Maple 11 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>
</tbody>
</table>
| • No prompt (>) displayed | • Enter problems at a prompt (>)
| • Math is entered and displayed in 2-D | • Math entered and displayed in 2-D or 1-D |
| • Press \( < \) to evaluate expression (inline results) | • Press \( \text{eval} \) to evaluate expression |
| • Press \( \equiv \) to evaluate expression (results on new line) | • Solve math problems with right-click menu on math expressions |
| • Solve math problems with right-click menu on input and output | • Switch to Document mode by creating document block |
| • Switch to Worksheet mode by inserting prompt | |

**Document mode** lets you create rich content. For example, the following solves for \( x \) without any commands:

\[
\frac{2 + a}{x - 2} = 1 \quad \text{solve for} \quad (x - 2 + a) = 2 + a
\]

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

- **Display quick help**
- **Refer to previous result using equation numbers**
- **Recompute calculations within a line**
- **Recompute all calculations in a document**
- **Symbol selection, e.g. \( \varepsilon \)**
- **Command completion, e.g. Lambert W function**
- **Perform context operation on math expression**
- **Insert prompt**
- **Insert text paragraph**

**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**

**Fraction** \( \frac{x}{y} \) , superscript \( x^0 \) , subscript \( x_0 \)

**Prime notation for derivatives**, e.g. \( y'' + y' = 0 \) for \( \frac{d^2y}{dx^2} + \frac{dy}{dx} = 0 \)

**Square root** \( \sqrt{x} \) , nth root \( \sqrt[n]{x} \)

**Symbol above**, e.g. \( x \)

**To enter literal characters (\_, ^, etc.), precede character with \( \backslash \) (backslash)**

**Special characters and symbols**: Enter leading characters and \( \pi, \theta, \phi \)

- \( \infty \)
- \( \text{infin} \)
- \( \alpha, \lambda \)
- \( \text{alpha, lambda} \)
- \( \geq \)
- \( \leq \)
- \( \neq \)
- \( \pm \)
## Expressions vs. Functions

<table>
<thead>
<tr>
<th>Operations</th>
<th>Expression $x^2 y^2$</th>
<th>Function (operator) $g(x,y) = x^2 y^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>$f := x^2 + y^2$;</td>
<td>$g := (x,y) \rightarrow x^2 + y^2$;</td>
</tr>
<tr>
<td>Evaluate at $x=1, y=2$</td>
<td>eval(f, [x=1, y=2]); produces 5</td>
<td>$g(1,2); \text{ produces } 5$</td>
</tr>
<tr>
<td>3-D plot for $x$ from 0 to 1, $y$ from 0 to 1</td>
<td>plot3d(, $x=0..1, y=0..1$);</td>
<td>plot3d$(g(x,y), x=0..1, y=0..1$);</td>
</tr>
<tr>
<td>Conversion to other form</td>
<td>$f2 := unapply(f,x,y);$</td>
<td>$g2 := g(x,1);$</td>
</tr>
<tr>
<td></td>
<td>$f2(1,2);$</td>
<td>$g2 + z;$</td>
</tr>
<tr>
<td></td>
<td>produces 5</td>
<td>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**
  - $\text{solve}(2x + a = 1,x)$; produces $x = \frac{1-a}{2}$
- **= Boolean equality**
  - if $a = 0 \text{ then }$
- **Suppress display of output**
  - Terminate command with a colon, e.g. $100! :$
- **[] List (ordered)**
  - $z := [c, b, a]; z[1]; \text{ produces } c$
- **{} Set (unordered, no duplicates)**
  - $(a, b, \text{ a, c}); \text{ produces } (a, b, c)$
- **Display help on topic**
  - ?topic

## Mathematical Operations

### Common manipulations (simplify, factor, expand, …)

- **Right-click expression and select from menu**
  - Solve equations
  - Solve numerically (floating-point)
  - Solve ODE
  - Integrate, differentiate
  - Evaluate expression at a point
  - Create a matrix or vector
  - Invert, transpose, solve matrix
  - Evaluate as floating-point

### Input and Output

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

## Plotting and Animation

- **Plot an existing expression**
  - $\text{Tools} \rightarrow \text{Assistants} \rightarrow \text{Plot Builder}$
- **Plot new expression**
  - $\text{Tools} \rightarrow \text{Assistants} \rightarrow \text{Plot Builder}$
- **Add new expression to existing plot**
  - Highlight and drag expression into plot
- **Add annotations to 2-D plots**
  - Click on plot, then $\text{Drawing}$ on the toolbar
- **Animation and parameter plots for functions of several variables**
  - Right-click-expression $\rightarrow$ Plots $\rightarrow$ Plot Builder and select a plot type

## Units and Tolerances

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

## Select Interactive Tools and Utilities

- **Quick introductory tour**
  - Help $\rightarrow$ Take a Tour of Maple
- **Show available task templates**
  - Tools $\rightarrow$ Tasks $\rightarrow$ Browse
- **Interactive Dictionary of Engineering and Mathematical terms**
  - Help $\rightarrow$ Manuals, Dictionary, and more $\rightarrow$ Dictionary
- **Plot Builder**
  - Right-click-expression $\rightarrow$ Plots $\rightarrow$ Plot Builder, or Tools $\rightarrow$ Assistants $\rightarrow$ Plot Builder
- **ODE Analyzer**
  - Tools $\rightarrow$ Assistants $\rightarrow$ ODE Analyzer
- **Data Analysis Assistant**
  - Tools $\rightarrow$ Assistants $\rightarrow$ Data Analysis
- **Unit Conversion utility**
  - Tools $\rightarrow$ Assistants $\rightarrow$ Units Calculator
- **Back-Solving Assistant**
  - Tools $\rightarrow$ Assistants $\rightarrow$ BackSolving
- **Apply numeric formatting**
  - Right-click-expression $\rightarrow$ Numeric Formatting
- **Manuals (Getting Started Guide, User Manual)**
  - Help $\rightarrow$ Manuals, Dictionary, and more $\rightarrow$ Manuals
- **Interactive education tutors for topics in Calculus, PreCalculus, and Linear Algebra**
  - Tools $\rightarrow$ Tutors