§14.6#5 Find the directional derivative of \( f \) at the given point in the direction indicated by the angle \( \theta \).

\[
f(x, y) = ye^{-x}, \quad (0, 4) \quad \theta = 2\pi/3
\]

**Solution.**

\[
\nabla f(x, y) = -ye^{-x}i + e^{-x}j
\]

\[
\nabla f(0, 4) = -(4)e^{(0)}i + e^{(0)}j = -4i + j
\]

\[
u = \cos 2\pi/3i + \sin 2\pi/3j = -\frac{1}{2}i + \sqrt{3}2j
\]

\[
D_u f(0, 4) = \nabla f(0, 4) \cdot u
\]

\[
= (-4i + j) \cdot \left( -\frac{1}{2}i + \sqrt{3}2j \right)
\]

\[
= (-4)(-1/2) + (1)(\sqrt{3}/2)
\]

\[
= \frac{4 + \sqrt{3}}{2}
\]