Fourier Series Solution 13.5.8
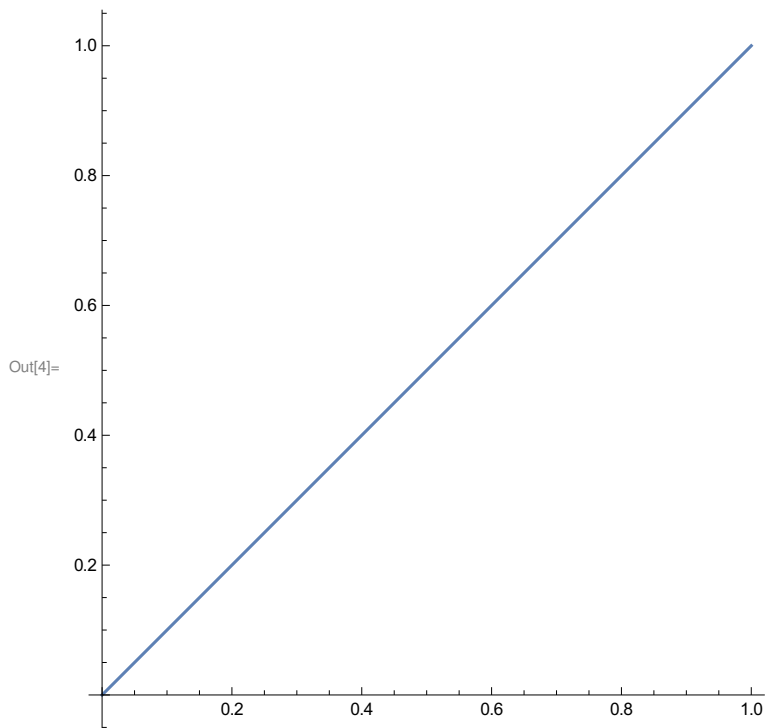
In[1]:= `a = 1`
`b = 1`
`f[x_] = x`

Out[1]= 1

Out[2]= 1

Out[3]= x

In[4]:= `Plot[f[x], {x, 0, a}, AspectRatio → Automatic]`

Out[4]=

In[5]:= `A[j_, x_] = Sin[j Pi x / a]`

Out[5]= $\text{Sin}[j \pi x]$

In[6]:= `c[j_] = (2 / a)`
`Integrate[ f[x] Sin[j Pi x / a], {x, 0, a}] / ((j Pi / a) Cosh[j Pi b / a] + Sinh[j Pi b / a])`

Out[6]= $\dfrac{2 \left(-j \pi \, \text{Cos}[j \pi] + \text{Sin}[j \pi]\right)}{j^2 \pi^2 \left(j \pi \, \text{Cosh}[j \pi] + \text{Sinh}[j \pi]\right)}$

In[7]:= `B[j_, y_] = c[j] ((j Pi / a) Cosh[j Pi y / a] + Sinh[j Pi y / a])`

Out[7]= $\left(2 \left(-j \pi \, \text{Cos}[j \pi] + \text{Sin}[j \pi]\right) \left(j \pi \, \text{Cosh}[j \pi y] + \text{Sinh}[j \pi y]\right)\right) /$
$\left(j^2 \pi^2 \left(j \pi \, \text{Cosh}[j \pi] + \text{Sinh}[j \pi]\right)\right)$
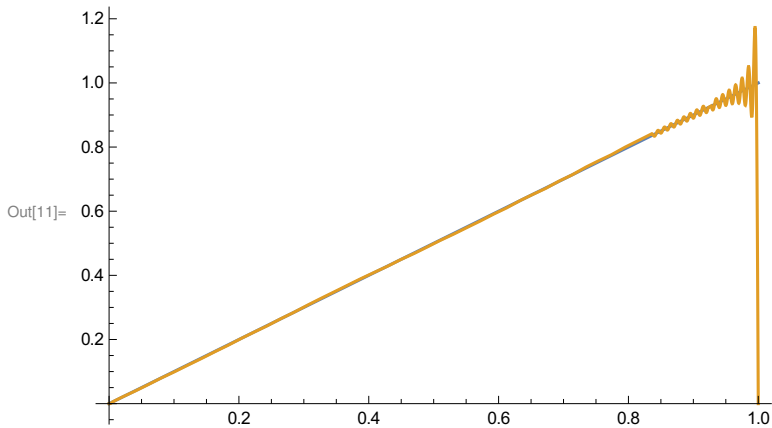
In[8]:= `u[x_, y_, k_] := Sum[A[j, x] B[j, y], {j, 1, k}]`
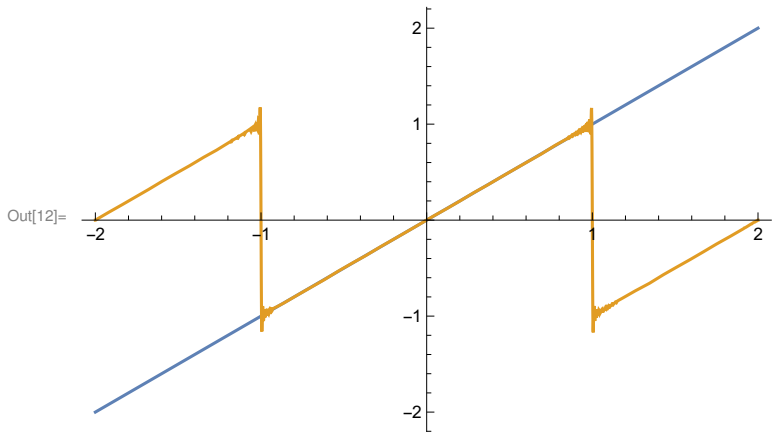
In[9]:=

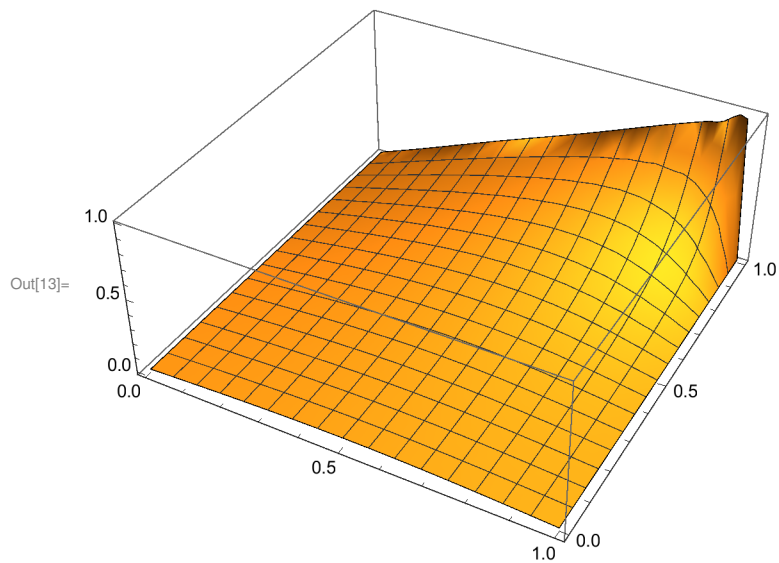In[10]:= `Plot[{f[x], u[x, 1, 2], u[x, 1, 4], u[x, 1, 10]}, {x, 0, a}]`

Out[10]=
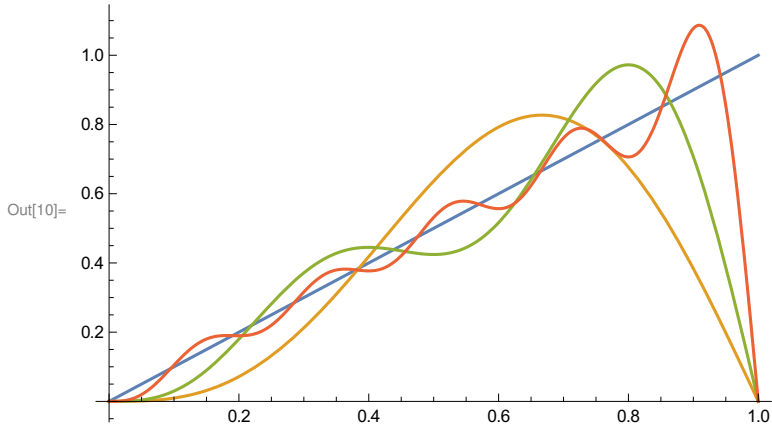
In[11]:= `Plot[{f[x], u[x, 1, 200]}, {x, 0, a}, PlotRange → All, AxesOrigin → {0, 0}]`

Out[11]=

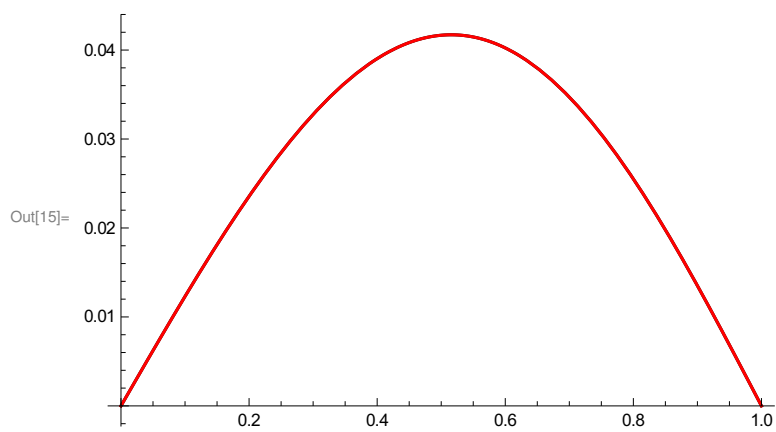In[12]:= `Plot[{f[x], u[x, 1, 200]}, {x, -2 a, 2 a}, PlotRange → All, AxesOrigin → {0, 0}]`

Out[12]=

In[13]:= `Plot3D[u[x, y, 200], {x, 0, a}, {y, 0, b}, PlotRange → All]`

Out[13]=
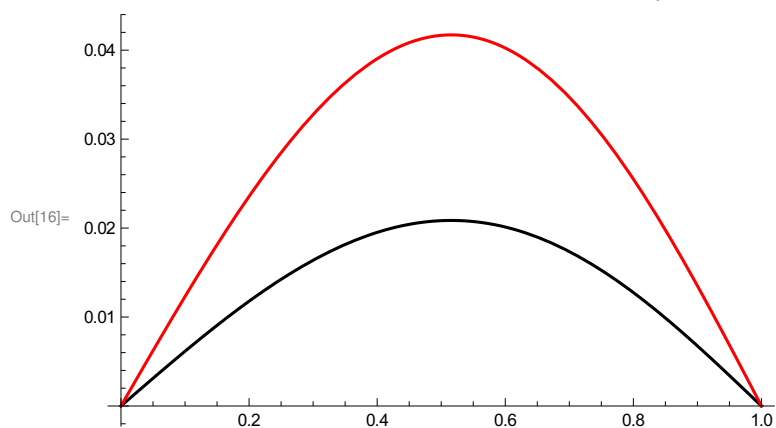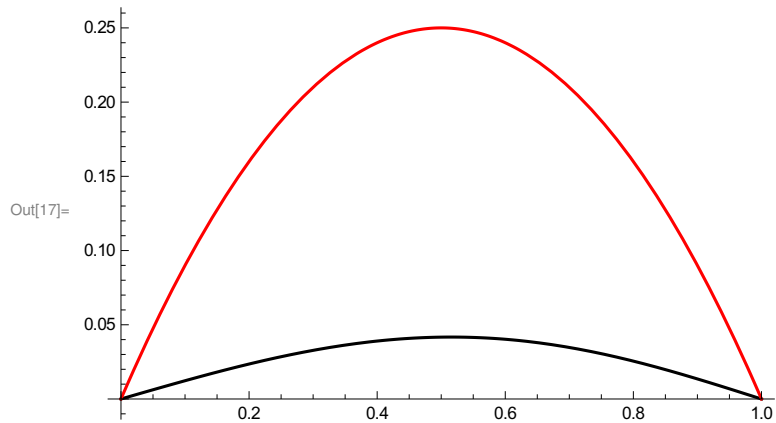

In[14]:= `uy200[x_, y_] = D[u[x, y, 200], y];`

In[15]:= `Plot[{uy200[x, 0], u[x, 0, 200]}, {x, 0, a}, PlotRange → All, PlotStyle → {Black, Red}]`

Out[15]=

In[16]:= `Plot[{uy200[x, 0] / 2, u[x, 0, 200]},`
`{x, 0, a}, PlotRange → All, PlotStyle → {Black, Red}]`

Out[16]=

In[17]:= `Plot[{u[x, 0, 200], x (1 - x)}, {x, 0, a}, PlotRange → All, PlotStyle → {Black, Red}]`

Out[17]=

In[18]:= `Plot[{u[x, 0, 200], x (1 - x) / 6}, {x, 0, a}, PlotRange → All, PlotStyle → {Black, Red}]`

Out[18]=