- MAT/19/99
  Monika Bhardwaj

EX: 3.2

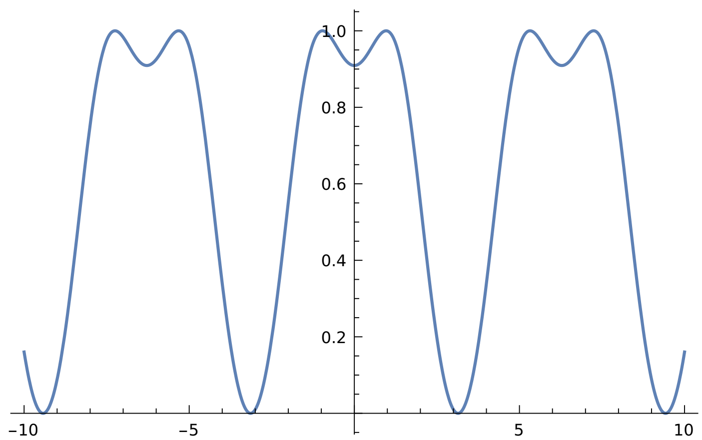
- Q. 1 : PLOT THE FOLLOWING FUNCTIONS ON THE DOMAIN -10≤ x≤10 .

a) sin(1+cos(x))

In[6]:=
```
f[x_] := Sin[1 + Cos[x]]
```

In[7]:=
```
Plot[f[x], {x, -10, 10}]
```

Out[7]=

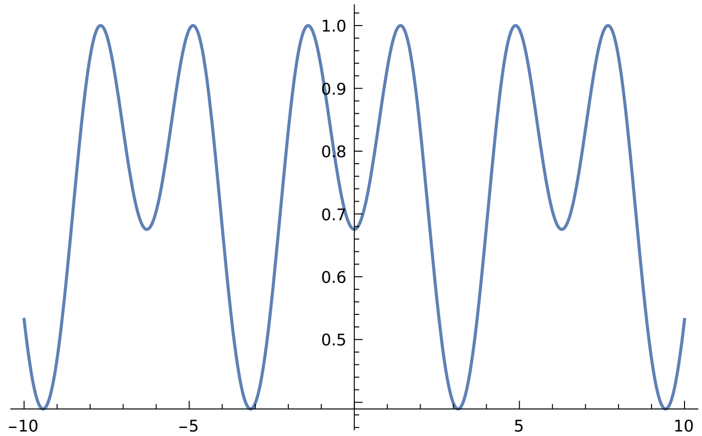


b) sin(1.4+cos(x))

In[8]:=
```
g[x_] := Sin[1.4 + Cos[x]]
```

In[9]:= `Plot[g[x], {x, -10, 10}]`

Out[9]=

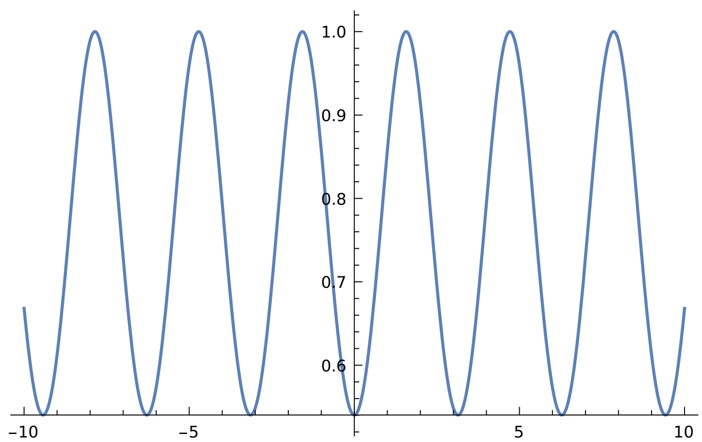


c) sin(pi/2 +cos(x))

In[11]:= `h[x_] := Sin[Pi / 2 + Cos[x]]`

In[12]:= `Plot[h[x], {x, -10, 10}]`

Out[12]=

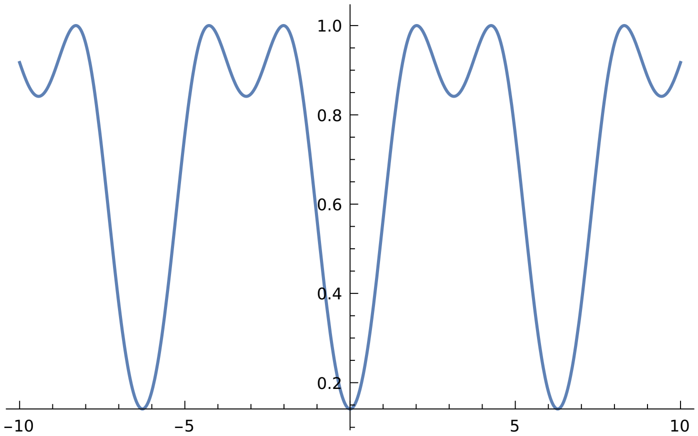


d) sin(2+cos(x))

In[13]:= `f[x_] := Sin[2 + Cos[x]]`

In[14]:=
```
Plot[f[x], {x, -10, 10}]
```

Out[14]=

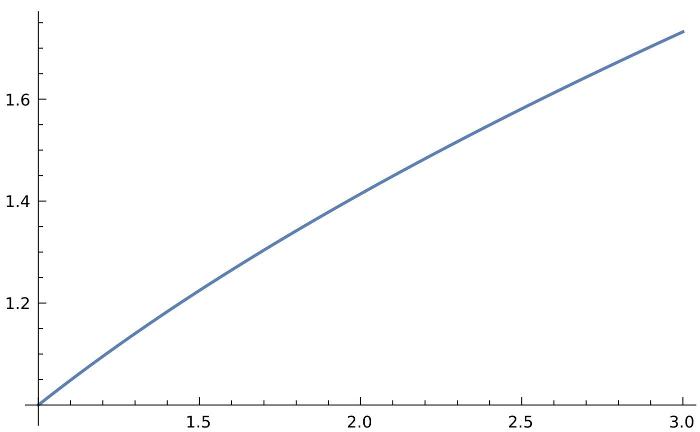


Q2 : CONSIDER THE SQUARE ROOT FUNCTION $f(x) = \sqrt{x}$, WHEN x IS NEAR 2 .

a) Graph of f as x goes from 1 to 3.

In[1]:=
```
With[{δ = 10^0}, Plot[Sqrt[x], {x, 2 - δ , 2 + δ }]]
```

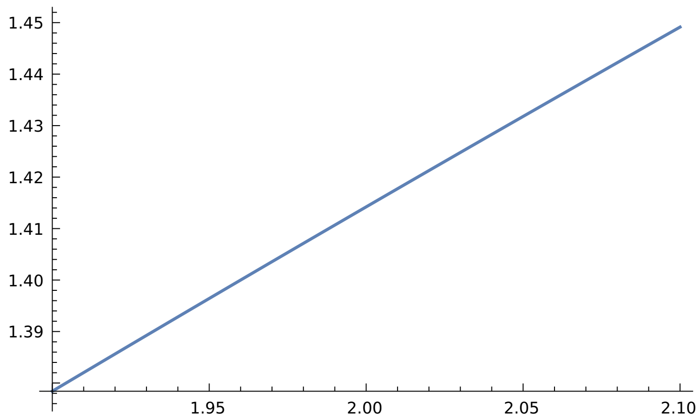
Out[1]=



b) Change the value of δ to be 10^-1 , 10^-2 , 10^-3 and see the graph of f as x goes from 1.9 to 2.1 .

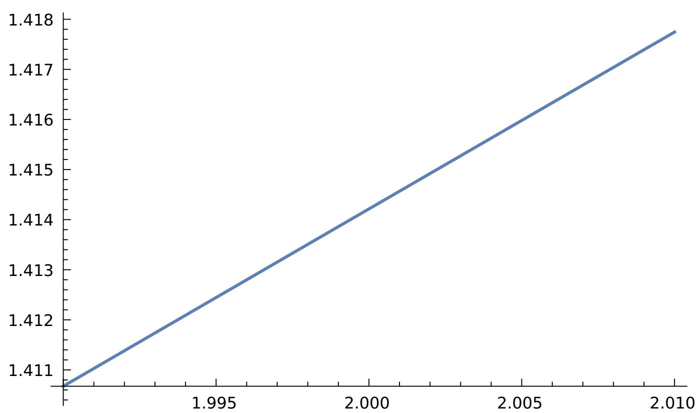
In[2]:=
```
With[{δ = 10 ^ - 1}, Plot[Sqrt[x], {x, 2 - δ , 2 + δ }]]
```

Out[2]=



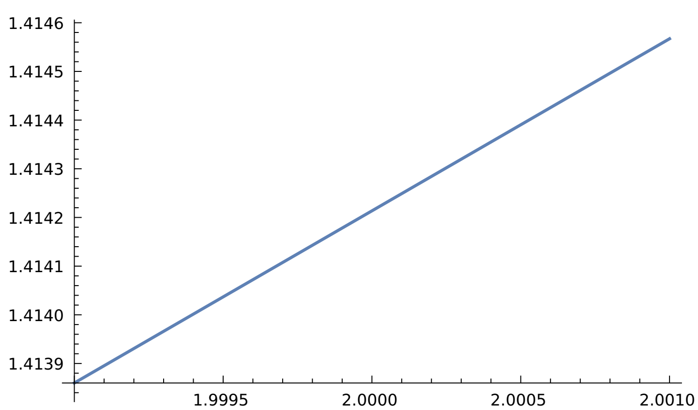
In[3]:=
```
With[{δ = 10 ^ - 2}, Plot[Sqrt[x], {x, 2 - δ , 2 + δ }]]
```

Out[3]=



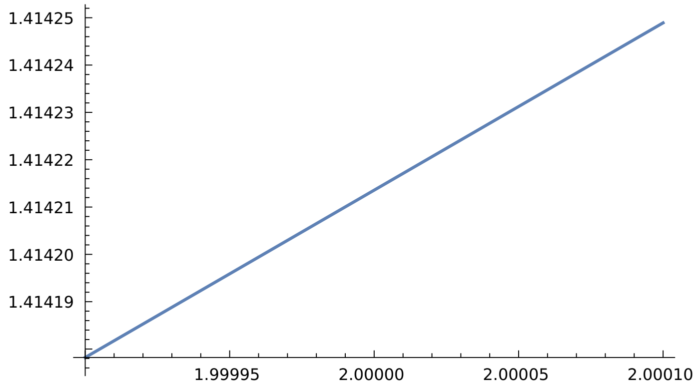
In[4]:=
```
With[{δ = 10 ^ - 3}, Plot[Sqrt[x], {x, 2 - δ , 2 + δ }]]
```

Out[4]=



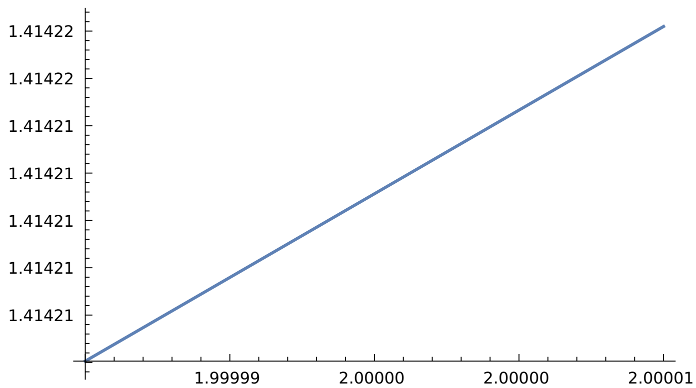
In[5]:= `With[{δ = 10^-4}, Plot[Sqrt[x], {x, 2 - δ , 2 + δ }]]`

Out[5]=



In[6]:= `With[{δ = 10^-5}, Plot[Sqrt[x], {x, 2 - δ , 2 + δ }]]`

Out[6]=



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c) Use the last plot to approximate $\sqrt{2}$ to six significant digits . check your answer using N.

By the above plots we can approximate that $\sqrt{2} = 1.41421$

In[7]:= `N[√ 2, 6]`

Out[7]= `1.41421`

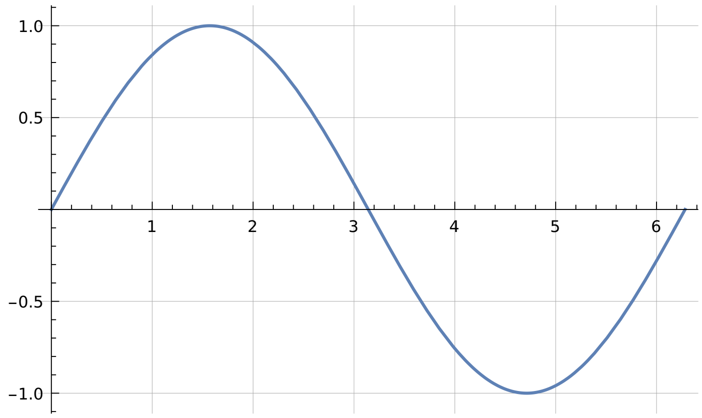
EX : 3.3

- Q.1. USE THE GRIDLINES AND TICK OPTIONS , AS WELL AS

THE SETTING GRIDLINESSTYLE->LIGHTER[GRAY] TO PLOT THE SINE FUNCTION .

In[25]:=
```
Plot[Sin[x], {x, 0, 2 * Pi}, GridLines → Automatic ,
 Ticks → Automatic , GridLinesStyle → Lighter[Gray]]
```

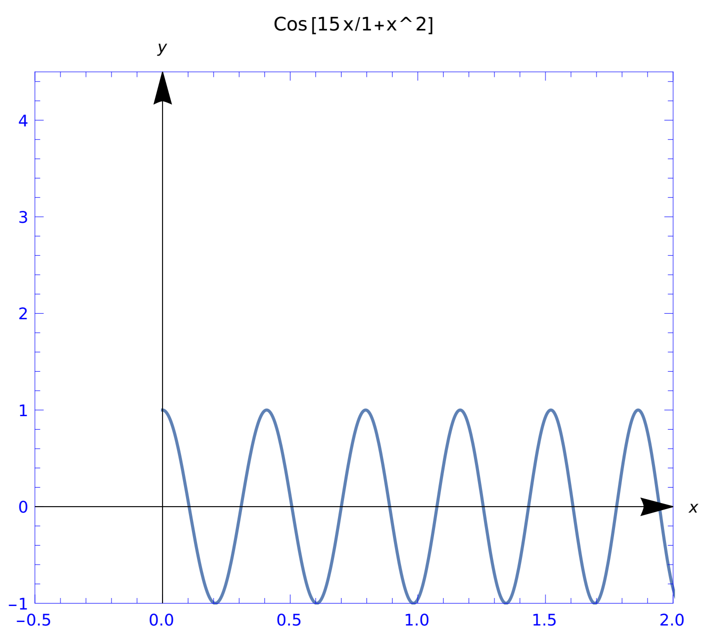
Out[25]=



Q.2. USE THE AXES , FRAME, FILLING , FRAMESTYLE , PLOTRANGE AND ASPECTRATIO OPTIONS TO PLOT Y=Cos(15x)/1+x^2 .

In[26]:=
```
Plot[Cos[15 * x / 1 + x ^ 2], {x, 0, Pi}, PlotRange → {{-0.5, 2}, {-1, 4.5}},
 Frame → True, AxesStyle → Arrowheads[00.05], AspectRatio → 5 / 6, Axes → True,
 AxesLabel → {x, y}, PlotLabel → "Cos[15x/1+x^2]", FrameStyle → Blue]
```

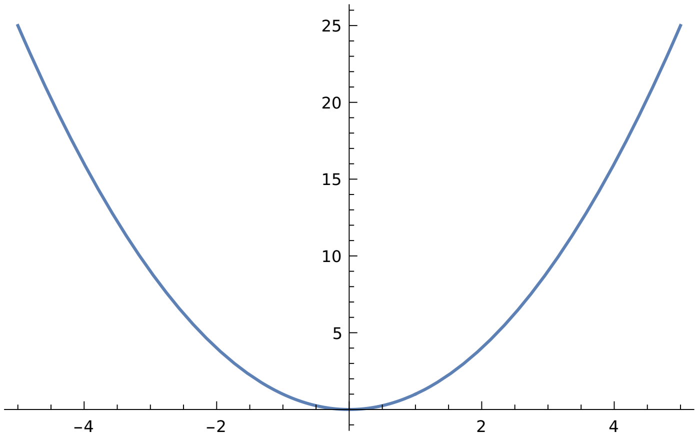
Out[26]=



- Q.4. PLOT THE FUNCTION f(x)=x^2 ON THE DOMAIN -2≤ x≤ 2 AND SET EXCLUSIONS TO x = 1 .

In[27]:=
```
Plot[x^2, {x, -5, 5}, Exclusions → {x == 1}]
```

Out[27]=

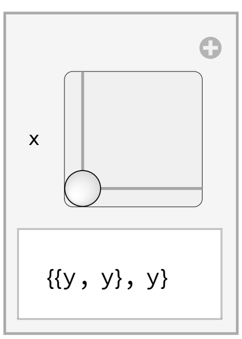


EX: 3.4

- Q.1. MAKE A HAS MANIPULATE OUTPUT {X,Y}, BUT HAS A SINGLE SLIDER2D CONTROLLER.

In[29]:=
```
Manipulate[{x, y}, {x, y, {0, 1}}]
```

Out[29]=

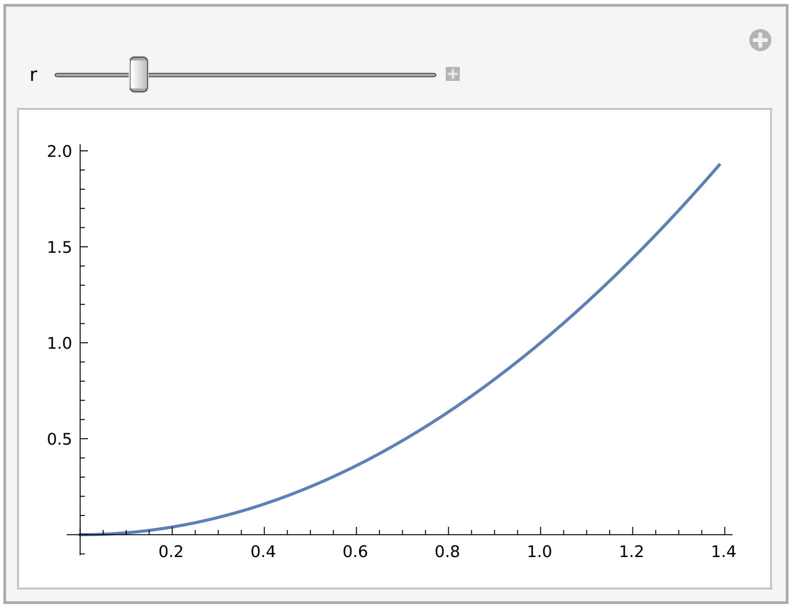


- Q.2. MAKE A MANIPULATE OF A PLOT WHERE THE USER CAN ADJUST THE ASPECTRATIO IN REAL TIME FROM STARTING VALUE OF 1/5 TO AN ENDING VALUE OF 5 .

SET IMAGE SIZE TO{AUTOMATIC128} SO THE HEIGHT REMAINS CONSTANT AS THE SLIDER IS MOVED

In[30]:=
```
Manipulate[Plot[x^2, {x, 0, r}], {r, 1, 3}, ImageSize → {Automatic128}, AspectRatio → 5/6]
```

Out[30]=



EX : 3.5

- Q.1. THE PARTITION COMMAND IS USED TO BREAK A SINGLE LIST INTO SUBLISTS OF EQUAL LENGTH. IT IS USFULL FOR BREAKING UP A LIST INTO ROWS FOR DISPLAYS WITHIN A GRID.

a) Enter the following inputs and discuss the outputs.

```
In[47]:= Range[100]
Out[47]= {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22,
 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41,
 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61,
 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81,
 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100}
```

```
In[38]:= Partition[Range[100], 10]
Out[38]= {{1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, {11, 12, 13, 14, 15, 16, 17, 18, 19, 20},
 {21, 22, 23, 24, 25, 26, 27, 28, 29, 30}, {31, 32, 33, 34, 35, 36, 37, 38, 39, 40},
 {41, 42, 43, 44, 45, 46, 47, 48, 49, 50}, {51, 52, 53, 54, 55, 56, 57, 58, 59, 60},
 {61, 62, 63, 64, 65, 66, 67, 68, 69, 70}, {71, 72, 73, 74, 75, 76, 77, 78, 79, 80},
 {81, 82, 83, 84, 85, 86, 87, 88, 89, 90}, {91, 92, 93, 94, 95, 96, 97, 98, 99, 100}}
```

b) Form a table of the first 100 integers , with twenty digits per row. he first two rows , for example , should look like this :
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

```
In[41]:= Table[x, {x, 1, 100}]
Out[41]= {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22,
 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41,
 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61,
 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81,
 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100}
```

In[42]:=
```
Partition[Table[x, {x, 1, 100}], 20]
```

Out[42]=
```
{{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20},
 {21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40},
 {41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60},
 {61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80},
 {81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100}}
```

c) Make the same table as above , but use only the table and range command.

In[49]:=
```
Table[Range[10], 10]
```

Out[49]=
```
{{1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, {1, 2, 3, 4, 5, 6, 7, 8, 9, 10},
 {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, {1, 2, 3, 4, 5, 6, 7, 8, 9, 10},
 {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, {1, 2, 3, 4, 5, 6, 7, 8, 9, 10},
 {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}}
```

d) Make the same table as above but use only the table command twice . do not use partition or range .

In[50]:=
```
Table[Table[x, {x, 1, 100}]]
```

Out[50]=
```
{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22,
 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41,
 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61,
 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81,
 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100}
```

Q.4. THE SUM COMMAND HAS A SYNTAX SIMILAR TO THAT OF TABLE .

a) Use the sum command to evaluate the following expression:
1^3+2^3+3^3+4^3+5^3+6^3+7^3+8^3+9^3+10^3+11^3+12^3+13^3+14^3+15^3
+16^3+17^3+18^3+19^3+20^3

In[51]:=
```
f[x_] := x^3
```

In[52]:=
```
Sum[f[x], {x, 1, 20}]
```

Out[52]=
```
44 100
```

b) Make a table of values for x=1, 2,.........,10 for the function
f(x)=1+2^x+3^x+4^x+5^x+6^x+7^x+8^x+9^x+10^x+11^x+12^x+13^x+14^x+15^x

+16^x+17^x+18^x+19^x+20^x

In[7]:=
```
f[x_] := 1 + 2 ^ x + 3 ^ x + 4 ^ x + 5 ^ x + 6 ^ x + 7 ^ x + 8 ^ x + 9 ^ x + 10 ^ x +
  11 ^ x + 12 ^ x + 13 ^ x + 14 ^ x + 15 ^ x + 16 ^ x + 17 ^ x + 18 ^ x + 19 ^ x + 20 ^ x
```

In[9]:=
```
Table[f[x], {x, 1, 10}]
```

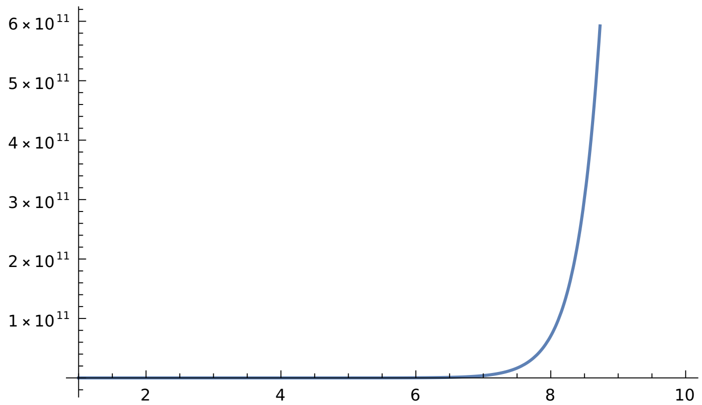
Out[9]=
```
{210 , 2870 , 44 100 , 722 666 , 12 333 300 , 216 455 810 ,
 3 877 286 700 , 70 540 730 666 , 1 299 155 279 940 , 24 163 571 680 850 }
```

c) Plot f(x) on the domain 1≤x≤10.

In[12]:=
```
f[x_] := 1 + 2 ^ x + 3 ^ x + 4 ^ x + 5 ^ x + 6 ^ x + 7 ^ x + 8 ^ x + 9 ^ x + 10 ^ x +
  11 ^ x + 12 ^ x + 13 ^ x + 14 ^ x + 15 ^ x + 16 ^ x + 17 ^ x + 18 ^ x + 19 ^ x + 20 ^ x
```

In[13]:=
```
Plot[f[x], {x, 1, 10}]
```

Out[13]=



EX: 3.6

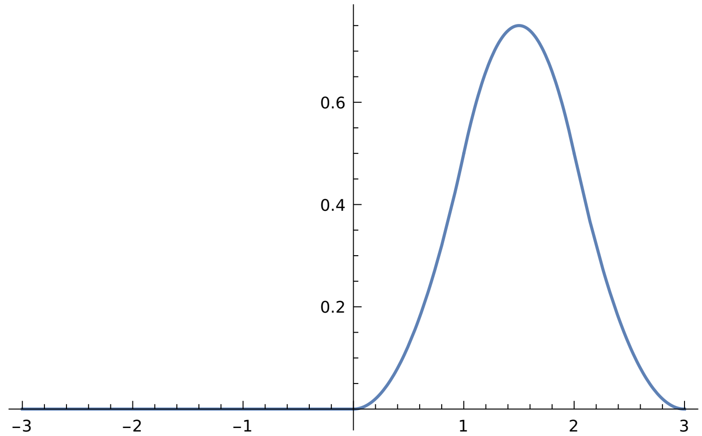
- ## Q.2. MAKE A PLOT OF A PIECEWISE FUNCTION BELOW AND COMMENT ON ITS SHAPE.

ff(x)={0, x<0 ;
x^2/2, 0≤x<1;
-x^2+3x-3/2, 1≤x<2
(1/2)(3-x)^2 , 2≤x<3
0, x≤3

In[32]:=
```
f[x_] := Piecewise[{{0, x < 0}, {x ^ 2 / 2, 0 ≤ x < 1},
   {-x ^ 2 + 3 x - 3 / 2, 1 ≤ x < 2}, {(1 / 2) (3 - x) ^ 2, 2 ≤ x < 3}, {0, x ≤ 3}}]
```

In[34]:= `Plot[f[x], {x, -3, 3}]`

Out[34]=



Q.3. A STEP FUNCTION ASSUMES A CONSTANT VALUE BETWEEN CONSECUTIVE INTEGERS N AND N+1 . MAKE A PLOT OF THE STEP FUNCTION f(X) WHOSE VALUE IS N^2 WHEN N ≤X<N+1. USE THE DOMAIN 0≤X≤20

In[30]:= `f[x_] := Piecewise[{{n^2, n ≤ x < n + 1}, {1, n ≤ x ≤ n + 1}}]`

In[35]:= `Plot[f[x], {x, 0, 20}]`

Out[35]=