statistic and check the total is 1. Used in: Jan 2026 Q5(c)(d); Oct 2025 Q3(d)(e); Jun 2025 Q4(a).

### Conditions for a model

Binomial: a fixed number of independent trials with a constant probability of success. Poisson: events occur singly, at random, independently and at a constant rate. Used in: Jan 2021 Q1(a)(b); Oct 2023 Q5(a); Jun 2025 Q2(a)(b).

### Hypotheses

Write H0 and H1 in terms of p or λ, never the sample values, and use a one-tailed H1 for 'more than' or 'less than' and a two-tailed H1 for 'changed'. Used in: Jan 2026 Q3(b); Jan 2026 (A) Q4(a)(i); Oct 2025 Q5(d).

### Carrying out a test

Under H0 find the probability of a result at least as extreme as the observed one and compare it with the significance level (halved in each tail for a two-tailed test), or find the critical region and see whether the observation is in it. Give a conclusion about H0, then one in context using the words of the claim. Used in: Oct 2025 Q2(c); Jan 2026 Q4(b); Jan 2026 (A) Q4(b).

### Critical region and actual significance level

The critical region is the set of values for which H0 is rejected, with each tail as close to the significance level as possible. The actual significance level is the probability of falling in it, so add both tails. Used in: Jan 2026 (A) Q4(a)(ii)(c); Jun 2025 Q2(d)(e); Jan 2026 Q3(c).

### Tests with an approximation

When the question says to use a suitable approximation, use Po(np) or a normal approximation; an exact binomial answer can lose the marks. Used in: Jan 2026 Q4(b); Oct 2025 Q5(c); Oct 2021 Q1(d).

### Counts from two Poisson intervals

Given the total from two Poisson intervals, the count in the first is binomial B(total, share of the rate), which the schemes accept as an alternative to conditional probability. Used in: Jan 2026 (A) Q7(e); Jun 2023 Q7(c).

### A valid p.d.f.

A p.d.f. is never negative and has total area 1, so a sketch that dips below the axis shows it is not valid. Used in: Oct 2025 (A) Q4(a).

### Skewness of a continuous distribution

Compare the mean, median and mode: median close to mode suggests no skew, and a longer upper tail is positive skew. Used in: Oct 2025 (A) Q4(e); Jan 2022 Q4(e).

## Using the booklet in the exam

- Write down the three c.d.f. rules before you start a continuous question: P(a < X < b) = F(b) - F(a), f = dF/dx and F(top) = 1. The booklet prints E(X), Var(X) and the uniform formulae, not these.
- The tables X4 and X5 print P(X <= x) only. Convert 'more than', 'at least' and 'between' before you read them, and scale a Poisson mean to the interval in the question first.
- When a question says use an approximation, name it, give its parameters and apply the continuity correction: N(np, np(1 - p)) for a binomial and Po(np) when n is large and p is small. The exact binomial answer loses the marks.
- For a test, state H0 and H1 in terms of p or λ, compare a probability (or critical region) with the significance level, and finish with a conclusion in the context of the claim.
- Where a question says 'algebraic integration' or that calculator technology is not acceptable, show the integral of x f(x) or $x^2$ f(x) with limits, and use Var(X) = $E(X^2)$ - $E(X)^2$.
- For a uniform variable, read the interval carefully: the p.d.f. is 1 / (b - a), the mean is (a + b) / 2 and the variance is $(b - a)^2$ / 12, all printed in the booklet.

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