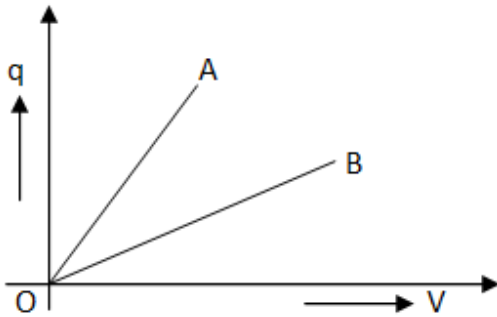**Q14.** The given graph shows the variation of charge q versus potential difference V for two capacitors C_1 and C_2. The two capacitors have same plate separation but the plate area of C_2 is double than that of C_1. Which of the lines in the graph correspond to C_1 and C_2 and why?

Answer: We know that $q = CV$ comparing with y=mx, here m=C=tanθ, higher is the slope higher is the capacitance. and graph A has a larger slope than B, so the graph A shows higher capacitance.

Also, $C = \frac{\varepsilon_0 A}{d}$ i.e., $C \propto A$

As the plate area of C_2 is double of that of C_1, so C_2 has a higher capacitance. Hence the line A of the graph corresponds to capacitor C_2.

Q15. Two cells E1 and E2 in the given circuit diagram have an emf of 5 V and 9 V and internal resistance of 0.3 Ω and 1.2 Ω respectively. Calculate the value of current flowing through the resistance of 3 Ω.
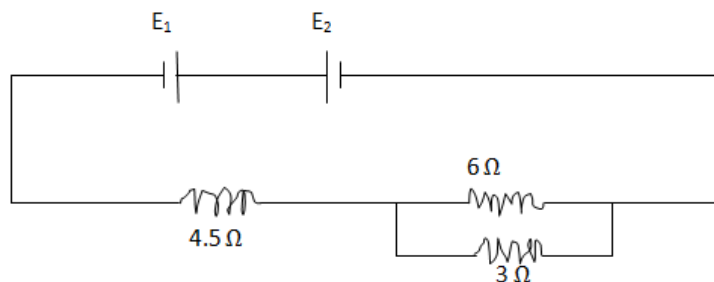
Answer: Net emf $= E_2 - E_1 = 9 - 5 = 4V$

Total resistance $= 0.3 + 1.2 + 4.5 + \frac{6 \times 3}{6+3} = 8 \, \Omega$

Current through the circuit, $I = \frac{4}{8} = 0.5 \, A$, Let i_1 and i_2 be the current in 6 and 3 Ω resistance respectively. Therefore i_1+i_2=0.5, as current remains same 0.5 in series with 4.5 Ω resistance. Now Potential difference in parallel resistance is same hence $6i_1 = 3i_2$ or $i_1=0.5i_2$, so $0.5i_2 +i_2$=0.5 or i_2=0.5/1.5=1/3 A

Q16. How is the mutual inductance of a pair of coils affected when:
- (I)   Separation between the coils is increased?
- (II)   The number of turns of each coil is increased?
- (III)   A thin iron sheet is placed between the two coils, other factors remaining the same?
         Explain your answer in each case.

Answer:

- (I)   When the separation between the two coils is increased, flux that is lines of force cutting the secondary decreases so the mutual inductance decreases.

- (II)   Mutual inductance is proportional to the product of number of turns in coils ($M \propto N_1 N_2$) Hence Mutual inductance increases when the number of turns in each coil is increased,

- (III)   Mutual inductance is proportional to the permeability $M \propto$ permeability (μ). Iron sheet being ferromagnetic has higher permeability allows more lines of force (flux) to pass through , hence when an iron sheet is placed between the two coils the mutual inductance M increases.