Jyoti
MAT/19/80

CHAPTER-3

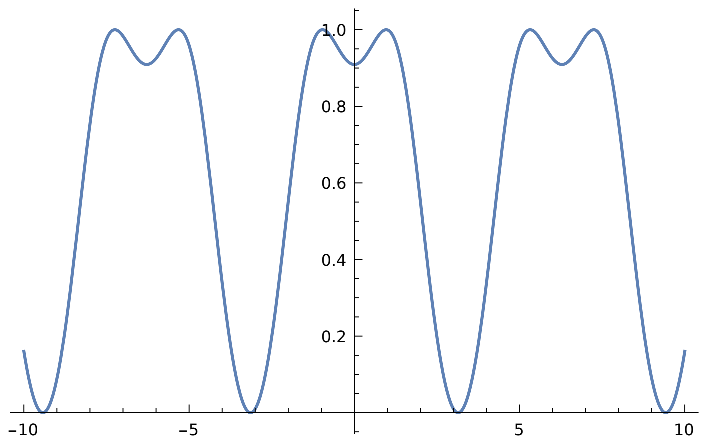
SEC :- 3.2

Ques1. Plot the functions on the domain -10< x <10.

a) sin(1+cos(x))

In[4]:=
```
Plot[Sin[1 + Cos[x]], {x, -10, 10}]
```

Out[4]=

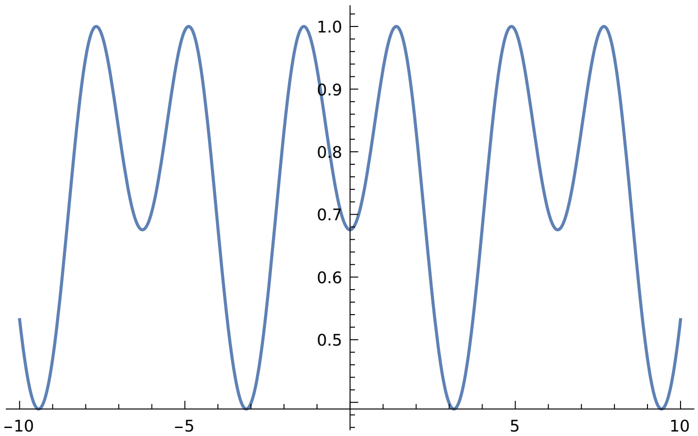


b) sin(1.4+cos(x))

In[6]:=

```
Plot[Sin[1.4 + Cos[x]], {x, -10, 10}]
```

Out[6]=

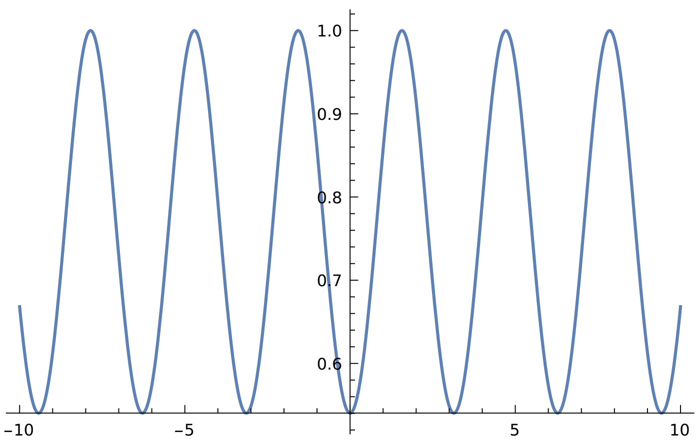


c) sin(π/2+cos(x))

In[7]:=

```
Plot[Sin[Pi / 2 + Cos[x]], {x, -10, 10}]
```

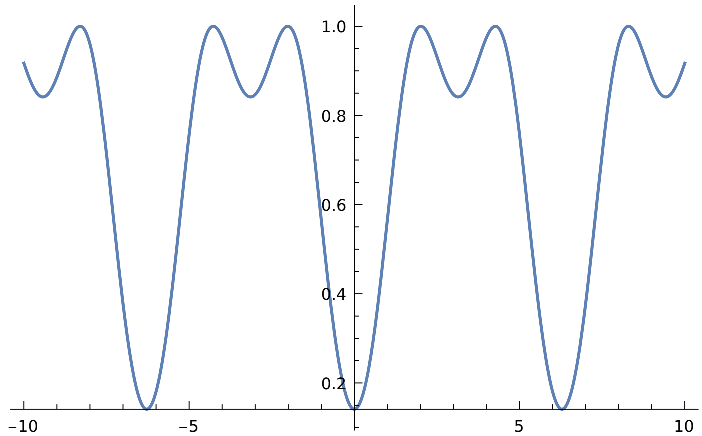
Out[7]=



d) sin(2+cos(x))

In[8]:=
```
Plot[Sin[2 + Cos[x]], {x, -10, 10}]
```

Out[8]=

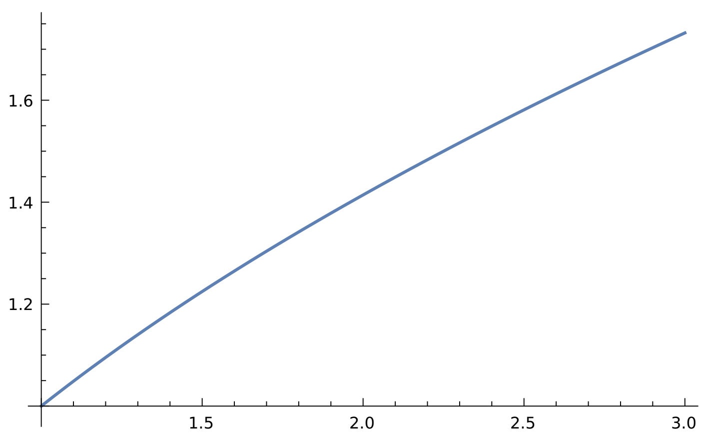


Ques2.One can zoom in toward a particular point in the domain of a function and see how the graph appears at different zoom levels. For instance, consider the square root function f (x)=$\sqrt{x}$ when x is near 2.

a) Enter the input given to see the graph as x ranges from 1 to 3.

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

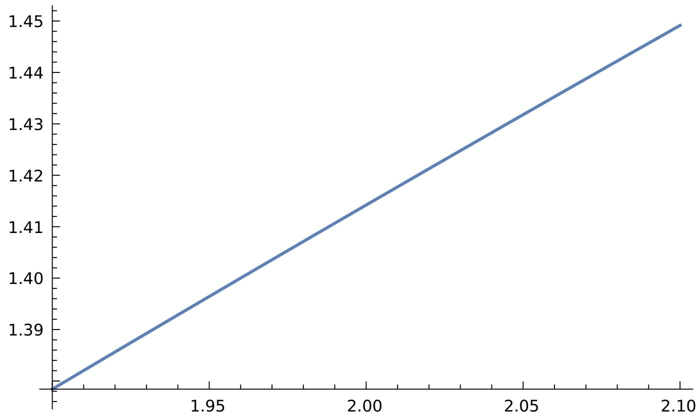
Out[9]=



b) Change the value of δ t o 10^-1,10^-2,10^-3,10^-4,10^-5.

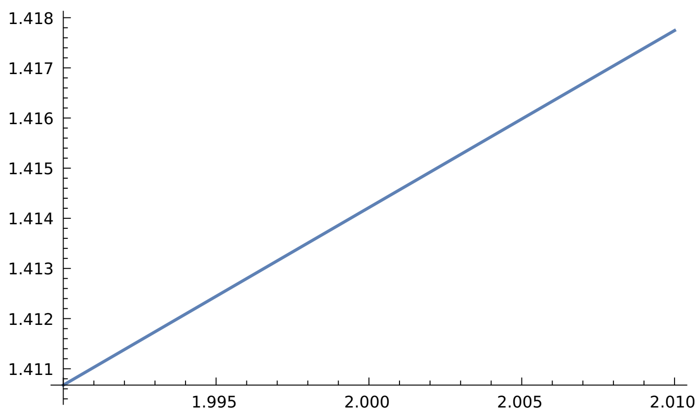
In[12]:=
```
With[{δ = 10 ^ -1}, Plot[√x, {x, 2 - δ, 2 + δ}]]
```

Out[12]=



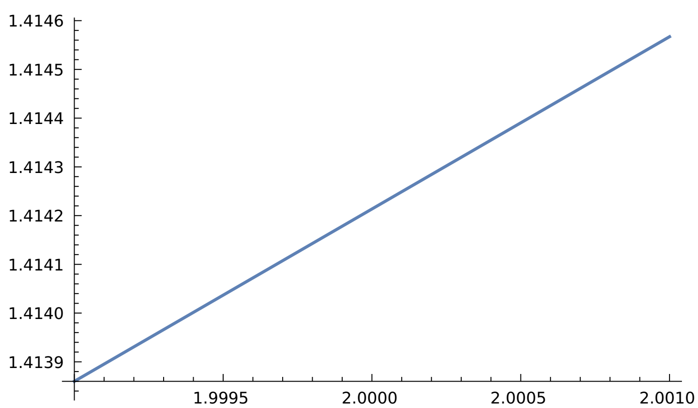
In[13]:=
```
With[{δ = 10 ^ -2}, Plot[√x, {x, 2 - δ, 2 + δ}]]
```

Out[13]=



In[14]:=
```
With[{δ = 10 ^ -3}, Plot[√x, {x, 2 - δ, 2 + δ}]]
```

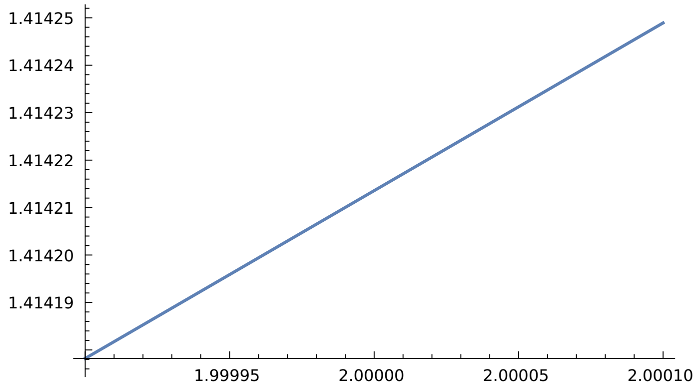
Out[14]=



In[15]:=

```
With[{δ = 10^-4}, Plot[√x, {x, 2 - δ, 2 + δ}]]
```

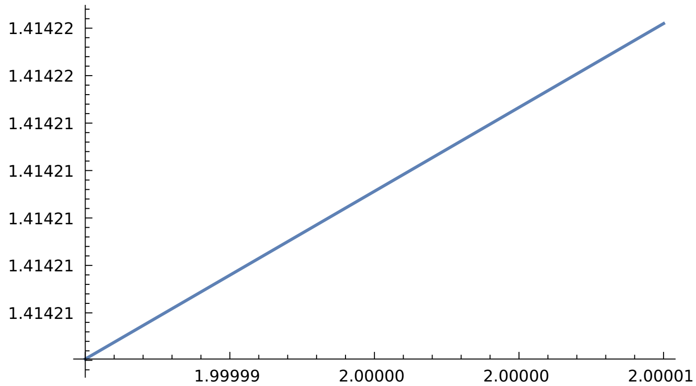
Out[15]=



In[16]:=

```
With[{δ = 10^-5}, Plot[√x, {x, 2 - δ, 2 + δ}]]
```

Out[16]=



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

In[17]:=

```
N[√2]
```

Out[17]=

```
1.41421
```

d) Plot $\sqrt{x}$ using δ=10^-20.

In[18]:=
```
With[{δ = 10^-20}, Plot[√x, {x, 2 - δ, 2 + δ}]]
```

Plot : Endpoints for x in $\left\{x, \frac{1999999999999999999999}{1000000000000000000000}, \frac{2000000000000000000001}{1000000000000000000000}\right\}$ must have distinct machine -precision numerical values .

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General : Further output of Plot::plld will be suppressed during this calculation .

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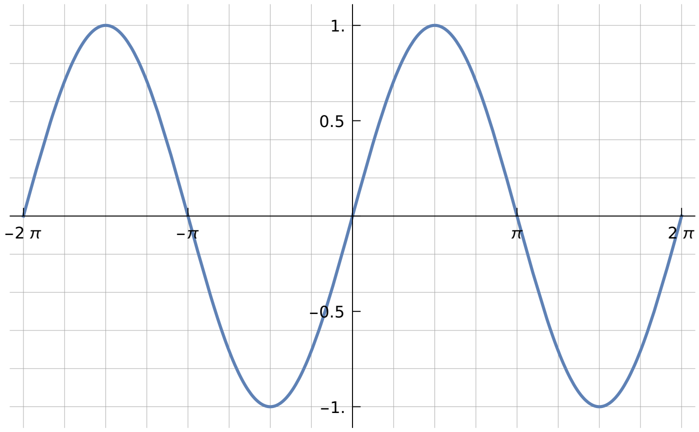
General : Further output of Plot::plld will be suppressed during this calculation .

Out[18]= $\text{Plot}\left[\sqrt{x}, \left\{x, 2 - \frac{1}{100\,000\,000\,000\,000\,000\,000}, 2 + \frac{1}{100\,000\,000\,000\,000\,000\,000}\right\}\right]$

SEC :- 3.3

Ques1.Use the GridLines and Ticks options, as well as the setting GridLinesStyle -> Lighter[Gray] to Plot of the sine function:

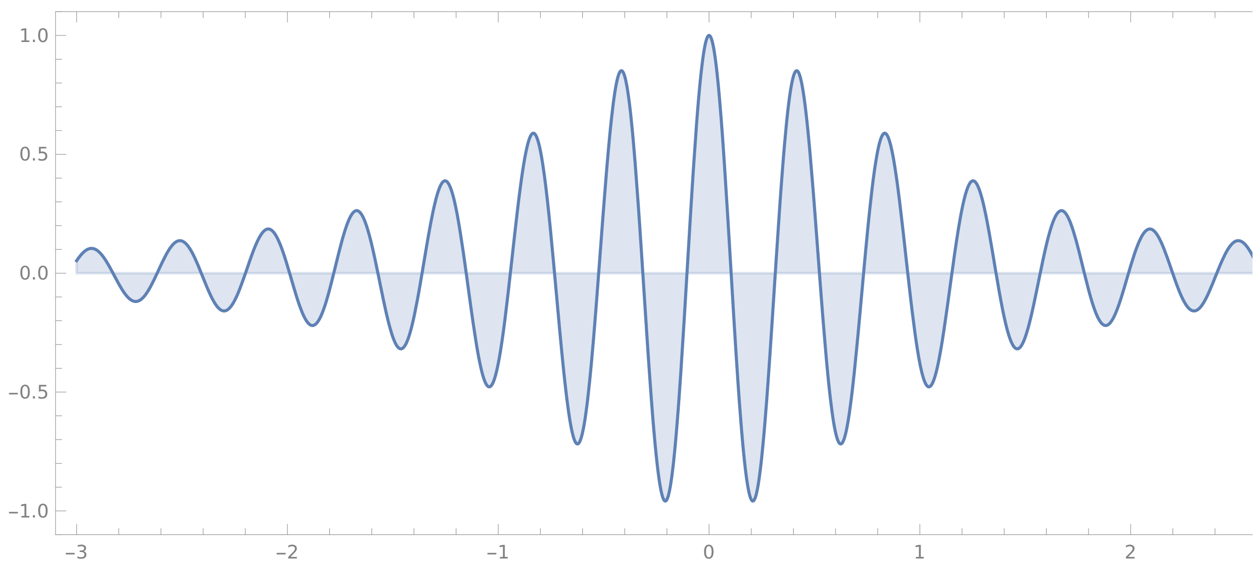
In[22]:=
```
Plot[Sin[x], {x, -2 Pi, 2 Pi}, GridLines → {Range[-2 Pi, 2 Pi, Pi / 4], Range[-1, 1, 0.2]},
 Ticks → {Range[-2 Pi, 2 Pi, Pi], Range[-1, 1, 0.5]}, GridLinesStyle → Lighter[Gray]]
```



Ques2.. Use the Axes, Frame, Filling, FrameStyle, PlotRange, and AspectRatio options to plot of the function y =cos(15 x)/ (1+x^2) :

In[66]:=
```
Plot[(Cos[15 x]) / (1 + x ^ 2), {x, -3, 3}, Axes → False, PlotRange → {{-3.1, 3.1}, {-1.1, 1.1}},
 Frame → True, FrameStyle → Directive[Gray, 10], AspectRatio → 2 / 5, Filling → Axis]
```

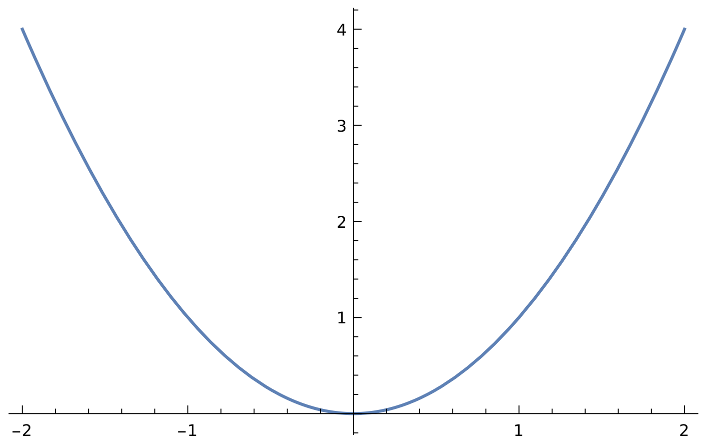
Out[66]=



Ques4.. Plot the function f (x)= x^2 on the domain -2 ≤ x ≤2, and set Exclusions to [x == 1]. Note that f has no vertical asymptote at x= 1. What happens?

In[70]:=
```
Plot[x^2, {x, -2, 2}, Exclusions → {x == 1}]
```

Out[70]=

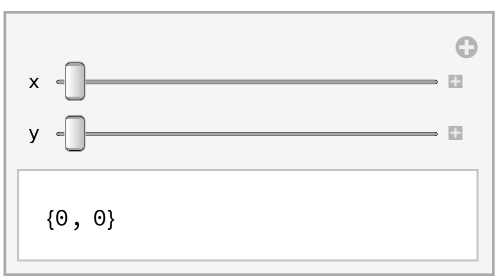


SEC :- 3.4

Ques1.. The following simple Manipulate has two sliders: one for x and one for y. Make a Manipulate that also has output {x,y}, but that has a single Slider2D controller.

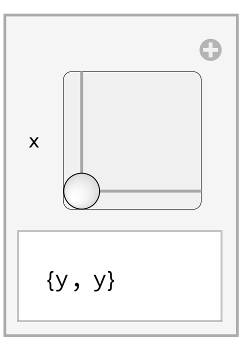
In[119]:=
```
Manipulate[{x, y}, {x, 0, 1}, {y, 0, 1}]
```

Out[119]=



In[120]:=
```
Manipulate[{x, y}, {{x, y}, {0, 0}, {1, 1}}]
```

Out[120]=

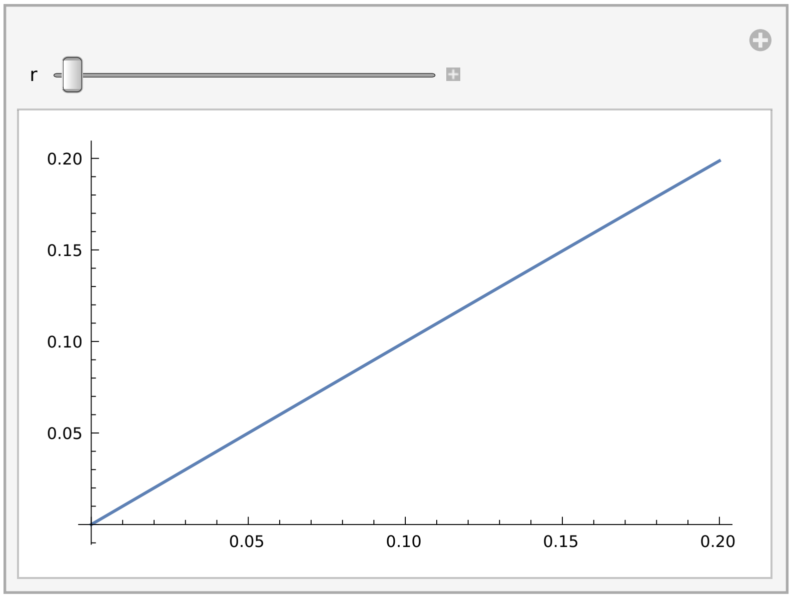


Ques2.Make a Manipulate of a Plot where the user can adjust the AspectRatio in

real time, from a starting value of 1 / 5 (five times as wide as it is tall) to an ending value of 5 (five times as tall as it is wide). Set ImageSize to [Automatic, 128]so the height remains constant as the slider is moved.

In[121]:=
```
Manipulate[Plot[Sin[x], {x, 0, r}], {r, 1/5, 5}, AspectRatio → {Automatic, 128}]
```

Out[121]=



SEC :- 3.5

Ques1.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.
Range[100]
Partition[Range[100],10]

In[13]:=
```
Range[100]
```

Out[13]=
```
{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[17]:=
```
Partition[Range[100], 10]
```

Out[17]=
```
{{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}}
```

```
The partition command broke down the single
  list of numbers from 1 to 100 into sublists of length = 10.
```

b) Format a table of the first 100 integers, with twenty 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[19]:=
```
Grid[Partition[Range[100], 20]]
```

Out[19]=

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[65]:=
```
Grid[Table[Range[x, x + 19], {x, {1, 21, 41, 61, 81}}]]
```

Out[65]=

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

d) Make the same table as above, but use only the Table command (twice). Do not use Partition or Range.

In[70]:=
```
f[x_] := x
```

In[76]:=
```
Grid[Table[Table[f[x], {x, x, x + 19}], {x, {1, 21, 41, 61, 81}}]]
```

Out[76]=

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

Ques4. 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[77]:= f[x_] := x ^ 3

In[79]:= Sum[f[x], {x, 1, 20}]

Out[79]= 44 100
```

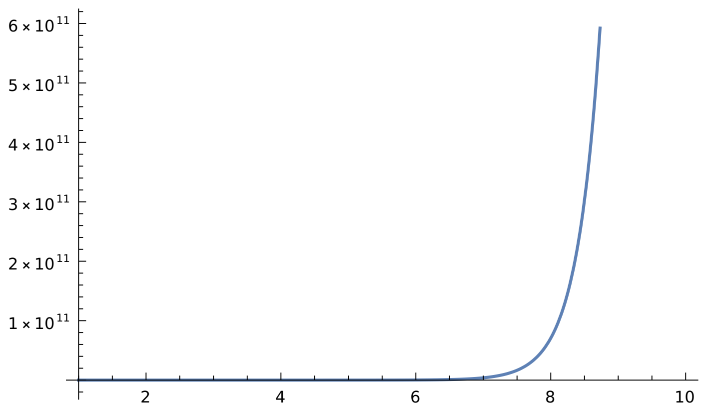
b) Make a table of values for x 1, 2, ... ,10 for the function f (x)= 1 +2^x +3^x + 4^x + 5^x + 6^x + 7^x + 8^x + 9^x + 10^x + 11^x + 12^x + 13^x + 14^x + 15^x + 16^x + 17^x + 18^x + 19^x + 20^x

```
In[93]:= f[a_] := a ^ x

In[82]:= Table[Sum[f[a], {a, 1, 20}], {x, 1, 10}]

Out[82]= {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[94]:= g[x_] := Sum[f[a], {a, 1, 20}]

In[95]:= Plot[g[x], {x, 1, 10}]
```

Out[95]=



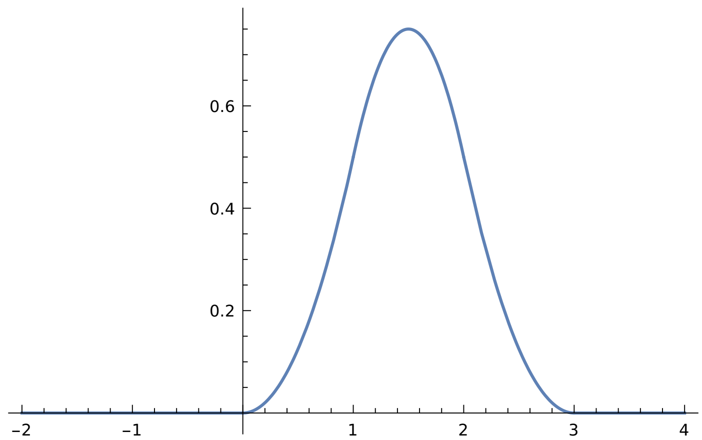
SEC :- 3.6

Ques2. Make a plot of the piecewise function, and comment on its shape.

In[97]:=
```
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, 3 ≤ x}}]
```

In[100]:=
```
Plot[f[x], {x, -2, 4}]
```

Out[100]=



Ques3.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[141]:=
```
f[x_] := Piecewise[{{n ^ 2, n ≤ x < n + 1}}, Element[n, Integer]]
```

In[142]:=
```
Plot[f[x], {x, 0, 20}]
```

Out[142]=