MAT-19-45

Chapter-3 (Torrence)

EX:3.2

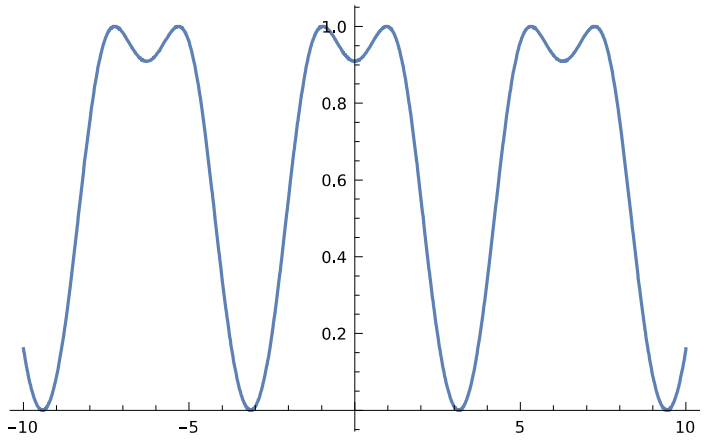
QUES 1: Plot the following functions on the domain -10≤x≤10

a) sin(1+cos(x))

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

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

Out[2]=

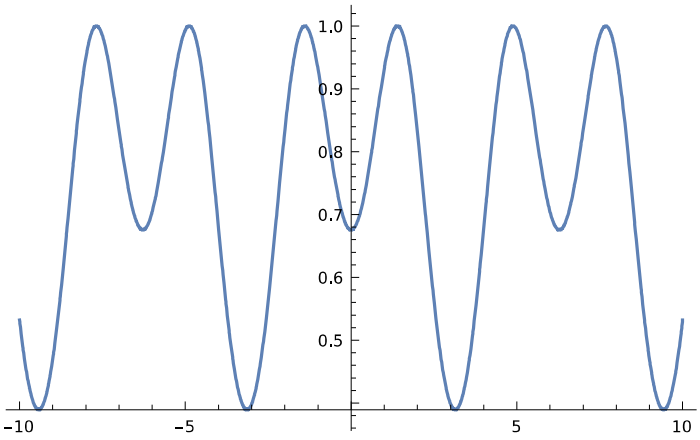


b) sin(1.4+cos(x))

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

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

Out[4]=

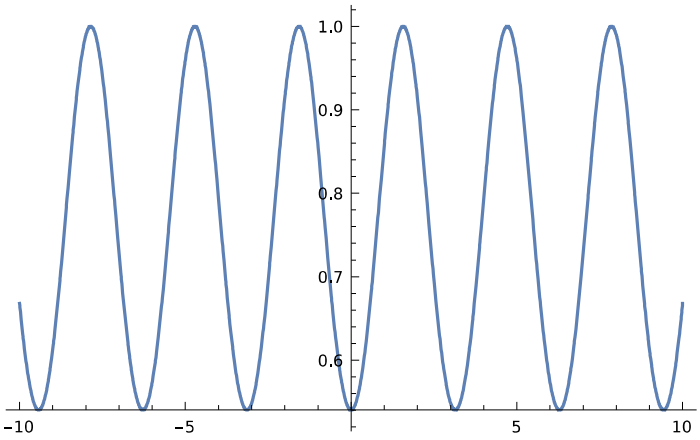


c)sin(pi/2+cos(x))

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

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

Out[6]=

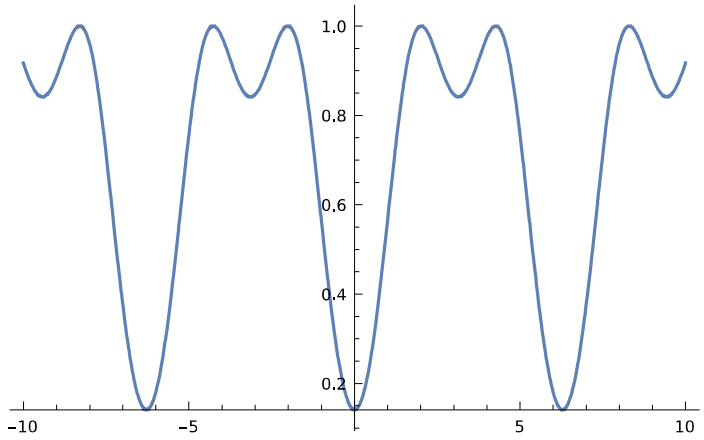


d) sin(2+cos(x))

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

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

Out[8]=

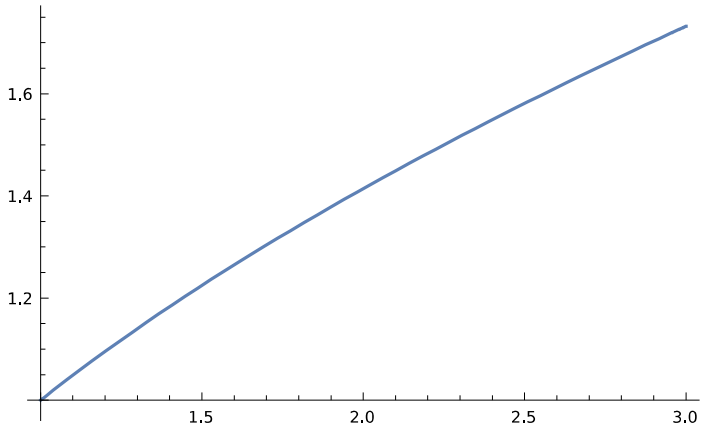


QUES 2:Consider the square root function f(x)=$\sqrt{}$x, when x is near 2

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

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

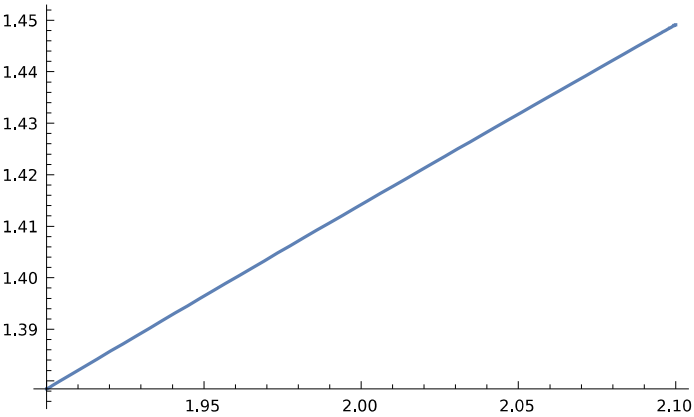
Out[9]=



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

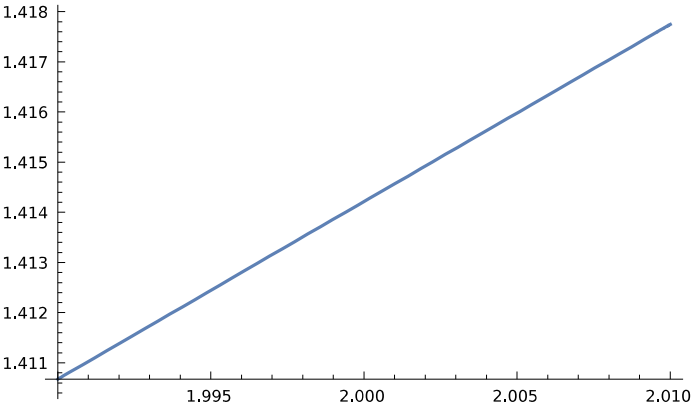
In[10]:=
```
With[{δ = 10^-1}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

Out[10]=



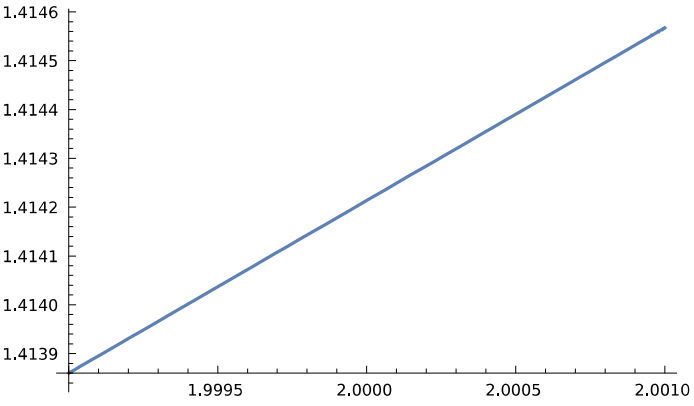
In[11]:=
```
With[{δ = 10^-2}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

Out[11]=



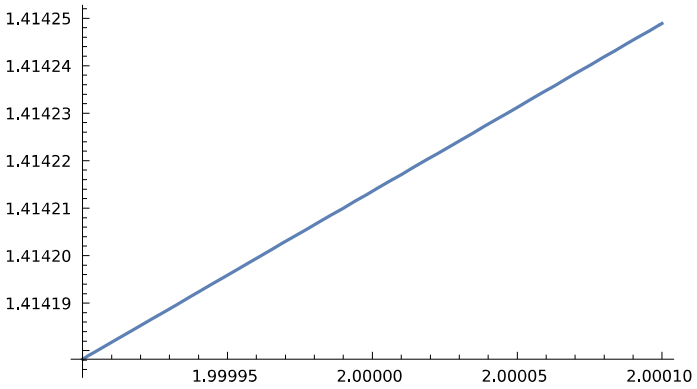
In[12]:=
```
With[{δ = 10^-3}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

Out[12]=



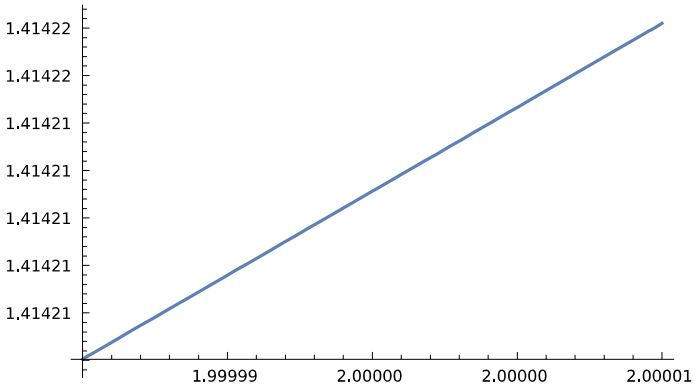
In[13]:=
```
With[{δ = 10^-4}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

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

In[15]:=
```
N[√2, 6]
```

Out[15]=
```
1.41421
```

d)When making a plot, the lower and upper bounds on the iterator must be distinct when rounded to machine precision.Enter the previous plot command with δ=10^-20.An error message results.Read the error message and speculate as to what is happening.The bottom line is that zooming has its limits.

In[15]:=
```
With[{δ = 10^-20}, Plot[√x, {x, 2 - δ, 2 + δ}]]
```

Plot : Endpoints for x in $\left\{x, \frac{19999999999999999999}{10000000000000000000}, \frac{20000000000000000001}{10000000000000000000}\right\}$ 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[15]=
$$\text{Plot}\left[\sqrt{x}, \left\{x, 2 - \frac{1}{100\,000\,000\,000\,000\,000\,000}, 2 + \frac{1}{100\,000\,000\,000\,000\,000\,000}\right\}\right]$$

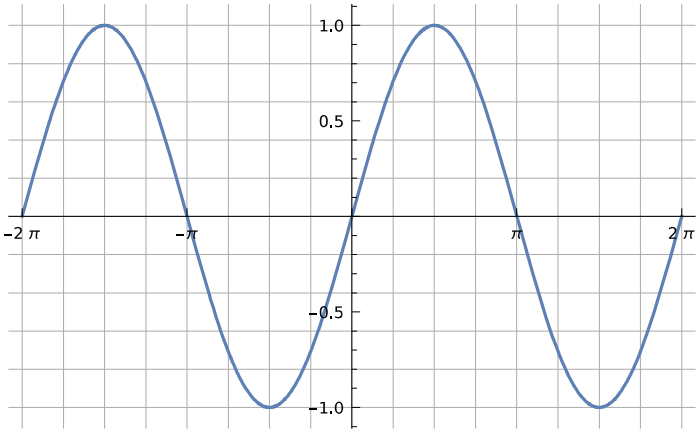
The two values and hence their difference is so small that it cannot be read by the computer thus the mathematical is showing error.

EX : 3.3

QUES 1:use the gridlines andtick options,as well as the setting gridlinesstyle→Lighter[gray] to plot the sine function.

In[1]:=
```
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], Automatic}, GridLinesStyle → Lighter[Gray]]
```

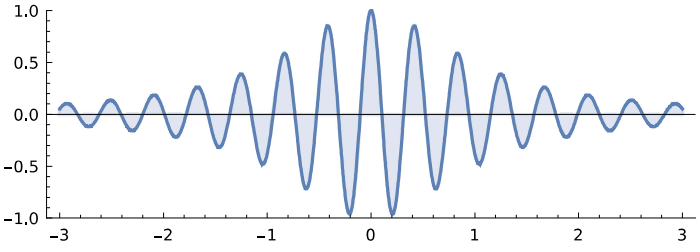
Out[1]=



QUES 2:use the axes,frame,filling,framestyle,plotrange and aspectratio options to plot y=Cos(15x)/1+x^2

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

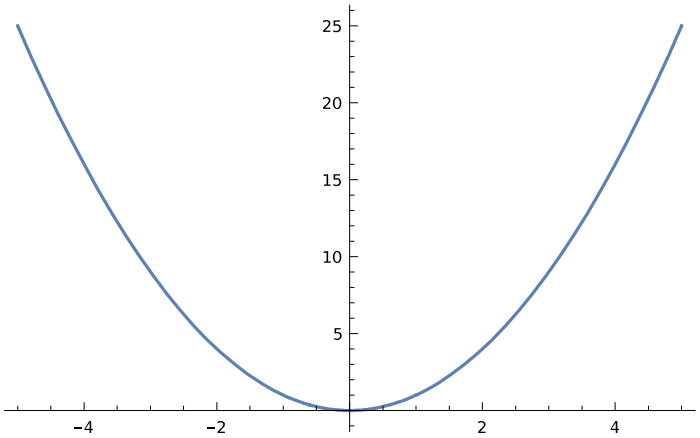
Out[2]=



QUES 4: Plot the function f(x)=x^2 on the domain -2≤x≤2 and set exclusions to x=1

In[20]:=
```
Plot[x^2, {x, -5, 5}, Exclusions → {x == 1}]
```

Out[20]=

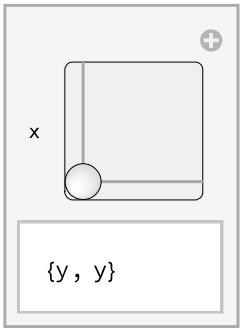


EX:3.4

QUES 1:Make a has manipulate output{x,y}, But has a single slider 2D controller.

In[22]:=
```
Manipulate[{x, y}, {x, y, {0, 1}}]
```

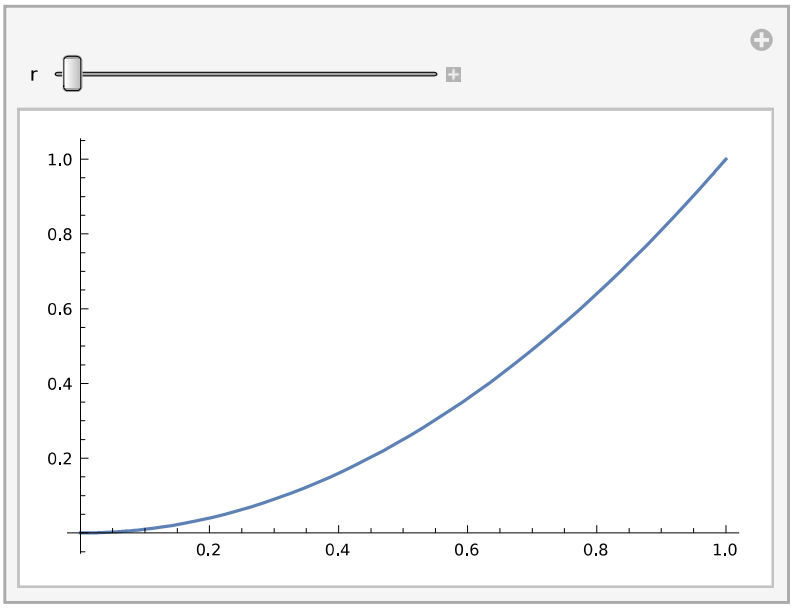
Out[22]=



QUES 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 endind value of 5.set image size to{Automatic128} so the height remains constant as the slider is moved

In[23]:=
```
Manipulate[Plot[x^2, {x, 0, r}], {r, 1, 3}, ImageSize → {Automatic128}, AspectRatio → 5/6]
```

Out[23]=



EX:3.5

QUES 1: The partition command is used tyo break a single list into sublists of equal length.It is usefull for breaking up a list into rows for displays within a grid

a) Enter the following inputs and discuss the outputs

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}}
```

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[1]:=
```
Grid[Partition[Range[100], 20]]
```

Out[1]=

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[3]:=
```
Grid[Table[Range[x, x + 19], {x, {1, 21, 41, 61, 81}}]]
```

Out[3]=

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[4]:=
```
f[x_] := x
```

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

Out[5]=

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

QUES 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[31]:=
```
f[x_] := x^3
```

In[32]:=
```
Sum[f[x], {x, 1, 20}]
```

Out[32]= 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[33]:=
```
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[34]:=
```
Table[f[x], {x, 1, 10}]
```

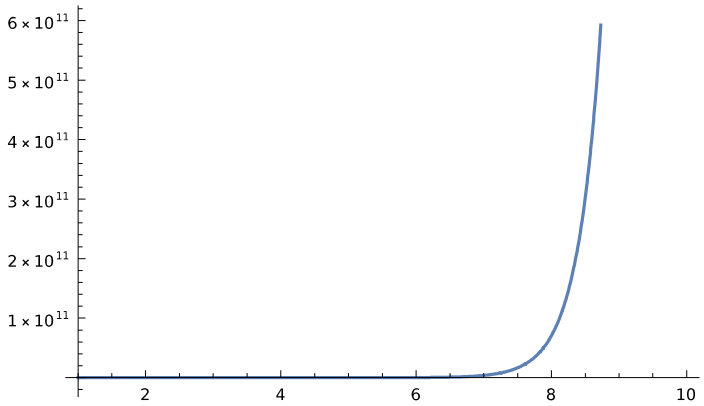
Out[34]= {210, 2870, 44 100, 722 666, 12 333 300, 216 455 810,
3 877 286 700, 70 540 730 666, 1 299 155 279 940, 24 163 571 680 850}

c)Plot f(x) on the domain 1≤x≤10

In[35]:=
```
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[36]:=
```
Plot[f[x], {x, 1, 10}]
```

Out[36]=



EX:3.6

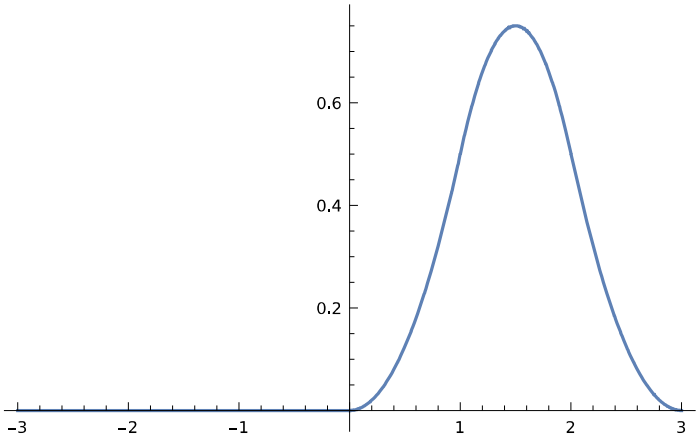
QUES 2: Make a Plot of a Piecewise Function below and comment on its shape

$$f(x)=\begin{cases} 0 & x<0 \\ x^2/2 & 0\le x<1 \\ -x^2+3x-3/2 & 1\le x<2 \\ (1/2)(3-x)^2 & 2\le x<3 \\ 0 & x\le 3 \end{cases}$$

In[37]:=
```
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[38]:=
```
Plot[f[x], {x, -3, 3}]
```

Out[38]=



QUES 3: A step 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[13]:=
```
f[x_] := Piecewise[{{n^2, n ≤ x < n + 1}, {1, n ≤ x ≤ n + 1}}]
```

In[14]:=
```
Plot[f[x], {x, 0, 20}]
```

Out[14]=