Multivariate chain rule exercise

TOTAL POINTS 5

1.Question 1

In this quiz, you will practice calculating the multivariate chain rule for various functions.

For the following functions, calculate the expression df/dt = (df/dx).(dx/dt) in matrix form, where x=(x_1,x_2)

f(x) = f(x_1, x_2) =x_1^2x_2^2 + x_1x_2

x_1(t) = 1-t^2 $x_1(t)=1-t_2$

x_2(t) = 1+t^2 $x_2(t)=1+t_2$

1 / 1 point

df/dt = (df/dx).(dx/dt) = [2x_1 x_2^2 + x_2, 2x_1^2 x_2 + x_1][[$-2t$], [$2t$]]

2.Question 2

For the following functions, calculate the expression df/dt = (df/dx).(dx/dt) in matrix form, where x=(x_1,x_2,x_3).

f(x) = f(x_1, x_2, x_3) =x_1^3cos(x_2)e^{x_3}

x_1(t) = 2t

x_2(t) =1-t^2

x_3(t) = e^t

1 / 1 point

df/dt = (df/dx).(dx/dt) = [3x_1^2 cos(x_2) e^{x_3}, -x_1^3 sin(x_2) e^{x_3}, x_1^3 cos(x_2) e^{x_3}][[2], [$-2t$], [e_t]]

3.Question 3

For the following functions, calculate the expression df/dt = (df/dx).(dx/du).(du/dt) in matrix form, where x=(x_1, x_2) and u=(u_1, u_2).

f(x) = f(x_1, x_2) = x_1^2 - x_2^2

x_1(u_1, u_2) = 2u_1 + 3u_2

x_2(u_1, u_2) =2u_1 -3u_2

u_1(t) = cos(t/2)

u_2(t) = sin(2t)

1 / 1 point

df/dt = (df/dx).(dx/du).(du/dt) = [2x_1, -2x_2][[2 3], [2 −3]][[−*sin*(*t*/2)/2], [2*cos*(2*t*)]]

4.Question 4

For the following functions, calculate the expression df/dt = (df/dx).(dx/du).(du/dt) in matrix form, where x=(*x*1,*x*2) and u=(*u*1,*u*2).

f(x) = f(x_1, x_2) = cos(x_1)sin(x_2)

x_1(u_1, u_2) = 2u_1^2 + 3u_2^2 -u_2

x_2(u_1, u_2) =2u_1 -5u_2^3

u_1(t) = e^{t/2}

u_2(t) = e^{-2t}

1 / 1 point

df/dt = (df/dx).(dx/du).(du/dt) = [-sin(x_1)sin(x_2), cos(x_1)cos(x_2)][[4*u*1 6*u*2−1], [2 −15*u*22]][[*e*^(*t*/2)/2], [−2*e*^(−2*t*)]]

5.Question 5

For the following functions, calculate the expression df/dt = (df/dx).(dx/du).(du/dt) in matrix form, where x=(*x*1,*x*2) and u=(*u*1,*u*2).

f(x) = f(x_1, x_2, x_3) = sin(x_1)cos(x_2)e^{x_3}

x_1(u_1, u_2) = sin(u_1) + cos(u_2)

x_2(u_1, u_2) = cos(u_1) - sin(u_2)

x_3(u_1, u_2) = e^{u_1 + u_2}

u_1(t) = 1 + t/2

u_2(t) = 1 - t/2

1 / 1 point

df/dt = (df/dx).(dx/du).(du/dt) = [cos(x_1)cos(x_2)e^{x_3}, -sin(x_1)sin(x_2)e^{x_3}, sin(x_1)cos(x_2)e^{x_3}] . [[*cos*(*u*1) −*sin*(*u*2)], [−*sin*(*u*1) −*cos*(*u*2)], [*e*^(*u*1+*u*2) *e*^(*u*1+*u*2)]] . [[1/2], [−1/2]]