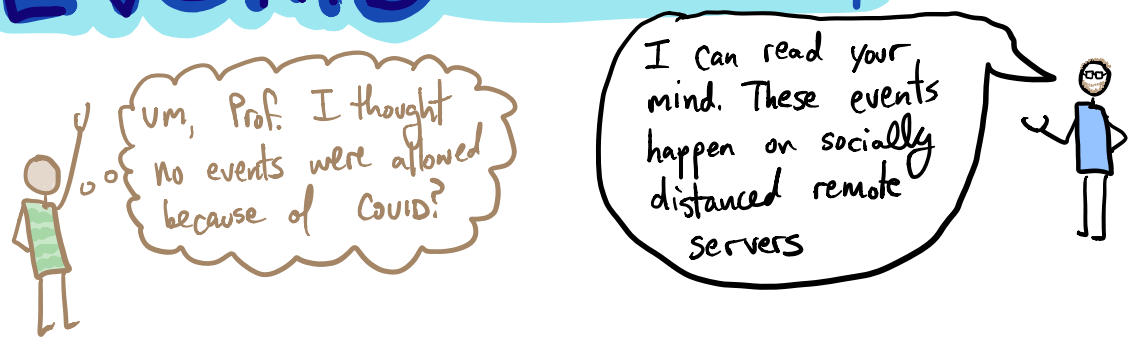
Events in solve_ivp



An event is defined by a function that is equal to zero somewhere.

This boat is a float.

$f_e(t, y) = 0$

f_e returns a float.

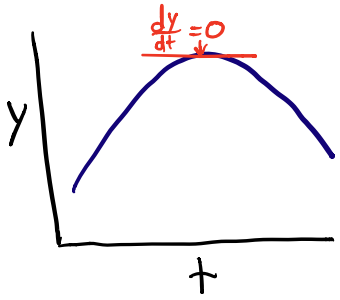
Examples

1. The solution has some value, e.g y_0

```
def f_e(t, y):
    return y - y0   ⇐ equals 0 when y = y0
```

You can use any function of t, y

② The derivative of the solution has some value, yp_0



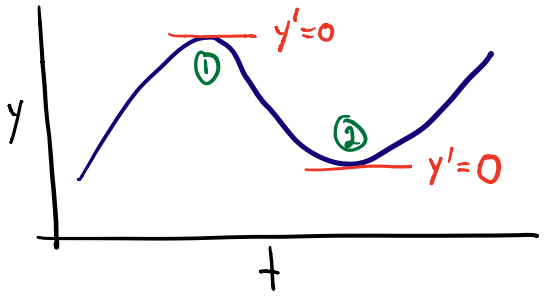
Say we have for the ODE

```
def dydt(t, y):
    return some_function
```

then we define our event function

```
def fe(t,y):
    return dydt(t, y) - yp0   ⇐ equals 0 when dydt(t, y) = yp0
```

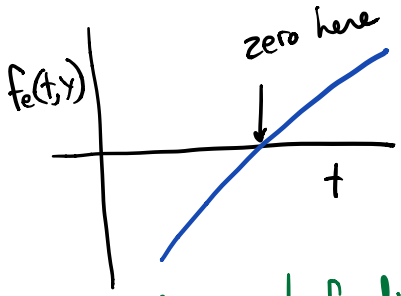
Which way are you going?



If we define our event based on $y'=0$
Then here we will get two results ① + ②
We can use fe.direction to fine tune what we get.

fe.direction can limit which event zeros count. The default is fe.direction = 0 which counts all zeros.

To get a zero, your event function usually changes sign.

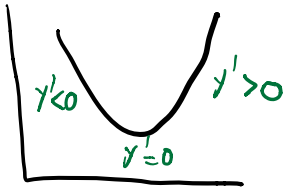


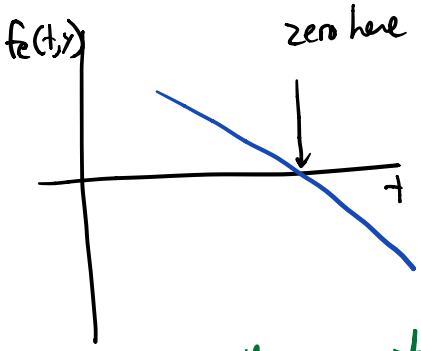
here the event function goes from negative to positive.

select these events with

fe.direction = 1

for derivatives = 0 this selects minima



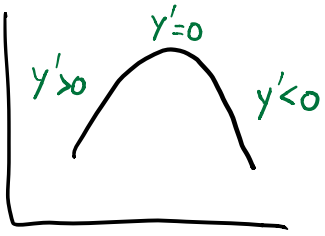


here the event goes from positive to negative

select these events with

fe.direction = -1

for derivatives = 0 selects maxima

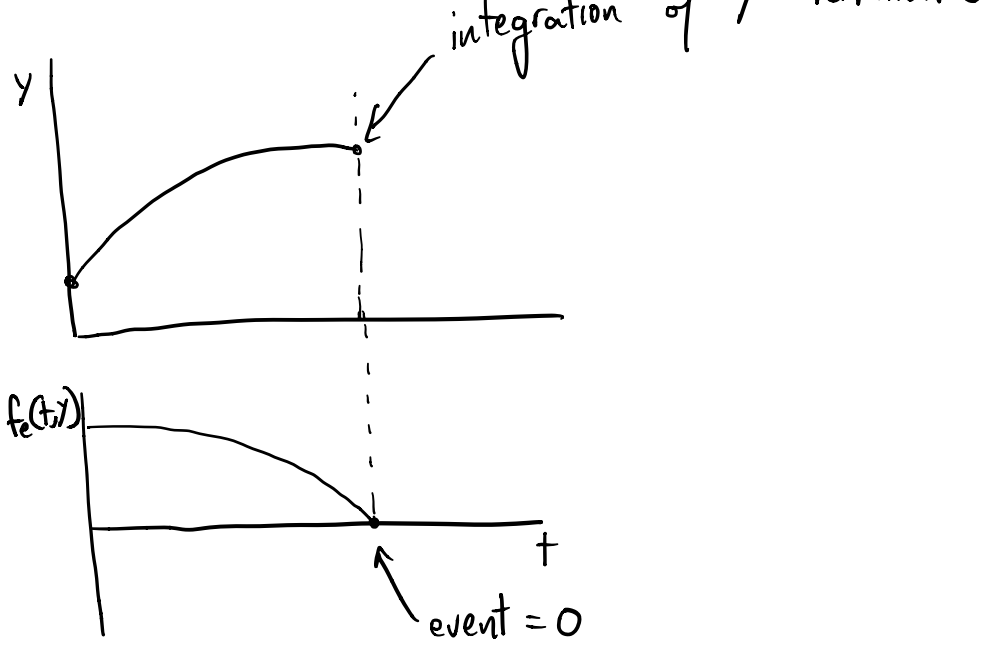


Collaborate and listen

We can use events to stop the integration.

Set the terminal attribute on the event function to True

fe.terminal = True



The default is fe.terminal = False