% Problem 1: Ligand binding
Kd=100; % Dissociation constant in units of nM
L=[1:1000]; % Ligand concentration
p=L./Kd./(1+L./Kd); % Probability of receptor occupancy
figure, plot(L,p)
xlabel('Ligand concentration [nM]')
ylabel('Probability')
title('Binding Curve')

% Problem 2: Matrix manipulation
M=[1 2 3; 4 5 6; 7 8 9] % Create a matrix
M(1,1) % Get elements M_11
M(2,3) % Get elements M_23
M(:,1) % Get first column
M(1,:) % Get first row
M.*pi % Multiply matrix by pi

% Problem 3: Logistic growth
r=1; % Rate constant in the logistic equation
K=1; % Saturation population size
% Choose a step that is much smaller than the smallest time scale in the problem
step=0.1;
% Total Integration time
TotalTime=10;
% The initial conditions is
N0=0.01;
% Now, do it for the actual integration
% We'll have our time information in the vector N
N(1)=N0;
% m is a counter that we will use in the for loop
m=2;
for i=step:step:TotalTime
    N(m)=N(m-1)+r*step*N(m-1)*(1-N(m-1)); % Logistic equation
    m=m+1; % Increment the counter
end
Times=0:step:TotalTime; % Create a vector of times for x-axis
figure, plot(Times,N,'-b')
xlabel('Time')
ylabel('Number of cells')
title('Logistic Growth')

M =
    1  2  3
    4  5  6
    7  8  9

ans =
    1

ans =
    6
\begin{verbatim}
ans =
    
    1
    4
    7

ans =
    
    1    2    3

ans =

    3.1416   6.2832   9.4248
  12.5664  15.7080  18.8496
  21.9911  25.1327  28.2743
\end{verbatim}

![Binding Curve](image)

Binding Curve
Logistic Growth

Number of cells vs Time

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