Test 4

- Current and conductivity
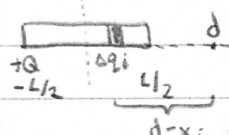- Ohm's Law
- Potential Field
- Electrical energy and power
- Combination of capacitors and resistors
- KCL and KVL
- RC circuits

Example #1
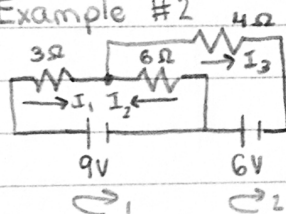

$$V_i = \frac{1}{4\pi\epsilon_0}\frac{\Delta q_i}{d-x_i} \qquad \lambda = \frac{Q}{L} \qquad dq = \lambda\, dx$$

$$V = \frac{1}{4\pi\epsilon_0}\int\frac{1}{d-x_i}\,dq = \frac{1}{4\pi\epsilon_0}\int_{-L/2}^{L/2}\frac{\lambda}{d-x_i}\,dx = \frac{1}{4\pi\epsilon_0}\frac{Q}{L}\left(-\ln(d-x)\right)\Big|_{-L/2}^{L/2}$$

$$= \frac{1}{4\pi\epsilon_0}\frac{Q}{L}\left(\ln\left(d+\frac{L}{2}\right) - \ln\left(d-\frac{L}{2}\right)\right)$$

$$\boxed{V = \frac{Q}{4\pi\epsilon_0 L}\ln\left(\frac{d+L/2}{d-L/2}\right)}$$

Example #2

$$I_1 + I_2 = I_3 \qquad \text{Loop 1: } \epsilon_1 - I_1 R_1 + I_2 R_2 = 0$$

$$\text{Loop 2: } \epsilon_2 - I_2 R_2 - I_3 R_3 = 0$$

$$9 - 3I_1 + 6I_2 = 0$$

$$6 - 6I_2 - 4I_3 = 0$$

$$\boxed{I_1 = 2.33\,A \qquad I_3 = 2\,A}$$
$$\boxed{I_2 = -0.33\,A}$$