MAT/19/72

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DEFINING FUNCTION and PLOTTING GRAPHS

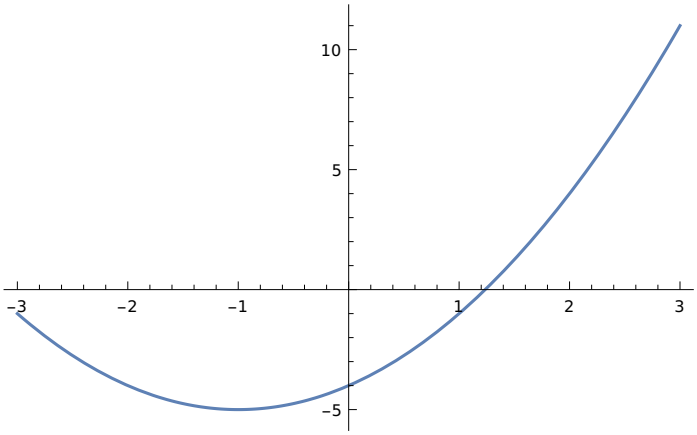
Before plotting graph of any function ,
we must define that function for our ease. This could be a polynomial ,
log function , exponential , etc. In MATHEMATICA ,
a function is defined using the command → `f[x_] :=`
`(our desired function)` **as given below : -**

```
f[x_] := x^2 + 2 x - 4
```

Now, we can plot this function using the command →
`Plot` **in our desired domain which is** `[-3, 3]` **here**

In[5]:=
```
Plot[f[x], {x, -3, 3}]
```

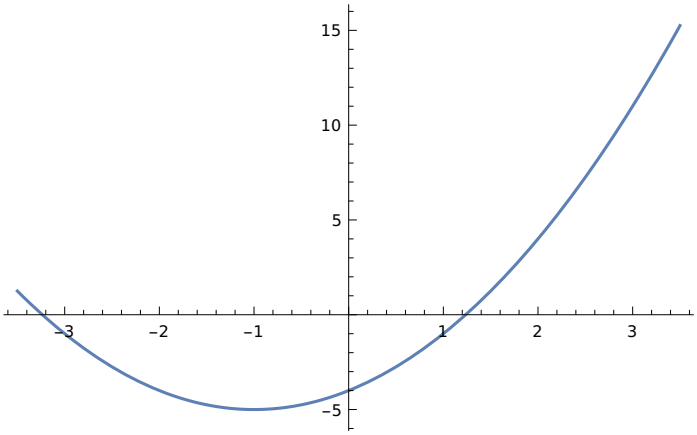
Out[5]=



We can alter our domain and choose any real value as per our requirement .

In[7]:=
```
Plot[f[x], {x, -3.5, 3.5}]
```

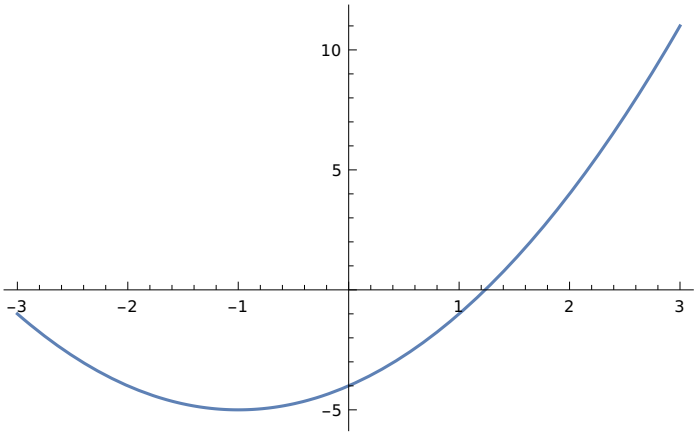
Out[7]=



Now , if we want to have a more zoomed view of the graph ,
for example , the result that the graph would hold at 3.00000 ... .1 ,
so it is quite difficult to write this
domain over and over in the input (i.e - command) ,
hence we define a term ' δ ' according to the decimal places we need and
by using the command → With , we can plot our graph as shown below : -

In[11]:=
```
With[{δ = 10^(-10)}, Plot[f[x], {x, -(3 - δ), 3 + δ}]]
```

Out[11]=



Above mentioned commands were the basic and mandatory commands for plotting , now we have some additional commands to beautify and highlight our graphs such as

1).**GridLines** – We use it to provide gridlines in our graph . It is written as **GridLines → Automatic .**

1.1). **GridLinesStyle** – used to decide colour , style of our grid . It is written as **GridLines → {desired style , color}**

2).**PlotStyle** – used to give color and style to our graph .

3).**AspectRatio** – It gives the equal scaling on both the axes . It is written as **AspectRatio → Automatic**

4).**AxesLabel** – It gives name to out x – axis and y – axis . It is written as **AxesLabel → {name of x – axis , name of y – axis}.**

5).**PlotLabel** – It is used to title our graph . It is written as **PlotLabel → name of the graph**

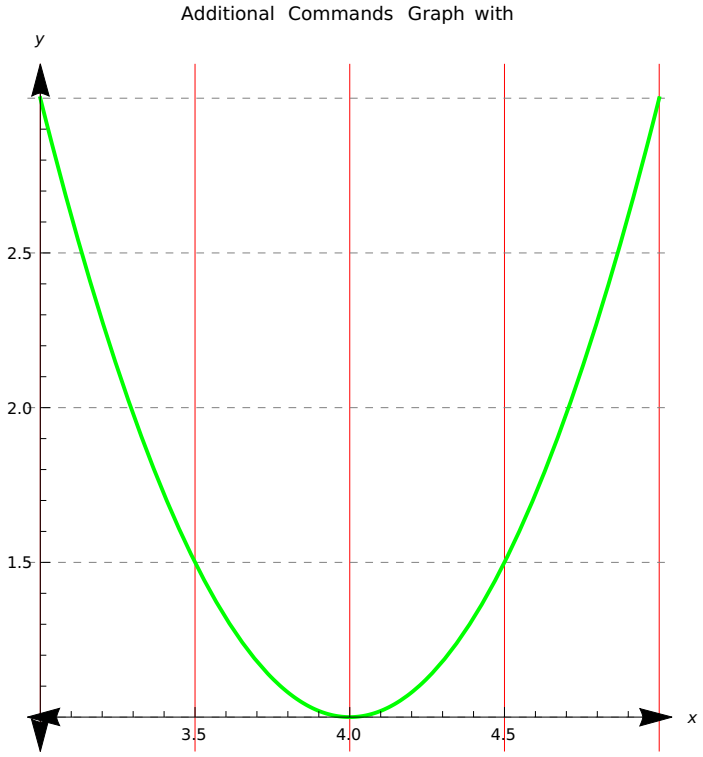
6).**AxesStyle and Arrowheads** – They give arrow as designs to our x and y axis . Written as **AxesStyle → Arrowheads [{– 0.05 , 0.05}]**. Here , 0.05 value means the head will scale to 5 × % of the width of the entire plot .

→ So , let ' s start applying these commands altogether as : –

In[12]:=
```
g[x_] := 2 (x – 4) ^ 2 + 1
```

In[31]:=
```
Plot[g[x], {x, 3, 5}, GridLines → Automatic , GridLinesStyle → {Red, Dashed},
 PlotStyle → {Green, Thick}, AspectRatio → Automatic , AxesLabel → {x, y},
 PlotLabel → Graph with Additional Commands , AxesStyle → Arrowheads [{-0.05, 0.05}]]
```

Out[31]=



Another additional commands we come across are : -

a). Axes → False - If we wan to remove the axes .

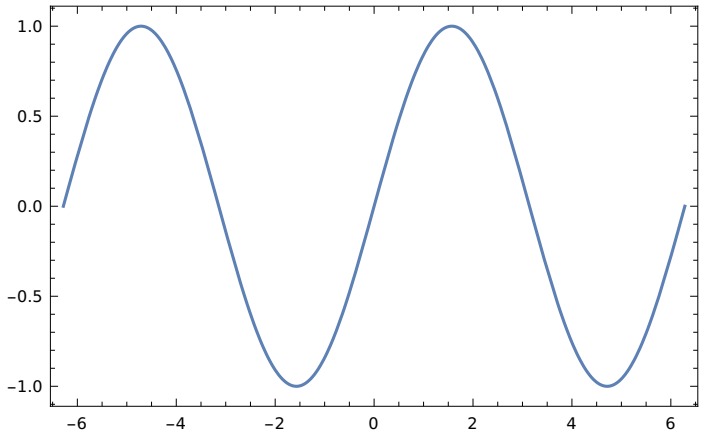
b). Frame → True - If we want our graph to be in a frame .

Usig these commands , we get the following results .

In[32]:=
```
h[x_] := Sin[x]
```

In[33]:=
```
Plot[h[x], {x, -2 π, 2 π}, Axes → False , Frame → True]
```

Out[33]=

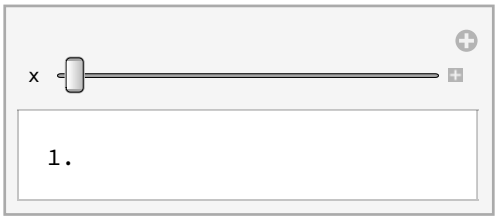


➔ MANIPULATE COMMANDS

We use this command to evaluate a function defined over an interval , say , $1 \le x \le 10$, as given in the below example .

In[34]:=
```
Manipulate[x^2, {x, 1, 10}]
```

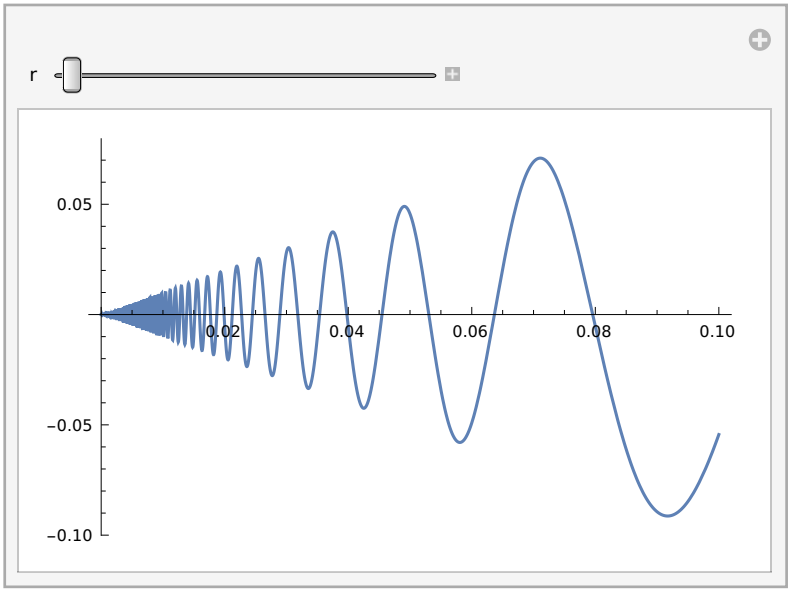
Out[34]=



Now , we can use this command to our plot command as well , to evaluate the result of our graph over any point or value , as follows : -

In[37]:=
```
Manipulate[Plot[x Sin[1 / x], {x, 0, r}], {r, 0.1, 2}]
```

Out[37]=



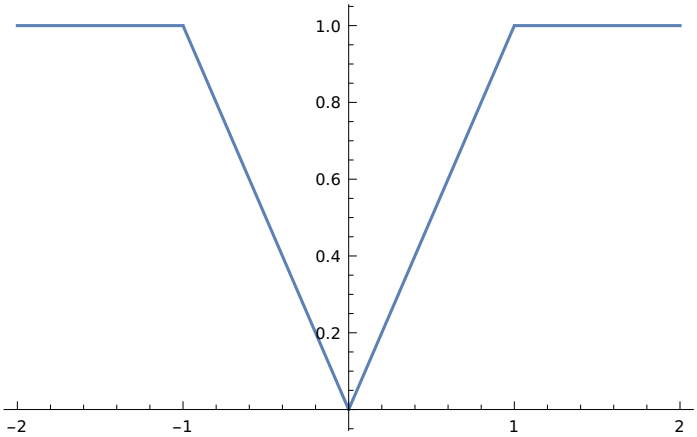
➔ PIECEWISE COMMANDS

Used to define a function possessing different values at different intervals .

In[38]:=
```
k[x_] := Piecewise[{{x, 0 ≤ x ≤ 1}, {-x, -1 < x < 0}}, 1]
```

In[39]:=
```
Plot[k[x], {x, -2, 2}]
```

Out[39]=

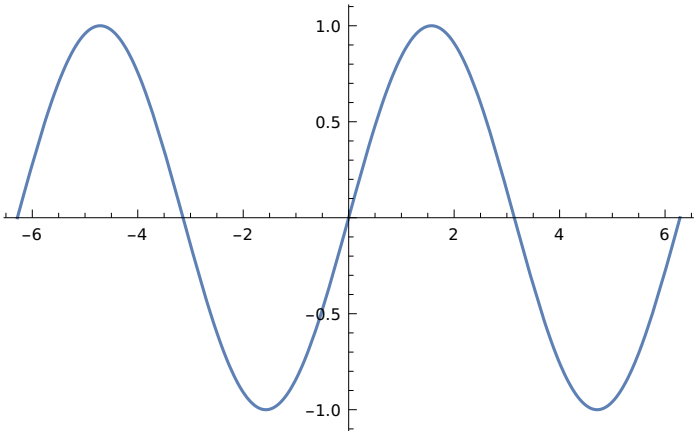


➔ SUPERIMPOSING GRAPHS

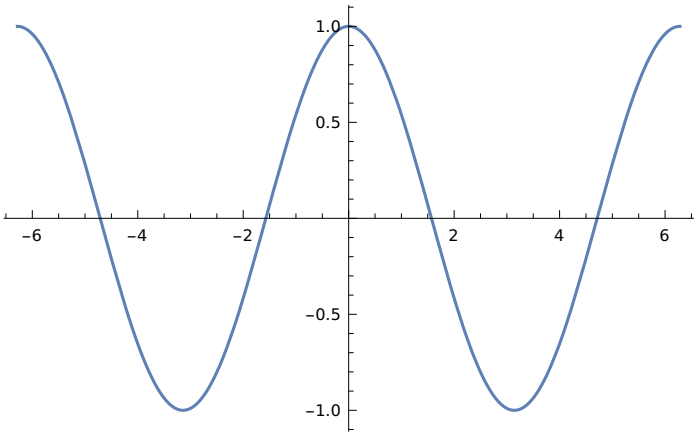
Using MATHEMATICA we can plot two or more graphs on the same plane.

In[42]:=
```
p1 = Plot[Sin[x], {x, -2 Pi, 2 Pi}]
p2 = Plot[Cos[x], {x, -2 Pi, 2 Pi}]
```

Out[42]=



Out[43]=



In[44]:=
```
Show[p1, p2]
```

Out[44]=