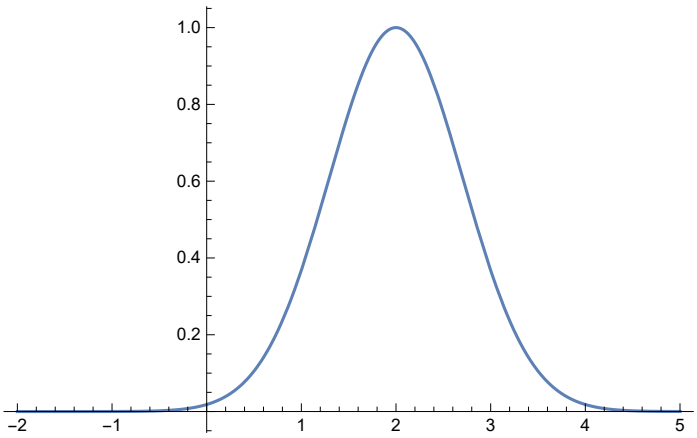
In[1]:=
```
f[x_] := Exp[-(x - a)^2];                    (*Not normalized*)
a = 2;
Plot[f[x], {x, -2, 5}, PlotRange → Full, PlotLegends → "Expressions"]
NIntegrate[f[x], {x, -∞, ∞}]
```

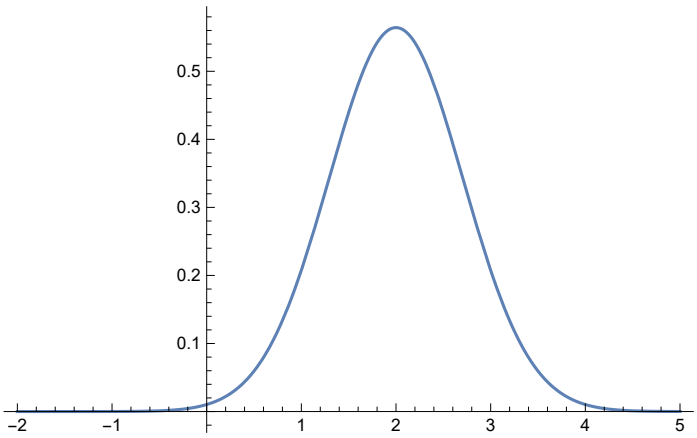
Out[2]=



Out[3]= 1.77245

In[4]:=
```
f[x_] := (1 / Sqrt[π]) * Exp[-(x - a)^2];          (*Normalized*)
a = 2;
Plot[f[x], {x, -2, 5}, PlotRange → Full, PlotLegends → "Expressions"]
NIntegrate[f[x], {x, -∞, ∞}]
```

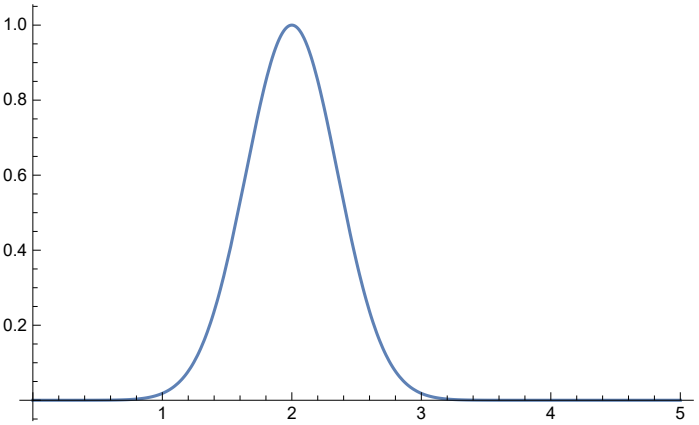
Out[5]=



Out[6]= 1.

In[7]:=
```
f[x_, k_] := Exp[-((x - a)^2) / k^2];
(*Not normalized*) (*What do k do in the exponential*)
a = 2;
Plot[f[x, k = 0.5], {x, 0, 5}, PlotRange → Full, PlotLegends → "Expressions"]
NIntegrate[f[x, k = 0.5], {x, -∞, ∞}]
2 * NIntegrate[f[x, k = 0.5], {x, -∞, ∞}]
```

Out[8]=

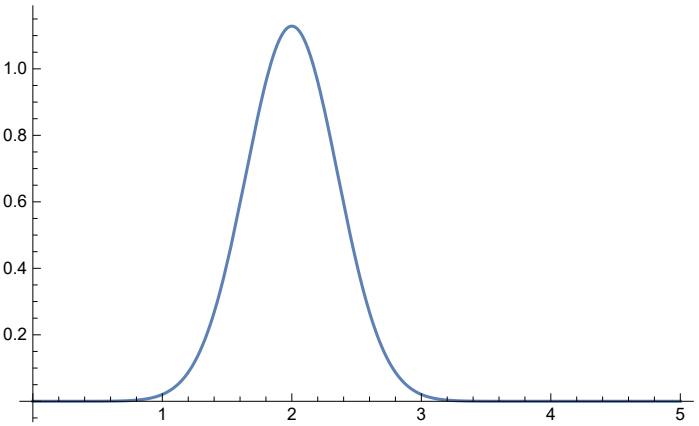


Out[9]= 0.886227

Out[10]= 1.77245

In[11]:=
```
f[x_, k_] := (1 / (k Sqrt[π])) Exp[-((x - a)^2) / k^2];          (*Normalized*)
a = 2;
Plot[f[x, k = 0.5], {x, 0, 5}, PlotRange → Full, PlotLegends → "Expressions"]
NIntegrate[f[x, k = 0.5], {x, -∞, ∞}]
NIntegrate[f[x, k = 0.05], {x, -∞, ∞}]
```

Out[13]=

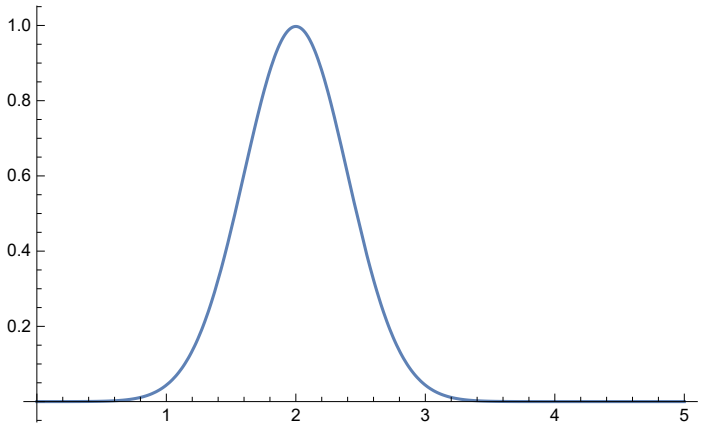


Out[14]= 1.

Out[15]= 1.

In[16]:=
```
G[x_] := (1 / (σ * Sqrt[2 Pi])) Exp[-((x - a)^2) / (2 σ^2)];
(*What do σ do in the exponenetial*)
a = 2; σ = 0.4;
Plot[G[x], {x, 0, 5}]
```

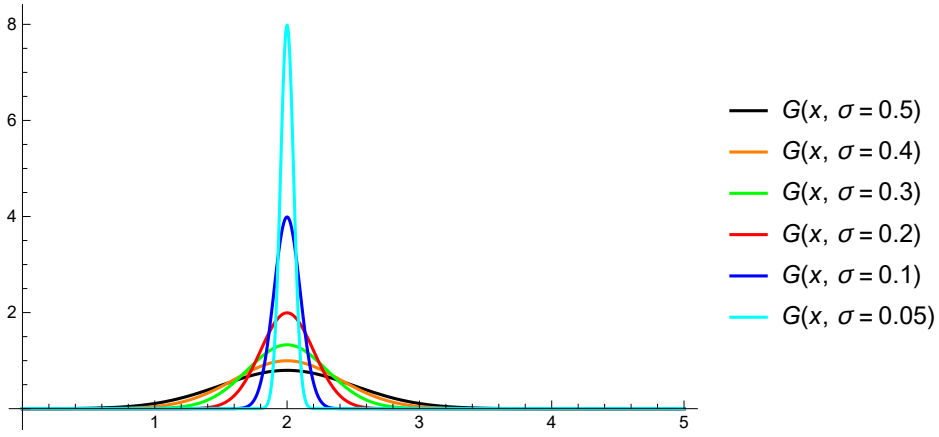
Out[17]=



In[18]:=
```
G[x_, σ_] := (1 / (σ * Sqrt[2 Pi])) Exp[-((x - a)^2) / (2 σ^2)];
(*What do σ do in the exponenetial*)
a = 2;
Plot[{G[x, σ = 0.5], G[x, σ = 0.4], G[x, σ = 0.3],
  G[x, σ = 0.2], G[x, σ = 0.1], G[x, σ = 0.05]}, {x, 0, 5}, PlotRange → Full,
 PlotStyle → {Black, Orange, Green, Red, Blue, Cyan}, PlotLegends → "Expressions"]
NIntegrate[G[x, σ = 0.5], {x, -∞, ∞}]
NIntegrate[G[x, σ = 0.05], {x, -∞, ∞}]
```

General: Exp[–799.918] is too small to represent as a normalized machine number; precision may be lost.

Out[19]=

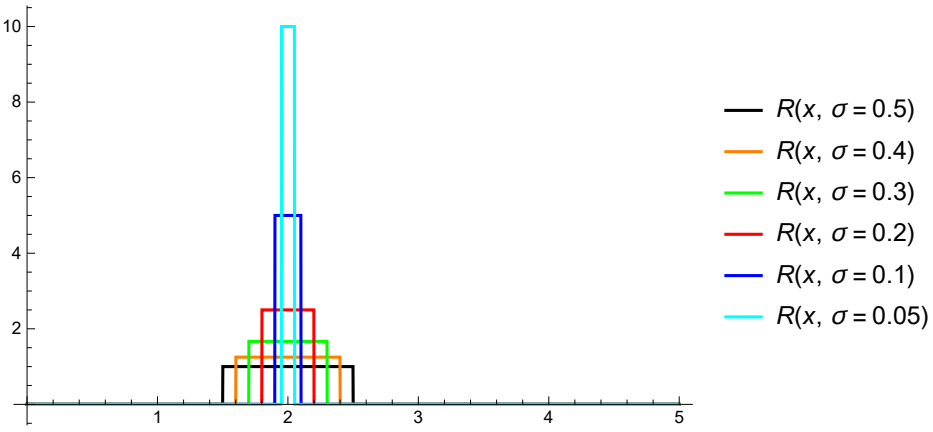


Out[20]= 1.

Out[21]= 1.

In[22]:=
```
R[x_, σ_] := Piecewise[{{1 / (2 σ), -σ < x - a < σ}, {0, Modulus[x - a] > σ}}];
a = 2;
Plot[{R[x, σ = 0.5], R[x, σ = 0.4], R[x, σ = 0.3],
   R[x, σ = 0.2], R[x, σ = 0.1], R[x, σ = 0.05]}, {x, 0, 5}, PlotRange → Full,
 PlotStyle → {Black, Orange, Green, Red, Blue, Cyan}, PlotLegends → "Expressions"]
NIntegrate[R[x, σ = 0.5], {x, -∞,  ∞}]
NIntegrate[R[x, σ = 0.05], {x, -∞,  ∞}]
```

Out[24]=

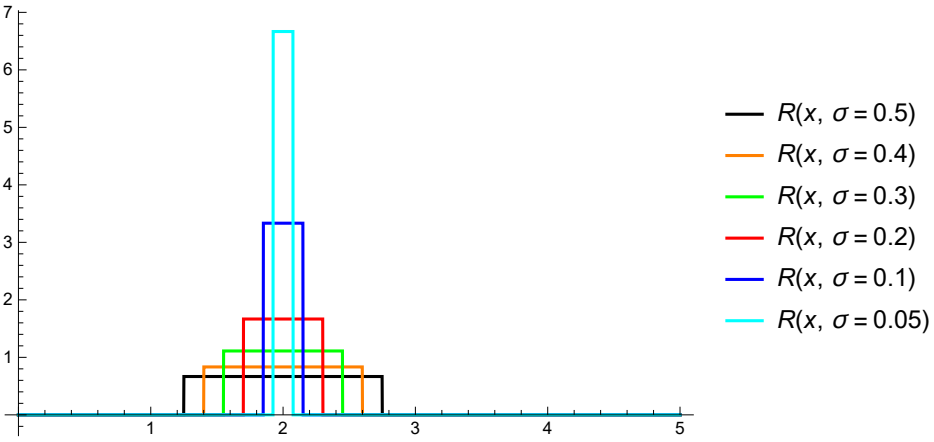


Out[25]= 1.

Out[26]= 1.

In[27]:=
```
R[x_, σ_] := Piecewise[{{1 / (3 σ), -3 σ / 2 < x - a < 3 σ / 2}, {0, Modulus[x - a] > 3 σ / 2}}];
a = 2;
Plot[{R[x, σ = 0.5], R[x, σ = 0.4], R[x, σ = 0.3],
   R[x, σ = 0.2], R[x, σ = 0.1], R[x, σ = 0.05]}, {x, 0, 5}, PlotRange → Full,
 PlotStyle → {Black, Orange, Green, Red, Blue, Cyan}, PlotLegends → "Expressions"]
NIntegrate[R[x, σ = 0.5], {x, -∞,  ∞}]
NIntegrate[R[x, σ = 0.05], {x, -∞,  ∞}]
```

Out[29]=

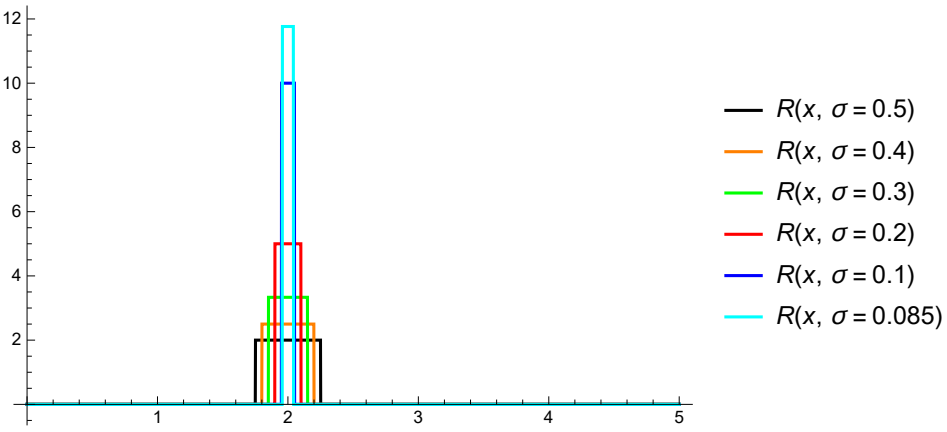


Out[30]= 1.

Out[31]= 1.

In[32]:=
```
R[x_, σ_] := Piecewise[{{1/σ, -σ/2 < x - a < σ/2}, {0, Modulus[x - a] > σ/2}}];
a = 2;
Plot[{R[x, σ = 0.5], R[x, σ = 0.4], R[x, σ = 0.3],
  R[x, σ = 0.2], R[x, σ = 0.1], R[x, σ = 0.085]}, {x, 0, 5}, PlotRange → Full,
 PlotStyle → {Black, Orange, Green, Red, Blue, Cyan}, PlotLegends → "Expressions"]
NIntegrate[R[x, σ = 0.5], {x, -∞,  ∞}]
NIntegrate[R[x, σ = 0.05], {x, -∞,  ∞}]
```

Out[34]=

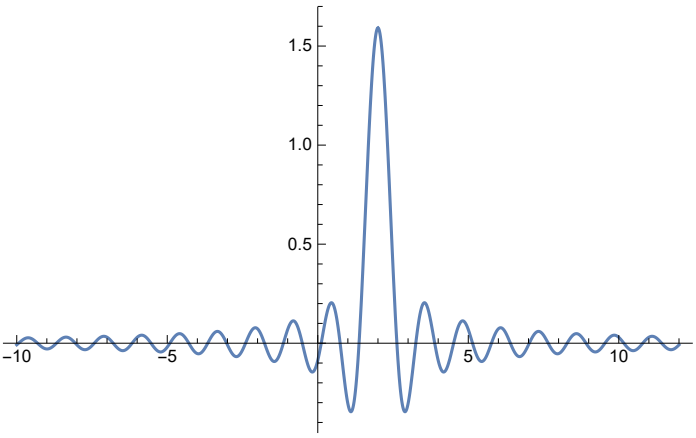


Out[35]= 1.

Out[36]= 1.

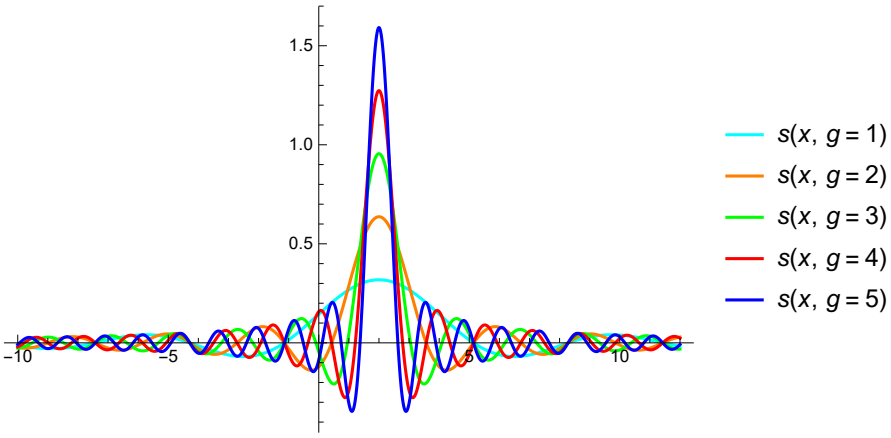
In[37]:=
```
s[x_] := Sin[g (x - a)] / (π (x - a));
a = 2; g = 5;
Plot[s[x], {x, -10, 10 + a}, PlotRange → Full, PlotLegends → "Expressions"]
```

Out[39]=



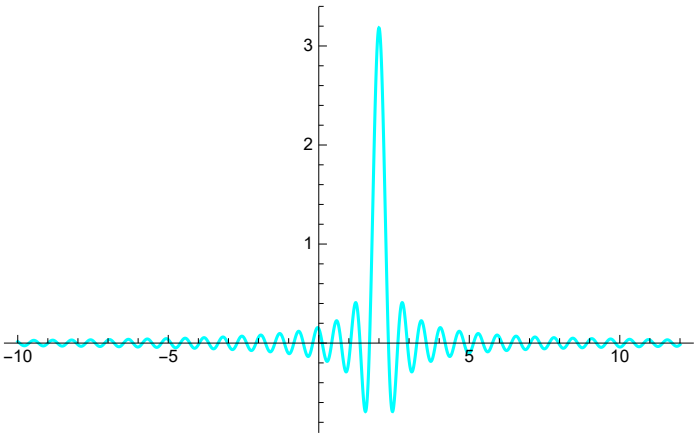
In[40]:=
```
s[x_, g_] := Sin[g (x - a)] / (π (x - a));
a = 2;
Plot[{s[x, g = 1], s[x, g = 2], s[x, g = 3], s[x, g = 4], s[x, g = 5]}, {x, -10, 10 + a},
 PlotRange → Full, PlotStyle → {Cyan, Orange, Green, Red, Blue}, PlotLegends → "Expressions"]
```

Out[42]=

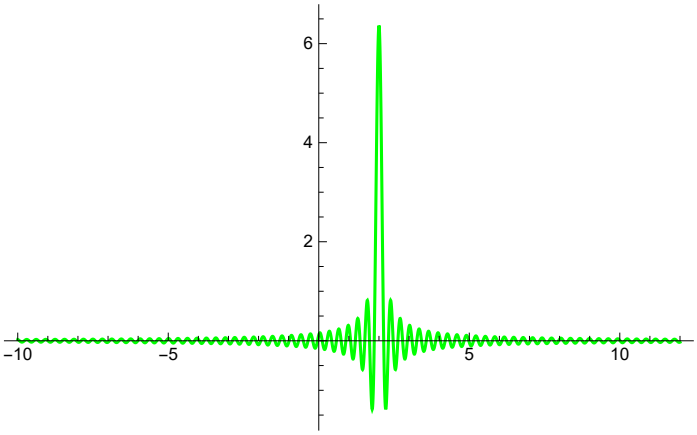


In[43]:=
```
s[x_, g_] := Sin[g (x - a)] / (π (x - a));
a = 2;
Plot[s[x, g = 10], {x, -10, 10 + a}, PlotRange → Full,
 PlotStyle → Cyan, PlotLegends → "Expressions"]
Plot[s[x, g = 20], {x, -10, 10 + a}, PlotRange → Full, PlotStyle → Green]
Plot[s[x, g = 50], {x, -10, 10 + a}, PlotRange → Full, PlotStyle → Blue]
Plot[s[x, g = 100], {x, -10, 10 + a}, PlotRange → Full, PlotStyle → Orange]
Plot[s[x, g = 1000], {x, -10, 10 + a}, PlotRange → Full, PlotStyle → Purple]
Plot[s[x, g = 1000], {x, -10, 10 + a}, PlotRange → Full, PlotStyle → Red]
```

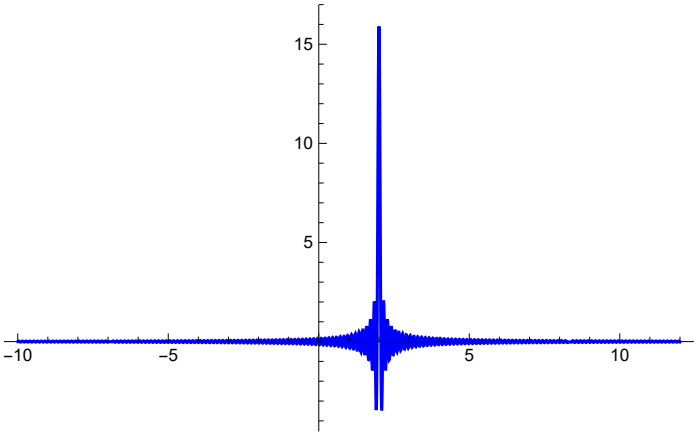
Out[45]=



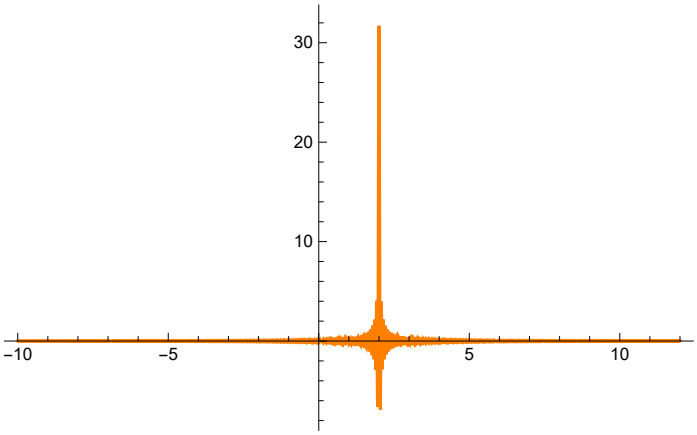
Out[46]=



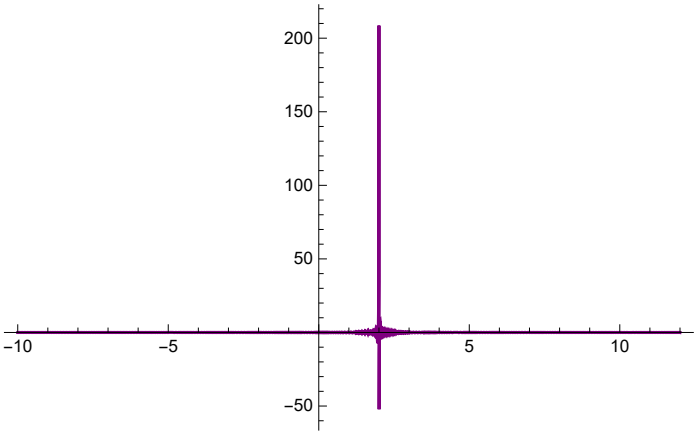
Out[47]=



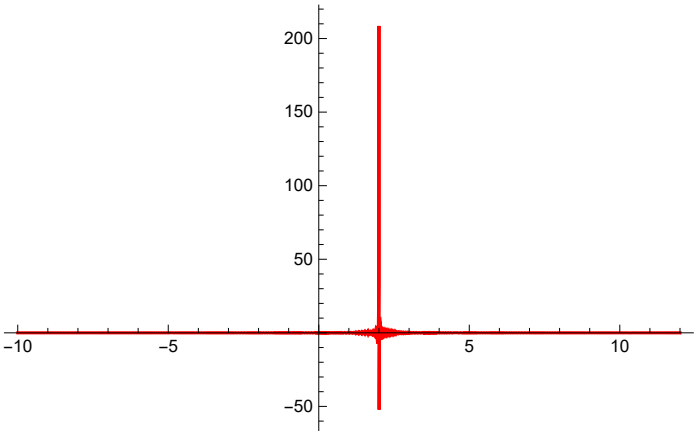
Out[48]=



Out[49]=



Out[50]=



In[51]:=