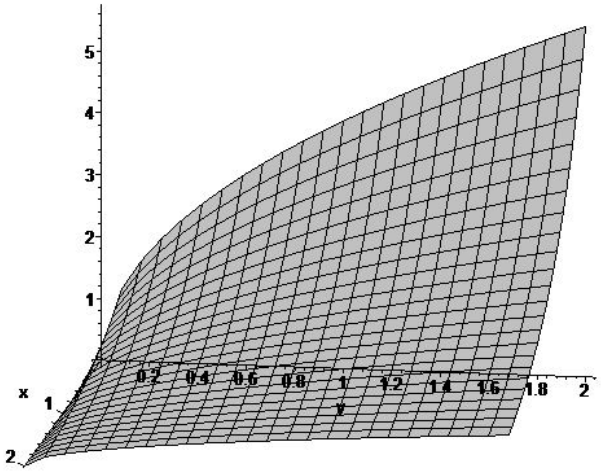
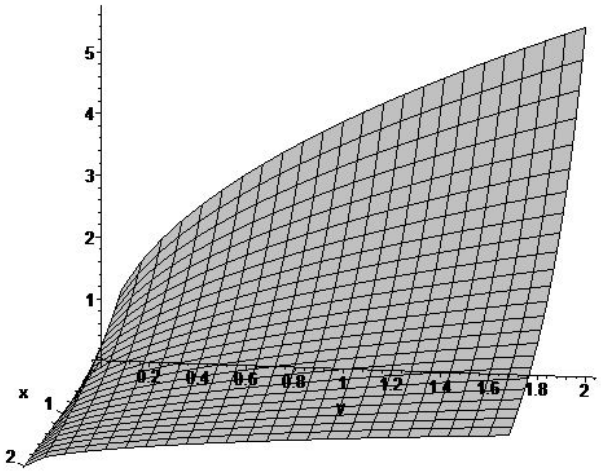
$$f(x,y) = 4\sqrt{y}\, e^{-x}$$



$$f(x,y) = 4\sqrt{y}\, e^{-x}$$

Calculate $D_{\vec{\mathbf{v}}} f(0,1)$ where $\vec{\mathbf{v}} = \frac{1}{2}\langle 1,\ \sqrt{3}\rangle$



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$$\nabla f = \left\langle \frac{\partial f}{\partial x},\ \frac{\partial f}{\partial y} \right\rangle = \left\langle -4\sqrt{y}\, e^{-x},\ \frac{2}{\sqrt{y}} e^{-x} \right\rangle$$

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$$\nabla f(0,\ 1) = \langle -4,\ 2\rangle$$

$$
\begin{aligned}
D_{\vec{\mathbf{v}}} f(0,1) &= \nabla f(0,\ 1) \bullet \vec{\mathbf{v}} \\
&= \langle -4,\ 2 \rangle \bullet \left\langle \frac{1}{2},\ \frac{\sqrt{3}}{2} \right\rangle \\
&= \sqrt{3} - 2
\end{aligned}
$$

$$D_{\vec{\mathbf{v}}} f(0,1) = \sqrt{3} - 2 < 0$$