**`Example 3.2.7 Heat Transfer with Nonlinear Radiation Boundary Conditions**

Example 3.2.4 is solved here using maple's 'dsolve' command. The boundary condition at the surface, x = 1, is taken as:



The example is solved in Maple below.

> restart:

> with(plots):

> eq:=diff(y(x),x$2)-(1+0.1\*y(x))\*y(x);



> BCs:=(D(y)(0),D(y)(1)=1-y(1)^4);

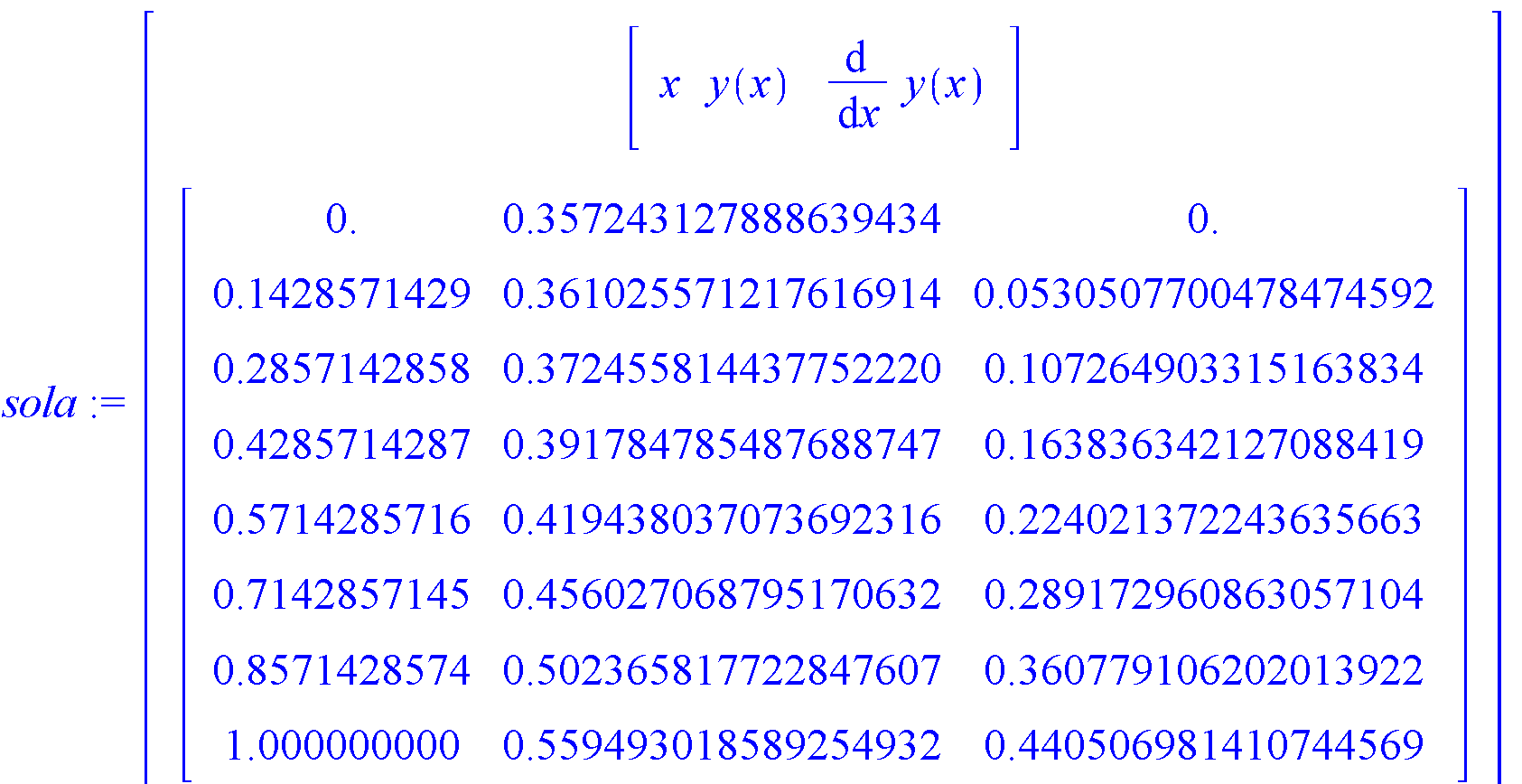


> sol:=dsolve({eq,BCs},{y(x)},type=numeric);

Error, (in dsolve/numeric/bvp) unable to store 'Limit(0.+1.0000000000000\*I, x = 0., left)' when datatype=float[8]

Maple is not able to solve this problem directly. An approximate solution can be provided to arrive at the exact solution. The approximate solution can be found using the linear boundary condition at x = 1. Note that the approximate solution has to be evaluated for at least eight node points.

> sola:=dsolve({eq,D(y)(0),D(y)(1)=1-y(1)},{y(x)},type=numeric,output=array([seq(i/7.,i=0..7)]));



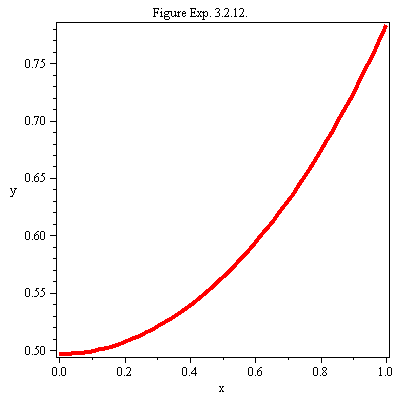
The numerical solution of the original boundary value problem is found as:

> sol:=dsolve({eq,BCs},{y(x)},type=numeric,approxsoln=sola);

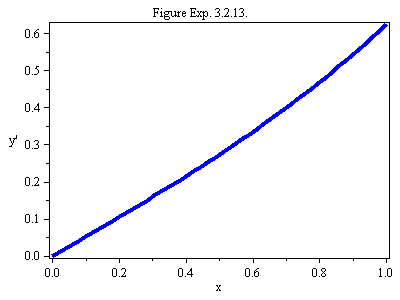


The derivative of the dependent variable can be plotted as:

> odeplot(sol,[x,y(x)],0..1,thickness=4,color=red,title="Figure Exp. 3.2.12.",axes=boxed);

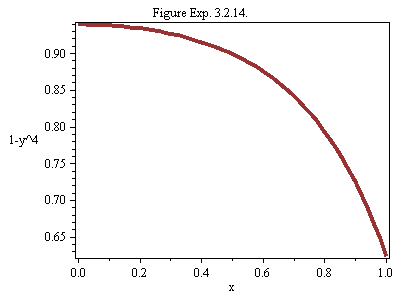


> odeplot(sol,[x,diff(y(x),x)],0..1,color=blue,title="Figure Exp. 3.2.13.",thickness=4,axes=boxed);



The functions of the dependent variables can be plotted as:

> odeplot(sol,[x,1-y(x)^4],0..1,thickness=4,color=brown,title="Figure Exp. 3.2.14.",axes=boxed);



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