**Activity 2-2 – August 31, 2016**

**Potential**

1. Consider a **uniformly charged (solid) sphere** with total charge *Q* and radius *R,* centered at the origin. The electric field for r<R and r>r is given by

**Which aspects of this formula now seem “obvious” to you?**



**What’s the principle of physics used to generate this formula?**(If you’re not sure of any details, take the time at home to rederive it from scratch! )

1. The definition of voltage (potential) says  .

Choosing V(∞)=0 (i.e. setting “O”= ∞ in this formula), this is easy enough to find if r>R:

**- Don’t just accept the details - check my math please!**

Talk with your neighbors, about any piece that seem at all confusing to you.

1. If r<R, I need to break that integral up into two pieces **(why?),** giving: 

**Work through all 5 lines**. Make sure you see what is going on at each step .   
Talk with your neighbors, or ask us about anything that seem at all confusing to you!

1. In the space below, sketch E(r) and V(r). (E should be easy. V is harder, be careful!)

E(r)

- Is E(r) continuous? Is V(r)? Should they be? **Why/why not?**  
 - Are their derivatives continuous? Should they be?   
  
  
 - Do the signs make sense *everywhere* ? **Explain!**   
  
 - Is the behavior of E(r) and V(r) at large r correct?   
  
  
 - What’s the “slope” of V(r) at the origin? (What should it be?)

R

r

R

r

V(r)

Now let **the origin** (r=0) be your choice of zero voltage, and re-sketch this *V* as a function of *r*.

V(r)

R

r

Explain how (if) the choice of zero voltage at the origin changes the electric field.