EX: 3.2

MAT/19/77

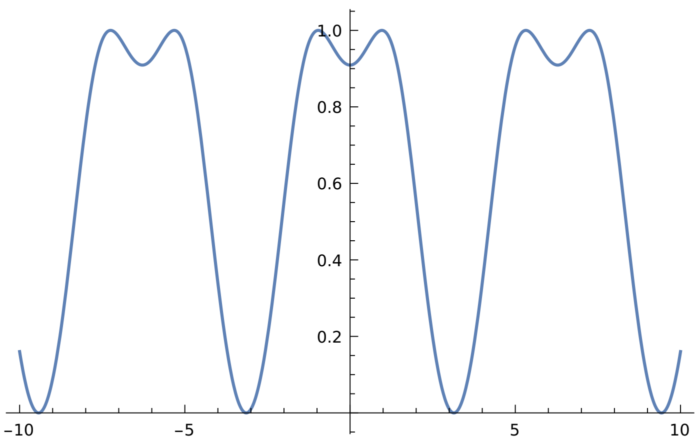
1) Plot the following functions on the domain-10 ≤ x ≤ 10.

a) sin(1+cos(x))

In[1]:=

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

Out[7]=

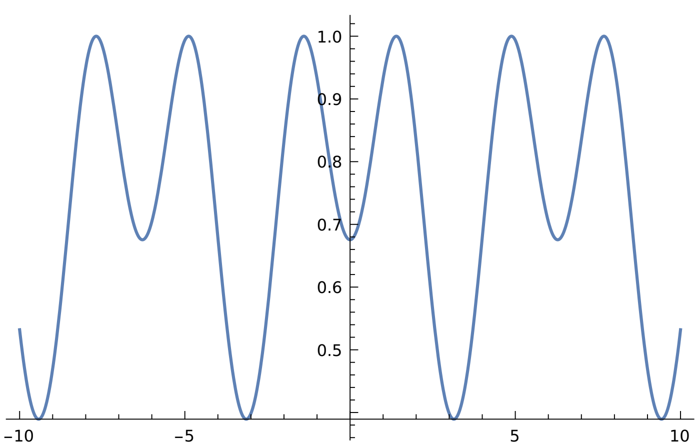


b) sin(1.4+cos(x))

In[8]:=

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

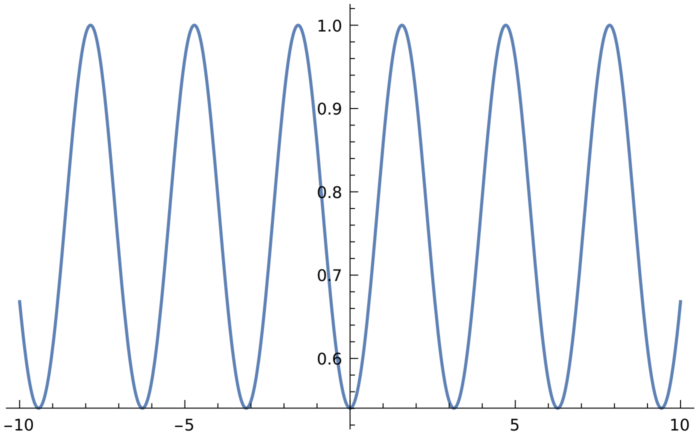
Out[9]=



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

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

Out[11]=

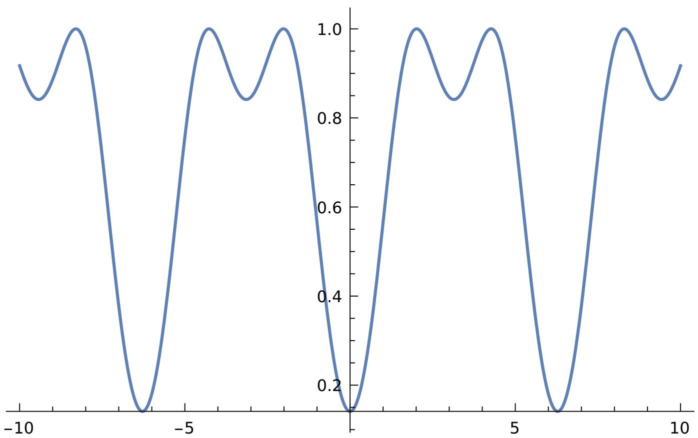


d) sin(2+cos(x))

In[12]:=
```
f[x_] := Sin[2 + Cos[x]]
```

In[13]:=
```
Plot[f[x], {x, -10, 10}]
```

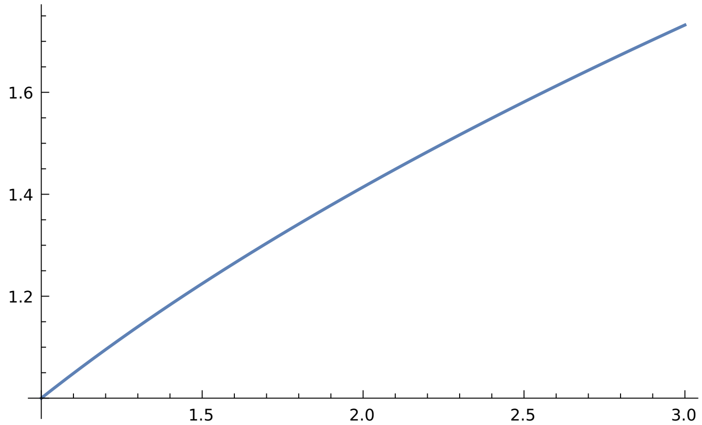
Out[13]=



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

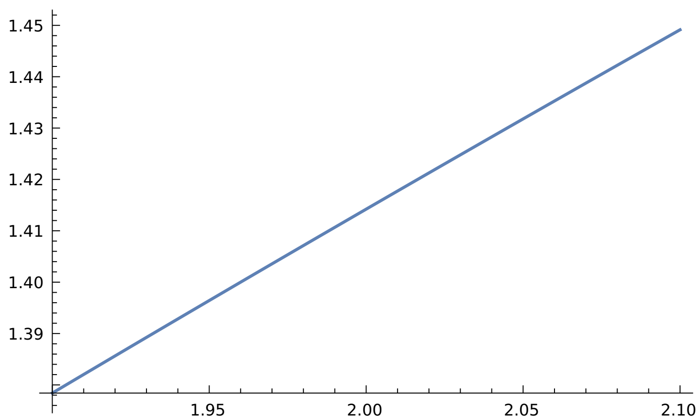
a) Graph of f as x goes from 1 to 3.

In[14]:=
```
With[{δ = 10 ^ 0}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

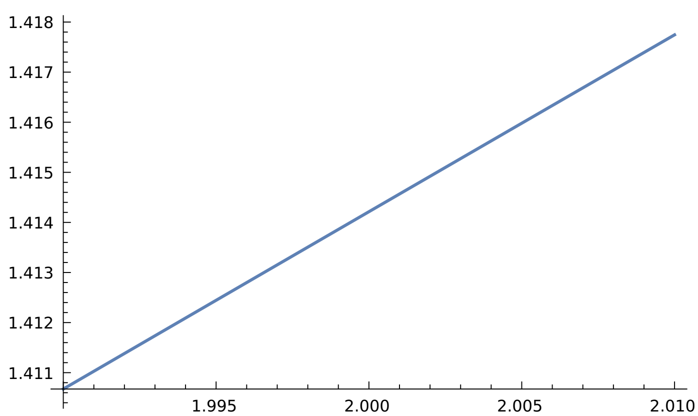
Out[14]=


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[15]:=
```
With[{δ = 10 ^ -1}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

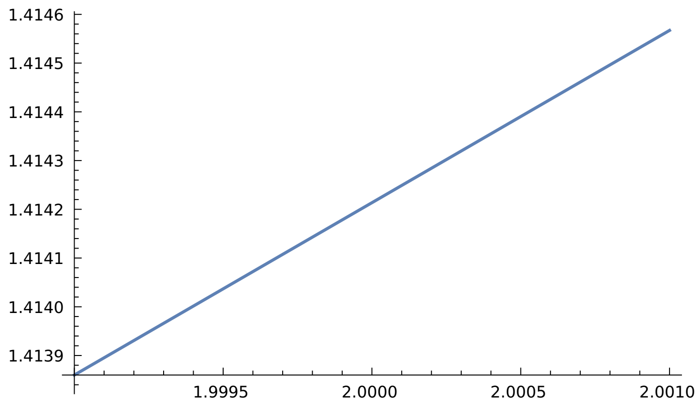
Out[15]=


In[16]:=
```
With[{δ = 10 ^ -2}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

Out[16]=


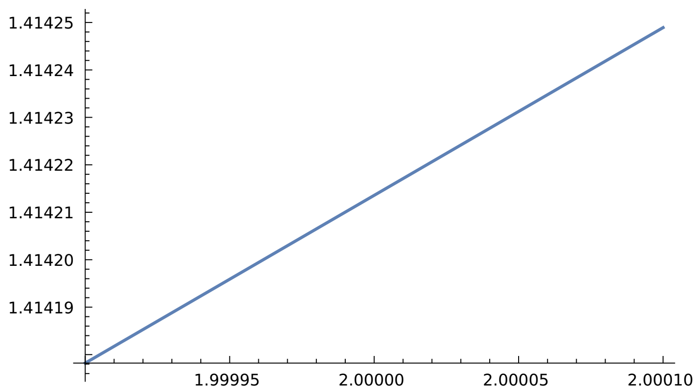
In[17]:=
```
With[{δ = 10^-3}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

Out[17]=



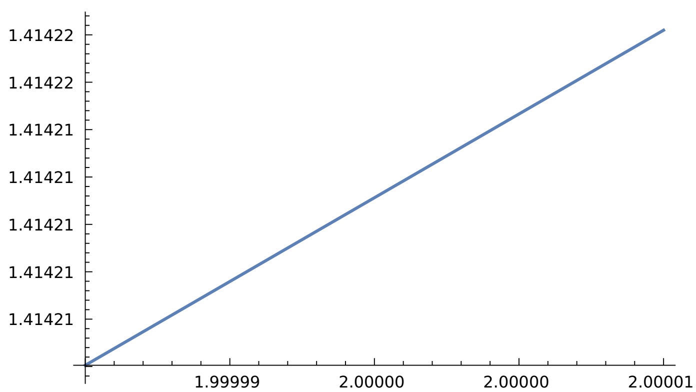
In[18]:=
```
With[{δ = 10^-4}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

Out[18]=



In[19]:=
```
With[{δ = 10^-5}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

Out[19]=



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 $\sqrt{2}$=1.414121

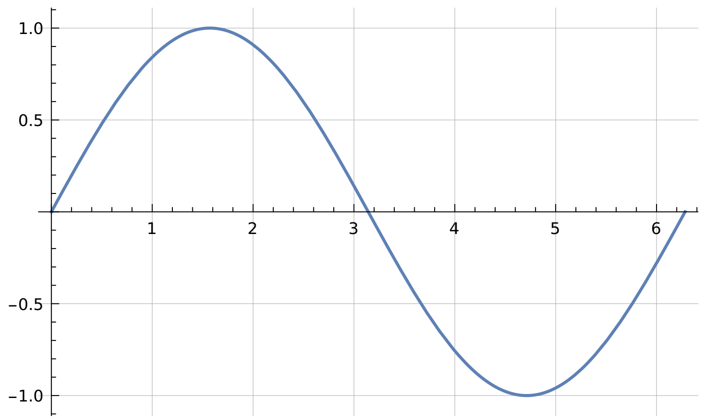
In[20]:=
```
N[√2, 6]
```

Out[20]=
```
1.41421
```

EX: 3.3

1) Use the gridlines and tick options, as well as the setting gridlinesstyle->lighter[gray] to plot the sine function.

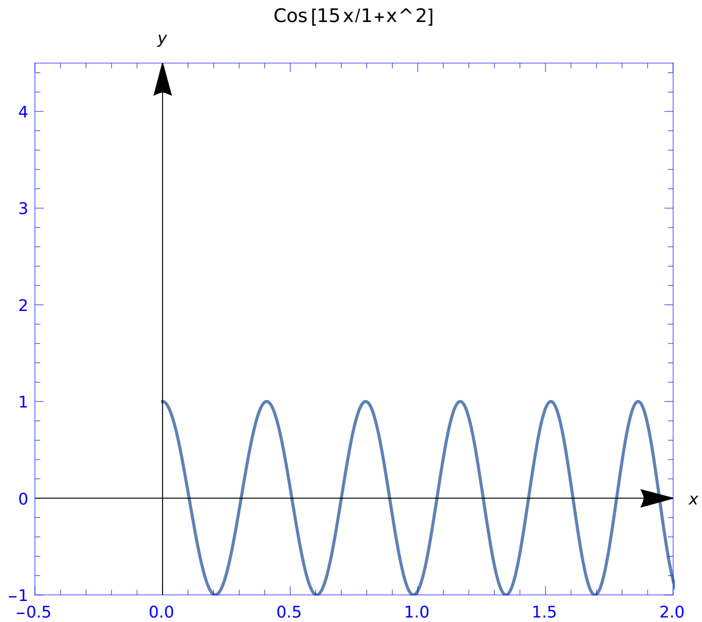
In[21]:=
```
Plot[Sin[x], {x, 0, 2*Pi}, GridLines → Automatic,
 Ticks → Automatic, GridLinesStyle → Lighter[Gray]]
```

Out[21]=


2) Use the axes, frame, filling, framestyle, plotrange and aspectration options to plot Y=Cos(15x)/1+x^2.

In[22]:=
```
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[15x/1+x^2]", FrameStyle → Blue]
```

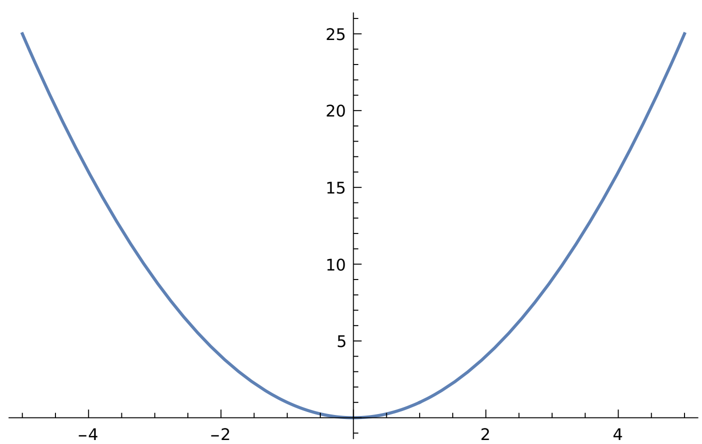
Out[22]=



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

In[23]:=
```
Plot[x ^ 2, {x, -5, 5}, Exclusions → {x == 1}]
```

Out[23]=

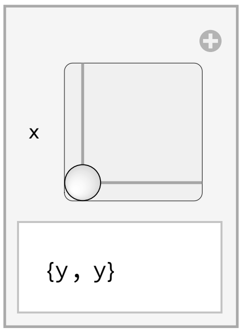


EX: 3.4

1) Make A has manipulate output {x,y}, but has a single slidered controller.

In[24]:=
```
Manipulate[{x, y}, {x, y, {0, 1}}]
```

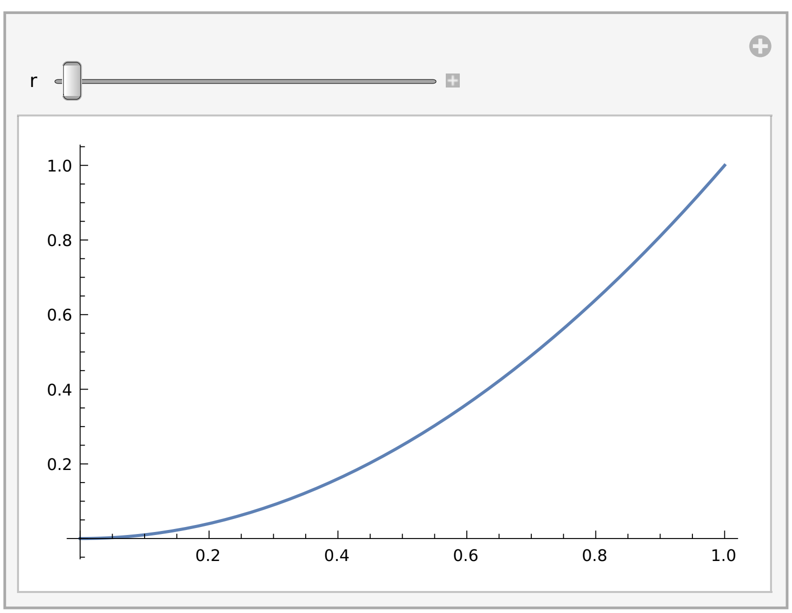
Out[24]=



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 ending value of 5. Set image size to {automatic128} so the height remains constant as the slider is moved.

In[25]:=
```
Manipulate[Plot[x^2, {x, 0, r}], {r, 1, 3}, ImageSize → {Automatic128}, AspectRatio → 5/6]
```

Out[25]=



EX: 3.5

1) The partition commands is used to break a single list into sublists of equal length. It is useful for breaking up a list into rows for displays within a grid.

a) Enter the following inputs and discuss the outputs.

In[26]:=
```
Range[100]
```

Out[26]=
```
{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[27]:=
```
Partition[Range[100], 10]
```

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}}
```

b) Form a table of the first 100 integers, with twenty digits per now. 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[29]:=
```
Table[x, {x, 1, 100}]
```

Out[29]=
```
{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[30]:=
```
Partition[Table[x, {x, 1, 100}], 20]
```

Out[30]=
```
{{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, nut use only the table and range command.

In[31]:=
```
Table[Range[10], 10]
```

Out[31]=
```
{{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[32]:=
```
Table[Table[x, {x, 1, 100}]]
```

Out[32]=
```
{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}
```

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[33]:=
```
f[x_] := x ^ 3
Sum[f[x], {x, 1, 20}]
```

Out[34]=
```
44 100
```

b) Make a table of values for x=1,2,.......,10 for the function f(x)=1+2^x+3^x.........................+20^x

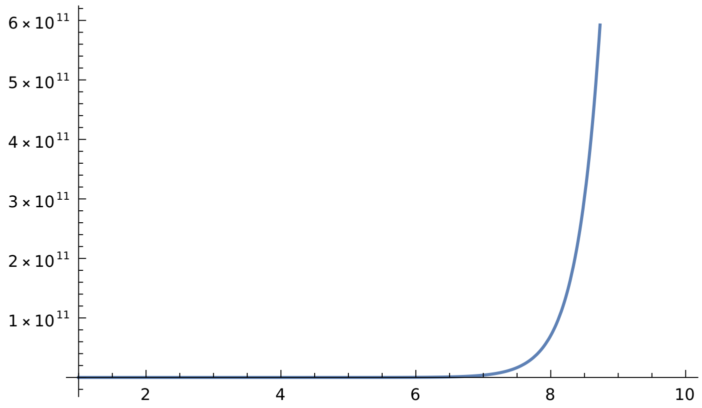
In[35]:=
```
f[x_] := 1 + 2 ^ x + 3 ^ x + 4 ^ x + 5 ^ x + 6 ^ x + 7 ^ x + 8 ^ x + 9 ^ x + 10 ^ x +
   11 ^ x + 12 ^ x + 13 ^ x + 14 ^ x + 15 ^ x + 16 ^ x + 17 ^ x + 18 ^ x + 19 ^ x + 20 ^ x
Table[f[x], {x, 1, 10}]
```

Out[36]=
```
{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 $1 \le x \le 10$.

In[37]:=
```
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
Plot[f[x], {x, 1, 10}]
```

Out[38]=

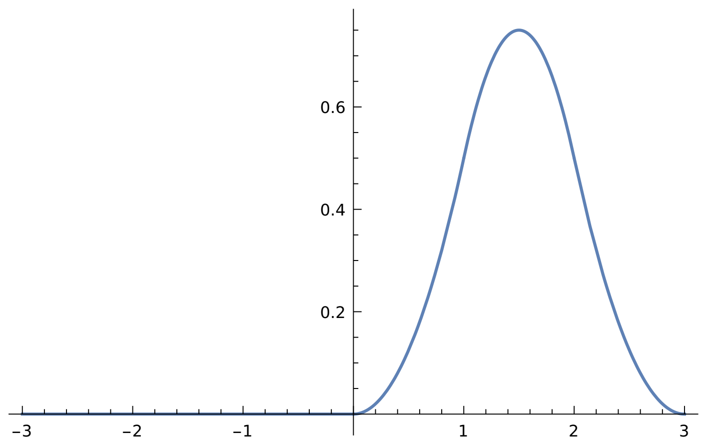


EX: 3.6

2) Make a plot of a piecewise function below and comment on its shape. as given in ques..

In[39]:=
```
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}}]
Plot[
 f[
  x],
 {x,
  -3,
  3}]
```

Out[40]=



3) 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[52]:=
```
f[x_] := Piecewise[{{n^2, n ≤ x < n + 1}, {1, n ≤ x ≤ n + 1}}]
```

In[53]:=
```
Plot[f[x], {x, 0, 20}]
```

Out[53]=