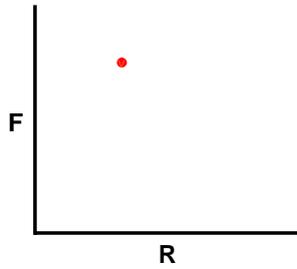


DIFFERENTIALS & PHASE SPACE



foxes and hares

PREDATOR-PREY INTERACTION

Lotka (1925)-Volterra (1926) model

differential equations

a: prey growth rate

b: predation rate

c: predator growth rate (feeding)

d: predator death rate (starving)

$$dR = a R(t) dt$$

$$dR = - b R(t) F(t) dt$$

$$dF = c R(t) F(t) dt$$

$$dF = - d F(t) dt$$

$$dR = a R(t) dt$$

$$dF = c R(t) F(t) dt$$

$$dR = - b R(t) F(t) dt$$

$$dF = - d F(t) dt$$

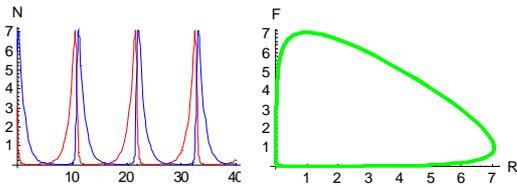
$$dR / dt = a R(t) - b R(t) F(t)$$

$$dF / dt = c R(t) F(t) - d F(t)$$

$$dR / dt = a R(t) - b R(t) F(t)$$

$$dF / dt = c R(t) F(t) - d F(t)$$

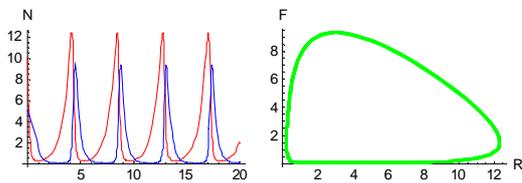
$$1 = a = b = c = d; R(0) = 3, F(0) = 6$$



$$dR / dt = a R(t) - b R(t) F(t)$$

$$dF / dt = c R(t) F(t) - d F(t)$$

$$a = 1.5, b = 1 = c, d = 3; R(0) = 10, F(0) = 5$$



$$dR / dt = a R(t) - b R(t) F(t) = 0$$

$$dF / dt = c R(t) F(t) - d F(t) = 0$$

$$\{R(t), F(t)\} = \{c / a, a / b\}$$
