```
> restart:
  with(PDETools):
  with(ODETools):
  with(plots):


  #
  N := 100:



  PDE :=Diff(A*x^(Dm-1)*s(x,t),t)+ Diff(x^(Dk-1)*s(x,t)^(beta)*Diff
  (s(x,t)^gamma,x),x)=0;
  #
  r:=1/2:
  q:=(Dm-Dk)/(2*(beta+gamma-1)):
  tr:={t=tau,x=y*tau^r,s(x,t)=f(y)*tau^q}:
  #       ,
  simplify(expand(simplify(dchange(tr, PDE, [y,tau,f(y)]),symbolic)
  )/tau^(-(1/4)*(-2*Dm*beta-2*Dm*gamma+3*Dk-Dm+6*beta+6*gamma-6)/
  (beta+gamma-1))*y^3*(beta+gamma-1)*f(y)^2/((y^((3/2)*Dk-(1/2)*Dm)
  ))/(-(1/2)*tau^((1/4)*(-Dm+Dk)/(beta+gamma-1))),symbolic):
  ODEA:= collect(collect(collect(simplify(%,symbolic),f(y)),y),
  diff);


  (*
  #
  A=mu[1]*m/(alpha*sqrt(k*m)):
  #
  PDE :=Diff(A*x^(Dm-1)*s(x,t),t)+ Diff(x^(Dk-1)*s(x,t)^(beta)*Diff
  (x^((Dk-Dm)/2)*s(x,t)^gamma,x),x)=0:
  #
  r:=1/2:
  q:=3*(Dm-Dk)/(4*(beta+gamma-1));
  tr:={t=tau,x=y*tau^r,s(x,t)=f(y)*tau^q};
  #       ,
  simplify(expand(simplify(dchange(tr, PDE, [y,tau,f(y)]),symbolic)
  )/tau^(-(1/4)*(-2*Dm*beta-2*Dm*gamma+3*Dk-Dm+6*beta+6*gamma-6)/
  (beta+gamma-1))*y^3*(beta+gamma-1)*f(y)^2/((y^((3/2)*Dk-(1/2)*Dm)
  )),symbolic):
  ODEA:= collect(collect(collect(simplify(%,symbolic),f(y)),y),
  diff);
  *)
```

Для обыкновенного дифференциального уравнения с новой переменной y рассмотрена первая краевая задача. Для численных расчетов взяты следующие значения параметров уравнения: $\alpha = 0.6$, $\beta = 2.5$, $d = 0.82$, $\gamma = 0.4$, $\mu_1 = 0.4$, $\tilde{m} = 0.4$, $\tilde{k} = 0.6$, $s(0) = 0.8$, $s(3) = 0.12$.

Графики шаговых решений, полученных средствами встроенных функций для ре

```
  solverPropitka:=proc(DmLocal,DkLocal,Nach)
  option remember;
  local lRight,lLeft,ODEAnumer,boundaryCond,sol1,Y,shagY,k,
```

```
solSetka,initialCond1;
global N:
#
lRight:=3:
lLeft:=0.01:

#
ODEAnumer:=evalf(simplify(subs(A=-mu[1]*m/(alpha*sqrt(k*m)),
alpha=0.6,beta=2.5,gamma=0.4,mu[1]=0.4,m=0.4,Dm=DmLocal,Dk=
DkLocal,k=0.6,ODEA),symbolic));



#

#boundaryCond1:=f(lLeft)=0.8,D(f)(lRight)=-0.00000001:
initialCond1:=f(lLeft)=0.8,D(f)(lLeft)=Nach:
#sol1:=dsolve({ODEAnumer,boundaryCond1},f(y),numeric,method=bvp,
initmesh=80000,maxmesh=100000, range = lLeft .. lRight,
continuation = lambda,'abserr'= 0.1):
sol1:=dsolve({ODEAnumer,initialCond1},f(y),numeric, range = lLeft
.. lRight);
#
Y[0]:=lLeft:
shagY:=(lRight-lLeft)/N:
for k from 1 to N do
Y[k] := Y[k-1]+shagY:
end do:

print(Y[N]):

#
for k from 0 to N do
print(Y[k]);
solSetka[k]:=subs(sol1(Y[k])[2], f(y)):
end do:

print("s"):
#
print(solSetka[N]);

#
seq([Y[k],solSetka[k]],k=0..N);
end proc:

resh00:=[solverPropitka(1,1,-0.435)]: plot(%);

resh04:=[solverPropitka(1,1.4,-1.355)]: plot(%,x=0..3);
(*
resh02:=[solverPropitka(1,1.2,-0.765)]:
resh04:=[solverPropitka(1,1.4,-1.355)]:
resh14:=[solverPropitka(1.1,1.4,-1.442)]:
resh24:=[solverPropitka(1.2,1.4,-1.496)]:
resh44:=[solverPropitka(1.4,1.4,-1.547)]:

#
plot([resh00,resh01,resh02,resh04,resh14,resh24,resh44],
```

```
thickness=2,
legend = ["resh00","resh01","resh02","resh04","resh14","resh24",
"resh44"],legendstyle=[font=["HELVETICA",9],location=right]);
*)
```

$$PDE := \frac{\partial}{\partial t}\left(A\,x^{Dm-1}\,s(x,t)\right) + \frac{\partial}{\partial x}\left(x^{Dk-1}\,s(x,t)^{\beta}\,\frac{\partial}{\partial x}\left(s(x,t)^{\gamma}\right)\right) = 0$$

$$ODEA := -2\,\gamma\,(\beta+\gamma-1)\,f(y)^{\beta+\gamma-1}\,y^{2-\frac{Dk}{2}+\frac{Dm}{2}}\,f(y)^{2}\left(\frac{d^{2}}{dy^{2}}\,f(y)\right) - 2\,\gamma\,(\beta+\gamma-1)^{2}\,f(y)^{-2+\beta+\gamma}\,y^{2-\frac{Dk}{2}+\frac{Dm}{2}}\,f(y)^{2}\left(\frac{d}{dy}\,f(y)\right)^{2} + \left(A\,(\beta+\gamma-1)\,y^{3-\frac{3\,Dk}{2}+\frac{3\,Dm}{2}} - 2\,\gamma\,(\beta+\gamma-1)\,(Dk-1)\,y^{1-\frac{Dk}{2}+\frac{Dm}{2}}\,f(y)^{\beta+\gamma-1}\right)f(y)^{2}\left(\frac{d}{dy}\,f(y)\right) + A\,(-Dm+Dk)\,y^{2-\frac{3\,Dk}{2}+\frac{3\,Dm}{2}}\,f(y)^{3} = 0$$

3.000000000
0.01
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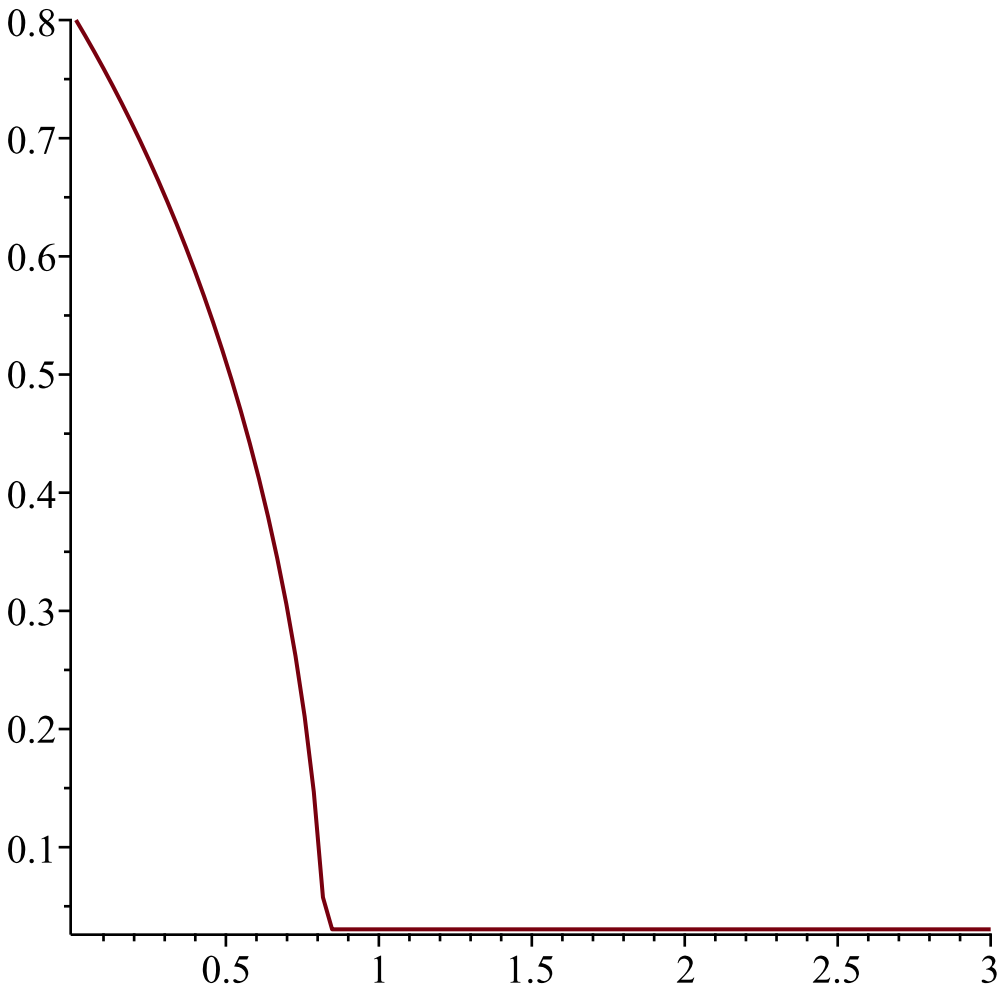

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3.000000000

"s"

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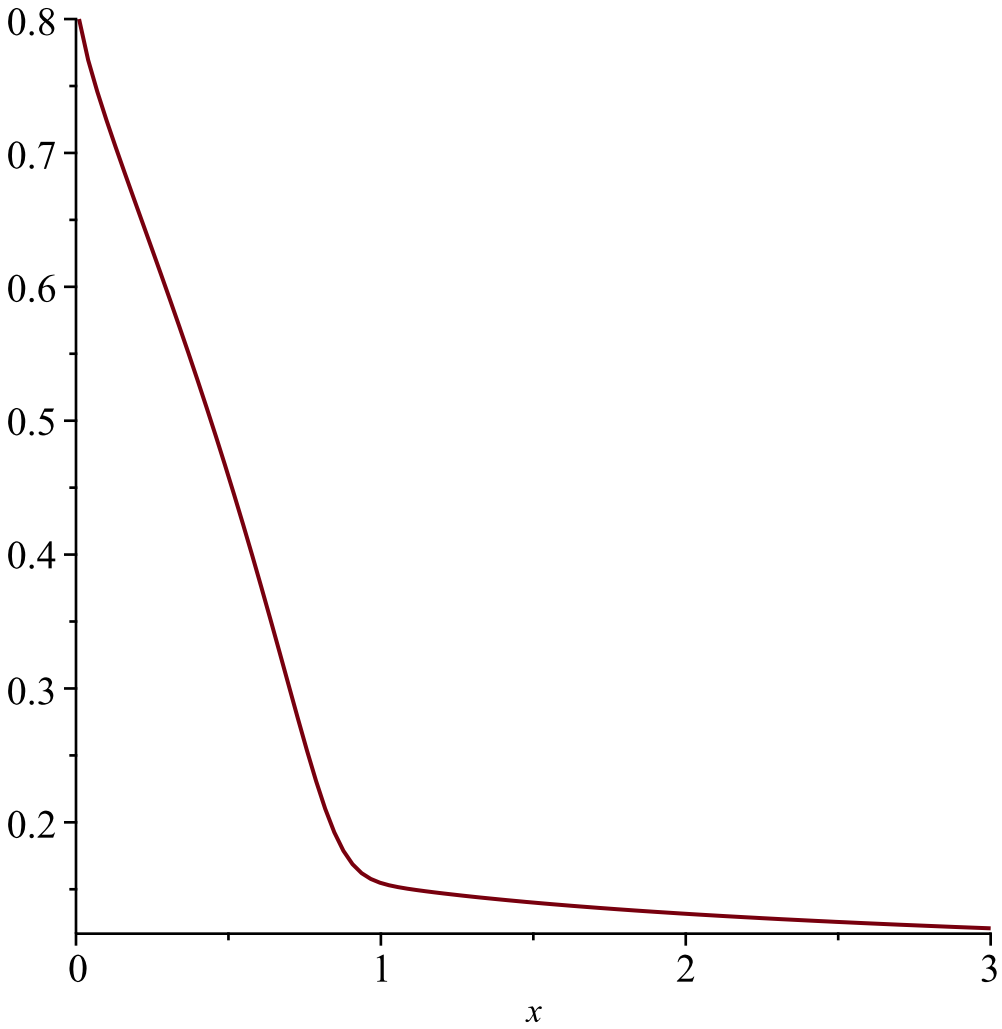



```
> resh00:=[solverPropitka(1,1,-0.4023)]:
  resh04:=[solverPropitka(1,1.4,-1.355)]:
  resh08:=[solverPropitka(1,1.8,-2.88)]:
  resh48:=[solverPropitka(1.4,1.8,-4.427)]:
  resh88:=[solverPropitka(1.8,1.8,-4.636)]:

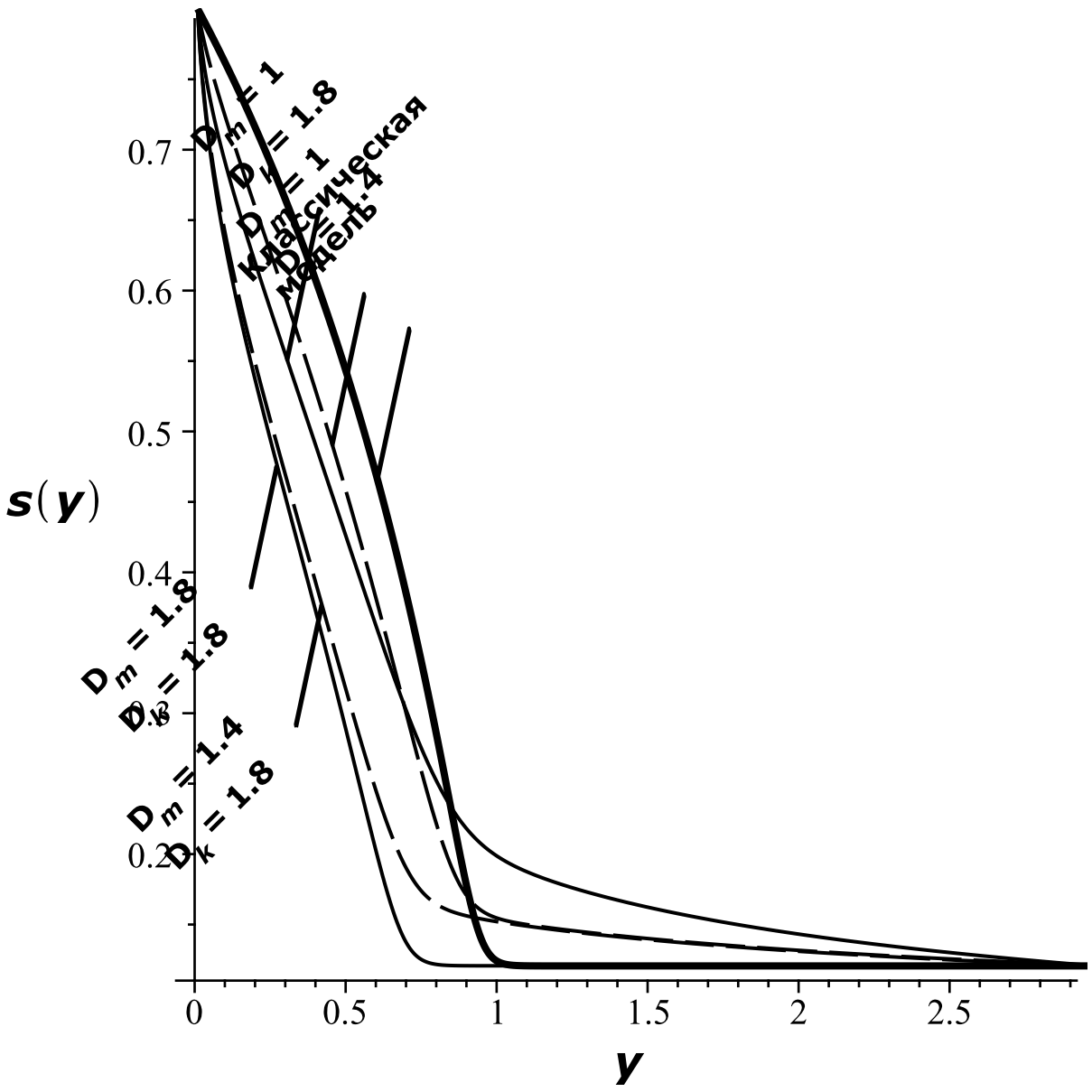
  plotreshClassic:=plot(resh00,color=black,thickness=3,labels=[y, s
  (y)],labelfont = ["Verdana",bold, 14]):
  plotreshFractal:=plot([resh04,resh08,resh48,resh88],color=black,
  thickness=1,linestyle = [longdash,solid]):



> plotStrelka88:=arrow([resh88[100][1]-0.12,resh88[100][2]-0.06],
  [1,1],length =0.12,width =0.003,border = true,head_length=0,
  head_width=0):
  plotText88 := textplot([resh88[100][1]-0.08,resh88[100][2]-0.11,
  ('typeset')(D[m]=1.8,"\n",D[k]=1.8),'font' = ["Verdana",bold, 10]
```

```
], 'align' = 'left',rotation=Pi/4):
plotStrelka48:=arrow([resh48[150][1]-0.12,resh48[150][2]-0.06],
[1,1],length =0.12,width =0.003,border = true,head_length=0,
head_width=0):
plotText48 := textplot([resh48[150][1]-0.08,resh48[150][2]-0.11,
('typeset')(D[m]=1.4,"\n",D[k]=1.8),'font' = ["Verdana",bold, 10]
], 'align' = 'left',rotation=Pi/4):
plotStrelka08:=arrow([resh08[100][1],resh08[100][2]],[1,1],length
=0.15,width =0.003,border = true,head_length=0,head_width=0):
plotText08 := textplot([resh08[100][1]+0.26,resh08[100][2]+0.17,
('typeset')(D[m]=1,"\n",D[k]=1.8),'font' = ["Verdana",bold, 10]],
'align' = 'left',rotation=Pi/4):
plotStrelka04:=arrow([resh04[150][1],resh04[150][2]],[1,1],length
=0.15,width =0.003,border = true,head_length=0,head_width=0):
plotText04 := textplot([resh04[150][1]+0.26,resh04[150][2]+0.17,
('typeset')(D[m]=1,"\n",D[k]=1.4),'font' = ["Verdana",bold, 10]],
'align' = 'left',rotation=Pi/4):
plotStrelkaClassic:=arrow([resh00[200][1],resh00[200][2]],[1,1],
length =0.15,width =0.003,border = true,head_length=0,head_width=
0):
plotTextClassic := textplot([resh00[200][1]+0.32,resh00[200][2]
+0.2, ('typeset')(" \n "),'font' = ["Verdana",
bold, 10]], 'align' = 'left',rotation=Pi/4):


display(plotreshClassic,plotreshFractal,plotStrelka88,plotText88,
plotStrelka48,plotText48,plotStrelka08,plotText08,plotStrelka04,
plotText04,plotStrelkaClassic,plotTextClassic);
```




```
> resh88[100]
```

$$[0.3060100000, 0.449195574003432] \quad (1)$$

```
> 0.15·cos(Pi/4); evalf(%)
```

$$0.07500000000\sqrt{2}$$
$$0.1060660172 \quad (2)$$

```
> [solverPropitka(1,1,-0.4023)]
```

$$3.000000000$$
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$$0.09970000000$$
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$$0.1595000000$$

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```
> [solverPropitka(1,1.4,-1.355)]
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