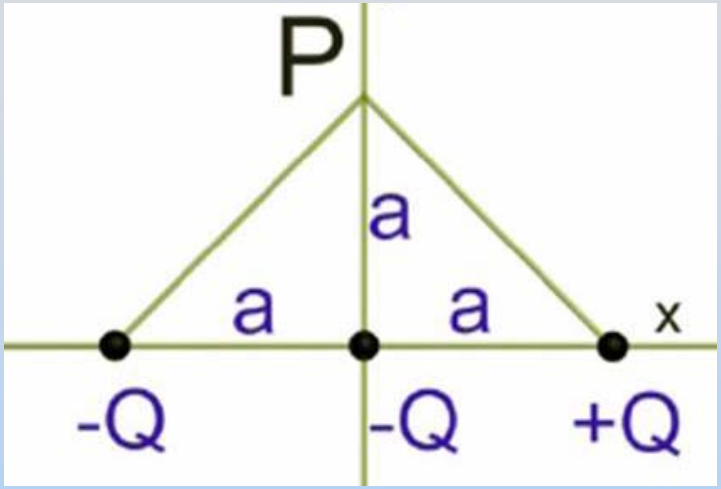
Concept Question: E from V

Consider the point charges you looked at earlier:



$$V(P) = -kQ/a$$

You calculated V(P). From that can you derive E(P)?

1. Yes, its kQ/a^2 (up)
2. Yes, its kQ/a^2 (down)
3. Yes in theory, but I don't know how to take a gradient
4. No, you can't get E(P) from V(P)
5. I don't know

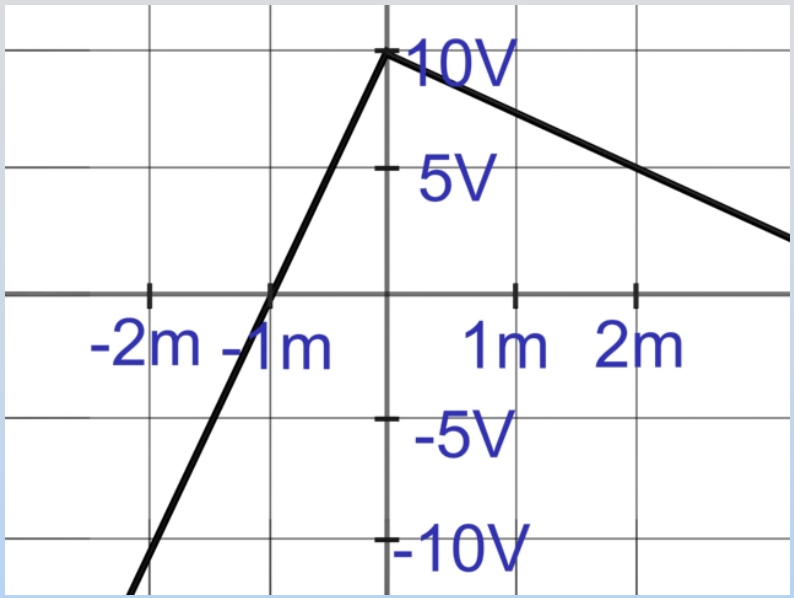
Concept Question Answer: E from V

4. No, you can't get E(P) from V(P)

The electric field is the gradient (spatial derivative) of the potential. Knowing the potential at a single point tells you nothing about its derivative.

People commonly make the mistake of trying to do this. Don't!

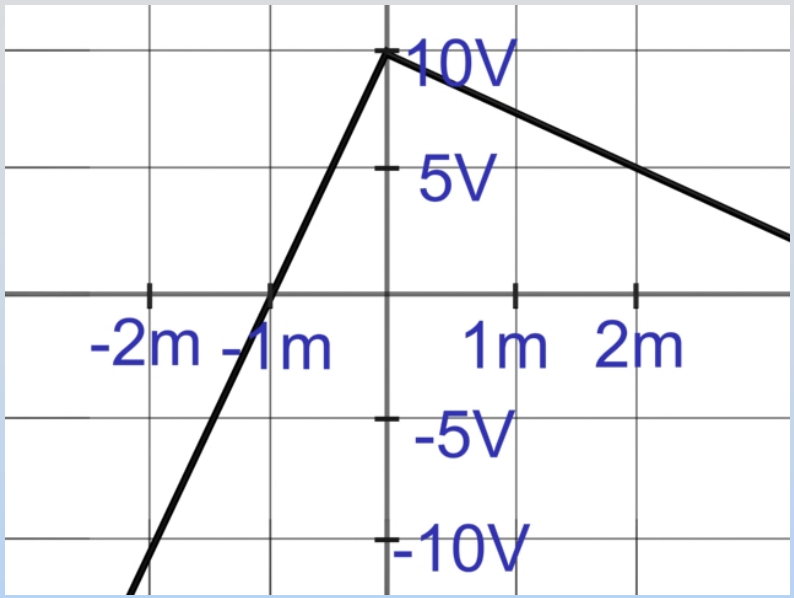
Concept Question: E from V



The graph above shows a potential V as a function of x. The *magnitude* of the electric field for x > 0 is

1. larger than that for x < 0
2. smaller than that for x < 0
3. equal to that for x < 0
4. I don't know

Concept Question Answer: E from V

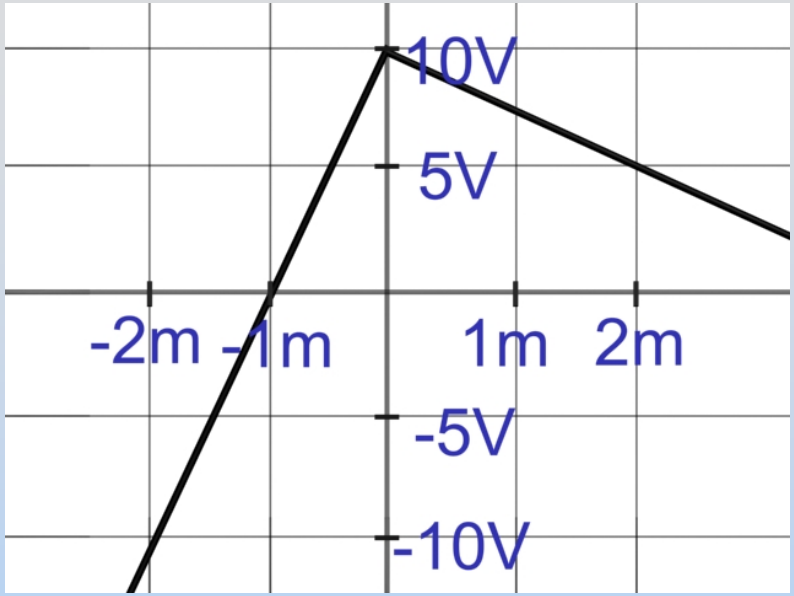


Answer: 2. The *magnitude* of the electric field for $x > 0$ is *smaller* than that for $x < 0$

The slope is smaller for $x > 0$ than $x < 0$

Translation: The hill is steeper on the left than on the right.

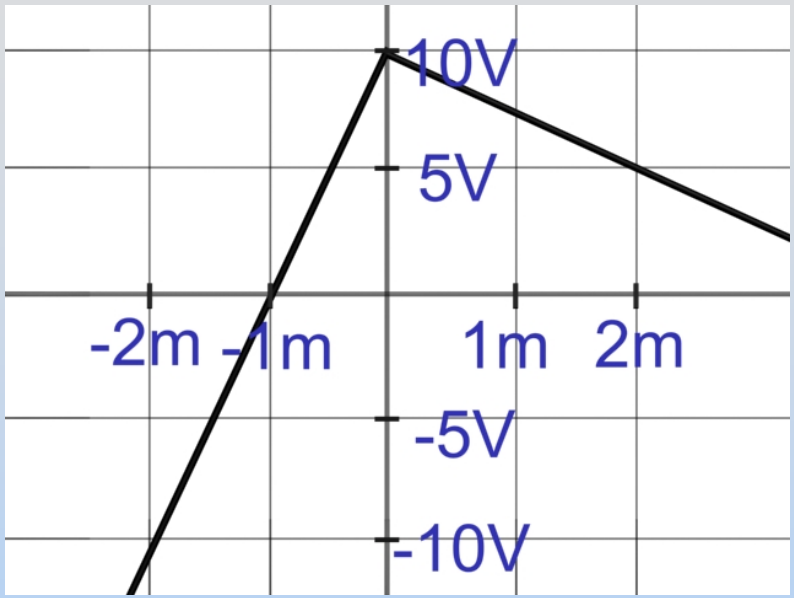
Concept Question: E from V



The above shows potential V(x). Which is true?

1. $E_{x>0}$ is > 0 and $E_{x<0}$ is > 0
2. $E_{x>0}$ is > 0 and $E_{x<0}$ is < 0
3. $E_{x>0}$ is < 0 and $E_{x<0}$ is < 0
4. $E_{x>0}$ is < 0 and $E_{x<0}$ is > 0
5. I don't know

Concept Question Answer: E from V



Answer: 2. $E_{x>0}$ is > 0 and $E_{x<0}$ is < 0

E is the negative slope of the potential, negative on the left, positive on the right

Translation: "Downhill" is to the left on the left and to the right on the right.

8.02SC Physics II: Electricity and Magnetism

Fall 2010