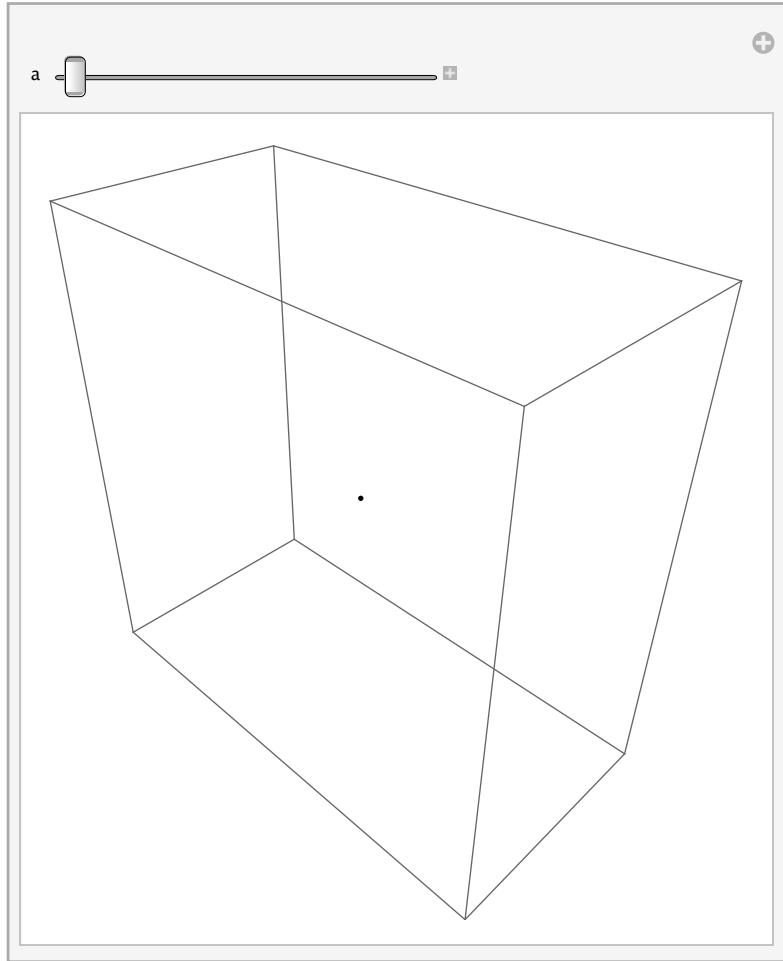


4. Dynamic Interactivity

Mathematica has several dynamic elements. It is very useful for visualization of the results if the problem contains some parameters and one wants to study it under the change of those parameters. You can study the following examples.

Example 1.

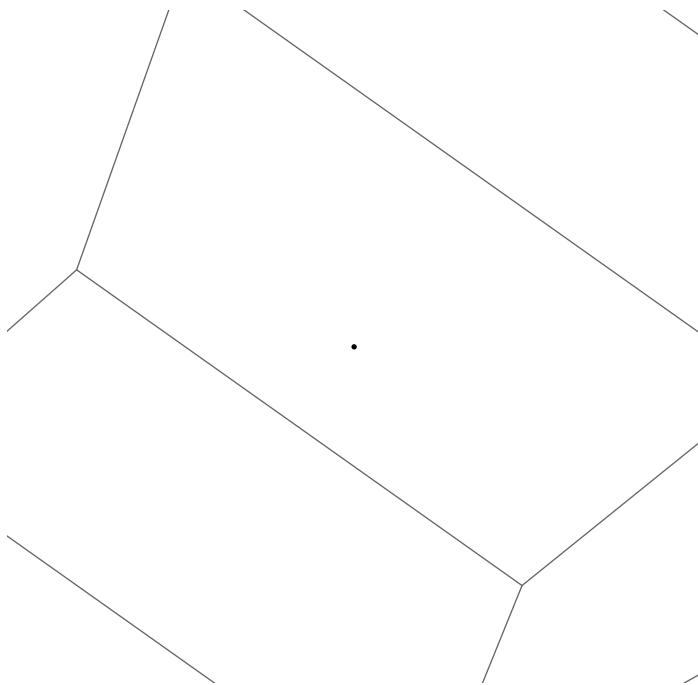
```
Manipulate[
 Show[Graphics3D[Point[{-1, 1/2, 1}], ViewPoint -> {a, 1, 1}], {a, -1, 1}]
```



Example 2.

```
b  
b  
Dynamic[b]  
0.  
Slider[Dynamic[b]]  
-
```

```
Show[Graphics3D[Point[{1, 1/2, 1}], ViewPoint -> {Dynamic[b], 1, 1}]]
```



Other examples.

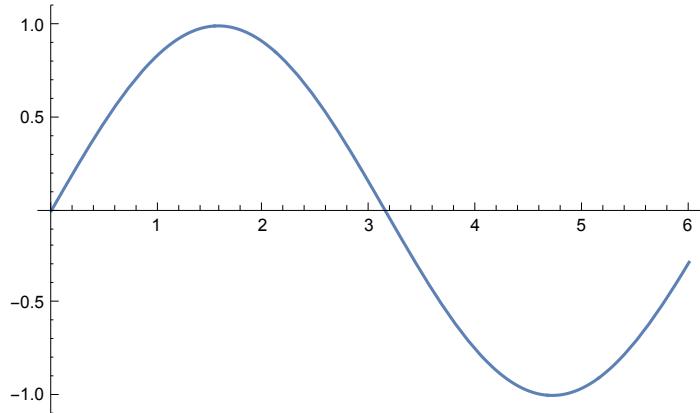
```
Dynamic[n]
```

```
0.
```

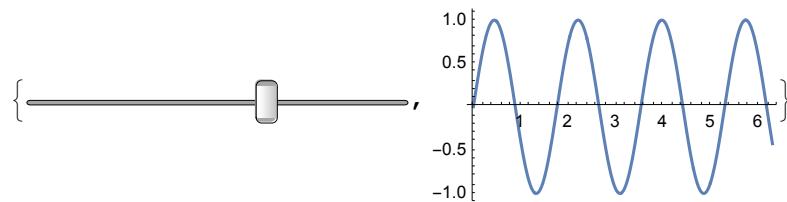
```
Slider[Dynamic[n]]
```



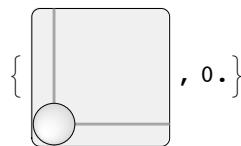
```
Dynamic[Plot[Sin[(n + 1) x], {x, 0, 6}]]
```



```
DynamicModule[{x},
{Slider[Dynamic[x], {1, 5}], Dynamic[Plot[Sin[x i], {i, 0, 2 Pi}]]}]
```



```
{Slider2D[Dynamic[x]], Dynamic[x]}
```



```
{InputField[Dynamic[x]], Dynamic[x]}
```



```
{Slider[Dynamic[1 - y, (y = 1 - #) &]], Dynamic[y]}
```

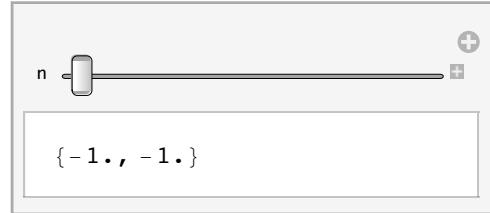


```
{Slider[Dynamic[x]], Slider[Dynamic[1 - x, (x = 1 - #) &]]}
```



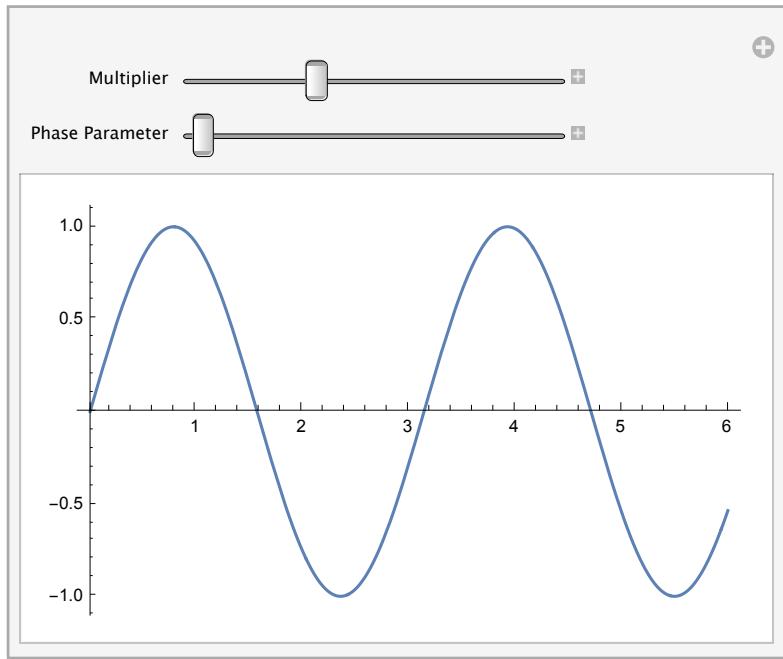
```
Clear[x, n]
```

```
Manipulate[Factor[x^n - 1], {n, 10, 100, 1}]
```



```
Clear[a, b, c, x, y]
```

```
Manipulate[Plot[Sin[a x + b], {x, 0, 6}],
{{a, 2, "Multiplier"}, 1, 4}, {{b, 0, "Phase Parameter"}, 0, 10}]
```



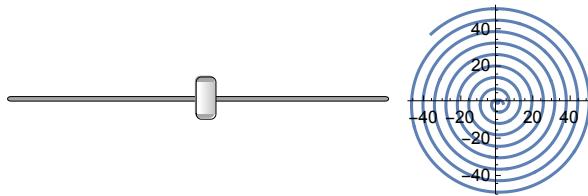
```
Grid[{{a, b, c}, {x, y, z}}]
```

a	b	c
x	y	z

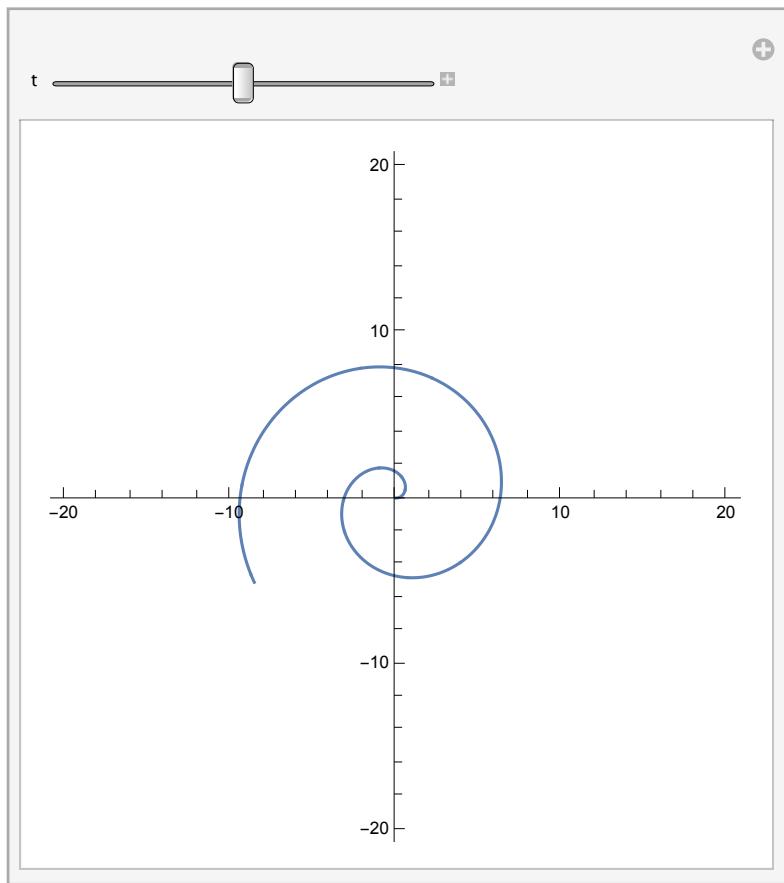
```
Grid[{{a, b, c}, {x, y^2, z^3}}, Frame -> All]
```

a	b	c
x	y^2	z^3

```
DynamicModule[{θ = 0}, Grid[{{Slider[Dynamic[θ], {0, 100}], Dynamic@PolarPlot[t, {t, -Pi, θ}], ImageSize -> Tiny}}]]
```



```
Manipulate[PolarPlot[θ, {θ, 0, t}, PlotRange -> 20], {t, 1, 6 Pi}]
```

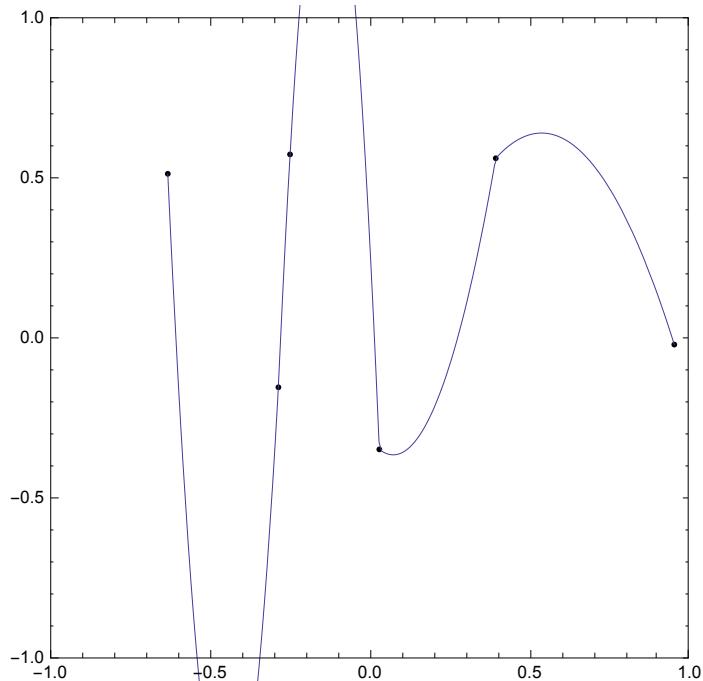


```
DynamicModule[{col = Green}, EventHandler[
  Style["text", FontColor -> Dynamic[col]], {"MouseClicked" :> (col = Red)}]]
text

DynamicModule[{col = Green},
  EventHandler[Style["text", FontColor -> Dynamic[col]],
  {"MouseClicked" :> (col = col /. {Red -> Green, Green -> Red})}]]
text

interpolationCurve[p_, n_] :=
  Module[{x, f = Interpolation[p, InterpolationOrder -> n]},
  First@Plot[Evaluate@f[x], {x, Min[p[[All, 1]]], Max[p[[All, 1]]]}]];
```

```
DynamicModule[{n = 2, p = {}, c = {}},  
 EventHandler[Dynamic@Graphics[{Point[p], c}, PlotRange -> 1, Frame -> True],  
 "MouseDown" :>  
 (p = Union[Sort@Append[p, MousePosition["Graphics"]]],  
 SameTest -> (First[#1] == First[#2] &);  
 If[Length[p] >= n + 1, c = interpolationCurve[p, n]])]
```



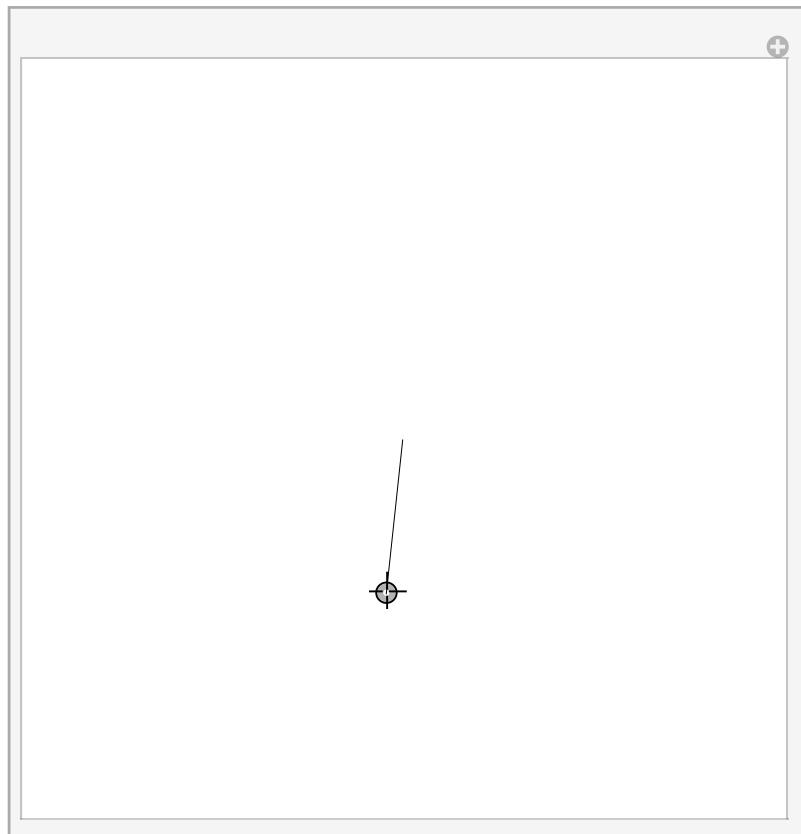
```
Graphics[Locator[{0, 0}], PlotRange -> 2]
```



```
DynamicModule[{p = {0.5, 0.5}},  
 {Graphics[Locator[Dynamic[p]], PlotRange -> 2], Dynamic[p]}]
```

{
 , {-0.388889, 0.7}}

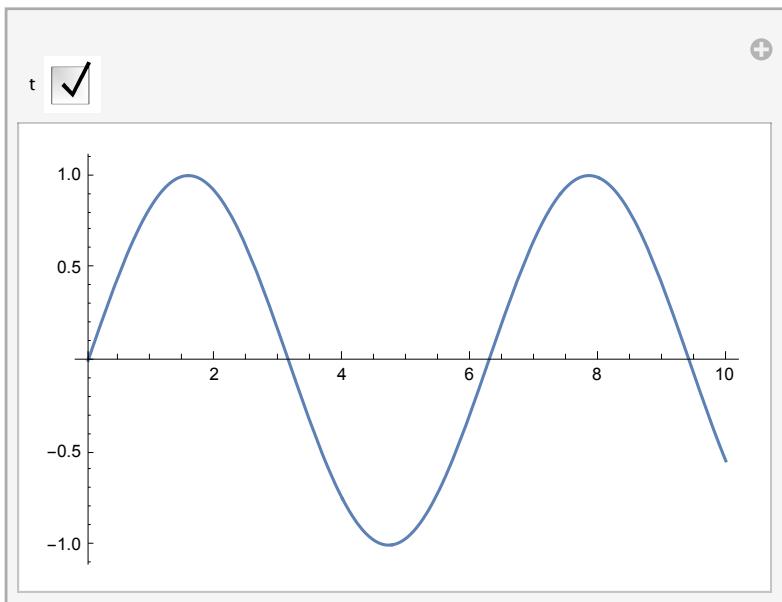
```
Manipulate[Graphics[Line[{{0, 0}, p}], PlotRange -> 2], {{p, {1, 1}}, Locator}]
```



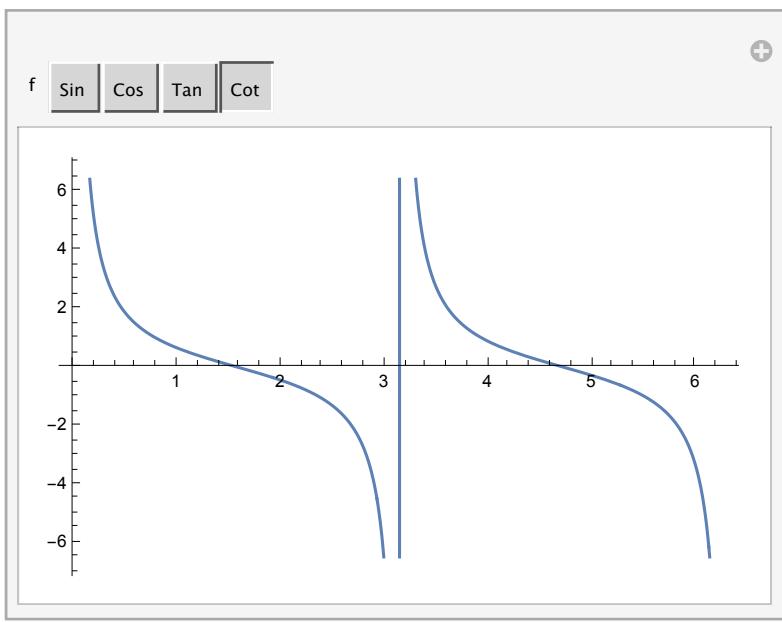
Manipulate options

```
Quit[]
```

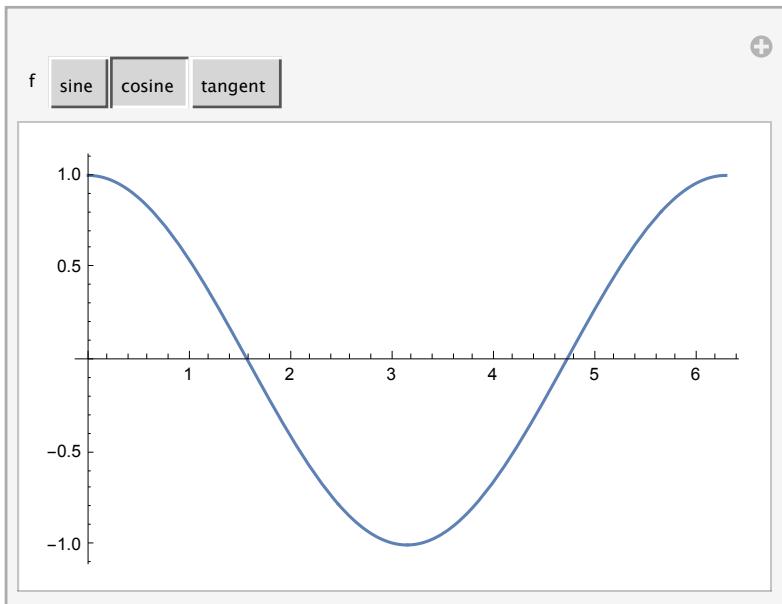
```
Manipulate[Plot[If[t, Sin[x], Cos[x]], {x, 0, 10}], {t, {True, False}}]
```



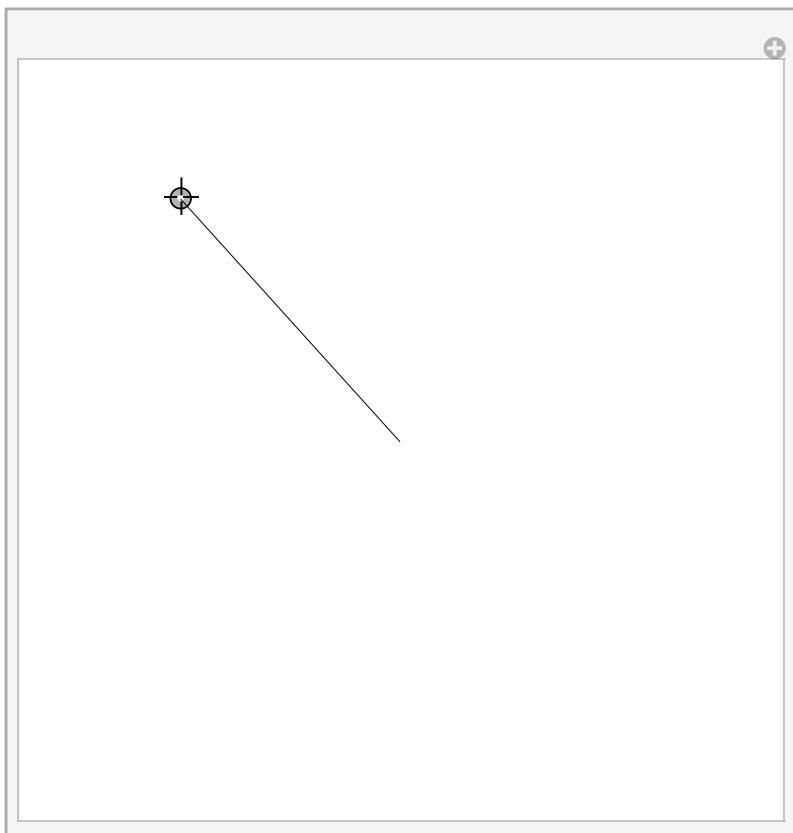
```
Manipulate[Plot[f[x], {x, 0, 2 Pi}], {f, {Sin, Cos, Tan, Cot}}]
```



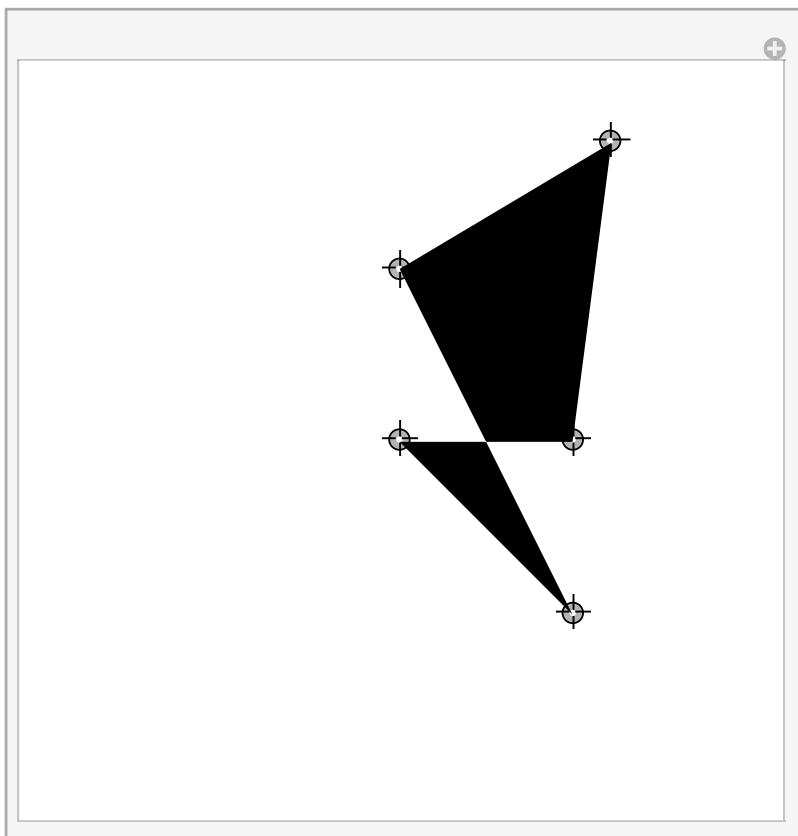
```
Manipulate[Plot[f[x], {x, 0, 2 Pi}],  
{f, {Sin -> "sine", Cos -> "cosine", Tan -> "tangent"}}]
```



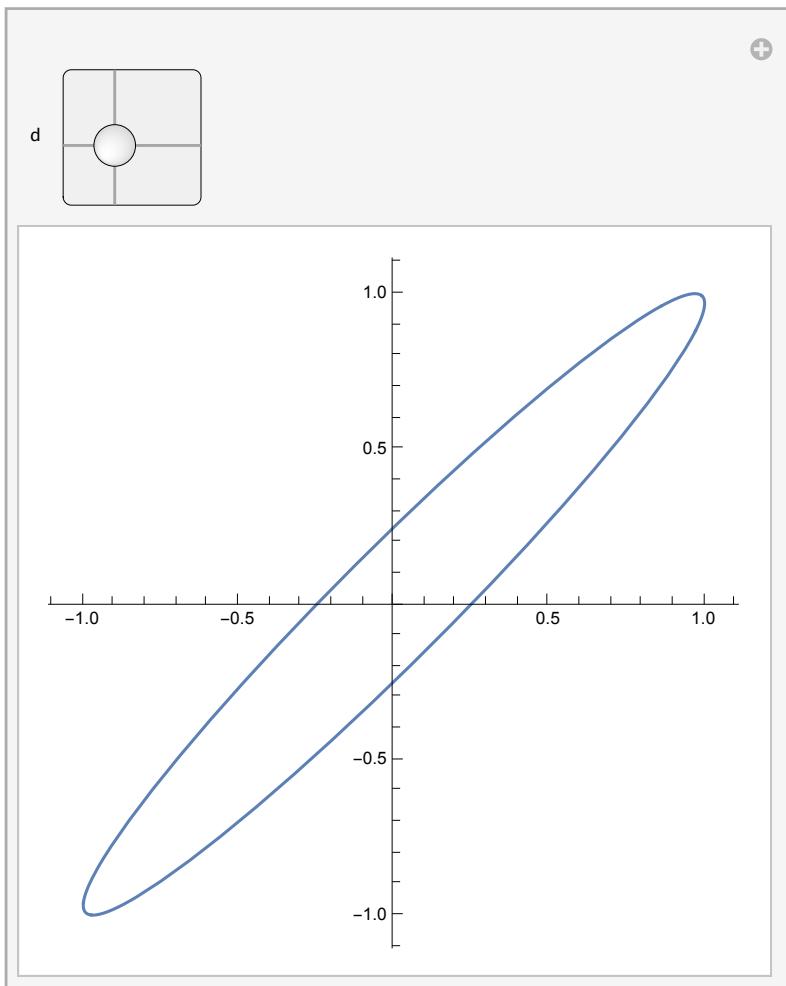
```
Manipulate[Graphics[Line[{{0, 0}, p}], PlotRange -> 2], {{p, {1, 1}}, Locator}]
```



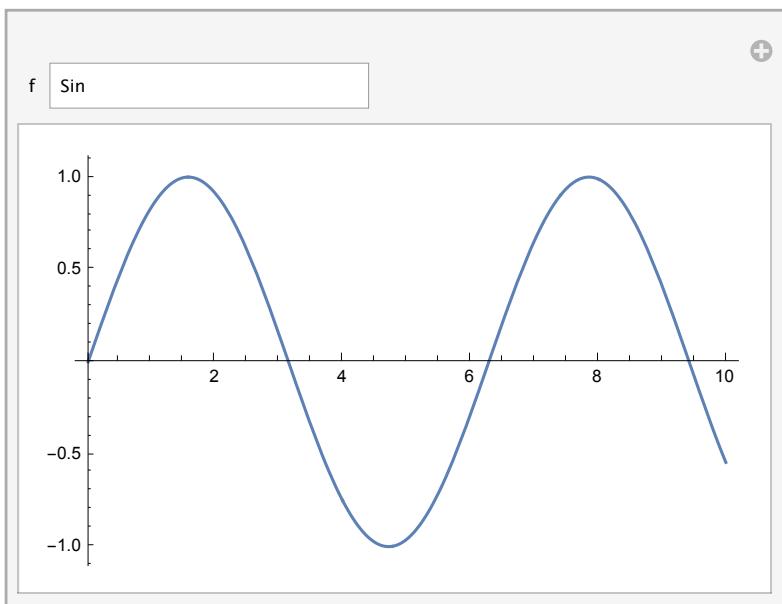
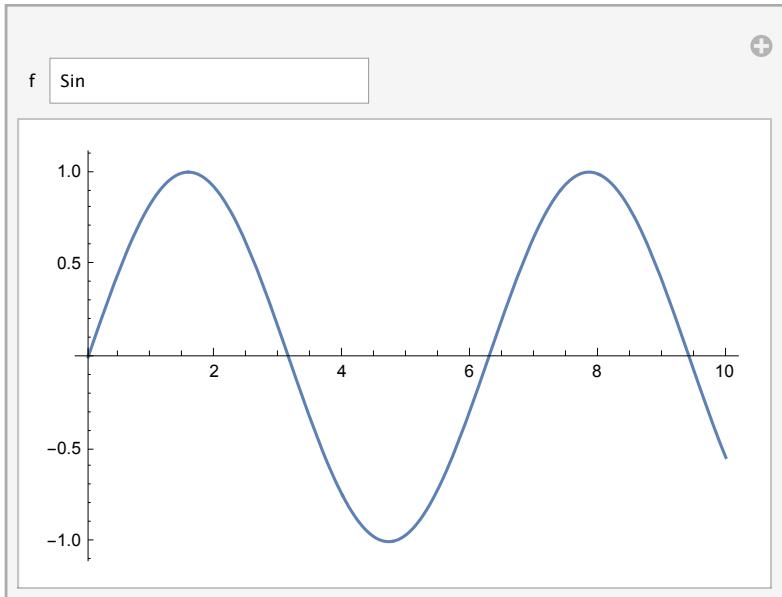
```
Manipulate[Graphics[Polygon[pt], PlotRange -> 2],  
 {{pt, {{0, 0}, {1, 0}, {1, 1}, {0, 1}, {1, -1}}}, Locator}]
```



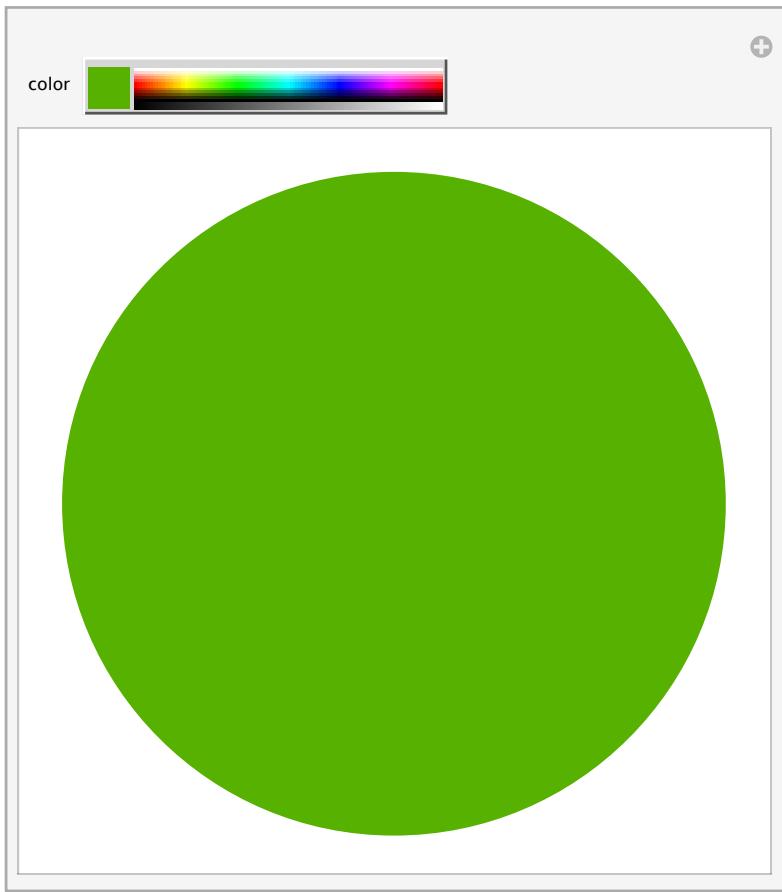
```
Manipulate[ParametricPlot[{Sin[t + d[[1]]], Sin[t + d[[2]]]}, {t, 0, 2 Pi}],  
{d, {0, 0}, {Pi, Pi}}]
```



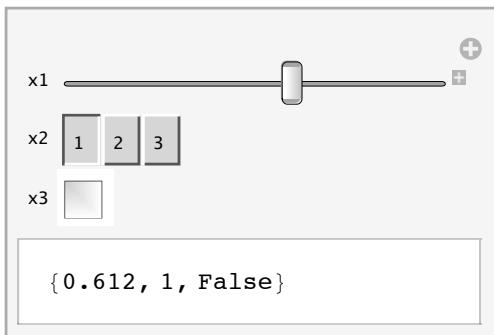
```
Manipulate[Plot[f[x], {x, 0, 10}], {f, Tan}]
```



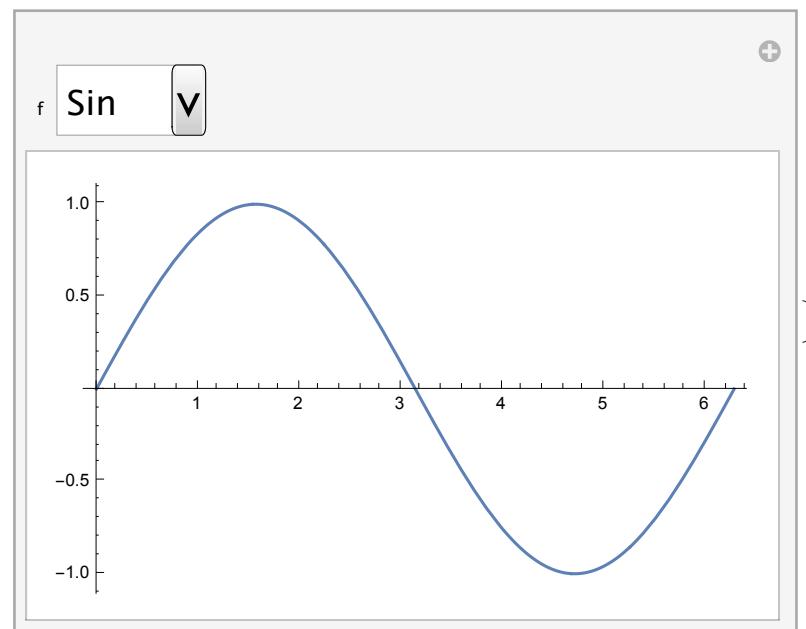
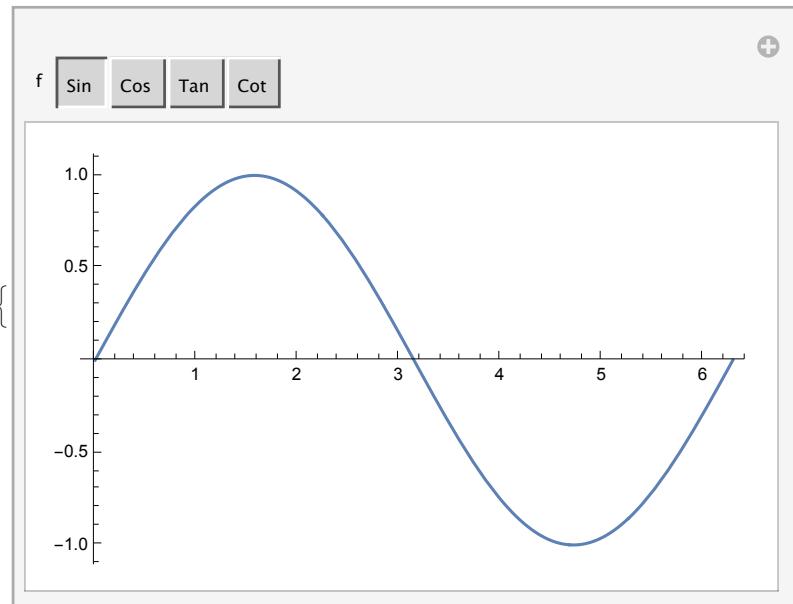
```
Manipulate[Graphics[{color, Disk[]}], {color, Purple}]
```



```
Manipulate[{x1, x2, x3}, {x1, 0, 1}, {x2, {1, 2, 3}}, {x3, {True, False}}]
```

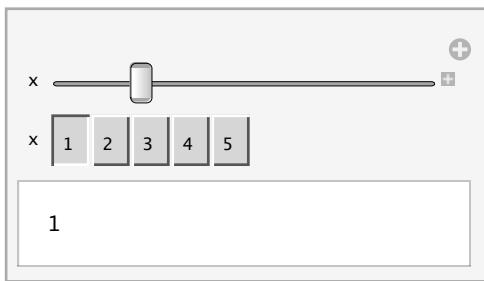


```
{Manipulate[Plot[f[x], {x, 0, 2 Pi}], {f, {Sin, Cos, Tan, Cot}}], Manipulate[
Plot[f[x], {x, 0, 2 Pi}], {f, {Sin, Cos, Tan, Cot}, ControlType -> PopupMenu}]} }
```

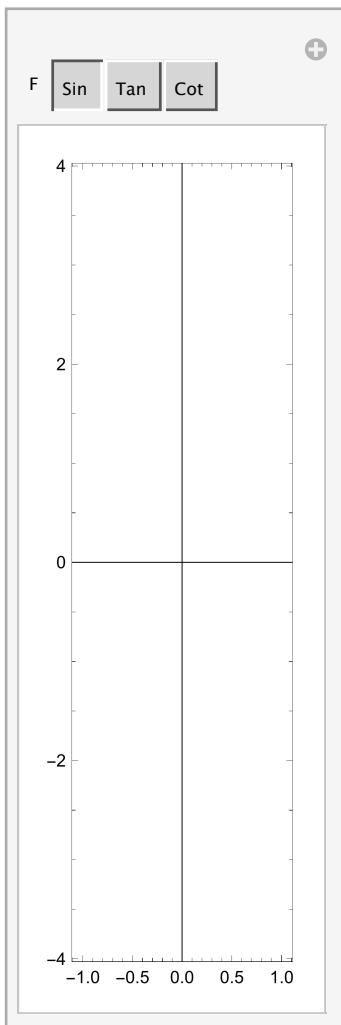


```
Manipulate[x, {{x, 0}, Button["random", x = RandomReal[]] &}]
```

```
Manipulate[x, {{x, 1}, 0, 5}, {x, Range[5]}]
```

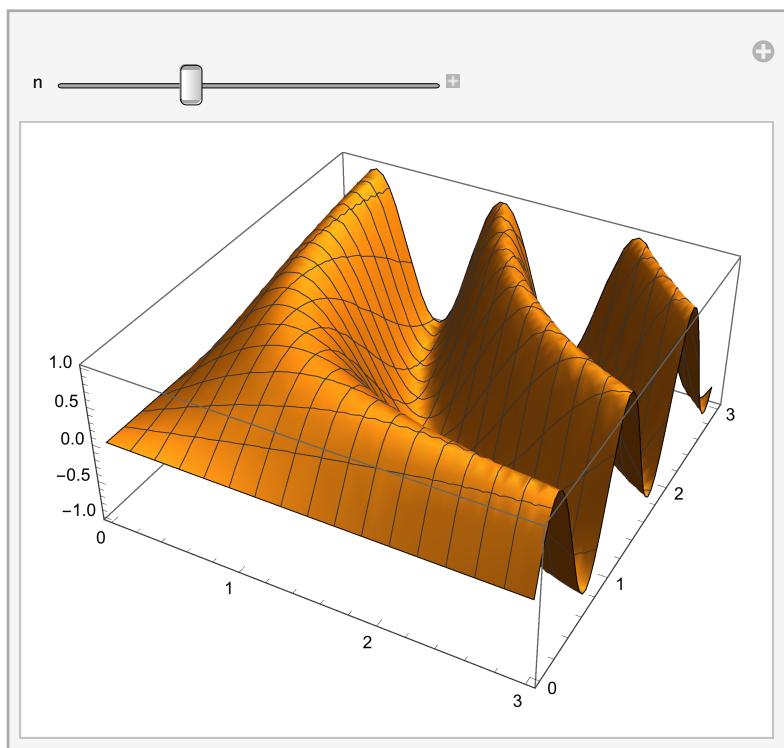


```
Manipulate[Block[{f = F[x + I y]}, ParametricPlot[
Evaluate[{Re[f], Im[f]}], {x, -Pi, Pi}, {y, -2, 2}]], {F, {Sin, Tan, Cot}}]
```

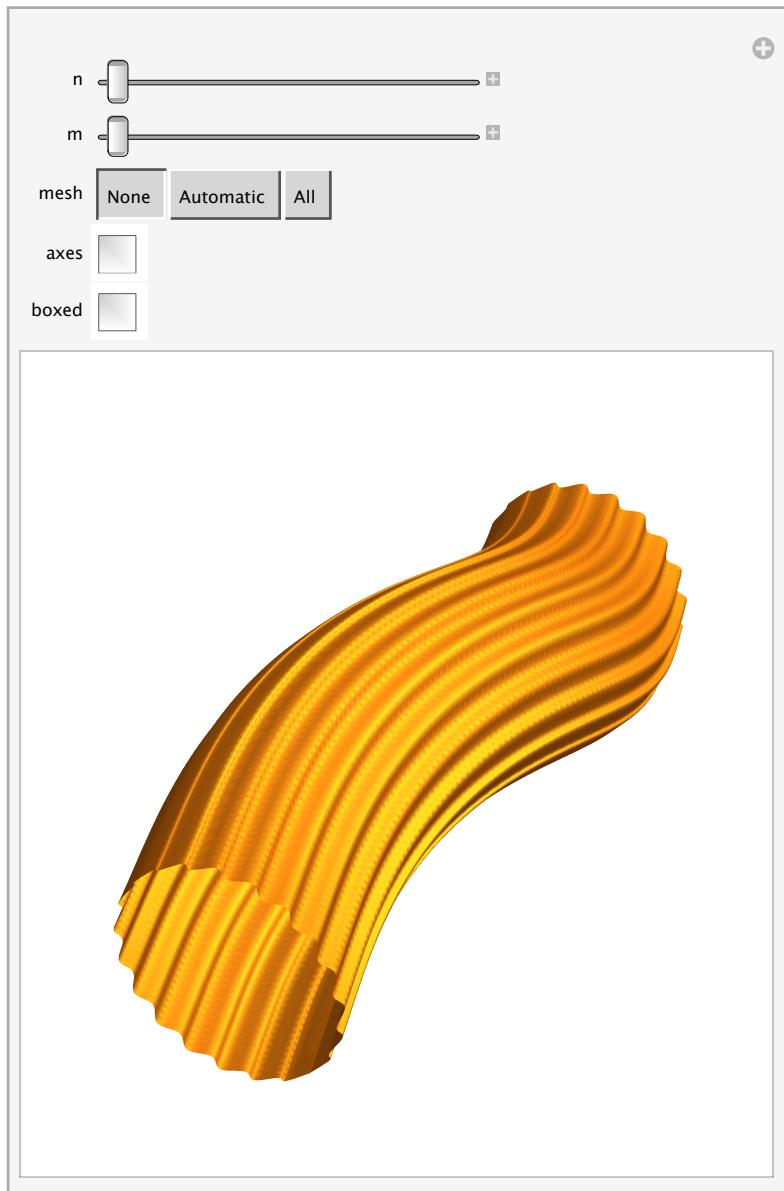


```
Quit[]
```

```
Manipulate[Plot3D[Sin[n x y], {x, 0, 3}, {y, 0, 3}], {n, 1, 4, 0.5}]
```

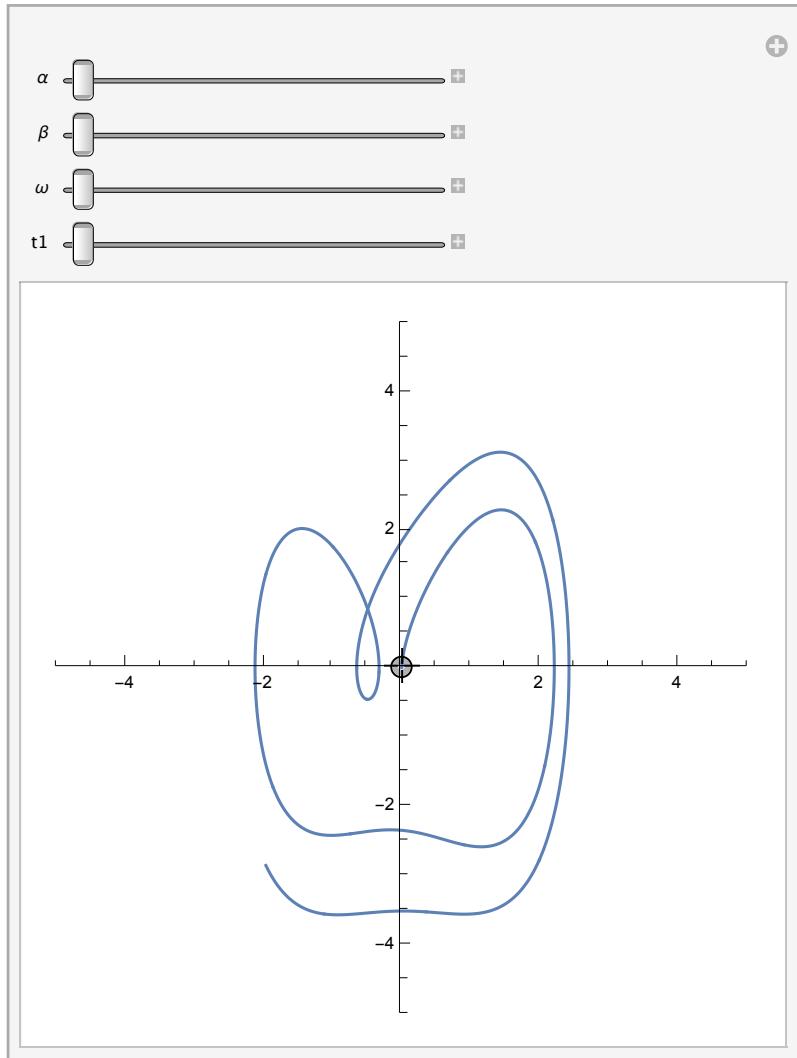


```
Manipulate[ParametricPlot3D[
{Cos[v] + 0.3 Sin[n u] + 0.04 Sin[20 v], u, Sin[v] + 0.3 Cos[m u] + 0.04 Sin[20 v]},
{u, -π, π}, {v, -π, π}, PlotPoints → 50, Mesh → mesh, Axes → axes, Boxed → boxed],
{n, 1, 5}, {m, 1, 5},
{mesh, {None, Automatic, All}},
{axes, {False, True}},
{boxed, {False, True}}]
```

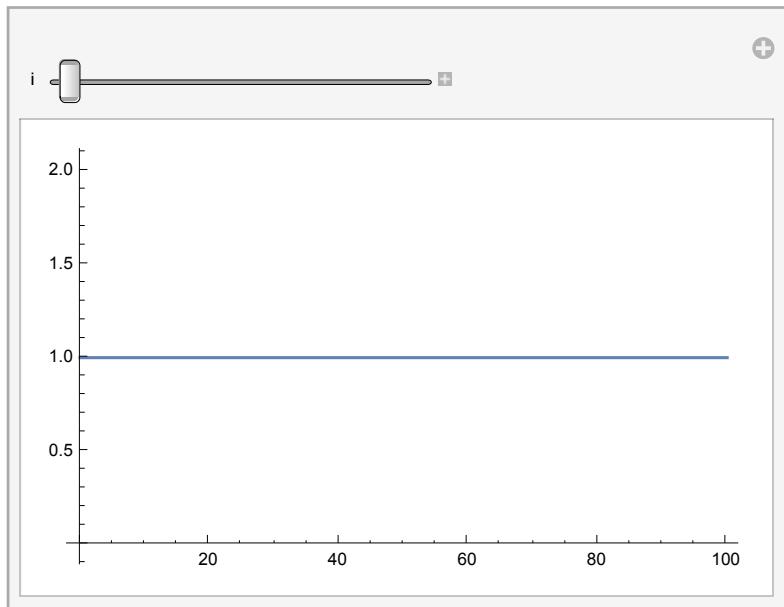


```
Quit[]
```

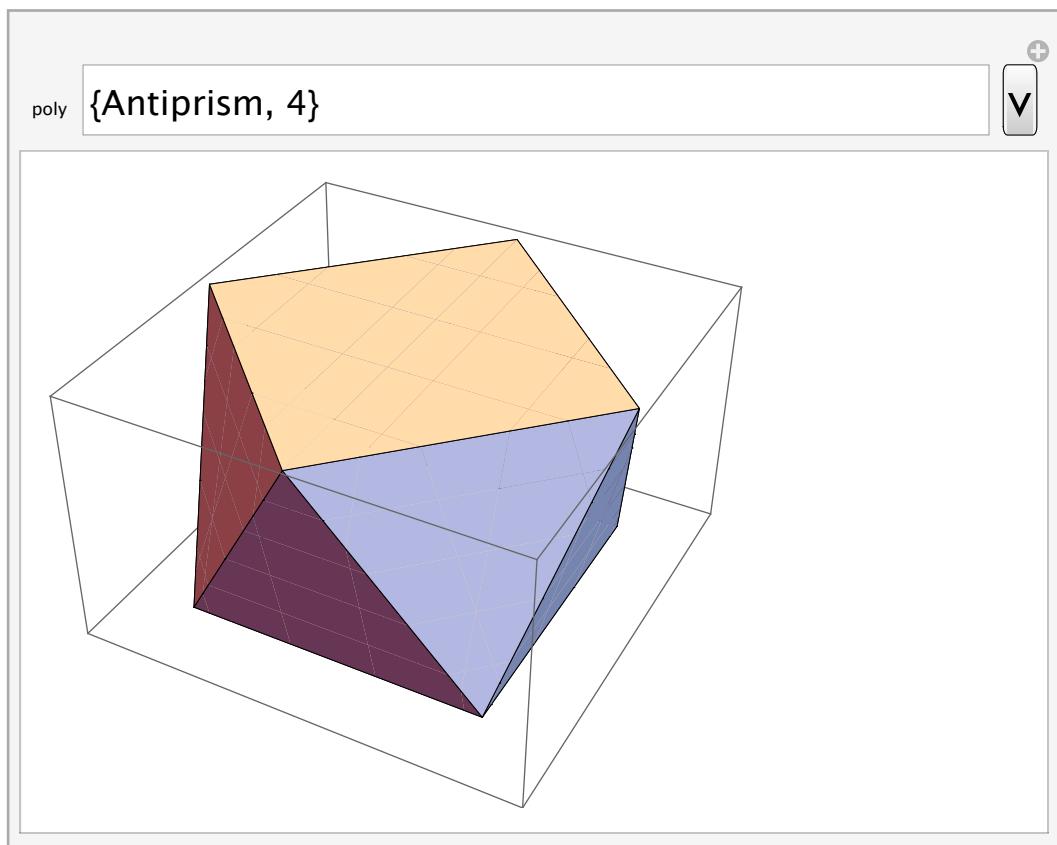
```
Manipulate[
Module[{x}, With[{sol = NDSolve[{x ''[t] + x[t]^3 == \[alpha] Sin[\[omega] t + \[beta]], x[0] == pt[[1]], x'[0] == pt[[2]]}, x, {t, 0, 50}]},
ParametricPlot[{x[t], x'[t]} /. sol, {t, 0, t1}, PlotRange \[Rule] 5]]],
{\[alpha], -3, 3}, {\[beta], -\[Pi], \[Pi]}, {\[omega], 1, 5}, {t1, 10, 50},
{{pt, {0, 0}}, Locator}, SaveDefinitions \[Rule] True]
```



```
Manipulate[Plot[Evaluate[Sum[ $\frac{1}{(k+1)^i}$ , {k, 0, n}]], {n, 0, 100}, PlotRange -> All], {i, 1, 10, 1}]
```



```
Manipulate[PolyhedronData[poly], {poly, PolyhedronData[]}]
```



```
Manipulate[With[  
  {img = ImageAdjust[  Column[{ImageHistogram[img], Image[img, ImageSize -> All]}]],  
 {{brightness, 0}, -1, 1}, {{contrast, 0}, -1, 1}]
```

