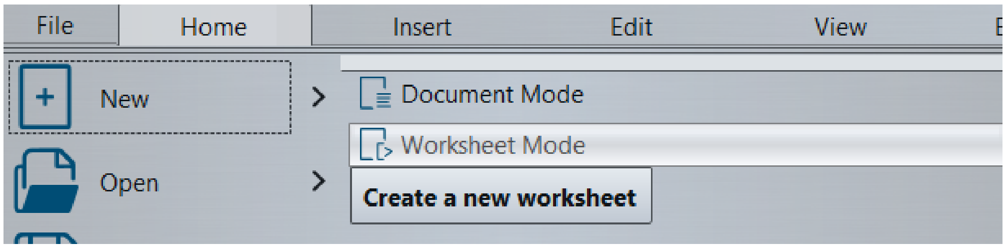
Maple for Calculus I

Start up

When getting familiar with Maple, it is best to start off with Worksheet Mode by pressing File > New > Worksheet Mode:



General information

- Maple is much like Microsoft Word in terms of equation input. Use the following characters to denote each operation: multiplication (*), division and fractions (/), exponents (^), and subscripts (_).
- Maple is also case sensitive: make sure to watch out for capitalization (e.g., the variables `mapleVariable` and `MapleVariable` will be different and the commands `limit()` and `Limit()` will show different things.)
- Most Maple input requires you to end in a semicolon (;), so it is best to get into the habit.
- Comments can be added to code via the hashtag symbol (#).
- Maple Worksheets can be saved and run later.

Basic math

Command	Output	Description
`>restart;`		Clears variables from memory
`>1234 + 4567;`	5801	You can use Maple as a regular calculator
$>\frac{5 \cdot 6 \cdot 9}{3};$	90	
`>%;`	90	Recalls the answer from the previous line
$>\frac{\%}{9};$	10	

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>(1 + 2)(1 + 2);	3	Do not forget the multiplication sign or erroneous answers will appear
>(1 + 2)·(1 + 2);	9	The correct way to write the above equation
>$\frac{2}{3}$;	$\frac{2}{3}$	Fractions will appear as fractions
>evalf$\left(\frac{2}{3}\right)$;	0.6666666667	Evaluates the fraction as a floating point number
>Pi;	π	
>evalf(Pi);	3.141592654	Evaluates Pi as a floating point number
>Pi;	π	
>evalf(%);	3.141592654	% recalls the answer from the previous line
>exp(1);	e	Euler's number
>evalf(%);	2.718281828	% recalls the answer from the previous line
>sqrt(144);	12	Computes the square root of 144

Simple expressions and variables

Command	Output	Description
>Area := Pi·r^2;	$Area := \pi r^2$	Defines the Area of a circle
>r := 10;	$r := 10$	Assigns 10 to the variable 'r'
>Area;	100π	Computes the Area of a circle
>evalf(Area);	314.1592654	Evaluates the Area as a floating point number
>r := 5;	$r := 5$	Assigns 5 to the variable 'r'
>Area;	25π	Computes the Area with the new 'r' value
>evalf(Area);	78.53981635	Evaluates the Area as a floating point number
>Area := \`Area';	$Area := Area$	Clears data from the 'Area' variable
>Area;	$Area$	Displays the Area variable

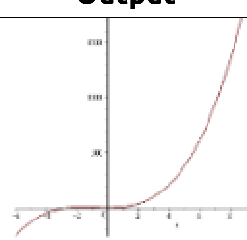
Defining and Solving

Command	Output	Description
`>y := 2·x^3 + 5·x^2;`	$y := 2x^3 + 5x^2$	Defines the expression $y = 2x^3 + 5x^2$
`>subs(x = 4, y);`	208	Substitutes $x = 4$ and solves for y
`>solve(y = 208);`	$4, -\frac{13}{4} - \frac{1}{4}i\sqrt{247}, -\frac{13}{4} + \frac{1}{4}i\sqrt{247}$	Solves for x when $y = 208$
`>fsolve(y = 208);`	4.	Solves for x when $y = 208$ (floating point)

Differentiating and Integrating

Command	Output	Description
`>diff(y, x);`	$6x^2 + 10x$	Differentiates y with respect to x
`>diff(y, x, x);`	$12x + 10$	Second derivative of y with respect to x
`>subs(x = 4, diff(y, x));`	136	Value of the first derivative when $x = 4$
`>implicitdiff(x^2*cos(y)=0,y,x)`	$\frac{2\cos(y)}{x\sin(y)}$	Differentiates the expression implicitly to get $\frac{dy}{dx}$
`>int(y, x);`	$\frac{1}{2}x^4 + \frac{5}{3}x^3$	Integrates y with respect to x
`>int(y, x = 0..6);`	1008	Integrates y from $x = 0$ to $x = 6$

Plotting

Command	Output	Description
`>plot(y, x = -6..9);`		Plots y vs. x (for a range from -6 to 9)
`>i := t -> sin(t);`	$i := t \rightarrow \sin(t)$	Defines the function $i(t) = \sin(t)$
`>j := t -> cos(t);`	$j := t \rightarrow \cos(t)$	Defines the function $j(t) = \cos(t)$

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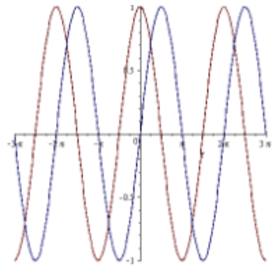
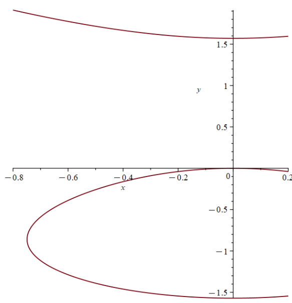
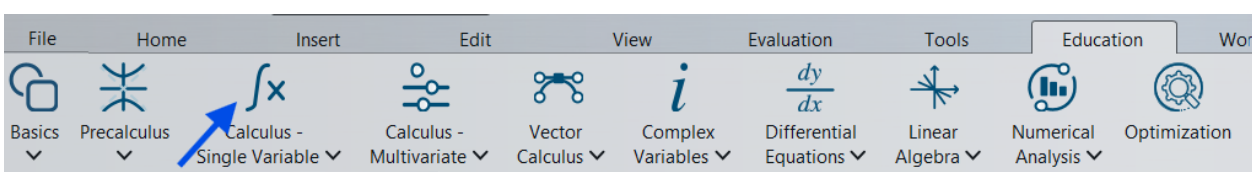
>plot({g, h}, t = -3·Pi..3·Pi);		Plots expressions g and h vs. t
>with(plots);		Loads additional plotting commands
>implicitplot(x+y*cos(y)=0);		Plots the implicit function as x vs. y

Limits

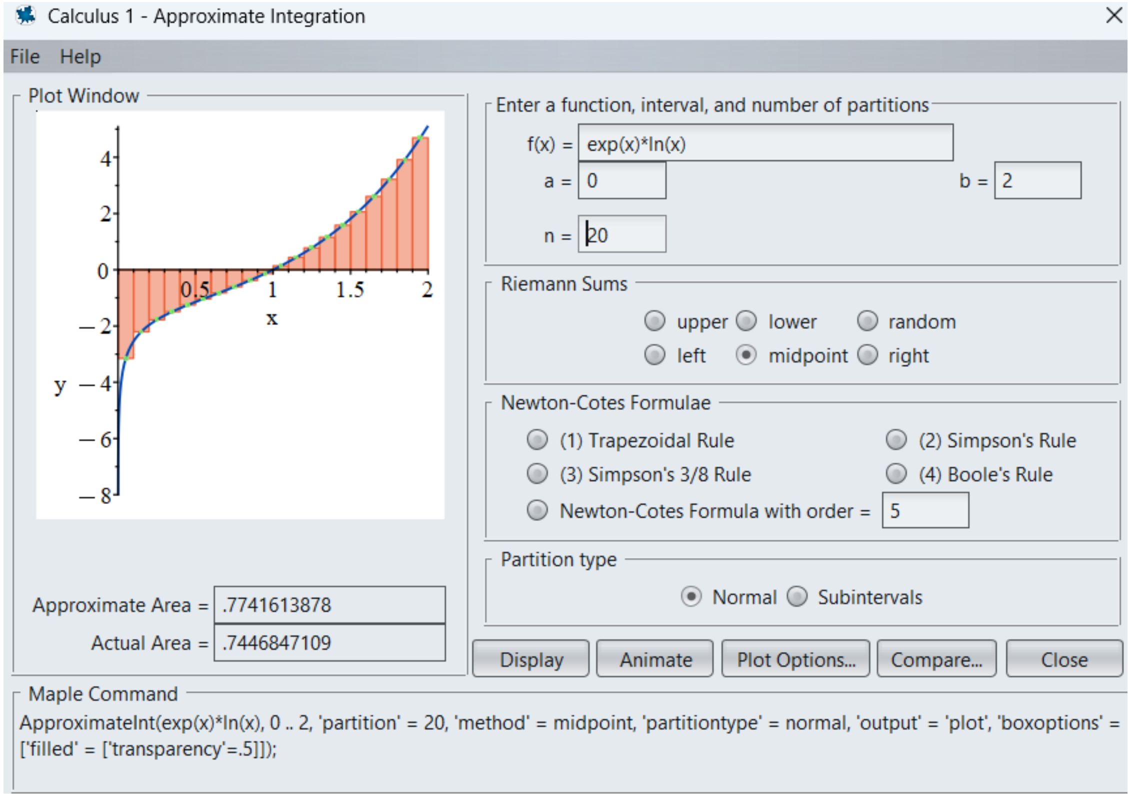
Command	Output	Description
>limit(g, t = 0);	0	The limit of g as t approaches 0
>limit(sqrt(x), x=0, right);	0	The limit of $\sqrt{x}$ as x approaches 0 from the right

Interactive Menus

Maple provides several interactive menus located under the "Education" tab. For Calculus I, we will work entirely within the "Calculus Single Variable" dropdown.



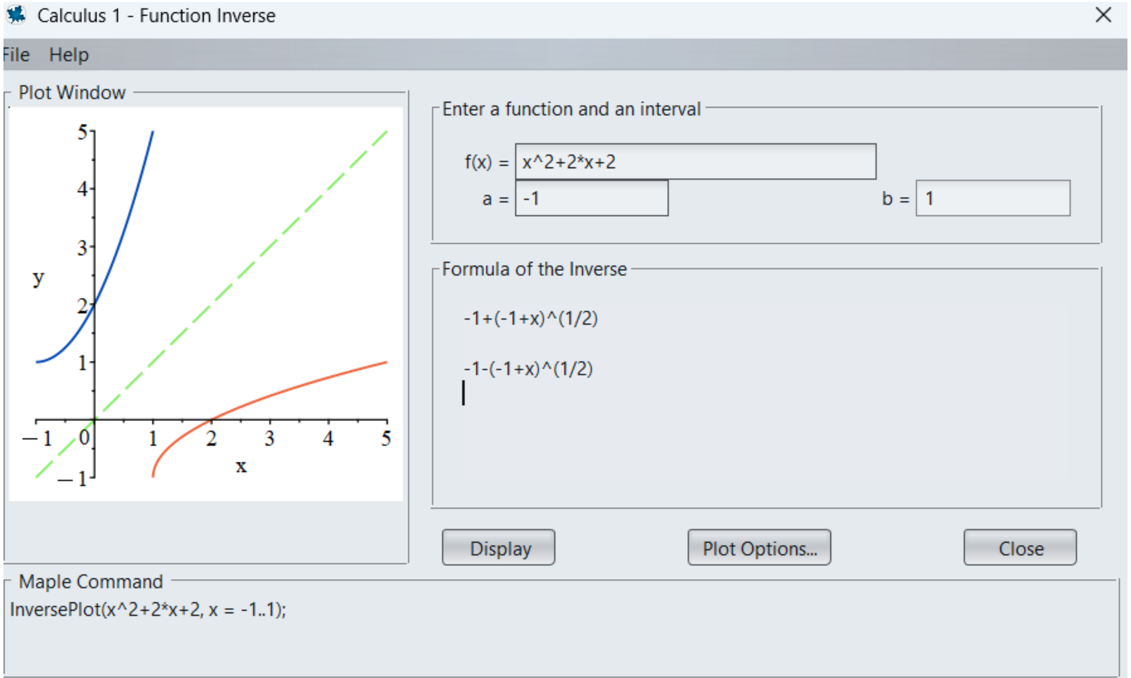
To **approximate integration** using finite Riemann sums, select the Approximate Integration tool. Once here, you can enter the function into the `f(x)` box, the endpoints into the `a` and `b` boxes, and the number of partitions into the `n` box. You can select your preferred sampling method from left, right, or midpoint. Once you are ready, click the "Display" button. You will see a visual

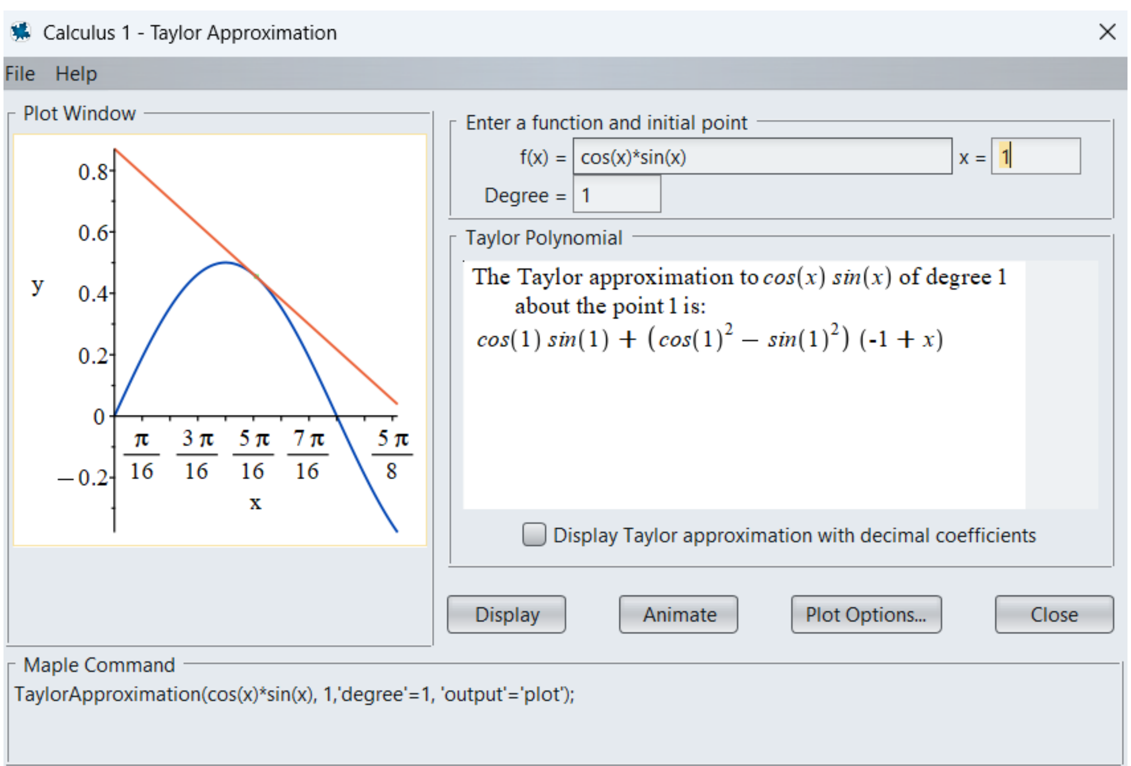


representation in the Plot Window. Below, you will see the Approximate Area (using Riemann sums) and the actual area (using definite integration).

To compute a **function inverse**, select the Function Inverse tool. Once here, enter your function into the `f(x)` box and enter the plotting bounds in the `a` and `b` boxes. Once you are ready, click the "Display" button. You will see a visual representation in the Plot Window. You can see the formula(s) of the inverse functions in the box to the right. Note: For complicated functions, you may not recognize the formula for the inverse; this is normal, since not all functions have elementary inverses.

To compute the **linearization or linear approximation** of a function around some point, select the Taylor Approximation tool. Once here, enter your function into the `f(x)` box, the point you want your approximation centred around into the `x` box, and enter 1 into the `Degree` box. Once you are ready, click the "Display" button. You will see a visual representation in the Plot Window. You can see the m and b values for the linearization in the Taylor Polynomial box. If you click the "Display Taylor approximation with decimal coefficients" box, it will give decimal coefficients.


Calculus 1 - Function Inverse
File
Help
Plot Window
Enter a function and an interval
f(x) = x^2+2*x+2
a = -1
b = 1
Formula of the Inverse
-1+(-1+x)^(1/2)
-1-(-1+x)^(1/2)
Display
Plot Options...
Close
Maple Command
InversePlot(x^2+2*x+2, x = -1..1);


Calculus 1 - Taylor Approximation
File
Help
Plot Window
Enter a function and initial point
f(x) = cos(x)*sin(x)
x = 1
Degree = 1
Taylor Polynomial
The Taylor approximation to cos(x) sin(x) of degree 1 about the point 1 is:
cos(1) sin(1) + (cos(1)^2 − sin(1)^2) (-1 + x)
Display Taylor approximation with decimal coefficients
Display
Animate
Plot Options...
Close
Maple Command
TaylorApproximation(cos(x)*sin(x), 1,'degree'=1, 'output'='plot');