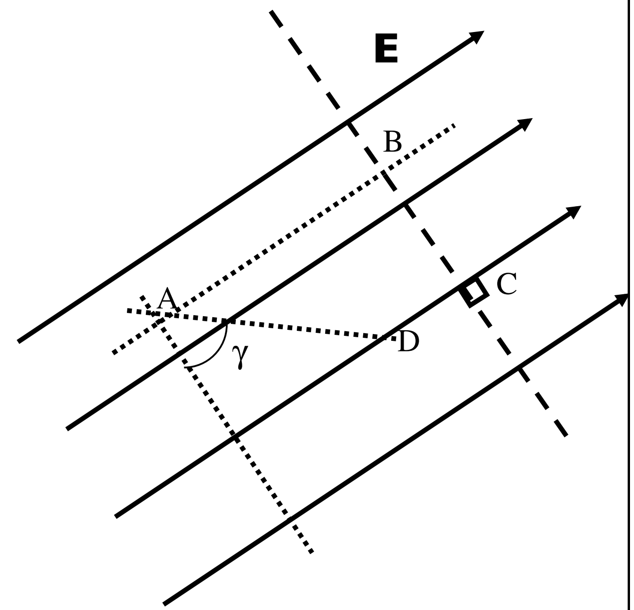
Extra 2: $d_{AC} = .7 \text{ m}$ $V_A = 45 \text{ volts}$
$d_{AB} = 1 \text{ m}$ $V_C = 25 \text{ volts}$
$d_{AD} = .5 \text{ m}$ $\gamma = 30^{\circ}$



a.) Determine E.

b.) Determine V_B

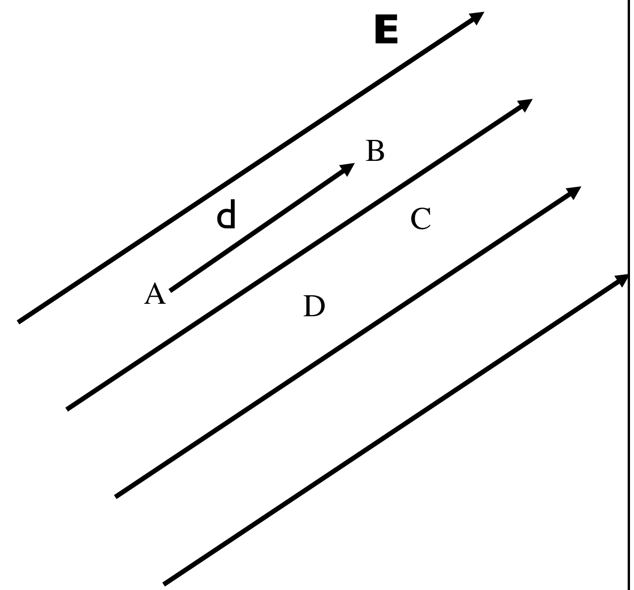
c.) Determine V_D

d.) Determine V_D another way.

e.) Release an electron at D. In what direction will it accelerate? Will it experience a voltage decrease or increase as it moves? Will it experience a potential energy decrease or increase as it moves?

Extra 2: $d_{AC} = .7 \text{ m} \quad d_{AB} = 1 \text{ m} \quad d_{AD} = .5 \text{ m}$

$V_A = 45 \text{ volts} \quad V_C = 25 \text{ volts} \quad \theta = 60^o$



Note that this problem is completely driven by the relationship

$$E \bullet d = -\left(V_{\text{final position}} - V_{\text{initial position}}\right)$$

a.) Determine E.

The first thing to notice is that Points B and C are on equipotential lines (they are both as far down stream in the electric field as the other, so both must have the same voltage). That means that $V_B = V_C = 25 \text{ volts}$. Assume we traversed the distance between points A and B by starting at A, we go a distance "d" WITH the electric field (see sketch). As such:

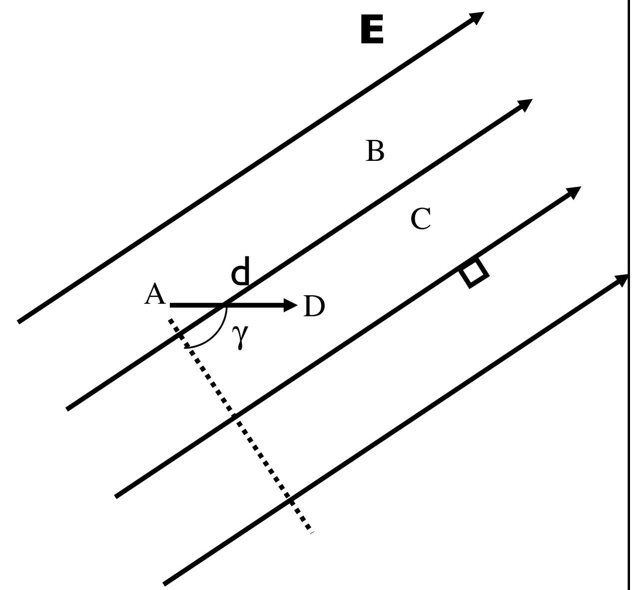
$$E \bullet d = -\left(V_{\text{final position}} - V_{\text{initial position}}\right)$$

$$\Rightarrow \quad E\, d \cos\theta = -\left(V_B - V_A\right)$$

$$\Rightarrow \quad E\,(1 \text{ m}) \cos 0^o = -(25 \text{ volts} - 45 \text{ volts})$$

$$\Rightarrow \quad E = 20 \text{ N/C}$$

Extra 2:



b.) Determine V_B

We' ve already done this. See Part a.

c.) Determine V_D

Knowing E, assuming we traverse from A to D as the arrow in the sketch shows, and noting that the angle between the line of E and the line of d is $\theta = 90^\circ - \delta = 90^\circ - 30^\circ = 60^\circ$, we can write:

$$E \bullet d = -(V_D - V_A)$$

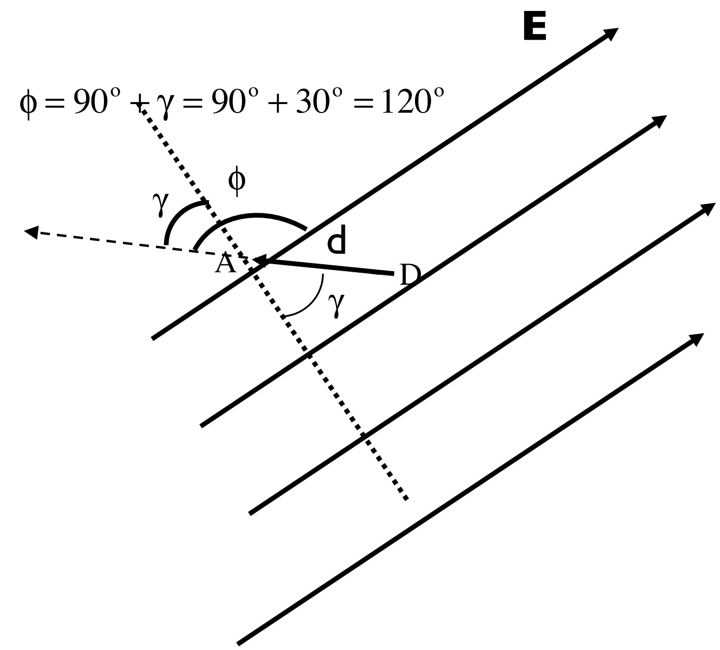
$$\Rightarrow \quad E\, d \cos\theta = -(V_D - V_A)$$

$$\Rightarrow \quad (20\ N/C)\ (.5\ m) \cos 60^\circ = -(V_D - 45\ volts)$$

$$\Rightarrow \quad V_D = 40\ volts$$

Extra 2:

d.) Determine V_D another way.



We still know E, but we could assume that we traverse from D to A as the arrow in the sketch shows. Noting in that case the angle between the line of E and the line of d is ϕ, we can write:

$$E \bullet d = -(V_D - V_A)$$

$$\Rightarrow \quad E\, d \cos\phi = -(V_A - V_D)$$

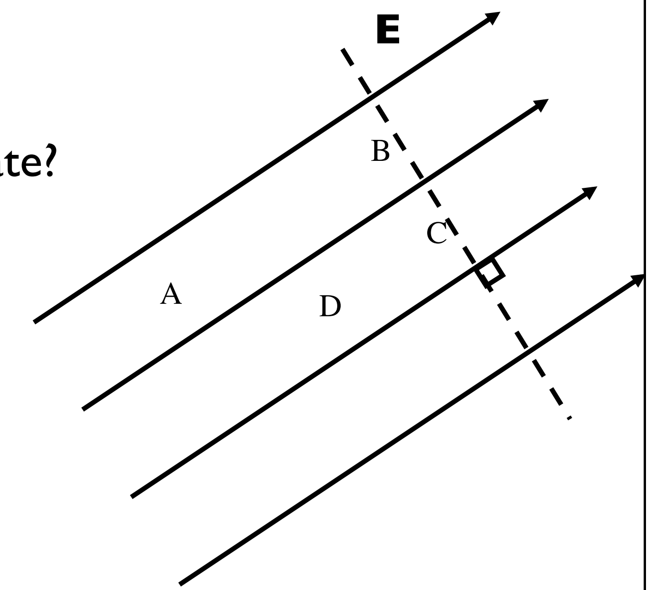
$$\Rightarrow \quad (20\ \text{N/C})\ (.5\ \text{m})\ \cos 120^\circ = -(45\ \text{volts} - V_D)$$

$$\Rightarrow \quad V_D = 40\ \text{volts}$$

SAME ANSWER AS PART C . . .

Note: It doesn't matter which way you traverse as long as you get the angle right and be consistent with your voltage difference.

Extra 2:



e.) Release an electron at D. In what direction will it accelerate?

If allowed to freely accelerate, electrons always accelerate opposite the direction of the E-fld. In this case, it will take off parallel to the E-fld but moving upstream (physically downward and to the left). (Note: That doesn't mean you can't force an electron to go down stream. It just isn't something an electron would do naturally.

Will it experience a voltage decrease or increase as it moves?

If protons move from higher voltage to lower voltage, electrons will move from lower voltage to higher voltage.

Will it experience a potential energy decrease or increase as it moves?

All object naturally tend from higher to lower potential energy. What's tricky here is that a lower voltage multiplied by a negative number (remember, $U_{e^-} = (-q)V$) is bigger than a higher voltage multiplied by a negative number. Electrons flow from points at which they have higher potential energy to points where they have lower potential energy.