Given that:

At time

With this value, solve for , we obtain:

Therefore the limit of the population is

At the time the population is one-half of the limit is:

Solve for , we get:

Thus the limit of the population model is and it takes to reach the one-half of its limit.

# 

Given that:

Where:

And:

Therefore the given differential equation is exact.

Solve the given differential equation:

Integrating both sides we obtain the final result:

Given that:

(Multiply both sides with )

Integrating both sides we obtain:

With the initial condition: , it leads to:

Hence, the solution of the equation is:

Or:

a) Given that:

Where:

Characteristic equation of the given ODE:

Since the right hand side of the given equation has two terms and , therefore the particular solution also has two term: , respectively.

Solve fore from:

Since we have: (double roots)

Hence:

Solve fore from:

Since, we have: is not a root of the characteristic equation.

Hence:

So:

b) Given that:

Characteristic equation of the given ODE:

Hence, the complement solution is:

Since, the right hand side with is a single root of the characteristic equation.

Therefore the particular solution has the following form:

Substituting back into the given equation we obtain:

Thus the general solution of the equation is:

a) Given that:

We have: .

We know that is a solution of , therefore substituting into , we get:

Thus, with any constant and , is a solution of

b) To find the general solution of , we rewire in the following form:

The Wronskian determinant for the equation is:

Hence:

Choose: for it leads to:

Choose

Since, the Wronskian determinant different from 0 for some , therefore and are linearly independence solution of the equation.

Thus, the general solution of the equation is: