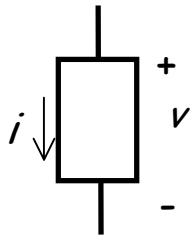
Special Problem 4.7-4

A **strange**, two-terminal device has the following relationship between the current through it (i) and the voltage across it (v):

$$i = 4v + v^2$$



where v is in volts and i in mA.

We can define the **small-signal resistance** r_{ss} of this device as:

$$r_{ss} = \frac{v_{ss}}{i_{ss}}$$

where v_{ss} is the **small-signal voltage** across the device and i_{ss} is the **small-signal current** through it.

a) Determine the **value** of this small-signal resistance r_{ss} if the **DC voltage** across the device is $V = 3.0$ V

b) Determine the **small-signal voltage** $v_{ss}(t)$ across this device if the **DC** voltage across it is 3.0 V, and the **small-signal current** i_{ss} through it is:

$$i_{ss}(t) = 0.2 \cos \omega t \text{ mA}$$