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MAT/19/50

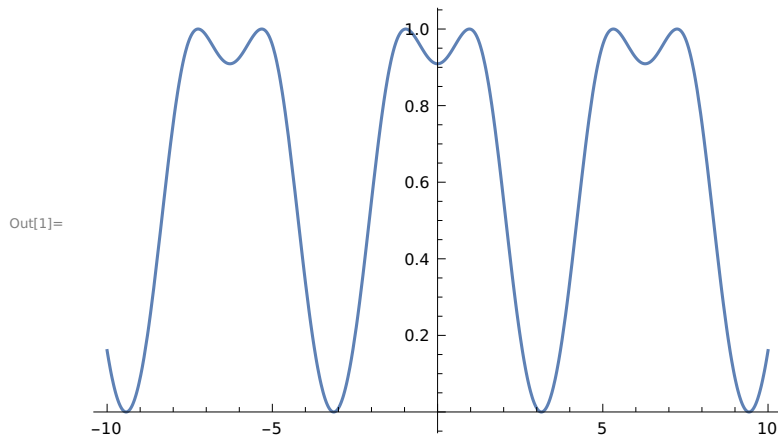
# CHAPTER 3 (TORRENCE)

## Section 3.2

Ques 1 : Plot the following functions on the domain  $-10 \leq x \leq 10$ .

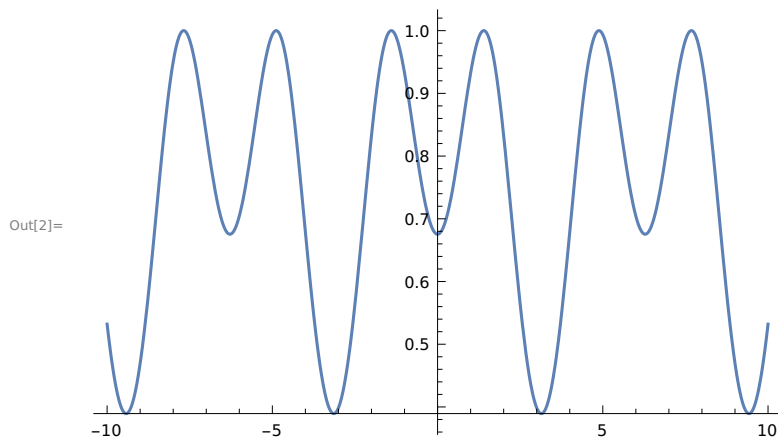
a)  $\sin(1+\cos(x))$

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



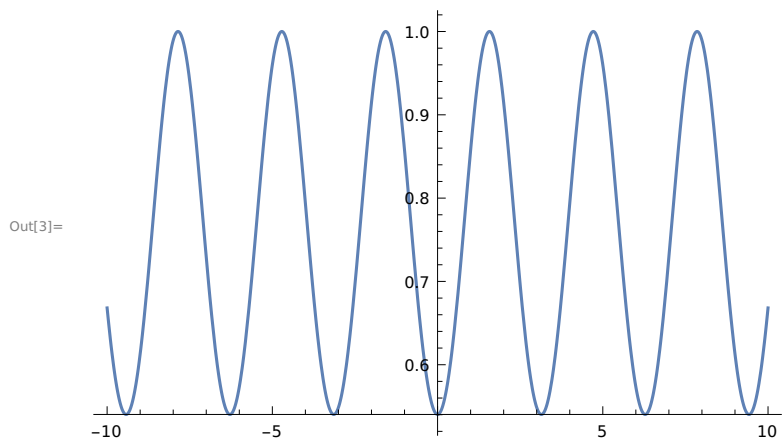
b)  $\sin(1.4+\cos(x))$

In[2]:= `Plot[Sin[1.4 + Cos[x]], {x, -10, 10}]`



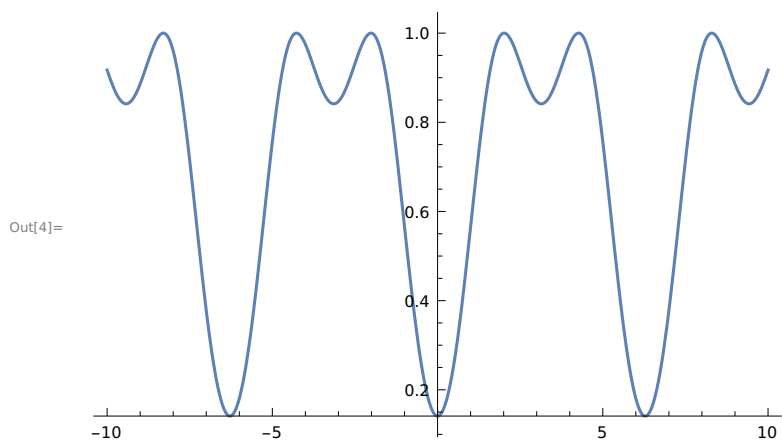
c)  $\sin(\pi/2 + \cos(x))$

In[3]:= `Plot[Sin[ $\pi/2 + \text{Cos}[x]$ ], {x, -10, 10}]`



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

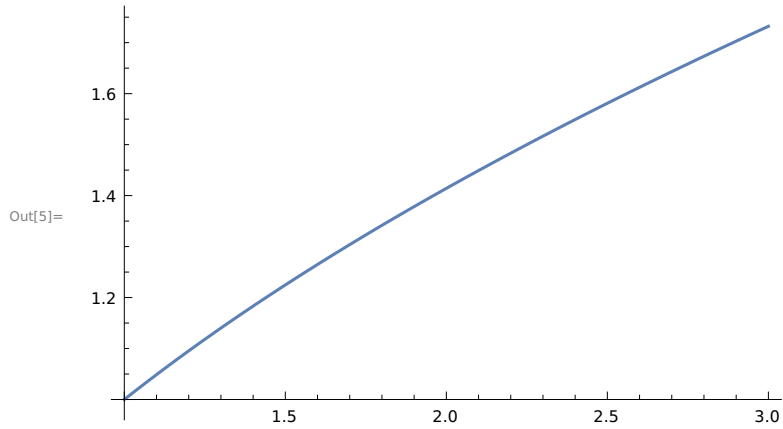
In[4]:= `Plot[Sin[2 + Cos[x]], {x, -10, 10}]`



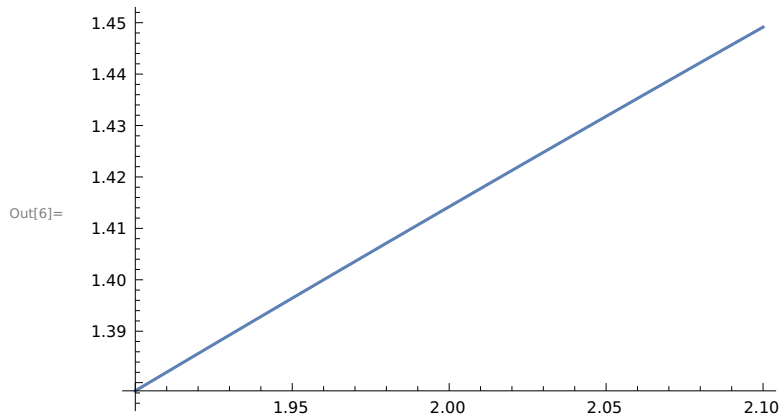
## Ques 2 :

A)

```
In[5]:= With[{ $\delta = 10^0$ }, Plot[ $\sqrt{x}$ , {x, 2 -  $\delta$ , 2 +  $\delta$ }]
```

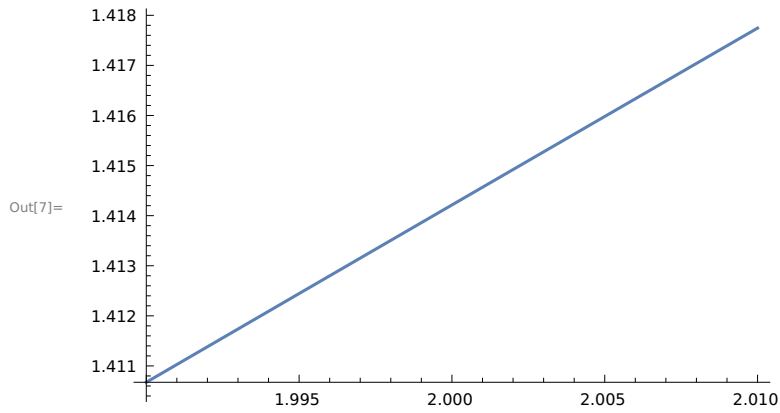
B)  $\delta = 10^{-1}$ 

```
In[6]:= With[{ $\delta = 10^{-1}$ }, Plot[ $\sqrt{x}$ , {x, 2 -  $\delta$ , 2 +  $\delta$ }]
```



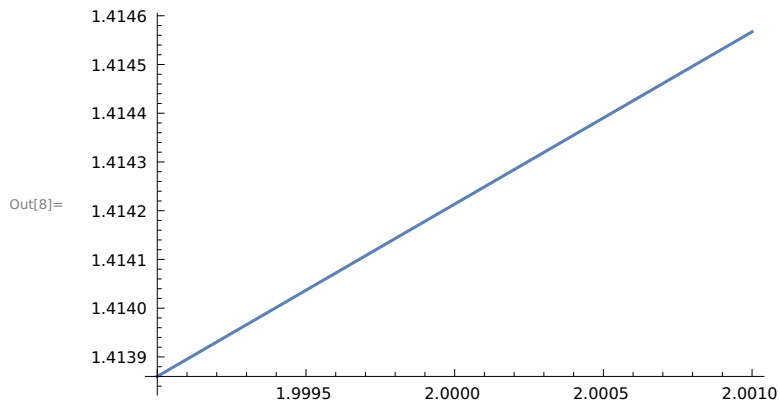
$$\delta = 10^{-2}$$

In[7]:= `With[{ $\delta = 10^{-2}$ }, Plot[ $\sqrt{x}$ , {x, 2 -  $\delta$ , 2 +  $\delta$ }]`



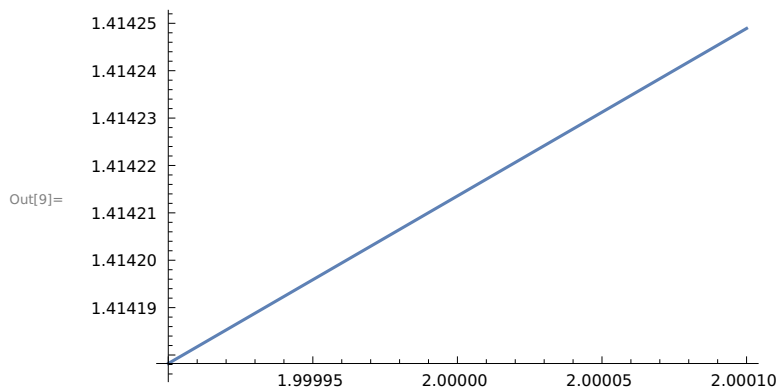
$$\delta = 10^{-3}$$

In[8]:= `With[{ $\delta = 10^{-3}$ }, Plot[ $\sqrt{x}$ , {x, 2 -  $\delta$ , 2 +  $\delta$ }]`



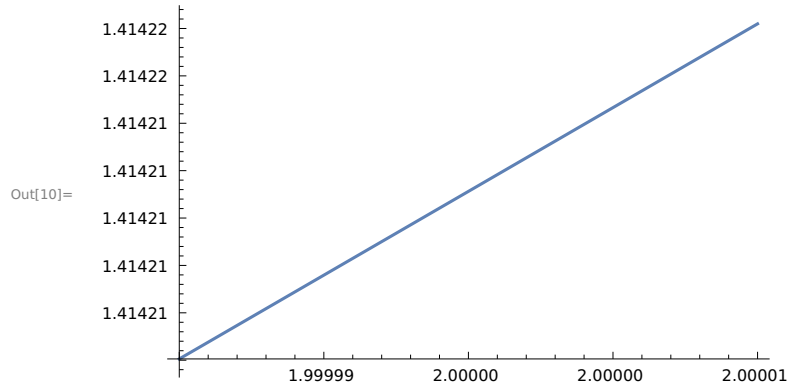
$$\delta = 10^{-4}$$

In[9]:= `With[{ $\delta = 10^{-4}$ }, Plot[ $\sqrt{x}$ , {x, 2 -  $\delta$ , 2 +  $\delta$ }]`



$$\delta = 10^{-5}$$

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



$$C) \sqrt{2}$$

```
In[11]:= N[ $\sqrt{2}$ , 6]
```

```
Out[11]= 1.41421
```

D)

In[13]:= **With**[[ $\delta = 10^{-20}$ ], **Plot**[ $\sqrt{x}$ , {x, 2 -  $\delta$ , 2 +  $\delta$ }]

**Plot** : Endpoints for x in  $\left\{x, \frac{19999999999999999999}{100000000000000000000}, \frac{200000000000000000001}{100000000000000000000}\right\}$  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 .

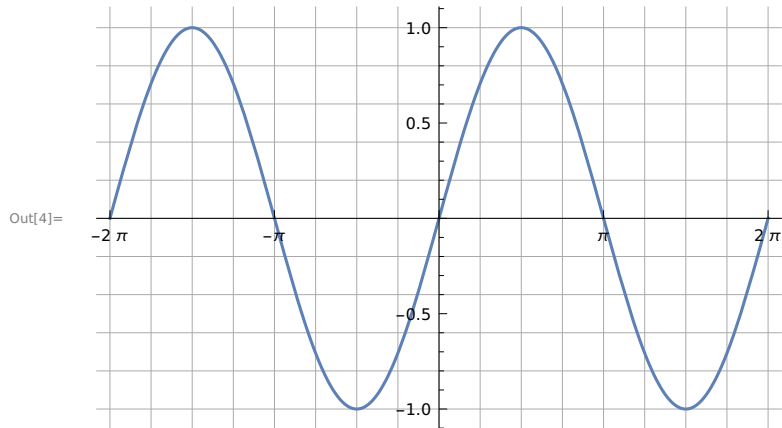
Out[13]= **Plot**[ $\sqrt{x}$ , {x, 2 -  $\frac{1}{100\ 000\ 000\ 000\ 000\ 000\ 000}$ , 2 +  $\frac{1}{100\ 000\ 000\ 000\ 000\ 000\ 000}$ }]

The two values and hence their difference is so small that it cannot be read by the computer thus mathematica is showing error.

## Section 3.3

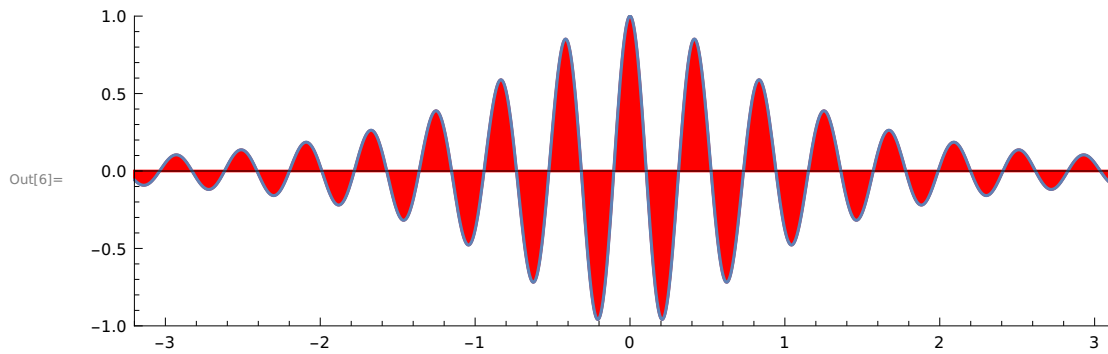
### Ques 1 :

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



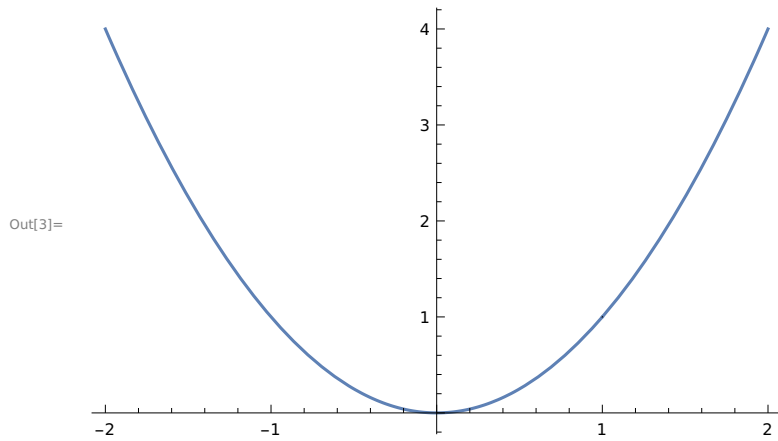
### Ques 2 :

```
In[6]:= Plot[(Cos[15 x]) / (1 + x^2), {x, -3.2, 3.2}, AspectRatio → Automatic ,
  AxesOrigin → {-3, 0}, Frame → {{True, False}, {True, False}}, Axes → {x, y},
  PlotRange → {{-3.2, 3.1}, {-1, 1}}, Filling → Axis, FillingStyle → Red]
```



### Ques 4 :

```
In[3]:= Plot[x^2, {x, -2, 2}, Exclusions -> {x == 1}, ExclusionsStyle -> Directive[Pink, Dashed]]
```

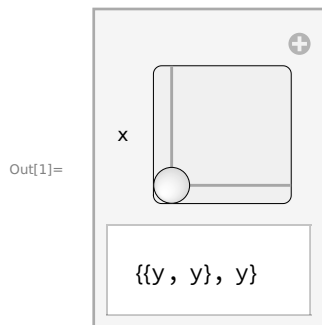


There is no vertical asymptote, this shows that the graph is continuous.

### Section 3.4

### Ques 1 :

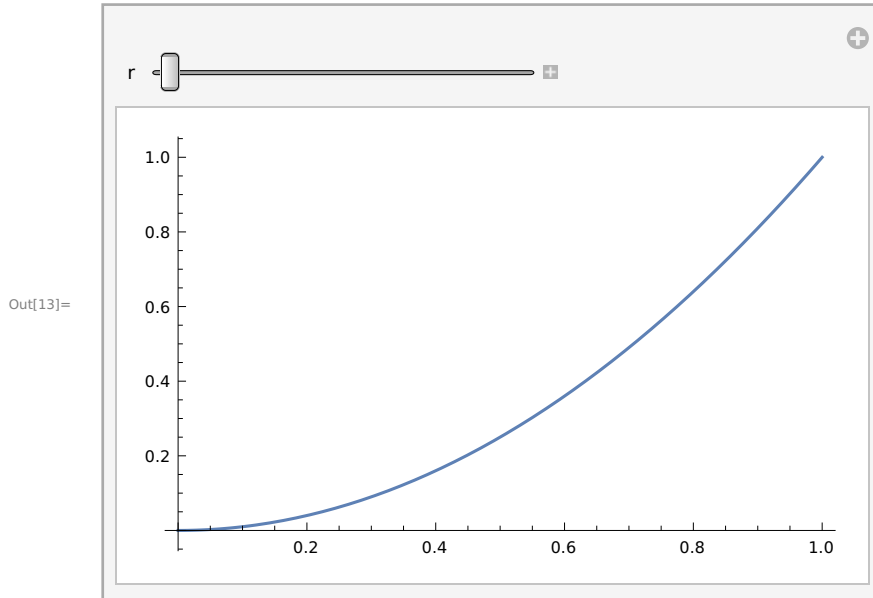
```
In[1]:= Manipulate[{x, y}, {x, y, {0, 1}}]
```





## Ques 2 :

```
In[13]:= Manipulate[Plot[x^2, {x, 0, r}], {r, 1, 3},
  ImageSize -> {Automatic, 128}, AspectRatio -> 5/6]
```



## Section 3.5

### Ques 1 :

A)

```
In[24]:= Range[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[Range[100], 10]
```

```
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}}
```

The `Range[100]` command displays numbers from 1 to 100 where as the command `Partition[Range[100],10]` displays the numbers from 1 to 100 while simultaneously segregating them in a list

of 10 numbers.

B)

```
In[3]:= Grid[Partition[Range[100], 20]]
      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
Out[3]= 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)

```
In[4]:= Grid[Table[Range[x, x + 19], {x, {1, 21, 41, 61, 81}}]]
      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
Out[4]= 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)

```
In[5]:= f[x_] := x
In[6]:= Grid[Table[Table[f[x], {x, x, x + 19}], {x, {1, 21, 41, 61, 81}}]]
      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
Out[6]= 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
```

Ques 4:

A)

```
In[44]:= f[x_] := x ^ 3
In[46]:= Sum[f[x], {x, 1, 20}]
Out[46]= 44 100
```

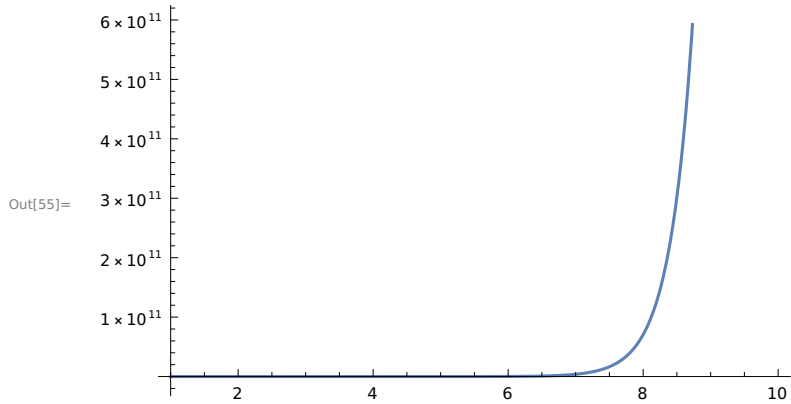
B)

```
In[53]:= 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[54]:= **Table[f[x], {x, 1, 10}]**

Out[54]= {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 }

In[55]:= **Plot[f[x], {x, 1, 10}]**

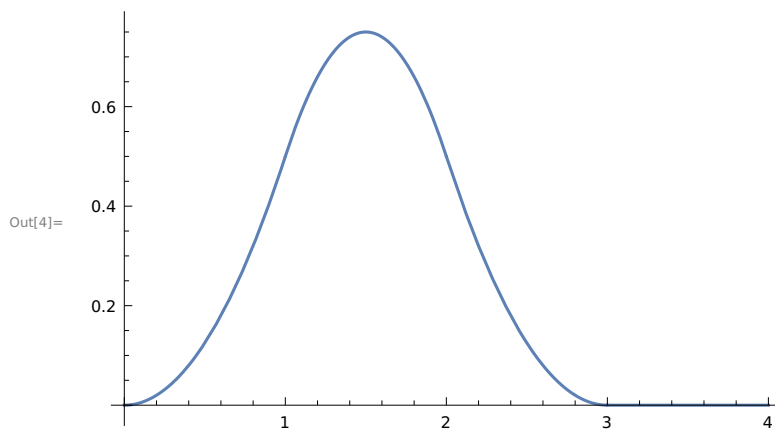


## Section 3.6

### Ques 2 :

In[2]:= **g[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[4]:= **Plot[g[x], {x, 0, 4}]**



### Ques 3 :

In[14]:= **f[x\_, n\_] := Piecewise[{{n ^ 2, n ≤ x < n + 1}}]**

In[15]:= **Plot[f[x, n], {x, 0, 20}]**

