



Appendix F: Mathematical Phrases, Symbols, and Formulas

By:
OpenStaxCollege

English Phrases Written Mathematically

When the English says:	Interpret this as:
X is at least 4.	$X \geq 4$
The minimum of X is 4.	$X \geq 4$
X is no less than 4.	$X \geq 4$
X is greater than or equal to 4.	$X \geq 4$
X is at most 4.	$X \leq 4$
The maximum of X is 4.	$X \leq 4$
X is no more than 4.	$X \leq 4$
X is less than or equal to 4.	$X \leq 4$
X does not exceed 4.	$X \leq 4$
X is greater than 4.	$X > 4$
X is more than 4.	$X > 4$
X exceeds 4.	$X > 4$
X is less than 4.	$X < 4$
There are fewer X than 4.	$X < 4$
X is 4.	$X = 4$
X is equal to 4.	$X = 4$

When the English says:	Interpret this as:
X is the same as 4.	$X = 4$
X is not 4.	$X \neq 4$
X is not equal to 4.	$X \neq 4$
X is not the same as 4.	$X \neq 4$
X is different than 4.	$X \neq 4$

Formulas

Formula 1: Factorial $n! = n(n - 1)(n - 2)\dots(1)$

$$0! = 1$$

Formula 2: Combinations $\binom{n}{r} = \frac{n!}{(n-r)! r!}$

Formula 3: Binomial Distribution $X \sim B(n, p)$

$$P(X = x) = \binom{n}{x} p^x q^{n-x}, \text{ for } x = 0, 1, 2, \dots, n$$

Formula 4: Geometric Distribution $X \sim G(p)$

$$P(X = x) = q^{x-1} p, \text{ for } x = 1, 2, 3, \dots$$

Formula 5: Hypergeometric Distribution $X \sim H(r, b, n)$

$$P(X = x) = \frac{\binom{r}{x} \binom{b}{n-x}}{\binom{r+b}{n}}$$

Formula 6: Poisson Distribution $X \sim P(\mu)$

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

Formula 7: Uniform Distribution $X \sim U(a, b)$

Appendix F: Mathematical Phrases, Symbols, and Formulas

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

Formula 8: Exponential Distribution $X \sim \text{Exp}(m)$

$$f(x) = me^{-mx} \quad m > 0, x \geq 0$$

Formula 9: Normal Distribution $X \sim N(\mu, \sigma^2)$

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}, \quad -\infty < x < \infty$$

Formula 10: Gamma Function $\Gamma(z) = \int_{\infty}^0 x^{z-1} e^{-x} dx \quad z > 0$

$$\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$$

$\Gamma(m+1) = m!$ for m , a nonnegative integer

otherwise: $\Gamma(a+1) = a\Gamma(a)$

Formula 11: Student's t -distribution $X \sim t_{df}$

$$f(x) = \frac{\left(1 + \frac{x^2}{n}\right)^{-\frac{(n+1)}{2}} \Gamma\left(\frac{n+1}{2}\right)}{\sqrt{n\pi} \Gamma\left(\frac{n}{2}\right)}$$

$$X = \frac{Z}{\sqrt{\frac{Y}{n}}}$$

$Z \sim N(0, 1)$, $Y \sim X_{df}^2$, $n = \text{degrees of freedom}$

Formula 12: Chi-Square Distribution $X \sim X_{df}^2$

$$f(x) = \frac{x^{\frac{n-2}{2}} e^{-\frac{x}{2}}}{2^{\frac{n}{2}} \Gamma\left(\frac{n}{2}\right)}, \quad x > 0, \quad n = \text{positive integer and degrees of freedom}$$

Formula 13: F Distribution $X \sim F_{df(n), df(d)}$

$df(n) = \text{degrees of freedom for the numerator}$

$df(d)$ = degrees of freedom for the denominator

$$f(x) = \frac{\Gamma(\frac{u+v}{2})}{\Gamma(\frac{u}{2})\Gamma(\frac{v}{2})} (\frac{u}{v})^{\frac{u}{2}} x^{\frac{u}{2}-1} [1 + (\frac{u}{v})x^{-0.5(u+v)}]$$

$X = \frac{Y_u}{W_v}$, Y , W are chi-square

Symbols and Their Meanings

Symbols and their Meanings

Chapter (1st used)	Symbol	Spoken	Meaning
Sampling and Data	$\sqrt{\quad}$	The square root of	same
Sampling and Data	π	Pi	3.14159... (a specific number)
Descriptive Statistics	Q_1	Quartile one	the first quartile
Descriptive Statistics	Q_2	Quartile two	the second quartile
Descriptive Statistics	Q_3	Quartile three	the third quartile
Descriptive Statistics	IQR	interquartile range	$Q_3 - Q_1 = IQR$
Descriptive Statistics	\bar{x}	x-bar	sample mean
Descriptive Statistics	μ	mu	population mean
Descriptive Statistics	s s_x s_x	s	sample standard deviation
Descriptive Statistics	s^2 s_x^2	s squared	sample variance
Descriptive Statistics	σ σ_x σ_x	sigma	population standard deviation

Appendix F: Mathematical Phrases, Symbols, and Formulas

Chapter (1st used)	Symbol	Spoken	Meaning
Descriptive Statistics	σ^2 σ_x^2	sigma squared	population variance
Descriptive Statistics	Σ	capital sigma	sum
Probability Topics	{ }	brackets	set notation
Probability Topics	S	S	sample space
Probability Topics	A	Event A	event A
Probability Topics	$P(A)$	probability of A	probability of A occurring
Probability Topics	$P(A B)$	probability of A given B	prob. of A occurring given B has occurred
Probability Topics	$P(A \text{ OR } B)$	prob. of A or B	prob. of A or B or both occurring
Probability Topics	$P(A \text{ AND } B)$	prob. of A and B	prob. of both A and B occurring (same time)
Probability Topics	A'	A-prime, complement of A	complement of A, not A
Probability Topics	$P(A')$	prob. of complement of A	same
Probability Topics	G_1	green on first pick	same
Probability Topics	$P(G_1)$	prob. of green on first pick	same
Discrete Random Variables	PDF	prob. distribution function	same
Discrete Random Variables	X	X	the random variable X
Discrete Random Variables	$X \sim$	the distribution of X	same
Discrete Random Variables	B	binomial distribution	same
Discrete Random Variables	G	geometric distribution	same

Appendix F: Mathematical Phrases, Symbols, and Formulas

Chapter (1st used)	Symbol	Spoken	Meaning
Discrete Random Variables	H	hypergeometric dist.	same
Discrete Random Variables	P	Poisson dist.	same
Discrete Random Variables	λ	Lambda	average of Poisson distribution
Discrete Random Variables	\geq	greater than or equal to	same
Discrete Random Variables	\leq	less than or equal to	same
Discrete Random Variables	$=$	equal to	same
Discrete Random Variables	\neq	not equal to	same
Continuous Random Variables	$f(x)$	f of x	function of x
Continuous Random Variables	pdf	prob. density function	same
Continuous Random Variables	U	uniform distribution	same
Continuous Random Variables	Exp	exponential distribution	same
Continuous Random Variables	k	k	critical value
Continuous Random Variables	$f(x) =$	f of x equals	same
Continuous Random Variables	m	m	decay rate (for exp. dist.)
The Normal Distribution	N	normal distribution	same
The Normal Distribution	z	z -score	same

Appendix F: Mathematical Phrases, Symbols, and Formulas

Chapter (1st used)	Symbol	Spoken	Meaning
The Normal Distribution	Z	standard normal dist.	same
The Central Limit Theorem	CLT	Central Limit Theorem	same
The Central Limit Theorem	\bar{X}	X -bar	the random variable X -bar
The Central Limit Theorem	μ_x	mean of X	the average of X
The Central Limit Theorem	$\mu_{\bar{x}}$	mean of X -bar	the average of X -bar
The Central Limit Theorem	σ_x	standard deviation of X	same
The Central Limit Theorem	$\sigma_{\bar{x}}$	standard deviation of X -bar	same
The Central Limit Theorem	ΣX	sum of X	same
The Central Limit Theorem	Σx	sum of x	same
Confidence Intervals	CL	confidence level	same
Confidence Intervals	CI	confidence interval	same
Confidence Intervals	EBM	error bound for a mean	same
Confidence Intervals	EBP	error bound for a proportion	same
Confidence Intervals	t	Student's t -distribution	same
Confidence Intervals	df	degrees of freedom	same
Confidence Intervals	$t_{\frac{\alpha}{2}}$	student t with $\alpha/2$ area in right tail	same

Appendix F: Mathematical Phrases, Symbols, and Formulas

Chapter (1st used)	Symbol	Spoken	Meaning
Confidence Intervals	$\hat{p}' ; p$	p -prime; p -hat	sample proportion of success
Confidence Intervals	$\hat{q}' ; q$	q -prime; q -hat	sample proportion of failure
Hypothesis Testing	H_0	H -naught, H -sub 0	null hypothesis
Hypothesis Testing	H_a	H - a , H -sub a	alternate hypothesis
Hypothesis Testing	H_1	H -1, H -sub 1	alternate hypothesis
Hypothesis Testing	α	alpha	probability of Type I error
Hypothesis Testing	β	beta	probability of Type II error
Hypothesis Testing	$\bar{X}_1 - \bar{X}_2$	X_1 -bar minus X_2 -bar	difference in sample means
Hypothesis Testing	$\mu_1 - \mu_2$	μ -1 minus μ -2	difference in population means
Hypothesis Testing	$P'_1 - P'_2$	P_1 -prime minus P_2 -prime	difference in sample proportions
Hypothesis Testing	$p_1 - p_2$	p_1 minus p_2	difference in population proportions
Chi-Square Distribution	X^2	Ky -square	Chi-square
Chi-Square Distribution	O	Observed	Observed frequency
Chi-Square Distribution	E	Expected	Expected frequency
Linear Regression and Correlation	$y = a + bx$	y equals a plus b - x	equation of a line
Linear Regression and Correlation	\hat{y}	y -hat	estimated value of y
Linear Regression and Correlation	r	correlation coefficient	same

Appendix F: Mathematical Phrases, Symbols, and Formulas

Chapter (1st used)	Symbol	Spoken	Meaning
Linear Regression and Correlation	ε	error	same
Linear Regression and Correlation	SSE	Sum of Squared Errors	same
Linear Regression and Correlation	$1.9s$	1.9 times s	cut-off value for outliers
F -Distribution and ANOVA	F	F -ratio	F -ratio