Plot the slope field (direction field) of the differential equation $y' = 2\sqrt{|y|}$:

```
[X, Y] = meshgrid(0:0.1:4, -1:0.2:8);
F = 2*sqrt(abs(Y));
quiver(X, Y, ones(size(F)), F)
axis tight, xlabel('x'), ylabel('y')
title('Slope field for $y'' = 2\sqrt{|y|}$','Interpreter','latex')
```

The initial value problem $y' = 2\sqrt{|y|},\ y(0) = 0$ has infinitely many solutions, including $y(x) = \max(x - c, 0)^2$ where $c \geq 0$ is any constant. Now show several solutions on the slope field:

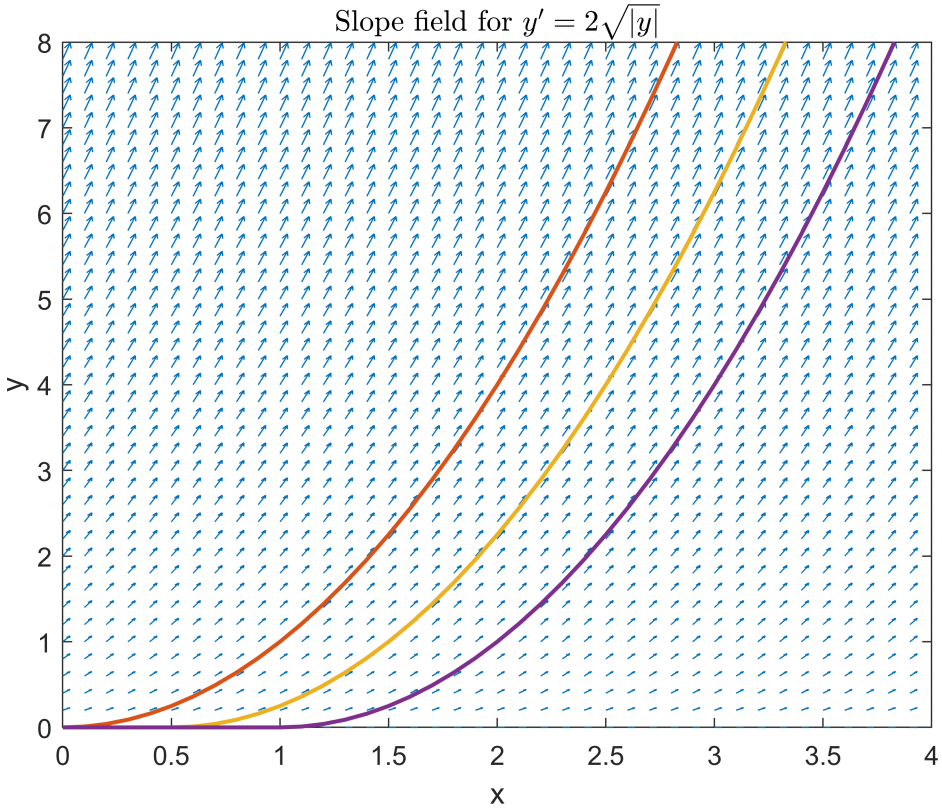
```
hold on
clist = [0 0.5 1];
for k = 1:3
    xx = 0:0.1:4;
    yy = max(0,xx - clist(k)).^2;
    plot(xx,yy,LineWidth=1.5), axis([0 4 0 8])
end
```

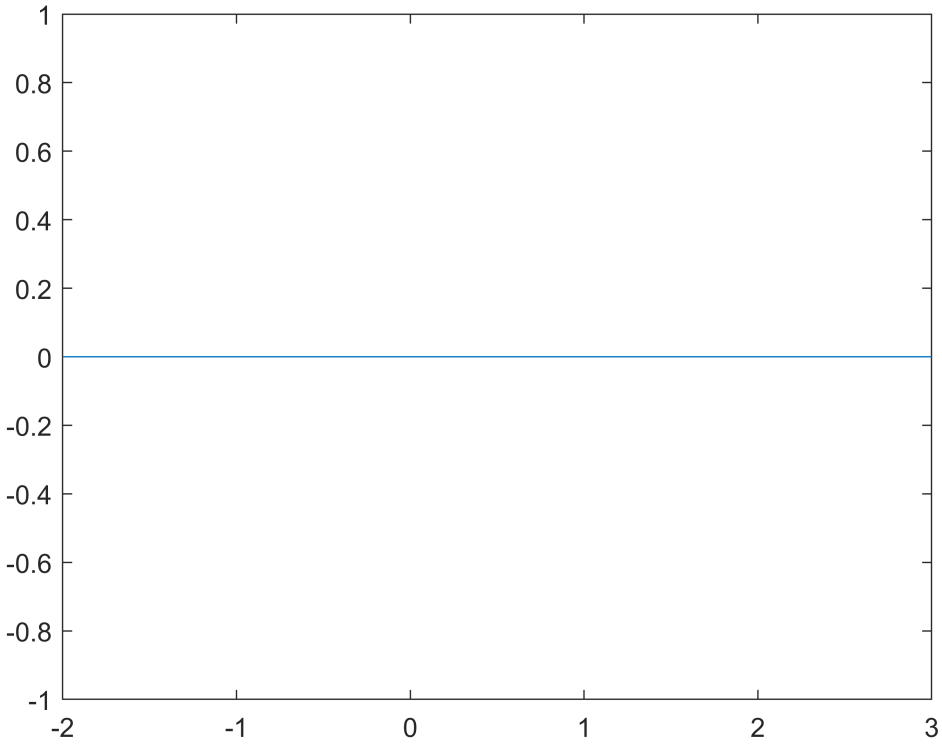
Now let's try to solve the initial value problem $y' = 2\sqrt{|y|},\ y(0) = 0$ using Chebfun toolbox.

```
L = chebop(0,3);
L.op = @(x,y) diff(y) - 2*sqrt(abs(y)); % Define the operator for the Chebop
L.lbc = 0;
y = L\0;
```

You will see Chebfun only gives you the simplest solution, which is the constant 0.

```
hold off
plot(y,[-2,3])
```


Slope field for $y' = 2\sqrt{|y|}$
y
x
0
1
2
3
4
5
6
7
8
0
0.5
1
1.5
2
2.5
3
3.5
4


1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-2
-1
0
1
2
3