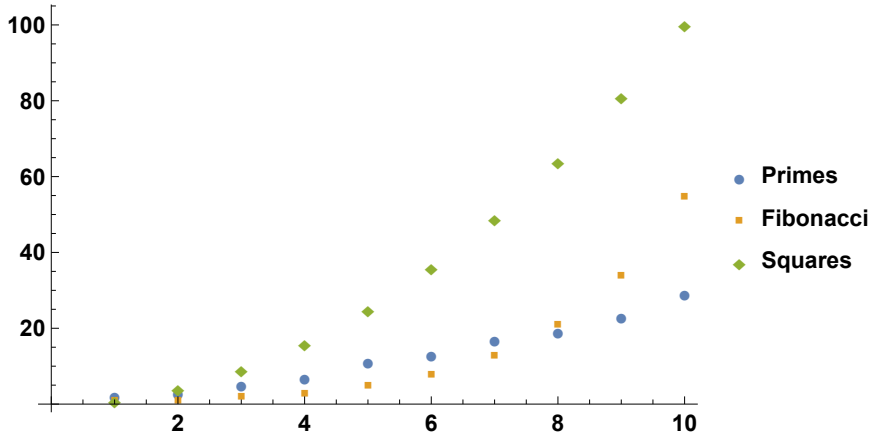
Assignment 04

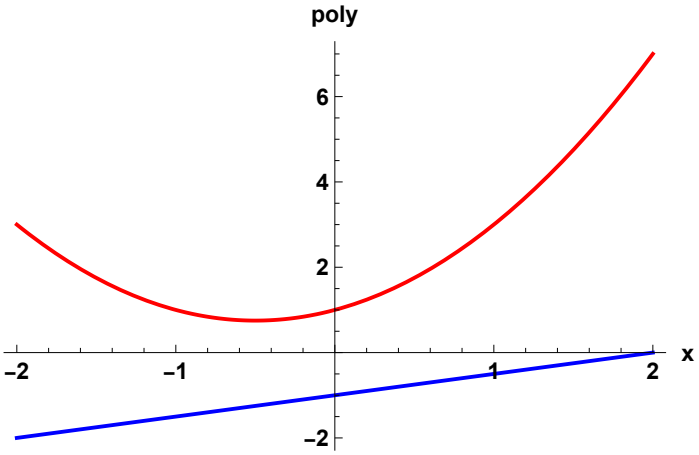
Plot together the set of points corresponding to the first ten primes, the first ten Fibonacci numbers, and the first ten perfect squares.
Use different symbols for the points
[hint: in help search for PlotMarkers].
Show a legend, place it in a position so that it does not cover the plot

```
Clear[l1, l2, l3];
l1 = Table[Prime[k], {k, 1, 10}];
l2 = Table[Fibonacci[k], {k, 1, 10}];
l3 = Table[k^2, {k, 1, 10}];
ListPlot[{l1, l2, l3}, PlotMarkers → Automatic,
 PlotLegends → {"Primes", "Fibonacci", "Squares"},
 LabelStyle → Directive[Black, Bold, Medium]]
```



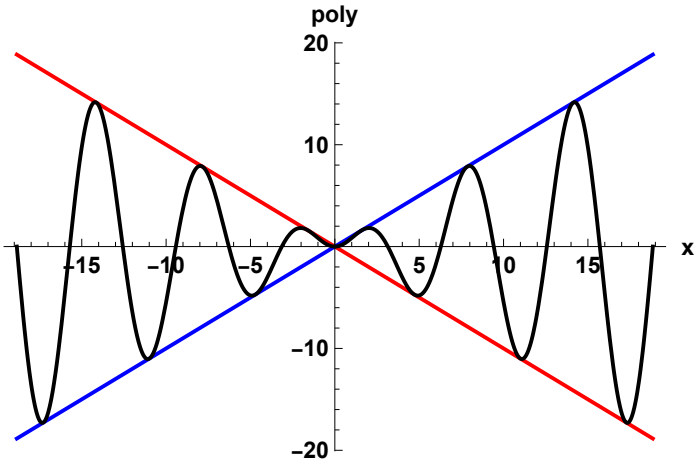
Plot simultaneously x^2 + x + 1 and x/2-1 from x=-2 to x=2. Choose different colors for the curves and make them thick, label the axes.

```
Plot[{x^2 + x + 1, x / 2 - 1}, {x, -2, 2},
 PlotStyle → {{Thick, Red}, {Thick, Blue}}, AxesLabel → {"x", "poly"},
 PlotRange → All, LabelStyle → Directive[Black, Bold, Medium]]
```



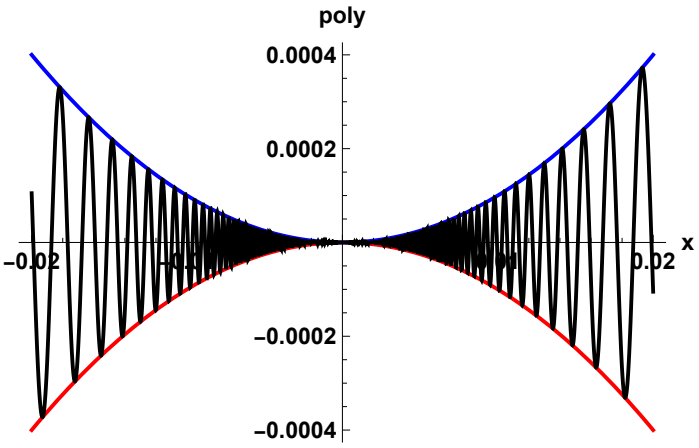
Plot simultaneously the functions y=-x, y=x, and y=x sinx on the interval [-6π,6π]. Choose different colors for the curves.

```
Plot[{-x, x, x Sin[x]}, {x, -6 Pi, 6 Pi},
 PlotStyle → {{Thick, Red}, {Thick, Blue}, {Thick, Black}},
 AxesLabel → {"x", "poly"}, PlotRange → All,
 LabelStyle → Directive[Black, Bold, Medium]]
```



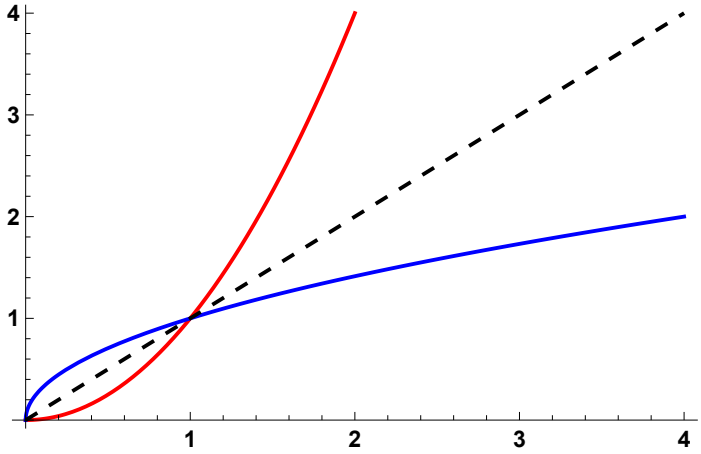
Plot simultaneously the functions y=-x^2, y=x^2, and y=x^2 sin(1/x) on the interval [-0.02,0.02].

```
Plot[{-x^2, x^2, x^2 Sin[1 / x]}, {x, -0.02, 0.02},
 PlotStyle → {{Thick, Red}, {Thick, Blue}, {Thick, Black}},
 AxesLabel → {"x", "poly"}, PlotRange → All,
 LabelStyle → Directive[Black, Bold, Medium]]
```



The function y1=x^2 is the inverse of y2= $\sqrt{x}$. Inverse functions are symmetric with respect to the line y=x.
Plot y1 in the interval [0,2] and y2 in the interval [0,4] with solid lines and y=x in the interval [0,4] with a dashed line. Observe the symmetry.
[hint: use "Show"]
Use different colors for each curve.
Use the same range for the x and y-axes from 0 to 4.

```
Clear[f1, f, f2];
f1 = Plot[x^2 , {x, 0, 2}, PlotStyle → {Red, Thick}];
f2 = Plot[Sqrt[x], {x, 0, 4}, PlotStyle → {Blue, Thick}];
f = Plot[x, {x, 0, 4}, PlotStyle → {Thick, Dashing[0.02], Black}];
Show[{f1, f2, f}, PlotRange → {{0, 4}, {0, 4}},
 LabelStyle → Directive[Black, Bold, Medium]]
```



INTERFERENCE IN SPACE

Suppose you have two sine waves
y(x,t) = A sin(k x + w t)
where one moves to the right and the other to the left.
Choose A=k=w=1.

Use a do-loop to plot the two waves together for x between -2π and 2π for some values of time between 0 and 2π.
The wave moving to the left should be blue and the on moving right should be red.
The curves should not be too thin.

The PlotRange for the y-axis should go from -1.1 to 1.1.
Label the axes.
Name each instant of the snapshot.

```
Do[
 Print[];
 Print["Time = ", t];
 Print[Plot[{Sin[ x + t], Sin[ x - t]}, {x, -2 Pi, 2 Pi},
   PlotStyle → {{Blue, Thick}, {Red, Thick}}, PlotRange → {-1.1, 1.1},
   AxesLabel → {"x", "y(x,t)"}, LabelStyle → Directive[Black, Bold, Medium]] ];
 ,
 {t,
  0,
  6}]
```

```
Do[
 Print[Plot[{Sin[ x + t], Sin[ x - t]}, {x, -2 Pi, 2 Pi},
    PlotStyle → {{Blue, Thick}, {Red, Thick}}, PlotRange → {-1.1, 1.1},
    AxesLabel → {"x", "y(x,t)"}, PlotLabel → {"Time = ", t}]];
 ,
 {t,
  0,
  6}]
```

Do the same as above, but using "Manipulate". DO NOT label the plot.

```
Manipulate[Plot[{Sin[ x + t], Sin[ x - t]},
  {x, -2 Pi, 2 Pi}, PlotStyle → {{Blue, Thick}, {Red, Thick}},
  PlotRange → {-1.1, 1.1}, AxesLabel → {"x", "y(x,t)"},
  LabelStyle → Directive[Black, Bold, Medium]], {t, 0, 2 Pi}]
```

Use "Manipulate" again, but this time, instead of two separate waves, plot their sum. Choose black as the color of the curve. Careful with the range of values for the y-axis, it should be stretched.

```
Manipulate[Plot[{Sin[ x + t] + Sin[ x - t]}, {x, -2 Pi, 2 Pi}, PlotStyle → {Black, Thick},
  PlotRange → {-2.1, 2.1}, LabelStyle → Directive[Black, Bold, Medium]], {t, 0, 2 Pi}]
```

Use "Manipulate[Column[{ plot of two curves, plot of the sum}], {values of time}]" to get both plots from (ii) and (iii) together.

```
Manipulate[Column[{Plot[{Sin[ x + t], Sin[ x - t]}, {x, -2 Pi, 2 Pi},
     PlotStyle → {{Blue, Thick}, {Red, Thick}}, PlotRange → {-1.1, 1.1},
     LabelStyle → Directive[Black, Bold, Medium]], Plot[{Sin[ x + t] + Sin[ x - t]},
     {x, -2 Pi, 2 Pi}, PlotStyle → {Black, Thick}, PlotRange → {-2.1, 2.1},
     LabelStyle → Directive[Black, Bold, Medium]]}], {t, 0, 2 Pi}]
```

FOR BETTER SIZES, use ImageSize

```
Manipulate[Column[{Plot[{Sin[ x + t], Sin[ x - t]}, {x, -2 Pi, 2 Pi},
     PlotStyle → {{Blue, Thick}, {Red, Thick}}, PlotRange → {-1.1, 1.1},
     LabelStyle → Directive[Black, Bold, Medium], ImageSize → 350],
    Plot[{Sin[ x + t] + Sin[ x - t]}, {x, -2 Pi, 2 Pi}, PlotStyle → {Black, Thick},
     PlotRange → {-2.1, 2.1}, LabelStyle → Directive[Black, Bold, Medium],
     ImageSize → 350]}], {t, 0, 2 Pi}]
```

BEAT

Suppose you have two sine waves
x(t) = A sin(w t)
with the same amplitude A=1, but two different frequencies w1 and w2.

Use "Manipulate[Column[ ] , {range of w1}, {range w2}]" to illustrate the beat caused by the interference in time of the two waves.

Label the axes.
The time should go from 0 to 10π
Each frequency from 0 to 10.

The top plot has both waves, one wave is red and the other is blue.
The bottom plot has the sum of the two waves, the curve is black.

```
Manipulate[Column[{Plot[{Sin[ w1 t], Sin[ w2 t]},
     {t, 0, 10 Pi}, PlotStyle → {{Blue, Thick}, {Red, Thick}},
     PlotRange → {-1.1, 1.1}, AxesLabel → {"time", "x"},
     LabelStyle → Directive[Black, Bold, Medium], ImageSize → 350],
    Plot[{Sin[w1 t] + Sin[w2 t]}, {t, 0, 10 Pi}, PlotStyle → {Black, Thick},
     PlotRange → {-2.1, 2.1}, AxesLabel → {"time", "Beat"}, LabelStyle →
      Directive[Black, Bold, Medium], ImageSize → 350]}], {w1, 1, 10}, {w2, 1, 10}]
```