1. Totales Differential berechnen

$$
\begin{aligned}
f(x,y) &= \sin\left(x^2+3\,y\right)+e^{-y^3} \\
df &= 2\,x\cos\left(x^2+3\,y\right)\,dx+\left(3\,\cos\left(x^2+3\,y\right)-3\,y^2e^{-y^3}\right)\,dy
\end{aligned}
$$

$$
\begin{aligned}
f(x,y) &= \cos\left(x^2y\right)+x^y \\
df &= \left(-2\,xy\sin\left(x^2y\right)+\frac{x^yy}{x}\right)\,dx+\left(-x^2\,\sin\left(x^2y\right)+x^y\ln\left(x\right)\right)\,dy
\end{aligned}
$$

$$
\begin{aligned}
f(x,y) &= e^{x\sin(y)} \\
df &= \sin\left(y\right)e^{x\sin(y)}\,dx+x\cos\left(y\right)e^{x\sin(y)}\,dy
\end{aligned}
$$

2. Ist δf ein totales Differential? (Satz vom Schwarz)

$$\delta f = 2\,x\cos\left(y\right)e^{x^2\cos(y)}\,dx+x\sin\left(y\right)e^{x^2\cos(y)}\,dy \qquad \text{nein}$$

$$\delta f = \left(3\,x^2y-6\,yxe^{-x^2}\right)\,dx+\left(x^3+3\,e^{-x^2}\right)\,dy \qquad \text{ja}$$

$$\delta f = \left(3\,x^2y-6\,yxe^{-x^2}\right)\,dx+\left(x^3+3\,e^{-x^2}+y^y\right)\,dy \qquad \text{ja}$$

3. Zeigen Sie, daß $\lambda(x,y)=x$ ein integrierender Faktor für δf ist.

$$\delta f = \left(-12\,yxe^{-x^3}+2\,y^2\right)\,dx+\frac{2\,x^2y+4\,e^{-x^3}}{x}\,dy$$