

# Review of New Features in Maple

## Summary

Many of the highlighted new features in Maple 2023, as in previous releases, appear heavily correlated with earlier features of Mathematica. Furthermore, the Maple feature is often only a shallow implementation of the Mathematica functionality.

Only a small fraction of Mathematica's advances make it into Maple at all. Major feature areas of Mathematica that Maple has yet to significantly cover in a serious way include machine learning, video and image processing, audio computation, mesh geometry, finite element analysis, report generation, cloud computation, hardware connectivity, natural language processing and semantic interpretation, spatial statistics, quadratic optimization, real-world data sources, astronomy and much more.

For those capabilities that Maple has implemented in the last 10 Maple releases, the median time lag between features being introduced in Mathematica and basic implementation in Maple has been around nine years.

If you want access to deep implementations of the very latest in computation, you should be using Mathematica.

## New Features in Maple 2023

Maple 2023	Mathematica	Notes
Math		
Improved integration		The examples given in Maple marketing literature of integrals now solved with compact results or the correct handling of assumptions are all already optimally solved by Mathematica.
Support for elementwise matrix relations in Solve	1988	
High dimension polyhedral sets	2014	Mathematica's Region framework is not limited to polyhedral regions.
IntegerHull	2022	Available in Mathematica as ResourceFunction["IntegerConvexHullMesh"].
Multivariate Puiseux series	2020	
Quantifier elimination	2003	Implemented in Mathematica as Reduce, ForAll and Exists.
Visualization		
Color bars for contour and density plots	2008	Mathematica provides a general primitives BarLegend, SwatchLegend, LineLegend, PointLegend that can be applied to any visualization, not just ContourPlot and DensityPlot.

Maple 2023	Mathematica	Notes
Additional color maps	2007	Mathematica's <code>ColorData</code> function provides 175 predefined color schemes for indexed or continuous palettes and also supports scaling and reversal.
Support for color maps in <code>densityplot</code> , <code>contourplot</code> and <code>deplot</code>	1988	Nearly all Mathematica visualizations support color maps to adjust their appearance.
<b>Coding tools</b>		
Open code files in Worksheet editor	1988	Mathematica has always been able to open code text files in its notebook editor, where a much richer collection of code editing tools are supported than the Maple Worksheet editor (see the <a href="#">Comparison of Ease-of-Use Features</a> ).
Code edit region improvements		Beacause Mathematica does not have a seperate code edit region, the code editing tools in Mathematica notebooks apply to all input. Tools include those now supported in Maple: palette-based command entry, units entry, code execution, search and replace.
Python language support	2017	Mathematica notebooks support cells that execute SQL, R, Julia, Octave, Ruby, NodeJS, shell scripts as well as Python. Code execution in these lanagues is also available programmatically via the command <code>ExternalEvaluate</code> .
<b>Interface</b>		
Hyerlinks to help pages	2007	
Open multiple help pages	2007	
Primed variables	2007	While Mathematica does not choose to allow alternative interpretations of ASCII 39, primed variables are supported via Unicode 2032 and there is a general mechanism for using variables with <code>OverDot</code> , <code>OverBar</code> or <code>Overscript</code> appearance, either as variables or functions.
Style canvas elements	2007	Mathematica implents canvas-based interfaces using <code>Graphics</code> and <code>Inset</code> . These support any kind of content that can be rendered by the Mathematica notebook, including <code>FontSize</code> , <code>FontCoolor</code> and <code>Background color</code> now supported by Maple.
Quiz building	2021	Mathematica provides quiz building tools via the menu "New/Programmatic Notebook/Question Notebook Authoring" or the command <code>CreateNotebook["QuestionNotebook"]</code>
Step-by-step solutions	2010	Mathematica's built-in use of Wolfram Alpha provides step-by-step solutions to many math, engineering and science tasks, including implicit differentiation, completing the square and long division, that are only now supported by Maple. To access step-by-step solutions in Mathematica, start your input with <code>==</code> and click the "Step-by-step solution" button in the output.
<b>Graph theory</b>		
Travelling salesman on weighted graphs	2007	Implemented in Mathematica as <code>FindShortestTour</code> and <code>FindShortestPath</code> .
Multigraph support	2010	
<code>GraphProduct</code>	2022	Mathematica supports six forms of <code>GraphProduct</code> compared to four in Maple.

Maple 2023	Mathematica	Notes
Additional special graphs	2007	Mathematica's <code>GraphData</code> command supports over 10,000 special graphs compared to the 119 that Maple now supports, including Hamming, house and windmill graphs.
<b>Signal processing</b>		
Quantize	2007	The different applications of this Maple utility function can be achieved in Mathematica with <code>Clip</code> , <code>Round</code> or <code>Nearest</code> .
SavitzkyGolayFilter	2014	Implemented in Mathematica as <code>SavitzkyGolayMatrix</code> .
Padding options for Convolve	1999	Mathematica's <code>ListConvolve</code> command supports arbitrary padding and centering values. It is not limited to the three named choices in Maple.
Padding and truncation for FFT	2014	Mathematica's <code>Fourier</code> supports the generation of specific terms. <code>ArrayResample</code> or <code>PadRight</code> can be used to pad lists to lengths that are powers of 2 that the new Maple option supports.
Apple Silicon support for signal processing operations	2021	Mathematica is fully Apple Silicon native.
<b>Programming</b>		
SortBy for arrays	2007	Mathematica's <code>SortBy</code> command can sort any expression by any comparator. It is not limited to rows or columns of rectangular arrays as the Maple command is.
IsSubsequence	2023	Implemented in Mathematica as <code>ResourceFunction["ContainsOrderedItemsQ"]</code> .
HSL, HSV color support	2019	Mathematica's "Color" Entity also supports HTML and Pantone color names, CIE 1976, Hunter 1948 Lab, CMYK, HSB, XYZ, Lab, LCH and LUV color spaces.
InversePermutation	2010	Implemented in Mathematica as <code>InversePermutation</code> .
Test whether a vector or matrix is a given type	1988	The Mathematica commands <code>MatrixQ</code> and <code>VectorQ</code> are not limited just to types but can apply arbitrary tests to elements.
RealBox and ComplexBox support inverse trigonometric functions	2021	Implemented in Mathematica as <code>CenteredInterval</code> .
Support for 2022 SI prefixes	2022	
Connect from Python	2019	Implemented as the Wolfram Client Library for Python.

Developments in Maple 2023 that do not appear to be following Mathematica developments include work algebraic physics, ZPolyhedral sets, perceptual color space support and OpenAPI support.

# New Features in Maple 2022

Maple 2022	Mathematica	Notes
<b>Interface</b>		
Customizable tooltips for hyperlinks	2007	Tooltips can be added to anything in Mathematica, not just hyperlinks. Unlike Maple, they can contain images, math or other content, not just text.
Linking to local bookmarks	1996	Mathematica hyperlinks can target specific cells in same notebook, another local notebook or a notebook on a remote website using the <code>CellTags</code> option. They can also target help pages or specific cells in help page, Wolfram Cloud notebooks or webpages.
Better zoom in the help system	1996	Mathematica's help system has consistently applied zoom to help pages, guide pages, tutorials and the master index since its creation.
Keyboard shortcut to navigate to help search	1996	
<b>Advanced math</b>		
Power series of non-polynomial expressions	1988	The examples given as newly solved in Maple 2022 release announcements were already solved by Mathematica.
Closed-form formal power series	1996–2008	The examples given as newly solved in Maple 2022 release announcements were already solved by Mathematica's <code>SeriesCoefficient</code> function.
Search a matrix row/column	1988	Mathematica's <code>Select</code> and <code>Cases</code> commands provide the same functionality but are not limited to searching rectangular arrays. The same functions can be used to search heirarchical data, mathematical expressions, documents or anything else that is expressible in the Wolfram Language.
Improved integraton		Independent tests have demonstrated Mathematica's strong lead over Maple for integration problems (see <a href="https://www.12000.org/my_notes/CAS_integration_tests/index.htm">https://www.12000.org/my_notes/CAS_integration_tests/index.htm</a> ). All of the integrals and integral transforms that are listed as newly solved by Maple 2022 in the release announcement were already solved by Mathematica.
Improved simplification		Independent tests have demonstrated Mathematica's strong lead over Maple for simplification problems (see <a href="https://www.12000.org/my_notes/simplification_in_CAS/index.htm">https://www.12000.org/my_notes/simplification_in_CAS/index.htm</a> ). The examples of improved simplification of trigonometric, log and piecewise functions and constants that are listed as newly solved by Maple 2022 in the release announcement were already solved by Mathematica.
Improved inflection points	2019	In the Maple 2022 release announcement, an example is given for finding inflection points of $(1+\sin(x))^{\cos(x)}$ . However, Maple solves this over a small finite interval and two of the results returned are approximate. The Mathematica function <code>ResourceFunction["InflectionPoints"]</code> solves this problem with exact results and a general formula for the infinite periodic sequence of values.
RealBox, ComplexBox	2021	Implemented in Mathematica as <code>CenteredInterval</code> .

Maple 2022	Mathematica	Notes
Traverse	2010	Available in Mathematica as <code>DepthFirstScan</code> and <code>BreadthFirstScan</code> . Much richer control is available for trees using <code>TreeTraversalOrder</code> .
CompleteKary Arborescence	2010	Available in Mathematica as <code>CompleteKaryTree</code> .
IsPerfectGraph	2005	Implemented in Mathematica as <code>PerfectQ</code> .
IsSimplicial	2010	Implemented in Mathematica as <code>SimpleGraphQ</code> .
IsChordal	2022	Available in Mathematica as <code>ResourceFunction["ChordalGraphQ"]</code> .
IsOriented	2022	Available in Mathematica as <code>ResourceFunction["OrientedGraphQ"]</code> .
IntegerHull	2022	Available in Mathematica as <code>ResourceFunction["IntegerConvexHullMesh"]</code> .
<b>Visualization</b>		
Discontinuity detection in 2D plots	2007	Mathematica automatically detects discontinuities in both 2D and 3D plots.
Recompute plot on zoom	2018	Available in Mathematica as <code>ResourceFunction["DragZoomPlot"]</code> .
Named color schemes	2007	Mathematica has 175 built-in color schemes supporting both indexed and smooth transition schemes.
Custom color schemes	2007	Available in Mathematica as <code>Blend</code> .
Stacked histograms	2008	Mathematica's <code>Histogram</code> supports "Grouped", "Stepped" and "Percentile" layouts as well as "Stacked". It also supports multiple histograms with common axes in the same plot or in a row, column or grid layout.
Alternate conversion for spherical coordinates	2012	Mathematica's <code>CoordinateTransform</code> and <code>CoordinateTransformData</code> functions support 175 different coordinate transformations.
<b>Thermophysical data</b>		
Gibbs free energy	2014	Mathematica's <code>ThermodynamicData</code> command supports 69 different thermodynamic properties of chemicals including the Gibbs free energy property that is now supported by Maple.
<b>Signal processing</b>		
Signal generation	2016	Mathematica's <code>AudioGenerator</code> function includes support for six standard oscillators and seven standard noise types, as well as support for models using functions, time series or random processes.
DynamicTimeWarping	2015	Supported in Mathematica as <code>WarpingCorrespondence</code> and <code>WarpingDistance</code> .

Maple 2022	Mathematica	Notes
DifferentiateData	1991	Mathematica's <code>Interpolation</code> function is differentiable and can accept multidimensional data with explicit or implicit indexing. The spectral method is available through the function <code>ResourceFunction["ListD"]</code> .
IntegrateData, IntegrateData2D	1991	Mathematica's <code>Interpolation</code> function is integratable and is not limited to one or two dimensions. It accepts explicit or implicitly indexed data.
Insert one signal into another	2014	Available in Mathematica as <code>TimeSeriesInsert</code> , <code>AudioInsert</code> and <code>VideoInsert</code> .
FindPeakPoints returns indices	2014	Mathematica's <code>FindPeaks</code> returns both values and indices.
<b>Units</b>		
Piecewise suport for units	2012	
Performance improvements for units		Maple does have an equivalent to Mathematica's <code>QuantityArray</code> , which allows unit-based computation on very large datasets without the overhead of repeated identical conversions.
<b>Step-by-step solutions</b>		
Show simplification steps	2010	All Wolfram Alpha Pro functionality is available from within Mathematica notebooks, including its step-by-step tutors.
<b>Creating and sharing interactive content</b>		
Canvas scripting	2007	While the Mathematica <code>Graphics</code> object has supported all of the features now supported by Maple's <code>Canvas</code> object, this is only a special case of the wider support for scripting notebooks. Any content of Mathematica notebooks can be created, updated or analyzed programmatically. A notebook can be deployed to the cloud, in whole or in part, where the same interactivity is supported as on the desktop. Furthermore, Mathematica notebooks can be shared and edited in the cloud to enable collaboration.
Plot supports on-click events	2007	Mathematica's <code>EventHandler</code> function is not limited to use within <code>Graphics</code> . Any visible content can have programs attached to mouse or keyboard events. <code>EventHandler</code> is also not limited only to on-click but also supports double-click, right-click, mouseover or mouse-dragged events.
Hidden state information	2007	Mathematica's <code>DynamicModule</code> supports hidden state with any kind of argument, not just strings or numbers.
<b>Print layout</b>		
Show page boundaries	1996	
Set page breaks	1996	
Prevent breaks within content	1996	As well as allowing the specification that page breaks should not happen within content, Mathematica also allows the user to specify that breaks should not happen immediately before or immediately after content, for example, to prevent a title appearing at the bottom of a page.

Maple 2022	Mathematica	Notes
Create well-proportioned tables and plots	1996	As well as providing interactive adjustment of plots and tables, Mathematica supports the programmatic specification of graphic, table, column and font sizes using proportions of available space as well as absolute size.
<b>Connectivity</b>		
Use Maple as a Jupyter engine	2018	Available from <a href="https://github.com/WolframResearch/WolframLanguageForJupyter">https://github.com/WolframResearch/WolframLanguageForJupyter</a> .
SMTLIB support		SMT to Mathematica conversion is supported by the third-party Tarski package <a href="https://modelwriter.github.io/Tarski">https://modelwriter.github.io/Tarski</a> .
Convert objects to TensorFlow	2020	Mathematica supports import and export of ONNX files, which are supported by a range of libraries including TensorFlow.
Indexing DeepLearning tensors	2020	Mathematica has a full symbolic representation of neural networks, making it possible to analyze, create or transform networks, in arbitrary ways, not just via access to the tensors involved. The Mathematica command <code>NetExtract</code> can read any learnable parameter from any layer of a network including the weights and biases tensors.
GradientTape	2017	Mathematica's <code>TrainingProgressFunction</code> option for its <code>NetTrain</code> command allows an arbitrary function to be executed during training, making any aspect of the training observable, not just gradients.
Two-dimensional barcode generation	2014	Mathematica's <code>BarcodeImage</code> command supports UPC, EAN8, EAN13, Code39, Code128, ITF, Codebar, Aztec and Datamatrix 1D and 2D barcodes as well as the QR code now supported by Maple. Mathematica can also extract barcode data from images using the function <code>BarcodeRecognize</code> .
Convert data from strings or byte arrays	1999	Mathematica's <code>ImportString</code> and <code>ImportByteArray</code> functions can convert between string or byte data and over 240 different formats.
Multipart form data	2014	Mathematica's <code>HTTPRequestData</code> gives full support to HTTP interactions, including multipart elements.

Developments in Maple 2022 that do not appear to be following Mathematica developments include work in algebraic physics and root finding.

## New Features in Maple 2021

Maple 2021	Mathematica	Notes
<b>Language and programming</b>		
DEQueue	2020	Efficient double queues are implemented in Mathematica as <code>DataStructure["Deque"]</code> . <code>DataStructure</code> supports more than 20 additional specialized data structures with optimized supporting operations.

Maple 2021	Mathematica	Notes
Multilevel break statements	1988	Implemented in Mathematica as Throw and Catch.
Interfaces with an indeterminate number of input fields	2014	Implemented in Mathematica as part of FormObject.
Generate evenly spaced sequences	2015	Implemented in Mathematica as Subdivide.
IsMonotonicQ	1988	Implemented in Mathematica as OrderedQ.
PersistentTable	2017	Mathematica's PersistentObject is not limited to table-like structures and provides control over the duration of the persistence and supports both local and cloud-based storage.
DataFrame indices and entries	2014	Mathematica's Dataset is not limited to rectangular two-dimensional data and has always supported equivalent functionality using the commands Keys and Values.
Units:-Split	2012	Implemented in Mathematica as QuantityMagnitude and QuantityUnit.
Limit information returned by Trace	1991	Mathematica's Trace command supports an arbitrary pattern for filtering returned information.
<b>Math</b>		
Multivariate limits		Examples given as newly solved in Maple are already solved in Mathematica.
Vectorized ODEs	1999	
Series expansion of log integral		LogIntegral was originally included in Mathematica in 1988 and is supported by Series.
GuessRecurrence	2008	Implemented in Mathematica as FindSequenceFunction.
MinimalRecurrence	2008	Implemented in Mathematica as FindLinearRecurrence.
Simplifications of LambertW	1996	The examples shown as new in the Maple 2021 announcement are already simplified in Mathematica. Implemented in Mathematica as ProductLog.
MatrixAdd, VectorAdd	1988	Because Mathematica automatically supports vectorized operations when appropriate, there is no need for such commands.
New differential equation solutions		Four of the five new examples shown in the release announcement produce solutions in Mathematica.
Multivariate CoefficientVector	2015	Implemented in Mathematica as CoefficientList.
EgoGraph	2010	Implemented in Mathematica as NeighborhoodGraph.



Maple 2021	Mathematica	Notes
GraphDensity	2012	Implemented as GraphDensity.
Newick	2021	Available in Mathematica as ResourceFunction["ExportNewickString"].
PrueferCode	2012	Implemented in Mathematica as LabeledTreeToCode.
SpanningForest	2014	Implemented in Mathematica as FindSpanningTree.
BipartiteMatch supports weighted graphs	2012	Implemented as FindMaximumFlow.
Additional special graphs	2007+	Mathematica's GraphData now supports 8349 special graphs compared to 113 supported by Maple, including the 16 added in this release of Maple.
<b>Visualization</b>		
Automatic domain choice for plots	2010	Using Wolfram Alpha's computational intelligence, Mathematica has been able to choose domains based on features such as asymptotes, roots, and maxima and minima. This feature was first trialled in Wolfram's CalculationCenter product in 2001.
Units in point plots and polygon plots	2012	Mathematica's units are supported in most plot types, not just the two that Maple now supports.
Arrow respects scale	2007	Mathematica's Arrow primitive has always taken scale into account for its head shape. The same is true for lines with beveled or round ends, neither of which are currently supported in Maple. Mathematica also gives full control over ArrowHead numbers, position, size and style.
<b>Deep learning</b>		Mathematica provides 56 neural network layer types compared to the nine now supported in Maple. Mathematica allows composition of layers in an arbitrary graph, not just through the linear chain supported by Maple.
EmbeddingLayer	2016	Implemented as EmbeddingLayer.
ConvolutionLayer	2016	Implemented as ConvolutionLayer.
DenseLayer	2016	Implemented as LinearLayer.
DropoutLayer	2016	Implemented as DropoutLayer.
EmbeddingLayer	2016	Implemented as EmbeddingLayer.
FlattenLayer	2016	Implemented as FlattenLayer.
GatedRecurrentUnitLayer	2017	Implemented as GatedRecurrentLayer.
LongShortTermMemory Layer	2017	Implemented as LongShortTermMemoryLayer.
MaxPoolLayer	2016	Implemented as PoolingLayer.

Maple 2021	Mathematica	Notes
Sequential	2016	Implemented as NetChain.
<b>Interface</b>		
Non-executable math in text	1996	Mathematica has always assumed that math embedded in text should not be executable by default.
Display multiplication in scientific notation	1996	As well as automatically displaying the times symbol in scientific notation, Mathematica allows the user to decide the character to be used in this and other implied multiplication situations.
Warning messages for <b>e</b> and <b>d</b> can be suppressed	1988	All evaluation warnings in Mathematica can be individually or collectively suppressed.
Copy selection as LaTeX	1996	
Enter LaTeX	1996	Since 1996, it has been possible to paste LaTeX for automatic translation into Mathematica typesetting. Since 2020, Mathematica has held the original LaTeX in the notebook for later editing, rendering it in real time for display.
Export to LaTeX	1996	
latex command	1988	Implemented in Mathematica as TeXForm.
<b>Student packages</b>		
Step-by-step solutions: equation solving, factoring polynomials and long division	2009	All Wolfram Alpha step-by-step solutions are available within Mathematica, including algebra. Mathematica supports step-by-step solutions for many problem types not supported by Maple, including linear algebra, discrete math, physics formulas, statistics, geometry, chemistry equations and proofs.
Step-by-step solutions: ODEs	2012	All Wolfram Alpha step-by-step solutions are available within Mathematica, including differential equations.
Study guides in Maple		Wolfram doesn't put study materials inside Mathematica but provides them, free of charge, through Wolfram U.
<b>Signal and image processing</b>		
Short-time Fourier transforms	2019	Implemented as ShortTimeFourier.
BandPower, MeanFrequency and SpectralEntropy	2016	Implemented in Mathematica as AudioMeasurements.
ShortTimeBandPower, ShortTimeMean Frequency and Short TimeSpectralEntropy	2016	Implemented in Mathematica as AudioLocalMeasurements.

Maple 2021	Mathematica	Notes
SampleImage	2007	Test images and other sample data are provided by the command <code>ExampleData</code> . In addition, Mathematica provides commands such as <code>WebImageSearch</code> and thousands of <code>Entity</code> objects that include an "Image" property.
Welch	2012	Implemented in Mathematica within <code>Periodogram</code> .
Hampel	2021	Available in Mathematica as <code>ResourceFunction["HampelFilter"]</code> .
PowerSpectrum accepts signals	2012	Mathematica's <code>PeriodogramArray</code> command accepts signal data and can also be applied to directly to Audio and Image data.

### Thermophysical data

Thermophysical data	2014	Implemented in Mathematica as <code>StandardAtmosphereData</code> .
<b>Quantum chemistry (additional purchase)</b>		Mathematica provides chemistry functionality without the need for additional purchases.
MolecularDictionary	2007	Implemented in Mathematica as <code>ChemicalData</code> .
PlotMolecule	2007	Implemented in Mathematica as <code>MoleculePlot</code> .
MolecularGeometry	2019	Implemented in Mathematica as <code>Molecule</code> .

Developments in Maple 2021 that do not appear to be following Mathematica developments include work in algebraic physics.

## New Features in Maple 2020

Maple 2020	Mathematica	Notes
<b>Graph theory</b>		
Betweenness centrality	2010	Implemented in Mathematica as <code>BetweennessCentrality</code> . Mathematica supports 12 different centrality measures while Maple now supports only 8.
Closeness centrality	2010	Implemented in Mathematica as <code>ClosenessCentrality</code> .
Degree centrality	2010	Implemented in Mathematica as <code>DegreeCentrality</code> .
Eigenvector centrality	2010	Implemented in Mathematica as <code>EigenvectorCentrality</code> .
Katz centrality	2010	Implemented in Mathematica as <code>KatzCentrality</code> .
Page-rank centrality	2010	Implemented in Mathematica as <code>PageRankCentrality</code> .

Maple 2020	Mathematica	Notes
Graph styling control	2014	As well as controlling style choices for edges and vertices, Mathematica can use arbitrary shape functions for either of these, allowing any kind of visual representation.
Graph self loops	2010	Mathematica's Graph object has always supported self-loops. Finding and counting self-loops is just a special case of finding edges that match a given pattern and can be achieved with <code>EdgeList[graph,(x_↔x_)](x_↔x_)</code> . By changing this pattern, Mathematica can distinguish between directed and undirected self-loops, which Maple's commands do not.
Geometric graphs	2020	Mathematica's <code>MeshConnectivityGraph</code> command can generate graphs of the connectivity of any subdimension of any dimensional mesh geometry.
Contract subgraphs	2014	Implemented in Mathematica as <code>VertexContract</code> .
Special graphs	2007	Mathematica includes support for over 8000 special graphs, including all 18 recently added to Maple. Even now, Maple supports only 97.
Nearest and farthest neighbor graphs	2015	Implemented in Mathematica as <code>NearestNeighborGraph</code> .
Sphere-of-influence graph	2015	Implemented in Mathematica as <code>NearestNeighborGraph</code> .
<b>Math</b>		
Assumptions can include Or	2007	
Quantified elimination over reals	2003	Implemented in Mathematica as <code>Reduce</code> , <code>ForAll</code> and <code>Exists</code> .
Series of WhittakerM, WhittakerW	2007	
Series of KummerM, KummerU	1988	Implemented in Mathematica as <code>Hypergeometric1F1</code> .
PointInPolygon	2014	Mathematica's function <code>RegionMember</code> tests whether a point in any-dimensional space is within regions defined by a collection of region primitives and derived regions. It is not limited to polygon primitives in 2D space as Maple is.
MinPoly	2007	Implemented in Mathematica as <code>MinimalPolynomial</code> .
JacobiP with negative arguments	1988	
JordanTotient	2008	This is a trivial combination of the Mathematica commands <code>DivisorSum</code> and <code>MoebiusMu</code> .
Simplification		Most new examples of simplification from Maple 2020 marketing materials were already simplified in Mathematica.

Maple 2020	Mathematica	Notes
<b>Integral transforms</b>		
Numerical evaluation of integral transforms	1999	In general, all Mathematica functions are designed to work with numerical values as well as symbolic.
Simpler definition of Hankel transform	2017	Mathematica has always used this more useful definition of <code>HankelTransform</code> that Maple has switched to in this release.
<b>New user experience</b>		
Warnings on misuse of <code>e</code> and <code>d</code>	2007	While Mathematica does not need to highlight the use of "e" and "d", since it uses visually different symbols for those symbols in typeset notation, it does support a wide range of automated syntax coloring to highlight user errors as they are typed. Even for this, more limited error detection, Maple does not warn as the error is typed but later when the input is evaluated.
Reactivation of time-limited licenses	1996	Mathematica does not need the new "Reactivate License" button that has been added to Maple, because it silently reactivates time-limited licenses without user intervention (unless blocked by an administrator at the user's organization).
Help on error messages	1996	Many common error messages are documented amongst more than 10,000 pages of thorough documentation available in Mathematica or online at <a href="http://reference.wolfram.com">http://reference.wolfram.com</a> .
<b>Learning tools for linear algebra</b>		
Step-by-step Gaussian elimination	1996	Wolfram Alpha's powerful step-by-step tools are accessible in the Mathematica notebook environment.
Eigenvector plot		Available to Mathematica as <code>ResourceFunction["EigenvectorPlot"]</code> .
Least squares plot		Available to Mathematica as <code>ResourceFunction["LeastSquaresPlot"]</code> .
<b>Math apps</b>		
New math apps	2007	Maple's MathApps guide currently lists fewer than 400 math apps. This compares to over 12,000 in the Wolfram Demonstrations Project.
<b>Visualization</b>		
Image size control for 3D plots	1996	All Mathematica visualizations support custom size control through the option <code>ImageSize</code> .
Legends on contour plots	2012	Mathematica can label any values on its <code>ContourPlot</code> legends, not just the contour values used, as Maple does. It also supports <code>LineLegend</code> , <code>PointLegend</code> and <code>SwatchLegend</code> styles, not just the line legend that Maple supports.
Adaptive mesh for plot3D	2012	Mathematica extends support for adaptive meshes to all 3D function visualizations, such as <code>ContourPlot3D</code> and <code>ParametricPlot2D</code> , not just <code>Plot3D</code> .

Maple 2020	Mathematica	Notes
CVD simulation	2012	Mathematica can simulate color vision deficiency using <code>ImageEffect</code> . The Maple <code>CVDSimulation</code> command can be applied only to colors, but the Mathematica <code>ImageEffect</code> command can also be applied directly to images, video, graphics and documents.
<b>Physics</b>		
Feynman diagrams	1990	Feynman diagrams are available in Mathematica through an open source package at <a href="https://feyncalc.github.io">https://feyncalc.github.io</a> .
<b>Signal and image processing</b>		
2D cross correlation	2008	Implemented in Mathematica as <code>ImageCorrelate</code> . Mathematica supports seven different distance measurements including the Dot product used in Maple.
Convolution with complex signals	1999	Mathematica's <code>ListConvolve</code> command can work with floating-point real and complex values, as Maple now can, but also with symbolic, exact and high-precision values.
HoughLine and ProbabilisticHoughLine	2010	Both of these commands are implemented in Mathematica in <code>ImageLines</code> .
2D Haar wavelet transform	2010	Mathematica's <code>DiscreteWaveletTransform</code> function can apply 16 different wavelet families, not just <code>HaarWavelet</code> . Furthermore, it can apply them to arrays and sounds, not just images. Mathematica also supports <code>ContinuousWaveletTransform</code> .
Hilbert transform	2012	Implemented in Mathematica as <code>HilbertFilter</code> .
Root mean square (RMS)	2007	Implemented in Mathematica as <code>RootMeanSquare</code> .
<b>Audio tools</b>		
Read part of an audio file	2016	Implemented in Mathematica as <code>AudioTrim</code> . Mathematica can import from AIFF, AU, FLAC, MPD, M4A, OggVorbis, SND, WAV and Wave64 files while Maple supports only WAV.
High sample rate audio	2016	Mathematica <code>Audio</code> functionality can process audio at sample rates of $2^{62}$ Hz and export to WAV at $2^{31}-1$ Hz.
White noise generator	2016	Mathematica's <code>AudioGenerator</code> command can generate test audio using 13 different models including "White" noise.
<b>Data import &amp; export</b>		
BSON	2018	Mathematica supports over 240 import and export formats from files, streams or URLs, including the two formats newly supported in Maple.
UBJSON	2018	

Maple 2020	Mathematica	Notes
Import matrices	1999	Most of Mathematica's 240 import and export filters support multiple options to control the details of data transfer. For tabular data, Mathematica's Import gives controls such as CharacterEncoding, "CurrencyTokens", "DateStringFormat", "FieldSeperators", "HeaderLines", "IgnoreEmptyLines", "LineSeperators" and "NumberPoint", as well as the two options "Numeric" and "RepeatedSeperators" for which there are now Maple equivalents.
Data conversion to and from Python	2017	Data format conversion is handled automatically when calling to or from Python via Mathematica's ExternalEvaluate command or using the Wolfram Client Library for Python.
<b>Programming</b>		
URL download with authentication	2016	Implemented in Mathematica as Authentication and with full OAuth support using SecuredAuthenticationKey.
Worksheets tools: RemoveSection, TableOfContents		Because Mathematica provides a full symbolic representation of notebooks that can be operated on by the Wolfram Language, it is possible to perform essentially any transformation, analysis or generation of Wolfram Notebooks. For example, Maple's RemoveSection command can be implemented as  NotebookPut[DeleteCases[NotebookGet[EvaluationNotebook[]],Cell[_, "Section", ____], Infinity]].
de Bruijn sequences	2018	Implemented in Mathematica as DeBruijnSequence.
<b>Interface</b>		
<b>Performance</b>		
Log expansion	1991	The Maple announcement blog claims to have reduced the computation $\text{PowerExpand}\left[\text{Log}\left[2^{10^5} \text{NextPrime}\left[10^4\right]\right]\right]$ to around 15 seconds. Mathematica performs this computation in around 0.1 seconds.

Developments in Maple 2020 that do not appear to be following Mathematica developments include work in group theory, Lie algebras and PDE solving.

## New Features in Maple 2019

Maple 2019	Mathematica	Notes
<b>Graph theory</b>		
FindVertexCover	2010	Mathematica's FindVertexCover command supports undirected graphs, directed graphs, multigraphs and mixed graphs.
FindHamiltonianCycle	2010	Mathematica's FindHamiltonianCycle command supports undirected graphs, directed graphs, multigraphs and mixed graphs.

Maple 2019	Mathematica	Notes
FindHamiltonianPath	2015	Mathematica's FindHamiltonianPath command supports undirected graphs, weighted graphs and optionally allows selection of minimum and maximum path lengths including support for arbitrary distance functions.
MaximumClique	2010	Mathematica's FindClique command supports undirected graphs, directed graphs, weighted graphs, multigraphs and mixed graphs. It can be directed to select cliques of specified size or intervals of sizes.
MaximumIndependentSet	2010	Mathematica's FindIndependentVertexSet command supports undirected graphs, directed graphs, weighted graphs, multigraphs and mixed graphs. Specific or intervals of vertex set sizes can be found.
Random graphs: BarabasiAlbertGraph	2010	Implemented in Mathematica as BarabasiAlbertGraphDistribution.
Random graphs: WattsStrogatzGraph	2010	Implemented in Mathematica as WattsStrogatzGraphDistribution.
New special graphs	2007	Mathematica includes a database of 7852 special graphs, which includes all 11 that are newly added to Maple.
TransitiveReduction	2014	Mathematica's TransitiveReductionGraph supports undirected graphs, directed graphs and multigraphs.
IsStronglyRegular	2007	"StronglyRegular" is one of the 516 properties available through the Mathematica function GraphData.
IsTriangleFree	2007	"TriangleFree" is one of the 516 properties available through the Mathematica function GraphData.
Vertex display shapes	2010	As well as providing many named shapes, as Maple now does, Mathematica also supports arbitrary graphics for vertex shapes.
Mouseover tooltip on vertices	2010	All Mathematica graphics can support tooltips, including graph vertices, which has now been added to Maple. Furthermore, tooltips in Mathematica can contain graphics, tables, typeset math and formatted text, not just the plain text supported by Maple.
<b>Computational geometry</b>		
PointInCircle	2014	Whether a point is in a circle is just a special case of Mathematica's much more general RegionMember function that can test for whether a point is in much more complex regions than circles. The circle specification used by Maple is computed in Mathematica using CircleThrough.
PointOnSegment	2014	Whether a point lies on a specific line segment is also just a special case of testing for region membership. In Mathematica, that is also handled by RegionMember without having to create another function.
SegmentIntersect	2014	This is just the simplest case of Mathematica's much more general RegionIntersection. RegionIntersection finds points, lines, areas and volumes of intersection of many region primitives and derived regions.



Maple 2019	Mathematica	Notes
MultiSegmentIntersect	2014	Implemented in Mathematica with the much more general RegionIntersection command.
3D Delaunay mesh	2014	While Mathematica does not support higher–dimension Delaunay triangulation, the important 3D case has been supported since 2014.
<b>Statistics and data analysis</b>		
LeastTrimmedSquares regression	2019	Available in Mathematica as ResourceFunction["TrimmedLinearFit"].
Correlogram	2019	Available in Mathematica as ResourceFunction["Correlogram"].
detrend	2014	Implemented in Mathematica as EstimatedBackground.
difference	2007	Implemeneted in Mathematica as Differences.
Dataserie and Dataframe support remove, select and selectremove	2014	Mathematica's Association and Dataset supported operations to select or remove elements from their inception. Maple's Dataframe remains limited to two–dimensional tables of data while Mathematica's Dataset can support any dimensionality of data.
<b>Signal processing</b>		
FindPeakPoints	2014	Implemented in Mathematica as FindPeaks.
Spectrogram overlap control	2012	As well as allowing control of overlap size, Mathematica's Spectrogram command supports user control of offsets, padding and smoothing.
Cepstrum	2017	
FFTShift	1988	While Maple has labeled this function FFTShift, that is a specific application of a more general list and matrix rearrangement implemented in Mathematica as RotateLeft and RotateRight.
EdgeDetect	2010	The Mathematica function EdgeDetect allows you to find edges of different separation levels and different thresholds of detection and by sharpness or straightness. Mathematica also supports edge detection on 3D image data.
<b>Dates and times</b>		
Format dates	2007	Implemented in Mathematica as DateString.
Parse date strings	2014	Implemented in Mathematica as DateObject.
<b>Language</b>		
Increment, decrement and assignment	1988	Implemented in Mathematica as Increment, Decrement, AddTo and SubtractFrom. Mathematica also supports similar functions PreIncrement, PreDecrement, TimesBy and DivideBy.

Maple 2019	Mathematica	Notes
Local scoping within expressions	1988	In Mathematica functions, procedures and expressions are the same thing, so local scoping has always been available within any kind of expression.
Operator precedures can have local variables	1988	Mathematica has never suffered from this limitation.
Using assignment, if, try and loops in expressions	1988	Mathematica has never suffered from this limitation.
Two variable for loops	1991	Mathematica's MapIndexed command serves this purpose but is more general in its ability to apply at any or all depths of any expressions, not just on matrices.
Remove	1991	Implemented in Mathematica as Delete.
Reverse supports Matrix, Vector and Array	1988	Mathematica's Reverse command has always supported any kind of expression.
convert/english	2014	Implemented in Mathematica as IntegerName and Interpreter.
tablereverse	2014	Implemented in Mathematica as GroupBy.
Download	2016	Implemented in Mathematica as URLDownload. Mathematica also supports asynchronous downloads of data using URLDownloadSubmit.
<b>Interface</b>		
Supress startup screen	2007	
Short forms of matrices		Mathematica has long supported techniques for providing compact representations of all large expressions, not just matrices. Manual methods such as Short were introduced as early as 1988 and applied automatically as early as 2007.
Short forms of audio	1991	Some specialized data formats such as sampled sound have had compact representations since 1991, but the concept was made much more general in 2016.
New Units by Dimensionality palette		While Mathematica supports too many units to sensibly put them in a palette, since 1996, it has been possible to create your own palettes organized how you wish.
Customizable favorites palette	1996	You can create any custom palette in Mathematica.
SVG export	2003	Mathematica supports 226 import and export formats, including SVG export.
echoFile	1988	Logging of inputs and outputs can be acheived using \$Pre and \$Post.
11 new apps		Mathematica interactive apps are collected at the Wolfram Demonstrations Project, where there are now over 11,000 available.

Maple 2019	Mathematica	Notes
<b>Advanced math</b>		
Improvements to integration	1988–2019	All of the new single-value integral examples given as "newly solved" in the Maple marketing are already solved by Mathematica's <code>Integrate</code> command.
Improvements to solve	1988–2019	All of the new solve examples given as "newly solved" in the Maple marketing are already solved by Mathematica's <code>Reduce</code> command.
Improvements to Fourier transforms	1988–2019	Some of the Fourier transform examples given as "newly solved" in the Maple marketing are already solved by Mathematica's <code>FourierTransform</code> command.
Improvements to PDE solvers	1988–2019	While both Maple and Mathematica have developed their symbolic PDE solvers over recent releases, Maple still lacks any FEA methods for solving numerical PDEs.
Improvement to limits	1988–2019	While both Mathematica and Maple have supported simple limits from their earliest versions, Maple still lacks support equivalent to Mathematica's <code>MaxLimit</code> , <code>MinLimit</code> , <code>DiscreteLimit</code> , <code>DiscreteMaxLimit</code> and <code>DiscreteMinLimit</code> functions.
Root finding	1988–2019	Mathematica automates root finding behind the higher-level functions <code>Reduce</code> and <code>NSolve</code> , removing the need for low-level operations like Maple's <code>isolate</code> . For example, the main demonstration of improvements in the Maple 2019 marketing material finds the intersection of two curves. In Maple, this example takes 40 separate inputs to explore two cases. In both cases, Mathematica's <code>Reduce</code> finds the roots in a single line of input.

Developments in Maple 2019 that do not appear to be following Mathematica developments are work in tensors, group theory and quantum physics.

## New Features in Maple 2018

Maple 2018	Mathematica	Notes
<b>Units</b>		
Units supported by <code>fsolve</code> , <code>solve</code> , <code>int</code> , etc.	2012	The Mathematica <code>Quantity</code> object supported a wide range of computations from its initial release. Mathematica also supports unit-based data for its data visualization functions, which Maple still does not.
Greek letters in unit display	2012	
<b>Computational geometry</b>		
<code>VoronoiDiagram</code>	1992	Revised in 2014, this is implemented in Mathematica as <code>VoronoiMesh</code> .
<code>ConvexHull</code>	1992	Revised in 2014, this is implemented in Mathematica as <code>ConvexHullMesh</code> .
<code>DelaunayTriangulation</code>	1992	Revised in 2014, this is implemented in Mathematica as <code>DelaunayMesh</code> .

Maple 2018	Mathematica	Notes
PolygonTriangulation	2014	Implemented in Mathematica within DiscretizeRegion.
<b>Graph theory</b>		
CliquePolynomial	2007	Implemented in Mathematica within GraphData.
DistancePolynomial	2007	Implemented in Mathematica within GraphData.
FindClique	2010	Implemented in Mathematica as FindClique.
GraphIntersection	2010	Implemented in Mathematica as GraphIntersection.
IndependencePolynomial	2007	Implemented in Mathematica within GraphData.
IsReachable	2016	Implemented in Mathematica using ConnectedGraphComponents.
Reachable	2016	Implemented in Mathematica using ConnectedGraphComponents.
Special graphs	2007	In Mathematica, GraphData provides information on 7,429 special graphs, including all of the eight recently added to Maple.
<b>Advanced mathematics</b>		
Improvements to integrate	1988–2014	Examples of improvements to int given in the "What's New in Maple 2018" pages are already solved by the Mathematica command Integrate.
Improvements to Sum	1988–2008	Examples of improvements to Sum given in the "What's New in Maple 2018" pages are already solved by the Mathematica command Sum.
Sturm supports algebraic coefficients	2007	The Mathematica equivalent, CountRoots, has always accepted algebraic coefficients.
Satisfiable	2008	Implemented in Mathematica as SatisfiableQ.
Satisfy	2003	Implemented in Mathematica as FindInstance.
Generalized Polylog	1999	
<b>Interpolation</b>		
Interpolation returns an object	1988	The Mathematica function Interpolation has always returned an object that behaves like a built-in function and is integrated into the wider system. For example, NDSolve returns InterpolatingFunction answers, making them easy to use in other computations, such as integrating them. Maple's dsolve 'numeric' still returns procedures that must be sampled at specific points.
Support irregular data	2008	

Maple 2018	Mathematica	Notes
Krigging	2014	Implemented in Interpolation as a method for Predict.
<b>Dates &amp; times</b>		
Date object	2014	Implemented in Mathematica as DateObject with support for all the capabilities of the Maple date function. Mathematica date calculations support a range of national holiday schedules, including key financial markets, and supports the notion of date granularity, which Maple does not. The Mathematica DateObject supports Gregorian, Julian, Islamic and Jewish calendar types; Maple supports only Gregorian.
Now	2014	Implemented in Mathematica as Now.
DayOfWeek, DayOfYear, etc.	2014	Implemented in Mathematica as a single function DateValue, which gives access to both numerical and name values of fields.
HostTimeZone	2007	Implemented in Mathematica as \$TimeZone.
IsLeapYear	2012	Implemented in Mathematica as LeapYearQ.
DateDifference	2007	Implemented in Mathematica as DateDifference.
<b>Thermophysical data &amp; scientific constants</b>		
Thermophysical data and scientific constants	2007	The addition of data on 2,000 chemicals still leaves Maple far behind Mathematica's ChemicalData database, which currently provides up to 100 properties for over 44,000 chemicals. Knowledge of chemicals is just one of many databases of real-world knowledge built into Mathematica. For example, Maple provides none of the data on astronomical bodies, human physiology, subatomic particles, weather, proteins, geo-elevation or the human genome that Mathematica does.
<b>Visualization</b>		
Rotatable text	2007	Any visual content can be displayed rotated in Mathematica, including typeset math, images and graphics—not just text.
ParetoChart	2002	Implemented as ParetoPlot.
Borderless arrow	2007	Mathematica supports arbitrary shapes for Arrowheads, including full border control, but does not support arrow-stem borders.
Image tools	1988	Surprisingly, Maple has lacked user tools for describing diagrams up to now, and the new Line, Poly, circle and text primitives fall far short of the equivalent Mathematica tools. Maple's tools support only 2D images, and require a prior decision about the output image resolution. Mathematica supports many more graphics primitives (BSplineCurve, Ellipsoid, Sphere, etc.), rasterizes them in real time according to the viewing size (unless you choose to fix the resolution) and can be combined with all of the built-in visualizations.
<b>Connectivity</b>		
Execute Python	2017	Implemented as ExternalEvaluate.

Maple 2018	Mathematica	Notes
Link to TensorFlow	2014	Rather than provide only a link to an external library, Mathematica contains a fully automated machine learning framework that integrates deeply with other parts of the system and is backed transparently by MXNet for low-level computations.
<b>Programming</b>		
Code editor improvements		Maple uses a different editor for code inside interactive elements than it does for general input. Error highlighting, function autocompletion and filename completion are not available in the rest of the Maple Worksheet. In Mathematica, they are supported in general input.
Until	1988	In Mathematica, <code>While[body; test]</code> is equivalent to an <code>Until</code> statement.
Inline assignments	1988	Any expression can be evaluated inside any other expression in Mathematica, including assignments.
Random variable names	1988	This need is addressed in Mathematica as <code>Unique</code> .
SameStructure	1988	Implemented in Mathematica as <code>SameQ</code> .
Encrypted procedures	1988	Implemented in Mathematica as <code>ReadProtected</code> .
Uneditable content	1996	The Wolfram Notebook has long supported the notion of uneditable content, but this can be controlled at the character level, not just at the whole-document level. It also supports control over whether content is selectable or copyable, which Maple does not.

Developments in Maple 2018 that do not appear to be following Mathematica developments are new interface layouts, practice sheet generation, extensions to quantum physics, group theory and differential equation solving functions

## New Features in Maple 2017

Maple 2017	Mathematica	Notes
<b>Visualization</b>		
Dynamic plot annotations	2007	Maple's annotation options are a limited version of Mathematica's <code>Tooltip</code> command. <code>Tooltip</code> is not limited to use within graphs, and can also be applied within tables, to text or within typeset math; it can also contain any kind of content, not just text. <code>Tooltip</code> is just one kind of annotation that Mathematica can apply to elements in graphics. <code>Label</code> and <code>Callout</code> allow annotations that appear in fixed positions or that can be automatically positioned to avoid overlap. Mathematica can also be set to execute arbitrary code using <code>EventHandler</code> on events such as mouse down, up, hover, drag and key events.
Contour plot support for tooltip	2007	As well as automatically adding tooltips in <code>ContourPlot</code> , Mathematica does the same in <code>GraphPlot</code> , <code>PieChart</code> and other visualizations that Maple, so far, does not. Mathematica also makes automatic use of <code>Tooltip</code> to disambiguate similar traditional math notations. Maple does not.

Maple 2017	Mathematica	Notes
Periodogram	2012	As well as Periodogram, Mathematica supports Spectrogram and Cepstrogram visualizations of signals and ImagePeriodogram visualizations from images. Mathematica can also compute 35 different properties of audio over time or frequency space using AudioMeasurements and AudioLocalMeasurements.
Violin plots	2010	Mathematica's DistributionChart supports eight different types of distribution visualization, of which violin plots are just one. Mathematica automatically annotates its violin plot with additional tooltip information. Maple does not.
Weibull plot	2010	Weibull plots are a special case of a QuantilePlot with a log-log scaling function.
Bar charts support color schemes	2008	Mathematica's BarChart also supports a collection of predefined and user-defined bar shapes.
Bar charts support individual bar colors	2008	Mathematica's BarChart also supports individual bar shapes.
Color palette display	2008	Mathematica's ColorDataFunction automatically displays as color swatches.
Chroma, Hue, Luma, etc.	2008	Mathematica natively supports six color spaces, allowing it to convert to or directly represent color in LCHColor.
Discontinuity option in DensityPlot	2007	Mathematica automatically detects discontinuities without needing special instruction.
<b>Statistics</b>		
Remove columns from DataFrame	2014	Maple's DataFrame design is limited to 2D tables of rows and columns. This addition continues to embed that assumption. Mathematica's Dataset, which appeared before Maple's DataFrame, allows arbitrarily deep data structures, including the simple case of rows and columns.
Sort supports DataFrame	2014	When Mathematica added its generalized database structure Dataset, every function could be applied to it.
<b>Geo computation</b>		
Choropleths	2014	Maple's ChoroplethMap command is a very limited implementation of Mathematica's GeoRegionValuePlot. Maple can only color country regions, while Mathematica knows the geometry of other administrative divisions such as states, counties and continents, historical country boundaries and user-defined regions. Mathematica supports a choice of map textures including street maps, terrain, a choice of satellite imagery and user-defined textures, while Maple maps are just blank colors. Mathematica supports over 500 map projections, while Maple supports only 16. Choropleth is just one type of geo visualization. Maple lacks other types such as GeoHistogram, GeoSmoothHistogram and GeoBubbleChart. Mathematica also supports geo visualization for other planets and moons, while Maple supports only Earth.
Geographic data	2007	Maple's new geographic data is a limited implementation of Mathematica's "City" entity type. The Mathematica entity system provides up to 97 properties on "City" entities, but also provides more than 60 other entity types for which geographic information is known, such as mountains, weather stations, oil fields and volcanoes. Mathematica can also convert street addresses into geo positions.

Maple 2017	Mathematica	Notes
Great circle paths	2014	While Maple can place lines between geo points, it cannot place lines using direction and distance directives or correctly draw geo disks and geo circles as Mathematica can.
<b>Graphs</b>		
Style control for graphs	2007	As well as being able to control the colors of edges and vertices, as Maple added in this release, Mathematica allows complete control of the shape of edges and vertices and provides a collection of predefined style collections.
New special graphs	2007	Mathematica's <code>GraphData</code> command provides access to over 450 properties of nearly 7,000 special graphs. All six of the new graphs added to Maple were already in this database.
<code>DrawAutomorphism</code>		While Mathematica does not provide this visualization, the underlying data is generated with the Mathematica command <code>GraphAutomorphismGroup</code> .
<code>GraphDiameter</code>	2010	Implemented in Mathematica as <code>GraphDiameter</code> .
Eccentricity	2010	Implemented in Mathematica as <code>VertexEccentricity</code> .
Graph6 import	2007	
<b>Math</b>		
<code>SearchSmallGroups</code>	2014	Mathematica uses a common function, <code>EntityList</code> , to search any entity type (cities, chemicals, animals, etc.) that matches a criterion. This includes searches of "FiniteGroup" entities.
<code>CharacterTable</code>	2014	<code>CharacterTable</code> is a property of the "FiniteGroup" Entity type.
Sums of binomial functions	1991	Most of the examples given as improved Maple output already produced compact answers in Mathematica in terms of <code>Binomial</code> functions.
Integration improvements		All the "What's New in Maple 2017" integration examples were already solvable in Mathematica.
<code>ChineseRemainder</code>	2007	
<code>lthFermat</code>		This Maple function just calculates $2^{2^n} + 1$ ; however, Maple returns "object too big" for <code>lthFermat(30)</code> , while Mathematica correctly calculates all 323,217,816 digits.
<code>SimplestRational</code>	1988	Implemented in Mathematica as <code>Rationalize</code> .
<code>coulditbe</code>	2003	Implemented in Mathematica as <code>Reduce</code> and <code>Exists</code> .
<code>Parity</code>	1988	Implemented in Mathematica as <code>Xor</code> .
<code>content</code>	1988	Similar functionality is available in Mathematica using the command <code>FactorTermsList</code> .
LambertW simplifications	1996	
Appell functions	1999	<code>AppellF1</code> is supported in Mathematica.



Maple 2017	Mathematica	Notes
New PDE solving algorithms		Some of the newly solved PDE examples given in the Maple promotional literature are already solved in Mathematica.
Improvements to Limit		Limit finding is longstanding functionality in both Maple and Mathematica. Mathematica has also added significant improvements to Limit in 2017.
<b>User interface</b>		
Automatically insert multiplication symbols	2007	Mathematica allows you to customize the choice of multiplication symbol that gets inserted.
Visibility control of code edit regions	1996	Notebooks have supported an option to hide content since they were first incorporated into the Wolfram Language.
Password protection	1991	Mathematica applies content encryption to code rather than notebook contents. Like this new Maple capability, the Mathematica command Encode allows you to read-protect source code, but it also allows you to limit the execution of code to a specific license or to a specific computer.
Track Combo Box or List Box by index	2007	Mathematica's PopupMenu and ListPicker can both be indexed by arbitrary labels, not just by index or value.
Time series operations from context menu	2012	Mathematica's Suggestions Bar has always supported TimeSeries operations.
30 new math apps	2007	In 2007, Wolfram launched the Wolfram Demonstrations Project as a home for all kinds of interactive demonstrations and math apps. In the same amount of time that Maple added 30 math apps, <a href="http://demonstrations.wolfram.com">http://demonstrations.wolfram.com</a> grew by over 700 demonstrations to total more than 11,200, thanks, in part, to the easy authoring made possible by Mathematica's Manipulate command.
<b>Connectivity</b>		
URL Package	2014	In addition to being able to construct arbitrary URL requests, Mathematica also supports asynchronous URL interaction and OAuth authentication.
SMT-LIB, YAML, MP4 import and export		While Mathematica does not yet support these formats, it still supports more than twice as many Import and Export formats as Maple does.

New features of Maple that did not appear to be correlated to Mathematica features include general relativity functions and Swift code generation, entropy charts, Venn diagrams and various user interface improvements.

## New Features in Maple 2016

Maple 2016	Mathematica	Notes
<b>Data science &amp; statistics</b>		
DataSeries	2014	Mathematica's Association data structure provides not only the convenience of a key-value data structure construct but is also an efficient hash table structure for large data sets.
DataFrame	2014	Maple's DataFrame structure is similar to Mathematica's Dataset structure except it is limited to simple 2D tables. In contrast, Mathematica also supports arbitrarily deep, irregularly structured heterogeneous data.
Multiset	2014	Maple's Multiset is only one special case of a more general reduce step in map-reduce type problems. Mathematica supports this with Merge[data, Total] but is capable of doing arbitrary merges of map data, for example, by tracking the largest key value using Merge[data, Max].
Principal component analysis	2010	As well as PrincipalComponents, Mathematica supports DimensionReduction and a range of machine-learning techniques using the functions Predict and Classify.
Scree plot	2010	This is implemented in Mathematica more generally as ParetoPlot and becomes a scree plot when applied to Eigenvalues.
Linear regression summarize	2008	Over 60 properties of a Mathematica LinearModelFit or NonlinearModelFit are available including ParameterTable.
Hypothesis testing summarize	2010	Mathematica hypothesis tests include the property TestDataTable for summarizing test results.
<b>Explore</b>		
In 2007, Mathematica introduced the concept of automatically-generated, interactive computational interfaces. Since then, Maple has been edging towards the functionality that was available in Mathematica's Manipulate function at launch. There are still many capabilities Maple's Explore command lacks, such as automatic cloud deployment, asynchronous evaluation, gamepad inputs, user-created control elements, automatic performance adjustment, and much more.		
Text area controllers for evaluating at custom values of a parameter	2007	Expression input fields in Mathematica support both inert and live evaluation content. Mathematica also supports a large collection of Interpreter types which can interpret and enforce input other than generic text or math, such as city names, country names, email addresses, chemical names, or more than a hundred other types.
Simplified calling sequence	2007	This change mirrored Mathematica's syntax for describing parameters directly.
Name resolution	1988	While Manipulate was added to Mathematica in 2007, the ability to create functions that consider their arguments before evaluating them has been a core part of the Wolfram Language since its inception using the attributes HoldAll, HoldFirst, and HoldRest.
Controller customization	2007	Mathematica allows customization of all of its controller types including size, step size, initial values, tooltips, etc.
Controller placement	2007	

Maple 2016	Mathematica	Notes
Color customization	2007	Mathematica provides a general Panel construct that can be used for any content, not just Manipulate. It has always supported arbitrary color choices.
Borders	2007	Mathematica provides a general Framed construct that can be applied to any content, not just Manipulate. Where Maple allows border settings of only true or false, Mathematica supports control of Thickness, color, Dashing, and corner RoundingRadius.
Alignment and width	2007	Mathematica allows widths and heights to be absolute or proportional to the container (such as page width or column width) and a range of alignment options.
Record	2007	Storing evaluation results to a variable in Mathematica's Manipulate command is the same as any other evaluation without needing a special option. In addition to storing in a variable, changes can be written to files, and there is a bookmark feature built into the Manipulate user interface that lets users save interesting combinations of parameters. These can also be predefined by the developer.
<b>Graph theory</b>		
DrawGraph: round vertices	2007	While Maple added support for round or square vertices in graph drawing, Mathematica allows any graphic or image to be used or can be programmatically generated from the vertex name or its coordinates.
MaximumMatching		This functionality is provided by the Mathematica commands FindMaximumFlow and FindMinimumCostFlow. Maple requires the data to be an undirected, unweighted, bipartite graph. This is the simplest possible case supported by the Mathematica commands, which can optimize flows over multiple weighted steps across directed, undirected, and mixed graphs.
CliqueCover, CliqueCoverNumber		Similar functionality can be achieved using Mathematica's FindCliques command.
GlobalClustering–Coefficient	2012	
IntervalGraph	2005	
IsArborescence		This can be achieved using ConnectedGraphQ and FindSpanningTree in Mathematica.
LocalClustering–Coefficient	2012	Implemented in Mathematica as LocalClusteringCoefficient.
ReverseGraph	2010	Implemented in Mathematica as ReverseGraph.
TransitiveClosure	2005	
<b>Logic</b>		
Logic: Satisfiable	2008	This is implemented in Mathematica as SatisfiableQ.
Logic: Satisfy	2008	This is implemented in Mathematica as SatisfiabilityInstances with additional functionality as SatisfiabilityCount.

Maple 2016	Mathematica	Notes
Logic: TruthTable	2008	This is implemented in Mathematica as BooleanTable.
<b>Mathematical functions</b>		
Conjugate of RootOf objects	1996	Support for Conjugate was included with the introduction of Root objects in Mathematica.
Products of RootOf objects	1996	Support for Product was included with the introduction of Root objects in Mathematica.
Series of Airy functions	1988	Support for Series was included with the introduction of Airy functions in Mathematica.
Series of Gamma function	1988	Support for Series was included with the introduction of Gamma in Mathematica.
Series of Hypergeometric functions	1996	Support for Series was included with the introduction of hypergeometric functions in Mathematica.
Limits of oscillatory functions	1988	The examples given in Maplesoft's marketing of improvements were all already solvable in Mathematica.
Integrals of rational functions	1988	The examples given in Maplesoft's marketing of improvements were all already solvable in Mathematica.
Sums involving Jacobi theta	1988	This is implemented in Mathematica as EllipticTheta.
Series of abs and signum	2004	
Piecewise sums	2004	
Sums diverging to $\pm \infty$		The examples given in Maplesoft's marketing of improvements were all already solvable in Mathematica.
Doubly infinite sums		The examples given in Maplesoft's marketing of improvement were already solvable in Mathematica.
Symbolic PDEs		Some of the new solutions provided by Maple for symbolic PDEs were already possible in Mathematica. For numeric PDE solving, Maple does not have an equivalent of the powerful FEA-based solver built into Mathematica.
Mathematical identities: Bessel, KelvinBei...	2015	Since 1998, Wolfram has maintained the website functions.wolfram.com, which contains over 107,000 formulas and identities ready to compute with Mathematica. Since 2015, Mathematica has included these as a built-in, searchable data source via the command MathematicalFunctionData.
<b>Document interface</b>		
From its inception in 1989, the Wolfram notebook interface has set the agenda for Maple's interface. In 1996, it was re-engineered so that documents could be entirely described in a Wolfram Language representation. The unification between document and language made a range of programmatic generation, analysis, and control of documents possible that Maple is still unable to match today.		
Tables: programmatic creation and control	1996	As well as programmatic control of table cell colors, sizes, and alignment, Mathematica provides support for styled borders and cells which span rows or columns.

Maple 2016	Mathematica	Notes
Programmatically adjust math containers	1996	
Non-executable math content	1996	Mathematica supports this feature on a cell, named style, stylesheet, or document level using the option <code>Evaluateable</code> .
Component font color	2007	Most interactive components in Mathematica support not just font color but also font family, weight, italics, background color, etc.
Component transparency and fill color	2007	
Replaceable content	1996	
Arbitrary document zoom level	1996	
Global zoom setting	1996	Mathematica allows zoom setting at any level, not just global and document. For example, a low resolution bitmap logo in a notebook's docked cell might use <code>Magnification -&gt; 1</code> to prevent it from following a user's choice of document-level zoom and appearing pixelated.
Full screen mode on Mac	2012	Mathematica has always supported Mac OS X with fully native implementations.
Optional section openers	1996	
<b>Visualization</b>		
Coloring with functions of coordinate values	1991	The Mathematica option <code>ColorFunction</code> provides parametric color control to many different kinds of plots. In addition, Mathematica's use of symbolic wrappers for data points makes support for <code>Tooltip</code> , <code>Button</code> actions, <code>Label</code> , and more controllable at an individual-point level.
HeatMap	2004	This is implemented in Mathematica as <code>MatrixPlot</code> , <code>ArrayPlot</code> , and <code>ListDensityPlot</code> depending on interpolation choices.
GridPlot		While no direct equivalent is available in Mathematica, this graphic can be easily created with the more general <code>GraphicsArray</code> command.
Color schemes	2007	Mathematica provides over 170 pre-defined color schemes. In addition, the <code>PlotTheme</code> option controls a whole collection of aesthetic choices at once from a collection of designs created by Wolfram graphic designers.
<b>Miscellaneous</b>		
Math Apps and applications		In 2007, Wolfram launched the Wolfram Demonstrations Project as a home for all kinds of interactive demonstrations and math apps. In this release, Maple added approximately 22 new interactive Math Apps and applications. In the same amount of time, <a href="https://demonstrations.wolfram.com">demonstrations.wolfram.com</a> grew by over 500 demonstrations to total more than 10,500, thanks, in part, to the easy authoring made possible by Mathematica's <code>Manipulate</code> command.

Maple 2016	Mathematica	Notes
NumberTheory package		Maple 2016 deprecated around 50 number theory commands and redesigned them to use Mathematica-style naming (full words with camel-case capitalization). For example, Maple's <code>cfrac</code> command has been renamed to <code>ContinuedFraction</code> , the same as in Mathematica. In general, recent additions to Maple use naming conventions similar to Mathematica, but most older Maple commands are still accessed by inconsistently abbreviated and capitalized legacy names.
Thermophysics data	2014	Mathematica provides access to thousands of data sets and thermophysics data is accessed via the command <code>ThermodynamicData</code> . It can also be accessed using free-form input in Mathematica which is interpreted by Wolfram Alpha. For example "enthalpy water 298K 1 atm" returns the result 104293 J/kg.
Student multivariate calculus		Mathematica does not attempt to provide student versions of its functions and so does not face the question of how many of its functions need two versions. Some of the functionality provided by student packages is available via the Wolfram Alpha integration to give rich, step-by-step solutions, and using the command <code>\$Pre=Assuming[_&lt;Reals,Simplify[##]&amp;</code> tells Mathematica to treat all user variables as reals.
Workbook file format		While Mathematica does not have the user interface for browsing within archives, it has supported the ability to read or write files within standard .zip or .gz archive formats since 2007. This allows you to package multiple files together and access each component separately, similar to this new Maple feature.
Saved variable values	1988	Mathematica has had the ability to save variables or other state information since its inception and extended it in 1996 with a very fast binary format. See <code>Save</code> and <code>DumpSave</code> . In 2015, Mathematica introduced the ability to automatically save changes to variables both locally and to the cloud. <code>CloudSymbol</code> can even be used to share between multiple users during simultaneous or asynchronous sessions.
Parallel computation: ThreadSafeLock		While Maplesoft promotes thread-based programming as a feature, it remains hampered by the small number of commands which are actually thread safe. <code>ThreadSafeLock</code> is another tool to allow users to try and manage this situation. Mathematica's approach to parallel computation, of launching multiple, full-compute kernels, does not suffer from thread safety issues, making it much simpler to use. See "Comparison of Parallel Programming"
Iterator package		Iterating over discrete structures is supported in the Wolfram Language.
Forgetting remember tables	1988	Because Mathematica's idiom for remember tables generates objects that can be manipulated by the Wolfram Language, Mathematica is able to clear individual or classes of remembered values, not just the whole table.
Word lists	2007	Maple added a dictionary of English words. Mathematica provides dictionaries and word searches in many languages; single-word translation between languages; and, for English, more than 30 properties of each word such as synonyms, antonyms, and parts of speech. See <code>WordData</code> , <code>DictionaryLookup</code> , and <code>WordTranslation</code> .

New features of Maple 2016 that were not, at least in part, following Mathematica capabilities focus on general relativity functions and Julia code generation.

# New Features in Maple 2015

Maple 2015	Mathematica	Notes
MapleCloud web access	2014	The capabilities of the MapleCloud remain far behind those of the Wolfram Cloud. MapleCloud does not support content creation, content editing, scheduled tasks, report generation, computational APIs, data accumulation, or programmatic control or offer a private version of its cloud. All of these capabilities and more are available in the Wolfram Cloud.
Data sets	2009	<p>In 2009, Wolfram launched Wolfram Alpha, a project to make the world's data computable. In the wake of Wolfram Alpha, Quandl was set up in 2012 but with more limited technical aspirations. It does not attempt to unify different data sets with common entity names (e.g. country names, cities, animal taxonomies, etc.) and common unit systems. It does not attempt to integrate relevant computation into the data and does not attempt to provide natural language access.</p> <p>Maple's link to Quandl is limited to data search and retrieval; it has not attempted the deep integration with data provided by Mathematica. For example, data requests in Mathematica are provided with units interpretable by Mathematica. Mathematica unit conversions automatically use current values for currencies. Geo computations in Mathematica can take any geographic entity (e.g. a city, building, or mountain name) as specifications. Forms in Mathematica applications can have semantic restrictions (e.g. the user must enter country name), which are validated against data. Mathematica users can also make data available through Wolfram Alpha through the Wolfram DataDrop.</p> <p>Data is deeply integrated into Mathematica, not just importable. Of course, Mathematica users can also easily access Quandl data using the <code>Import</code> command.</p>
Polyhedral sets	2014	Mathematica contains a powerful geometric regions package, which supports arbitrary combinations of $n$ -dimension discrete, parametric, or primitive defined regions. Polyhedral regions are one of the simplest subsets of this framework and can be created by using the Mathematica function <code>ImplicitRegion</code> with only linear constraints. While the properties calculated by Maple's Polyhedral Sets functions are not a strict subset of Mathematica's region framework, the scope of regions is. Maple cannot represent non-convex regions, disjoint regions, or regions with curved edges.
Plot thumbnails in output	2007	Mathematica's Computable Document Format (CDF) has a general symbolic content description that allows any displayable content to be embedded in any other content. Plots appearing in output is just one such example of this much more general principle. In contrast, Maple still cannot put a plot on the face of a button, buttons in graphics, images in combo-boxes, or many other combinations which are trivial in Mathematica.
Default point probe	2008	Mathematica's graphics support the option <code>CoordinatesToolOptions</code> , which allows any content driven by any program to be dynamically displayed as a point probe, not just the four fixed choices that Maple now provides.
Trigonometric and hyperbolic functions palette		<p>Since 1996, Mathematica has allowed users to create arbitrary palettes. This palette can be implemented in Mathematica with:</p> <pre>CreatePalette[Grid[Partition[PasteButton/@ {Sin, Cos, Tan, Sec, Csc, Cot, Sinh, Cosh, Tanh, Sech, Csch, Coth, ArcSin, ArcCos, ArcTan, ArcSec, ArcCsc, ArcCot, ArcSinh, ArcCosh, ArcTanh, ArcSech, ArcCsch, ArcCoth, <math>\theta</math>, <math>\pi</math>, <math>\phi</math>, <math>\omega</math>},4]]]</pre>
Random variables palette		Since 1996, Mathematica has allowed users to create arbitrary palettes. This palette can also be implemented in Mathematica in a few minutes.

Maple 2015	Mathematica	Notes
Content generation: layout elements	2007	Mathematica provides a full symbolic description for documents, allowing arbitrary content generation, transformation, and analysis, not just generation. Every aspect of the content, layout, style, and interactivity is controllable, not just a subset of layout elements. Mathematica also provides a template system to make repeated automatic content generation even easier.
Content generation: embedded components and application authoring	2007	Mathematica's full symbolic description for documents includes all interactive elements, allowing arbitrary content generation, transformation, and analysis, not just generation.
Content generation: the Tabulate command	2007	Mathematica's Grid command allows much more control over tabular layout than Maple's Tabulate command, including individual cell level background color, size, alignment, and frame controls (not just whole grid settings). It supports horizontally and vertically spanning cells and vertical alignment. Maple supports none of these.
Data plots: many plots in one plot command		This function is a syntactic shortcut to existing plot types, all of which are supported in Mathematica.
Data plots: new intuitive calling sequences and support for different data types	1988	Mathematica has a unified data model so you do not need to worry about whether your data is a list, matrix, array, or any other type. The issue of competing similar data types still affects many other Maple functions, not just data plots.
Numerical solutions of ODE with delay	2008	Maple's numerical differential equation solvers still lack the finite element methods available in Mathematica that are needed to solve partial differential equations. Maple can only handle delay differential equations numerically. Mathematica can solve them symbolically as well.
Explore		Mathematica introduced the powerful Manipulate command for instant interface creation in 2007. Maple continues to incrementally develop functionality towards that offered by the initial release of Manipulate but still has a long way to go.
Explore: customizable interactive marker controls on 2D plots	2007	In Maple, the number of interactive markers is fixed by the author. In Mathematica, you can also allow users to add or remove markers interactively.
Explore: images on play/pause/loop animation controls	2007	In Mathematica, buttons and other UI elements can use any image, but in Maple, only pre-defined ones can be used.
Explore: 2D math for parameters with sliding controls	2007	In this context, it appears that Maplesoft means math characters (like $\alpha$ ), rather than 2D math. In Mathematica, as well as arbitrary special characters, parameters can be labeled with any content, including full 2D typeset expressions (including fractions, roots, etc.) or images. In fact, you can put such content anywhere.
Explore: support for vertical orientation of slider controls	2012	Mathematica's Rotate command, can display any control or other content with any angle of orientation, not just vertical and horizontal.
Explore: CheckBox controllers	2007	
Explore: startup code	2007	Mathematica also supports code that initializes when content that needs it is first displayed on screen. This allows you to avoid unnecessary code execution for content that is not viewed.



Maple 2015	Mathematica	Notes
Explore: document properties when launching as a new document	1996	While Mathematica's <code>Manipulate</code> command was only added in 2007, the ability to generate interactive content in fresh windows and control the window properties has been available since 1996.
Finance: computing Greeks on derivatives	2010	Maple supports general Greeks calculations on the Black–Scholes model, while Mathematica's <code>FinancialDerivative</code> command supports specific Greeks calculations on over 100 different financial derivatives contracts.
Grid computing: <code>Run</code> , <code>Set</code> , <code>Get</code> , <code>GetLastResult</code> , <code>Wait</code> , <code>WaitForFirst</code>	2008 (Available earlier as an add-on)	These functions are roughly equivalent to the Mathematica commands <code>ParallelSubmit</code> , <code>DistributeDefinitions</code> , <code>WaitNext</code> , and <code>WaitAll</code> . Maple still lacks some of the higher level functions that make Mathematica's parallel programming so simple, such as <code>ParallelMap</code> , <code>ParallelTable</code> , and <code>SetSharedVariable</code> .
Sub-second current time	1996	
Group theory: group data	2010	Amongst the huge collection of datasets built into Mathematica, there is a searchable <code>FiniteGroupData</code> database with over 50 properties of several hundred finite groups.
Group theory: <code>CayleyGraph</code>	2010	
Group theory: <code>IsCyclic</code>	2010	Mathematica's <code>Cycles</code> command fully enumerates cycles.
Group theory: <code>ComplexProduct</code>	2010	For permutation groups, this is provided in Mathematica by <code>PermutationProduct</code> .
Group theory: <code>ElementOrder</code>	2010	For permutation groups, this is provided in Mathematica by <code>PermutationOrder</code> .
Import/export	1996	Maple followed Mathematica's design of having automated generic <code>Import</code> and <code>Export</code> commands, which can import different kinds of data automatically. However, Mathematica's <code>Import</code> and <code>Export</code> commands support over 185 different formats, while Maple's supported only 51 formats. Furthermore, many of the Mathematica import and export filters provide additional options. For example, when importing a JPEG into Mathematica, you can choose whether you are importing an image, the image data, or the EXIF and other meta-data (such as camera shutter speed, image capture date, image device name, etc.).
Import/export: MathML	1999	
Import/export: FASTA	2007	
Import/export: GenBank, SHP	2008	
Import/export: KML	2010	Mathematica provides import and export of KML. Maple provides only import.
Import/export: JSON, GPX	2010	

Maple 2015	Mathematica	Notes
Import/export: Graphlet, GraphML, GXL, Pajek, and TGF	2010	
Import/export: FASTQ	2012	
Integrate		Mathematica has extremely powerful symbolic integration. All examples given in Maplesoft marketing materials as newly solved in Maple 2015 were already solved by Mathematica.
Embedded components: speaker component	1992	Mathematica documents can contain MIDI sound as well as waveform sounds. Maple supports only waveform sounds.
Embedded components: microphone component	2007	As well as being able to capture sound from a GUI component, Mathematica can also capture images from a webcam or other imaging device.
Embedded components: gauges, set initial angle	2012	
Embedded components: gauges, set range	2012	
Math functions: coulditbe		This functionality is part of the Reduce function in Mathematica, which also solves broader classes of quantifier elimination problems.
Embedded components: ListBox	2012	This is supported as ListPicker in Mathematica. In Mathematica elements of the ListPicker can be images, 2D typeset math, or other content, not just text.
Embedded components: Meter, Rotary Gauge, Volume Gauge, Plot, Text, Radiobutton, and Components programmatic setting	2007	All Mathematica interactive and static components can be programmatically set or changed.
Embedded components: resizable slider	2007	In Mathematica, most interactive components can be made arbitrary sizes. Slider is no exception.
Bifurcation maps	1996	While not a named function in Mathematica, bifurcation plots are sufficiently simple that they have existed as examples in the documentation of Mathematica since 1996.
Math apps	2007–Present	In 2007, Wolfram launched the Wolfram Demonstrations Project as a home for all kinds of interactive demonstrations and math apps. In this release, Maple added approximately 60 new math apps to total around 400. In the same amount of time, thanks partly to the easy authoring made possible by Mathematica's Manipulate command, demonstrations.wolfram.com grew by over 300 apps to total more than 10,000.
Special functions identities	2002	Wolfram Research makes its database of functions available for free at functions.wolfram.com. It currently contains over 300,000 formulas relating to more than 320 special and elementary functions. Mathematica added programmatic access to this database in 2015.
Statistical reference tables	N/A	Computational software should remove the need for reference tables. If you really want printed statistical reference tables, then they would be easy to produce in Mathematica by using the Grid and Table commands.

Maple 2015	Mathematica	Notes
Units: temperature object	1992	Units, including temperature units, were first included in Mathematica in 1992. Since 2012, Mathematica's units have been handled automatically in data plots, solvers, optimization routines, and more. They handle live data units (such as currency rates) and time-based units (such as currency rates). Mathematica's use of Wolfram Alpha linguistics allows entry of units in any format (e.g. "kph," "kilometers per hour," etc.). Maple's units system did not do any of these.
Visualization: shading between two curves	2007	Mathematica's <code>Filling</code> allows shading between any combination of curves, axes, and plot boundaries, not just between two curves.
Visualization: empty plots	1988	
Visualization: pointline style	2007	
Visualization: color schemes for curves	2007	As well as allowing you to define custom color schemes, Mathematica provides more than 170 pre-designed color schemes. These are designed for different aesthetic choices, standard interpretations (e.g. heat map), continuous gradients, and indexed discrete collections.
Robust regression	2007	Use of the <code>NormFunction</code> option within <code>FindFit</code> allows for several robust fitting approaches. Loess fitting has been available as a free package since 1998.

New features of Maple 2015 were not, at least in part, following Mathematica capabilities focus on ordinals, general relativity functions, bivariate limits, and new code generation targets.

## New Features in Maple 18 (2014)

Maple 18 (2014)	Mathematica	Notes
Time series	2012	Maple does not include Mathematica's support of FARIMA processes, time series-based hypothesis testing, or time series property measurements such as covariance functions. Mathematica does not yet support exponential smoothing models.
Exponential smoothing	2007	Implemented in Mathematica as <code>ExponentialMovingAverage</code> .
Keyword and command name searching in help	1996	Mathematica's help system is built around interactive CDF content, allowing examples to be edited and evaluated in place and dynamic content to be interacted with. Maple's help files are static, uneditable, and unevaluatable.
Visualization—background colors in 2D plots	1988	Background colors are controllable in Mathematica's 3D plots as well as 2D plots.
Visualization—custom plot shading	2007	As well as being able to apply arbitrary color blends or pre-designed color gradients to plots, Mathematica also allows the application of these blends using a custom mapping function, effectively giving you an extra dimension to 3D plots.
Visualization—background images in plots	2007	Mathematica provides powerful image processing capabilities that Maple lacks, so that as well as background images being included verbatim, they can also be transformed programmatically.

Maple 18 (2014)	Mathematica	Notes
Visualization—texture mapping	2010	Mathematica provides powerful image processing capabilities that Maple lacks, so that as well as texture images being used verbatim, they can also be transformed programmatically.
Visualization—color tools	2012	Mathematica supports CMYK, HSB, XYZ, LAB, and LUV color spaces, as well as RGB.
Visualization—programmatic control of image size	1988	
Signal processing—Blackman–Nuttall and Bohman windows	2012	
Calculus palette	1996	Mathematica 3.0 introduced completely customizable input and action palettes that can be shared between users.
Möbius Project	2007	<p>In 2007 the Wolfram Demonstrations Project set out a clear vision for a platform for sharing interactive apps for demonstrating technical ideas. In the year since MapleSoft launched their imitation, it accumulated 235 apps, 75 of which were included in Maple.</p> <p>Thanks to the ease of interface creation provided by Mathematica's superior Manipulate command, in the same period the Wolfram Demonstrations Project grew from 8500 apps to over 9400 apps.</p>
One-step app creation—custom placement of controls	2007	Maple's "Explore" command is a skin-deep attempt to support Mathematica's popular Manipulate command. As well as being able to position controls spacially, Mathematica also supports advanced layout controls such as collapsible areas, tab views, and more. These can be applied to both controls and outputs.
One-step app creation—choice of control types	2007	While Maple now allows you to change the control component for ranges, Mathematica also provides alternative control choices for discrete, Boolean, and color inputs and supports custom component creation.
One-step app creation—combo boxes	2007	Mathematica also allows lists of parameters to be chosen by setter bars, multi-select combo boxes, sliders, and custom components.
One-step app creation—customization of the size of the display component	2007	As well as controlling the size of output, Mathematica supports dynamic resizing under program or user control. Mathematica also supports constrained region resizing with automatic scrollable area and dynamic adjustment of the interface to accommodate large content.
One-step app creation—interactive marker controls on 2D plots	2007	Mathematica also supports user creation and deletion of locators and custom locator appearance, using any image.
One-step app creation—image output	2007	Mathematica's Manipulate command automatically supports any kind of output supported by Mathematica, including formatted text, math, sound, graphs, 2D and 3D graphics, dynamic content, and GUIs, as well as images and 3D images. Maple still has a long way to go to catch up with Manipulate.
Interactive components—controllable shortcuts	2007	
Interactive components—masked input fields	2010	

Maple 18 (2014)	Mathematica	Notes
Interactive components—auto-fit math component	2007	All kinds of output can be auto-fitted or constrained with automatic scroll bars in Mathematica GUIs.
Interactive components—custom image toggle button	2007	
Interactive components—embed sounds	2007	While Mathematica did not support OGG until later that year it already supported AIFF, AU, FLAC, SND, Wav, Wave64, and MIDI sounds.
Interactive components—hide borders	2007	As well as being able to control the presence of borders, Mathematica allows you to control the style of borders independently on each side (thickness, color, dashing, transparency, etc.) It also supports arbitrary rounded corners.
Statistics for students	2013	There is a rich ecosystem of educational tools built on Mathematica, but they are not included in the product itself. The Wolfram Demonstrations Project is a key source, but the central tool of the Maple Statistics for Students functionality is similar to this example published on the Wolfram Blog in 2013.
Graph theory—DrawGraph performance improvements	2007	Mathematica's GraphPlot supports six different styles of graph plotting. The Maple 18 marketing materials make an ill-considered comparison in graph-drawing performance with Mathematica, since Mathematica defaults to a "spring" layout method, while Maple does not. Maplesoft documents acknowledge that "spring" will usually give the best visualization, but if performance is the priority then each of Mathematica's other methods is faster than Maple for the example used in the Maple marketing materials. Three of Mathematica's methods produce the visualization in under 0.25 seconds, compared to 18 seconds in Maple.
Step-by-step solutions	2010	Maple's Student Basics package provides step-by-step solutions only for linear equation solving and polynomial expanding. Mathematica, through its connection to Wolfram Alpha, can also provide Step-by-step solutions for polynomial, trigonometric, and logarithmic equation solving; as well as limits, integrals, derivatives, differential equations, partial fractions, line intercepts, number theory factoring, completing the square, determinants, row reduction statistics problems, basic arithmetic and more.
URL import	2007	Mathematica can import data from URLs in over 160 formats.
3D graphics formats	2007	Mathematica supports 16 3D graphics formats, including the six that Maple added.
Compressed file support	2007	As well as the ZIP and GZIP formats supported by Maple, Mathematica also supports TAR, BZIP2, and two formats of its own that are optimized for compressing Mathematica expressions.
Inert expression representation	1988	Implemented in Mathematica as HoldForm and Hold.
Random matrix generation	2007	Mathematica supports generation of random data over any number of dimensions from over 140 different distributions.

# New Features in Maple 17 (2013)

Maple 17 (2013)	Mathematica	Notes
One step app creation	2007	Maple's "Explore" command is a skin-deep attempt to appear to support Mathematica's popular Manipulate command. It only supported sliders while Mathematica's, much more powerful Manipulate function can automatically use checkboxes, pop up-menus, sliders with arbitrary discrete steps, 2D sliders, 2D discrete sliders, locators within displayed contents and more, as well as sliders. "Explore" has no control over the appearance, direction, size or placement of its sliders and no control or automation over refresh quality or triggers. "Explore" cannot be nested, doesn't support bookmarks, cannot be exported to animations, and does not support hardware controllers. It cannot be extended with custom controllers, or automatically embedded in generated reports. Mathematica supports all of this and more.
Möbius Project	2007	The Wolfram Demonstrations Project set out a clear vision for a platform for sharing interactive apps for demonstrating technical ideas. Thanks to the ease of interface creation provided by Mathematica's superior Manipulate command, over 8500 apps had been created and shared by the Mathematica community. The Möbius Project was initially an imitation of Demonstrations before being redesigned after failing to attract the same quantity of content.
Maple Player	2007	Wolfram Research has provided a free Player for Mathematica content for over 20 years. With the advent of easy-to-author interactive content in 2007, the MathPlayer was upgraded to Wolfram CDF Player with a full Mathematica Kernel to drive interactive computational content in the Computable Document Format. CDF Player supports all major platforms and can be embedded in HTML under all major browsers.
Math apps	2007+	Specialized Mathematica apps appear for free in The Wolfram Demonstrations Project not in Mathematica. In the preceding year Demonstrations grew by around 1000 apps compared to the 45 promoted in this Maple release. The Maple 17 New Features pages show three examples: "River crossing" appeared in the Demonstrations Project in 2012, there are 22 Demonstrations related to "Cost of production" and the "Tides" example can be implemented in a single line of Mathematica code. These are not major features.
Advanced Code Editor: Syntax Highlighting	2007	Maple syntax highlighting works only for plain-text code and only for keywords and operators. In contrast, Mathematica also supports syntax highlighting for expressions within or containing typeset 2D mathematical expressions and also colors local variables, and function parameters for easier code reading.
Advanced Code Editor: Bracket Matching	2007	Again the Maple support is skin-deep, matching brackets only if you limit yourself to plain text coding. Bracket matching is particularly important in math expressions where highly nested brackets can be common and putting a bracket in the wrong level of a 2D expression is a common mistake.
Advanced Code Editor: Quote Matching	2007	Maple supports this only for text, not in typeset math. Mathematica supports both.
Advanced Code Editor: Automatic Indentation	2007	Maple supports this only for text, not in typeset math. Mathematica supports both.
Advanced Code Editor: Command Completion	2012	Maple supports this only for text, not in typeset math. This missing feature is particularly significant given the inconsistent naming and capitalization of Maple's mathematical functions. Using Mathematica's typeset layout for clarity of complex expressions does not have to come at the price of more limited ease of use.

Maple 17 (2013)	Mathematica	Notes
Advanced Code Editor: Error checking	2007	Maple supports this only for text, not in typeset math. Mathematica error checks whether options are valid for the function they appear in, as well as checking argument count and structure.
Performance: Hardware elementary functions	1999	These may have been implemented in response to being highlighted in the numerical performance benchmark created by Wolfram Research in 2011 which showed Maple to be, on average, 318–2845 times slower for these operations and 38 times slower for other numerical computations.
Performance: Parallel linear algebra	2005	The claimed improvements appear to be mainly for OSX and Linux, with only modest improvements to <code>Eigenvalues</code> and <code>Eigenvectors</code> under Windows. See the latest benchmarks <a href="#">here</a> .
Performance: Sparse vector concatenation	1999	These may have been implemented in response to being highlighted in the numerical performance benchmark created by Wolfram Research in 2011 which showed Maple to be, on average, 13,512 times slower for sparse matrix computations and 38 times slower for other numerical computations.
Signal processing: Cosine, fast Fourier and wavelet transforms	2010	Typically skin-deep, Maple's implementation of DWT supports only the Haar wavelet, only in its <code>float[8]</code> data type and lacks continuous wavelet transforms. Mathematica's <code>DiscreteWaveletTransform</code> supports 10 different discrete wavelet families using floating point, complex or arbitrary precision numbers and <code>ContinuousWaveletTransform</code> with with 5 different continuous wavelet families. Maple's DCT supports only Type II DCT, Mathematica supports Type I,II,III and IV DCTs.
Signal processing: Bartlett, Blackman, Kaiser, Hann, and Hanning(sic) windows	2010	Again, Maple supports only a subset of Mathematica's functionality. Mathematica supports 14 non-parametric window functions and 10 parametric windows, including the 5 supported by Maple.
Signal processing:Signal generation	2012	Maple's support for signal generation still falls considerably short of Mathematica's.
Signal processing:Cross- correlation, autocorrelation, data statistics, and upsampling/downsamplin g	2012	There are now two different <code>AutoCorrelation</code> functions in Maple, one for <code>float[8]</code> data and one for other data. Mathematica handles the data type used automatically. Maple's <code>UpSample</code> can take only <code>float[8]</code> or <code>complex[8]</code> data. Mathematica can handle any kind of data.
Signal processing:FIR, IIR, and Butterworth filters	2012	Some of this functionality has been in Mathematica since 2003.
Search and replace in math expressions	2007	Maple's concept of search and replace in math expressions is limited to finding text in math expressions. Mathematica allows searching and replace for whole typeset expressions, and using the Mathematica language search and replace can find and transform math expressions by layout, style, and general pattern matching.
Graph theory: invariant polynomials	1990s	Scope and performance of Graph Theory is much greater in Mathematica.
Graph theory: IsIsomorphic	2010	Maple's <code>IsIsomorphic</code> function can only handle undirected, unweighted graphs. Mathematica's <code>GraphIsomorphicQ</code> handles all graph types.
Graph theory: LaplacianMatrix	2008	Mathematica is able to return <code>SparseArrays</code> for very high performance when handling large graphs while Maple can only return dense matrices limiting its application to smaller graphs.
Math: Linear inequality solving	2003	

Maple 17 (2013)	Mathematica	Notes
Math: Semialgebraic system solving	2003	
Math: Solving equations with branch cuts	2003	
Visualization: Automatic 3D axes	1988	Wolfram Research highlighted this and many other sub-optimal Maple graphics defaults and controls in a 2009 report. Clear visualizations prevent mis-understandings and supports professional quality for your reports and publications. Wolfram Research has always considered this important. See the latest comparison of visualizations here.
Visualization: Plotting of inequalities	2002	Maple still supports this only in 2D. Mathematica supports both 2D and 3D inequality plotting.
Visualization: Visualize branch cuts	2007	Maple's functionality is not equivalent to Mathematica's automatic branch cut detection – it allows you to request a visualization of the branch cuts of individual functions but does not detect branch cuts in functions which you try to plot.
Visualization: Cayley Tables		Available on demonstrations.wolfram.com.
Control: The FrequencyResponse routine handles differential equations with input derivatives.	2010	In 2012 Mathematica added support for linear descriptor systems so that even systems with input derivatives of higher order than the plant variables are fully integrated.
Control: All models now accept linear, non-differential systems.	2012	
Control: Frequencies option for all frequency-based plots	2010	Minor feature correcting an unnecessary limitation.
Control: The Grammians command has been extended to work with discrete systems.	2010	
Programming: Use of D, I, etc as local variables	1988	
Programming: Sort with output option	2000	
Programming: Selecting or removing items from a table	1988	
Essay tools		While this package is rather specialized, Mathematica's string handling and semantic word data, make this kind of semantic analysis, similarity measurement and word counting easy.



For more comparison information, see:

<http://www.wolfram.com/mathematica/compare-mathematica/compare-mathematica-and-maple.html>

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