CHAPTER - 3 EXERCISE

SECTION - 3.2

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

a. sin(1 + cos(x))

b. sin(1.4 + cos(x))

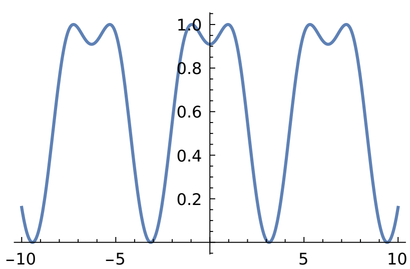
c. sin(π/2 + Cos(x))

d. sin(2 + cos(x))

In[24]:=
```
f[x_] := Sin[1 + Cos[x]]
```

In[25]:=
```
Plot[f[x], {x, -10, 10}]
```

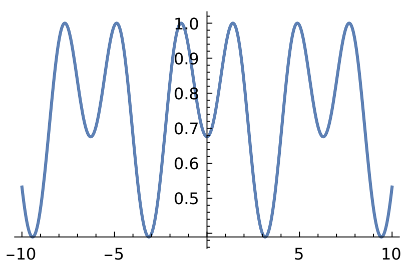
Out[25]=



In[26]:=
```
g[x_] := Sin[1.4 + Cos[x]]
```

In[27]:=
```
Plot[g[x], {x, -10, 10}]
```

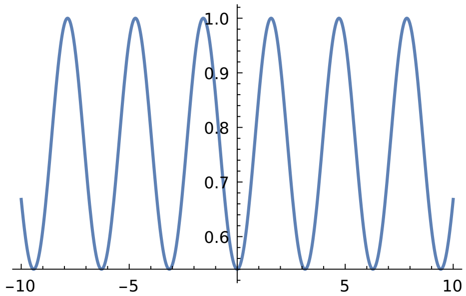
Out[27]=



In[32]:=
```
h[x_] := Sin[Pi / 2 + Cos[x]]
```

In[33]:=
```
Plot[h[x], {x, -10, 10}]
```

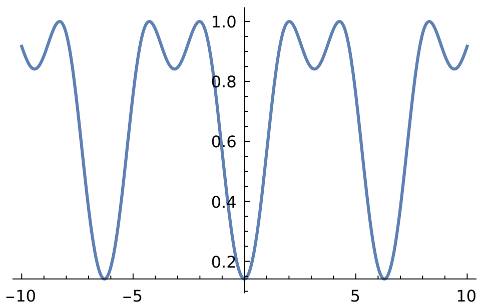
Out[33]=



In[34]:=
```
s[x_] := Sin[2 + Cos[x]]
```

In[35]:=
```
Plot[s[x], {x, -10, 10}]
```

Out[35]=



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

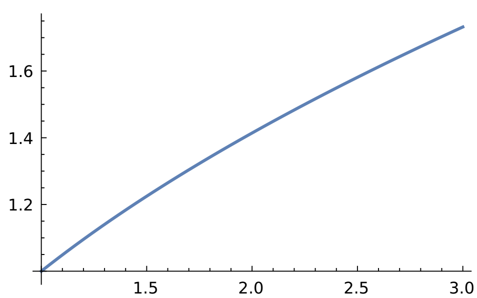
a. Graph of f as x goes from 1 to 3

b. Change the value of δ to be 10^(-1) and see the graph of f as x goes from 1.9 to 2.1. Do this again for δ = 10^(-2), 10^(-3), 10^(-4) and 10^(-5).

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

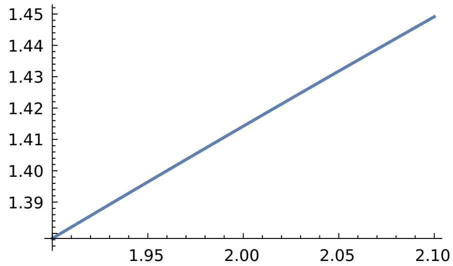
In[36]:=
```
With[{δ = 10^0}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

Out[36]=



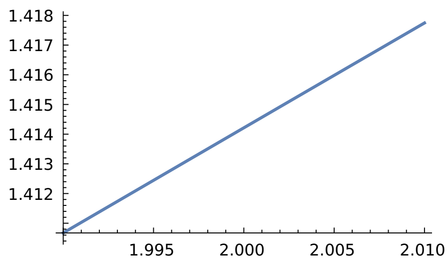
In[37]:=
```
With[{δ = 10^(-1)}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

Out[37]=



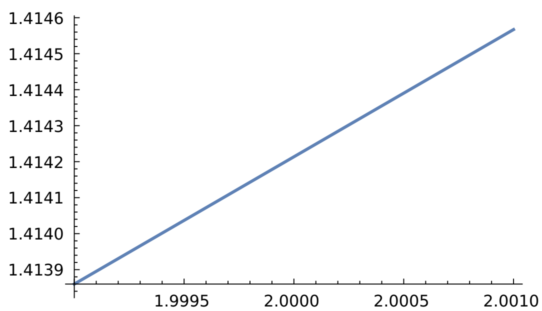
In[38]:=
```
With[{δ = 10^(-2)}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

Out[38]=



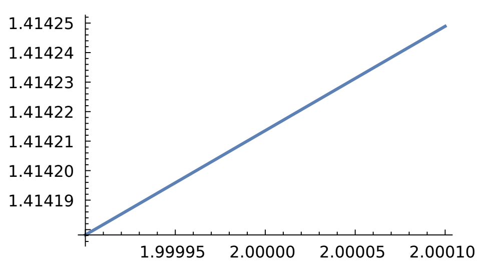
In[39]:=
```
With[{δ = 10^(-3)}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

Out[39]=



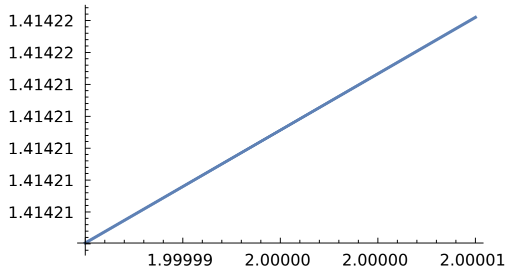
In[40]:=
```
With[{δ = 10^(-4)}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

Out[40]=



In[41]:=
```
With[{δ = 10^(-5)}, Plot[Sqrt[x], {x, 2 - δ, 2 + δ}]]
```

Out[41]=



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

In[42]:=
```
N[Sqrt[2], 6]
```

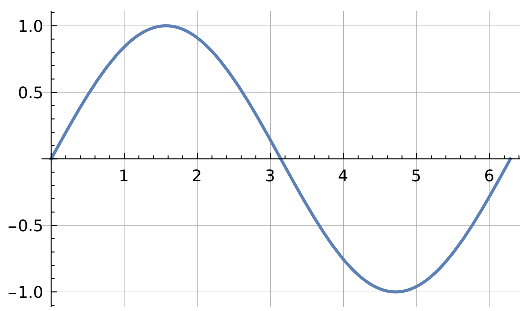
Out[42]= 1.41421

Section - 3.3

Q 1. Use the GridLines and Ticks option, as well as the setting GridLinesStyle → Lighter[Gray], to plot Sine function.

In[43]:=
```
Plot[Sin[x], {x, 0, 2 Pi}, GridLines → Automatic,
 Ticks → Automatic, GridLinesStyle → Lighter[Gray]]
```

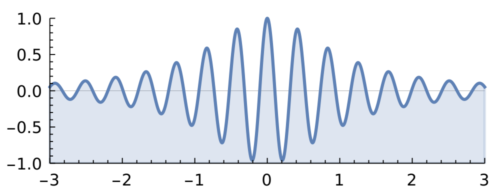
Out[43]=



Q 2. Use the Axes, Frame, Filling, FrameStyle, PlotRange, and AspectRatio options to produce the plot of the function y = Cos[15 x]/(1 + x^2).

In[5]:=
```
Plot[Cos[15 x]/(1 + x^2), {x, -3, 3}, PlotRange → {{-3, 3}, {-1, 1}},
 Frame → False, AspectRatio → Automatic, Axes → True,
 Filling → {Axis}, AxesOrigin → {-3, -1}, GridLines → {{}, {0, 0}}]
```

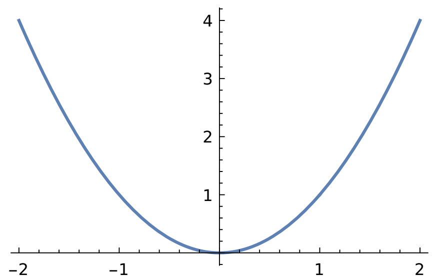
Out[5]=



Q 4. 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[6]:=
```
Plot[x^2, {x, -2, 2}, Exclusions → {x == 1}]
```

Out[6]=

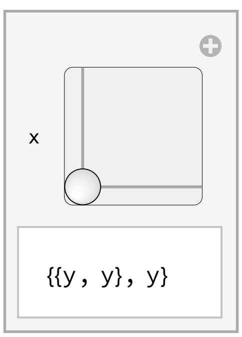


Section - 3.4

Q 1. Make a manipulate that also has output {x,y}, but that has a single Slider2D controller.

In[8]:=
```
Manipulate[{x, y}, {x, y, {0, 1}}]
```

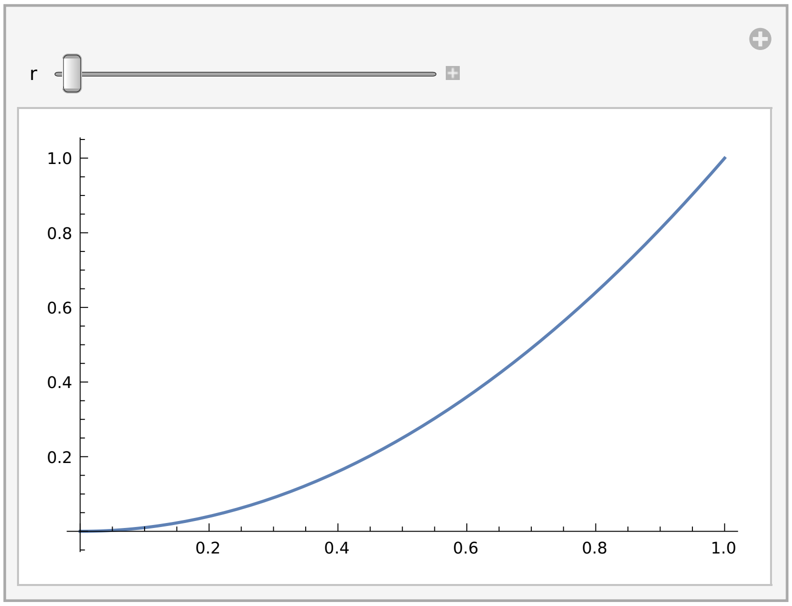
Out[8]=



Q 2. Make a manipulate of a plot where the user can adjust the AspectRatio in real time, from a starting value of 1/5 to an ending value of 5. Set ImageSize to {Automatic,128} so the height remains constant as the slider is moved.

In[9]:=
```
Manipulate[Plot[x^2, {x, 0, r}], {r, 1, 3},
 ImageSize → {Automatic, 128}, AspectRatio → 5/6]
```

Out[9]=



Section - 3.5

Q 1. 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 inputs as Range[100] and Partition[range[100],10] and discuss outputs.
b) Format a table of the first 100 integers, with 20 digits per row.
c) Make the same table ,but use only the Table and Range commands.
b) Make the same table, but use only the table command (twice).

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

Out[10]=
```
{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[11]:=
```
Partition[Range[100], 10]
```
Out[11]=
```
{{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[12]:=
```
Table[x, {x, 1, 100}]
```
Out[12]=
```
{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[13]:=
```
Partition[Table[x, {x, 1, 100}], 20]
```
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[14]:=
```
Table[Range[10], 10]
```
Out[14]=
```
{{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}}
```
In[19]:=
```
Table[Table[x, {x, 1, 100}], 1]
```
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}}
```

Q 4. The Sum command has a syntaxsimilar to that of Table.

a) Use the sum command to evaluate the following expression:

1^3 + 2^3 + 3^3 + 4^3 +....+ 20^3.

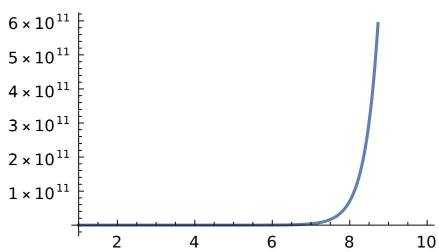
b) Make a table of values for x = 1,2,...,10 for the function

f(x) = 1^x + 2^x + 3^x +4^x +...+ 20^x.

c) Plot f(x) on the domain 1 ≤ x ≤ 10.

```
In[1]:= f[x_] := x^3

In[2]:= Sum[f[x], {x, 1, 20}]

Out[2]= 44100

In[3]:= 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[4]:= Table[f[x], {x, 1, 10}]

Out[4]= {210, 2870, 44100, 722666, 12333300, 216455810,
          3877286700, 70540730666, 1299155279940, 24163571680850}

In[5]:= Plot[f[x], {x, 1, 10}]
```

Out[5]=



Section - 3.6

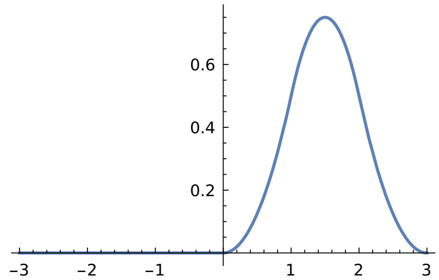
Q 1. Make a plot of the piecewise function below, and comment on its shape.

f(x) =	**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[6]:= 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[7]:=
```
Plot[f[x], {x, -3, 3}]
```

Out[7]=



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

In[2]:=
```
Plot[f[x], {x, 0, 20}]
```

Out[2]=