

MATH 213 - QUIZ 12 - 24 APRIL 2012

Answer the following question in the space provided. There is no need to justify your answers. This quiz is worth 5 points.

Compute the Jacobian of the transformation $x = \frac{u}{v}$, $y = \frac{v}{u+1}$. Be sure to fully simplify your answer.

$$x = \frac{u}{v} \rightarrow \frac{\partial x}{\partial u} = \frac{1}{v} \quad \frac{\partial x}{\partial v} = -\frac{u}{v^2}$$

$$y = \frac{v}{u+1} \rightarrow \frac{\partial y}{\partial u} = \frac{-v}{(u+1)^2} \quad \frac{\partial y}{\partial v} = \frac{1}{u+1}$$

$$J(u, v) = \begin{vmatrix} \frac{1}{v} & -\frac{u}{v^2} \\ \frac{-v}{(u+1)^2} & \frac{1}{u+1} \end{vmatrix} = \frac{1}{v(u+1)} - \frac{uv}{v^2(u+1)^2}$$

$$= \frac{v(u+1) - uv}{v^2(u+1)^2} = \frac{1}{v^2(u+1)^2} //$$

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Answer the following question in the space provided. There is no need to justify your answers. This quiz is worth 5 points.

Compute the Jacobian of the transformation $x = e^{-u} \sin(v)$, $y = e^u \cos(v)$. Be sure to fully simplify your answer.

$$x = e^{-u} \sin(v) \rightarrow \frac{\partial x}{\partial u} = -e^{-u} \sin(v) \quad \frac{\partial x}{\partial v} = e^{-u} \cos(v)$$

$$y = e^u \cos(v) \rightarrow \frac{\partial y}{\partial u} = e^u \cos(v) \quad \frac{\partial y}{\partial v} = -e^u \sin(v)$$

$$J(u, v) = \begin{vmatrix} -e^{-u} \sin(v) & e^{-u} \cos(v) \\ e^u \cos(v) & -e^u \sin(v) \end{vmatrix}$$

$$= \sin^2(v) - \cos^2(v) //$$

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Answer the following question in the space provided. There is no need to justify your answers. This quiz is worth 5 points.

Compute the Jacobian of the transformation $x = uv^2$, $y = v(1 + u^2)$. Be sure to fully simplify your answer.

$$x = uv^2 \rightarrow \frac{\partial x}{\partial u} = v^2 \quad \frac{\partial x}{\partial v} = 2uv$$

$$y = v(1 + u^2) \rightarrow \frac{\partial y}{\partial u} = 2uv \quad \frac{\partial y}{\partial v} = 1 + u^2$$

$$J(u, v) = \begin{vmatrix} v^2 & 2uv \\ 2uv & 1 + u^2 \end{vmatrix} = v^2(1 + u^2) - 4u^2v^2$$

$$= v^2 + v^2u^2 - 4u^2v^2 = v^2 - 3u^2v^2 //$$