**PHYS 259: Notes**
**Electricity And Magnetism**
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**Coulomb's Law:**
The magnitude of the force between 2 charges is proportional to the product of the charges on the 2 particles over the distance, $r$, squared or,

$$F_{1\ on\ 2} = F_{2\ on\ 1} = K\frac{|q_1||q_2|}{r^2}$$

where $K$ is the electrostatic constant and $K = 8.99 \times 10^9 N \cdot m^2 C^{-2}$ or equally

$$F_{1\ on\ 2} = F_{2\ on\ 1} = \frac{1}{4\pi\epsilon_0}\frac{|q_1||q_2|}{r^2}$$

where $\epsilon_0$ is the permittivity of free space and $\epsilon_0 = 8.85 \times 10^-12 s^4 \cdot A^2 \cdot m^{-3} \cdot kg^{-1}$

**Superposition Principle:**
The total force on a charge is the vector sum of the individual forces acting on it.

$$\vec{F}_{on\ n} = \sum_{k=1}^{n-1} \vec{F}_{k\ on\ n}$$

$$E = \int dE \cos\theta = \int_0^{2\pi r} dt$$

**Gauss' Law:**
The $\oint \vec{E} \cdot \vec{n} dA$

**Capacitors:**
A capacitor is any two electrodes separated by some distance. Regardless of the geometry we call the electrodes "plates". By convention a capacitor has equal and opposite charges on its plates, although technically this does not have to be true. The source charges on the capacitor plates create a uniform electric field between the plates of

$$\vec{E} = \frac{\sigma}{\epsilon_0}$$

The capacitance $C$ of two parallel plates is given by $\frac{\epsilon_0 A}{d}$ where

$$Q = C\Delta V$$