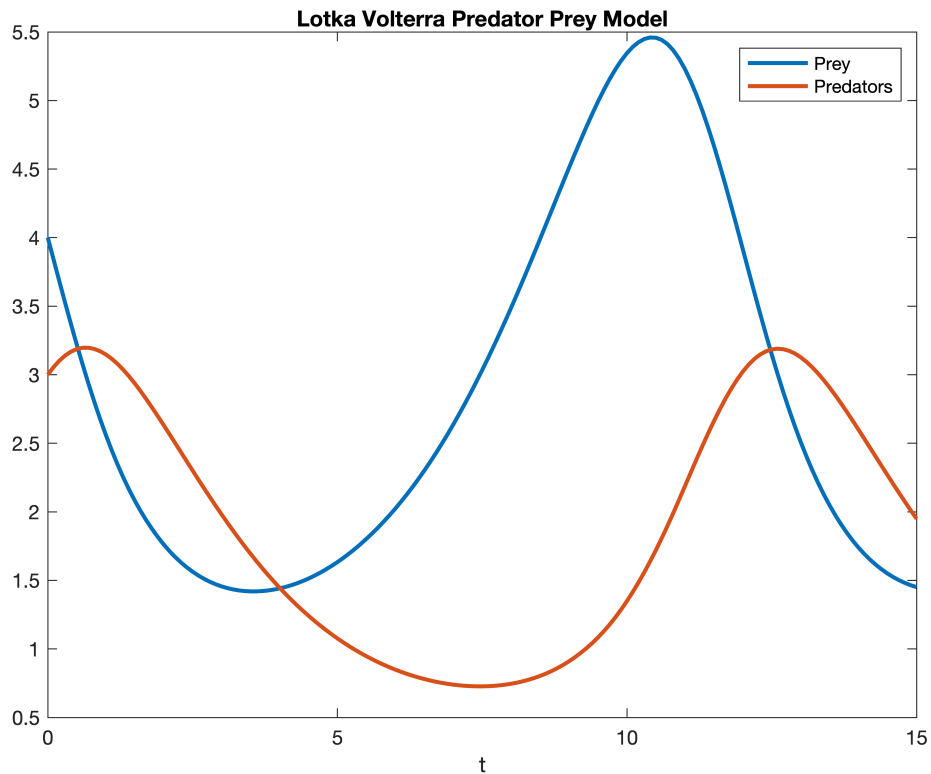


Classic Lotka-Volterra Predator Prey Model

$$x' = ax - bxy, \quad y' = mxy - ny \quad \text{with } a, b, m, n > 0$$

```
% Set Initial values
x10 = 4;
x20 = 3;

% Set Values for Parameters
a = 1/2;
b = 3/10;
m = 1/5;
n = 3/5;
IC = [x10, x20];
tspan = 0: .1: 15;
[tSoln, xSoln] = ode45( @(t,x) LotkaVolterra(t, x, a, b, m, n), tspan, IC);
figure;
plot(tSoln, xSoln, 'LineWidth', 2), xlabel('t'), legend('Prey', 'Predators')
title('Lotka Volterra Predator Prey Model')
```



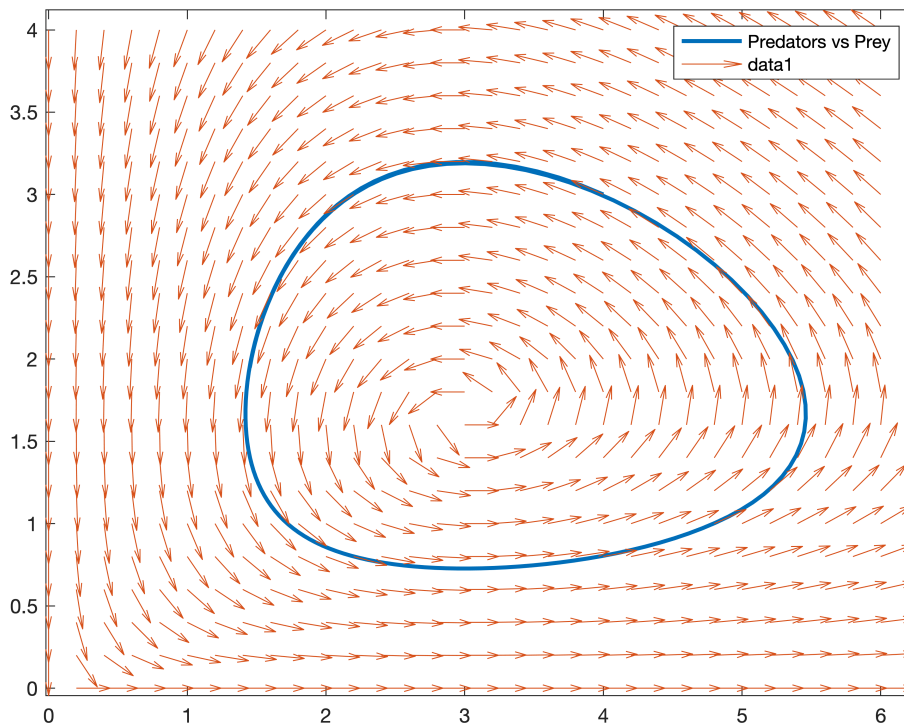
Plot Phase Portrait and Trajectory

```

figure;
plot(xSoln(:,1), xSoln(:,2), 'LineWidth', 2)
legend('Predators vs Prey')
axis tight
hold on

[x,y]=meshgrid(0:.2:6,0:.2:4);
xprime=a * x - b * x.*y;
yprime=-n.*y + m.*x.*y;
L = sqrt(xprime.^2 + yprime.^2);
dyu=yprime./L;
dxu=xprime./L;
quiver(x,y,dxu,dyu)
hold off

```



Multiple Initial Conditions

```

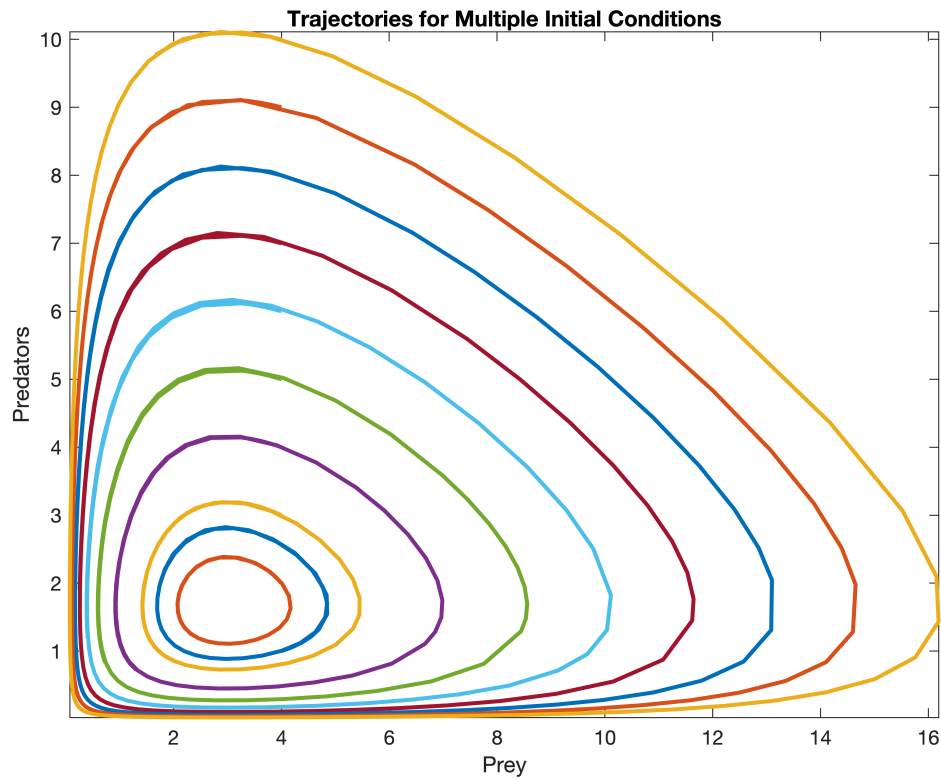
t0 = 0;
tfinal = 18;
y0 = 1:1:10;
for k = 1:length(y0)
    [t,p] = ode45(@(t,x) LotkaVolterra(t,x,a,b,m,n), [t0 tfinal],[4 y0(k)]);
    plot(p(:,1),p(:,2), 'LineWidth',2)
end

```

```

axis tight
hold on
end
title('Trajectories for Multiple Initial Conditions')
xlabel('Prey')
ylabel('Predators')
hold on

```



Define The Model

```

function dx = LotkaVolterra(t, x, a, b, m, n)
dx = [a * x(1) - b * x(1) .* x(2)
m * x(1) .* x(2) - n * x(2)];
end

```