2014-09-26_lecture

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September 26, 2014

In [2]:
```python
kB = 1.381e-23  # J/K
q = 1.602e-19  # C

def id(vd, Is=1e-15, T=300):
    VT = kB*T/q
    return Is*(exp(vd/VT) - 1)

def id_approx(vd, Is=1e-15, T=300):
    VT = kB*T/q
    return Is*exp(vd/VT)

def axisLines():
    ax = gca()
    hlines(0, *ax.get_xlim())
    vlines(0, *ax.get_ylim())
```

In [6]:
```python
VT = kB*300/q

vd = linspace(-0.1, 1, 1e3)

id1 = id(vd)
id2 = (10 - vd) / 10e3

plot(vd, 1e3*id1, '-', label='1')
plot(vd, 1e3*id2, '.', label='2')
ylim((-0.1, 3))
xlim((vd.min(), vd.max()))
legend(loc='best')

axisLines()

#intersection between plots
# find the first point where #1 is larger
idx = find(id1 > id2)
i0 = idx[0]
print 'index:', i0
print 'vd + =', vd[i0], 'V'
print 'vd - =', vd[i0-1], 'V'
print 'vd a =', (vd[i0] + vd[i0-1])/2, 'V'

print 'i_D =', id(vd[i0])*1e3, 'mA'
```
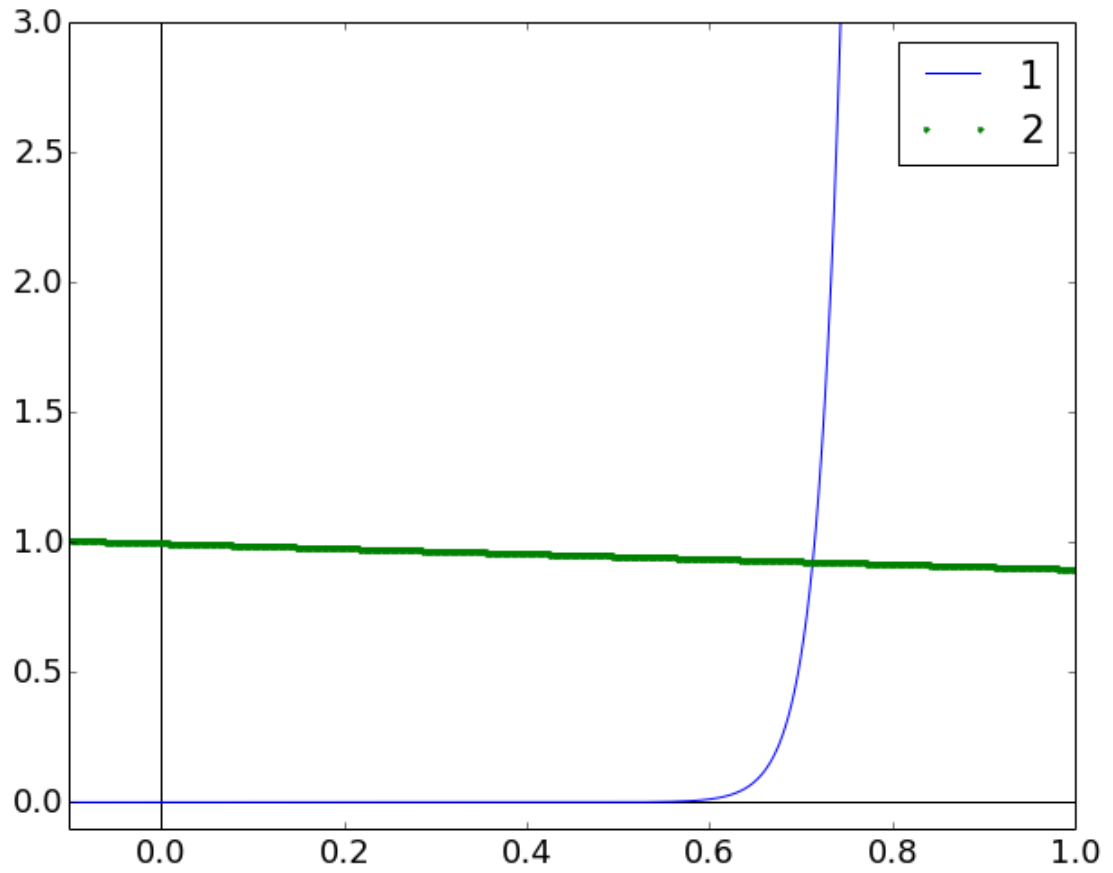```
index: 739
vd + = 0.713713713714 V
vd - = 0.712612612613 V
vd a = 0.713163163163 V
i_D = 0.967149906608 mA
```

Solution to the circuit is the intersection of the two equations.

In [ ]: