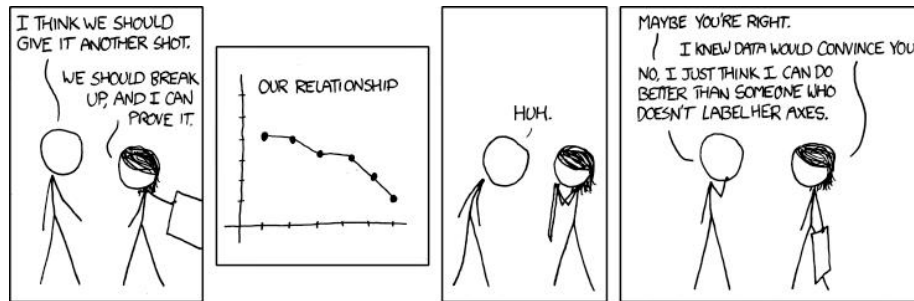


February 24, 2017      Physics 132      Prof. E. F. Redish

■ **Theme Music: Rustcycle**  
***Capacitance***

■ **Cartoon: Randall Munroe**  
*xkcd*



2/24/17

Physics 132

1

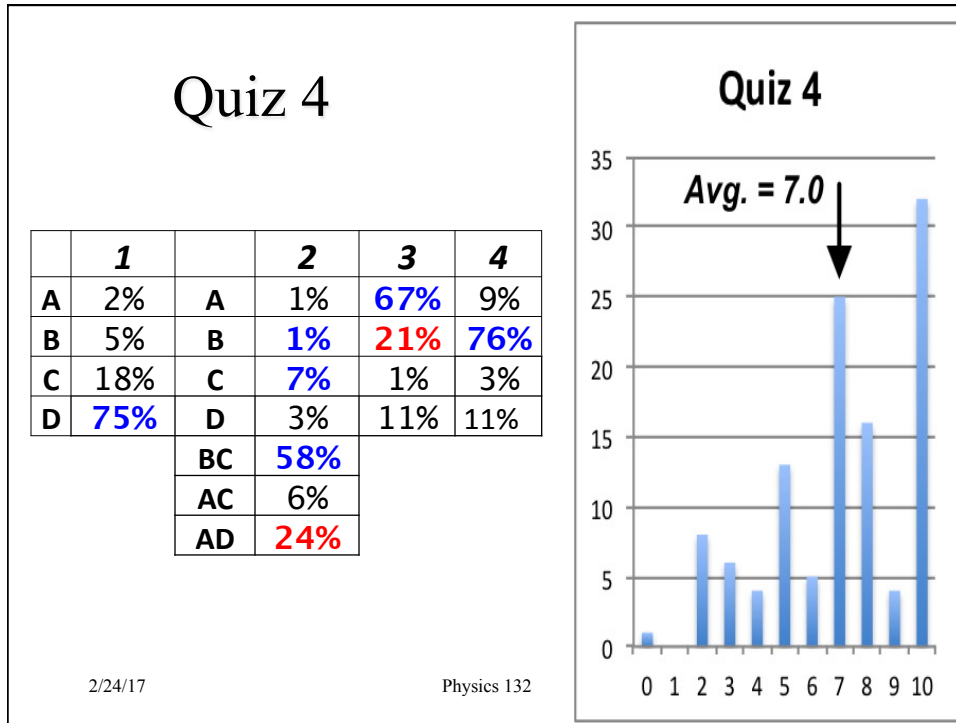
## Outline

- Go over Quiz 4
- Recap: Field from one large uniform plate
- Field of two large parallel plates
- Capacitance
- The field and potential in a capacitor

2/24/17

Physics 132

2



If we choose the electric potential to be 0 at the surface of a large uniform sheet of charge, what does the potential look like as a function of the distance from the sheet?



■ Hints: Since  $\vec{F} = -\vec{\nabla}U$ ,  $\vec{E} = -\vec{\nabla}V$   
 (or in 1D  $F = -\frac{dU}{dx}$   $E = -\frac{dV}{dx}$ )

### The sheet of charge

- Field is constant, pointing away from positive sheet, towards negative sheet.
- Constant!!?  
How can that be?

2/24/17
Physics 132
9

### Two sheets of charge

2/24/17
Physics 132
10

### Result

The fields of the two plates cancel each other on the outside.

The fields of the two plates add on the inside, producing double the field of a single plate.

The fields of the two plates cancel each other on the outside.

Physics 132

2/24/17
11

## Some basic electrical ideas

- **Conductor** – a material that permits some of its charges to move freely within it.
- **Insulator** – a material that permits some of its charges to move a little, but not freely.
- **Battery** – a device that creates and maintains a constant potential difference across its terminals.

2/24/17
12