Demystifying the population growth model

Mathematical models can seem like magic. Let's see if we cannot gain some intuition for these models by plugging in numbers

The models

Again, we have two equations: The exponential model (left) and the logistic model (right)

$$\frac{dN}{dt} = rN \qquad\qquad \frac{dN}{dt} = rN\left(1 - \frac{N}{k}\right)$$

We can divide both sides by N to get the per capita growth rate in each

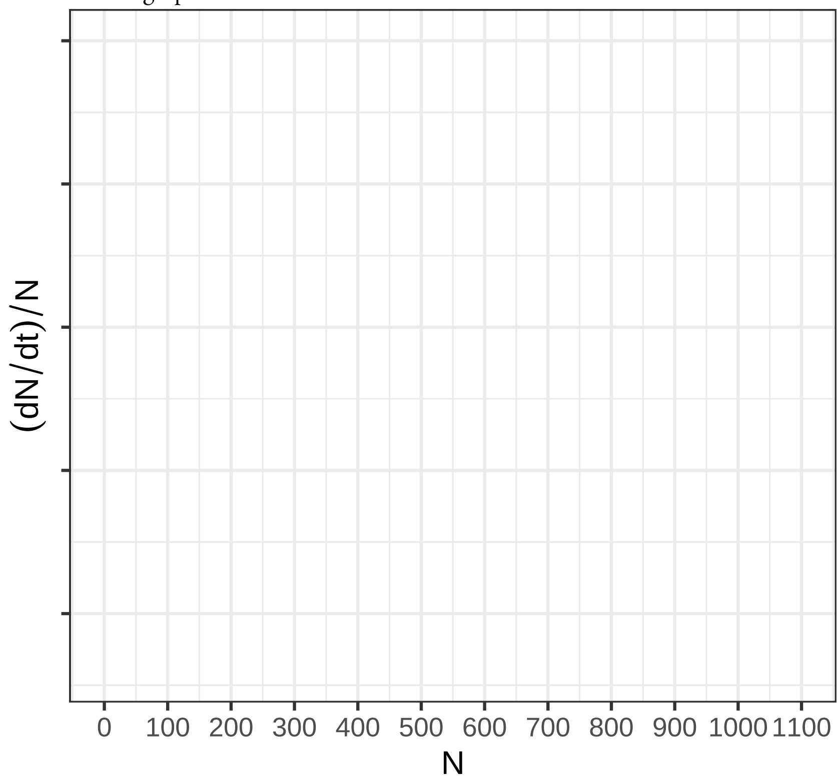
$$\frac{\frac{dN}{dt}}{N} = \frac{rN}{N} = r \qquad\qquad \frac{\frac{dN}{dt}}{N} = \frac{rN\left(1-\frac{N}{k}\right)}{N} = r - \frac{r}{k}N$$

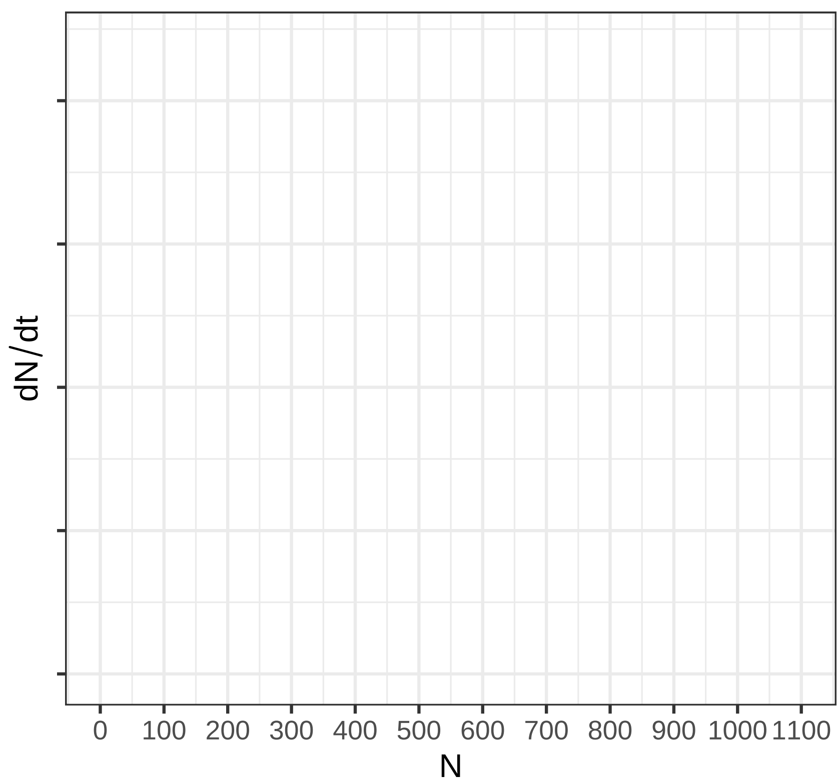
Let's choose some values for r and k[1] and fill in the table.

[1] r = ________ k = ________

N	(dN/dt)/N exponential	dN/dt exponential	(dN/dt)/N logistic	dN/dt logistic
0				
100				
200				
300				
400				
500				
600				
700				
800				
900				
1000				
1100				

Then we can graph these numbers…





Then we can use these numbers to figure out the population size over time, $N(t)$. Let's fill out the table. Remember, what we have in the next time step is what we had in *this* time step plus however much the population grows[2].

[2] This is approximately true when the time steps are small. It's fine for our purposes

t	N(t)	dN/dt	N(t)	dN/dt
0	100		100	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

And plot the results