

Physical Systems - CM - Fall 2002 - week 3 - E7Z

Help sheet for 2.20 raindrop.  $\rho_0 =$  water density

$\rho_1 =$  air density

We showed in class that  $\frac{dm}{dt} = k \cdot \text{area} = \rho_1 v \pi r^2$  (a)

(b)  $m(t) =$  density of water, volume of sphere  $= \rho_0 \frac{4}{3} \pi r(t)^3$

(c)  $\frac{dm}{dt} = \frac{dr}{dt}$

First find how radius changes in time, Apply product rule to Newton's:  $F = gt = \frac{d}{dt}(mv) =$  (c)

Sub in (a) and (b):

Divide by  $\rho_0$ : (1)

Trick:  $\frac{\rho_1}{\rho_0} \sim 10^{-3} =$  negligible!

Simplify (1):

Solve for  $v(t) =$  (2)

Now find  $r(t)$ : Equate (a) and (c):

Solve for  $r(t)$ : (3)