1. For the two charges, \( Q = +5 \text{ nC} \), at opposite points of the square shown,
   a) Find the potential energy that results from the two charges.
   b) What does the sign of the potential energy tell you?
   c) Find the Electric Field at the point P (x = 3cm, y=0) (Magnitude AND direction)
   d) Find the electric force on a charge of -10 nC placed at point P. (Magnitude AND direction)

2. An electric potential as a function of distance as shown below.
   a. An electron is initially sitting at point A. What is the minimum kinetic energy the electron will need to get from point A to point C?
   b. A proton is initially sitting at point A. What is the minimum kinetic energy the proton will need to get from point A to point C?
   c. Does your answer change for the electron if the particle moves from A to E? Explain.
   d. Does your answer change for the proton if the particle moves from A to E? Explain.

3. A parallel plate capacitor has a charge of \( 0.02 \mu \text{C} \) on each plate with a potential difference of 240 V. The parallel plates are separated by 0.40 mm of air.
   a) What is the capacitance for this capacitor?
   b) What is the area of a single plate?
   c) At what voltage will the air between the plates become ionized? Assume a dielectric strength of 3.0 kV/mm for air.

4. For the circuit on the right, \( V=50 \text{ volts} \). \( R1 \) is 10 \( \Omega \), \( R2 \) is 60 \( \Omega \), \( R3 \) is 30 \( \Omega \), and \( R4 \) is 15 \( \Omega \).
   a) Find the equivalent resistance for \( R2 \) and \( R3 \) in parallel.
   b) Find the equivalent resistance for the complete network of resistors shown in the circuit on the right (\( R1, R2, R3, R4 \)).
   c) Find the voltage across \( R2 \).
   d) Find the current through \( R2 \).
2. Below is a sketch of the equipotential lines for a dipole where the positive charge is on the left and the negative charge is on the right. The equipotential lines are spaced at 10 Volt intervals with the line nearest each charge having a magnitude of 50V.

a. Label the potential of each line shown below.
b. How much work is done by the electric force when an electron is moved from point A to point B?
c. What is the change in potential energy for the electron in part b?
d. What does the sign of the change in potential energy mean?
e. Sketch the Electric field lines for the two point charge system shown below.