
Sakshi Gairola

MAT/19/94

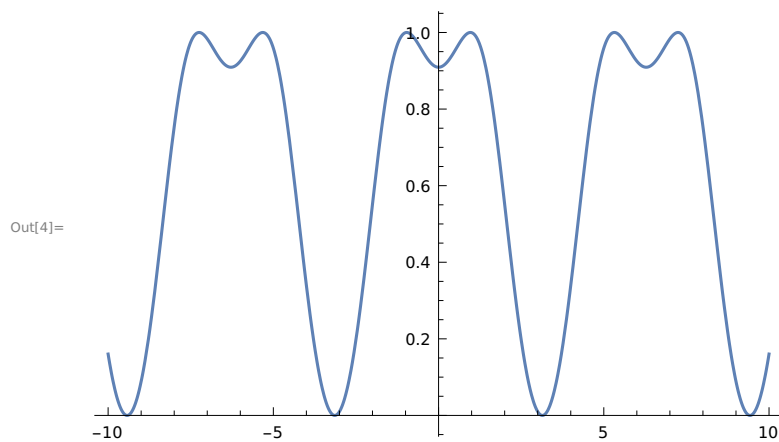
CHAPTER-3

SEC :- 3.2

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

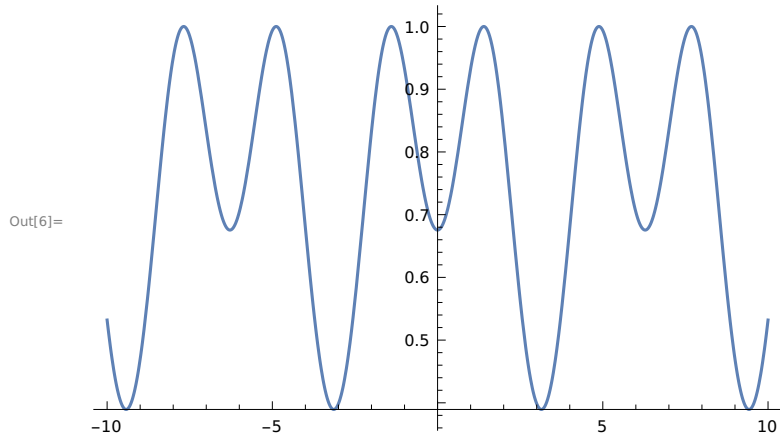
a) $\sin(1+\cos(x))$

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

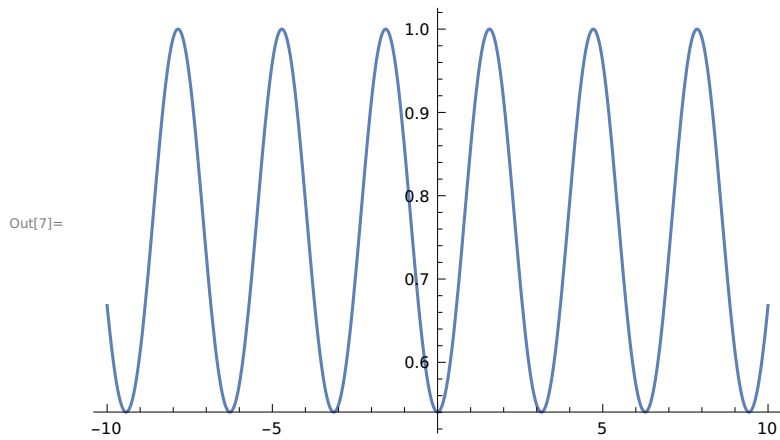


b) $\sin(1.4 + \cos(x))$

```
In[6]:= Plot[Sin[1.4 + Cos[x]], {x, -10, 10}]
```

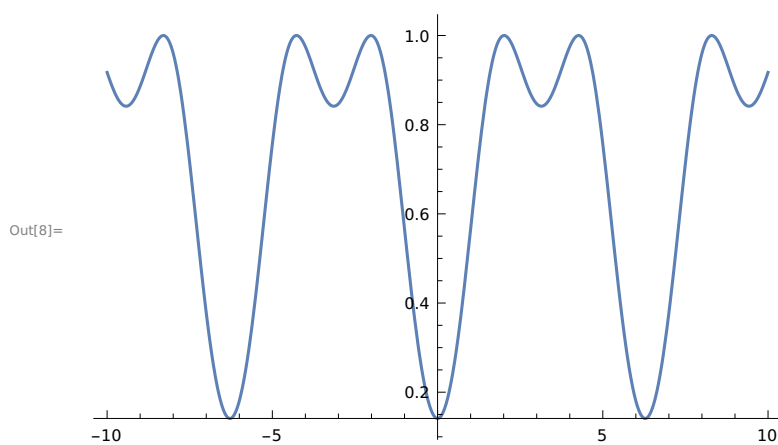
c) $\sin(\pi/2 + \cos(x))$

```
In[7]:= Plot[Sin[Pi / 2 + Cos[x]], {x, -10, 10}]
```



d) $\sin(2+\cos(x))$

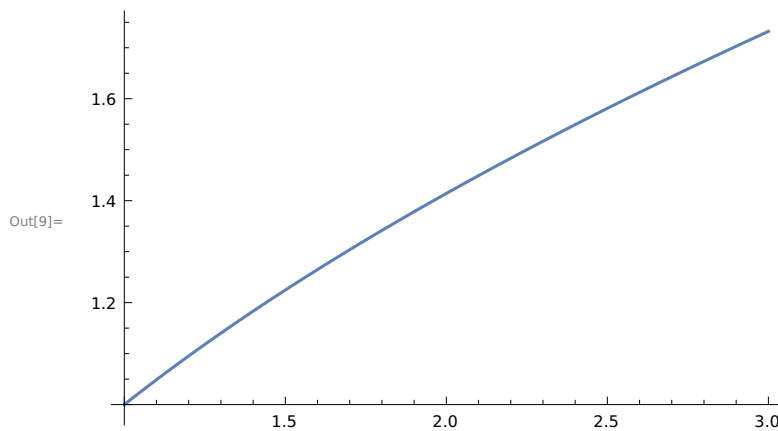
In[8]:= `Plot[Sin[2 + Cos[x]], {x, -10, 10}]`



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.

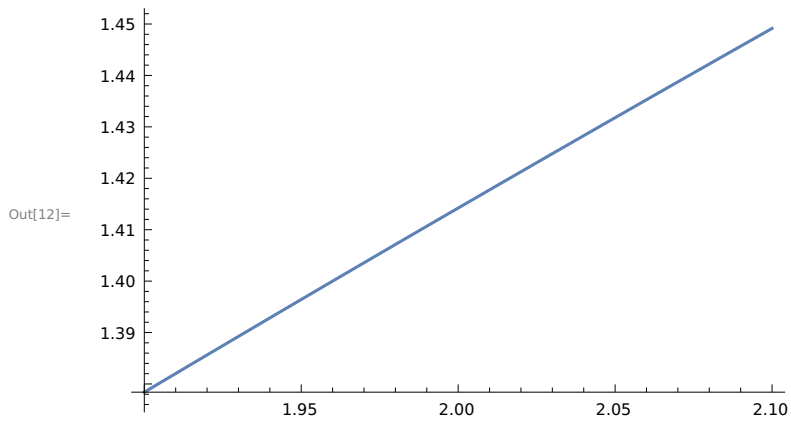
a) Enter the input given to see the graph as x ranges from 1 to 3.

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

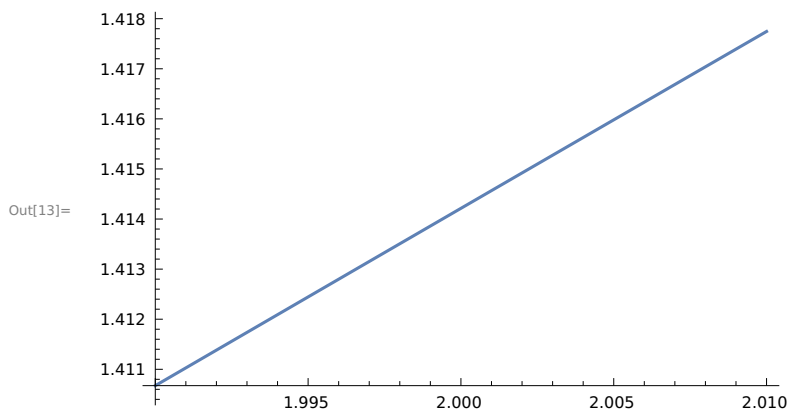


b) Change the value of δt to $10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}$.

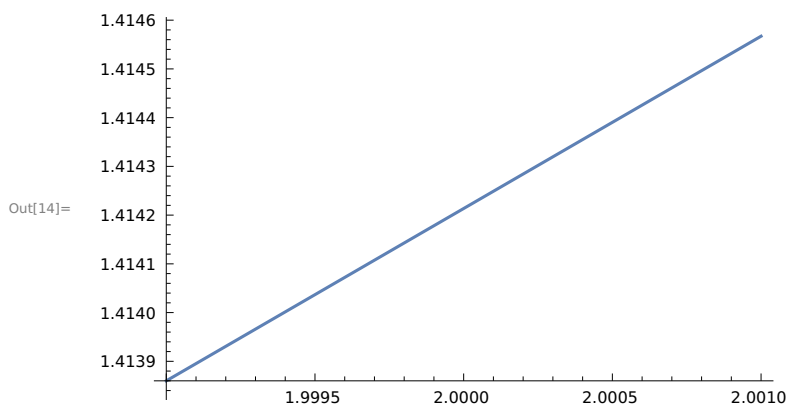
In[12]:= `With[{ $\delta = 10^{-1}$ }, Plot[\sqrt{x} , {x, 2 - δ , 2 + δ }]`



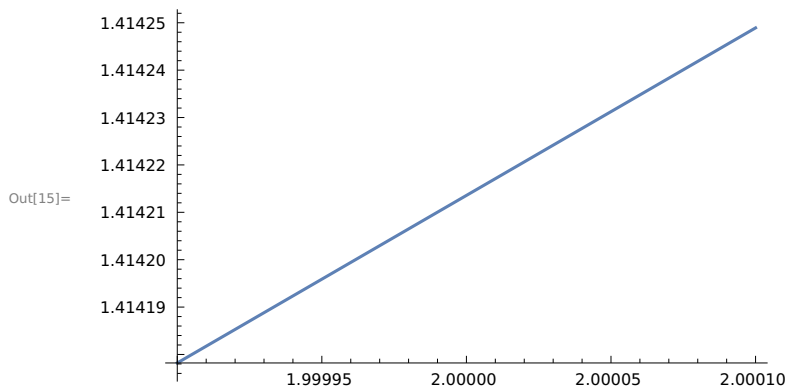
In[13]:= `With[{ $\delta = 10^{-2}$ }, Plot[\sqrt{x} , {x, 2 - δ , 2 + δ }]`



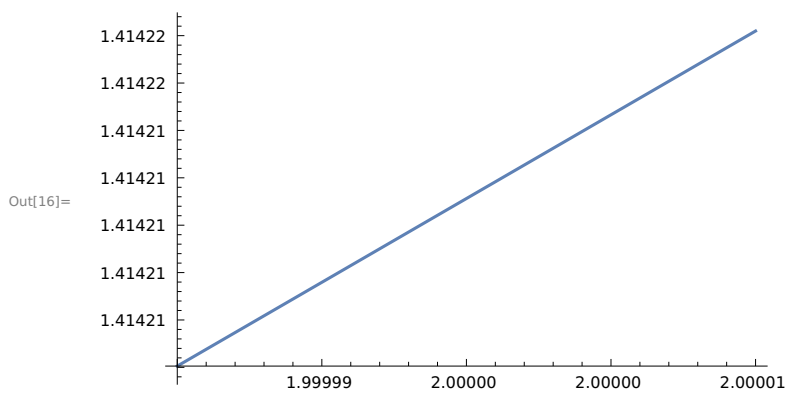
In[14]:= `With[{ $\delta = 10^{-3}$ }, Plot[\sqrt{x} , {x, 2 - δ , 2 + δ }]`



In[15]:= `With[{ $\delta = 10^{-4}$ }, Plot[\sqrt{x} , {x, $2 - \delta$, $2 + \delta$ }]`



In[16]:= `With[{ $\delta = 10^{-5}$ }, Plot[\sqrt{x} , {x, $2 - \delta$, $2 + \delta$ }]`



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

In[17]:= `N[$\sqrt{2}$]`

Out[17]= 1.41421

d) Plot \sqrt{x} using $\delta = 10^{-20}$.

In[18]:= **With**[[$\delta = 10^{-20}$], **Plot**[\sqrt{x} , {x, 2 - δ , 2 + δ]]

Plot: Endpoints for x in {x, $\frac{19999999999999999999}{100000000000000000000}$, $\frac{200000000000000000001}{100000000000000000000}$ } must have distinct machine-precision numerical values .

Plot: Endpoints for x in {x, $\frac{19999999999999999999}{100000000000000000000}$, $\frac{200000000000000000001}{100000000000000000000}$ } must have distinct machine-precision numerical values .

Plot: Endpoints for x in {x, $\frac{19999999999999999999}{100000000000000000000}$, $\frac{200000000000000000001}{100000000000000000000}$ } must have distinct machine-precision numerical values .

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

Plot: Endpoints for x in {x, $\frac{19999999999999999999}{100000000000000000000}$, $\frac{200000000000000000001}{100000000000000000000}$ } must have distinct machine-precision numerical values .

Plot: Endpoints for x in {x, $\frac{19999999999999999999}{100000000000000000000}$, $\frac{200000000000000000001}{100000000000000000000}$ } must have distinct machine-precision numerical values .

Plot: Endpoints for x in {x, $\frac{19999999999999999999}{100000000000000000000}$, $\frac{200000000000000000001}{100000000000000000000}$ } must have distinct machine-precision numerical values .

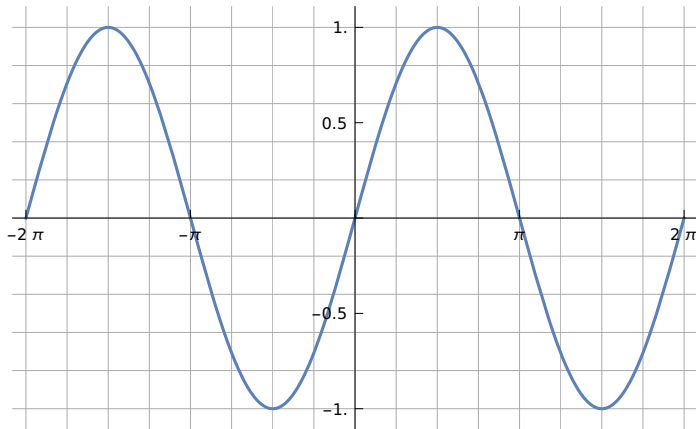
General: Further output of Plot::plld will be suppressed during this calculation .

Out[18]= **Plot**[\sqrt{x} , {x, 2 - $\frac{1}{100000000000000000000}$, 2 + $\frac{1}{100000000000000000000}$ }]

SEC :- 3.3

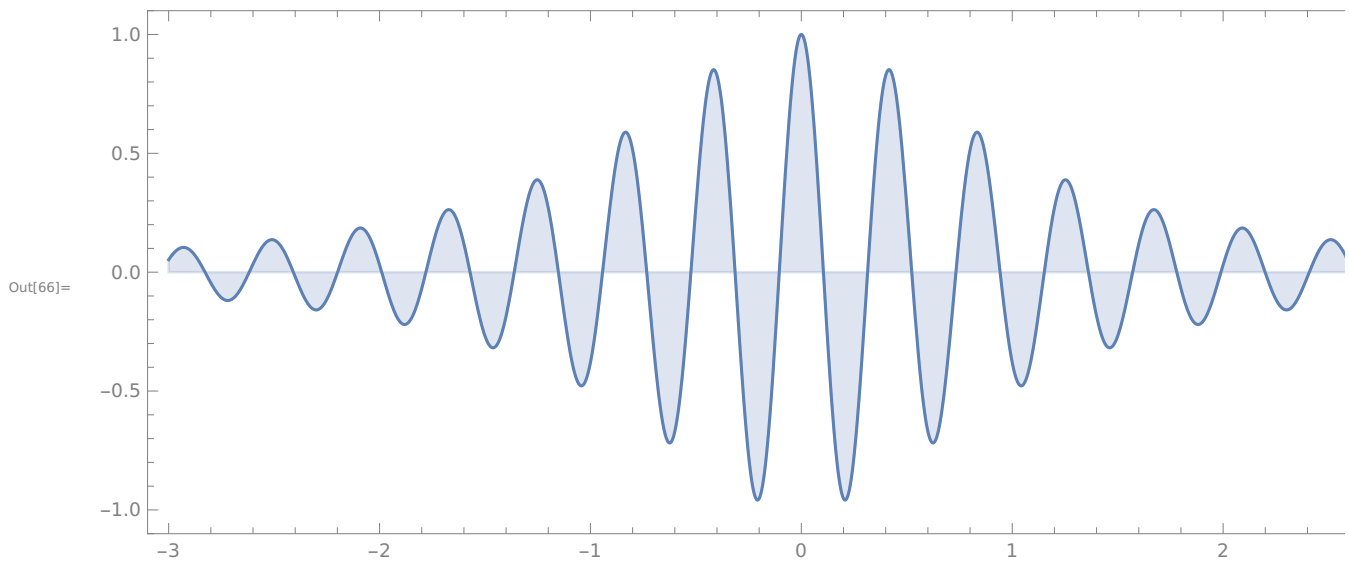
Ques1. Use the GridLines and Ticks options, as well as the setting GridLineStyle -> Lighter[Gray] to Plot of the sine function:

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]}, **GridLineStyle** -> Lighter[Gray]]



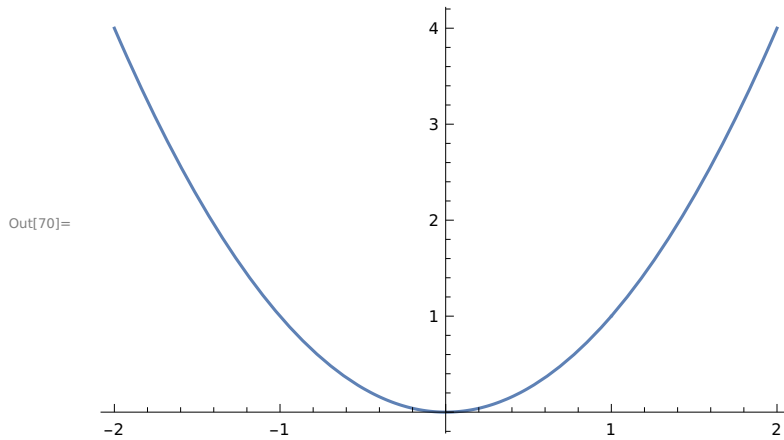
Ques2.. Use the Axes, Frame, Filling, FrameStyle, PlotRange, and AspectRatio options to plot of the function $y = \cos(15x)/(1+x^2)$:

```
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]
```



Ques4.. Plot the function $f(x) = x^2$ on the domain $-2 \leq x \leq 2$, and set Exclusions to $\{x == 1\}$. Note that f has no vertical asymptote at $x = 1$. What happens?

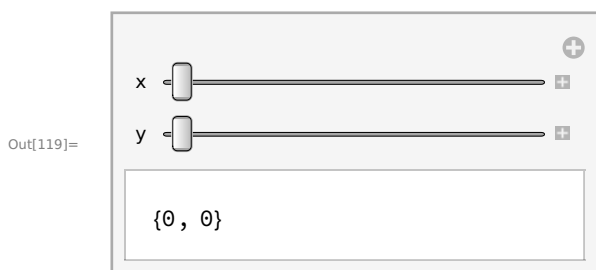
In[70]:= `Plot[x^2, {x, -2, 2}, Exclusions -> {x == 1}]`



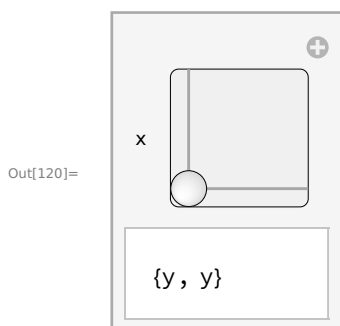
SEC :- 3.4

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}]`



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

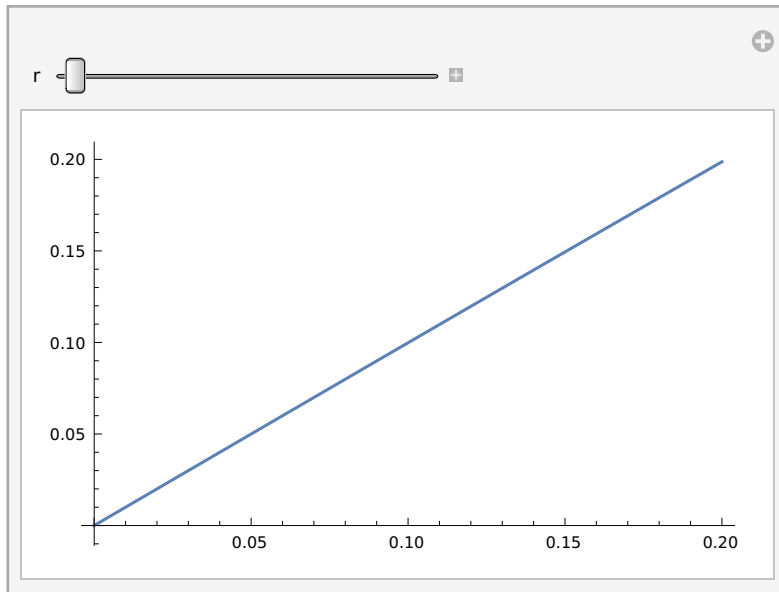


Ques2. Make a Manipulate of a Plot where the user can adjust the AspectRatio in

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`

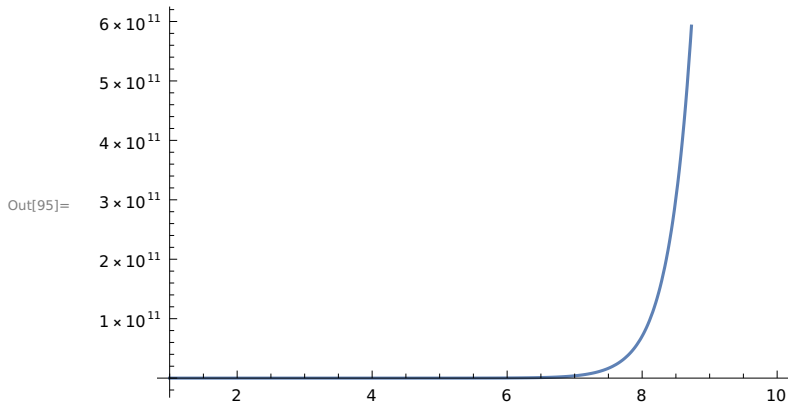
In[82]:= `Table[Sum[f[a], {a, 1, 20}], {x, 1, 10}]`

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 $1 \leq x \leq 10$.

In[94]:= `g[x_] := Sum[f[a], {a, 1, 20}]`

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

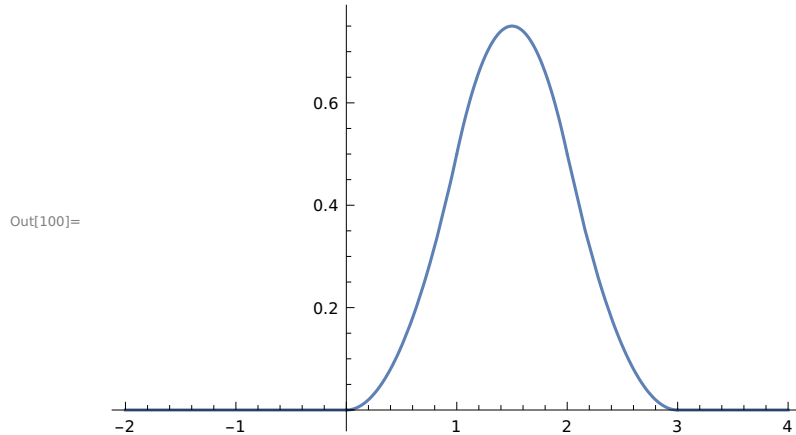


SEC :- 3.6

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 + 3x - 3/2, 1 ≤ x < 2}, {(1/2)(3-x)^2, 2 ≤ x < 3}, {0, 3 ≤ x}}
```

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



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 $n \leq x < n + 1$. Use the domain $0 \leq x \leq 20$.

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

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

