第二次作业

2. 4. 4

由(25)式,

$$x(t)=\frac{x_m}{1+ce^{-rt}},c=\frac{x_m}{x_0}-1$$

则

$$x''(t)=\left(\frac{2c^2e^{-2rt}r^2}{(1+ce^{-rt})^3}-\frac{ce^{-rt}r^2}{(1+ce^{-rt})^2}\right)x_m$$

令 $x''=0$,

$$e^{rt_0}=c=\frac{x_m}{x_0}-1$$

回代有

$$x(t)=\frac{x_m}{1+e^{-r(t-t_0)}}$$

2. 4. 5

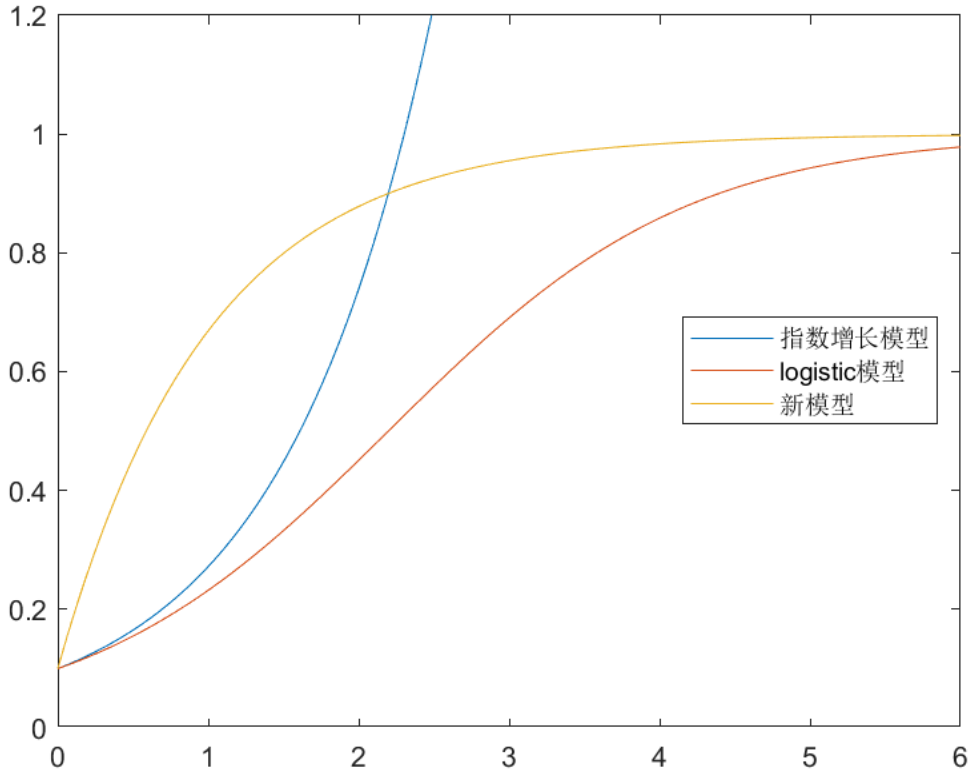
推导:

$$\begin{aligned}x(t+\Delta t)-x(t)&=k(x_m-x(t))\Delta t\\x'(t)&=k(x_m-x(t))\\x(t)&=x_m-(x_m-x_0)e^{-kt}\end{aligned}$$

code:

```
 x0 = 0.1;
xm = 1;
r = 1;
t = linspace(0, 6, 100)
x1 = @(t) x0 * exp(r * t);
x2 = @(t) xm ./ (1 + (xm / x0 - 1) * exp(-r * t));
x3 = @(t) xm - (xm -x0) * exp(-r * t);
plot(t, x1(t), t, x2(t), t, x3(t))
legend('指数增长模型', 'logistic模型', '新模型', 'Location', 'best')
ylim([0, 1.2])
saveas(gcf, '2.4.5.1.png');
```

图像:


1.2
1
0.8
0.6
0.4
0.2
0
0
1
2
3
4
5
6
指数增长模型
logistic模型
新模型