Night 4 Part 2

5

In[154]:=
```
D[(x^2) * Sin[x * y^2], x]
```
Out[154]= $x^2\, y^2 \operatorname{Cos}\left[x\, y^2\right] + 2\, x \operatorname{Sin}\left[x\, y^2\right]$

In[155]:=
```
D[(x^2) * Sin[x * y^2], y]
```
Out[155]= $2\, x^3\, y \operatorname{Cos}\left[x\, y^2\right]$

6

d^2f/dx^2

In[156]:=
```
D[D[(x^2) * Sin[x * y^2], x], x]
```
Out[156]= $4\, x\, y^2 \operatorname{Cos}\left[x\, y^2\right] + 2 \operatorname{Sin}\left[x\, y^2\right] - x^2\, y^4 \operatorname{Sin}\left[x\, y^2\right]$

d^2f/dy^2

In[157]:=
```
D[D[(x^2) * Sin[x * y^2], y], y]
```
Out[157]= $2\, x^3 \operatorname{Cos}\left[x\, y^2\right] - 4\, x^4\, y^2 \operatorname{Sin}\left[x\, y^2\right]$

d^f/dydx

In[158]:=
```
D[D[(x^2) * Sin[x * y^2], y], x]
```
Out[158]= $6\, x^2\, y \operatorname{Cos}\left[x\, y^2\right] - 2\, x^3\, y^3 \operatorname{Sin}\left[x\, y^2\right]$

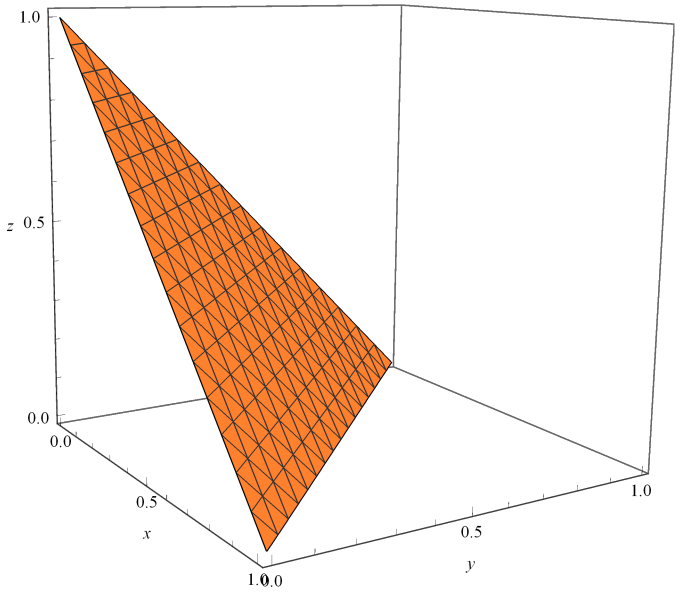
d^f/dxdy

In[159]:=
```
D[D[(x^2) * Sin[x * y^2], x], y]
```
Out[159]= $6\, x^2\, y \operatorname{Cos}\left[x\, y^2\right] - 2\, x^3\, y^3 \operatorname{Sin}\left[x\, y^2\right]$

9a

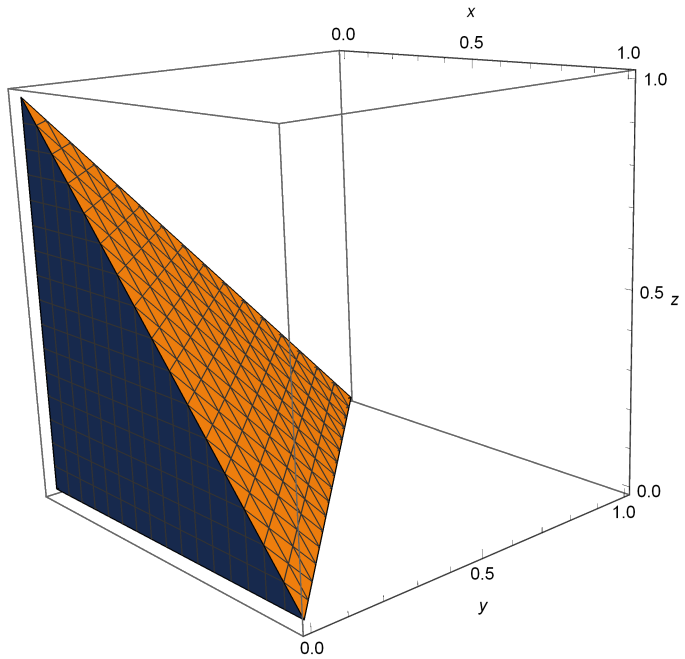
In[203]:=
```
Clear[x, y, z]
ContourPlot3D[x + y + z - 1 == 0, {x, 0, 1}, {y, 0, 1}, {z, 0, 1},
 PlotTheme → "Scientific", Axes → True, AxesLabel → {x, y, z}]
```

Out[204]=



In[211]:=
```
RegionPlot3D[x + y + z - 1 < 0, {x, 0, 1},
 {y, 0, 1}, {z, 0, 1}, Axes → True, AxesLabel → {x, y, z}]
```

Out[211]=



In[215]:=
```
Integrate[Integrate[1 - x - y, {y, 0, 1 - x}], {x, 0, 1}]
```

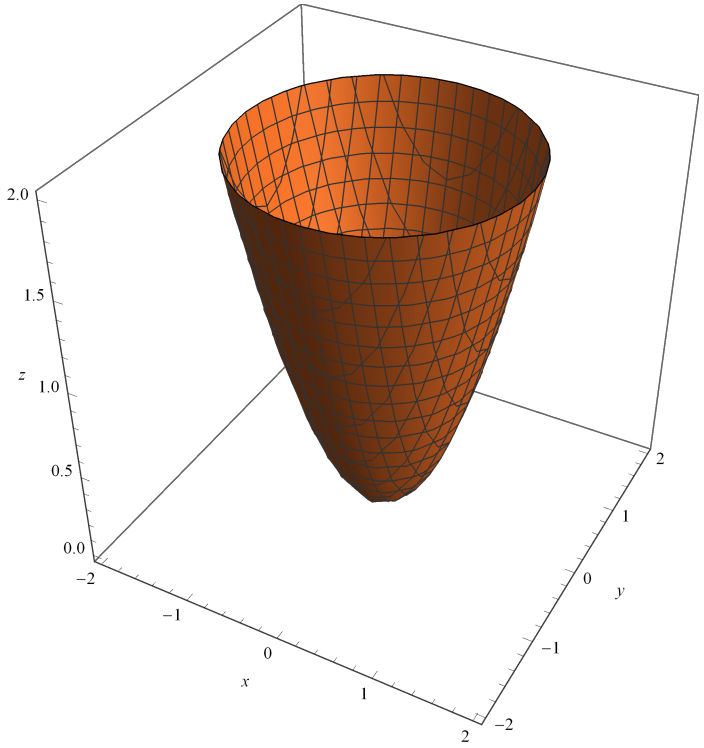
Out[215]= $\frac{1}{6}$

9b

In[170]:=
```
Clear[z]
```

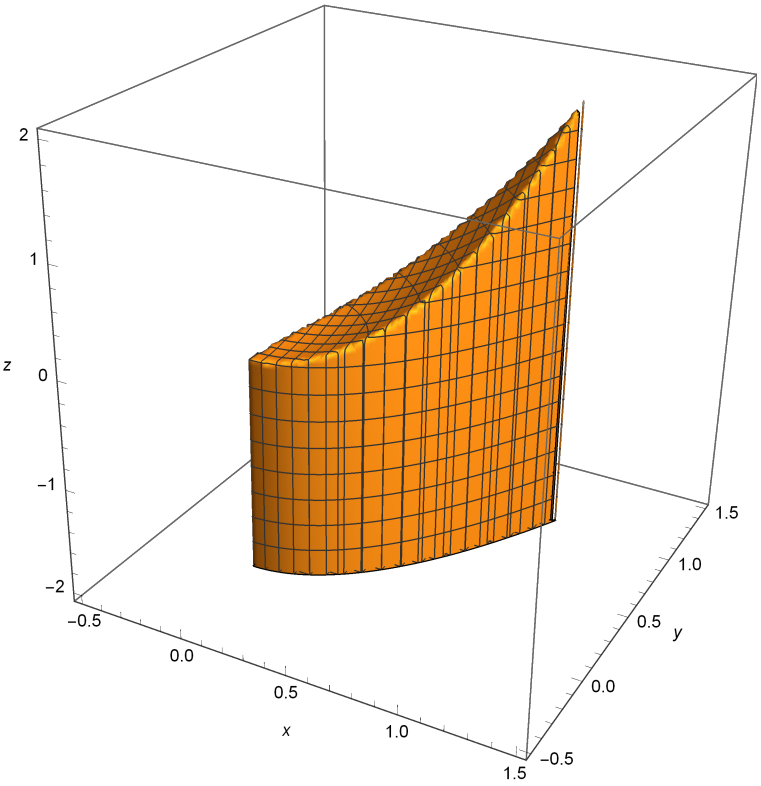
In[171]:=
```
ContourPlot3D[x^2 + y^2 == z, {x, -2, 2}, {y, -2, 2}, {z, 0, 2},
 PlotTheme → "Scientific", Axes → True, AxesLabel → {x, y, z}]
```

Out[171]=



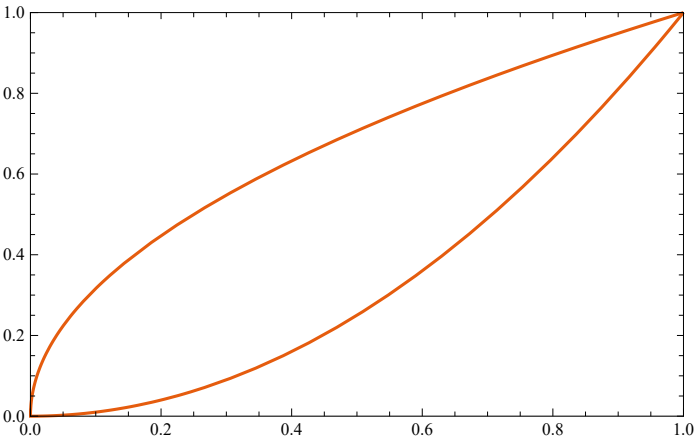
In[240]:=
```
RegionPlot3D[z ≤ (x^2) + (y^2) && y ≥ (x^2) && x ≥ (y^2), {x, -0.5, 1.5},
 {y, -0.5, 1.5}, {z, -2, 2}, PlotPoints → 100, Axes → True, AxesLabel → {x, y, z}]
```

Out[240]=



In[238]:=
```
Show[Plot[x^2, {x, -1, 1}, PlotRange → {{0, 1}, {0, 1}}, PlotTheme → "Scientific"],
 Plot[Sqrt[x], {x, -1, 1}, PlotRange → {{0, 1}, {0, 1}}, PlotTheme → "Scientific"]]
```

Out[238]=



In[246]:=
```
Integrate[Integrate[(x^2) + (y^2), {y, x^2, Sqrt[x]}], {x, 0, 1}]
```

Out[246]= $\frac{6}{35}$

In[247]:=
```
N[%]
```

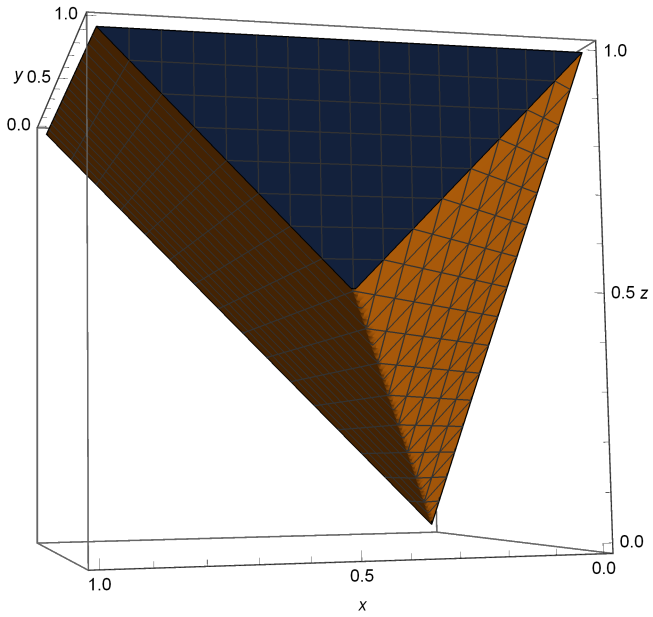
Out[247]= 0.171429

10a

Visualize and evaluate

In[293]:=
```
RegionPlot3D[0 ≤ z ≤ 1 && 0 ≤ y ≤ (x + z) && 0 ≤ x ≤ z, {x, 0, 1}, {y, 0, 1},
 {z, 0, 1}, PlotPoints → 100, Axes → True, AxesLabel → {x, y, z}]
```

Out[293]=



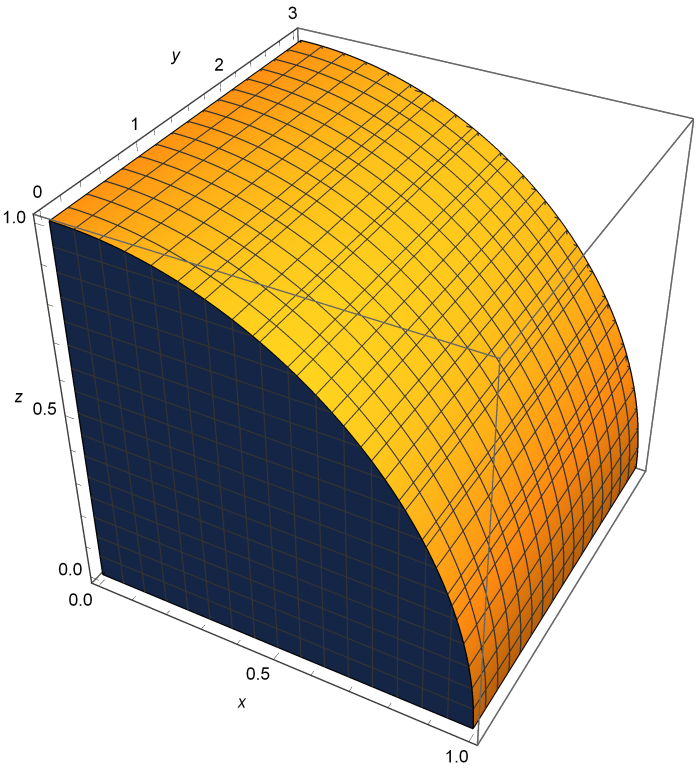
In[252]:=
```
Integrate[Integrate[Integrate[1, {y, 0, x + z}], {x, 0, z}], {z, 0, 1}]
```

Out[252]=
$$\frac{1}{2}$$

10b

In[292]:=
```
RegionPlot3D[0 ≤ x ≤ Sqrt[1 - (z^2)] && 0 ≤ z ≤ 1 && 0 ≤ y ≤ (3), {x, 0, 1},
  {y, 0, 3}, {z, 0, 1}, PlotPoints → 60, Axes → True, AxesLabel → {x, y, z}]
```

Out[292]=



In[267]:=
```
Integrate[Integrate[Integrate[1, {x, 0, Sqrt[1 - z^2]}], {z, 0, 1}], {y, 0, 3}]
```

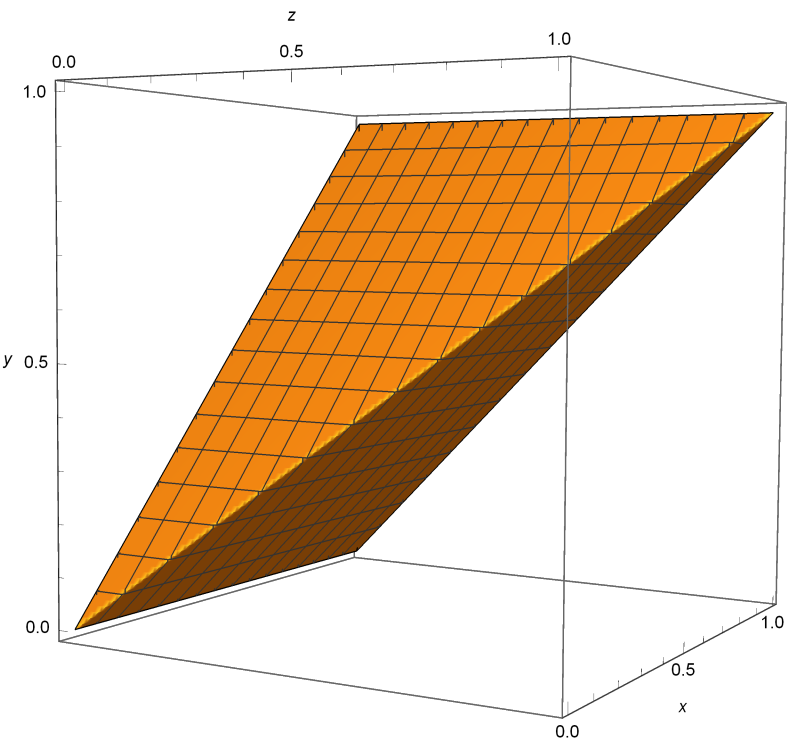
Out[267]=
$$\frac{3\pi}{4}$$

11a

Visualize and figure out another triple integral that is the same

In[303]:=
```
RegionPlot3D[0 ≤ z ≤ (y) && y ≤ x ≤ 1 && 0 ≤ y ≤ (1), {x, 0, 1}, {y, 0, 1},
 {z, 0, 1}, PlotPoints → 100, Axes → True, AxesLabel → {x, y, z}]
```

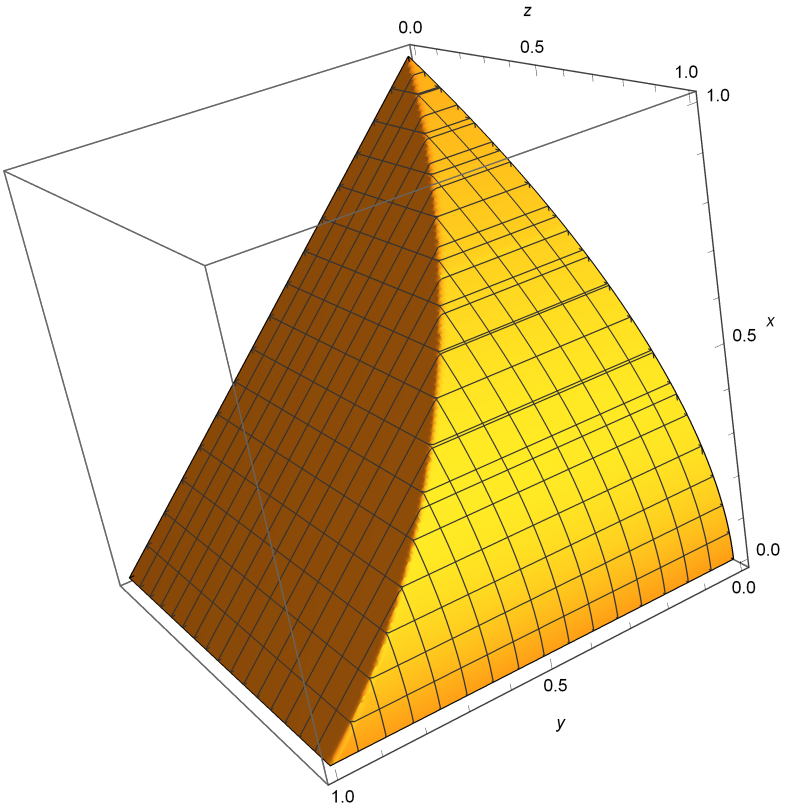
Out[303]=



11b

In[304]:=
```
RegionPlot3D[0 ≤ x ≤ (1) && 0 ≤ z ≤ (1 - x^2) && 0 ≤ y ≤ (1 - x), {x, 0, 1},
  {y, 0, 1}, {z, 0, 1}, PlotPoints → 100, Axes → True, AxesLabel → {x, y, z}]
```

Out[304]=

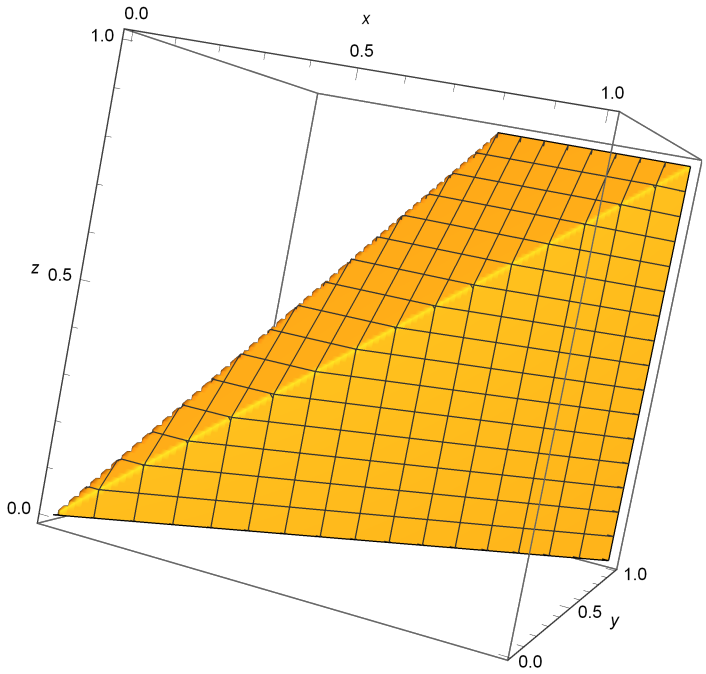


12a

Visualize and evaluate

In[308]:=
```
RegionPlot3D[0 ≤ z ≤ (y) && x ≤ y ≤ (2 * x) && 0 ≤ x ≤ (1), {x, 0, 1},
 {y, 0, 1}, {z, 0, 1}, PlotPoints → 100, Axes → True, AxesLabel → {x, y, z}]
```

Out[308]=



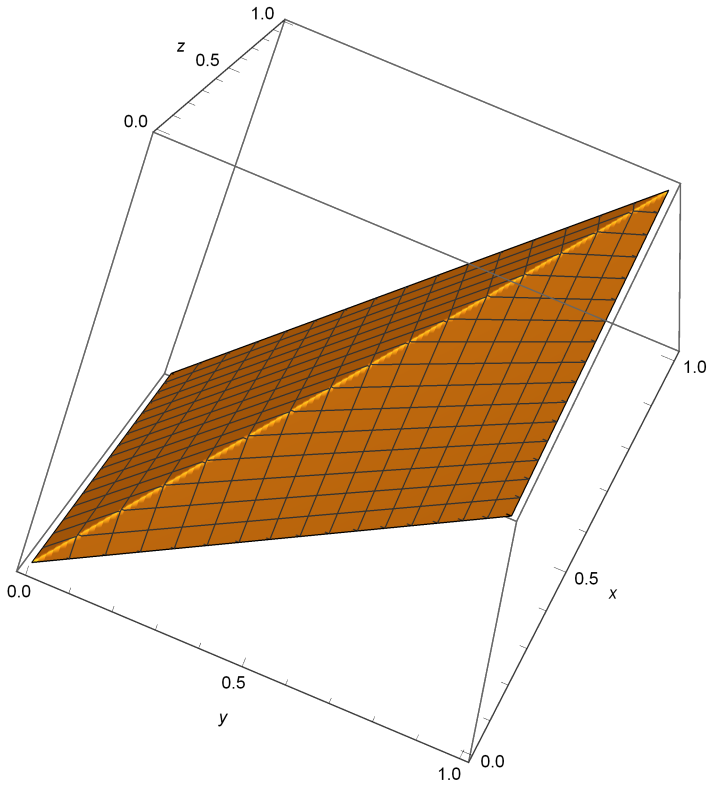
In[243]:=
```
Integrate[Integrate[Integrate[2 * x * y * z, {z, 0, y}], {y, x, 2 * x}], {x, 0, 1}]
```

Out[243]=
$$\frac{5}{8}$$

12b

In[309]:=
```
RegionPlot3D[0 ≤ x ≤ (y) && 0 ≤ y ≤ (z) && 0 ≤ z ≤ (1), {x, 0, 1},
  {y, 0, 1}, {z, 0, 1}, PlotPoints → 100, Axes → True, AxesLabel → {x, y, z}]
```

Out[309]=



In[244]:=
```
Integrate[Integrate[Integrate[z * Exp[-y^2], {x, 0, y}], {y, 0, z}], {z, 0, 1}]
```

Out[244]=
$$\frac{1}{4\,e}$$