In[1]:= **1**

Out[1]= 1

In[4]:=
```
Integrate[E^(-Abs[x + y] / u) * (1 / w - Abs[x] / w^2), {x, -w, w},
 Assumptions → Element[w, Reals] && Element[u, Reals] && u > 0 && w > 0 && Element[y, Reals]]
```

Out[4]=

$$
\begin{cases}
\dfrac{e^{-\frac{w}{u}-\frac{y}{u}}\left(-1+e^{\frac{w}{u}}\right)^{2}u^{2}}{w^{2}} & w-y<0\ \&\&\ w>0\ \&\&\ y>0\ \&\&\ w+y>0 \\[2ex]
\dfrac{e^{-\frac{w}{u}+\frac{y}{u}}\left(-1+e^{\frac{w}{u}}\right)^{2}u^{2}}{w^{2}} & w>0\ \&\&\ w-y>0\ \&\&\ y\le 0\ \&\&\ w+y\le 0 \\[2ex]
-\dfrac{e^{-\frac{w}{u}-\frac{y}{u}}u\left(-u-e^{\frac{2y}{u}}u+2e^{\frac{w}{u}+\frac{2y}{u}}u-2e^{\frac{w}{u}+\frac{y}{u}}w-2e^{\frac{w}{u}+\frac{y}{u}}y\right)}{w^{2}} & y<0\ \&\&\ w>0\ \&\&\ w-y>0\ \&\&\ w+y>0 \\[2ex]
\dfrac{e^{-\frac{w}{u}-\frac{y}{u}}u\left(u-2e^{\frac{w}{u}}u+e^{\frac{2y}{u}}u+2e^{\frac{w}{u}+\frac{y}{u}}w-2e^{\frac{w}{u}+\frac{y}{u}}y\right)}{w^{2}} & w-y>0\ \&\&\ w>0\ \&\&\ y>0\ \&\&\ w+y>0 \\[2ex]
\dfrac{e^{-\frac{w}{u}-\frac{y}{u}}u\left(u-2e^{\frac{w}{u}}u+e^{\frac{w}{u}+\frac{y}{u}}u+e^{\frac{w}{u}+\frac{y}{u}}w-e^{\frac{w}{u}+\frac{y}{u}}y\right)}{w^{2}} & w-y==0\ \&\&\ w>0\ \&\&\ y>0\ \&\&\ w+y>0 \\[2ex]
-\dfrac{e^{-\frac{w}{u}-\frac{y}{u}}u\left(-u-e^{\frac{2y}{u}}u+e^{\frac{w}{u}+\frac{y}{u}}u+e^{\frac{w}{u}+\frac{2y}{u}}u-e^{\frac{w}{u}+\frac{y}{u}}w-e^{\frac{w}{u}+\frac{2y}{u}}w-e^{\frac{w}{u}+\frac{y}{u}}y\right)}{w^{2}} & \text{True}
\end{cases}
$$

In[10]:= `f[y_, u_, w_] :=`

$$
\begin{cases}
\dfrac{e^{-\frac{w}{u}-\frac{y}{u}}\left(-1+e^{\frac{w}{u}}\right)^2 u^2}{w^2} & w-y<0\ \&\&\ w>0\ \&\&\ y>0\ \&\&\ w+y>0 \\[2ex]
\dfrac{e^{-\frac{w}{u}+\frac{y}{u}}\left(-1+e^{\frac{w}{u}}\right)^2 u^2}{w^2} & w>0\ \&\&\ w-y>0\ \&\&\ y\le 0\ \&\&\ w+y\le 0 \\[2ex]
-\dfrac{1}{w^2}e^{-\frac{w}{u}-\frac{y}{u}}\,u\left(-u-e^{\frac{2y}{u}}u+2e^{\frac{w}{u}+\frac{2y}{u}}u-2e^{\frac{w}{u}+\frac{y}{u}}w-2e^{\frac{w}{u}+\frac{y}{u}}y\right) & y<0\ \&\&\ w>0\ \&\&\ w-y>0\ \&\&\ w+y>0 \\[2ex]
\dfrac{1}{w^2}e^{-\frac{w}{u}-\frac{y}{u}}\,u\left(u-2e^{\frac{w}{u}}u+e^{\frac{2y}{u}}u+2e^{\frac{w}{u}+\frac{y}{u}}w-2e^{\frac{w}{u}+\frac{y}{u}}y\right) & w-y>0\ \&\&\ w>0\ \&\&\ y>0\ \&\&\ w+y>0 \\[2ex]
\dfrac{1}{w^2}e^{-\frac{w}{u}-\frac{y}{u}}\,u\left(u-2e^{\frac{w}{u}}u+e^{\frac{w}{u}+\frac{y}{u}}u+e^{\frac{w}{u}+\frac{y}{u}}w-e^{\frac{w}{u}+\frac{y}{u}}y\right) & w-y==0\ \&\&\ w>0\ \&\&\ y>0\ \&\&\ w+y>0 \\[2ex]
-\dfrac{1}{w^2}e^{-\frac{w}{u}-\frac{y}{u}}\,u\left(-u-e^{\frac{2y}{u}}u+e^{\frac{w}{u}+\frac{y}{u}}u+e^{\frac{w}{u}+\frac{2y}{u}}u-e^{\frac{w}{u}+\frac{y}{u}}w-e^{\frac{w}{u}+\frac{2y}{u}}w-e^{\frac{w}{u}+\frac{y}{u}}y\right) & \text{True}
\end{cases}
$$

In[13]:=
```
Integrate[E^(-Abs[x + y] / u) * (1 / w - Abs[x] / w^2),
 {x, -w, w}, Assumptions → Element[w, Reals] && Element[u, Reals] &&
   u > 0 && w > 0 && Element[y, Reals] && w == 1 && u == 10]
```

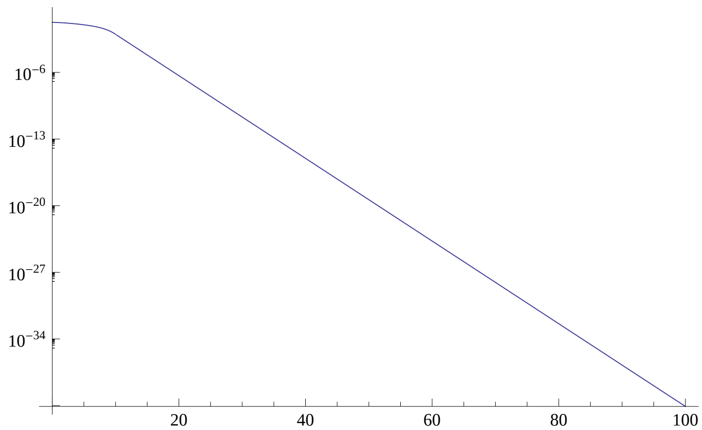
Out[13]=

$$\begin{cases} 10\left(10 - 20\, e^{1/10} + 10\, e^{1/5}\right) e^{-\frac{1}{10}-\frac{y}{10}} & w == 1\ \&\&\ y \geq 1 \\ 10\left(10 - 20\, e^{1/10} + 10\, e^{1/5}\right) e^{-\frac{1}{10}+\frac{y}{10}} & w == 1\ \&\&\ y \leq -1 \\ -10\, e^{-\frac{1}{10}-\frac{y}{10}} \left(-10 - 2\, e^{\frac{1}{10}+\frac{y}{10}} + 20\, e^{\frac{1}{10}+\frac{y}{5}} - 10\, e^{y/5} - 2\, e^{\frac{1}{10}+\frac{y}{10}}\, y\right) & w == 1\ \&\&\ -1 < y < 0 \\ 10\, e^{-\frac{1}{10}-\frac{y}{10}} \left(10 - 9\, e^{\frac{1}{10}+\frac{y}{10}} - 9\, e^{\frac{1}{10}+\frac{y}{5}} + 10\, e^{y/5} + e^{\frac{1}{10}+\frac{y}{10}}\, y\right) & w == 1\ \&\&\ y == 0 \\ -10\, e^{-\frac{1}{10}-\frac{y}{10}} \left(-10 + 20\, e^{1/10} - 2\, e^{\frac{1}{10}+\frac{y}{10}} - 10\, e^{y/5} + 2\, e^{\frac{1}{10}+\frac{y}{10}}\, y\right) & \text{True} \end{cases}$$

In[15]:=
```
f[1, 1, 10]
```

In[17]:=
```
LogPlot[f[x, 1, 10], {x, 0, 100}]
```

Out[17]=



$$\texttt{FullSimplify}\left[\begin{cases} \dfrac{e^{-\frac{w}{u}-\frac{y}{u}}\left(-1+e^{\frac{w}{u}}\right)^2 u^2}{w^2} & w-y<0\ \&\&\ w>0\ \&\&\ y > \\ \dfrac{e^{-\frac{w}{u}+\frac{y}{u}}\left(-1+e^{\frac{w}{u}}\right)^2 u^2}{w^2} & w>0\ \&\&\ w-y>0\ \&\&\ y \le \\ -\dfrac{1}{w^2}e^{-\frac{w}{u}-\frac{y}{u}}u\left(-u-e^{\frac{2y}{u}}u+2e^{\frac{w}{u}+\frac{2y}{u}}u-2e^{\frac{w}{u}+\frac{y}{u}}w-2e^{\frac{w}{u}+\frac{y}{u}}y\right) & y<0\ \&\&\ w>0\ \&\&\ w-y > \\ \dfrac{1}{w^2}e^{-\frac{w}{u}-\frac{y}{u}}u\left(u-2e^{\frac{w}{u}}u+e^{\frac{2y}{u}}u+2e^{\frac{w}{u}+\frac{y}{u}}w-2e^{\frac{w}{u}+\frac{y}{u}}y\right) & w-y>0\ \&\&\ w>0\ \&\&\ y > \\ \dfrac{1}{w^2}e^{-\frac{w}{u}-\frac{y}{u}}u\left(u-2e^{\frac{w}{u}}u+e^{\frac{w}{u}+\frac{y}{u}}u+e^{\frac{w}{u}+\frac{y}{u}}w-e^{\frac{w}{u}+\frac{y}{u}}y\right) & w-y==0\ \&\&\ w>0\ \&\&\ y \\ -\dfrac{1}{w^2}\, e^{-\frac{w}{u}-\frac{y}{u}}u\left(-u-e^{\frac{2y}{u}}u+e^{\frac{w}{u}+\frac{y}{u}}u+e^{\frac{w}{u}+\frac{2y}{u}}u-e^{\frac{w}{u}+\frac{y}{u}}w-e^{\frac{w}{u}+\frac{2y}{u}}w-e^{\frac{w}{u}+\frac{y}{u}}y\right) & \text{True} \end{cases}\right.$$

$$\begin{cases} \dfrac{e^{-\frac{w+y}{u}}\left(-1+e^{\frac{w}{u}}\right)^2 u^2}{w^2} & w>0\ \&\&\ w<y \\ \dfrac{e^{\frac{-w+y}{u}}\left(-1+e^{\frac{w}{u}}\right)^2 u^2}{w^2} & w>0\ \&\&\ w+y\le 0 \\ \dfrac{e^{-\frac{w+y}{u}}u\left(\left(1+e^{\frac{2y}{u}}\right)\left(1-2e^{\frac{w}{u}}\right)u+2e^{\frac{w+y}{u}}(w+y)\right)}{w^2} & y<0\ \&\&\ w+y>0 \\ \dfrac{e^{-\frac{w+y}{u}}u\left(\left(1-2e^{\frac{w}{u}}+e^{\frac{2y}{u}}\right)u+2e^{\frac{w+y}{u}}(w-y)\right)}{w^2} & y>0\ \&\&\ y<w \\ \dfrac{e^{-\frac{2y}{u}}\left(-1+e^{\frac{y}{u}}\right)^2 u^2}{y^2} & w>0\ \&\&\ y>0\ \&\&\ w==y \\ \dfrac{e^{-\frac{w+y}{u}}u\left(\left(1+e^{\frac{2y}{u}}\right)u+e^{\frac{w+y}{u}}\left(-u+w+e^{\frac{y}{u}}(-u+w)+y\right)\right)}{w^2} & \text{True} \end{cases}$$