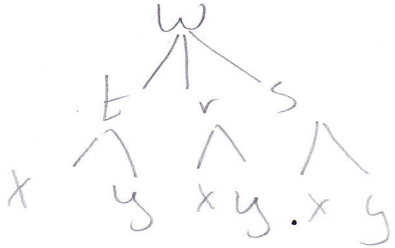


1. Suppose $w(t,r,s)$ and $t, r,$ and s are all functions of x and y .

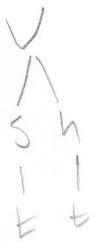
Make a tree diagram AND write the chain rule for $\frac{\partial w}{\partial y}$.



$$\frac{\partial w}{\partial y} = w_t t_y + w_r r_y + w_s s_y$$

2. Suppose a pyramid of height h and with a square base, s depend on time. The volume,

V , is given by $V = \frac{1}{3}s^2h$. At a certain instant the height is 4 ft and decreasing at the rate of 2 ft/sec and the side s is 6 ft and increasing at the rate of 5 ft/sec. What is the rate of change in volume at this instant? Include units.



$$\left. \frac{dh}{dt} \right|_{h=4} = -2$$

$$\left. \frac{ds}{dt} \right|_{s=6} = 5$$

$$V_s = \frac{2}{3}sh$$

$$V_s(6,4) = \frac{2}{3}(6)(4) = 16$$

$$V_h = \frac{1}{3}s^2$$

$$V_h(6,4) = \frac{1}{3}(6)^2 = 12$$

$$\frac{dV}{dt} = V_s \frac{ds}{dt} + V_h \frac{dh}{dt} = (16)(5) + 12(-2) = 80 - 24 = 56 \frac{\text{ft}^3}{\text{sec}}$$

3. Let $f(x,y,z) = x \ln(yz)$. Find the equation of the tangent plane to the surface at the point $(2,1,e)$

$$f_x = \ln(yz) \quad f_y = \frac{x \cdot z}{yz} = \frac{x}{y} \quad f_z = \frac{x \cdot y}{y^2 z} = \frac{x}{z}$$

$$f_x(2,1,e) = 1 \quad f_y(2,1,e) = 2 \quad f_z(2,1,e) = \frac{2}{e}$$

$$x + 2y + \frac{2}{e}z = C \Rightarrow 2 + 2 + \frac{2}{e} \cdot e = C \Rightarrow C = 6$$

$$x + 2y + \frac{2}{e}z = 6$$

Problem 4 is a Multiple Choice question. It is on the next page. So that you don't have to send a second page, just put your answer to the multiple choice question below.

4. B zero because: if it's a max, then $(0,0,6)$ is a critical point and $f_x = f_y = 0$ at $(0,0,6)$.