

## Answer key to the Final Exam review problems

### Problem 1:

```
In[*]:= S = ParametricRegion[{u + v, u - v, 1 + 2 u + v}, {{u, 0, 2}, {v, 0, 3}}];  
SurfaceIntegrate[x + y + z, {x, y, z} ∈ S]
```

```
Out[*]=  
39  $\sqrt{14}$ 
```

### Problem 2:

```
In[*]:= S = ImplicitRegion[x + y == 7 && y^2 + z^2 ≤ 9, {x, y, z}];  
SurfaceIntegrate[x * z, {x, y, z} ∈ S]
```

```
Out[*]=  
0
```

### Problem 3:

Note that  $Qx - Py = 2 - 1 = 1$ . Let R be the region enclosed by C.

```
In[*]:= R = ImplicitRegion[x^2 ≤ y ≤ Sqrt[x] && 0 ≤ x ≤ 1, {x, y}];  
-Integrate[1, {x, y} ∈ R]
```

```
Out[*]=  
 $-\frac{1}{3}$ 
```

### Problem 4:

```
In[*]:= curve = ParametricRegion[{1 + 3 t, 1 + 2 t}, {{t, 0, 1}}];  
LineIntegrate[{2 x + y, x}, {x, y} ∈ curve]
```

```
Out[*]=  
26
```

### Problem 5:

The reversed curve is parametrized by  $x = t, y = 2 + \cos(t)$  where  $0 \leq t \leq \pi$

```
In[*]:= curve = ParametricRegion[{t, 2 + Cos[t]}, {{t, 0, Pi}}];  
-LineIntegrate[{Sin[y], x * Cos[y] - Sin[y]}, {x, y} ∈ curve]
```

```
Out[*]=  
-Sin[1] ( $\pi + 2 \text{Sin}[2]$ )
```

### Problem 6:

```
In[*]:= R = ImplicitRegion[0 ≤ x - y ≤ 2 && 0 ≤ x + y ≤ 3, {x, y}];  
Integrate[(x + y) E^(x^2 - y^2), {x, y} ∈ R]
```

```
Out[*]=  
 $\frac{1}{4} (-7 + e^6)$ 
```

### Problem 7:

```
In[*]:= solid = ImplicitRegion[1 ≤ x^2 + y^2 ≤ 16 && 0 ≤ z ≤ y + 4, {x, y, z}];  
Integrate[1, {x, y, z} ∈ solid]
```

Out[\*]=

$60\pi$