CHAPTER - 3 EXERCISE

EX 3.2

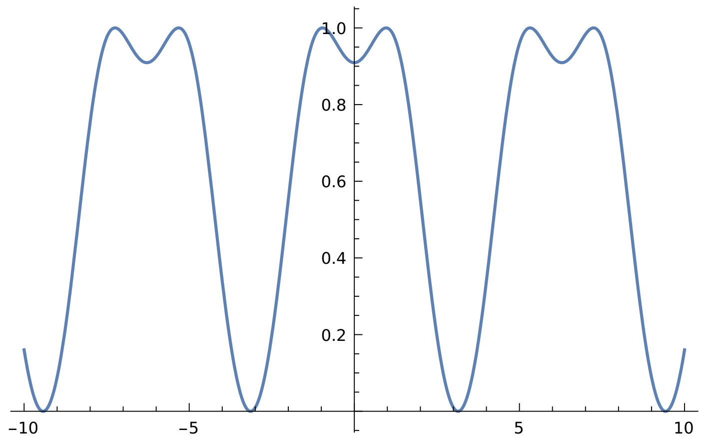
Q1. Plot the following functions on the domain -10≤x≤10

a) Sin(1+Cos(x))

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

In[2]:=
```
Plot[f[x], {x, -10, 10}]
```

Out[2]=

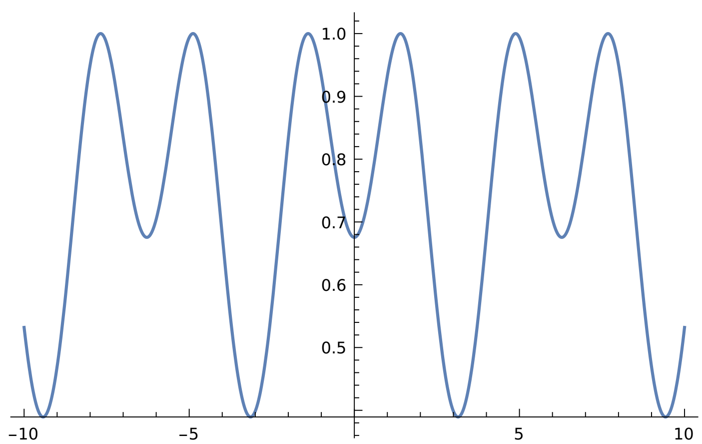


b) Sin(1.4+Cos(x))

In[3]:=
```
f[x_] := Sin[1.4 + Cos[x]]
```

In[4]:=
```
Plot[f[x], {x, -10, 10}]
```

Out[4]=

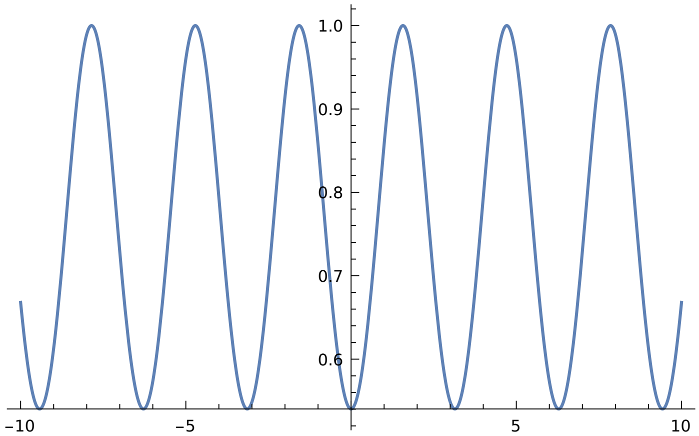


c) Sin(pi/2+Cos(x))

In[5]:=
```
f[x_] := Sin[Pi / 2 + Cos[x]]
```

In[6]:=
```
Plot[f[x], {x, -10, 10}]
```

Out[6]=

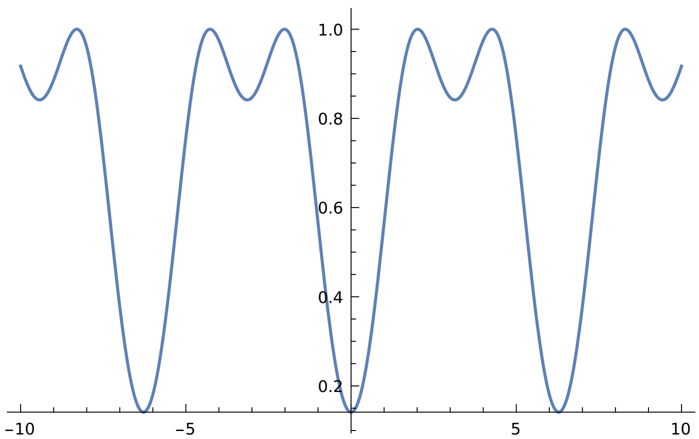


d) Sin(2+Cos(x))

In[7]:=
```
f[x_] := Sin[2 + Cos[x]]
```

In[8]:=
```
Plot[f[x], {x, -10, 10}]
```

Out[8]=

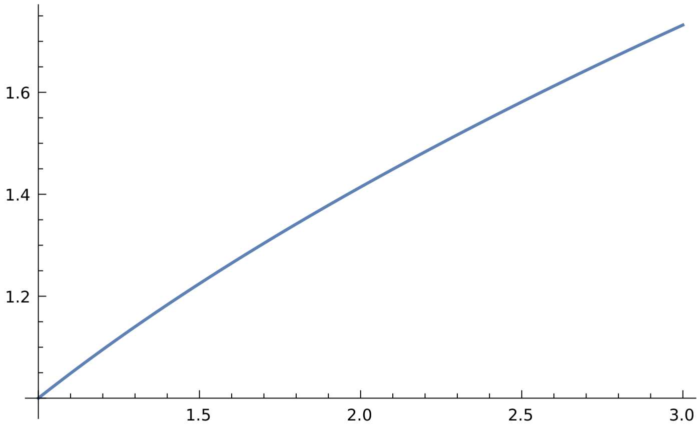


Q2. One can zoom in toward a particular point in the domain of a function and see how the graph appears at different zoom levels.

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

In[9]:=
```
With[{δ = 10 ^ 0}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

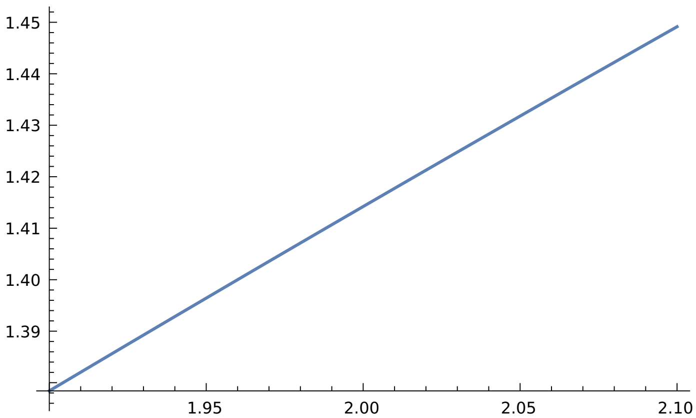
Out[9]=



b) Change the value of δ to be 10^(-1) and re-enter the input above to see the graph of f as x goes from 1.9 to 2.1. Do this again for δ=10^(-2) , 10^(-3) , 10^(-4), and 10^(-5).

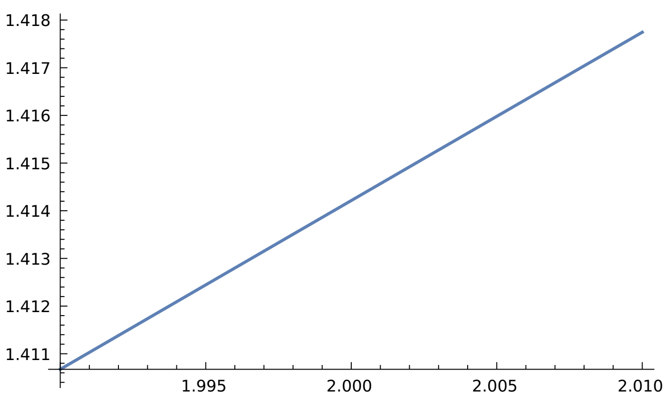
In[10]:=
```
With[{δ = 10 ^ (-1)}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

Out[10]=

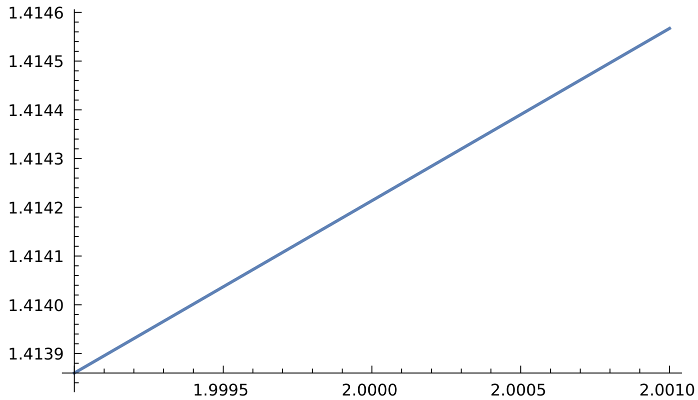


In[11]:=
```
With[{δ = 10 ^ (-2)}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

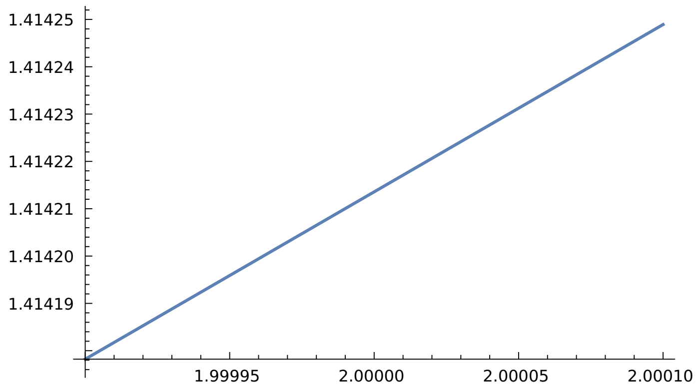
Out[11]=



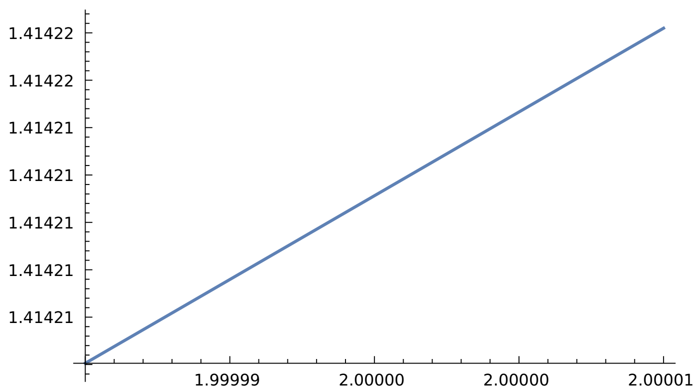
In[12]:= **With[{δ = 10 ^ (-3)}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]**

Out[12]=


In[13]:= **With[{δ = 10 ^ (-4)}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]**

Out[13]=


In[14]:= **With[{δ = 10 ^ (-5)}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]**

Out[14]=


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

By the above plot we can approximate that √2 = 1.41421

In[15]:= **N[√2, 6]**

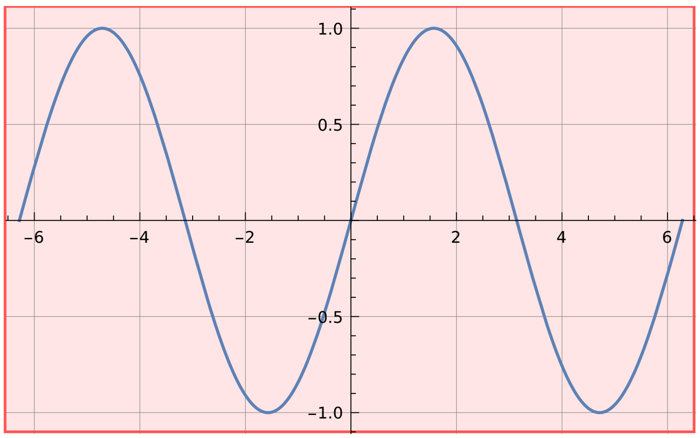
Out[15]= 1.41421

EX 3.3

Q1. Use the GRIDLINES and TICKS options, as well as the setting GridLinesStyle→ Lighter[Gray], to produce the following plot of the sine function:

In[17]:=
```
Plot[Sin[x], {x, -2 Pi, 2 Pi}, GridLines → Automatic,
 Ticks → Automatic, GridLinesStyle → Light[Gray]]
```

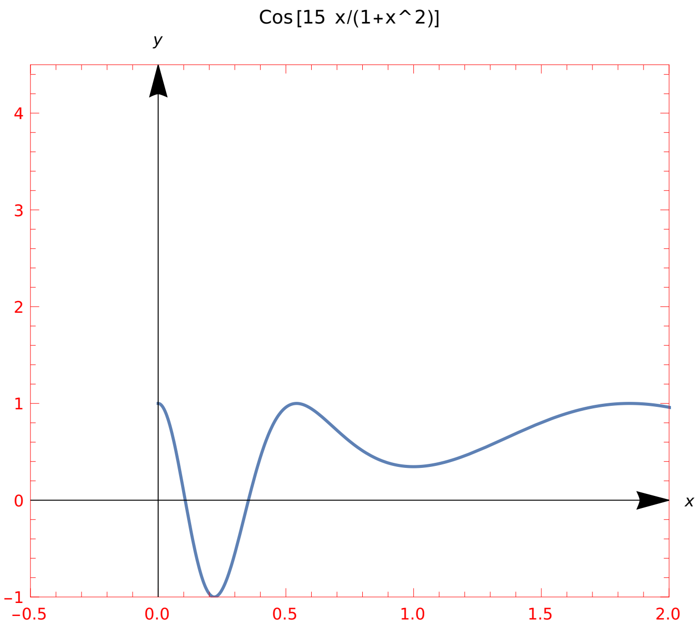
Out[17]=



Q2. Use the AXES, FRAME, FILLING FRAMESTYLE, PLOTRANGE and ASPECTRATIO options to produce the plot of the function
y=Cos(15 x)/1+x^2 :

In[18]:=
```
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[15  x/(1+x^2)]", FrameStyle → Red]
```

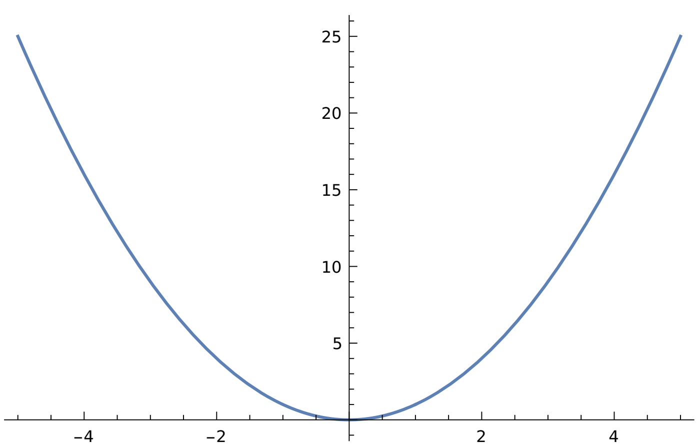
Out[18]=



Q4. Plot the function f(x)=x^2 on the domain -2≤x≤2, and set EXCLUSIONS to {x=1} such that f has no vertical assymptote at x=1.

In[19]:=
```
Plot[x ^ 2, {x, -5, 5}, Exclusions → {x == 1}]
```

Out[19]=

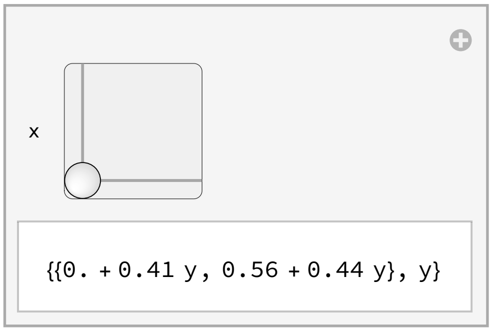


EX 3.4

Q1. Make a MANIPULATE that has output [x,y], but has a single SLIDER2D controller.

In[20]:=
```
Manipulate[{x, y}, {x, y, {0, 1}}]
```

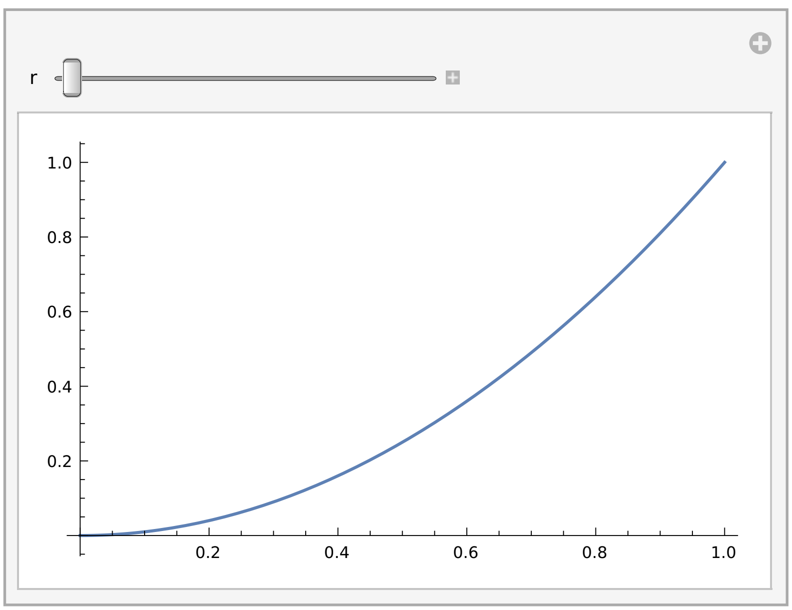
Out[20]=



Q2. Make a MANIPULATE of a PLOT where the user can adjust the ASPECTRATIO in real time, from a starting value of 1/5 to an ending value of 5. Set IMAGESIZE to {AUTOMATIC,128} so the height remains constant as the slider is moved.

In[21]:=
```
Manipulate[Plot[x^2, {x, 0, r}], {r, 1, 3}, ImageSize → {Automatic128}, AspectRatio → 5/6]
```

Out[21]=



EX 3.5

Q1. The PARTITION command is used to break a single list into sublists of equal length. It is useful for breaking up a list into rows for display within a GRID.

a) Enter the following inputs and discuss the outputs.

```
In[22]:= Range[100]

Out[22]= {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[23]:= Partition[Range[100], 10]

Out[23]= {{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) Format a table of the first 100 integers, with 20 digits per row . The 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[24]:= Table[x, {x, 1, 100}]

Out[24]= {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[25]:= Partition[Table[x, {x, 1, 100}], 20]

Out[25]= {{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 commands. Do not use PARTITION.

In[26]:=
```
Table[Range[10], 10]
```

Out[26]=
```
{{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[27]:=
```
Table[Table[x, {x, 1, 100}]]
```

Out[27]=
```
{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}
```

Q4. 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[28]:=
```
f[x_] := x ^ 3
```

In[29]:=
```
Sum[f[x], {x, 1, 20}]
```

Out[29]=
```
44 100
```

b) Make a table of values foe 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[30]:=
```
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
```

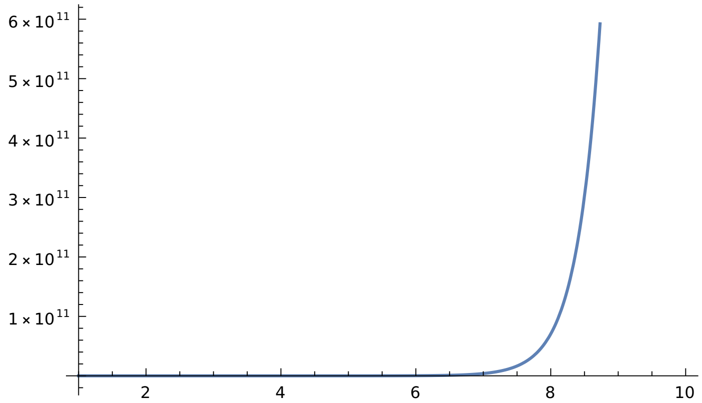
In[31]:=
```
Table[f[x], {x, 1, 10}]
```

Out[31]=
```
{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[32]:=
```
Plot[f[x], {x, 1, 10}]
```

Out[32]=



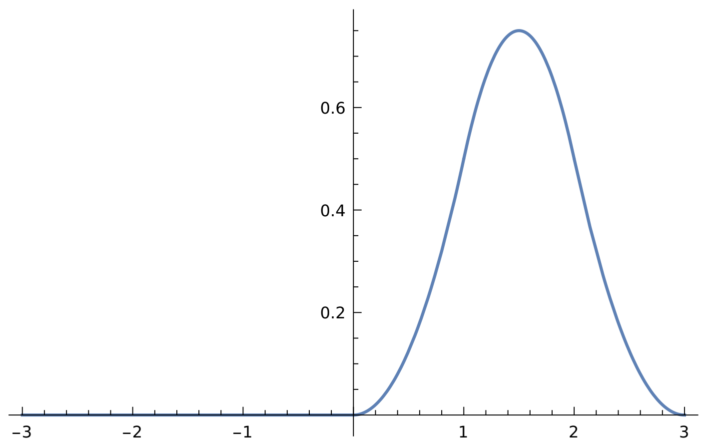
EX 3.6

Q2. Make a plot of the piecewise function below, and comment on its shape.

In[33]:=
```
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]=



Q3. 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[43]:=
```
f[x_] := Piecewise[{{n ^ 2, n ≤ x < n + 1}, {1, n ≤ x < n + 1}}]
```

In[46]:= `Plot[f[x], {x, 0, 20}]`

Out[46]=