

TZDII Pr. 8-12. Sketch Contour plots of $|\Psi|^2$, the probability density distribution in space, for the square box with

i) $n_x=1, n_y=2$

ii) $n_x=2, n_y=2$

iii) $n_x=4, n_y=3$

I chose contours at 5%, 25%, 50%, 75% and 100% to show the probability of finding the particle along that contour.

```
In[*]:= Psi[nx_, ny_] := (2/a) Sin[nx * pi * x/a] * Sin[ny * pi * y/a]
```

```
PsiSquared[nx_, ny_] := (Psi[nx, ny])^2
```

i) $n_x = 1, n_y = 2$

```
In[*]:= Clear[nx]
Clear[ny]
a = 1;
nx = 1;
ny = 2;
PsiSquared[nx, ny]
```

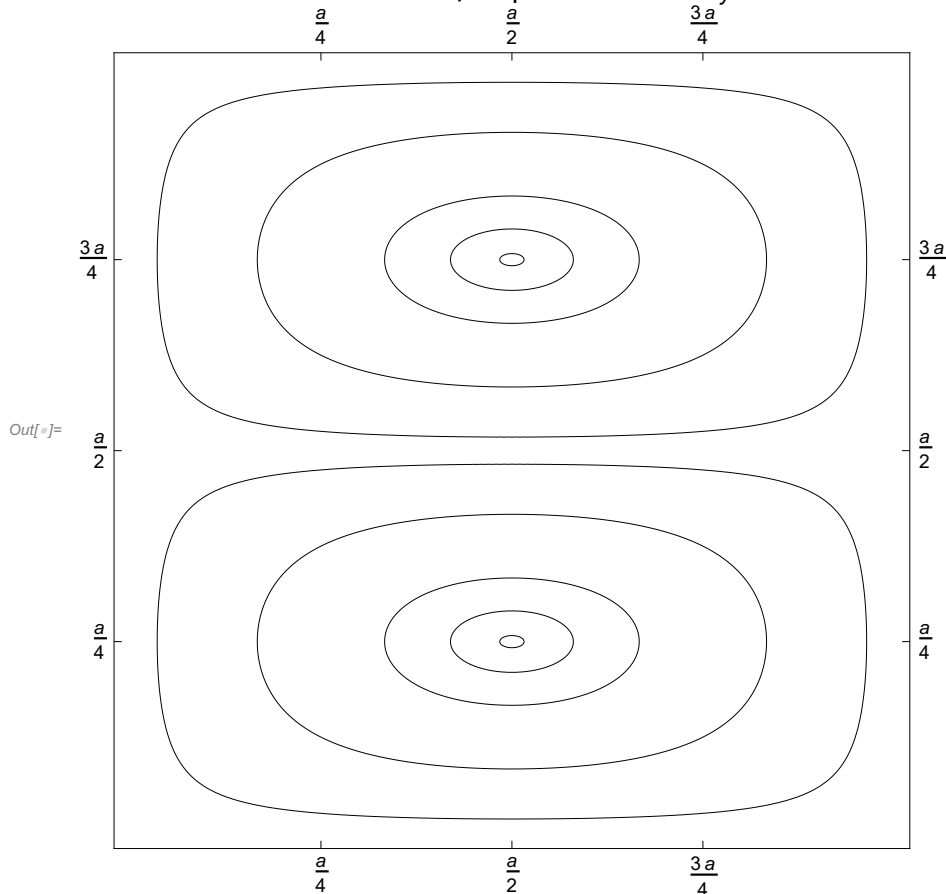
```
Out[*]= 4 Sin[pi x]^2 Sin[2 pi y]^2
```

```

In[ ]:= ContourPlot[PsiSquared[nx, ny], {x, 0, a},
  {y, 0, a}, Contours -> {0.05, 1.0, 3, 3.75, 3.99}, FrameTicks ->
  {{{{0.25, "a/4"}, {0.5, "a/2"}, {0.75, "3a/4"}}, {{0.25, "a/4"}, {0.5, "a/2"}, {0.75, "3a/4"}}},
  ContourShading -> None, BaseStyle -> {FontSize -> 14, FontColor -> RGBColor[0, 0.5, 0]},
  PlotPoints -> 100, PlotLabel -> "Problem 8.12: |Ψ|^2 for nx = 1, ny = 2"]

```

Problem 8.12: $|\Psi|^2$ for $n_x = 1, n_y = 2$



ii) $n_x = 2, n_y = 2$

```

In[ ]:= Clear[nx]
Clear[ny]
a = 1;
nx = 2;
ny = 2;
PsiSquared[nx, ny]

```

```

Out[ ]:= 4 Sin[2 π x]^2 Sin[2 π y]^2

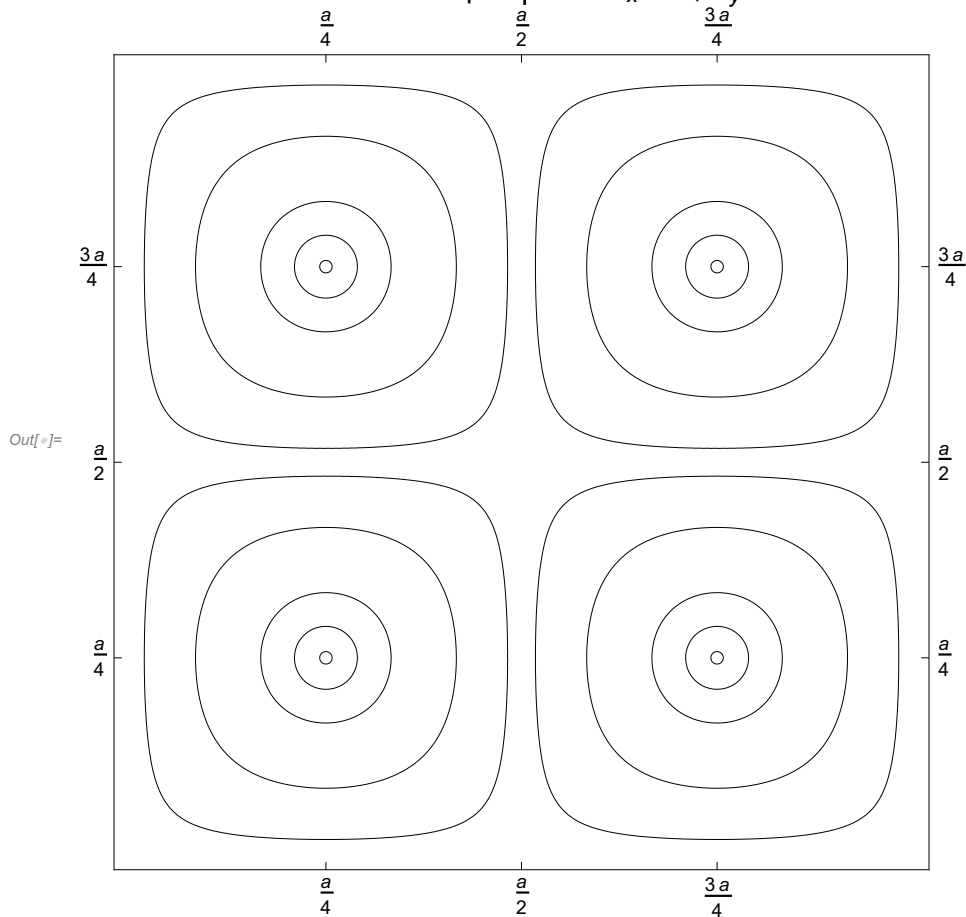
```

```

In[ ]:= ContourPlot[PsiSquared[nx, ny], {x, 0, a},
  {y, 0, a}, Contours -> {0.05, 1.0, 3, 3.75, 3.99}, FrameTicks ->
  {{{{0.25, "a/4"}, {0.5, "a/2"}, {0.75, "3a/4"}}, {{0.25, "a/4"}, {0.5, "a/2"}, {0.75, "3a/4"}}},
  ContourShading -> None, BaseStyle -> {FontSize -> 14, FontColor -> RGBColor[0, 0.5, 0]},
  PlotPoints -> 100, PlotLabel -> "Problem 8.12: |Ψ|^2 for nx = 2, ny = 2"]

```

Problem 8.12: $|\Psi|^2$ for $n_x = 2, n_y = 2$



iii) $n_x = 4, n_y = 3$

```

In[ ]:= Clear[nx]
Clear[ny]
a = 1;
nx = 4;
ny = 3;
PsiSquared[nx, ny]

```

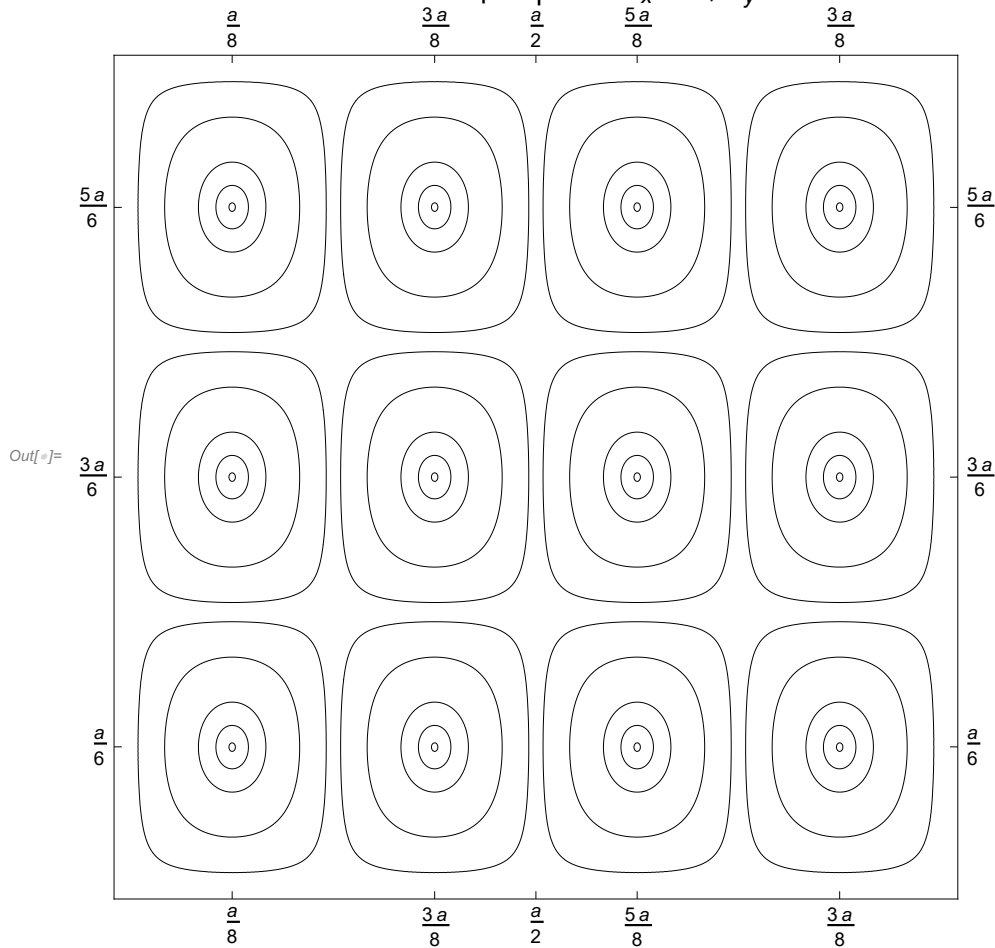
Out[]:= $4 \sin[4 \pi x]^2 \sin[3 \pi y]^2$

```

In[ ]:= ContourPlot[PsiSquared[nx, ny], {x, 0, a}, {y, 0, a}, Contours -> {0.05, 1.0, 3, 3.75, 3.99},
  FrameTicks -> {{{0.125, "a/8"}, {0.375, "3a/8"}, {0.5, "a/2"}, {0.625, "5a/8"}, {0.875, "3a/4"}},
  {{{0.167, "a/6"}, {0.5, "3a/6"}, {0.833, "5a/6"}}, ContourShading -> None,
  BaseStyle -> {FontSize -> 14, FontColor -> RGBColor[0, 0.5, 0]}, PlotPoints -> 100,
  PlotLabel -> "Problem 8.12: |Ψ|² for nx = 4, ny = 3"]

```

Problem 8.12: $|\Psi|^2$ for $n_x = 4$, $n_y = 3$



```

In[1]:= Export["ParticleInA2DBox.pdf", SelectedNotebook[ ]]

```