

### Eulers for unrealistic parameters:

$$\alpha = 0.05, \eta = 0.04, \beta = \lambda = 0.0002, M_0 = 500, F_0 = 600, \Delta t = 0.1$$

$$\text{At } t_0 = 0$$

$$\frac{dM}{dt} = -0.05(500) + 0.0002(500)(600) = 36$$

$$\frac{dF}{dt} = -0.04(600) + 0.0002(500)(600) = 35$$

### Eulers formula

$$M_{n+1} = M_n + \Delta t \cdot \frac{dM}{dt} \quad F_{n+1} = F_n + \Delta t \cdot \frac{dF}{dt}$$

$$M_1 = 500 + 0.1 \times 36 = 503.6 \quad F_1 = 600 + 0.1 \times 35 = 603.6$$

Next for  $t = 0.2$

$$\frac{dM}{dt} = -0.05(503.6) + 0.0002(503.6)(603.6) = 35.283$$

$$\frac{dF}{dt} = -0.04(603.6) + 0.0002(503.6)(603.6) = 36.639$$

$$M_2 = 503.6 + 0.1(35.283) = 507.028$$

$$F_2 = 603.6 + 0.1(36.639) = 607.261$$

⋮

### Eulers for Realistic Parameters:

$$\alpha = 0.05 \quad \eta = 0.04 \quad \beta = \lambda = 0.00005$$

$$M(0) = 500, F(0) = 600 \quad \Delta t = 0.1$$

$$\frac{dM}{dt} = -0.05(500) + 0.00005(500)(600) = -10$$

$$\frac{dF}{dt} = -0.04(600) + 0.00005(500)(600) = -9$$

$$M_1 = 500 + 0.1(-10) = 499 \quad F_1 = 600 + 0.1(-9) = 599.1$$

Next for  $t = 0.2$

$$\frac{dM}{dt} = -0.05(499) + 0.00005(499)(599.1) = -10.002$$

$$\frac{dF}{dt} = -0.04(599.1) + 0.00005(499)(599.1) = -9.016$$

$$M_2 = 499 + 0.1(-10.002) = 497.910$$

$$F_2 = 599.1 + 0.1(-9.016) = 598.198$$

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