Let:

$$\mathcal{T}f\left(r,s,y_1,y_2\right)=\int_0^\infty\left[f\left(r-t\cdot\frac{1}{\sqrt{1+y_1^2}},s+t\cdot\frac{y_1}{\sqrt{1+y_1^2}}\right)+f\left(r+t\cdot\frac{1}{\sqrt{1+y_2^2}},s+t\cdot\frac{y_2}{\sqrt{1+y_2^2}}\right)\right]dt$$

$$\frac{\partial}{\partial r}\mathcal{T}f=\mathcal{T}\frac{\partial}{\partial x}f,\quad \frac{\partial}{\partial s}\mathcal{T}f=\mathcal{T}\frac{\partial}{\partial y}f$$

$$\frac{\partial}{\partial y_1}\mathcal{T}f\left(r,s,y_1,y_2\right)=\int_0^\infty\left[\frac{\partial f}{\partial x}\left(r-t\cdot\frac{1}{\sqrt{1+y_1^2}},s+t\cdot\frac{y_1}{\sqrt{1+y_1^2}}\right)\cdot\frac{ty_1}{\sqrt{\left(1+y_1^2\right)^3}}+\frac{\partial f}{\partial y}\left(r-t\cdot\frac{1}{\sqrt{1+y_1^2}},s+t\cdot\frac{y_1}{\sqrt{1+y_1^2}}\right)\cdot\frac{t}{\sqrt{\left(1+y_1^2\right)^3}}\right]dt$$

$$\frac{\partial}{\partial y_2}\mathcal{T}f\left(r,s,y_1,y_2\right)=\int_0^\infty\left[\frac{\partial f}{\partial x}\left(r+t\cdot\frac{1}{\sqrt{1+y_2^2}},s+t\cdot\frac{y_2}{\sqrt{1+y_2^2}}\right)\cdot\frac{-ty_2}{\sqrt{\left(1+y_2^2\right)^3}}+\frac{\partial f}{\partial y}\left(r+t\cdot\frac{1}{\sqrt{1+y_2^2}},s+t\cdot\frac{y_2}{\sqrt{1+y_2^2}}\right)\cdot\frac{t}{\sqrt{\left(1+y_2^2\right)^3}}\right]dt$$

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$$\mathcal{T}f\left(r,s,\theta,\phi\right)=\int_0^\infty\left[f\left(r+t\cos\left(\theta+\phi\right),s+t\sin\left(\theta+\phi\right)\right)+f\left(r+t\cos\left(\theta-\phi\right),s+t\sin\left(\theta-\phi\right)\right)\right]dt$$

$$\frac{\partial}{\partial r}\mathcal{T}f=\mathcal{T}\frac{\partial}{\partial x}f,\quad \frac{\partial}{\partial s}\mathcal{T}f=\mathcal{T}\frac{\partial}{\partial y}f$$

$$\frac{\partial}{\partial\theta}\mathcal{T}f\left(r,s,\theta,\phi\right)=\int_0^\infty\left[\begin{matrix}-t\sin\left(\theta+\phi\right)\cdot\frac{\partial f}{\partial x}\left(r+t\cos\left(\theta+\phi\right),s+t\sin\left(\theta+\phi\right)\right)+t\cos\left(\theta+\phi\right)\cdot\frac{\partial f}{\partial y}\left(r+t\cos\left(\theta+\phi\right),s+t\sin\left(\theta+\phi\right)\right)\dots\\ \dots-t\sin\left(\theta-\phi\right)\cdot\frac{\partial f}{\partial x}\left(r+t\cos\left(\theta-\phi\right),s+t\sin\left(\theta-\phi\right)\right)+t\cos\left(\theta-\phi\right)\cdot\frac{\partial f}{\partial y}\left(r+t\cos\left(\theta-\phi\right),s+t\sin\left(\theta-\phi\right)\right)\end{matrix}\right]dt$$

$$\frac{\partial}{\partial\phi}\mathcal{T}f\left(r,s,\theta,\phi\right)=\int_0^\infty\left[\begin{matrix}-t\sin\left(\theta+\phi\right)\cdot\frac{\partial f}{\partial x}\left(r+t\cos\left(\theta+\phi\right),s+t\sin\left(\theta+\phi\right)\right)+t\cos\left(\theta+\phi\right)\cdot\frac{\partial f}{\partial y}\left(r+t\cos\left(\theta+\phi\right),s+t\sin\left(\theta+\phi\right)\right)\dots\\ \dots+t\sin\left(\theta-\phi\right)\cdot\frac{\partial f}{\partial x}\left(r+t\cos\left(\theta-\phi\right),s+t\sin\left(\theta-\phi\right)\right)-t\cos\left(\theta-\phi\right)\cdot\frac{\partial f}{\partial y}\left(r+t\cos\left(\theta-\phi\right),s+t\sin\left(\theta-\phi\right)\right)\end{matrix}\right]dt$$

$$\frac{\partial^2\mathcal{T}f}{\partial\theta\partial r}\left(r,s,\theta,\phi\right)=\int_0^\infty\left[\begin{matrix}-t\sin\left(\theta+\phi\right)\cdot\frac{\partial^2 f}{\partial x^2}\left(r+t\cos\left(\theta+\phi\right),s+t\sin\left(\theta+\phi\right)\right)+t\cos\left(\theta+\phi\right)\cdot\frac{\partial f}{\partial x\partial y}\left(r+t\cos\left(\theta+\phi\right),s+t\sin\left(\theta+\phi\right)\right)\dots\\ \dots-t\sin\left(\theta-\phi\right)\cdot\frac{\partial f}{\partial x^2}\left(r+t\cos\left(\theta-\phi\right),s+t\sin\left(\theta-\phi\right)\right)+t\cos\left(\theta-\phi\right)\cdot\frac{\partial f}{\partial x\partial y}\left(r+t\cos\left(\theta-\phi\right),s+t\sin\left(\theta-\phi\right)\right)\end{matrix}\right]dt$$