## Maple 10 Quick Reference Card

### Document Mode vs. Worksheet Mode

Maple 10 offers two primary modes of problem entry and content creation: Document mode and Worksheet mode. Both modes have respective advantages and you can easily switch from one mode to the other for maximum flexibility.

<table>
<thead>
<tr>
<th><strong>Document Mode</strong></th>
<th><strong>Worksheet Mode</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Quick problem-solving and free-form, rich content composition</td>
<td>• Traditional Maple problem-solving environment</td>
</tr>
<tr>
<td>• No prompt (&gt;) displayed</td>
<td>• Enter problems at a prompt (&gt;)</td>
</tr>
<tr>
<td>• Math is entered and displayed in 2-D</td>
<td>• Math entered and displayed in 2-D or 1-D</td>
</tr>
<tr>
<td>• Press ( \text{tab} ) to evaluate expression (inline results)</td>
<td>• Press ( \text{tab} ) to evaluate expression</td>
</tr>
<tr>
<td>• Press ( \text{tab} ) to evaluate expression (results on new line)</td>
<td>• Solve math problems with right-click menu on math expressions</td>
</tr>
<tr>
<td>• Solve math problems with ( \text{tab} ) - click menu on input and output</td>
<td>• Switch to Document mode by creating document block</td>
</tr>
</tbody>
</table>

**Note:**
- **Document mode** lets you create rich content. For example, the following solves for \( x \) without any commands: \( x^2 - \alpha = 1 \rightarrow (x = 2 + \alpha) \)
- **Worksheet mode** follows traditional Maple problem-solving environment, where you can enter problems at a prompt, and expressions are entered and displayed in 2-D or 1-D. Use the \( \text{tab} \) button to evaluate expressions.

### Common Operations Available in Both Document and Worksheet Modes

- **Display quick help** for **Quick Help**, \( \text{F1} \) for **Quick Reference Card** (this guide)
- **Refer to previous result using equation numbers** then enter equation number in dialog
- **Recompute calculations within a highlighted selection** on toolbar
- **Recompute all calculations in a document** on toolbar
- **Symbol selection, e.g. \( \epsilon \)** Enter leading characters, e.g. `eps`
- **Command completion, e.g. Lambert W function** Enter leading characters, e.g. `Lamb`
- **Perform context operation on math expression** - click any math expression
- **Insert prompt** on toolbar
- **Insert text paragraph** on toolbar

### 2-D Math Editing Operations, Keyboard Shortcuts, and Operations

- **Navigate through expression**
- **Move cursor to different level in expression, e.g. out of exponent**
- **Navigate through placeholders**
- **Add, remove, rearrange palettes** View → Palettes → Arrange Palettes or \( \text{F5} \) - click palette
- **Fraction \( \frac{x}{y} \), superscript \( x^0 \), subscript \( x_0 \)** \( x/y, x^n, x_n \)
- **Prime notation for derivatives, e.g. \( y'' + y' = 0 \) for \( \frac{d^2y}{dx^2} + \frac{dy}{dx} = 0 \)** \( y'' + y' = 0 \)
- **Square root \( \sqrt{x} \), nth root \( \sqrt[n]{x} \)** Enter leading characters `sqrt`, \( \text{F9} \), nthroot
- **Symbol above, e.g. \( x \)** Enter leading characters `\( \text{F9} \)`, then symbol, e.g. `\( \text{F9} \)` from Arrows palette
- **To enter literal characters (\( _{\text{^\text{\textbackslash}}} \), etc.), precede character with \( \text{\textbackslash} \) (backslash)** e.g. `foo\bar` produces `foo_bar`
- **Greek letter entry mode (single letter)**
- **Special characters and symbols**: Enter leading characters and `\( \text{F9} \)`, `\( \text{F9} \)`, `\( \text{F9} \)`

**Note:**
- Greek letters, symbols, and special characters are accessible through the Math palette or by typing leading characters followed by \( \text{F9} \).
- Keyboard shortcuts are provided for common operations, allowing for efficient math entry.
**Expressions vs. Functions**

<table>
<thead>
<tr>
<th>Operations</th>
<th>Expression (x^2y^2)</th>
<th>Function (operator) (g(x,y) = x^2y^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>(f := x^2 + y^2)</td>
<td>(g := (x,y) \rightarrow x^2y^2)</td>
</tr>
<tr>
<td>Evaluate at (x=1, y=2)</td>
<td>(eval(f, {x=1, y=2})); produces 5</td>
<td>(g(1,2)); produces 5</td>
</tr>
<tr>
<td>3-D plot for (x) from 0 to 1, (y) from 0 to 1</td>
<td>(plot3d(f, x=0..1, y=0..1);)</td>
<td>(plot3d(g(x,y), x=0..1, y=0..1);)</td>
</tr>
<tr>
<td>Conversion to other form</td>
<td>(f2 := unapply(f, x, y);) (f2(1,2);) produces 5</td>
<td>(g2 := g(x,1);) (g2 + z;) produces (x^2+1+z)</td>
</tr>
</tbody>
</table>

**Important Maple Syntax**

- Assignment: \(a := 2;\) \(b := 3 + x;\) \(c := a + b;\) produces \(5 + x\) for \(c\)
- Mathematical equation: \(solve(2x + a = 1, x);\) produces \(x = 1-g/2\)
- Boolean equality: \(if a = 0 \text{ then } ...\)
- Suppress display of output: Terminate command with a colon, e.g. \(1000! :\)
- Display help on topic: \(?\)topic

**Mathematical Operations**

Common manipulations (simplify, factor, expand, ...)

- Solve equations: \(\text{click expression} \rightarrow \text{Solve}\)
- Solve numerically (floating-point): \(\text{click equation} \rightarrow \text{Solve Numerically}\)
- Solve ODE: \(\text{click DE expression} \rightarrow \text{Solve DE Interactively}\)
- Integrate, differentiate: \(\text{click expression} \rightarrow \text{Integrate or Differentiate}\)
- Evaluate expression at a point: \(\text{click expression} \rightarrow \text{Evaluate at a Point}\)
- Create a matrix or vector: \(\text{Matrix palette} \rightarrow \text{Choose} \rightarrow \text{Insert}\)
- Invert, transpose, solve matrix: \(\text{click matrix} \rightarrow \text{Standard operations} \rightarrow \text{select Inverse, Transpose, ...}\)
- Evaluate as floating-point: \(\text{click expression} \rightarrow \text{Approximate}\)
- Various operations and tasks: \(\text{Use Task Templates: Tasks} \rightarrow \text{Tasks} \rightarrow \text{Browse}\)

**Input and Output**

- Interactive data import assistant: \(\text{Tools} \rightarrow \text{Assistants} \rightarrow \text{Import Data}\)
- Import audio or image file: \(\text{Tools} \rightarrow \text{Assistants} \rightarrow \text{Import Data}\)
- Code generation (C, FORTRAN, Java, Visual Basic®, MATLAB®): \(\text{click expression} \rightarrow \text{Language Conversions. See CodeGeneration for help and details.}\)
- Publish document in HTML, LaTeX, or Microsoft® Word-RTF: \(\text{File} \rightarrow \text{Export As} \rightarrow \text{Select HTML, LaTeX, or Rich Text Format}\)

**Plotting and Animation**

- Plot an existing expression: \(\text{click expression} \rightarrow \text{Plots} \rightarrow \text{Plot Builder}\)
- Plot new expression: \(\text{Tools} \rightarrow \text{Assistants} \rightarrow \text{Plot Builder}\)
- Add new expression to existing plot: \(\text{Highlight and drag expression into plot}\)
- Animation and parameter plots for functions of several variables: \(\text{click expression} \rightarrow \text{Plots} \rightarrow \text{Plot Builder}\)
- Select a plot type: \(\text{click}\)

**Units and Tolerances**

- Add units to value or expression: Place cursor to right of quantity. Use Units (SI) or Units (FPS) palette or \(\text{click} \rightarrow \text{Units} \rightarrow \text{Affix unit}\).
- Add arbitrary unit: \(\text{from Units (SI) or Units (FPS) palette and enter desired unit}\)
- Simplify units in an expression: \(\text{click expression} \rightarrow \text{Units} \rightarrow \text{Simplify}\)
- Convert units: \(\text{click expression} \rightarrow \text{Units} \rightarrow \text{Convert}\)
- Enable automatic units simplification: \(\text{with(Units[Standard])}\)
- Enable tolerance calculations: \(\text{with(Tolerances)}\)
- Tolerance quantity in 2-D Math: \(9 \text{ pm } 1.1\)
- Tolerance quantity in 1-D Math: \(9 \text{ of } 1.1\) for \(9 \pm 1.1\)

**Select Interactive Tools and Utilities**

- Quick introductory tour: \(\text{Help} \rightarrow \text{Take a Tour of Maple}\)
- Show available task templates: \(\text{Tools} \rightarrow \text{Tasks} \rightarrow \text{Browse}\)
- Interactive Dictionary of Engineering and Mathematical terms: \(\text{Help} \rightarrow \text{Manuals, Dictionary, and more} \rightarrow \text{Dictionary}\)
- Plot Builder: \(\text{click expression} \rightarrow \text{Plots} \rightarrow \text{Plot Builder, or Tools} \rightarrow \text{Assistants} \rightarrow \text{Plot Builder}\)
- ODE Analyzer: \(\text{Tools} \rightarrow \text{Assistants} \rightarrow \text{ODE Analyzer}\)
- Data Analysis Assistant: \(\text{Tools} \rightarrow \text{Assistants} \rightarrow \text{Data Analysis}\)
- Unit Conversion utility: \(\text{Tools} \rightarrow \text{Assistants} \rightarrow \text{Unit Converter}\)
- Manuals (Getting Started Guide, User Manual): \(\text{Help} \rightarrow \text{Manuals, Dictionary, and more} \rightarrow \text{Manuals}\)
- Interactive education tutors for topics in Calculus, Precalculus, and Linear Algebra: \(\text{Tools} \rightarrow \text{Tutors}\)

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