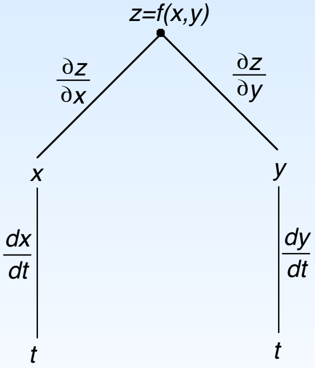
Recall:

Given $f(x, y)$, where x, y are functions of t



$$\frac{df}{dt} = \frac{\partial f}{\partial x}\frac{dx}{dt} + \frac{\partial f}{\partial y}\frac{dy}{dt}$$

1. Use the chain rule to find the indicated derivatives:

   (a) $g'(t)$, where

$$g(t) = f(x(t), y(t)) \qquad f(x,y) = \sqrt{x^2 + y^2}$$
$$x(t) = \sin(t) \qquad y(t) = t^2 + 2$$

   (b) $\dfrac{\partial g}{\partial u}$, where

$$g(u,v) = f(x(u,v), y(u,v)) \qquad f(x,y) = 4x^2y^3$$
$$x(u,v) = u^3 - v\sin(u) \qquad y(u,v) = 4u^2$$

2. Draw a tree diagram to figure out the chain rule for composite functions of the form $z = g(u,v) = f(x(r,s), y(r,s,t))$, where r, s, and t are all functions of u and v.

3. Use the chain rule twice to find $g''(t)$ if $g(t) = f(x(t), y(t))$.

Recall:

If we have $z = f(x, y)$, then the equation of the tangent plane at (a, b) (when $f(x, y)$ has continuous first partials at (a, b)) is

$$z = f_x(a, b)(x - a) + f_y(y - b) + f(a, b).$$

Note: This equation only gives the tangent plane if the tangent plane is non-vertical.

Rephrasing this slightly:

If we have $z = f(x, y)$, then the equation of the tangent plane at the point (a, b, c) (when $f(x, y)$ has continuous partials at $x = a$, $y = b$) is

$$z = z_x(a, b)(x - a) + z_y(a, b)(y - b) + c.$$