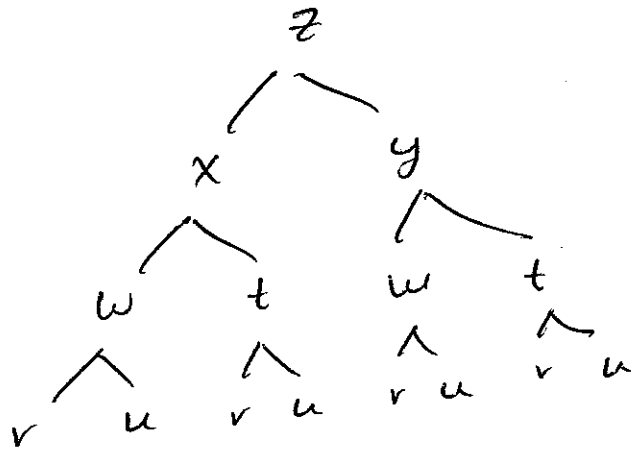


#13



So:

$$z_r = z_x x_r + z_y y_r$$

where:

$$x_r = x_w w_r + x_t t_r$$

and

$$y_r = y_w w_r + y_t t_r$$

Now,  $z = x^2 - y^2$ , so  $z_x = 2x$ ,  $z_y = -2y$

$$x = w + 4t \Rightarrow x_w = 1, \quad x_t = 4$$

$$y = w^2 - 5t + 4 \Rightarrow y_w = 2w, \quad y_t = -5$$

$$w = r^2 - 5u \Rightarrow w_r = 2r$$

$$t = 3r + 5u \Rightarrow t_r = 3$$

Substitute:

$$\begin{aligned} z_r &= (2x) (1 \cdot (2r) + 4 \cdot 3) + (-2y) (2w \cdot 2r + (-5)(3)) \\ &= 2x(2r + 12) - 2y(4wr - 15) \end{aligned}$$

↑ Fine to leave in this form.