## 1 | Voltage

## 1.1 | First, a geography thing.



Figure 1: Screen Shot 2020-09-02 at 8.37.26 PM.png

In a topological map, you could probably guess that the **steepest path downwards/upwards is perpendicular to the lines.** 

The constant voltage lines works in a similar way.

## 1.2 | Then, a Energy Thing.

If we have an object in the air

Object

\_{Air}

..ground..

What is that object's gravitation potential energy?

... ... ...

You will realize that I just asked a very dumb question. This is because that energy must be relative to

**something.** You must *raise* the object (giving us the  $\Delta h$  part of  $gpe=mg\Delta h$  to gain gravitational potential energy.

## 1.3 | Electric Potential

Electrical Potential  $\{\frac{V}{C}\}$  Voltage is a measure of how much electric potential energy (yes, it is an *energy* (in J, joules)), would change per Couloub of energy that is moved through.

Recall the energy example above. When you raise an object of 1kg from a place with elevation  $(\Delta h) \ 10m$  to 100m, you could represent the change in gravitation potential energy of that operation as  $mg\Delta h_1 - mg\Delta h_0 = m(g\Delta h_1 - g\Delta h_0) = 1kg(9.8\frac{m}{s^2}100m - 9.8\frac{m}{s^2}10m)$ . Where,  $g\Delta h_1$  is a unit  $\frac{m^2}{s^2} = \frac{J}{kg}$ . Proving this last relationship is left as an excercise to the reader.

Funny way to write it, I know. But, we could take the equation  $m(g\Delta h_1 - g\Delta h_0)$  and use it as a perfect analogy for using electric potential.

The amount of electric potential energy that would change by moving an object of charge 1C from a place with voltage ( $\Delta V$ ) 10V to 100V, is  $Q_2(V_1-V_0)=1C(100V-10V)$ , where Voltage, V, represent the energy potential — analogous to, drumroll please,  $\frac{J}{ka}$ , except this time its  $\frac{J}{C}$ .

[Where  $Q_2$  is the the charge in Coulombs C of the test charge, and  $V_1$  and  $V_0$  are the electric potential values of the points the charge is being moved to and from]Electric Potential Energy $Q_2(V_1-V_0)$  Electric Potential, Volts $\{V=\frac{J}{C}\}$