The Abdus Salam
International Centre for Theoretical Physics

United Nations
Educational, Scientific and
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IAEA
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2223-4

Winter College on Optics in Imaging Science

31 January - 11 February, 2011

Sampling + Example

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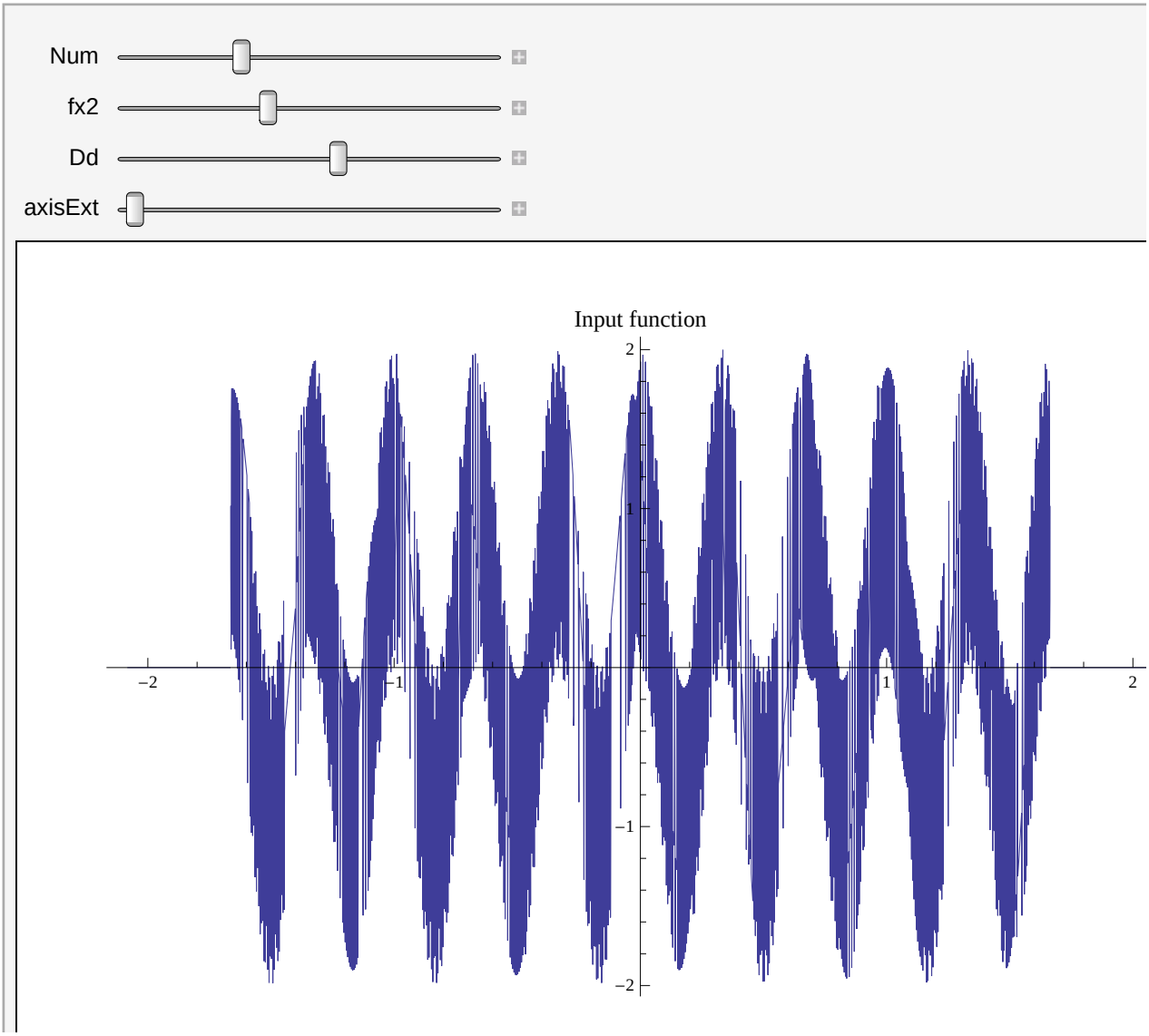
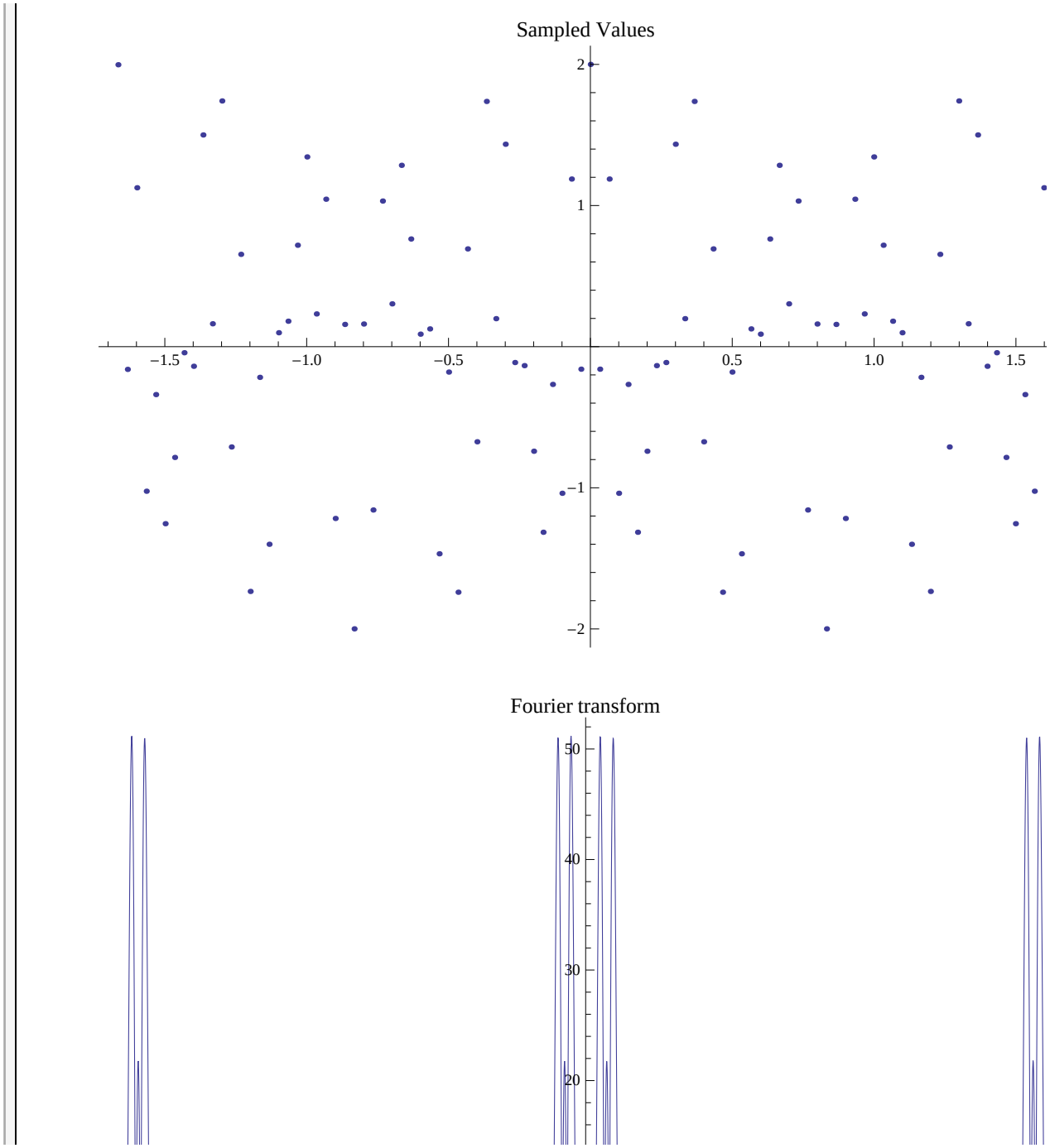
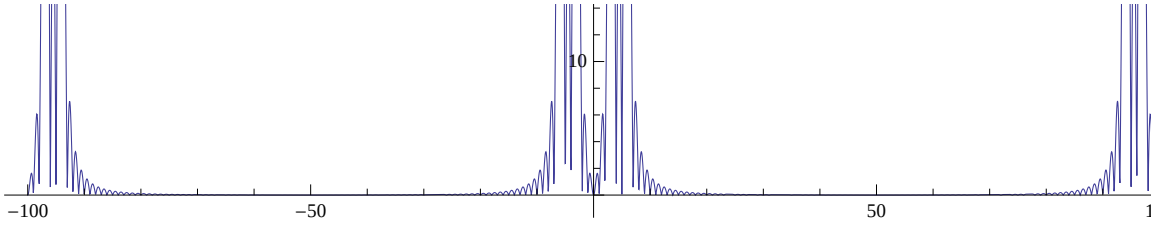
```
Manipulate[Show[GraphicsArray[{{Plot[{InpFunc[x, fx1D, fx2, Dd]},
       {x, -1.25 Dd, 1.25 Dd}, ImageSize → Large, PlotLabel → "Input function"]},
     {ListPlot[SampledValues[fx1D, fx2, Dd, Num], PlotLabel → "Sampled Values"]},
     {Plot[{Abs[FTInpFunc[v, fx1D, fx2, DdD, Num]]}, {v, -FreqExt, axisExt},
       PlotRange → All, ImageSize → Large, PlotLabel → "Fourier transform"]}}]],
 {Num, 10, 300}, {fx2, 1, 500}, {Dd, DdD, 5 DdD}, {axisExt, FreqExt, 5 FreqExt},
 SaveDefinitions → True]
```




Sampled Values
2
1
−1
−2
−1.5
−1.0
−0.5
0.5
1.0
1.5
Fourier transform
50
40
30
20

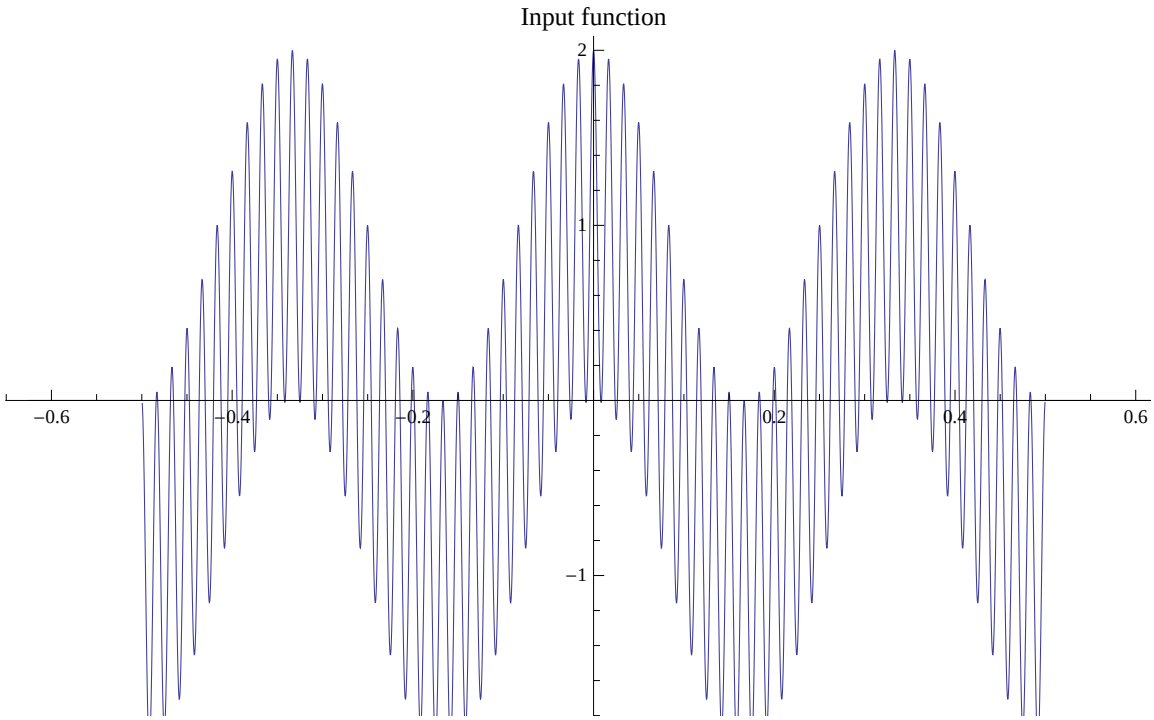


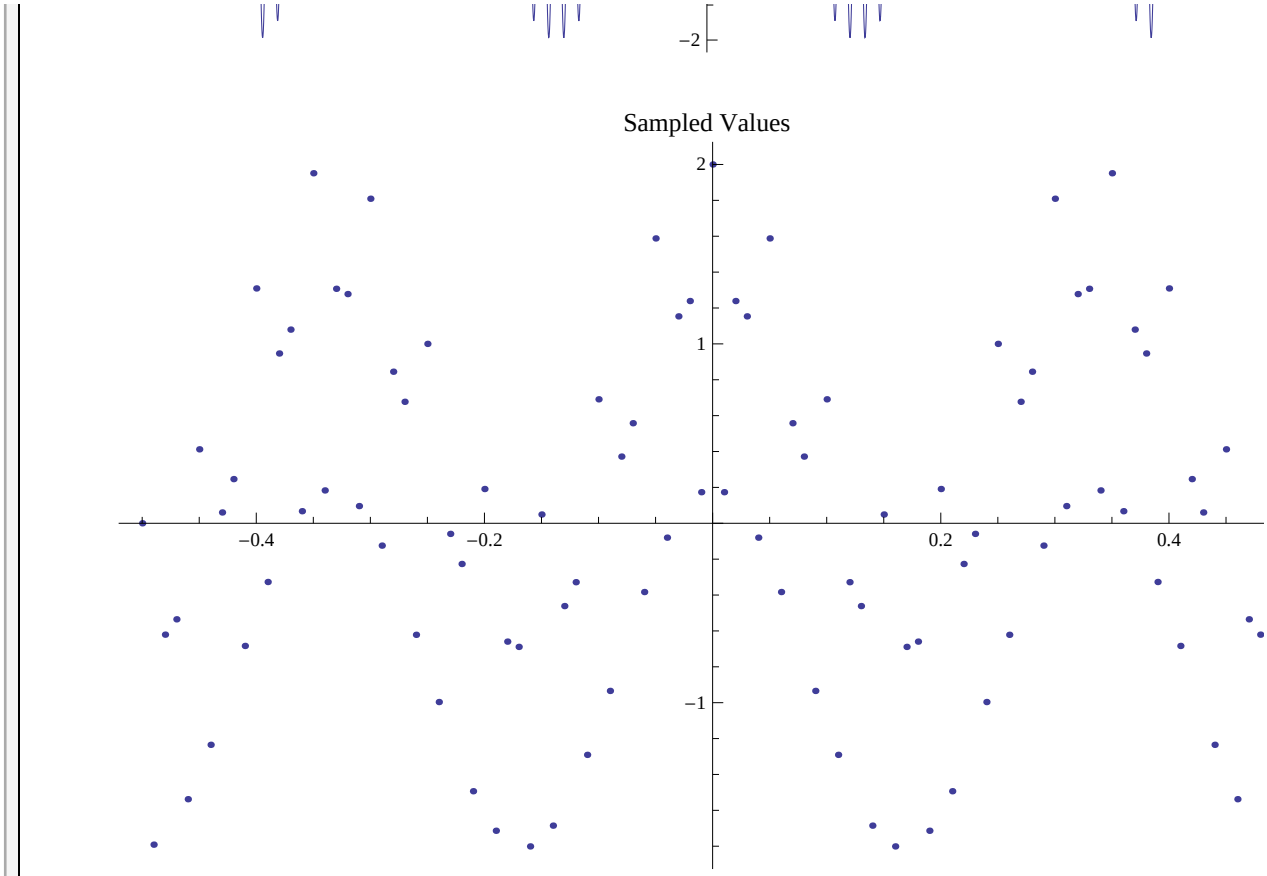
Num

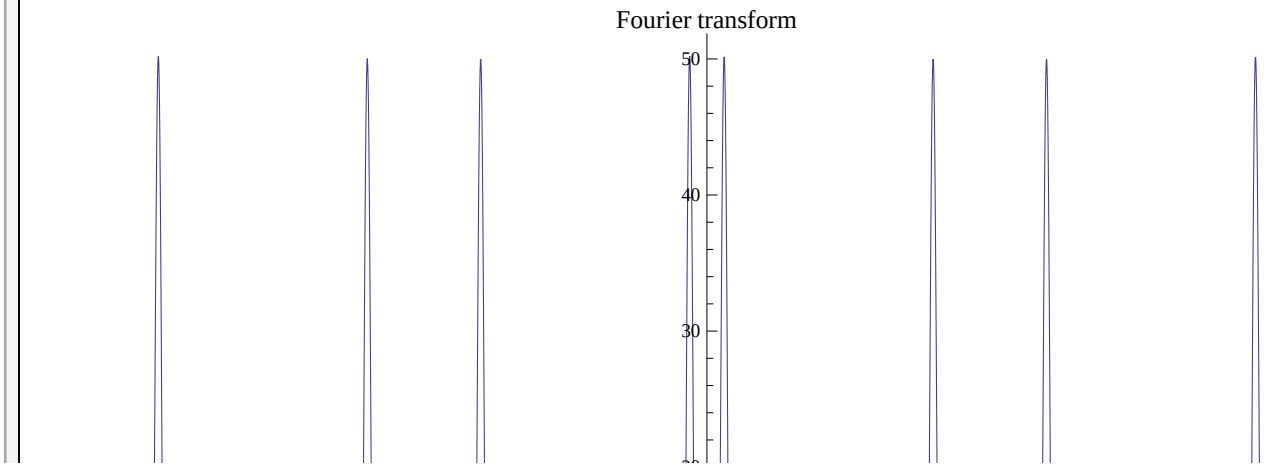
fx2

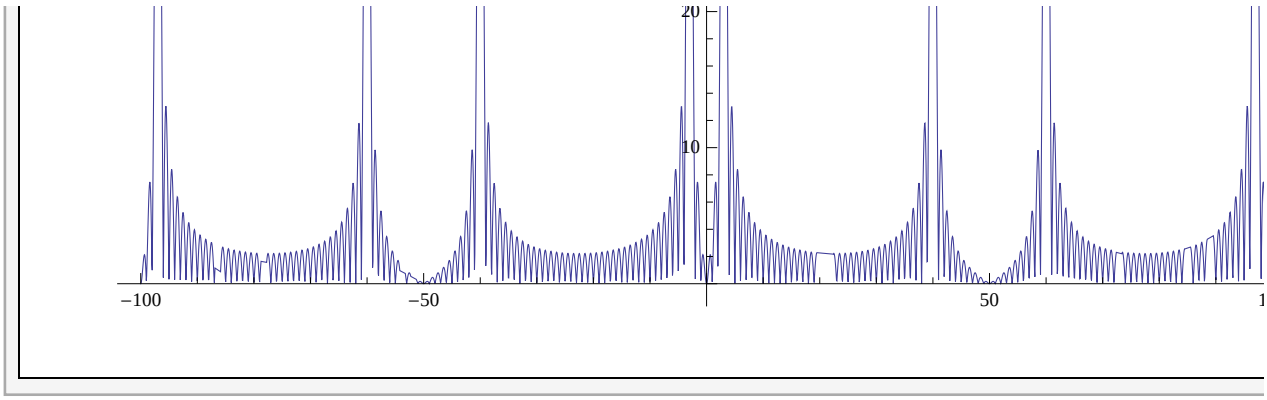
Dd

axisExt




Sampled Values
2
1
−1
−2
−0.4
−0.2
0.2
0.4


Fourier transform
50
40
30




```
Rectang[x_, l_] = UnitStep[(x + l)] - UnitStep[(x - l)];
```

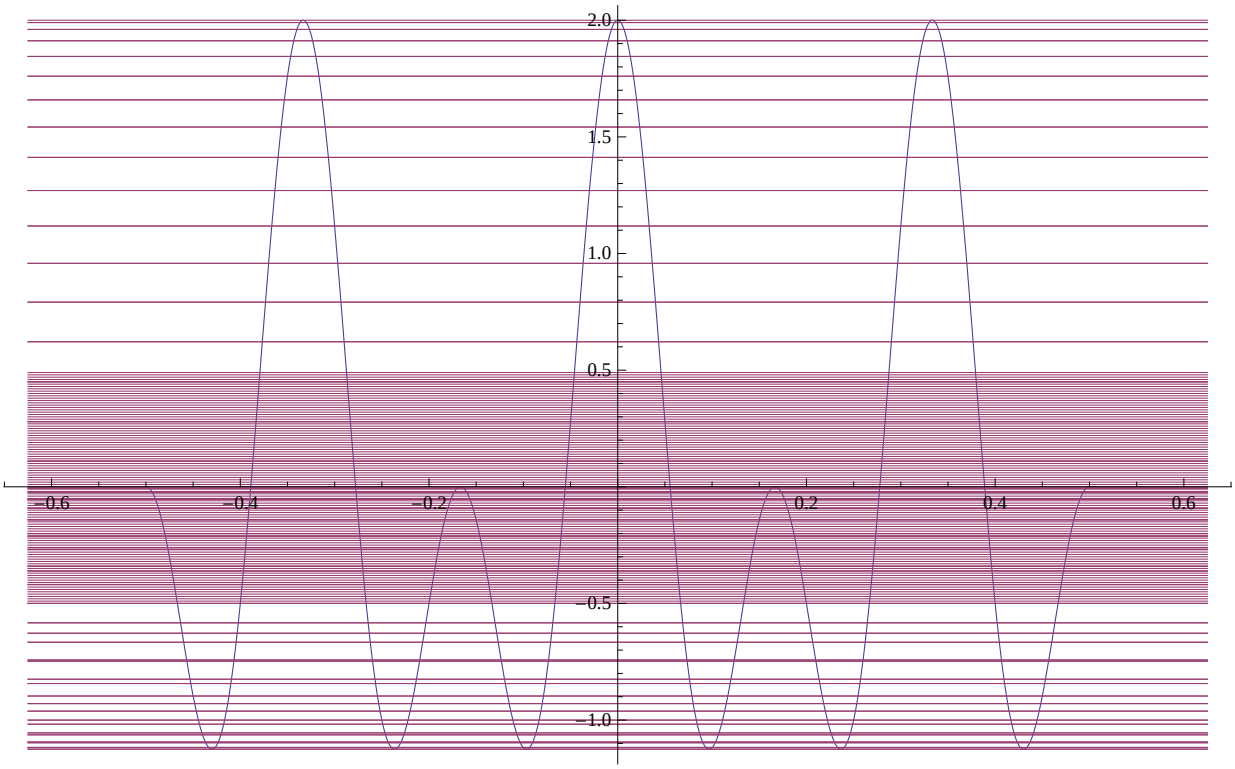
```
InpFunc[x_, fx1_, fx2_, L_] := Rectang[x, L] (Cos[2 π fx1 x] + Cos[2 π fx2 x])
```

```
FTInpFunc[v_, fx1_, fx2_, L_, Num_] :=
 Sum[InpFunc[x, fx1, fx2, L] Exp[- I 2 π x v], {x, -L, L - 2 L / Num, 2 L / Num}]
```

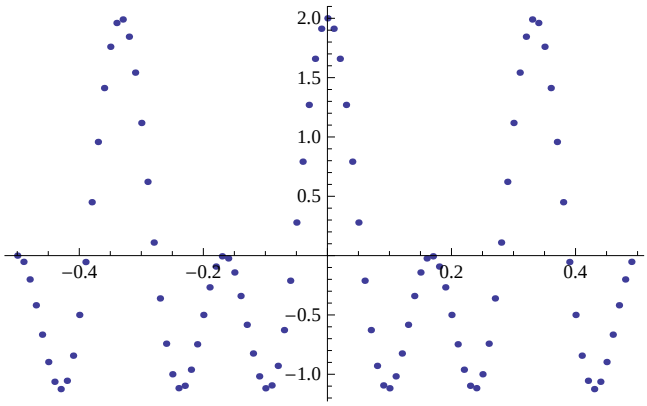
```
SampledValues[fx1_, fx2_, L_, Num_] :=
 Table[{x, InpFunc[x, fx1, fx2, L]}, {x, -L, L - 2 L / Num, 2 L / Num}]
```

```
fx1D = 3;
fx2D = 6;
DdD = 0.5;
```

```
Plot[{InpFunc[x, fx1D, fx2D, DdD], SampledValues[fx1D, fx2D, DdD, NumD]},
 {x, -1.25 DdD, 1.25 DdD}, ImageSize → Large]
```



```
ListPlot[SampledValues[fx1D, fx2D, DdD, NumD]]
```

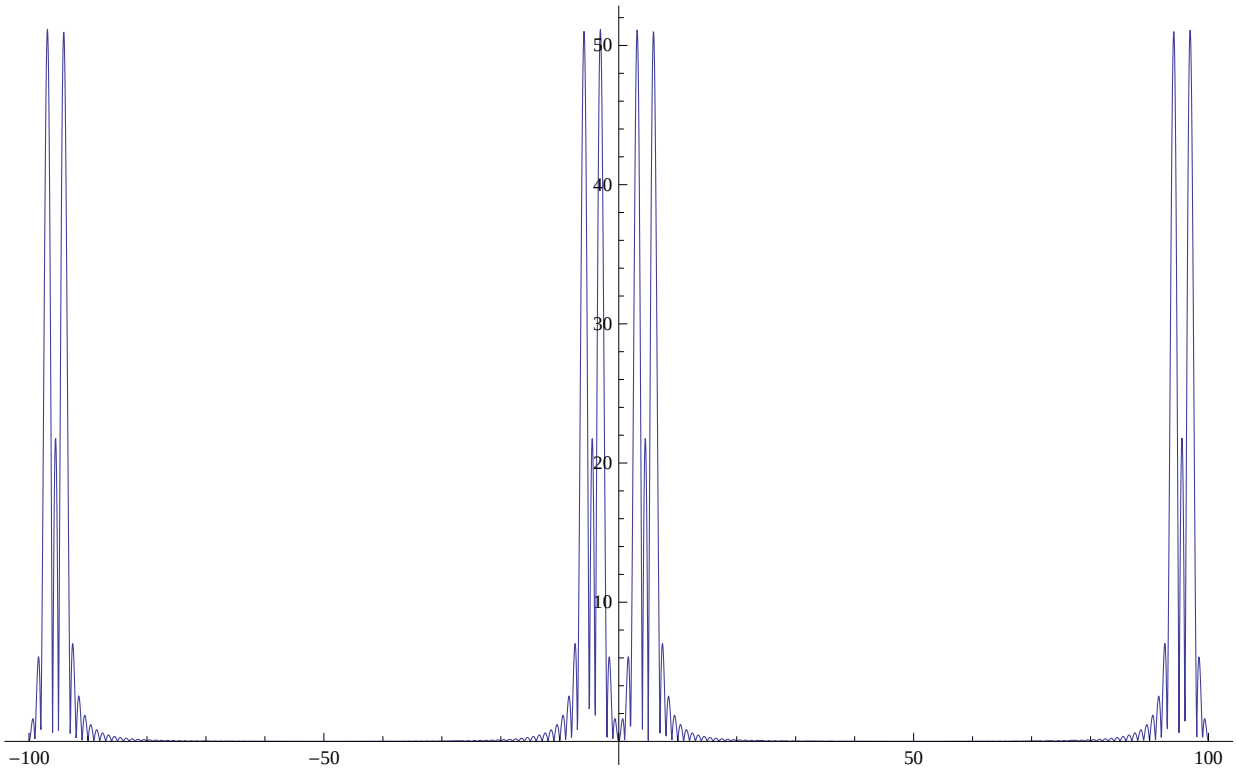



```
Ext = 2 DdD;
NumD = 100;

δx = Ext / NumD;

FreqExt = 1 / δx;

Plot[{Abs[FTInpFunc[v, fx1D, fx2D, DdD, NumD]]},
 {v, -FreqExt, FreqExt}, PlotRange → All, ImageSize → Large]
```




```
InpFunc[.1, fx1D, fx2D, DdD]
```

```
Cos[0.628319 f1] + Cos[0.628319 f2]
```