Temperature Distribution in a Cold Region With a Heated Surface

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Mathematical Physics 212 B
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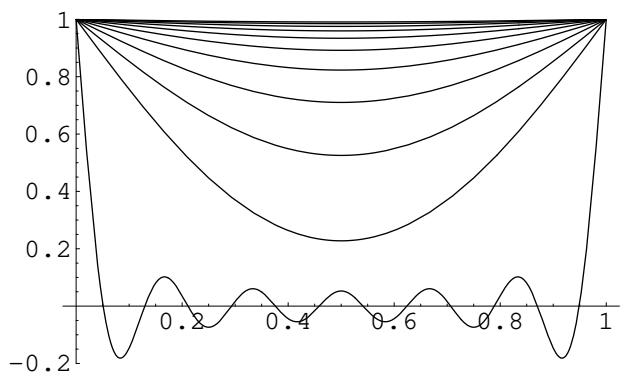
■ Temperature at surface is 1, length L is 1, diffusion constant κ = 1.

■ One Dimensional Plate Distribution

```
In[1]:= ? Sum

        Sum[f, {i, imax}] evaluates the sum of the expressions f as evaluated for each i from 1 to
          imax. Sum[f, {i, imin, imax}] starts with i = imin. Sum[f, {i, imin, imax, di}] uses steps
          di. Sum[f, {i, imin, imax}, {j, jmin, jmax}, ... ] evaluates a sum over multiple indices.

In[55]:= Tsum := 1 - (4 / Pi) Sum[(1 / n) Sin[n Pi x] Exp[-n^2 Pi^2 t], {n, 1, 11, 2}]

In[67]:= t =.

In[68]:= Tsum
```

$$\text{Out[68]= } 1 - \frac{1}{\pi}\left(4\left(E^{-\pi^2 t}\,\text{Sin}[\pi x] + \frac{1}{3}E^{-9\pi^2 t}\,\text{Sin}[3\pi x] + \frac{1}{5}E^{-25\pi^2 t}\,\text{Sin}[5\pi x] + \frac{1}{7}E^{-49\pi^2 t}\,\text{Sin}[7\pi x] + \frac{1}{9}E^{-81\pi^2 t}\,\text{Sin}[9\pi x] + \frac{1}{11}E^{-121\pi^2 t}\,\text{Sin}[11\pi x]\right)\right)$$

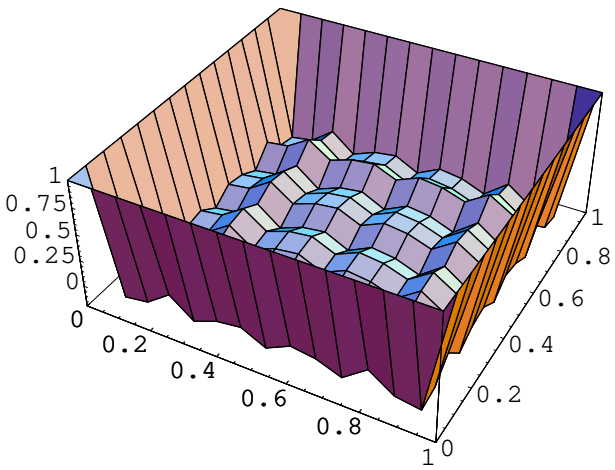
```
In[64]:= tabplot := Table[Tsum, {t, 0, .5, .05}]

In[65]:= Plot[Evaluate[tabplot], {x, 0, 1}, PlotRange -> {-0.2, 1}]
```

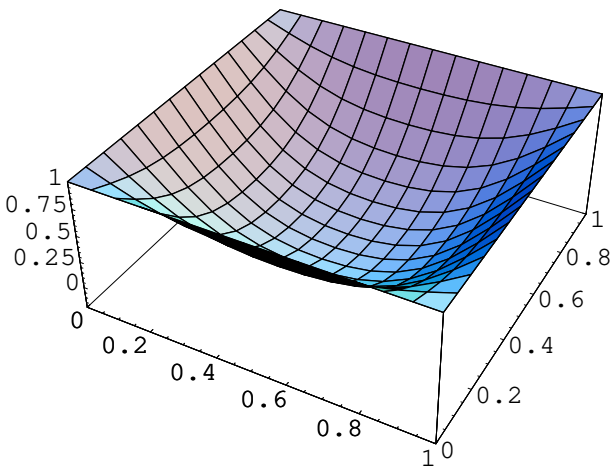


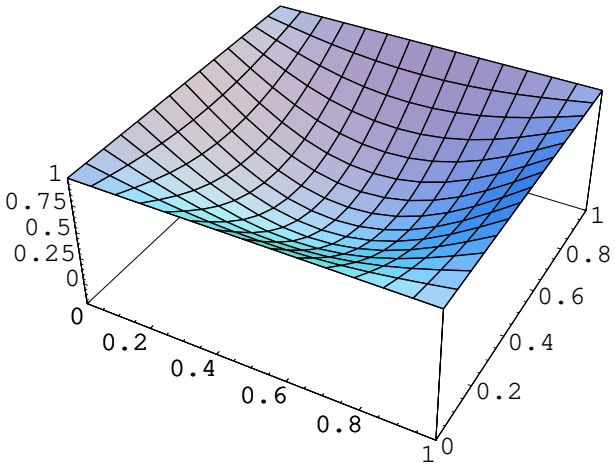

```
Out[65]= - Graphics -
```

■ Two Dimensional Rectangular Box Distribution

```
In[69]:= ? Sum

         Sum[f, {i, imax}] evaluates the sum of the expressions f as evaluated for each i from 1 to
           imax. Sum[f, {i, imin, imax}] starts with i = imin. Sum[f, {i, imin, imax, di}] uses steps
           di. Sum[f, {i, imin, imax}, {j, jmin, jmax}, ... ] evaluates a sum over multiple indices.

In[70]:= Tsum2 := 1 -
           (16 / π^2) Sum[1 / (k m) Sin[k π x] Sin[m π y] Exp[-(k^2 + m^2) π^2 t], {k, 1, 9, 2}, {m, 1, 9, 2}]

In[76]:= Table[Plot3D[Evaluate[Tsum2], {x, 0, 1}, {y, 0, 1}, PlotRange -> {-0.2, 1}],
          {t, 0, 0.1, .02}]
```






1
0.75
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1
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0.2
0.4
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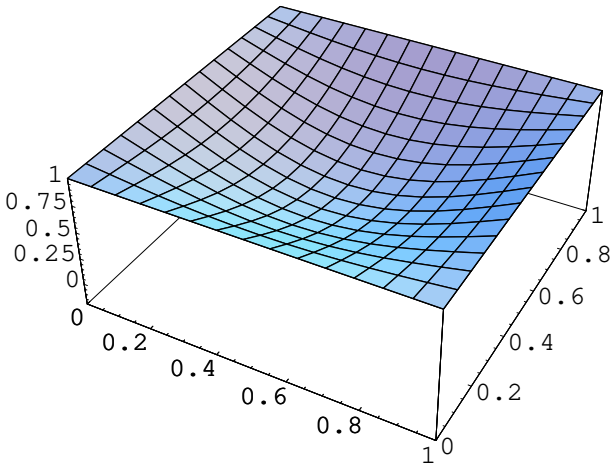
1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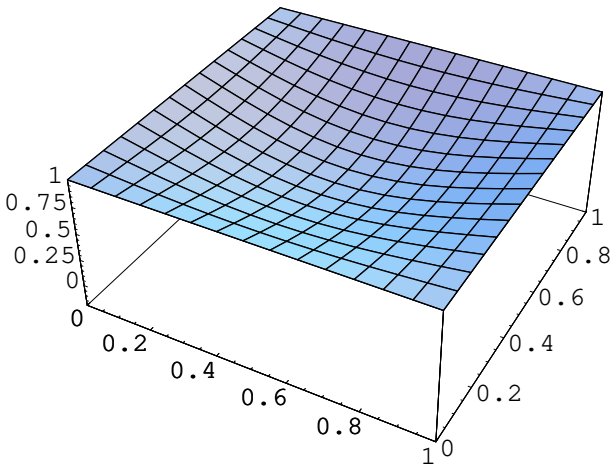
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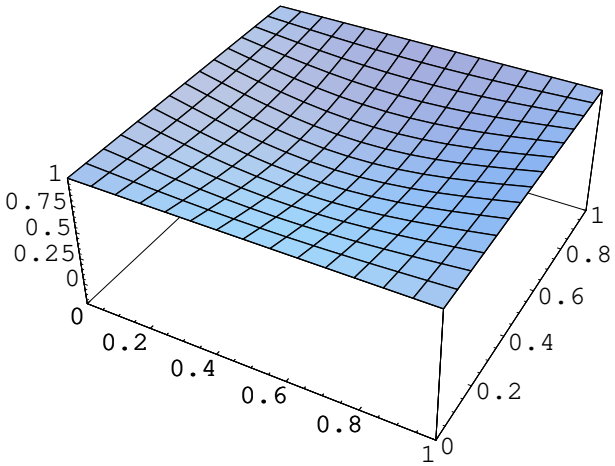

Out[76]= {- SurfaceGraphics -, - SurfaceGraphics -, - SurfaceGraphics -, - SurfaceGraphics -, - SurfaceGraphics -, - SurfaceGraphics -}

In[77]:= **ShowAnimation[%]**