```
> read "DESite.m":
```

Aplikaľní pŚíklad 5:

V inŋenýrských aplikacích se zŚídka setkáváme s úlohami, které nemají Śeŋení. Tento pŚíklad uvádí jeden z takových
pŚípadŢ. PrŢbŀh exotermní reakce u explozivních materiálŢ lze popsat rovnicí

$$\frac{d^2}{dx^2}\theta = -\delta e^{\theta},\ \text{s okrajovými podmínkami}: \theta(1) = 0,\ \frac{d}{dx}\theta(0) = 0.$$

Pro ŭ<ŭ* má tato rovnice pro dané okrajové podmínky Śeŋení, pro ŭ>ŭ* toto Śeŋení neexistuje (v takovém pŚípadŋ dochází k výbuchu).
Ukaŋte, ŋe hodnota tohoto kritického parametru ŭ* je ŭ*=0,8785.
Mirce vyŋlo ŭ*=0,93727
Rovnici pŚevedeme substitucí ŭ x = z na rovnici:

$$\frac{d^2}{dz^2}\theta = -e^{\theta},\ \text{s okrajovými podmínkami}: \theta(\delta) = 0,\ \frac{d}{dx}\theta(0) = 0.$$

ř eŋení ...zmlŔ

Definice parametrŢ diferenciální rovnice

```
> delta0:=0.93719:    #deltaDopor:=0.8785 :deltaKrit:=0.937261,
   delta0:=0.93719 OK(a)^(1/n);
```

Definice pravé strany diferenciální rovnice

```
> f:=(x,y,dy)->-exp(y)
```

Warning, inserted missing semicolon at end of statement

$$f := (x, y, dy) \rightarrow -e^{y} \qquad \textbf{(1.1)}$$

Definice parametrŢ metody sítí.

```
> a := 0.0:
  b := delta0:
  alfa1 := 0:
  alfa2 := 1:
  beta1 := 1:
  beta2 := 0:
  gama1 := 0:
  gama2 := 0:
  eps := 0.1e-5:
```

```
> n := 20:
  y0:=evalf([seq(0.5,i=1..n+1)]);
  y0[1]:=1.0;
  y0[n+1]:=1.0;
```

$y0 := [0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5]$

$$y0_1 := 1.0$$

$$y0_{21} := 1.0 \qquad \textbf{(1.2)}$$

```
> yres := DESite2(n,f,a, b,alfa1,alfa2,beta1,beta2,gama1,
  gama2, eps, y0, 15):
```

"iterace = ", 0

"y = ", [0.5000000000, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5,

0.5, 0.5, 0.5, 0.5, 0.]

"iterace = ", 1, " s = ", 0.5574407152

"y = ", [0.8924061947, 0.8898902966, 0.8823426020, 0.8697904360, 0.8522792408, 0.8298724120, 0.8026510685, 0.7707137593, 0.7341761063, 0.6931703865, 0.6478450520, 0.5983641935, 0.5449069456, 0.4876668386, 0.4268510980, 0.3626798939, 0.2953855444, 0.2252116738, 0.1524123316, 0.0772510720, 0.]

"iterace = ", 2, " s = ", 0.1663776242

"y = ", [1.046263480, 1.043180445, 1.033931342, 1.018571564, 0.9971920457, 0.9699172006, 0.9369021662, 0.8983294785, 0.8544053206, 0.8053554909, 0.7514212474, 0.6928551680, 0.6299171532, 0.5628706767, 0.4919793704, 0.4175039958, 0.3396998401, 0.2588145487, 0.1750863860, 0.08874290610, 0.]

"iterace = ", 3, " s = ", 0.06669502488

"y = ", [1.118000476, 1.114661622, 1.104645061, 1.088017010, 1.064885955, 1.035399878, 0.9997425763, 0.9581292724, 0.9108017260, 0.8580230595, 0.8000725186, 0.7372403520, 0.6698229760, 0.5981185465, 0.5224230289, 0.4430268148, 0.3602119061, 0.2742496606, 0.1853990691, 0.09390552035, 0.]

"iterace = ", 4, " s = ", 0.03024184234

"y = ", [1.152701755, 1.149239017, 1.138850802, 1.121608595, 1.097629428, 1.067072745, 1.030136282, 0.9870511492, 0.9380763872, 0.8834932373, 0.8235993723, 0.7587033004, 0.6891191235, 0.6151617791, 0.5371428614, 0.4553670677, 0.3701292832, 0.2817122889, 0.1903850508, 0.09640153741, 0.]

"iterace = ", 5, " s = ", 0.01437054755

"y = ", [1.169690614, 1.166167199, 1.155596956, 1.138053957, 1.113659425, 1.082578433, 1.045015553, 1.001209691, 0.9514283582, 0.8959616779, 0.8351163511, 0.7692098288, 0.6985648701, 0.6235046247, 0.5443483324, 0.4614076881, 0.3749838773, 0.2853652670, 0.1928257009, 0.09762334339, 0.]

"iterace = ", 6, " s = ", 0.006875789694

"y = ", [1.177936029, 1.174383163, 1.163724563, 1.146035561, 1.121439416, 1.090103934, 1.052237007, 1.008081325, 0.9579085150, 0.9020130093, 0.8407058918, 0.7743089535, 0.7031491561, 0.6275536341, 0.5478453378, 0.4643393574, 0.3773399357, 0.2871381496, 0.1940102097, 0.09821631649, 0.]

"iterace = ", 7, " s = ", 0.003112292301

"y = ", [1.181693935, 1.178127645, 1.167428777, 1.149673233, 1.124985200, 1.093533730, 1.055528230, 1.011213113, 0.9608618817, 0.9047709339, 0.8432533508, 0.7766329020, 0.7052384631, 0.6293989855, 0.5494391106, 0.4656754760, 0.3784137174, 0.2879461468, 0.1945500537, 0.09848656599, 0.]

"iterace = ", 8, " s = ", 0.001125578025

"y = ", [1.183057234, 1.179486075, 1.168772597, 1.150992911, 1.126271542, 1.094777993, 1.056722221, 1.012349264, 0.9619333047, 0.9057714543, 0.8441775182, 0.7774759840, 0.7059964219, 0.6300684422, 0.5500173001, 0.4661601935, 0.3788032642, 0.2882392723, 0.1947458984, 0.09858460718, 0.]

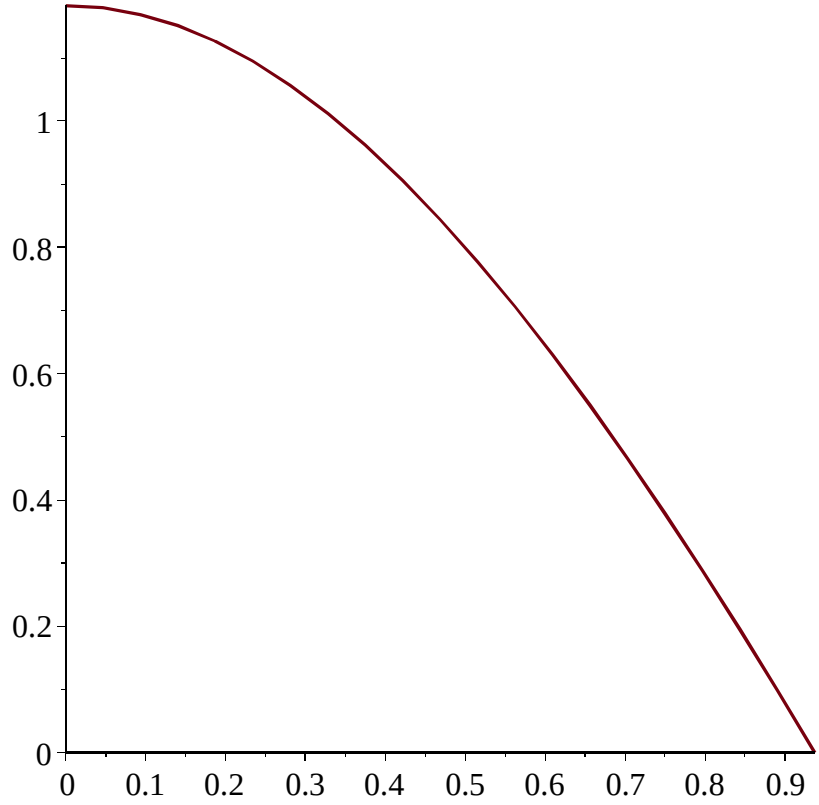
"iterace = ", 9, " s = ", 0.0001949012500

"y = ", [1.183293559, 1.179721556, 1.169005547, 1.151221677, 1.126494530, 1.094993688, 1.056929202, 1.012546219, 0.9621190396, 0.9059448986, 0.8443377272, 0.7776221365, 0.7061278178, 0.6301844963, 0.5501175324, 0.4662442220, 0.3788707943, 0.2882900872, 0.1947798491, 0.09860160314, 0.]

```
                    "iterace = ", 10, "      s = ", 0.000006911522334
"y = ", [1.183301945, 1.179729911, 1.169013811, 1.151229793, 1.126502441,
    1.095001339, 1.056936544, 1.012553204, 0.9621256266, 0.9059510494,
    0.8443434077, 0.7776273176, 0.7061324747, 0.6301886084, 0.5501210836,
    0.4662471990, 0.3788731868, 0.2882918875, 0.1947810520, 0.09860220531, 0.]
                    "iterace = ", 11, "      s = ", 0.000006873489916
"y = ", [1.183310281, 1.179738218, 1.169022028, 1.151237861, 1.126510305,
    1.095008946, 1.056943843, 1.012560150, 0.9621321773, 0.9059571671,
    0.8443490595, 0.7776324746, 0.7061371121, 0.6301927048, 0.5501246218,
    0.4662501652, 0.3788755706, 0.2882936813, 0.1947822505, 0.09860280529, 0.]
                    "iterace = ", 12, "      s = ", 0.00001074861408
"y = ", [1.183297245, 1.179725228, 1.169009178, 1.151225243, 1.126498006,
    1.094997050, 1.056932427, 1.012549287, 0.9621219325, 0.9059476000,
    0.8443402218, 0.7776244118, 0.7061298628, 0.6301863014, 0.5501190909,
    0.4662455285, 0.3788718443, 0.2882908773, 0.1947803770, 0.09860186742, 0.]
                    "iterace = ", 13, "      s = ", 0.000001680857186
"y = ", [1.183299287, 1.179727263, 1.169011191, 1.151227219, 1.126499931,
    1.094998911, 1.056934213, 1.012550985, 0.9621235330, 0.9059490933,
    0.8443416000, 0.7776256683, 0.7061309922, 0.6301872992, 0.5501199529,
    0.4662462511, 0.3788724251, 0.2882913143, 0.1947806690, 0.09860201363, 0.]
                    "iterace = ", 14, "      s = ", 9.556074610 10^-7
"y = ", [1.183300441, 1.179728414, 1.169012331, 1.151228339, 1.126501023,
    1.094999968, 1.056935227, 1.012551951, 0.9621244449, 0.9059499457,
    0.8443423888, 0.7776263889, 0.7061316412, 0.6301878729, 0.5501204484,
    0.4662466665, 0.3788727589, 0.2882915655, 0.1947808368, 0.09860209758, 0.]
```

(1.3)

```
> # Graf funkce yres(x)
> plot(yres);
```




```
> # Tabulka hodnot funkce yres(x)
> linalg[matrix](yres);
```

(1.4)

0.	1.183300441
0.04685950000	1.179728414
0.09371900000	1.169012331
0.1405785000	1.151228339
0.1874380000	1.126501023
0.2342975000	1.094999968
0.2811570000	1.056935227
0.3280165000	1.012551951
0.3748760000	0.9621244449
0.4217355000	0.9059499457
0.4685950000	0.8443423888
0.5154545000	0.7776263889
0.5623140000	0.7061316412
0.6091735000	0.6301878729
0.6560330000	0.5501204484
0.7028925000	0.4662466665
0.7497520000	0.3788727589
0.7966115000	0.2882915655
0.8434710000	0.1947808368
0.8903305000	0.09860209758
0.9371900000	0.

(1.4)