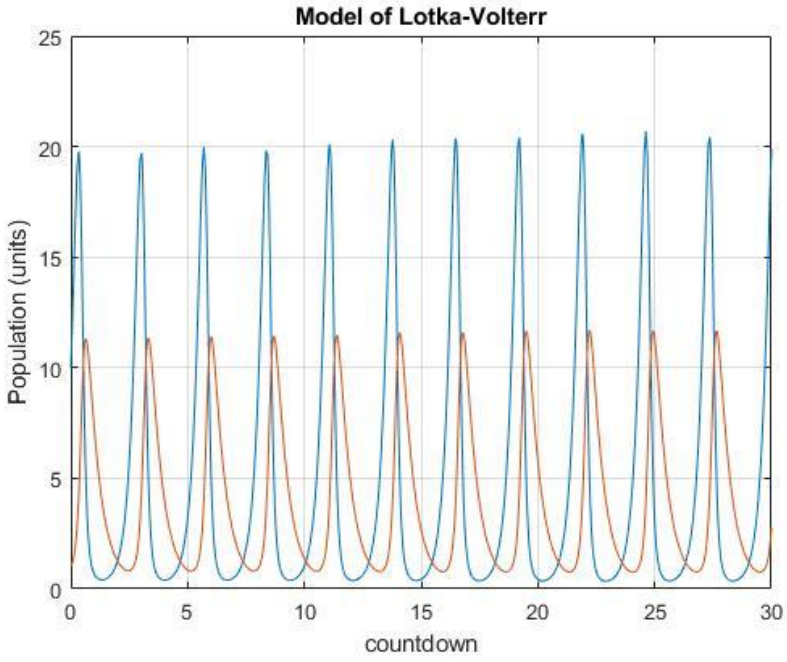
Запрограммируем модель Вальтерра – Лотки в программной среде Matlab R2019a. Рыжим обозначены хищники, синим обозначены жертвы.

```
%model Lotki-Volterr
close all;
clear all;

%constants for ode
a = 1; %coeff of prey's death
b1 = 4; %coeff of preys' birth
b2 = 2; %coeff of predator's death
k = 0.4; %coeff of conversation prey's biomass in predator's

%initial condition of population (number)
N1 = 10; %prey's population for odefun2
N2 = 1; %predator's population for odefun1


%range of integration
range = [0 30];

[t1, y1] = ode45(@(t1,y1) lotka_valterr(t1,y1,b1,b2,a,k), range, [N2;N1]);


plot(t1,y1);
grid on;
title('Model of Lotka-Volterr');
xlabel('countdown');
ylabel('Population (units)');

function lv = lotka_valterr(t, y, b1, b2, a, k)
    lv = [b1*y(1) - a*y(1)*y(2); -b2*y(2)+k*a*y(1)*y(2)];
end
```



```
%model Lotki-Volterr
close all;
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%constants for ode
a = 1; %coeff of prey's death
b1 = 4; %coeff of preys' birth
b2 = 2; %coeff of predator's death
k = 0.4; %coeff of conversation prey's biomass in predator's

%initial condition of population (number)
N1 = 10; %prey's population for odefun2
N2 = 2; %predator's population for odefun1


%range of integration
range = [0 30];
[t1, y1] = ode45(@(t1,y1) lotka_valterr(t1,y1,b1,b2,a,k), range, [N1;N2]);
plot(y1(:,1),y1(:,2));
grid on;
title('Model of Lotka-Volterr. Phase-space');
xlabel('prey');
ylabel('predator');
pause(0.05);
function lv = lotka_valterr(t, y, b1, b2, a, k)
    lv = [b1*y(1) - a*y(1)*y(2); -b2*y(2)+k*a*y(1)*y(2)];
end
```
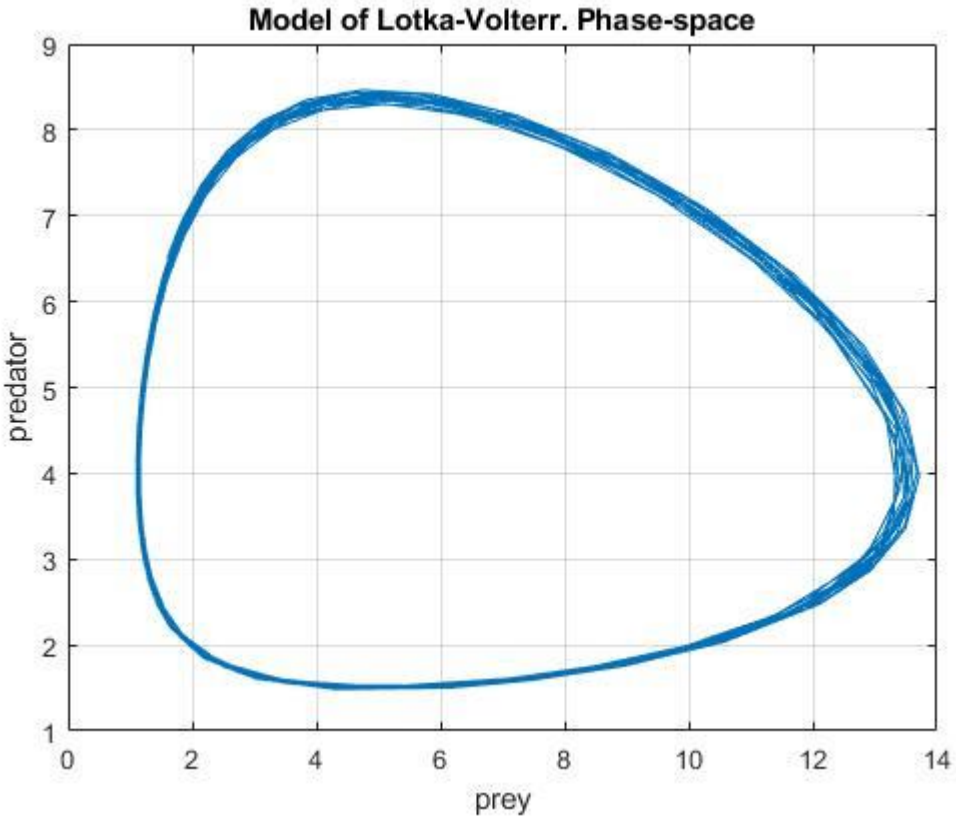
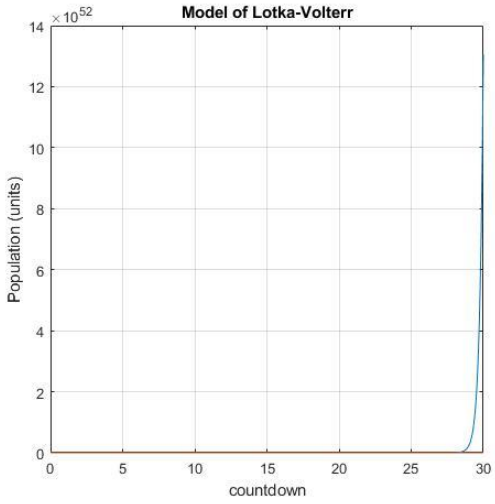
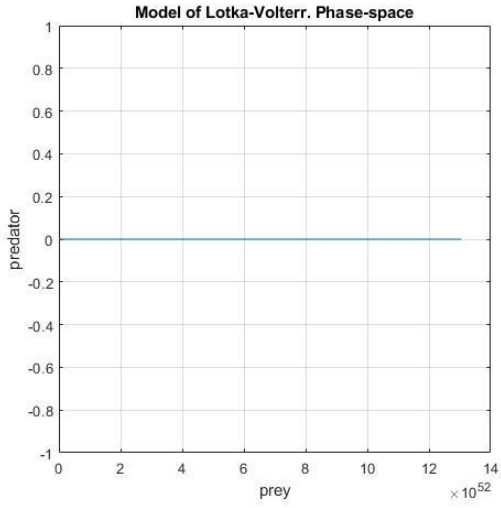
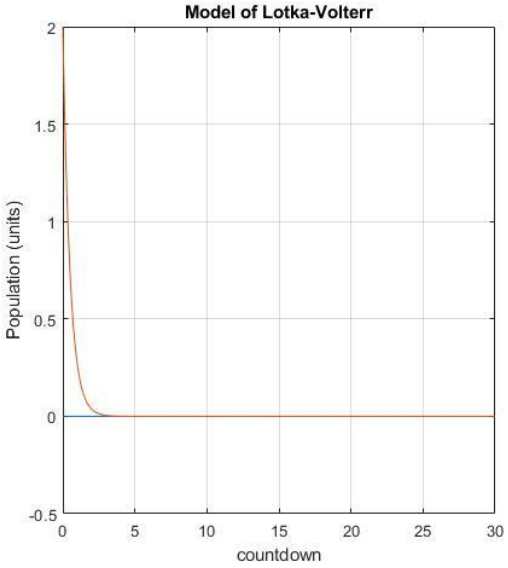



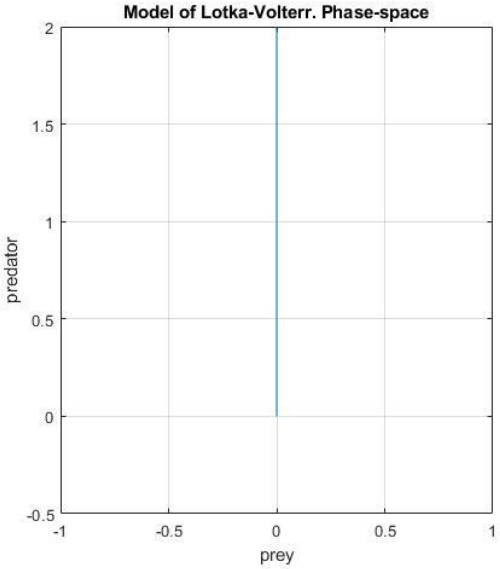
При 0 количестве хищников





При 0 количестве жертв

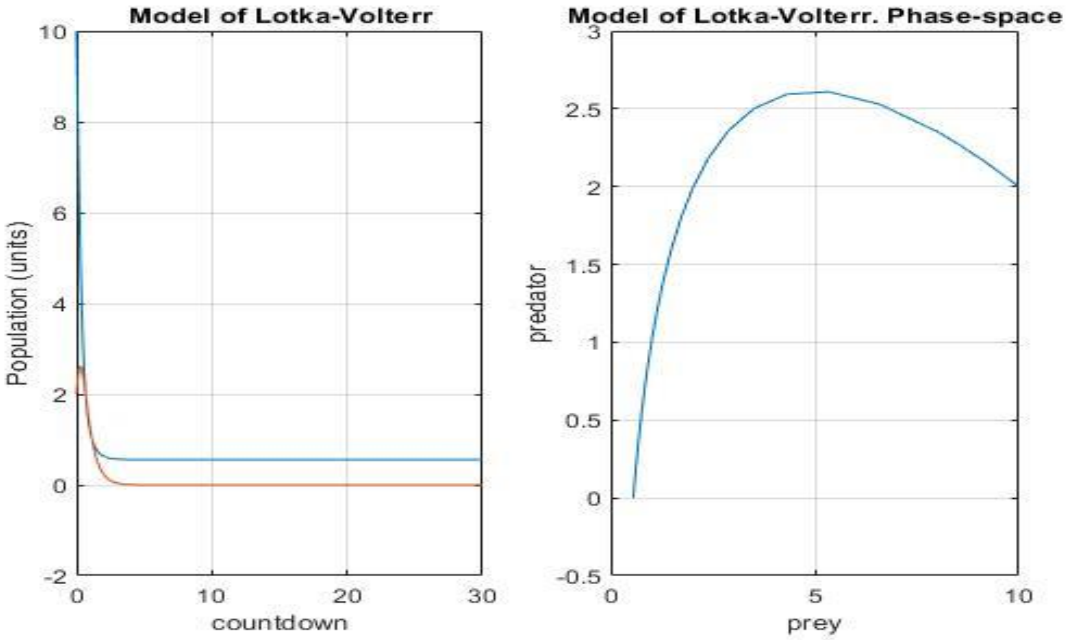




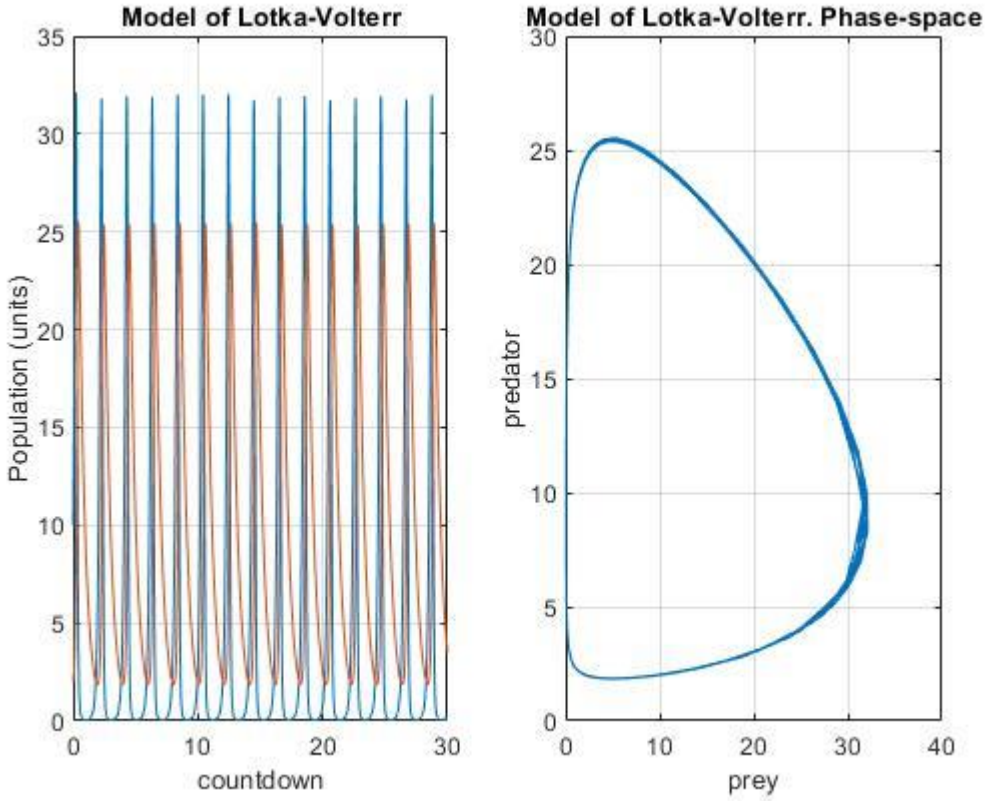
Для динамики (анимации) графиков будем использовать цикл for. Таким образом поварьируем все коэф-ты.

```
%model Lotki-Volterr
close all;
clear all;

%constants for ode
a = 1; %coeff of prey's death
b1 = 4; %coeff of preys' birth
b2 = 2; %coeff of predator's death
k = 0.4; %coeff of conversation prey's biomass in predator's

%initial condition of population (number)
N1 = 10; %prey's population for odefun2
N2 = 2; %predator's population for odefun1


%range of integration
for i = 1:10
b1 = -1;
b1 = b1 + i;
range = [0 30];
[t1, y1] = ode45(@(t1,y1) lotka_valterr(t1,y1,b1,b2,a,k), range, [N1;N2]);
subplot(1,2,1);
plot(t1,y1);
grid on;
title('Model of Lotka-Volterr');
xlabel('countdown');
ylabel('Population (units)');
subplot(1,2,2);
plot(y1(:,1),y1(:,2));
grid on;
title('Model of Lotka-Volterr. Phase-space');
xlabel('prey');
ylabel('predator');
pause(5);
end;
function lv = lotka_valterr(t, y, b1, b2, a, k)
    lv = [b1*y(1) - a*y(1)*y(2); -b2*y(2)+k*a*y(1)*y(2)];
end
```

Коэффициент рождаемости жертв = 0.



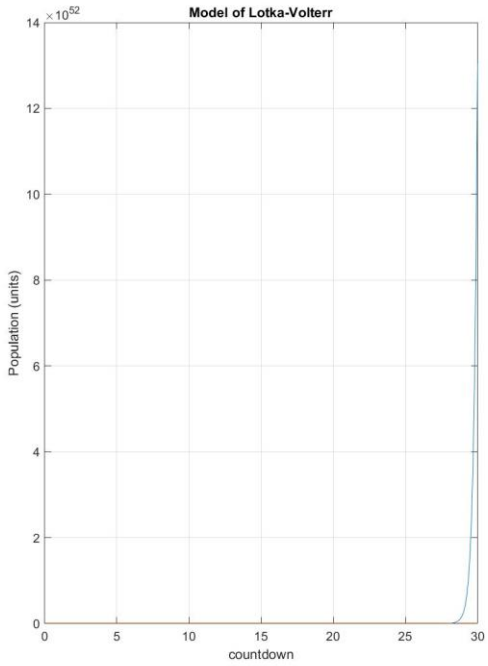
Коэффициент рождаемости жертв = 9.

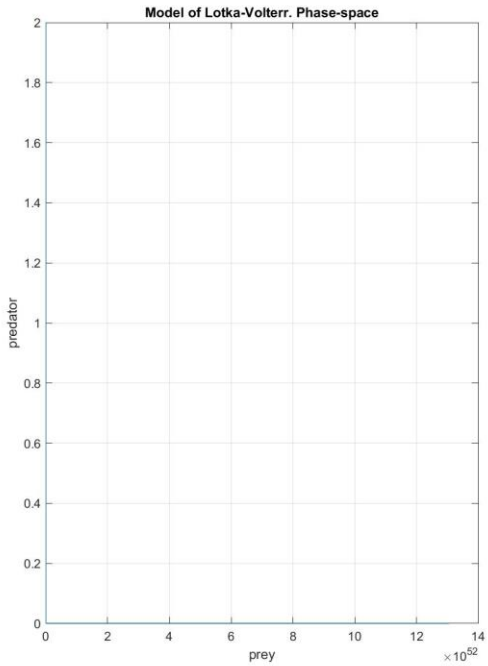


Пример программы с анимацией при изменении коэффициентов.

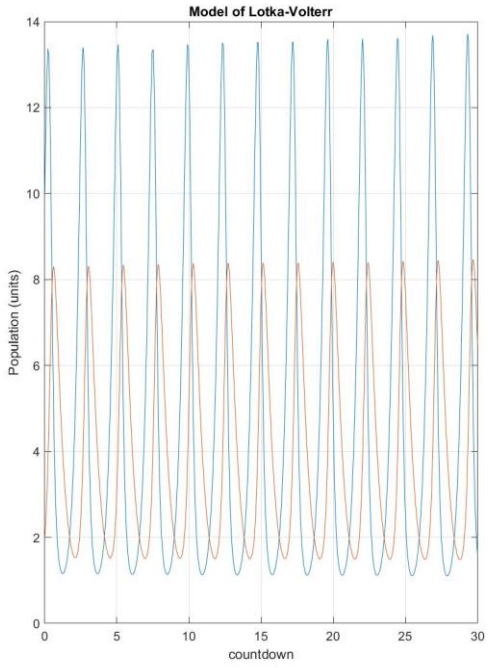
```
%model Lotki-Volterr
%developed by GremIS 03.10.21
close all;
clear all;

%constants for ode
a = 1; %coeff of prey's death
b1 = 4; %coeff of preys' birth
b2 = 2; %coeff of predator's death
k = 0.4; %coeff of conversation prey's biomass in predator's

%initial condition of population (number)
N1 = 10; %prey's population for odefun2
N2 = 2; %predator's population for odefun1


%range of integration
for i = 1:10
a = -1;
a = a + i;
range = [0 30];
[t1, y1] = ode45(@(t1,y1) lotka_valterr(t1,y1,b1,b2,a,k), range, [N1;N2]);
St1=['C:\Users\IVAN\Desktop\магистратура, 1курс\math_modeling\','1_',
num2str(i),'.jpg'];
Fig=figure('Position',[50 50 1400 800]);
subplot(1,2,1);
plot(t1,y1);
grid on;
title('Model of Lotka-Volterr');
xlabel('countdown');
ylabel('Population (units)');
subplot(1,2,2);
plot(y1(:,1),y1(:,2));
grid on;
title('Model of Lotka-Volterr. Phase-space');
xlabel('prey');
ylabel('predator');
pause(0.05);
%print(Fig,'-djpeg',St1);
end;
function lv = lotka_valterr(t, y, b1, b2, a, k)
    lv = [b1*y(1) - a*y(1)*y(2); -b2*y(2)+k*a*y(1)*y(2)];
end
```

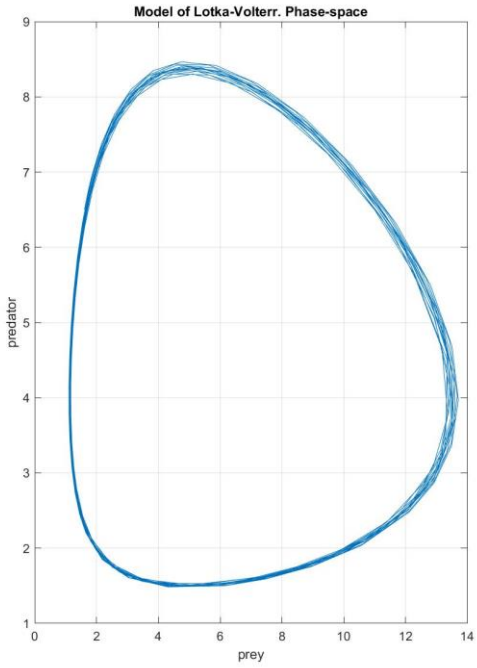
Коэффициент смерти жертв = 0.



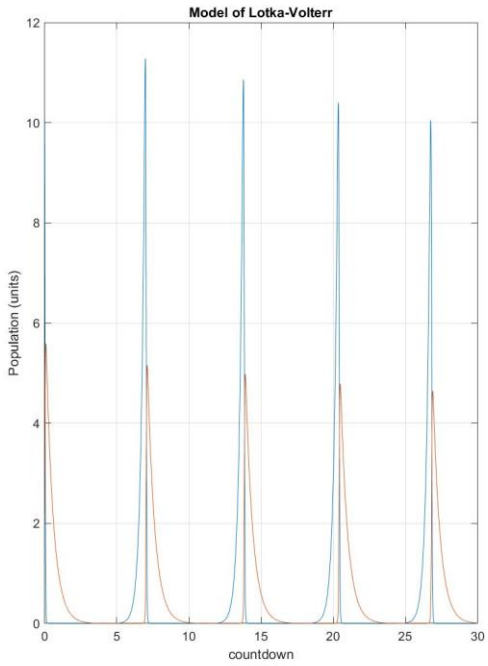


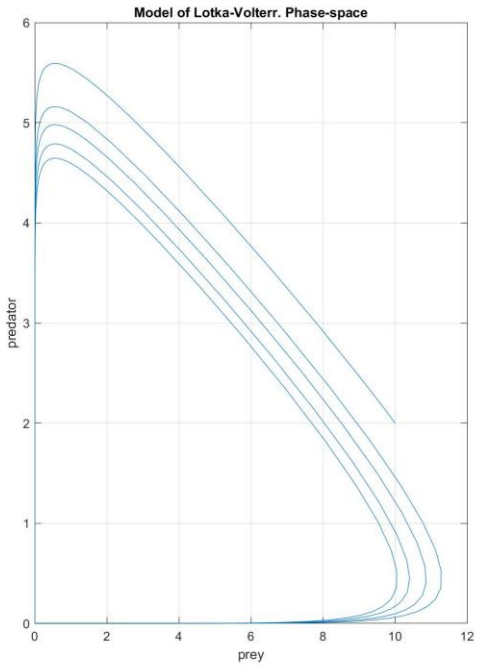
Коэффициент смерти жертв =1.





Коэффициент смерти жертв = 9.





Ссылка на анимацию: https://github.com/breatheuntiludie/model_valterra_lotka/blob/master/Valterra-Lotki.gif

Аналогично для других параметров.