```
> restart;
> cor1 := (1 - a1 - a2)*y(tn) + a1*y(tn - h) + a2*y(tn - 2*h) + h*(
  (3/8 - a1/24)*D(y)(tn + h) + (19/24 + (13*a1)/24 + a2/3)*D(y)(tn)
  + (-5/24 + (13*a1)/24 + (4*a2)/3)*D(y)(tn - h) + (1/24 - a1/24 +
  a2/3)*D(y)(tn - 2*h));
```

$$cor1 := (1-a1-a2)\,y(tn)+a1\,y(tn-h)+a2\,y(tn-2\,h)+h\left(\left(\frac{3}{8}-\frac{a1}{24}\right)\mathrm{D}(y)(tn+h)+\left(\frac{19}{24}+\frac{13\,a1}{24}+\frac{a2}{3}\right)\mathrm{D}(y)(tn)+\left(-\frac{5}{24}+\frac{13\,a1}{24}+\frac{4\,a2}{3}\right)\mathrm{D}(y)(tn-h)+\left(\frac{1}{24}-\frac{a1}{24}+\frac{a2}{3}\right)\mathrm{D}(y)(tn-2\,h)\right) \quad (1)$$

```
> pred1 := (-8 - a2)*y(tn) + 9*y(tn - h) + a2*y(tn - 2*h) + h*(
  (17/3 + a2/3)*D(y)(tn) + ((4*a2)/3 + 14/3)*D(y)(tn - h) + (-1/3 +
  a2/3)*D(y)(tn - 2*h));
```

$$pred1 := (-8-a2)\,y(tn)+9\,y(tn-h)+a2\,y(tn-2\,h)+h\left(\left(\frac{17}{3}+\frac{a2}{3}\right)\mathrm{D}(y)(tn)+\left(\frac{4\,a2}{3}+\frac{14}{3}\right)\mathrm{D}(y)(tn-h)+\left(-\frac{1}{3}+\frac{a2}{3}\right)\mathrm{D}(y)(tn-2\,h)\right) \quad (2)$$

```
> c2:=subs({a1=0,a2=2/5},cor1);
```

$$c2 := \frac{3\,y(tn)}{5}+\frac{2\,y(tn-2\,h)}{5}+h\left(\frac{3\,\mathrm{D}(y)(tn+h)}{8}+\frac{37\,\mathrm{D}(y)(tn)}{40}+\frac{13\,\mathrm{D}(y)(tn-h)}{40}+\frac{7\,\mathrm{D}(y)(tn-2\,h)}{40}\right) \quad (3)$$

```
> p2:=subs(a2=1,pred1);
```

$$p2 := -9\,y(tn)+9\,y(tn-h)+y(tn-2\,h)+h\,(6\,\mathrm{D}(y)(tn)+6\,\mathrm{D}(y)(tn-h)) \quad (4)$$

```
> c3:=eval(subs(D(y)=(x->f(x,y(x))),c2));
```

$$c3 := \frac{3\,y(tn)}{5}+\frac{2\,y(tn-2\,h)}{5}+h\left(\frac{3\,A\,y(tn+h)}{8}+\frac{37\,A\,y(tn)}{40}+\frac{13\,A\,y(tn-h)}{40}+\frac{7\,A\,y(tn-2\,h)}{40}\right) \quad (5)$$

```
> p3:=eval(subs(D(y)=(x->f(x,y(x))),p2));
```

$$p3 := -9\,y(tn)+9\,y(tn-h)+y(tn-2\,h)+h\,(6\,A\,y(tn)+6\,A\,y(tn-h)) \quad (6)$$

```
> pc3:=subs(y(tn+h)=p3,c3);
```

$$pc3 := \frac{3\,y(tn)}{5}+\frac{2\,y(tn-2\,h)}{5}+h\left(\frac{1}{8}\left(3\,A\left(-9\,y(tn)+9\,y(tn-h)+y(tn-2\,h)+h\,(6\,A\,y(tn)+6\,A\,y(tn-h))\right)\right)+\frac{37\,A\,y(tn)}{40}+\frac{13\,A\,y(tn-h)}{40}+\frac{7\,A\,y(tn-2\,h)}{40}\right) \quad (7)$$

```
> f:=(xi,eta)->A*eta;
```

$$f := (\xi, \eta) \mapsto A \cdot \eta \tag{8}$$

```
> m4:=y(tn+h)=pc3;
```

$$m4 := y(tn+h) = \frac{3\,y(tn)}{5} + \frac{2\,y(tn-2\,h)}{5} + h\left(\frac{1}{8}(3\,A\,(-9\,y(tn)+9\,y(tn-h)+y(tn-2\,h)+h\,(6\,A\,y(tn)+6\,A\,y(tn-h))))+\frac{37\,A\,y(tn)}{40}+\frac{13\,A\,y(tn-h)}{40}+\frac{7\,A\,y(tn-2\,h)}{40}\right) \tag{9}$$

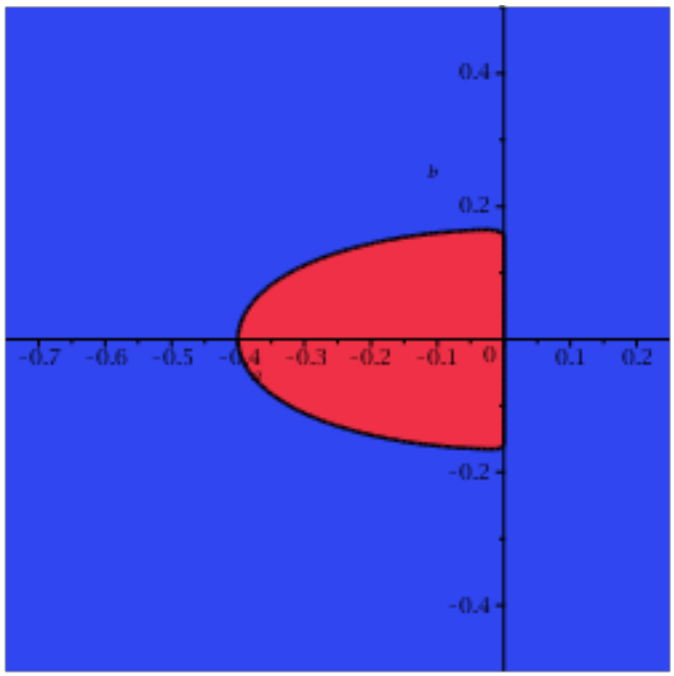
```
> ceq:=eval(subs(y=(s->rho^s),m4));
```

$$ceq := \rho^{tn+h} = \frac{3\,\rho^{tn}}{5} + \frac{2\,\rho^{tn-2\,h}}{5} + h\left(\frac{3\,A\left(-9\,\rho^{tn}+9\,\rho^{tn-h}+\rho^{tn-2\,h}+h\left(6\,A\,\rho^{tn}+6\,A\,\rho^{tn-h}\right)\right)}{8}+\frac{37\,A\,\rho^{tn}}{40}+\frac{13\,A\,\rho^{tn-h}}{40}+\frac{7\,A\,\rho^{tn-2\,h}}{40}\right) \tag{10}$$

```
> ceq2:=subs({tn=1,h=1},ceq);
```

$$ceq2 := \rho^{2} = \frac{3\,\rho}{5} + \frac{2}{5\,\rho} + \frac{3\,A\left(-9\,\rho+9+\frac{1}{\rho}+6\,A\,\rho+6\,A\right)}{8} + \frac{37\,A\,\rho}{40} + \frac{13\,A}{40} + \frac{7\,A}{40\,\rho} \tag{11}$$

```
> S2:=solve(ceq2,rho):
> Z1:=subs(A=a+I*b,abs(S2[1])):
> Z2:=subs(A=a+I*b,abs(S2[2])):
> Z3:=subs(A=a+I*b,abs(S2[3])):
> with(plots):
> contourplot(max(Z1,Z2,Z3),a=-0.75..0.25,b=-0.5..0.5,contours=[1],
    grid=[100,100],filled=true);
```


0.4
b
0.2
-0.7
-0.6
-0.5
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
-0.2
-0.4